Acid and Metalliferous Drainage Risk Assessment

Mining Area C and South Flank

16 July 2021

Contents

Executive Summary

This acid and metalliferous drainage (AMD) risk assessment has been prepared for Mining Area C (MAC) and South Flank (SF) with consideration to BHP's internal preliminary AMD risk assessment procedure (BHP, 2017a).

To understand AMD source hazard potential, all blocks within the resource model are assigned an AMD code using a BHP specific AMD classification system. This system is based on net acid producing potential (NAPP) values calculated from standard geochemical assays (S, MgO, CaO and LOI) and is applied to over 506,000 drillhole samples. Those NAPP results and hence AMD coding assumptions in the resource model were validated against specific acid base accounting (ABA) data and other geochemical tests of representative drillhole samples. The mining models, which based on the resource models of each orebody, represent the main data source for this AMD hazards assessment. Mining model parameters analysed include spatial coordinates, block volumes, AMD classifications, weathering classifications, proximity to the pre-mining groundwater table, and mining designations. Volumes of waste rock and low-grade ore mined and to be mined were assessed as a function of AMD Class, sulphur content, ANC, and NAPP. High grade ore was not assessed as this will not remain on site at Closure. Data processing and visualisation software Microsoft PowerBI was used to analyse the datasets and estimate the potential AMD hazard.

MAC comprises a total of 14 deposits, namely 7 Marra Mamba deposits (Deposit A, B, C, D, E, F and Deadend) and 7 Brockman bedrock deposits (P1W, P1E, P2, P3, P4, P5 and P6). The section of the mine containing the Marra Mamba deposits is referred to as Northern Flank, while the section with the Brockman deposits is referred to as Packsaddle. SF comprises 4 deposits (Highway, Grand Central, Vista Oriental and R deposit), all of which are Marra Mamba deposit.

Waste material (waste rock and possibly low-grade ore) from mining is expected to be stored on site. Note that while all waste rock (not ore) is likely to be stockpiled in the OSAs, low-grade ore may be stockpiled separately for blending and, ultimately, shipped out of site. The proportion of low-grade ore regarded as ore rather than mine waste is generally not known until excavated and may change as a function of market conditions. There is, therefore, potential for some or all of the low-grade ore to be permanently disposed in the OSAs. In this report, mining waste refers to waste rock and low-grade ore. Where possible the characteristics of the two material domains are listed separately. Note that the mined waste volume including all low-grade ore represent the upper limit for the expected volumes to be stored on site.

A summary of the total as-mined and to-be-mined waste rock and low-grade ore volumes per AMD Class per deposit are presented in the tables below, with the material balance for MAC listed first, followed by that for SF.

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class

Formation	Deposit	Status	Waste type	AMD Class 0 (m^3)	AMD Class 1 (m^3)	AMD Class 2 (m^3)	AMD Class 3 (m^3)
Packsaddle (MAC) - Brockman Bedrock	MAC P1W	as-mined	Waste rock	345,600	0	4,400	0
			Low grade ore	2,828,000	0	26,000	0
		to-be-mined	Waste rock	78,187,200	0	527,200	0
			Low grade ore	170,721,600	0	904,800	18,000
	MAC P1E	as-mined	Waste rock	11,680,400	0	92,800	0
			Low grade ore	9,544,400	0	302,800	0
		to-be-mined	Waste rock	13,280,800	0	25,600	400
			Low grade ore	10,904,400	0	102,400	0
	MAC P2	as-mined	Waste rock	781,200	0	4,000	0
			Low grade ore	436,800	0	0	0
		to-be-mined	Waste rock	12,096,000	0	71,200	0
			Low grade ore	15,298,400	0	121,600	0
	MAC P3	as-mined	Waste rock	31,198,800	0	17,200	0
			Low grade ore	19,536,400	0	92,800	0

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m³)**	**AMD Class 1 (m³)**	**AMD Class 2 (m³)**	**AMD Class 3 (m³)**
		to-be-mined	Waste rock	25,810,400	0	0	0
			Low grade ore	22,222,000	0	83,200	0
	MAC P4	as-mined	Waste rock	12,019,200	0	0	0
			Low grade ore	17,714,000	0	78,400	0
		to-be-mined	Waste rock	27,818,800	0	6,800	0
			Low grade ore	28,460,400	0	63,600	0
	MAC P5	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	18,192,000	0	0	0
			Low grade ore	29,438,700	0	424,800	0
	MAC P6	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	15,675,200	0	417,600	0
			Low grade ore	28,299,200	0	501,200	6,800
	Total	**m³**	**Waste rock**	**247,085,600**	**0**	**1,166,800**	**400**
	% total	**%**		**99.53**	**0**	**0.35**	**0**
	Total	**m³**	**Low grade ore**	**355,404,300**	**0**	**2,701,600**	**24,800**
	% total	**%**		**99.24**	**0**	**0.75**	**0.01**
North Flank (MAC) - Marra Mamba	MAC A	as-mined	Waste rock	28,666,400	0	0	0
			Low grade ore	20,195,600	0	0	0
		to-be-mined	Waste rock	34,792,800	0	0	0
			Low grade ore	21,294,000	0	0	0
	MAC B	as-mined	Waste rock	4,114,800	0	34,000	0
			Low grade ore	7,474,400	0	595,200	14,400
		to-be-mined	Waste rock	32,811,200	0	10,800	0
			Low grade ore	37,946,000	0	135,600	702,000
	MAC C	as-mined	Waste rock	56,190,800	0	337,200	0
			Low grade ore	43,037,200	0	480,400	0
		to-be-mined	Waste rock	3,417,600	0	0	0
			Low grade ore	3,758,400	0	0	0
	MAC D	as-mined	Waste rock	5,334,450	0	0	0
			Low grade ore	7,436,275	0	0	0
		to-be-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
	MAC E	as-mined	Waste rock	95,782,800	0	98,400	0
			Low grade ore	33,952,800	0	307,600	6,400
		to-be-mined	Waste rock	52,976,000	0	400	0
			Low grade ore	17,075,200	0	0	0
	MAC F	as-mined	Waste rock	12,368,000	0	62,000	0
			Low grade ore	8,278,400	0	722,000	0
		to-be-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m^3)**	**AMD Class 1 (m^3)**	**AMD Class 2 (m^3)**	**AMD Class 3 (m^3)**
	MAC Dead end	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	9,690,400	0	2,400	0
			Low grade ore	8,956,400	0	75,600	0
	Total	**m^3**	**Waste rock**	**336,145,250**	**0**	**545,200**	**0**
	% total	**%**		**99.84**	**0**	**0.16**	**0**
	Total	**m^3**	**Low grade ore**	**209,404,675**	**0**	**2,316,400**	**722,800**
	% total	**%**		**98.57**	**0**	**1.09**	**0.34**

South Flank - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m^3)**	**AMD Class 1 (m^3)**	**AMD Class 2 (m^3)**	**AMD Class 3 (m^3)**
South Flank - Marra Mamba	SF R	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	64,476,800	0	0	67,600
			Low grade ore	63,152,800	0	2,000	400
	SF Highway	as-mined	Waste rock	417,600	0	2,000	0
			Low grade ore	676,000	0	120,800	36,800
		to-be-mined	Waste rock	82,945,600	0	230,000	119,200
			Low grade ore	53,982,400	0	2,148,400	48,000
	SF Grand Central	as-mined	Waste rock	4,354,400	0	383,600	200,400
			Low grade ore	5,077,600	0	505,600	172,000
		to-be-mined	Waste rock	104,517,600	0	3,273,600	2,061,200
			Low grade ore	61,603,600	0	4,066,800	1,801,600
	SF Vista Oriental	as-mined	Waste rock	7,443,600	0	12,400	99,600
			Low grade ore	6,526,800	0	144,400	369,200
		to-be-mined	Waste rock	122,277,200	0	1,267,200	226,800
			Low grade ore	83,559,200	0	2,626,000	450,000
	Total	**m^3**	**Waste rock**	**386,432,800**	**0**	**5,168,800**	**2,774,800**
	% total	**%**		**97.99**	**0**	**1.31**	**0.7**
	Total	**m^3**	**Low grade ore**	**274,578,400**	**0**	**9,614,000**	**2,878,000**
	% total	**%**		**95.65**	**0**	**3.35**	**1**

The key potential source hazards are presented in the table below:

Formation	Deposit	Source hazard risk	
		Waste (ex-pit / in-pit)	Pit surface
Packsaddle (MAC) - Brockman Bedrock	P1W	**risk ranking: low-moderate** – AMD2 waste comprises appx. 0.67% (or 531,600 m3) and 0.53% (or 930,800 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0% (or 0 m3) and 0.01% (or 18,000 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 1,480,400 m3, representing 0.58% of the total LoA waste materials for P1W deposit.	**risk ranking: low-moderate** – A total exposure area of 28,900 m2 AMD material (27,900 m2 AMD2 and 1,000 m2 AMD3) representing ~0.40% of the total pit surface area (6,541,800 m2) for P1W deposit.
	P1E	**risk ranking: low** – AMD2 waste comprises appx. 0.47% (or 118,400 m3) and 1.94% (or 405,200 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 524,000 m3, representing 1.14% of the total LoA waste materials for P1E deposit.	**risk ranking: low** – 17,600 m2 of AMD2 exposure representing ~0.60% of the total pit surface area (2,959,700 m2) for P1E deposit.
	P2	**risk ranking: low** – AMD2 waste comprises appx. 0.58% (or 75,200 m3) and 0.77% (or 121,600 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 196,800 m3, representing 0.68% of the total LoA waste materials for P2 deposit.	**risk ranking: low** – An inconsequential exposure of 4,200 m2 AMD2 material representing ~0.30% of the total pit surface area (1,345,000 m2) for P2 deposit.
	P3	**risk ranking: low** – AMD2 waste comprises appx. 0.03% (or 17,200 m3) and 0.42% (or 176,000 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 193,200 m3, representing 0.20% of the total LoA waste materials for P3 deposit.	**risk ranking: low** – An inconsequential exposure of 7,000 m2 AMD2 material representing ~0.20% of the total pit surface area (4,431,100 m2) for P3 deposit.
	P4	**risk ranking: low** – AMD2 waste comprises appx. 0.02% (or 6,800 m3) and 0.31% (or 142,000 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 148,800 m3, representing 0.17% of the total LoA waste materials for P4 deposit.	**risk ranking: low** – An inconsequential exposure of 2,600 m2 AMD2 material representing <0.1% of the total pit surface area (3,813,500 m2) for P4 deposit.
	P5	**risk ranking: low** – AMD2 waste comprises appx. 0% (or 0 m3) and 1.42% (or 424,800 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 424,800 m3, representing 0.88% of the total LoA waste materials for P5 deposit.	**risk ranking: low** – A negligible exposure of 400 m2 AMD2 material representing <0.1% of the total pit surface area (2,082,100 m2) for P5 deposit.
	P6	**risk ranking: low** – AMD2 waste comprises appx. 2.59% (or 417,600 m3) and 1.74% (or 501,200 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0% (or 0 m3) and 0.02% (or 6,800 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 925,600 m3, representing 2.06% of the total LoA waste materials for P6 deposit.	**risk ranking: low** – An inconsequential exposure of 6,600 m2 AMD2 material representing ~0.30% of the total pit surface area (1,916,900 m2) for P6 deposit.

Formation	Deposit	Source hazard risk	
		Waste (ex-pit / in-pit)	Pit surface
North Flank (MAC) - Marra Mamba	A	**risk ranking: low**	**risk ranking: low**
		– None (LoA waste completely AMD0)	– None of any AMD1-3 exposure
	B	**risk ranking: low-moderate**	**risk ranking: low**
		– AMD2 waste comprises appx. 0.12% (or 44,800 m3) and 1.56% (or 730,800 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0% (or 0 m3) and 1.53% (or 716,400 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 1,492,000 m3, representing 1.78% of the total LoA waste materials for B deposit.	– A total exposure area of 23,700 m2 AMD material (17,200 m2 AMD2 and 6,500 m2 AMD3) representing ~0.50% of the total pit surface area (4,516,900 m2) for B deposit.
	C	**risk ranking: low**	**risk ranking: low**
		– AMD2 waste comprises appx. 0.56% (or 337,200 m3) and 1.02% (or 480,400 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 817,600 m3, representing 0.76% of the total LoA waste materials for C deposit.	– An inconsequential exposure of 5,400 m2 AMD2 material representing ~0.2% of the total pit surface area (3,468,800 m2) for C deposit.
	D	**risk ranking: low**	**risk ranking: low**
		– None (LoA waste completely AMD0)	– None of any AMD1-3 exposure
	E	**risk ranking: low**	**risk ranking: low-moderate**
		– AMD2 waste comprises appx. 0.07% (or 98,800 m3) and 0.60% (or 307,600 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0% (or 0 m3) and 0.01% (or 6,400 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 412,800 m3, representing 0.21% of the total LoA waste materials for E deposit.	– 31,800 m2 of AMD2 exposure representing ~0.48% of the total pit surface area (6,739,300 m2) for E deposit.
	F	**risk ranking: low**	**risk ranking: low**
		– AMD2 waste comprises appx. 0.50% (or 62,000 m3) and 8.02% (or 722,000 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 784,000 m3, representing 3.66% of the total LoA waste materials for F deposit.	– An inconsequential exposure of 4,700 m2 AMD2 material representing ~0.30% of the total pit surface area (1,765,500 m2) for F deposit.
	Deadend	**risk ranking: low**	**risk ranking: low**
		– AMD2 waste comprises appx. 0.02% (or 2,400 m3) and 0.84% (or 75,600 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 78,000 m3, representing 0.42% of the total LoA waste materials for Deadend deposit.	– An inconsequential exposure of 6,300 m2 AMD2 material representing ~0.40% of the total pit surface area (1,737,600 m2) for Deadend deposit.
South Flank - Marra Mamba	Highway	**risk ranking: low-moderate**	**risk ranking: low-moderate**
		– AMD2 waste comprises appx. 0.28% (or 232,000 m3) and 3.98% (or 2,269,200 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0.14% (or 119,200 m3) and 0.15% (or 84,800 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 2,705,200 m3, representing 1.92% of the total LoA waste materials for Highway deposit.	– A total exposure area of 67,400 m2 AMD material (66,400 m2 AMD2 and 1,000 m2 AMD3) representing ~0.80% of the total pit surface area (8,157,600 m2) for Highway deposit.
		risk ranking: moderate-high	**risk ranking: low-moderate**

Formation	Deposit	Source hazard risk	
		Waste (ex-pit / in-pit)	Pit surface
	Grand Central	– AMD2 waste comprises appx. 3.19% (or 3,657,200 m3) and 6.24% (or 4,572,400 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 1.97% (or 2,261,600 m3) and 2.70% (or 1,973,600 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 12,464,800 m3, representing 6.63% of the total LoA waste materials for Grand Central deposit.	– A total exposure area of 123,100 m2 AMD material (113,000 m2 AMD2 and 10,100 m2 AMD3) representing ~1.00% of the total pit surface area (11,905,600 m2) for Grand Central deposit.
		risk ranking: low-moderate	**risk ranking: low-moderate**
	Vista Oriental	– AMD2 waste comprises appx. 0.97% (or 1,279,600 m3) and 2.96% (or 2,770,400 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0.25% (or 326,400 m3) and 0.87% (or 819,200 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 5,195,600 m3, representing 2.31% of the total LoA waste materials for Vista Oriental deposit.	– A total exposure area of 82,700 m2 AMD material (77,200 m2 AMD2 and 5,500 m2 AMD3) representing ~0.70% of the total pit surface area (11,355,600 m2) for Vista Oriental deposit.
		risk ranking: low	**risk ranking: low**
	R	– AMD2 waste comprises appx. 0% (or 0 m3) and <0.01% (or 2,000 m3) of the total waste rock and low-grade ore for the LoA, respectively. – AMD3 waste comprises 0.10% (or 67,600 m3) and <0.01% (or 400 m3) of the total waste rock and low-grade ore for the LoA, respectively. – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 70,000 m3, representing 0.05% of the total LoA waste materials for R deposit.	– A negligible exposure of 1,100 m2 AMD2 material representing <0.1% of the total pit surface area (4,484,600 m2) for R deposit.

1 Introduction

This acid and metalliferous drainage (AMD) risk assessment has been prepared for MAC and SF with consideration to BHP's internal preliminary AMD risk assessment procedure (BHP, 2017a).

The assessment has been restricted to potential AMD sources that may remain on site at closure, i.e. waste rock and low-grade ore. Therefore, as all high-grade ore material is to be transported offsite for processing, ore has been excluded. This assessment assumes that all temporary high grade-ore stockpiles and run-of-mine pads associated with high-grade ore stockpiling will be removed at closure.

As described in *Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry* (DITR, 2016), the term AMD within this assessment is defined as acid and metalliferous drainage, which includes acidic drainage (acid rock drainage; ARD), pH neutral metalliferous drainage (NMD), and saline drainage (SD), generally caused by the oxidation of sulphide minerals, or the leaching of secondary sulphide oxidation products. Potential sources of AMD are sulphide minerals within fresh rock (e.g. pyrite, FeS_2) and/or soluble or sparingly soluble secondary acid generating sulphate minerals within partially weathered rock (e.g. melanterite, alunite, jarosite). Material domains with potential for AMD generation include waste rock dumps, ore stockpiles, tailings storage facilities, and pit wall rock.

This AMD risk assessment is based on the AMD source terms at MAC and SF coupled with local/regional hydrology and environmental receptors to derive a high-level source-pathway-receptor (SPR) risk profile.

The following supporting information is appended to this report:

Appendix A – Abbreviations;

Appendix B – Definitions;

Appendix C – AMD Basics and Laboratory Methods;

Appendix D – WAIO Classification System;

Appendix E – Summary of Lithological Categories

Appendix F – Environmental Geochemical Results; and

Appendix G – Environmental Geochemical PowerBI Dashboard.

1.1 AMD Management

Management of AMD materials at BHP Western Australian Iron Ore (WAIO) operations is governed by the WAIO AMD Management Standard (BHP, 2018a), the WAIO Mines Closure Design Guidance (BHP, 2016), and BHP's Global Acid and Metalliferous Drainage Management Standard (BHP, 2019a). These documents outline requirement for AMD management throughout the life of mine from exploration through mine planning, operations, and closure such that that risks associated with AMD are identified and controlled. This AMD risk assessment provides information related to the first two phases of the AMD management process (BHP, 2018a) for MAC and SF, specifically *Characterisation of Potential AMD Sources and Assessment of Potential AMD Risk* (Figure 1-1).

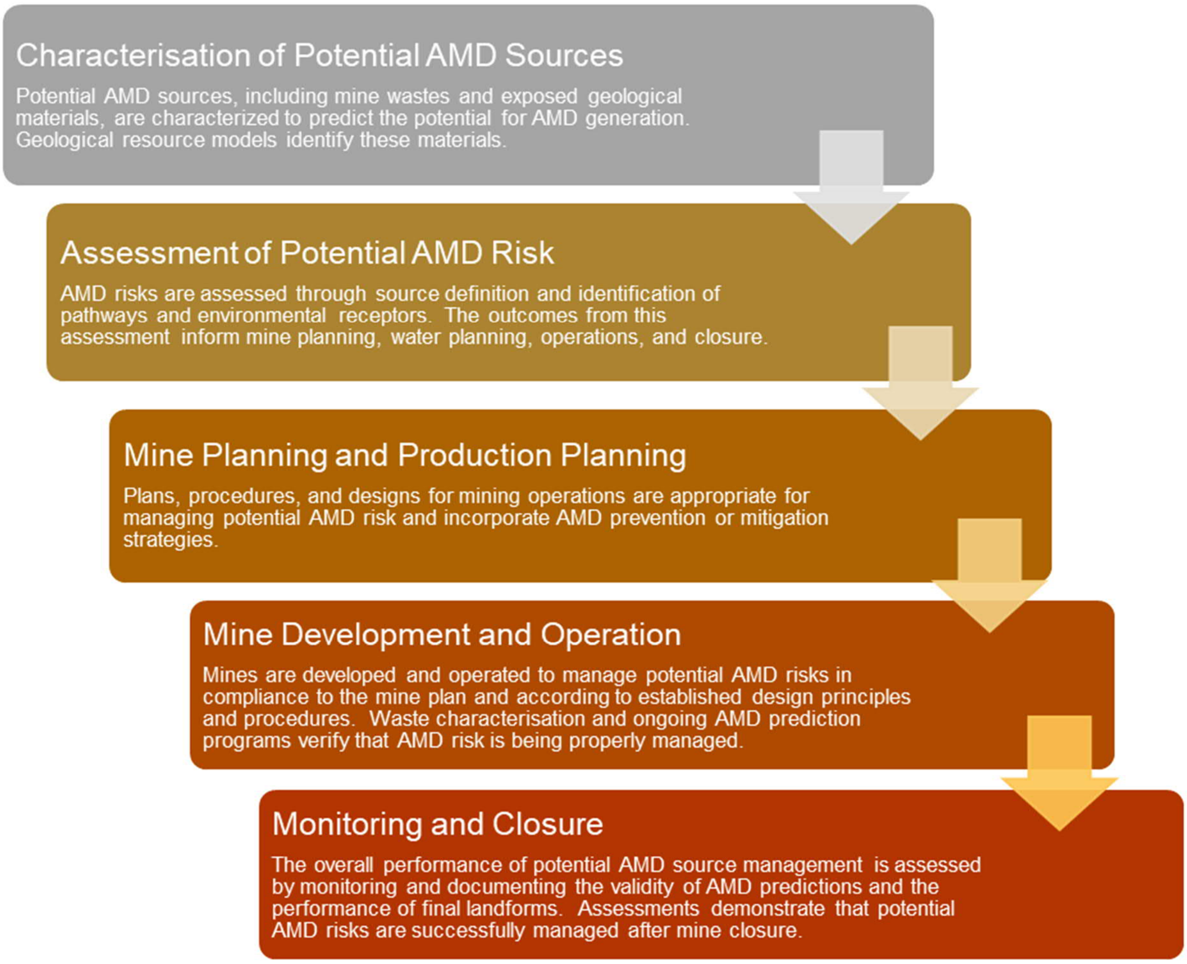


Figure 1-1 AMD Management process flow (BHP, 2018a)

1.2 Project background

1.2.1 Mine Planning

BHP's central Pilbara hub is comprised of Mining Area C (MAC) and South Flank (SF) iron ore mines, located approximately 100 kilometres (km) to the north-west of the town of Newman in the Pilbara region of Western Australia (WA) (Figure 1-2). The conventional open cut mining is employed at MAC and SF.

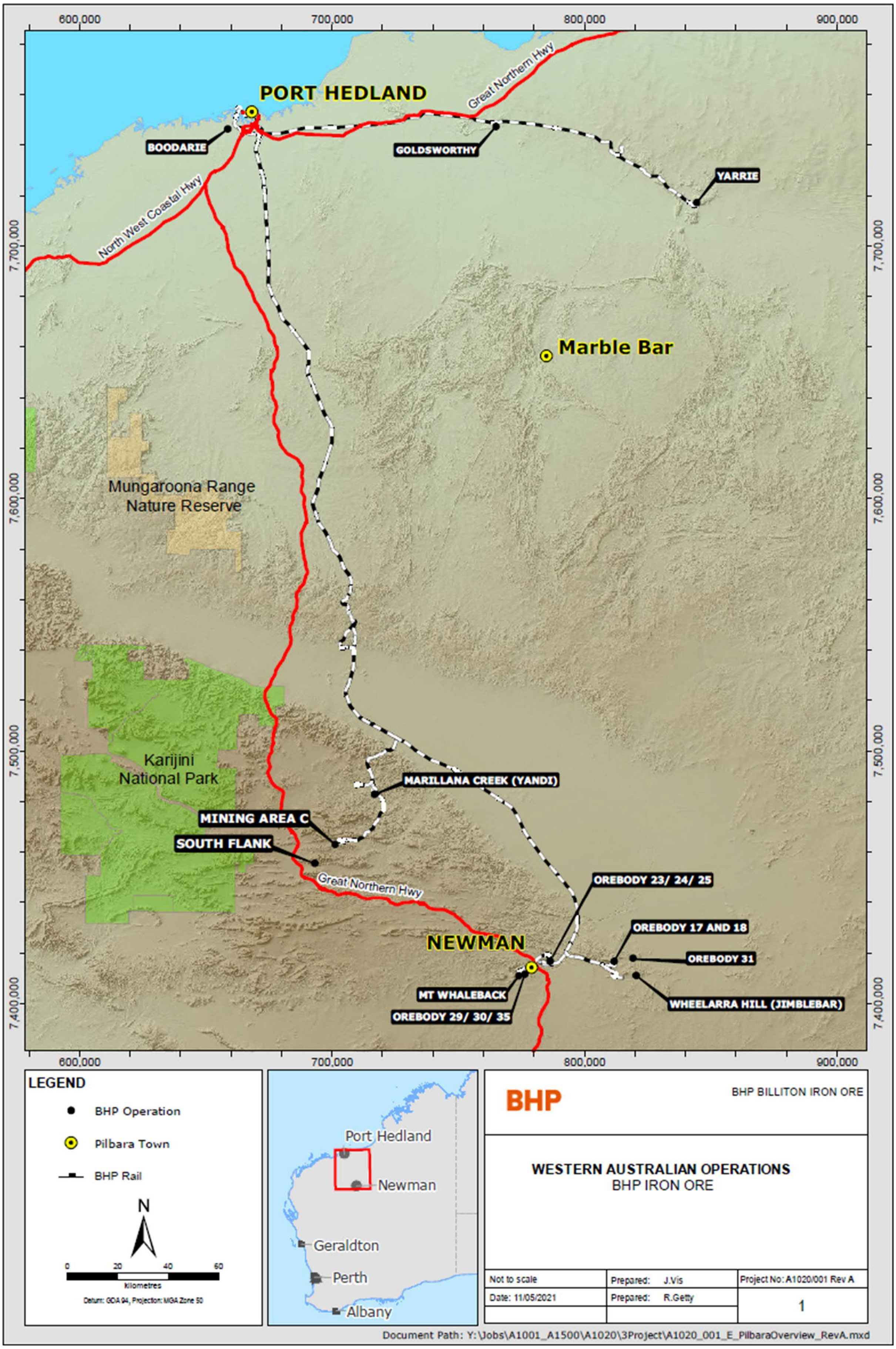


Figure 1-2 Mining Area C and South Flank regional location

A brief summary of the mine plan and key mining domains considered in this assessment is presented in Figure 1-3.

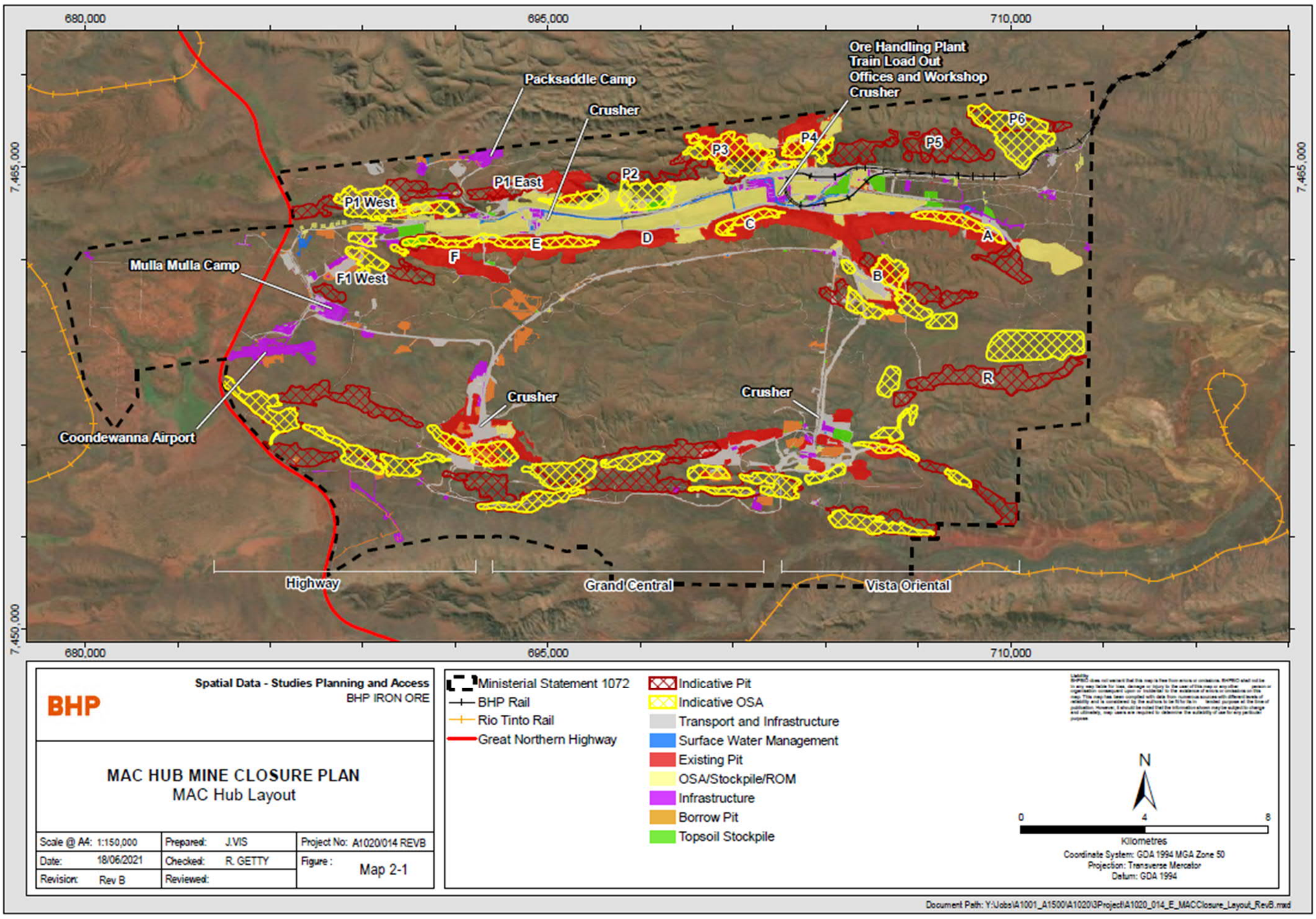


Figure 1-3 Ming Area C and South Flank general layout

1.2.2 Climate

The MAC and SF mining operations are located within the East Pilbara region, which has an arid to semi-arid climate with hot summers and mild winters. The area receives summer rainfall, typically associated with episodic events such as tropical depressions or cyclones.

Rainfall statistics from the Bureau of Meteorology (BOM) Newman Airport weather station (station number 7176) are presented in Table 1-1. These statistics are based on records dating from October 1971 to December 2020. Given rainfall's association with episodic events such as tropical depressions and cyclones in the region, annual rainfall is highly variable - ranging between 37 mm to 620 mm per year. Average annual rainfall is estimated to be approximately 325 mm.

Table 1-1 Summary rainfall statistics for the Newman Airport weather station (BOM, 2021)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	69.8	70.2	41.7	21.3	18.4	15.9	14.4	6.4	3.6	5.9	12.4	35.3	325
Lowest	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	36.6
P10	9.7	5.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	157
Median	41.2	42.8	29.5	8.4	5.6	5.2	4.0	0.2	0.0	1.2	8.0	21.6	324
P90	194	163	109	55.0	57.6	57.0	34.4	21.2	8.1	20.3	29.6	70.3	475
Highest	240	306	214	107	113	77.8	140	79.6	44.6	34.8	79.2	236	619

Average evaporation far exceeds average rainfall with the annual mean Class A pan evaporation rate expected to range between 3,200 and 3,600 mm per (BOM, 2006).

1.2.3 Geology

1.2.3.1 Regional Geology

The Pilbara region comprises a portion of the ancient continental Western Shield that dominates the geology of WA. The Western Shield is comprised of pre-Cambrian, Proterozoic, and Archaean rocks. The Pilbara Craton dates back to the Archaean and includes some of the oldest rocks in the world. It is overlain by Proterozoic rocks deposited in the Hamersley and Bangemall Basins.

The MAC and SF deposits are located within the Hamersley Basin and typical of the Pilbara Region. Stratigraphy across MAC and SF deposits is mainly of the Hamersley Group (~2,630 to 2,450 Ma), which is a 2.5 km thick sequence of predominantly deep water sediments with lesser turbidites and intrusives. Lithologies include BIF, hemipelagic shales, dolomite, chert, tuff, and turbiditic volcanics. Since deposition, the Hamersley Group has undergone significant structural and geochemical alteration (Perring and Hronsky, 2019). Mineralisation at MAC and SF is located within the early Proterozoic Hamersley Group (Marra Mamba and Brockman Iron Formations) and Tertiary Sediments.

1.2.3.2 Local Geology

The local geology of MAC and SF were documented by Perring and Hronsky (2019). The stratigraphic units associated with MAC and SF comprise, from youngest to oldest:

- Surface Scree and Tertiary Sediments (Detritals);
- Brockman Iron Formation (Yandicoogina Shale Member, Joffre Member, Whaleback Shale Member, Dales Gorge Member);
- Mt McRae Shale;
- Mount Sylvia Formation;
- Wittenoom Formation (Bee Gorge Member, Paraburdoo Member, West Angela Member); and
- Marra Mamba Iron Formation (Mt Newman Member, MacLeod Member, Nammuldi Member).

<u>Surface Scree</u>

Surface Scree represents unconsolidated sediment accumulated through periodic rockfall from adjacent cliff faces at the base of valley shoulders and mountain cliffs. At Mining Area C, Surface Scree overlies Tertiary Detritals along most of the North Flank Valley and low relief areas at South Flank (mainly south of the hills area). BHP Iron Ore codes this lithology as SZ.

<u>Tertiary Sediments / Tertiary Detritals</u>

Tertiary alluvial sediments have been deposited in the North Flank and South Flank valley areas, where they overlie the eroded bedrock mostly of the Wittenoom Formation. The sediments are composed of semi-consolidated and cemented alluvium, colluvium/detritals comprising sands, silts, clays, lignite and ligneous clays and calcrete deposits up to tens of meters in thickness. BHP Iron Ore recognised three lithological units within this formation; the lithological code is TDx, with “x” ranging from 1 to 3.

Pyrite can be associated with these sediments, particularly with lignite and ligneous clays located within the fresh zone. This pyrite is formed as a result of bacterially mediated sulphate reduction in the presence of iron and organic carbon. Pyrite from these sediments is ultra-fine grained, framboidal, and is expected to be far more reactive (i.e. more rapid oxidation rate) than pyrite within the Proterozoic formations. In addition, acidity storing secondary minerals (e.g. alunite and jarosite) within the oxidised portion of the sediments may be present. As a result, these materials have the potential to generate AMD.

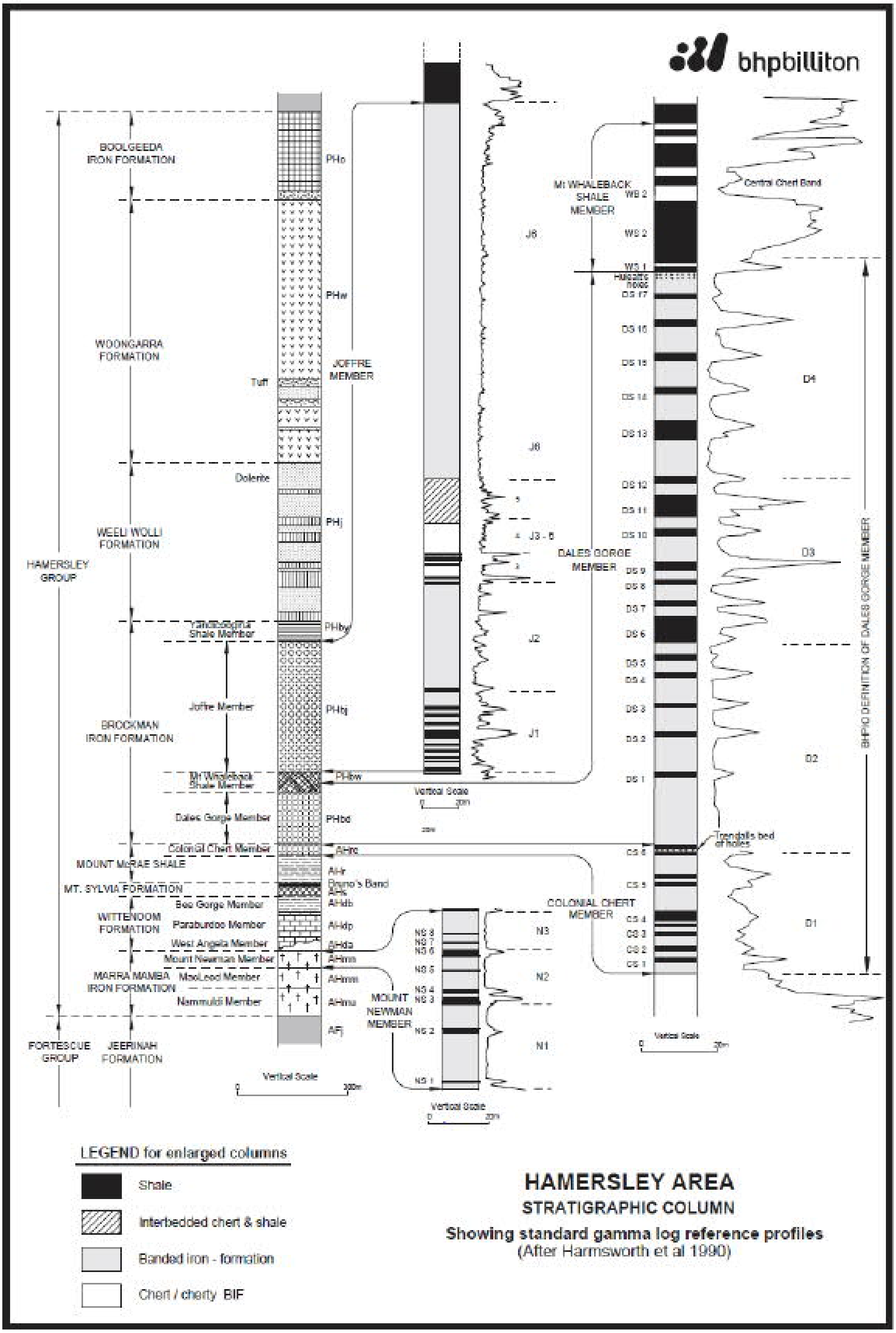


Figure 1-4 Hamersley Group stratigraphic column (Perring and Hronsky, 2019)

<u>Brockman Iron Formation</u>

The four members comprising the formation have a total thickness of ~520 m and include the following:

Yandicoogina Shale Member – The uppermost member of the Brockman Iron Formation, the Yandicoogina Shale Member is a 60 m thick sequence of interbedded chert and shale with dolerite sills. BHP Iron Ore codes this member as Y.

Joffre Member – This member is approximately 360 m thick and is dominated by BIF with minor shale bands. BHP Iron Ore codes this member as Jx with “x” ranging from 1-6 representing distinct subunits; undifferentiated Joffre Member is coded J.

Whaleback Shale – This member consists of 50 m of shale interbedded with chert and BIF and has been sub-divided in two zones: a lower zone of shale and BIF (code WL); and an upper zone of chert and shale (WU). Undifferentiated Whaleback Shale is coded W.

Dales Gorge Member – This member, which is approximately 150 m thick, hosts most of the mineralisation for the Packsaddle Range deposits. The Dales Gorge Member is the basal member of the Brockman Iron Formation and comprises an interlayered sequence of BIF and shale macrobands. BHP Iron Ore codes this member as Dx with “x” ranging from 1-4 representing distinct subunits. Undifferentiated Dales Gorge Member is coded D.

Significant concentrations of sulphide-bearing minerals can be found within the Brockman Iron Formation, and thus it has the potential to generate AMD.

Mount McRae Shale

The Mount McRae Shale (~30 m thick) consists of alternating bands of black carbonaceous shale and chert and is commonly capped with pyritic chert bands. The Mount McRae Shale forms the basal unit to the ore horizons in the Brockman Iron Formation and contains a limited enriched ore zone. BHP Iron Ore informally subdivides this lithology into five units based on lithology and pyrite content. The lithology code for the Mt McRae Shale is Rx with “x” representing alphabetical characters U, N, C, and L to represents upper, nodule zone, chert, and lower unit, respectively. Undifferentiated Mt McRae Shale is coded R.

Several zones within the unit contain abundant pyrite nodules, thus, the formation is commonly regarded as a significant AMD risk throughout the Pilbara region.

Mount Sylvia Formation

The Mount Sylvia Formation (~2.5 Ma) has a thickness of ~50 m in the vicinity of the town of Newman, WA, and consists of three BIFs separated by interlayered shale and dolomite as well as small amounts of chert. BHP Iron Ore codes this member as Sx with “x” ranging from 1-6 representing distinct subunits. If undifferentiated this formation is coded S.

Wittenoom Formation

The Wittenoom formation is located stratigraphically above and is younger than (2.6 – 2.5 Ma) the Marra Mamba Formation. The Wittenoom Formation has been deeply eroded in the development area and is mostly covered by Tertiary Detritals. The formation is predominantly comprised of calcareous and manganiferous shales, cherts and dolomite and includes the following members:

Bee Gorge Member – This is the uppermost member of the Wittenoom Formation and consists of alternating beds of shale and dolomite with minor cherts, volcaniclastics and BIF. This unit is present, but not planned to be mined at Mining Area C. BHP Iron Ore codes this member as OD.

Paraburdoo Member – The Paraburdoo Member is the middle unit of the Wittenoom Formation and consists of thin to thick-bedded dolomite with minor amounts of chert and argillite partings. BHP Iron Ore codes this member as OB.

West Angela Member – This member is a shale unit located at the base of the Wittenoom Formation and contains dolomite, dolomitic argillite, chert and minor BIF. At Mining Area C, the West Angela Member is present as two distinct units (WA1 and WA2.) The basal WA1 overlying the Newman Member is a cherty BIF with interbedded shale. The WA2 Member is a clay rich weathered horizon. Undifferentiated West Angela Member is coded OA.

Carbonate materials within Wittenoom Formation represent a local source for acid neutralisation and are likely to contribute to elevated alkalinity in the local aquifer.

Marra Mamba Iron Formation

The Marra Mamba Iron Formation is approximately 205 m thick and is the oldest formation (2.6 Ma) identified in the project area. It is comprised of a sequence of BIF, shales, siltstones and minor cherts. The Mount Newman Member hosts the bulk of the mineralisation associated with the Marra Mamba Iron Formation Deposits. The formation is divided into the following members:

Mt Newman Member – This uppermost, youngest unit of the Marra Mamba Iron Formation is a sequence of BIF, shales, siltstones and minor cherts containing significant martite-goethite-ochreous goethite mineralisation. This member represents the main host to mineralisation at Mining Area C. BHP Iron Ore codes this member as Nx, with “x” ranging from 1-3. Undifferentiated Mt Newman Member is coded MN.

MacLeod Member – This member is the middle unit of the Marra Mamba Iron Formation, consisting of interbedded shales and chert. BHP Iron Ore codes this member as MM.

Nammuldi Member – This is the base unit of the Marra Mamba Iron Formation, comprising yellow weathering chert, cherty BIF and some shale bands. It has a maximum thickness of 100 m. BHP Iron Ore codes this member as MU.

MAC comprises 7 Marra Mamba deposits at North Flank (Deposit A, B, C, D, E, F and Deadend) and 7 Brockman bedrock deposits at Packsaddle (P1W, P1E, P2, P3, P4, P5 and P6), while the 4 deposits at South Flank (Highway, Grand Central, Vista Oriental and R deposit) are fully Marra Mamba deposit (Figure 1-5).

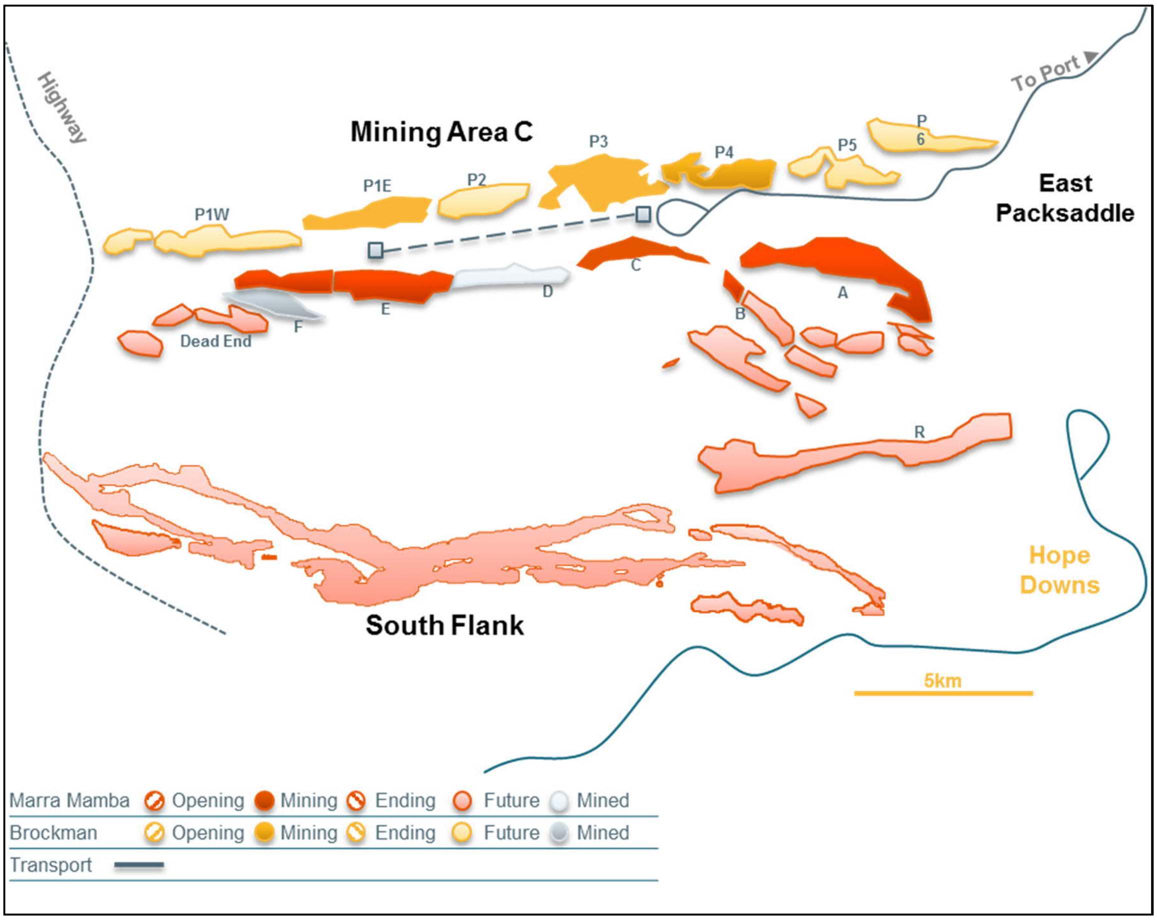


Figure 1-5 Location of MAC and SF deposits (Perring and Hronsky, 2019)

1.2.4 Surface Water

The central and eastern sections of MAC and SF are located within the upper reaches of the Weeli Wolli creek catchment, and the western sections of MAC and SF are located in the Coondewanna catchment (see Figure 1-6).

The natural divide between the Weeli Wolli and Coondewanna catchments is on the west side of the E Deposit crusher at MAC. The mine drainage feature in the Weeli Wolli catchment is Weeli Wolli Creek, an ephemeral feature flowing in direct response to large rainfall events. Flows are generally recorded 0-2 times a year, and flow events are generally short in duration with little post rainfall persistence. Weeli Wolli Spring, a natural surface expression of groundwater flow and the main water feature in Weeli Wolli Creek, is located approximately 25 km downstream of MAC. Weeli Wolli Creek discharges to the Fortescue Marsh approximately 60 km downgradient from Weeli Wolli Spring. The Weeli Wolli catchment area upstream from Weeli Wolli Spring is approximately 1,450 km^2, and the total Weeli Wolli catchment discharging to Fortescue Marsh is approximately 4,220 km^2 (BHP, 2018b).

Coondewanna catchment is an internally draining catchment of approximately 860 km^2. Catchment run-off drains to an internal depression named Lake Robinson, located in the south-eastern section of the catchment known as Coondewanna Flats (BHP, 2018b). Lake Robinson is an ephemeral feature, and it is estimated that inundation of Lake Robinson occurs approximately once every four to five years (RPS, 2013, as cited in BHP, 2018b).

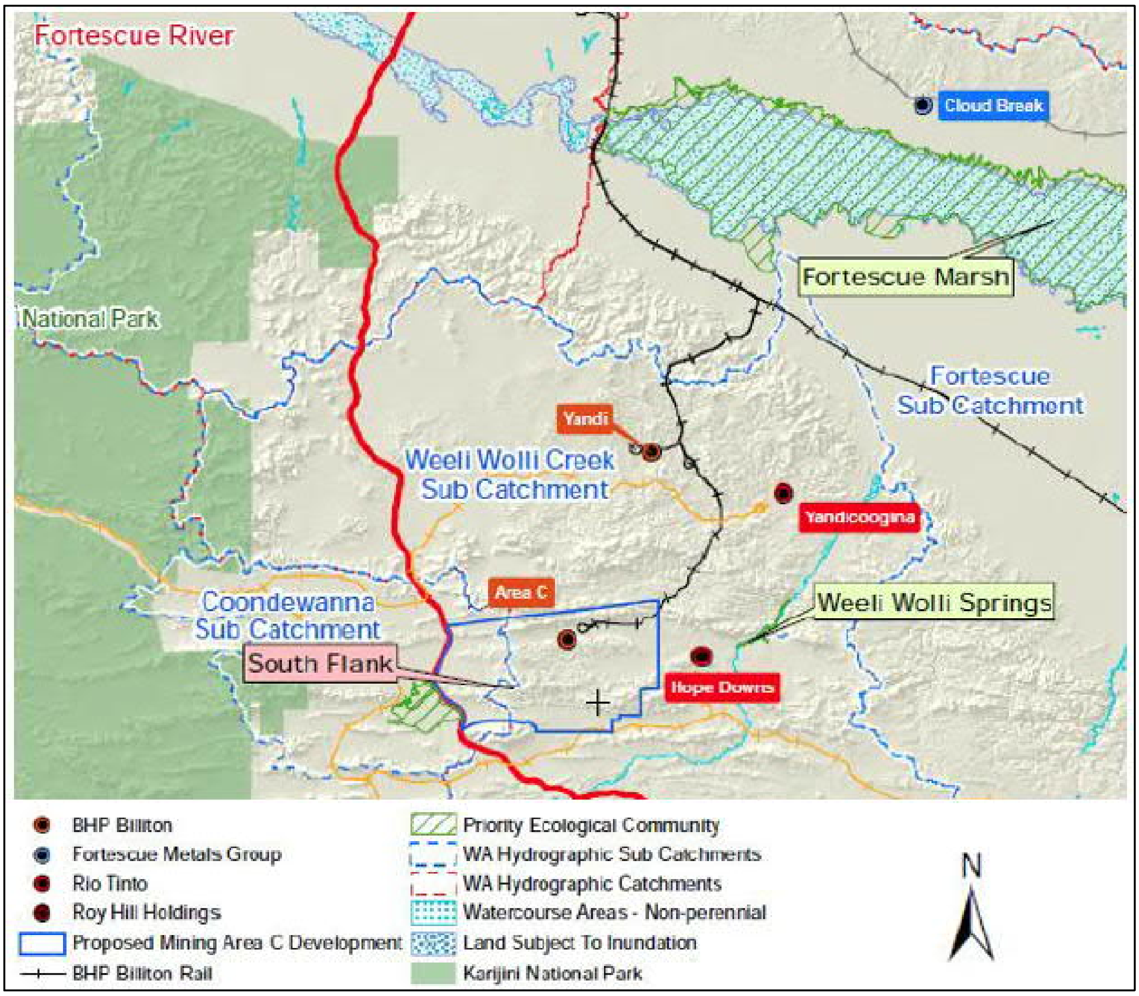


Figure 1-6 Mining Area C and South Flank surface water catchment (modified from BHP, 2020)

1.2.5 Groundwater

1.2.5.1 Hydrogeological Framework

There are two main aquifer types in the region, including the regional aquifer and the orebody aquifers as described below:

- The regional aquifer comprises weathered dolomite of the Paraburdoo Member (Wittenoom Formation) and overlying Tertiary Detritals. The Paraburdoo dolomite has undergone karstification over much of the region and has high permeability (BHP, 2019b).
- The southern Marra Mamba Formation orebodies have significant saturated thicknesses and present the orebody aquifers. These have variable connectivity to the regional aquifer (BHP, 2018c).

The northern Brockman Formation orebodies at MAC are unsaturated or have limited saturated thicknesses. These orebodies are further hydraulically disconnected from the regional aquifer by the low permeability Mount McRae Shale and the Mount Sylvia Formations (with the latter units acting as aquitards).

The North Flank has further been intruded by a series of dolerite dykes, with northwest – southeast and northeast – southwest orientations. These mafic dykes weather to clay – forming low permeability restrictions to groundwater flow (BHP, 2018c).

A summary of hydraulic conductivity (K) and specific yield (Sy) values, derived through groundwater numerical model calibration, is provided in Table 1-2.

Table 1-2 Hydraulic parameters derived from numerical model calibration (BHP, 2018c)

Material	K* (m/d)	Sy (%)
Calcrete	25	20
Tertiary Detritals	1.5 - 5	5 - 10
Weeli Wolli Formation	1×10^{-3}	0.1
Unmineralised Brockman Formation	1×10^{-3}	0.1
Mineralised Brockman Formation	3	20
Mount McRae Shale and Mount Sylvia Formation	1×10^{-3}	0.1
Fresh Paraburdoo Dolomite / Bee Gorge (Wittenoom Formation)	0.1	0.1
Weathered Paraburdoo Dolomite (Wittenoom Formation)	20 - 100	0.2 - 0.5
West Angela Shale (Wittenoom Formation)	0.1	0.1
Unmineralised Mount Newman Member (Marra Mamba Formation)	0.8	0.1
Submineralised Mount Newman Member (Marra Mamba Formation)	1	0.5
Mineralised Mount Newman Member (Marra Mamba Formation)	3	20
McLead Member (Marra Mamba Formation)	1×10^{-4}	0.1
Nammuldi Member (Marra Mamba Formation)	1×10^{-4}	0.1

1.2.5.2 Groundwater Flow

Conceptual groundwater flow directions are shown on Figure 1-7. Groundwater generally flows from west to east, from the Coondewanna Flats recharge area along the strike of the Wittenoom Formation and Tertiary Detritals in the North and South Flank valleys. Dolerite dykes and fault systems are known to intersect the dolomite and present local, leaky barriers to groundwater flow (BHP, 2017b). Weeli Wolli Springs and the alluvial aquifer underlying the Springs mark the discharge point for groundwater flow from the groundwater catchment, with groundwater flows concentrated into the Spring by low permeability basement rocks (BHP, 2018c).

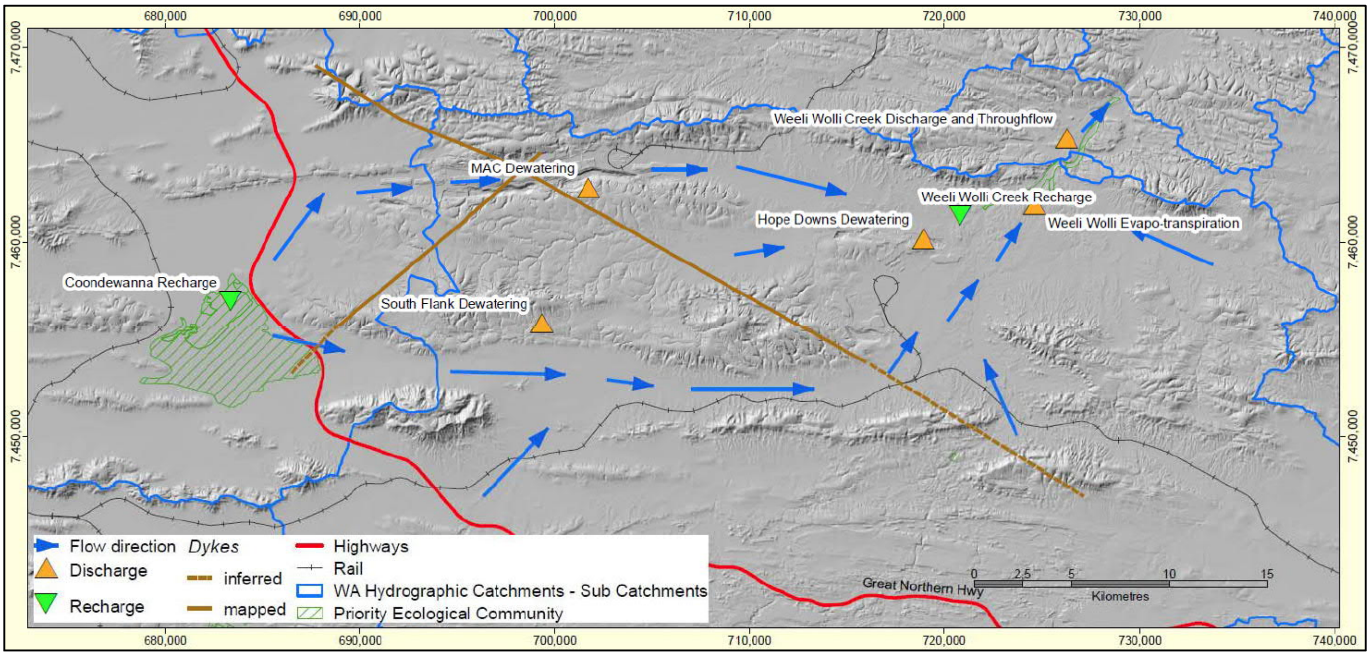


Figure 1-7 Conceptual groundwater flow (BHP, 2017b)

1.2.5.3 Groundwater

Groundwater pH is circum-neutral to slightly alkaline, generally ranging between pH 7 and 8 (BHP, 2019b). Salinity levels, as indicated by electrical conductivity (EC) measurements, are generally relatively low with some differentiation across the project area. General EC patterns include the following observations:

- Groundwater is consistently fresh (with EC measurements between 400 and 800 µS/cm) at A, C and E Deposit orebodies.
- Groundwater is consistently fresh and very consistent at Coondewanna Flats (with EC measurements between 600 and 800 µS/cm).
- At the Hope Downs Valley (observations just east of A Deposit), groundwater is somewhat more saline with EC measurements ranging between 1,000 and 1,600 µS/cm. This higher salinity has been interpreted to be due to evaporation processes at and near Weeli Wolli Spring (BHP, 2018c).

1.2.6 Potential Pathways

Potential pathways for AMD transport that would apply to MAC and SF include:

- Seepage from waste rock overburden storage areas (OSAs) and low-grade ore stockpiles to surface water or groundwater, with subsequent potential AMD transport in surface water or groundwater.
- Runoff from pit wall rock to the base of pits. Post-closure, pits that are not backfilled would be expected to form groundwater sinks limiting migration of impacted water, if any, away from the pit lakes. Backfilling of pits could however result in a groundwater through flow system which could result in impacted groundwater migrating away from the pits (BHP, 2020).

Ex-pit surface water flows that have been in contact with OSAs and low-grade ore stockpiles could present pathways towards Weeli Wolli Creek (for drainage within the Weeli Wolli catchment) and Robinson Lake (for drainage within the Coondewanna catchment).

Groundwater pathways would be expected to be predominantly through the regional and orebody aquifers. During mine operations and active dewatering, groundwater flows in the immediate vicinity of the dewatered pits would be towards the pit, and depending on the extent of the groundwater dewatering cone, flows from underneath the OSAs may also be towards the pits. Away from the dewatering cones, groundwater flow would be towards the east. If flow-through conditions develop in backfilled pits once operations cease groundwater flow from these pits would be expected to be to the east towards Weeli Wolli Springs.

1.2.7 Potential Receptors

1.2.7.1 Environmental Receptors

No Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) occur within the MAC Development Envelope (BHP, 2020), which include both the MAC and SF Operations.

PECs that fall outside of the Development Envelope, but within the Weeli Wolli and Coondewanna catchments, include Weeli Wolli Spring, Ben's Oasis and the Coondewanna Flats wetlands – including Lake Robinson (BHP, 2018a). The locations of these ecohydrological receptors are shown on Figure 1-8.

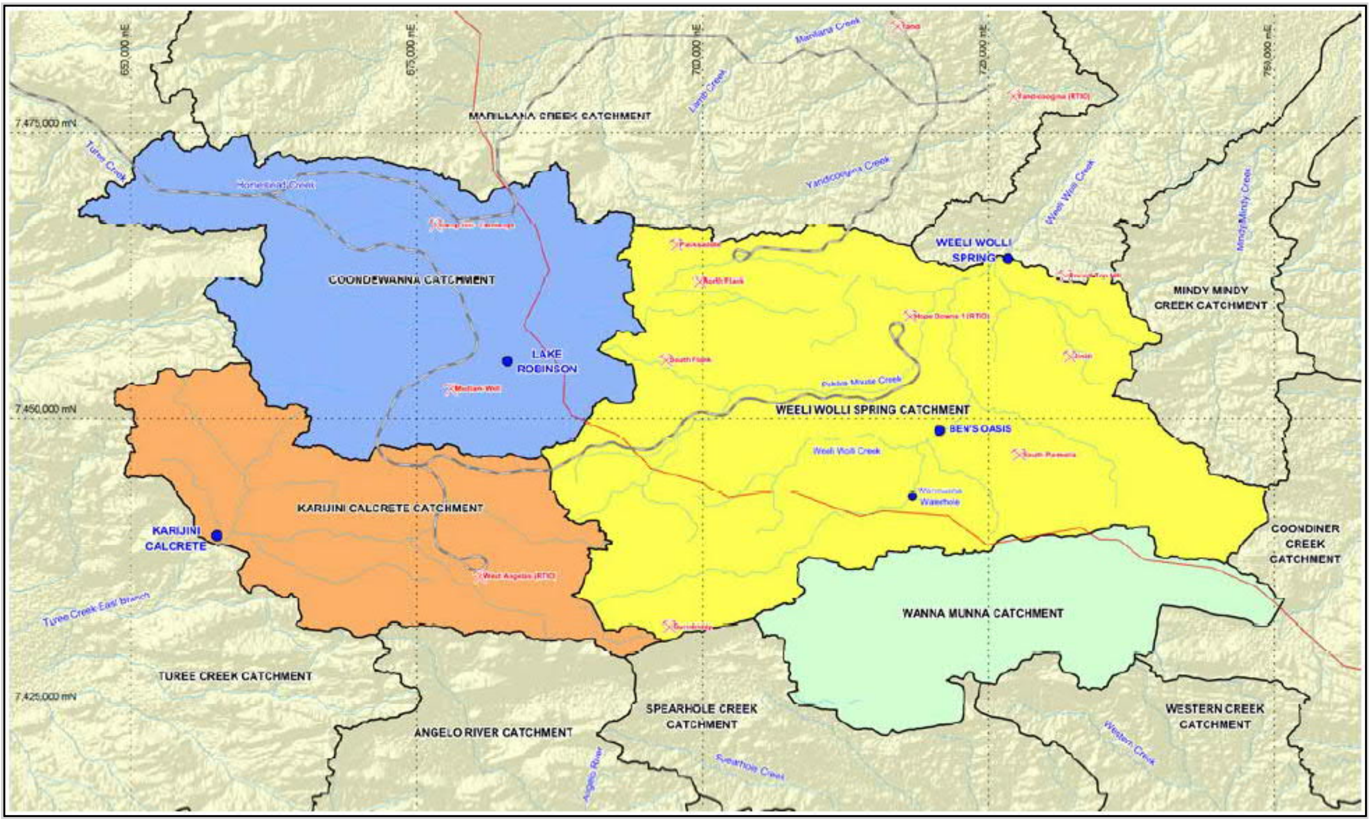


Figure 1-8 Locations of Weeli Wolli Spring, Ben's Oasis and Lake Robinson in relation to surface water catchments (BHP, 2018b)

A description of these receptors, taken from BHP (2017b), is provided below:

- Weeli Wolli Spring: The Spring is located at a point where Weeli Wolli Creek flows through a gorge within the Wildflower Range. The Spring area is recognised as having multiple ecological values and has been listed as a Priority 1 PEC. The community is described as fringing forest or woodland of *Melaleuca argentea* and *Eucalyptus camaldulensis* over trees of Coolibah and a dense shrub layer dominated by *Acacia citronoviridis*. A relatively high diversity of stygofauna is associated with the calcrete and alluvial aquifer at the Springs. The creek valley at Weeli Wolli Spring further supports a diverse bird assemble of over 60 species and a microbat assemble including the Ghost bat (*Macroderma gigas*) – a State listed species.
- Ben's Oasis: Ben's Oasis is a perennial pool along the channel of Weeli Wolli Creek where groundwater has mounded upstream of a dolerite dyke. These pools support riparian woodland and forest associations and has been designated as a Priority 1 PEC along with Weeli Wolli Spring. Limited documented information is available on the ecology of Ben's Oasis.
- Coondewanna Flats including Lake Robinson: The wetland features are located in an internally draining alluvial plain which is the terminus for surface water flow within catchment. While the Coondewanna Flats wetlands present surface water receptors, they are not considered to present groundwater receptors given significant (> 20 m below ground surface) depth to groundwater. The Flats include several vegetation communities with ecological value and is listed as a PEC. A series of sub-types have been identified including:
  - Tussock grassland *of Eriachne benthamii*, *Eulalia aurea* and *Themeda triandra* with open woodland of *Eucalyptus victrix* over shrubland of *Duma florulenta*. The vegetation type is limited to the Lake Robinson depression and corresponds with the Priority 1 PEC.
  - Open forest of *Acacia aptaneura* and *Eucalyptus victrix* over open tussock grassland of *Eulalia aurea* and *Eriachne benthamii* with open shrubland of *Duma florulenta*. The vegetation type is widespread across the Coondewanna Flats and corresponds with the Priority 3 PEC.
  - Closed forest of *Eucalyptus victrix* and *Acacia aptaneura* and over open tussock grassland of *Eriachne benthamii* and *Eulalia aurea* with open shrubland of *Duma florulenta.* The vegetation type occurs as a mosaic of discrete patches and corresponds with the Priority 3 PEC (BHP, 2017b).

1.2.7.2 Heritage Receptors

Comprehensive archaeological and ethnographic surveys have been undertaken at the MAC operations and heritage sites have reportedly been recorded at different locations within the MAC Development Envelope (BHP, 2020). The locations and extent of the recorded Aboriginal heritage sites were not recorded in the latest closure management plan (BHP, 2020) out of respect for the wishes of Traditional Owners. For the purposes of this AMD risk assessment, it can be stated that none of the known heritage sites fall within surface water drainage lines, or within areas that may be affected by groundwater seepage.

1.2.7.3 Borefields

Groundwater is widely abstracted in the region and groundwater borefields include the MAC borefield, the SF borefield, the Hope Downs borefield (operated by Rio Tinto) and pastoral bores. Known locations of mine production bores are shown on Figure 1-9.

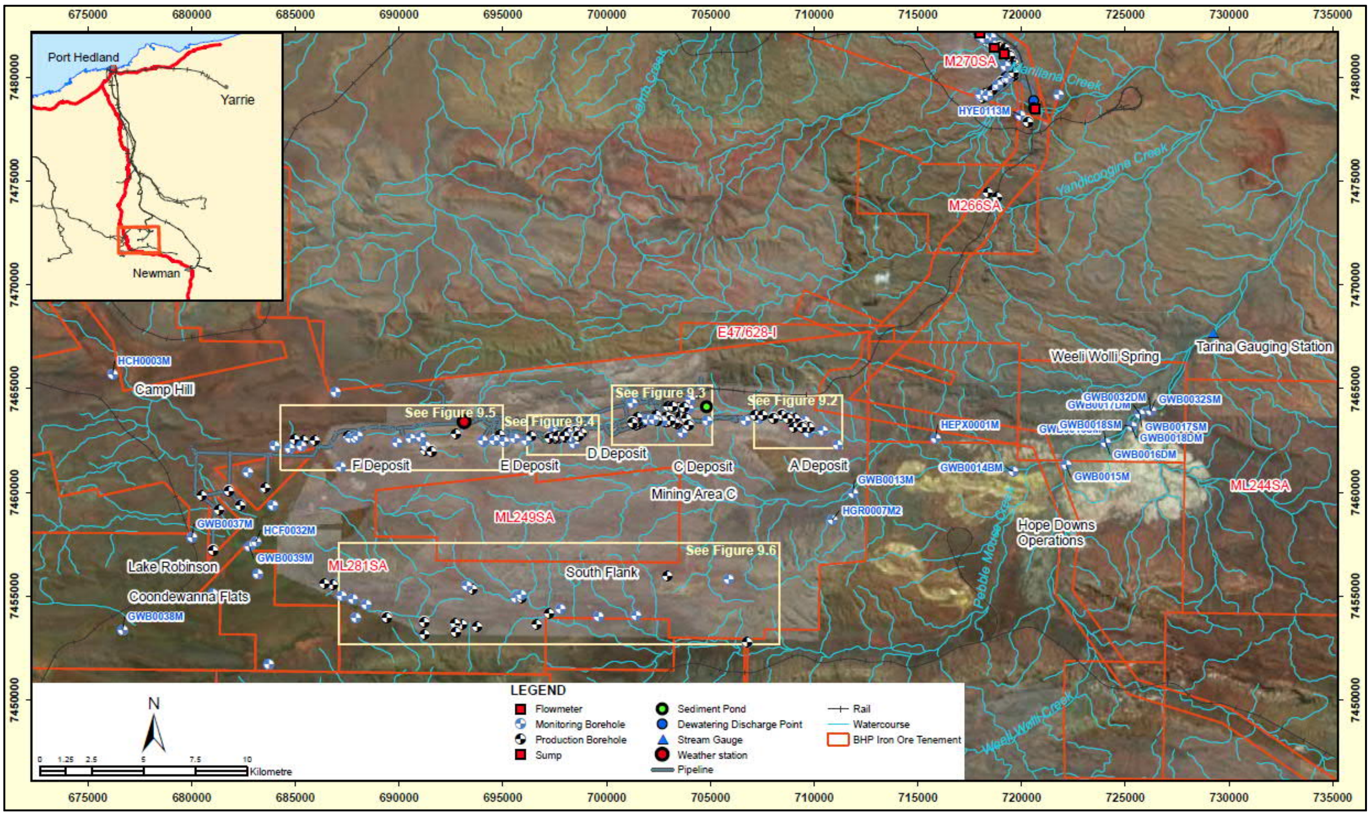


Figure 1-9 Regional borefields (modified from BHP, 2019b)

A description of the borefields is provided below:

- The MAC borefields include productions bores located at multiple deposits including A Deposit, C Deposit, D Deposit, E Deposit and F Deposit. Groundwater is further abstracted from four Rail Loop bores, installed in the Paraburdoo Member and located to the north of C Deposit. The borefield provides water for potable use, processing facilities, dust suppression and construction activities.
- The SF water supply borefield, located approximately 7 km to the south of Deposit E. The borefield provides water for potable use, processing facilities, dust suppression and construction activities.
- The Rio Tinto operated Hope Downs water supply borefield is located approximately 10 km to the east and downstream of Deposit A. The borefield provides water supply for potable use, processing facilities, dust suppression and construction activities.

In addition to the mine water supply borefields listed above, pastoral bores are known to occur within the Coondewanna area west of MAC (BHP, 2018c).

2 Assessment Methods

The following section details the methods employed to assess the AMD risk for Packsaddle, North Flank and South Flank. An introduction to AMD is provided in Appendix C. For the purpose of this assessment, AMD is defined in accordance with BHP's Global AMD Management Standard (BHP, 2019a), which aligns with industry accepted guidance (AMIRA, 2002; Price, 2009; INAP, 2010; DMP, 2016; DITR, 2016).

Acid and Metalliferous Drainage (AMD) includes both acidic drainage, metalliferous drainage, and saline drainage resulting typically associated with sulphide oxidation +/- neutralisation reactions releasing acidity, trace metals/metalloids and / or salinity.

- Acidic Drainage: A form of AMD, characterised by low pH, elevated trace metal/metalloid concentrations, high sulphate concentrations and high salinity.
- Neutral-Metalliferous Drainage (NMD): A form of AMD characterised by near-neutral pH, elevated metal/metalloid concentrations, and high sulphate salinity.
- Saline Drainage (SD): A form of AMD, characterised by high sulphate (+/- calcium, magnesium, bicarbonate) salinity but near-neutral to alkaline pH and generally low concentrations of metals/metalloids.

2.1 Data Review

Table 2-1 presents the data sources that were reviewed in the context of identifying potential AMD source hazards as well as already identified pathways and receptors to facilitate a source-pathway-receptor risk assessment.

Table 2-1 List of data sources for review

Data Source Type	File Name
Mining Block Models	cph_20201019_MACA_v8_MM.bmf
	cph_20201005_MACB_v4_MM.bmf
	CPH_20160430_MACC_MM.bmf
	cph_20190312_mac_d_ltp_v3.bmf
	CPH_20201006_EFDeadend_V7V4V3_MM.bmf
	CPH_20201006_EFDeadend_V7V4V3_MM.bmf
	CPH_20201005_MAC_P1W-v4_P1E-v6_MM.bmf
	CPH_20201005_MAC_P1W-v4_P1E-v6_MM.bmf
	cph_20201008_P2-v4_P3-v8_P4-v6_MM.bmf
	cph_20201008_P2-v4_P3-v8_P4-v6_MM.bmf
	cph_20201008_P2-v4_P3-v8_P4-v6_MM.bmf
	CPH_20160430_MACP5_MM_3m.bmf
	CPH_20160430_MACP6__MM__4m.bmf
	cph_20200911_sf_hwy_v6_MM.bmf
	cph_20200911_sf_gc_10yr_MM.bmf
	cph_20200911_sf_vsta_V7_MM.bmf
	CPH_20160801_MACR_MM.bmf
Geological Assay Database	ad_mined_geo_sample.csv; ad_future_geo_sample.csv
	bd_mined_geo_sample.csv; bd_future_geo_sample.csv
	cd_mined_geo_sample.csv; cd_future_geo_sample.csv
	dd_mined_assay_geo_sample.csv
	de_future_geo_sample.csv
	ed_mined_geo_sample.csv; ed_future_geo_sample.csv
	fd_mined_geo_sample.csv

Data Source Type	File Name
	p1e_mined_geo_sample.csv; p1e_future_geo_sample.csv
	pw_mined_geo_sample.csv; pw_future_geo_sample.csv
	p2_mined_geo_sample.csv; p2_future_geo_sample.csv
	p3_mined_geo_sample.csv; p3_future_geo_sample.csv
	p4_mined_geo_sample.csv; p4_future_geo_sample.csv
	p5_future_geo_sample.csv
	p6_future_geo_sample.csv
	hw_mined_geo_sample.csv; hw_future_geo_sample.csv
	gc_mined_geo_sample.csv; gc_future_geo_sample.csv
	vo_mined_geo_sample.csv; vo_future_geo_sample.csv
	rd_future_geo_sample.csv
Environmental Geochemical Dataset	MAC_All_PAF_Extended_Assays.csv
	MAC_All_PAF_Primary_Assays.csv
Surface Topographies & Proposed Pit Shell Solids/Surfaces	cph_20121022_macab_sur_orig-topo_extended.00t; maca_rpdc_014_pitshell.00t; EOFY21_ad_pits_comb_asmined_solid.00t; EOFY21_ad_pits_comb_future_sol.00t
	cph_20121129_macb_original_topo.00t; CPH_20190429_B_Deposit_V4_WF_Pre_Mining_WT.00t; EOFY21_BD_Comb_mined_solid.00t; EOFY21_BD_Comb_future_sol.00t; macb_rpdc_012_pitshell.00t
	cph_20121022_macc_sur_orig-topo.00t; MAC_CD_Pit_Shell.00t; EOFY21_CD_asmined_solid.00t; EOFY21_CD_comb_future_sol.00t;
	cph_20121022_macc_sur_orig-topo.00t; macd_rpd_005_mined_sol.00t; macd_rpdc_008_pitshell.00t
	cph_20121022_macfdead_sur_orig-topo.00t; deadend_future_Solid.00t; deadend_pitshell_v3.00t
	CPH_20121022_MACDEADEF_TOP_ORIGINAL.00t; ed_rpdc_036_pitshell.00t; EOFY21_ED_future_Solid.00t; EOFY21_ED_Mined_Solid.00t
	CPH_20121022_MACDEADEF_TOP_ORIGINAL.00t; FD_asmined_solid.00t; macf_rpdc_018_pitshell.00t
	CPH_20170622_P1E_P1W_Orig_Topo.00t; EOFY21_p1E_comb_future_sol_NEW2.00t; EOFY21_p1E_comb_Mined_sol_New.00t; P1E_rpdc_pitshell.00t
	cph_20121129_macp1w_surv_orig-topo.00t; EOFY21_pw_comb_future_sol.00t; EOFY21_pw_comb_mined_sol.00t; pw_rpdc_008_pitshell.00t
	MAC_20151020_P2P3P4_Surv-orig-topo_ext.00t; macp2_rpdc_001_pitshell.00t; EOFY21_p2_comb_mined_sol.00t; EOFY21_p2_comb_future_sol.00t
	cph_20121022_macp3_sur_orig-topo.00t; p3_rpdc_034_pitshell.00t; EOFY21_P3_Mined_Solid_NEW2.00t; EOFY21_P3_Future_Solid_NEW4.00t
	MAC_20151020_P2P3P4_Surv-orig-topo_ext.00t; p4_rpdc_021_pitshell.00t; EOFY21_P4_Mined_Solid_NEW3.00t; EOFY21_p4_comb_future_sol_New3.00t
	cph_20070801_macp5_topo.00t; MAC_P5_pitshell.00t; macP5_comb_future_sol.00t
	CPH_20141111_P6_Orig_Topo.00t; MAC_P6_pitshell.00t; macp6_comb_future_sol.00t
	CNPH_20190829_SF_SUR_TOPO.00t; SF_HWY_pitshell.00t ; EOFY21_hwy_comb_Mined_sol_v2.00t; EOFY21_hwy_comb_future_sol.00t
	CNPH_20190829_SF_SUR_TOPO.00t; SF_GC_pitshell.00t; EOFY21_GC_Mined_Solid_v2.00t; EOFY21_GC_comb_future_sol.00t
	CNPH_20190829_SF_SUR_TOPO.00t; SF_VO_pitshell.00t; EOFY21_vo_comb_mined_sol_v2.00t; EOFY21_vo_comb_future_sol.00t
	CNPH_20160601_R_DEP_WF_TOPO.00t; SF_R_Pitshell.00t; RD_Future_sol.00t
Mine Plan	cph_20200512_MAC&SF_FY22LoA_Pushback_sequence
Mine Closure Plan	Mining Area C_Mine Closure Plan_Rev 3.3
Previous AMD Risk Assessment	KCB, 2014. Mining Area C Preliminary AMD Risk Assessment, July 2014 BHP, 2016. Preliminary Southern Flank AMD Risk Assessment, August 2016
Vertebrate Fauna Study	BHP, 2017b. Mining Area C Southern Flank Proposal. Hydrological Impact Assessment and Water Management Summary.
Flora and Vegetation Study	BHP, 2017b. Mining Area C Southern Flank Proposal. Hydrological Impact Assessment and Water Management Summary.

Geological data is routinely collected by BHP from drill holes. The geological and assay data are entered into a master database, which is used to prepare 3D geological and resource models. Two suites of data are typically collected:

- Standard assay suite – Fe, SiO2, Al2O3, TiO2, CaO, P, S, MgO, Mn, K2O, Na2O, and loss on ignition (LOI); and
- Extended assay suite – As, Ba, Cl, Co, Cr, Cu, Ni, Pb, Sn, Sr, V, Zn, and Zr.

In addition, drilling logs record weathering characteristics, the water table elevation, and stratigraphic information.

2.2 WAIO AMD Classification

WAIO AMD Classifications (BHP, 2018a) was used to assess the acid generation potential of individual waste rock blocks within the MAC and SF deposits. This classification was also applied to the environmental geochemical dataset to validate the classification against industry standard approaches based on laboratory testwork (e.g., AMIRA, 2002 and Price, 2009).

BHP has developed an AMD classification system that assigns an AMD Class to waste rock across all planning levels, including mining models. WAIO classifies wastes to inform the management of different waste types according to their geochemical and physical properties using two interconnected classifications; AMD class (Figure 2-1) and physical property (WMAT) class (WMAT analysis is excluded from this assessment). These classifications have been devised to support informed management of beneficial and problematic waste rock during mine planning and operations. The preliminary classifications are included into mining and geological models, with classifications confirmed though analysis and inspection of blast cone chips prior to mining. Furthermore, targeted test work is also conducted, as required, to validate the AMD classification assumptions and physical materials properties.

Classification	Geochemical / Physical Stability Stratigraphy	Description
AMD1	**Geochemically problematic:** All stratigraphies below water table, NAPP ≥3 kgH_2SO_4/tonne.	**Adverse AMD waste rock** for containment within OSAs following specific dumping guidance due to the adverse geochemical properties leading to Acid and Metalliferous Drainage (AMD). **Management recommended** AMD1: Paddocked dumped and encapsulated AMD2 /AMD3: Encapsulated by at least 10m of geochemically stable waste.
AMD2	**Geochemically problematic:** All stratigraphies above water table, NAPP ≥3 kgH_2SO_4/tonne.	
AMD3	**Geochemically problematic:** All Non-bedrock stratigraphies, ie. Detritals. NAPP ≥3 kgH_2SO_4/tonne, includes alluvial, Scree, Tertiary Detritals (TD1, TD2, and TD3)	

Figure 2-1 WAIO AMD classification system (all other material is classified as AMD Class 0 and is considered as inert waste)

The AMD classification system is based on net acid production potential (NAPP) values calculated from parameters in BHP's extensive assay datasets. The NAPP approach evaluates the balance between acid generating and acid neutralising potential for a sample or mine block. Where material from below the water table (BWT) is assessed as having a NAPP ≥ 3 kg H_2SO_4/t, the mine block is classified as PAF (AMD Class = 1) and encapsulated in PAF management cells as per WAIO's AMD Management Standard (BHP, 2018a). Weathered and detrital material assessed as having a NAPP ≥ 3 kg H_2SO_4/t are managed as a lower AMD risk material (AMD Class = 2 and 3 respectively). All other material is classified as NAF (AMD Class = 0). More information is provided in Appendix D.

2.3 Acidic Drainage Potential

This assessment is designed to identify specific potential acid generation or acid neutralisation characteristics associated with key materials within the proposed pit. It was completed to highlight stratigraphies and/or mine domains that may pose an acid generation hazard as well as those that may offer beneficial characteristics (i.e., acid neutralisation capacity).

The key data sources interrogated were the mining model, the proposed pit shell, and the environmental geochemical dataset. The geological assay database (primary assay), on which the mining model is derived, was used to provide additional information, where required.

The mining models assessment was restricted to material within the bounds of the proposed pit shell as well as material to remain in the pit wall following mining. The geological DH assay database used to generate the mining models contains 506,030 drillhole samples (145,385 for Packsaddle deposits, 184,512 for North Flank deposits and 176,133 for South Flank deposits), with S, Ca, Mg and LOI data available to generate the AMD layer in the resource and geological models. Generally, environmental geochemical sampling programs select samples from in-fill exploration programs that are assumed to be within a given pit shell at the time of sampling. However, depending on the mine plan, some of the drill holes chosen for testing may not be included in the final pit shell bound. For the environmental data assessment within the risk assessment, preference was given to the samples sourced from within bounds of the pit shells assessed however, as applicable, supporting data were also sourced from samples outside the pit shell.

The environmental geochemical dataset was used to assess the geochemical properties of key materials via standard industry AMD characterisation procedures (Appendix C). Acid base accounting (ABA) was conducted to predict the acid generation characteristics of a waste rock material through determination of the acid neutralising capacity (ANC) and the maximum potential acidity (MPA). The environmental geochemical dataset was assessed to facilitate the refinement, where needed, of the current understanding of potential AMD hazard risk of key materials. The environmental geochemical dataset provides detailed results regarding the potential acidity, neutralising potential, leaching potential of metals and metalloids, and salts.

Key geochemical parameters assessed, within both the mining model and assay database, included sulphur, magnesium, calcium, and loss on ignition. Sulphur was used to estimate the maximum potential acidity (MPA), while calcium, magnesium, and loss of ignition were used to infer the acid neutralisation capacity ANC (Appendix D). Using the calculated MPA and ANC values, ABA is undertaken to calculate the NAPP value.

The mining model provides the primary data source for the assessment of potential AMD hazards. Additional mining model parameters assessed include spatial coordinates, block volumes, AMD classifications, weathering classifications, proximity to the pre-mining groundwater table, and mining designations (Table 2-2). Volumes of waste rock per AMD Class are tabulated and assessed as well as waste volumes per key geochemical parameter (e.g. sulphur content, ANC, and NAPP). Data processing and visualisation software Microsoft PowerBI was used to analyse the datasets and estimate the potential AMD hazard.

Table 2-2 Summary of relevant mining designation types

Category	Mining Designation
High Grade	14
Detritals	8
Blend Grade (assessed in combination with Low Grade materials)	7
Low Grade	6
Fibrous	3
PAF Waste Rock (AMD Class 1)	2
Waste Rock (AMD Classes 0, 2, and 3)	1

Note AMD Classes 0, 1, 2, and 3 are also assigned to ore and therefore the mining designation must be used in conjunction with the AMD classes.

Estimation of final pit shell surface areas per AMD class was undertaken to assess the potential for exposed AMD 1, 2, or 3 surfaces to generate AMD. The method used was as follows:

- Mining models and pit shells were loaded into Maptek's Vulcan software.
- The pit shells strings were triangulated to create a 3D surface.
- A 3D surface showing the intersections of triangulated pit shells and the mining model was created to identify exposures of AMD Class 1, 2, and 3 material.

- Where exposures of AMD Class 1, 2, and 3 material were identified, polygons were created that were wrapped to the 3D triangulated surface to enable an estimation of the surface area (m^2).

2.4 Metalliferous and Saline Drainage Potential

This assessment is designed to identify neutral metalliferous drainage (NMD) and/or saline drainage (SD) characteristics (e.g. high sulphur, high ANC) for key material domains within the proposed pit that are associated with sulphide oxidation. It was completed to highlight stratigraphies and/or mine domains that may pose a higher NMD/SD risk.

The key data sources interrogated to assess the NMD/SD source hazard potential of waste rock and wall rock, were the mining model, the proposed pit shell, and the environmental geochemical dataset. The assessment was restricted to material within the bounds of the proposed pit shell as well as material to remain in the pit wall following mining.

High sulphur and excess ANC is a characteristic of both NMD and SD, therefore, in the absence of elevated sulphur, NMD and SD would be unlikely. Sulphur and ANC distribution within the mining model were interrogated to identify high sulphur material (i.e. > 0.5 wt% S) with accompanying high ANC so that the resulting NAPP is <3 kg H_2SO_4/t. The potential for NMD/SD is not limited to high sulphur materials that also contain high ANC materials. For instance, co-disposal of high ANC waste rock with high sulphur waste rock as a management approach can lead to elevated sulphate and/or metal concentrations (e.g. NMD/SD). Therefore, the assessment of NMD and SD was not limited to materials containing both high sulphur and high ANC and was also considered when recommending waste rock disposal options.

The NMD and/or SD hazard potential was also assessed through interrogation of the environmental geochemical dataset, specifically sulphur speciation, NAG, and titrated ANC.

2.5 Elemental Composition

Solid phase total or near-total analysis is achieved in two major steps. In the first step, the sample is digested in a strong acid combination or hot chemical flux. This is followed by analysis of the digestion solution by a technique such as inductively coupled plasma (ICP) or x-ray fluorescence (XRF). Total elemental analysis can be used to identify elements enriched relative to average crustal abundances. However, an enrichment in a specific element does not imply mobility or bioavailability.

An elemental enrichment assessment was completed using the Geochemical Abundance Index (GAI; Förstner et al. 1993). The GAI quantifies an assay result for a particular element in terms of the average crustal abundance of that element. The GAI (based on a log-2 scale) is expressed in 7 integer increments (viz. 0 to 6). A GAI of 0 indicates that the content of the element is less than, or similar to, the average crustal-abundance; a GAI of 3 corresponds to a 12-fold enrichment above the average crustal-abundance; and so forth, up to a GAI of 6 which corresponds to a 96-fold, or greater, enrichment above average crustal abundances. Generally, a GAI of 3 or greater signifies enrichment that warrants further examination. The average-crustal-abundances of the elements for the GAI calculations are based on the values listed in Field Geologists' Manual (AusIMM, 2011) supplemented with data from Bowen (1979) for mean crustal abundance for the elements Al, Ca, Fe, K, Mg, Na, P, S, and Ti.

2.6 Approach to Source-Pathway-Receptor Risk Assessment

Risk Management is an integral component of the BHP closure planning process. The risk management process involves establishing the context, risk identification, risk analysis, risk evaluation and risk treatment identification associated with selection of closure options or the design and execution of closure projects.
Initially a source hazard risk ranking is completed to identify potential key AMD sources (e.g. mine domains). Although the ranking is relative to the other identified potential key AMD sources for the site, potential sources are assigned a source hazard risk (low, moderate, or high) based on type and quantity (of both volume/area and percentage) of AMD waste rock the source will contain (Table 2-3 and Table 2-4).

Table 2-3 Source hazard risk categories (waste rock and low-grade ore)

Source Hazard Risk	AMD1		AMD2 and AMD3	
	Volume (Mm^3)	Percentage	Volume (Mm^3)	Percentage
Low	<0.1	<0.5%	<1	<5%
Moderate	0.1 - 0.5	0.5 - 2.5%	1 - 10	5% - 10%
High	>0.5	>2.5%	>10	>10%

If a different source hazard risk exists between different AMD types, the highest source hazard risk applies.

Table 2-4 Source hazard risk categories (pit surface exposures)

Source Hazard Risk	AMD1		AMD2 and AMD3	
	Surface Area (m^2)	Percentage	Surface Area (m^2)	Percentage
Low	<2,500	<0.2%	<25,000	<2%
Moderate	2,500 - 25,000	0.2% - 1%	25,000 - 125,000	2% - 10%
High	>25,000	>1%	>125,000	>10%

If a different source hazard risk exists between different AMD types, the highest source hazard risk applies.

AMD risk assessments involve the evaluation of source, pathway and receptor risk (Figure 2-2) of impacts for environmental, ecological or human health risk. The process involves technical specialists in quantitative and qualitative assessment based on scientific data and information. Relevant and current knowledge on source, pathway and receptors is used to inform the overall AMD risk assessment.

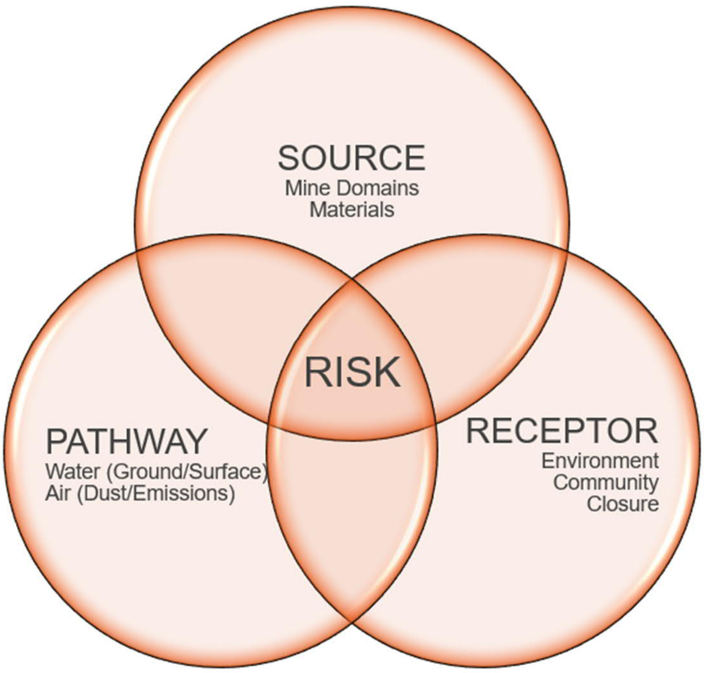


Figure 2-2 Source – Pathway – Receptor (SPR) Model (adapted from *INAP, 2009*)

3 Results of AMD Source Hazard Assessment

The following section details the results of the AMD source hazard assessment for MAC (North Flank and Packsaddle) and SF, in this order. Tabulated results from the environmental geochemical dataset are provided in:

- Appendix F – Environmental Geochemical Results;
- Appendix G – Environmental Geochemical PowerBI Dashboard.

3.1 Acidic Drainage Potential

The following section details the findings of the acidic drainage potential assessment.

To aid discussion of total sulphur contents, the following ranges are used:

- Very Low ≤ 0.1 wt%
- Low = 0.1-0.2 wt%
- Low-Moderate = 0.2-0.5 wt%
- Moderate = 0.5-1.0 wt%
- High ≥ 1.0 wt%

To aid discussion of ANC, the following ranges are used:

- Very Low ≤ 1 kg H_2SO_4/t
- Low = 1-10 kg H_2SO_4/t
- Low-Moderate = 10-20 kg H_2SO_4/t
- Moderate = 20-50 kg H_2SO_4/t
- High ≥ 50 kg H_2SO_4/t

3.1.1 Mining Block Model Data

3.1.1.1 Summary

This section discusses the mining block model outputs and covers both as-mined and to-be-mined waste materials. The volumes of as-mined and to-be-mined waste rock and low-grade ore per AMD class per deposit are presented in Table 3-1 to Table 3-4. Table 3-3 and Table 3-4 illustrates the % distribution of mine waste (waste rock and low-grade ore) as a function of AMD class for the LoA of each deposit and associated mining hub.

The key observations from the mining model material balance are:

<u>MAC Packsaddle and North Flank deposits</u>

- The overwhelming majority of waste rock (99.7%) and low-grade ore (99%), as-mined and to-be-mined across the Packsaddle and North Flank deposits are classified as AMD0 (NAF). For each single deposit the proportion of AMD0 mine waste (waste rock and low-grade ore combined) is generally greater than 99%, with the exception of P1E (98.9%), P6 (97.9%), B deposit (98.2%), and F deposit (96.3%).
- None of the mining block models predict any as-mined or to-be-mined AMD Class 1 blocks, for waste rock and low-grade ore alike.
- AMD Class 2 blocks comprise appx. 0.3% (or 1,712,000 m^3) and 0.9% (or 5,018,000 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The volume of AMD2 mine waste for the Packsaddle and North Flank deposits across the LoA is low, with approximately 1,166,800 m^3 (or 0.35%) and 545,200 m^3 (or 0.16%) of AMD2 waste rock expected at Packsaddle and North Flank respectively. Approximately 1% of low-grade at Packsaddle (2,701,600 m^3 or 0.75%) and North Flank (2,316,400 m^3 or 1.09%) are predicted to be AMD2. Note however, that this is a conservative estimate, as not all of the low-grade ore will be wasted, and the WAIO AMD classification overestimates the proportion of AMD2 waste.

- Of the total volume of AMD2 waste predicted at MAC, 32% (or 545,000 m^3) will be produced by North Flank pits, and 68% (or 1,166,800 m^3) will be produced by Packsaddle pits.
- All pits, but P6, B deposit, and C deposit, are predicted to generate <1% of AMD2 waste rock for the LoA.
- Of the total volume of AMD2 low-grade ore predicted at MAC, 46% (or 2,316,400 m^3) will be produced by North Flank pits, and 54% (or 2,701,600 m^3) will be produced by Packsaddle pits.

- AMD Class 3 blocks comprise appx. 0.1% (or 747,600 m^3) of the total low-grade ore as-mined and to-be mined volume.
  - Of the total volume of AMD3 low-grade ore predicted at MAC, the vast majority (97% or 722,800 m^3) will be produced by North Flank pits, and only 3% (or 24,800 m^3) will be produced by Packsaddle pits.

South Flank deposits

- The overwhelming majority of waste rock (97.9%) and low-grade ore (95.6%), as-mined and to-be-mined across at SF are classified as AMD0 (NAF). For each single deposit the proportion of AMD0 mine waste (waste rock and low-grade ore combined) is generally greater than 1% at all deposits, with the exception of SF R deposit.
- None of the mining block models predict any as-mined or to-be-mined AMD Class 1 blocks, for waste rock and low-grade ore alike.
- AMD Class 2 blocks comprise appx. 1% (or 5,168,800 m^3) and 3% (or 9,614,000 m^3) of the total waste and low-grade ore as-mined and to-be mined volume, respectively.
  - The volume of AMD2 waste rock the LoA is predicted to be less than 1% at R deposit, Highway, and Vista Oriental, while at Grand Central the proportion of AMD2 waste rock is expected to be approximately 3%. Low-grade ore is expected to comprise a somewhat proportion of AMD2 material compared to waste rock, at all deposits, but R deposit. AMD2 low-grade ore across the LoA, will range approximately between 2% at Highway and Vista Oriental and 4% at Grand Central. Note however, that this is a conservative estimate, as not all of the low-grade ore will be wasted, and the WAIO AMD classification overestimates the proportion of AMD2 waste.
- AMD Class 3 blocks comprise appx. 0.7% (or 2,774,800 m^3) and 1% (or 2,878,00 m^3) of the total waste and low-grade ore as-mined and to-be mined volume, respectively. 74% of the AMD3 mine waste predicted to be mined across the LoA is expected to be mostly associated with the Grand Central deposit.

Table 3-1 Total as-mined and to be mined waste rock and low grade ore volume per AMD class per deposit at Packsaddle and North Flank deposits

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m^3)**	**AMD Class 1 (m^3)**	**AMD Class 2 (m^3)**	**AMD Class 3 (m^3)**
Packsaddle (MAC) - Brockman Bedrock	MAC P1W	as-mined	Waste rock	345,600	0	4,400	0
			Low grade ore	2,828,000	0	26,000	0
		to-be-mined	Waste rock	78,187,200	0	527,200	0
			Low grade ore	170,721,600	0	904,800	18,000
		% of total	Waste rock (LoA)	99.3%	0.0%	0.67%	0.00%
		% of total	Low grade ore (LoA)	99.5%	0.0%	0.53%	0.01%
		% of total	Low grade ore and Waste rock (LoA)	99.4%	0.0%	0.58%	0.01%
	MAC P1E	as-mined	Waste rock	11,680,400	0	92,800	0
			Low grade ore	9,544,400	0	302,800	0
		to-be-mined	Waste rock	13,280,800	0	25,600	400
			Low grade ore	10,904,400	0	102,400	0
		% of total	Waste rock (LoA)	99.5%	0.0%	0.47%	0.00%

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	Deposit	Status	Waste type	AMD Class 0 (m^3)	AMD Class 1 (m^3)	AMD Class 2 (m^3)	AMD Class 3 (m^3)
		% of total	Low grade ore (LoA)	98.1%	0.0%	1.94%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	98.9%	0.0%	1.14%	0.00%
	MAC P2	as-mined	Waste rock	781,200	0	4,000	0
			Low grade ore	436,800	0	0	0
		to-be-mined	Waste rock	12,096,000	0	71,200	0
			Low grade ore	15,298,400	0	121,600	0
		% of total	Waste rock (LoA)	99.4%	0.0%	0.58%	0.00%
		% of total	Low grade ore (LoA)	99.2%	0.0%	0.77%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.3%	0.0%	0.68%	0.00%
	MAC P3	as-mined	Waste rock	31,198,800	0	17,200	0
			Low grade ore	19,536,400	0	92,800	0
		to-be-mined	Waste rock	25,810,400	0	0	0
			Low grade ore	22,222,000	0	83,200	0
		% of total	Waste rock (LoA)	100.0%	0.0%	0.03%	0.00%
		% of total	Low grade ore (LoA)	99.6%	0.0%	0.42%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.8%	0.0%	0.20%	0.00%
	MAC P4	as-mined	Waste rock	12,019,200	0	0	0
			Low grade ore	17,714,000	0	78,400	0
		to-be-mined	Waste rock	27,818,800	0	6,800	0
			Low grade ore	28,460,400	0	63,600	0
		% of total	Waste rock (LoA)	100.0%	0.0%	0.02%	0.00%
		% of total	Low grade ore (LoA)	99.7%	0.0%	0.31%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.8%	0.0%	0.17%	0.00%
	MAC P5*	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	18,192,000	0	0	0
			Low grade ore	29,438,700	0	424,800	0
		% of total	Waste rock (LoA)	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore (LoA)	98.6%	0.0%	1.42%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.1%	0.0%	0.88%	0.00%
	MAC P6*	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	15,675,200	0	417,600	0
			Low grade ore	28,299,200	0	501,200	6,800
		% of total	Waste rock (LoA)	97.4%	0.0%	2.59%	0.00%
		% of total	Low grade ore (LoA)	98.2%	0.0%	1.74%	0.02%
		% of total	Low grade ore and Waste rock (LoA)	97.9%	0.0%	2.05%	0.02%

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m^3)**	**AMD Class 1 (m^3)**	**AMD Class 2 (m^3)**	**AMD Class 3 (m^3)**
	Total	**m^3**	**Waste rock**	**247,085,600**	**0**	**1,166,800**	**400**
	% total	**%**		**99.53**	**0**	**0.35**	**0**
	Total	**m^3**	**Low grade ore**	**355,404,300**	**0**	**2,701,600**	**24,800**
	% total	**%**		**99.24**	**0**	**0.75**	**0.01**
North Flank (MAC) - Marra Mamba	MAC A	as-mined	Waste rock	28,666,400	0	0	0
			Low grade ore	20,195,600	0	0	0
		to-be-mined	Waste rock	34,792,800	0	0	0
			Low grade ore	21,294,000	0	0	0
		% of total	Waste rock (LoA)	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore (LoA)	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	100.0%	0.0%	0.00%	0.00%
	MAC B	as-mined	Waste rock	4,114,800	0	34,000	0
			Low grade ore	7,474,400	0	595,200	14,400
		to-be-mined	Waste rock	32,811,200	0	10,800	0
			Low grade ore	37,946,000	0	135,600	702,000
		% of total	Waste rock (LoA)	99.9%	0.0%	0.12%	0.00%
		% of total	Low grade ore (LoA)	96.9%	0.0%	1.56%	1.53%
		% of total	Low grade ore and Waste rock (LoA)	98.2%	0.0%	0.93%	0.85%
	MAC C	as-mined	Waste rock	56,190,800	0	337,200	0
			Low grade ore	43,037,200	0	480,400	0
		to-be-mined	Waste rock	3,417,600	0	0	0
			Low grade ore	3,758,400	0	0	0
		% of total	Waste rock (LoA)	99.4%	0.0%	0.56%	0.00%
		% of total	Low grade ore (LoA)	99.0%	0.0%	1.02%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.2%	0.0%	0.76%	0.00%
	MAC D	as-mined	Waste rock	5,334,450	0	0	0
			Low grade ore	7,436,275	0	0	0
		to-be-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		% of total	Waste rock (LoA)	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore (LoA)	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	100.0%	0.0%	0.00%	0.00%
	MAC E	as-mined	Waste rock	95,782,800	0	98,400	0
			Low grade ore	33,952,800	0	307,600	6,400
		to-be-mined	Waste rock	52,976,000	0	400	0
			Low grade ore	17,075,200	0	0	0
		% of total	Waste rock (LoA)	99.9%	0.0%	0.07%	0.00%
		% of total	Low grade ore (LoA)	99.4%	0.0%	0.60%	0.01%

MAC (Packsaddle and North Flank) - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m^3)**	**AMD Class 1 (m^3)**	**AMD Class 2 (m^3)**	**AMD Class 3 (m^3)**
		% of total	Low grade ore and Waste rock (LoA)	99.8%	0.0%	0.20%	0.00%
	MAC F	as-mined	Waste rock	12,368,000	0	62,000	0
			Low grade ore	8,278,400	0	722,000	0
		to-be-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		% of total	Waste rock (LoA)	99.5%	0.0%	0.50%	0.00%
		% of total	Low grade ore (LoA)	92.0%	0.0%	8.02%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	96.3%	0.0%	3.66%	0.00%
	MAC Dead end	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	9,690,400	0	2,400	0
			Low grade ore	8,956,400	0	75,600	0
		% of total	Waste rock (LoA)	100.0%	0.0%	0.02%	0.00%
		% of total	Low grade ore (LoA)	99.2%	0.0%	0.84%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.6%	0.0%	0.42%	0.00%
	Total	**m^3**	**Waste rock (LoA)**	**336,145,250**	**0**	**545,200**	**0**
	% total	**%**		**99.84**	**0**	**0.16**	**0**
	Total	**m^3**	**Low grade ore (LoA)**	**209,404,675**	**0**	**2,316,400**	**722,800**
	% total	**%**		**98.57**	**0**	**1.09**	**0.34**
Total MAC	**% Total**	**%**	**Waste rock (LoA)**	**99.71**	**0**	**0.29**	**0.00**
	% Total	**%**	**Low-grade ore (LoA)**	**98.99**	**0**	**0.88**	**0.13**

*Note: * mining not started yet at the time of writing.*

Table 3-2 Total as-mined and to be mined waste rock and low grade ore volume per AMD class per deposit at South Flank deposits

South Flank - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m^3)**	**AMD Class 1 (m^3)**	**AMD Class 2 (m^3)**	**AMD Class 3 (m^3)**
South Flank - Marra Mamba	R*	as-mined	Waste rock	0	0	0	0
			Low grade ore	0	0	0	0
		to-be-mined	Waste rock	64,476,800	0	0	67,600
			Low grade ore	63,152,800	0	2,000	400
		% of total	Waste rock (LoA)	99.9%	0.0%	0.00%	0.10%
		% of total	Low grade ore (LoA)	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore and Waste rock (LoA)	99.9%	0.0%	0.00%	0.05%
	SF Highway	as-mined	Waste rock	417,600	0	2,000	0
			Low grade ore	676,000	0	120,800	36,800

South Flank - Material balance for waste and Low-grade ore as a function of deposit and AMD class							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m³)**	**AMD Class 1 (m³)**	**AMD Class 2 (m³)**	**AMD Class 3 (m³)**
		to-be-mined	Waste rock	82,945,600	0	230,000	119,200
		to-be-mined	Low grade ore	53,982,400	0	2,148,400	48,000
		% of total	Waste rock (LoA)	99.6%	0.0%	0.28%	0.14%
		% of total	Low grade ore (LoA)	95.9%	0.0%	3.98%	0.15%
		% of total	Low grade ore and Waste rock (LoA)	98.1%	0.0%	1.78%	0.14%
	SF Grand Central	as-mined	Waste rock	4,354,400	0	383,600	200,400
		as-mined	Low grade ore	5,077,600	0	505,600	172,000
		to-be-mined	Waste rock	104,517,600	0	3,273,600	2,061,200
		to-be-mined	Low grade ore	61,603,600	0	4,066,800	1,801,600
		% of total	Waste rock (LoA)	94.8%	0.0%	3.19%	1.97%
		% of total	Low grade ore (LoA)	91.1%	0.0%	6.24%	2.70%
		% of total	Low grade ore and Waste rock (LoA)	93.4%	0.0%	4.38%	2.25%
	SF Vista Oriental	as-mined	Waste rock	7,443,600	0	12,400	99,600
		as-mined	Low grade ore	6,526,800	0	144,400	369,200
		to-be-mined	Waste rock	122,277,200	0	1,267,200	226,800
		to-be-mined	Low grade ore	83,559,200	0	2,626,000	450,000
		% of total	Waste rock (LoA)	98.8%	0.0%	0.97%	0.25%
		% of total	Low grade ore (LoA)	96.2%	0.0%	2.96%	0.87%
		% of total	Low grade ore and Waste rock (LoA)	97.7%	0.0%	1.80%	0.51%
	Total	**m³**	**Waste rock (LoA)**	**386,432,800**	**0**	**5,168,800**	**2,774,800**
	% total	**%**	**Waste rock (LoA)**	**97.99**	**0**	**1.31**	**0.7**
	Total	**m³**	**Low grade ore (LoA)**	**274,578,400**	**0**	**9,614,000**	**2,878,000**
	% total	**%**	**Low grade ore (LoA)**	**95.65**	**0**	**3.35**	**1**

*Note: * mining not started yet at the time of writing.*

Table 3-3 Predicted percent (%) of total to-be-mined and as-mined waste rock and low grade ore as a function of AMD class per deposit at MAC North Flank and Packsaddle

MAC (Packsaddle and North Flank) - Predicted % of waste and Low-grade ore as a function of deposit and AMD class for as-mined and to be mined mine waste							
Formation	**Deposit**	**Status**	**Waste type**	**% AMD Class 0**	**% AMD Class 1**	**% AMD Class 2**	**% AMD Class 3**
Packsaddle (MAC) - Brockman Bedrock	MAC P1W	% of total	Waste rock	99.3%	0.0%	0.67%	0.00%
		% of total	Low grade ore	99.5%	0.0%	0.53%	0.01%
		% of total	Low grade ore and Waste rock	99.4%	0.0%	0.58%	0.01%
	MAC P1E	% of total	Waste rock	99.5%	0.0%	0.47%	0.00%
		% of total	Low grade ore	98.1%	0.0%	1.94%	0.00%
		% of total	Low grade ore and Waste rock	98.9%	0.0%	1.14%	0.00%
	MAC P2	% of total	Waste rock	99.4%	0.0%	0.58%	0.00%

MAC (Packsaddle and North Flank) - Predicted % of waste and Low-grade ore as a function of deposit and AMD class for as-mined and to be mined mine waste							
Formation	**Deposit**	**Status**	**Waste type**	**% AMD Class 0**	**% AMD Class 1**	**% AMD Class 2**	**% AMD Class 3**
		% of total	Low grade ore	99.2%	0.0%	0.77%	0.00%
		% of total	Low grade ore and Waste rock	99.3%	0.0%	0.68%	0.00%
	MAC P3	% of total	Waste rock	100.0%	0.0%	0.03%	0.00%
		% of total	Low grade ore	99.6%	0.0%	0.42%	0.00%
		% of total	Low grade ore and Waste rock	99.8%	0.0%	0.20%	0.00%
	MAC P4	% of total	Waste rock	100.0%	0.0%	0.02%	0.00%
		% of total	Low grade ore	99.7%	0.0%	0.31%	0.00%
		% of total	Low grade ore and Waste rock	99.8%	0.0%	0.17%	0.00%
	MAC P5	% of total	Waste rock	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore	98.6%	0.0%	1.42%	0.00%
		% of total	Low grade ore and Waste rock	99.1%	0.0%	0.88%	0.00%
	MAC P6	% of total	Waste rock	97.4%	0.0%	2.59%	0.00%
		% of total	Low grade ore	98.2%	0.0%	1.74%	0.02%
		% of total	Low grade ore and Waste rock	97.9%	0.0%	2.05%	0.02%
	% total	**%**	**Waste rock**	**99.53**	**0**	**0.35**	**0**
	% total	**%**	**Low-grade ore**	**99.24**	**0**	**0.75**	**0.01**
North Flank (MAC) - Marra Mamba	MAC A	% of total	Waste rock	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore and Waste rock	100.0%	0.0%	0.00%	0.00%
	MAC B	% of total	Waste rock	99.9%	0.0%	0.12%	0.00%
		% of total	Low grade ore	96.9%	0.0%	1.56%	1.53%
		% of total	Low grade ore and Waste rock	98.2%	0.0%	0.93%	0.85%
	MAC C	% of total	Waste rock	99.4%	0.0%	0.56%	0.00%
		% of total	Low grade ore	99.0%	0.0%	1.02%	0.00%
		% of total	Low grade ore and Waste rock	99.2%	0.0%	0.76%	0.00%
	MAC D	% of total	Waste rock	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore and Waste rock	100.0%	0.0%	0.00%	0.00%
	MAC E	% of total	Waste rock	99.9%	0.0%	0.07%	0.00%
		% of total	Low grade ore	99.4%	0.0%	0.60%	0.01%
		% of total	Low grade ore and Waste rock	99.8%	0.0%	0.20%	0.00%
	MAC F	% of total	Waste rock	99.5%	0.0%	0.50%	0.00%
		% of total	Low grade ore	92.0%	0.0%	8.02%	0.00%
		% of total	Low grade ore and Waste rock	96.3%	0.0%	3.66%	0.00%
		% of total	Waste rock	100.0%	0.0%	0.02%	0.00%

MAC (Packsaddle and North Flank) - Predicted % of waste and Low-grade ore as a function of deposit and AMD class for as-mined and to be mined mine waste							
Formation	**Deposit**	**Status**	**Waste type**	**% AMD Class 0**	**% AMD Class 1**	**% AMD Class 2**	**% AMD Class 3**
	MAC Dead end	% of total	Low grade ore	99.2%	0.0%	0.84%	0.00%
		% of total	Low grade ore and Waste rock	99.6%	0.0%	0.42%	0.00%
	% total	**%**	**Waste rock**	**99.84**	**0**	**0.16**	**0**
	% total	**%**	**Low-grade ore**	**98.57**	**0**	**1.09**	**0.34**

Table 3-4 Predicted percent (%) of total to-be-mined and as-mined waste rock and low grade ore as a function of AMD class per deposit at South Flank

South Flank – Predicted % of waste and Low-grade ore as a function of deposit and AMD class for as-mined and to be mined mine waste							
Formation	**Deposit**	**Status**	**Waste type**	**AMD Class 0 (m³)**	**AMD Class 1 (m³)**	**AMD Class 2 (m³)**	**% AMD Class 3**
South Flank - Marra Mamba	R	% of total	Waste rock	99.9%	0.0%	0.00%	0.10%
		% of total	Low grade ore	100.0%	0.0%	0.00%	0.00%
		% of total	Low grade ore and Waste rock	99.9%	0.0%	0.00%	0.05%
	SF Highway	% of total	Waste rock	99.6%	0.0%	0.28%	0.14%
		% of total	Low grade ore	95.9%	0.0%	3.98%	0.15%
		% of total	Low grade ore and Waste rock	98.1%	0.0%	1.78%	0.14%
	SF Grand Central	% of total	Waste rock	94.8%	0.0%	3.19%	1.97%
		% of total	Low grade ore	91.1%	0.0%	6.24%	2.70%
		% of total	Low grade ore and Waste rock	93.4%	0.0%	4.38%	2.25%
	SF Vista Oriental	% of total	Waste rock	98.8%	0.0%	0.97%	0.25%
		% of total	Low grade ore	96.2%	0.0%	2.96%	0.87%
		% of total	Low grade ore and Waste rock	97.7%	0.0%	1.80%	0.51%
	% total	**%**	**Waste rock**	**97.99**	**0**	**1.31**	**0.7**
	% total	**%**	**Low-grade ore**	**95.65**	**0**	**3.35**	**1**

3.1.1.2 MAC A deposit

3.1.1.2.1 MAC A deposit (as-mined waste)

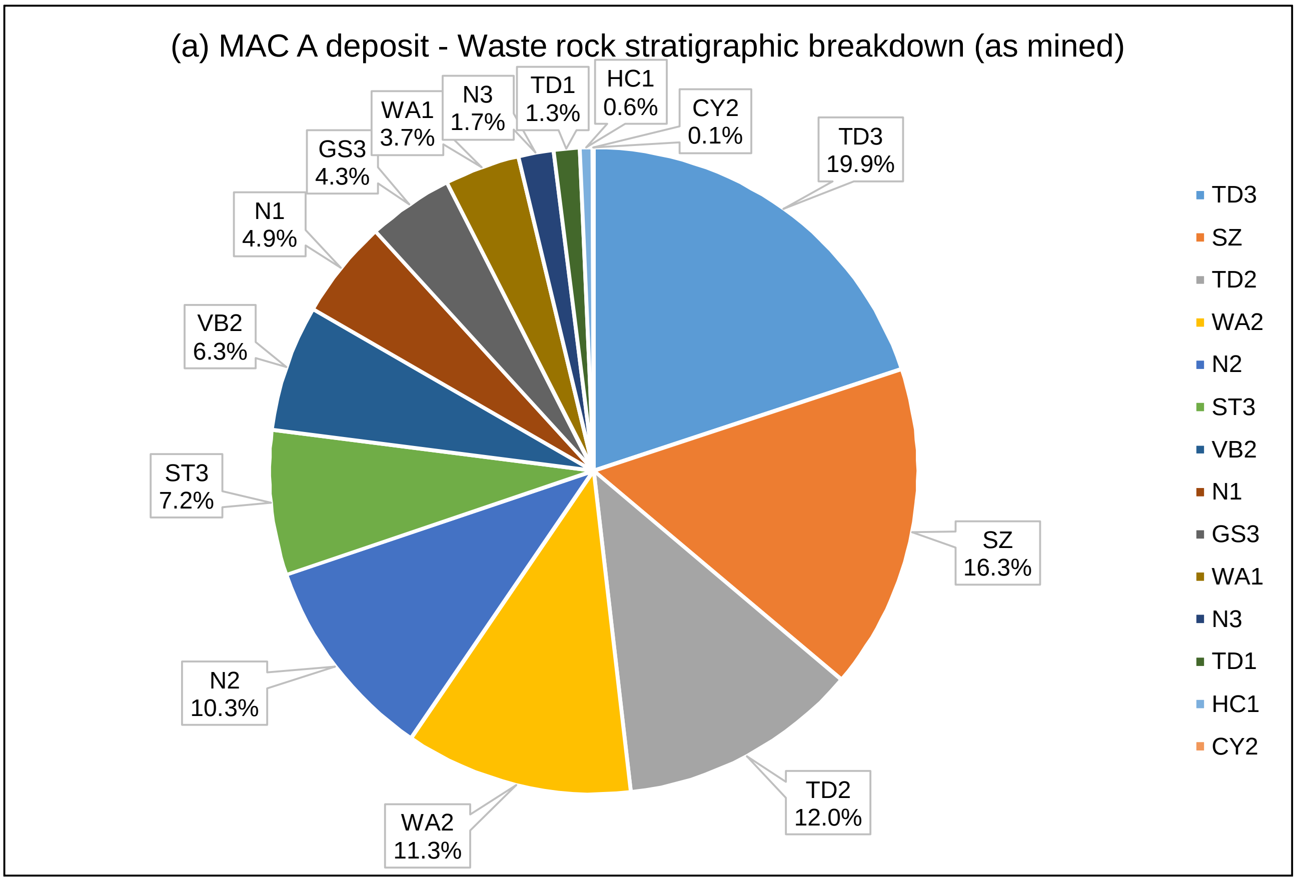
A pie chart showing the distribution of as-mined waste rock and low-grade ore as a function of stratigraphic unit is shown in Figure 3-1. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from A deposit are shown in Figure 3-2 and Figure 3-3, respectively.

Table 3-5 presents as-mined waste volume from A deposit split by total sulphur content per stratigraphy. Table 3-6 and Table 3-7 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC A deposit is presented in Figure 3-4.

The block model data indicate that:

- The Tertiary Detritals group (68.0%, incl. TD3, SZ, TD2, ST3, VB2, GS3, TD1 and HC1) comprises the majority of the as-mined waste, with subordinate contributions from the Marra Mamba Iron Formation (17.0% incl. N2, N1 and N3) and Wittenoom Formation (15.1%, WA2 and WA1). Similarly, as-mined low-grade ore mainly consists of Tertiary Detritals group (58.3%), with the reminder of the as-mined low grade ore split equally between Marra Mamba Iron Formation (21.4%), and Wittenoom Formation (20.3%) (Figure 3-1).
- As-mined waste rock and low-grade ore have very low total sulphur concentration with all stratigraphic units in waste rock blocks and low-grade ore showing 95th percentile total sulphur well below < 0.1wt% (Figure 3-2).
- The low sulphur characteristic of as-mined waste rock and low-grade ore at A deposit is further presented in Table 3-5, which demonstrates that very low sulphur blocks (<0.1%) comprise 100% as-mined waste rock and 99.9% of low-grade ore volume. Only inconsequential amounts, namely 0.08% (16,000 m^3 TD2, WA1 and N3) and 0.02% (4,800 m^3 N3) of the total as-mined low-grade ore volumes have total S in the range of 0.1-0.2% and 0.2-0.3%, respectively.
- As-mined waste rock and low-grade ore have low median ANC values at near or below 10 kg H_2SO_4/t, with the exception of CY2 waste rock (~18800 m^3). CY2 has elevated ANC values with 5th percentile ANC ≥ 50 kg H_2SO_4/t and median ANC ≥ 200 kg H_2SO_4/t. On the other hand, Marra Mamba Iron Formation (N3, N2 and N1) is particularly devoid of ANC with values near 1 kg H_2SO_4/t (Figure 3-3).
- As-mined waste rock and low-grade ore are entirely classed as AMD0 according to the current MAC A deposit mining block model (Table 3-6). The total mined out volume of waste rock and low-grade ore are approximately 28,666,400 m^3 and 20,195,600 m^3, respectively.
- Approximately 95.8% of waste rock and 95.6% of low-grade ore blocks are predicted to have been mined out from above water table (Table 3-7).



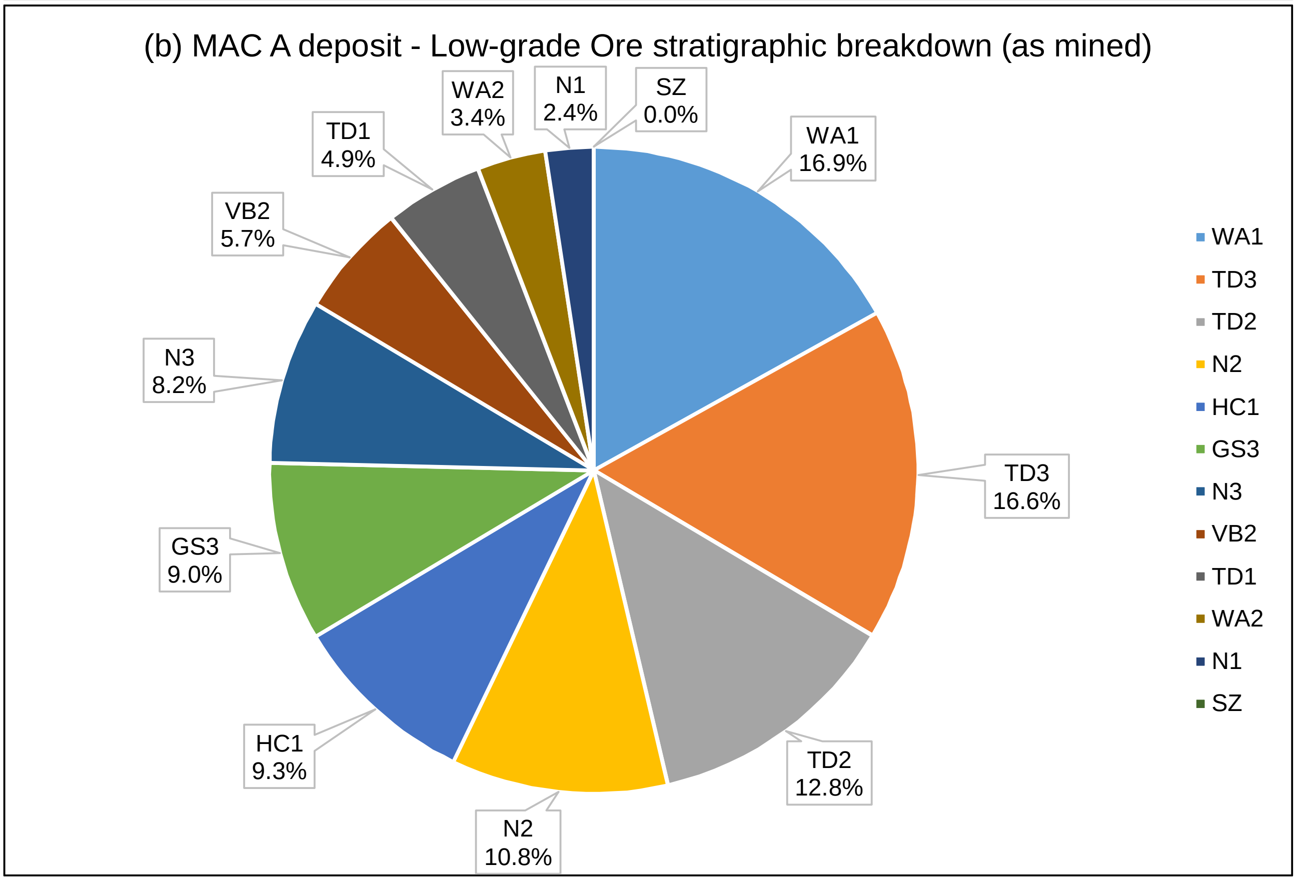


Figure 3-1 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC A deposit mining model

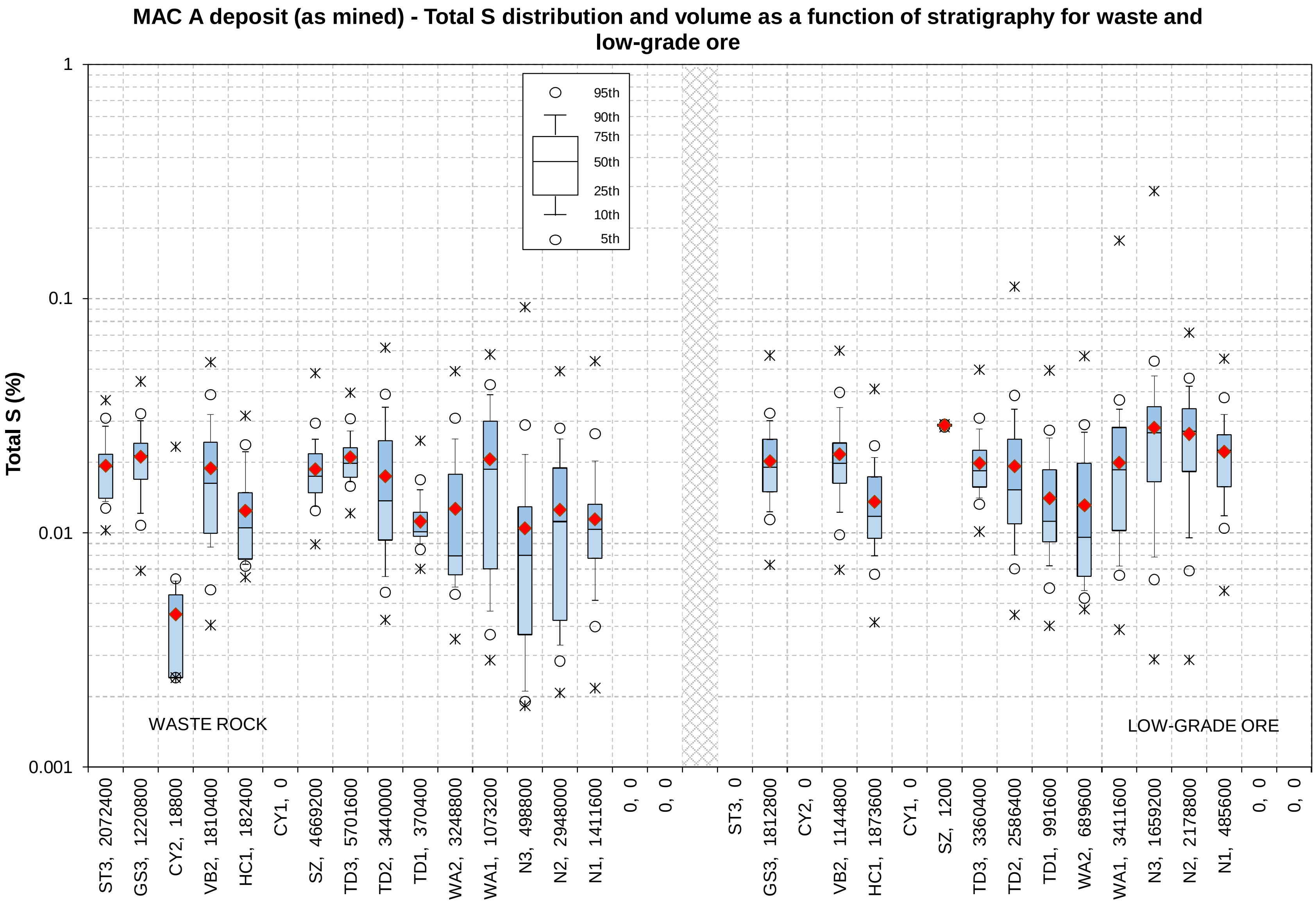


Figure 3-2 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC A deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

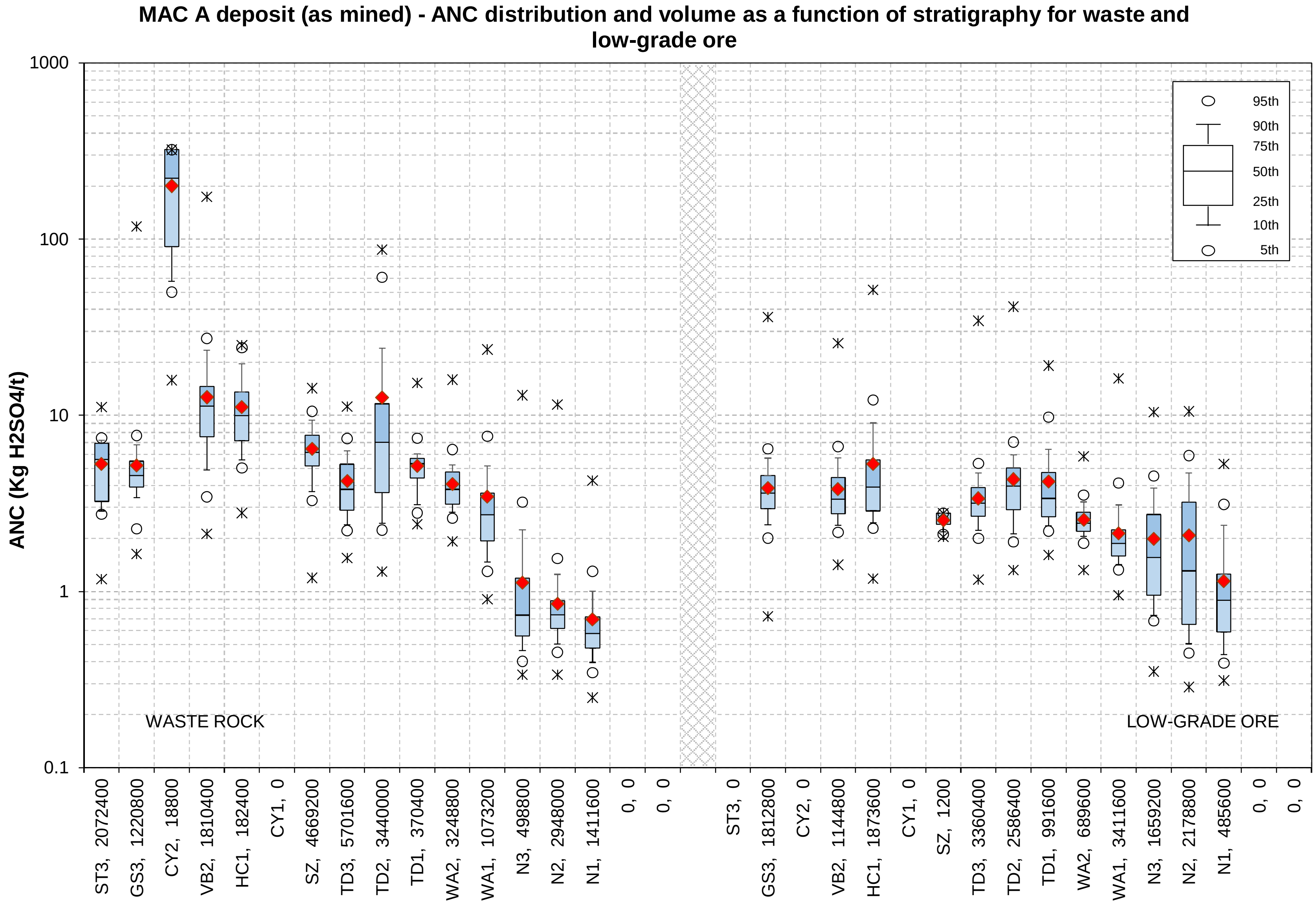


Figure 3-3 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC A deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-5 MAC A deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9190 - ST3	2,072,400	7.23%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	1,220,800	4.26%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9150 - CY2	18,800	0.07%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9130 - VB2	1,810,400	6.32%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9120 - LT2	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9110 - HC1	182,400	0.64%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	4,669,200	16.29%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	5,701,600	19.89%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	3,440,000	12.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	370,400	1.29%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4200 - OB	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	3,248,800	11.33%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	1,073,200	3.74%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	498,800	1.74%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	2,948,000	10.28%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	1,411,600	4.92%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Total	**28,666,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9190 - ST3	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9180 - GS3	1,812,800	8.99%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9130 - VB2	1,144,800	5.67%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9120 - LT2	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9110 - HC1	1,873,600	9.29%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9100 - CY1	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8150 - SZ	1,200	0.01%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8130 - TD3	3,360,400	16.66%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8120 - TD2	2,582,400	12.80%	4,000	25.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8110 - TD1	991,600	4.92%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
4200 - OB	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
4120 - WA2	689,600	3.42%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
4110 - WA1	3,406,800	16.89%	4,800	30.00%	0	0.00%	0	N/A	0	N/A	0	N/A
3430 - N3	1,647,200	8.16%	7,200	45.00%	4,800	100.00%	0	N/A	0	N/A	0	N/A
3420 - N2	2,178,800	10.80%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
3410 - N1	485,600	2.41%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
3300 - MM	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
Total	**20,174,800**	**100.00%**	**16,000**	**100.00%**	**4,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.90%**		**0.08%**		**0.02%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-6 MAC A deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9190 - ST3	2,072,400	7.23%	0	N/A	0	N/A	0	N/A	2,072,400	7.23%
9180 - GS3	1,220,800	4.26%	0	N/A	0	N/A	0	N/A	1,220,800	4.26%
9160 - CA2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9150 - CY2	18,800	0.07%	0	N/A	0	N/A	0	N/A	18,800	0.07%
9130 - VB2	1,810,400	6.32%	0	N/A	0	N/A	0	N/A	1,810,400	6.32%
9120 - LT2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9110 - HC1	182,400	0.64%	0	N/A	0	N/A	0	N/A	182,400	0.64%
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8150 - SZ	4,669,200	16.29%	0	N/A	0	N/A	0	N/A	4,669,200	16.29%
8130 - TD3	5,701,600	19.89%	0	N/A	0	N/A	0	N/A	5,701,600	19.89%
8120 - TD2	3,440,000	12.00%	0	N/A	0	N/A	0	N/A	3,440,000	12.00%
8110 - TD1	370,400	1.29%	0	N/A	0	N/A	0	N/A	370,400	1.29%
4200 - OB	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
4120 - WA2	3,248,800	11.33%	0	N/A	0	N/A	0	N/A	3,248,800	11.33%
4110 - WA1	1,073,200	3.74%	0	N/A	0	N/A	0	N/A	1,073,200	3.74%
3430 - N3	498,800	1.74%	0	N/A	0	N/A	0	N/A	498,800	1.74%
3420 - N2	2,948,000	10.28%	0	N/A	0	N/A	0	N/A	2,948,000	10.28%
3410 - N1	1,411,600	4.92%	0	N/A	0	N/A	0	N/A	1,411,600	4.92%
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**28,666,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**28,666,400**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
9190 - ST3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9180 - GS3	1,812,800	8.98%	0	N/A	0	N/A	0	N/A	1,812,800	8.98%
9160 - CA2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9150 - CY2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9130 - VB2	1,144,800	5.67%	0	N/A	0	N/A	0	N/A	1,144,800	5.67%
9120 - LT2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9110 - HC1	1,873,600	9.28%	0	N/A	0	N/A	0	N/A	1,873,600	9.28%
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
8150 - SZ	1,200	0.01%	0	N/A	0	N/A	0	N/A	1,200	0.01%
8130 - TD3	3,360,400	16.64%	0	N/A	0	N/A	0	N/A	3,360,400	16.64%
8120 - TD2	2,586,400	12.81%	0	N/A	0	N/A	0	N/A	2,586,400	12.81%
8110 - TD1	991,600	4.91%	0	N/A	0	N/A	0	N/A	991,600	4.91%
4200 - OB	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
4120 - WA2	689,600	3.41%	0	N/A	0	N/A	0	N/A	689,600	3.41%
4110 - WA1	3,411,600	16.89%	0	N/A	0	N/A	0	N/A	3,411,600	16.89%
3430 - N3	1,659,200	8.22%	0	N/A	0	N/A	0	N/A	1,659,200	8.22%
3420 - N2	2,178,800	10.79%	0	N/A	0	N/A	0	N/A	2,178,800	10.79%
3410 - N1	485,600	2.40%	0	N/A	0	N/A	0	N/A	485,600	2.40%
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**20,195,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**20,195,600**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-7 MAC A deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	27,466,400	1,200,000	28,666,400	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**27,466,400**	**1,200,000**	**28,666,400**	100.00%
% of Total	**95.81%**	**4.19%**	**100.00%**	
Low grade ore				
0	19,307,200	888,400	20,195,600	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**19,307,200**	**888,400**	**20,195,600**	100.00%
% of Total	**95.60%**	**4.40%**	**100.00%**	

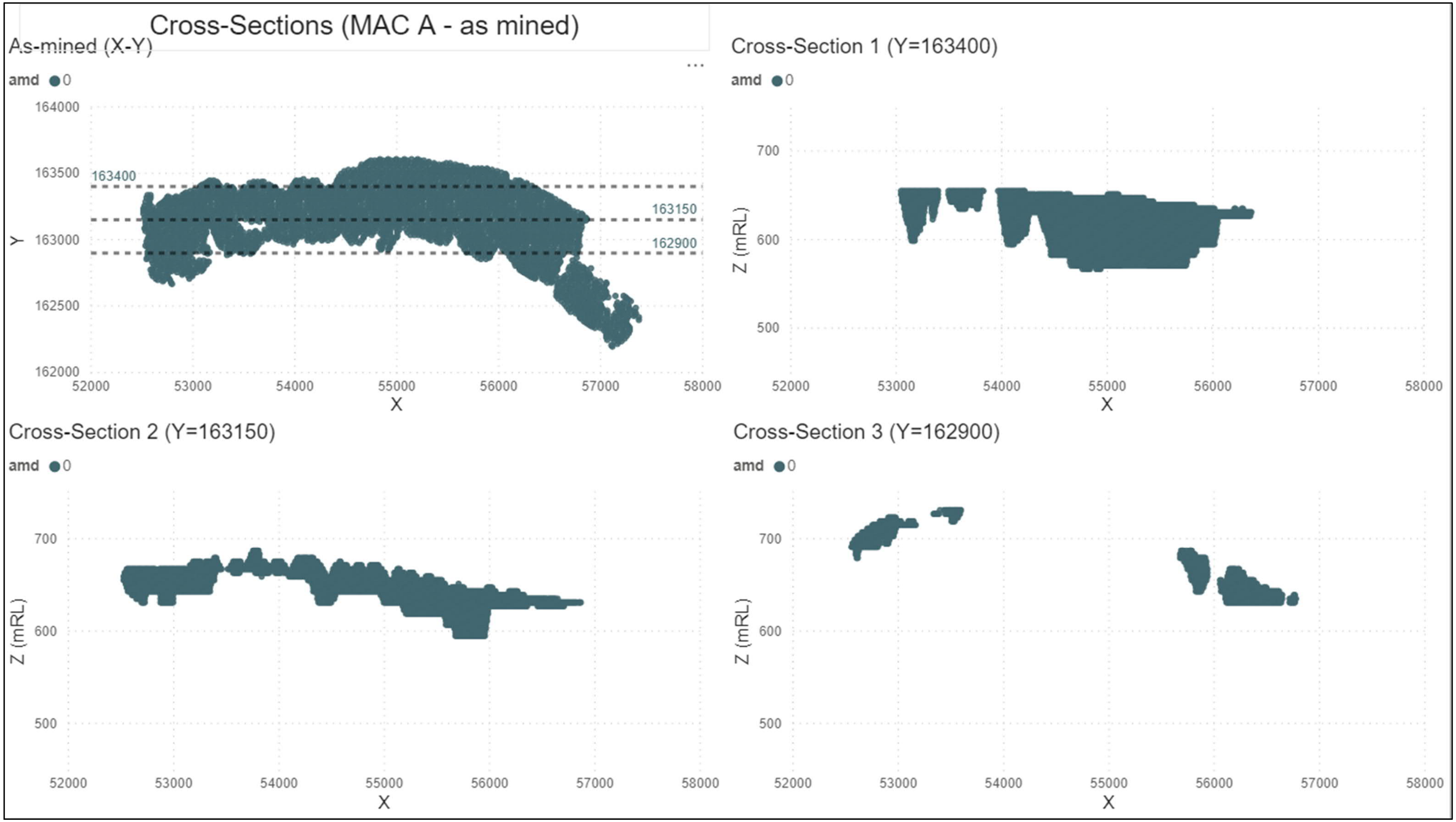


Figure 3-4 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC A deposit mining model (including all waste rock, low grade ore and ore blocks).

3.1.1.2.2 MAC A deposit (to-be-mined waste)

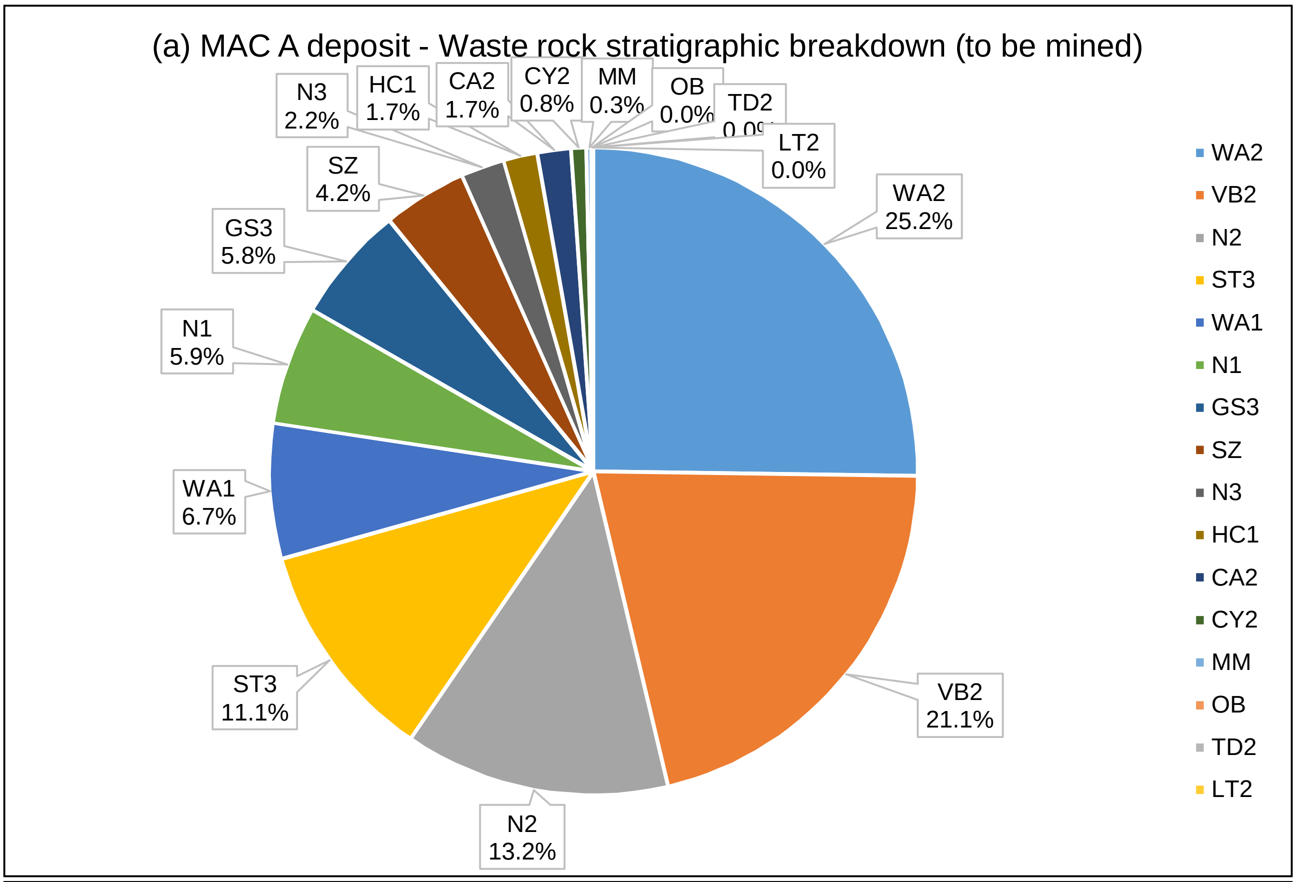
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore as a function of stratigraphic unit is shown in Figure 3-5. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from A deposit are shown in Figure 3-6 and Figure 3-7, respectively.

Table 3-8 presents to-be-mined waste volume from A deposit split by total sulphur content per stratigraphy. Table 3-9 and Table 3-10 present to-be-mined waste volumes split by strat unit, and split by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC A deposit is presented in Figure 3-8.

The block model data indicate that:

- To-be-mined waste rock is comprised of 46.4% Tertiary Detritals (incl. VB2, ST3, GS3, SZ, HC1, CA2, and CY2), 32.0% Wittenoom Formation (WA2 and WA1) and 21.6% Marra Mamba Iron Formation (N2, N1, N3 and MM), while to-be-mined low-grade ore consists primarily of Tertiary Detrital group strats (60.7%), and secondarily by Wittenoom Formation (24.8%) and Marra Mamba Iron Formation (14.5%) units.
- To-be-mined waste rock and low-grade ore from A deposit are both very low in total sulphur, with maximum total sulphur content always below 0.1% for all stratigraphic units (Figure 3-6). Very low sulphur blocks (<0.1%) comprise 100% of to-be-mined waste rock and low-grade ore volume (Table 3-8).
- ANC rich waste rock stratigraphies comprise:
  - CA2 (577,200 m^3) with 5th percentile ANC > 240 kg H_2SO_4/t and median ANC > 410 kg H_2SO_4/t,
  - CY2 (268,800 m^3) and OB (16,400 m^3) waste rock, with 25th percentile ANC > 20 kg H_2SO_4/t.
- All other stratigraphic units of to-be-mined waste rock generally have the 25th/75th percentile ANC values in the range of 1 - 10 kg H_2SO_4/t. To-be-mined low-grade ore show relatively lower ANC with the 90th percentile values consistently below 10 kg H_2SO_4/t for all strat units.
- Consistently with as-mined waste, the current MAC A deposit mining block model predicts that the entire to-be-mined waste rock (34,792,800 m^3) and low-grade ore (21,294,000 m^3) is AMD Class 0 (Table 3-9).
- The volume of material to be mined from below water table is 8,175,200 m^3 for waste rock and 4,217,600 m^3 for low-grade ore, representing 23.5% and 19.8% of the total to-be-mined waste rock and low-grade ore, respectively.



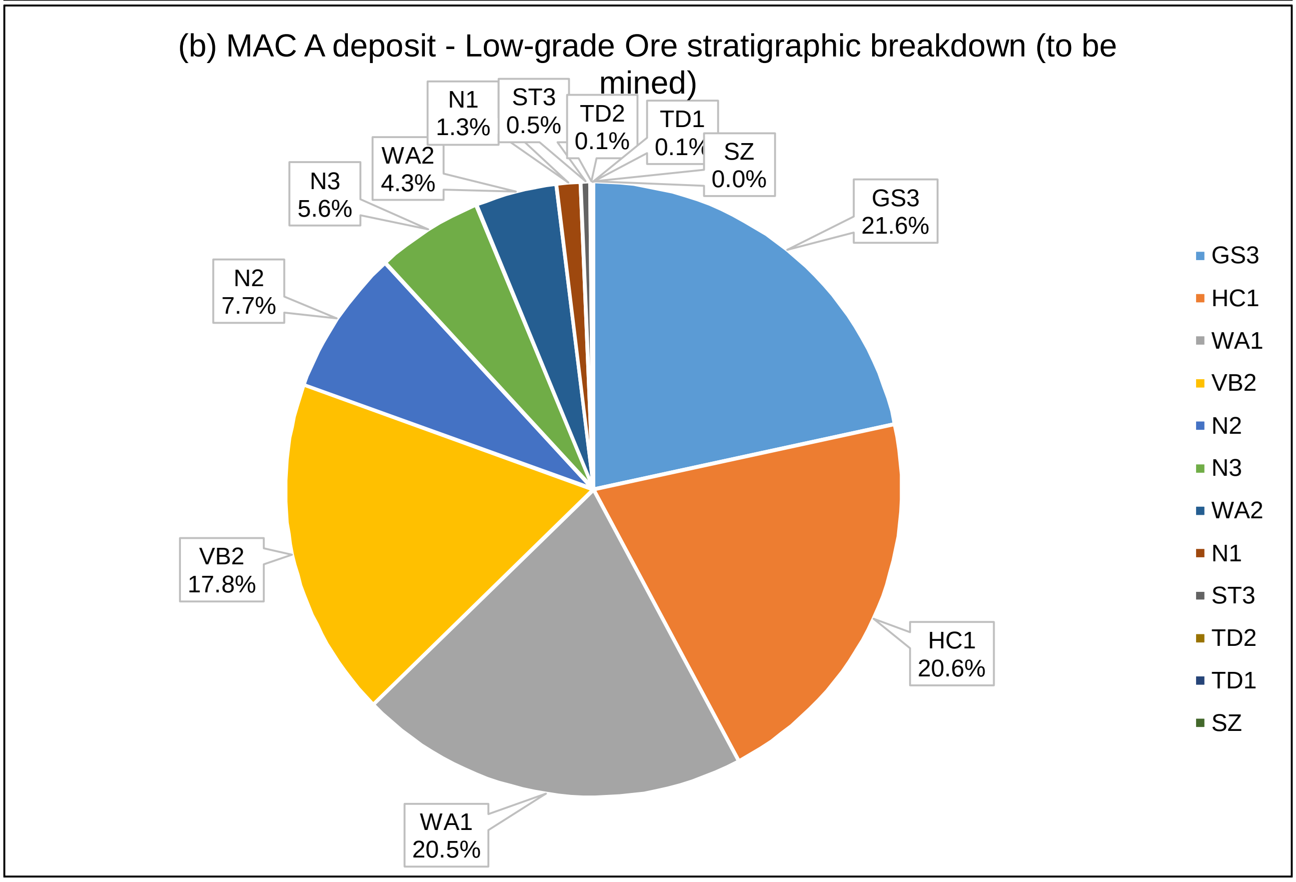


Figure 3-5 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC A deposit mining model

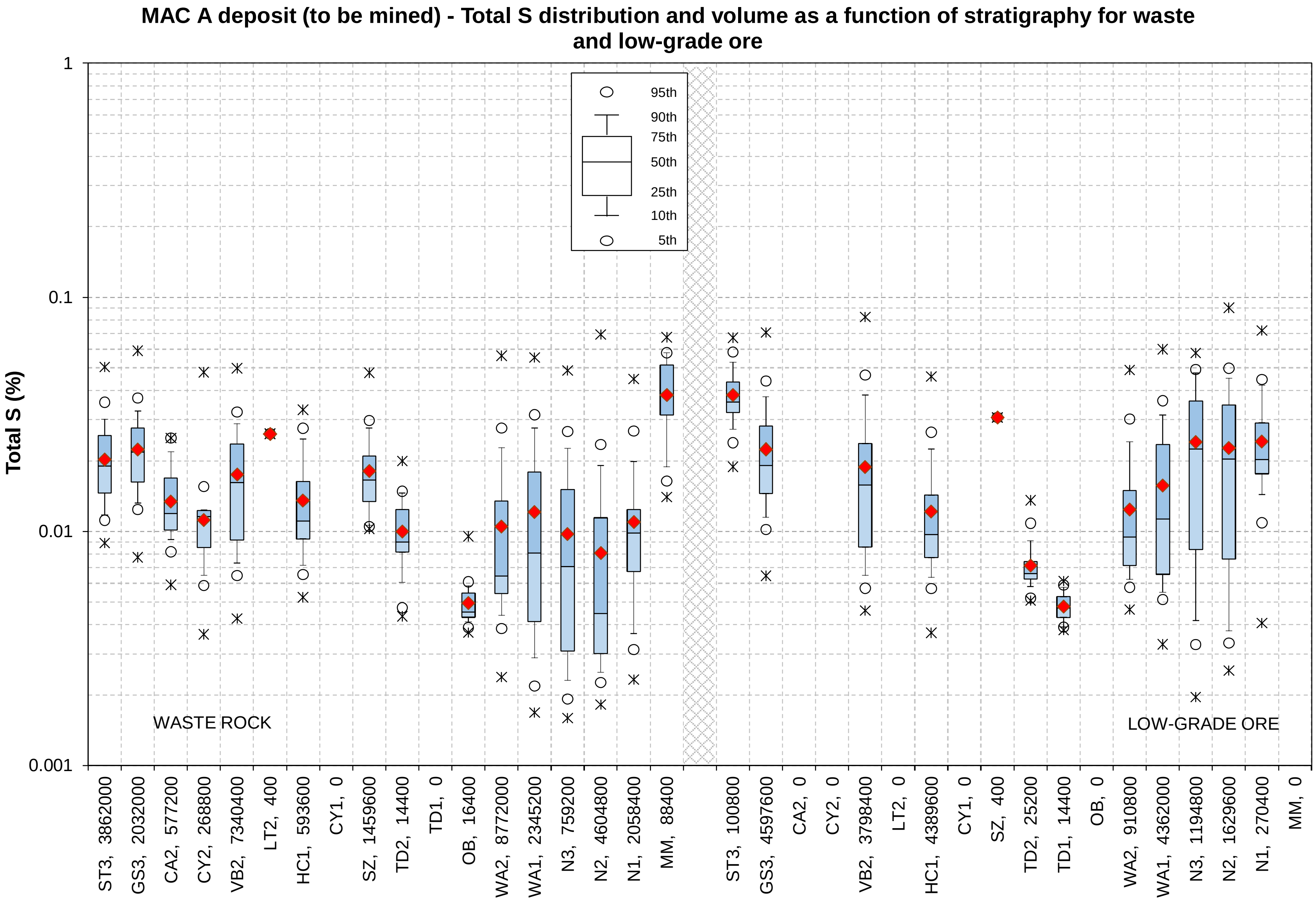


Figure 3-6 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC A deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

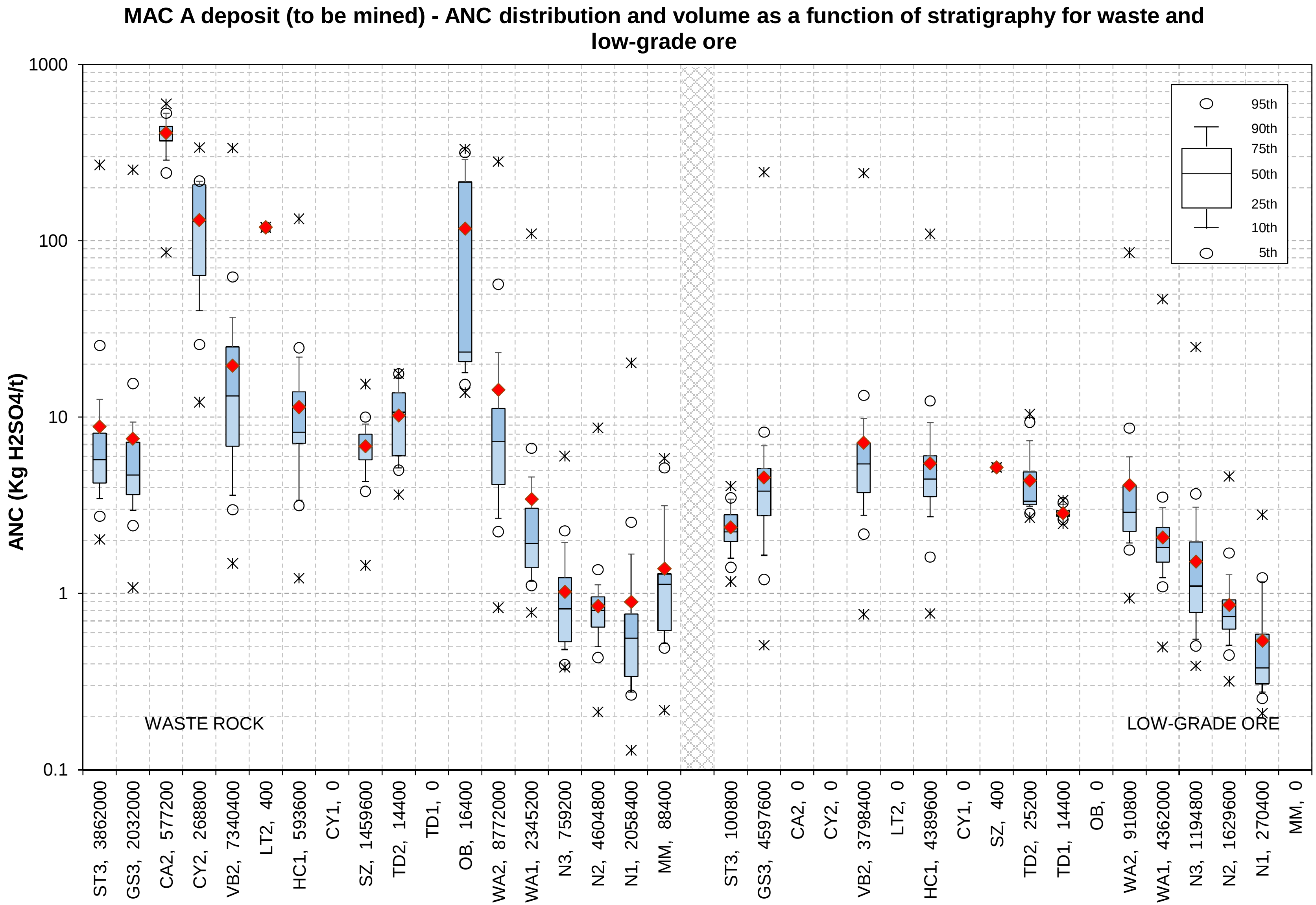


Figure 3-7 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC A deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-8 MAC A deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9190 - ST3	3,862,000	11.10%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	2,032,000	5.84%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9160 - CA2	577,200	1.66%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9150 - CY2	268,800	0.77%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9130 - VB2	7,340,400	21.10%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9120 - LT2	400	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9110 - HC1	593,600	1.71%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	1,459,600	4.20%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	14,400	0.04%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4200 - OB	16,400	0.05%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	8,772,000	25.21%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	2,345,200	6.74%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	759,200	2.18%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	4,604,800	13.23%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	2,058,400	5.92%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	88,400	0.25%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Total	**34,792,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9190 - ST3	100,800	0.47%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	4,597,600	21.59%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9150 - CY2	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9130 - VB2	3,798,400	17.84%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9120 - LT2	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9110 - HC1	4,389,600	20.61%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	400	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	25,200	0.12%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	14,400	0.07%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4200 - OB	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	910,800	4.28%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	4,362,000	20.48%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	1,194,800	5.61%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	1,629,600	7.65%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%
3410 - N1	270,400	1.27%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Total	**21,294,000**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-9 MAC A deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%
Waste rock										
9190 - ST3	3,862,000	11.10%	0	N/A	0	N/A	0	N/A	3,862,000	11.10%
9180 - GS3	2,032,000	5.84%	0	N/A	0	N/A	0	N/A	2,032,000	5.84%
9160 - CA2	577,200	1.66%	0	N/A	0	N/A	0	N/A	577,200	1.66%
9150 - CY2	268,800	0.77%	0	N/A	0	N/A	0	N/A	268,800	0.77%
9130 - VB2	7,340,400	21.10%	0	N/A	0	N/A	0	N/A	7,340,400	21.10%
9120 - LT2	400	0.00%	0	N/A	0	N/A	0	N/A	400	0.00%
9110 - HC1	593,600	1.71%	0	N/A	0	N/A	0	N/A	593,600	1.71%
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8150 - SZ	1,459,600	4.20%	0	N/A	0	N/A	0	N/A	1,459,600	4.20%
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8120 - TD2	14,400	0.04%	0	N/A	0	N/A	0	N/A	14,400	0.04%
8110 - TD1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
4200 - OB	16,400	0.05%	0	N/A	0	N/A	0	N/A	16,400	0.05%
4120 - WA2	8,772,000	25.21%	0	N/A	0	N/A	0	N/A	8,772,000	25.21%
4110 - WA1	2,345,200	6.74%	0	N/A	0	N/A	0	N/A	2,345,200	6.74%
3430 - N3	759,200	2.18%	0	N/A	0	N/A	0	N/A	759,200	2.18%
3420 - N2	4,604,800	13.23%	0	N/A	0	N/A	0	N/A	4,604,800	13.23%
3410 - N1	2,058,400	5.92%	0	N/A	0	N/A	0	N/A	2,058,400	5.92%
3300 - MM	88,400	0.25%	0	N/A	0	N/A	0	N/A	88,400	0.25%
Total	**34,792,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**34,792,800**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
9190 - ST3	100,800	0.47%	0	N/A	0	N/A	0	N/A	100,800	0.47%
9180 - GS3	4,597,600	21.59%	0	N/A	0	N/A	0	N/A	4,597,600	21.59%
9160 - CA2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9150 - CY2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9130 - VB2	3,798,400	17.84%	0	N/A	0	N/A	0	N/A	3,798,400	17.84%
9120 - LT2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9110 - HC1	4,389,600	20.61%	0	N/A	0	N/A	0	N/A	4,389,600	20.61%
9100 - CY1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
8150 - SZ	400	0.00%	0	N/A	0	N/A	0	N/A	400	0.00%
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8120 - TD2	25,200	0.12%	0	N/A	0	N/A	0	N/A	25,200	0.12%
8110 - TD1	14,400	0.07%	0	N/A	0	N/A	0	N/A	14,400	0.07%
4200 - OB	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
4120 - WA2	910,800	4.28%	0	N/A	0	N/A	0	N/A	910,800	4.28%
4110 - WA1	4,362,000	20.48%	0	N/A	0	N/A	0	N/A	4,362,000	20.48%
3430 - N3	1,194,800	5.61%	0	N/A	0	N/A	0	N/A	1,194,800	5.61%
3420 - N2	1,629,600	7.65%	0	N/A	0	N/A	0	N/A	1,629,600	7.65%
3410 - N1	270,400	1.27%	0	N/A	0	N/A	0	N/A	270,400	1.27%
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**21,294,000**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**21,294,000**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-10 MAC A deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	26,617,600	8,175,200	34,792,800	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**26,617,600**	**8,175,200**	**34,792,800**	100.00%
% of Total	**76.50%**	**23.50%**	**100.00%**	
Low grade ore				
0	17,076,400	4,217,600	21,294,000	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**17,076,400**	**4,217,600**	**21,294,000**	100.00%
% of Total	**80.19%**	**19.81%**	**100.00%**	

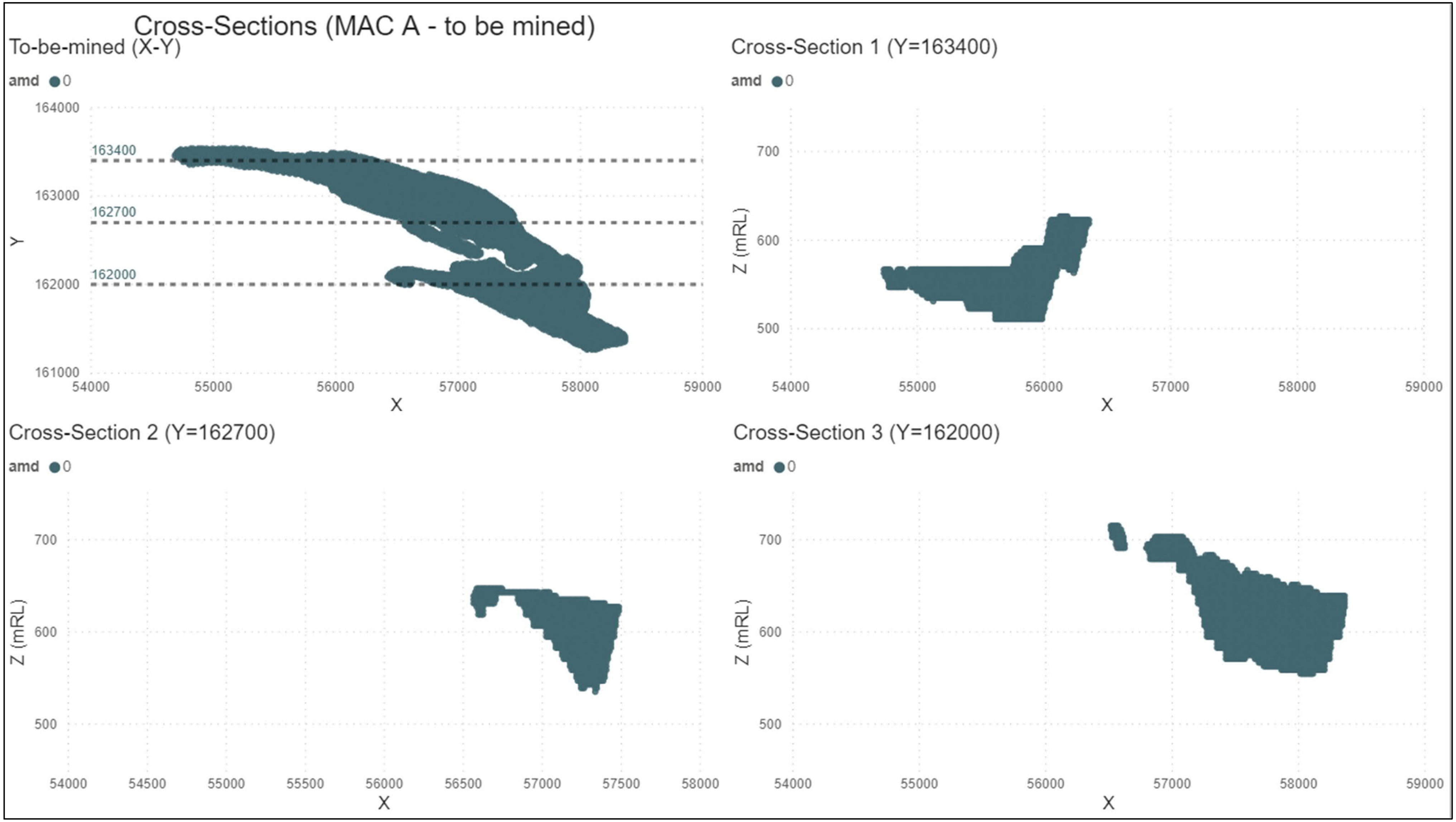


Figure 3-8 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC A deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.3 MAC B deposit

3.1.1.3.1 MAC B deposit (as-mined waste)

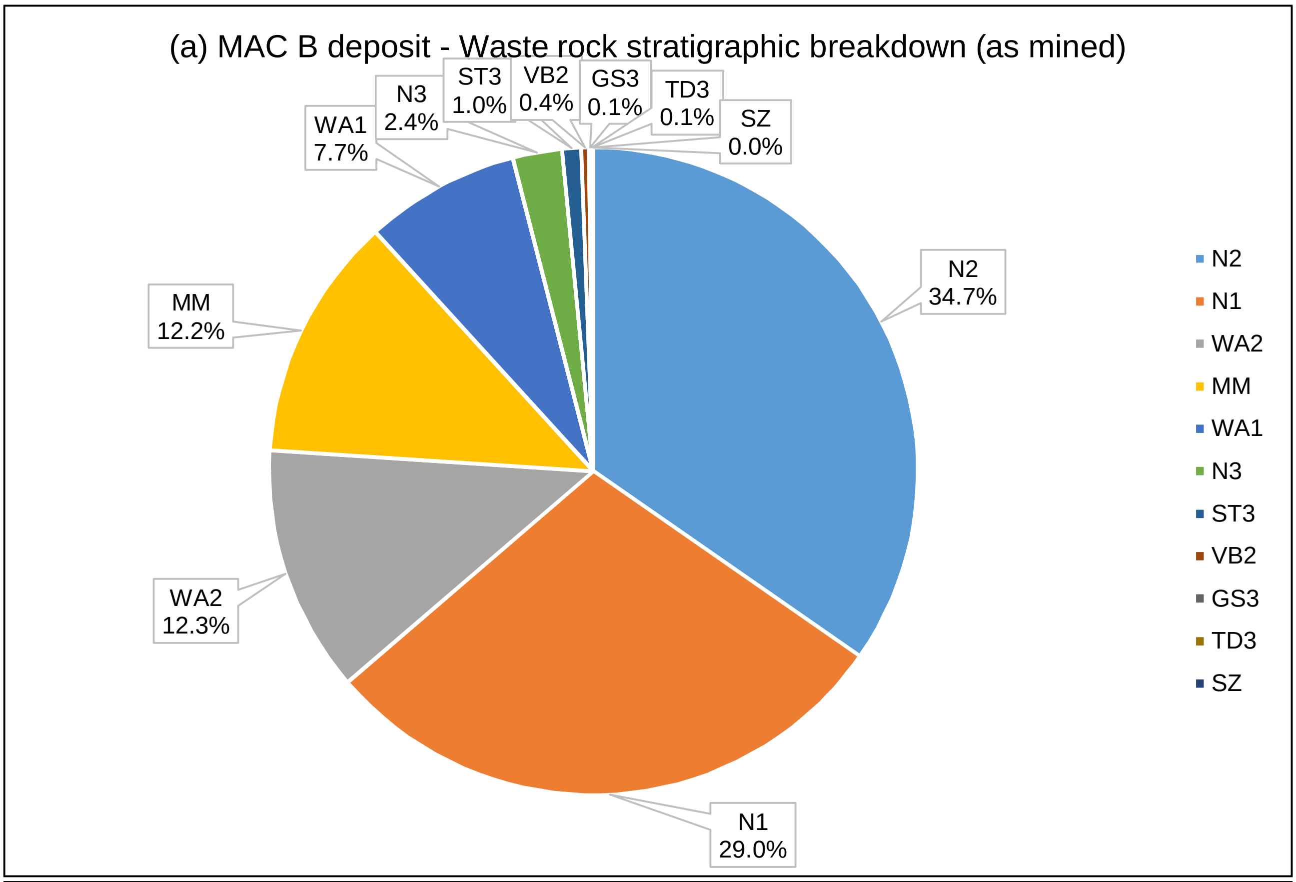
A pie chart showing the distribution of as-mined waste rock and low-grade ore from B deposit as a function of stratigraphic unit is shown in Figure 3-9. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from B deposit are shown in Figure 3-10 and Figure 3-11, respectively.

Table 3-11 presents as-mined waste volume from B deposit split by total sulphur content per stratigraphy. Table 3-12 and Table 3-13 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC B deposit is presented in Figure 3-12.

The block model data indicate that:

- As-mined waste rock from B deposit is dominated by Marra Mamba Iron Formation (78.4% incl. N2, N1, MM and N3) with minor portions from Wittenoom Formation (20.1% incl. WA2 and WA1) and Tertiary Detritals (1.6%). Similarly, as-mined low-grade ore mainly consists of 69.8% Marra Mamba Iron Formation (N2, N3, N1 and MM) and 28.2% Wittenoom Formation (WA1 and WA2).
- As-mined waste rock and low-grade ore blocks generally show low sulphur concentration with the 75th percentile values below or close to 0.1 wt% and the 90th percentile values below 0.2 wt% throughout all the mined out blocks (Figure 3-10). For Marra Mamba Iron Formation, the median total sulphur is slightly higher (but still below 0.1 wt%) in low-grade ore blocks than in waste rock blocks.
- Table 3-11 indicates that very low sulphur blocks (<0.1%) comprise 98.0% of as-mined waste rock and 88.0% of low-grade ore volume, and that low sulphur blocks (0.1-0.2%) comprise 1.3% as-mined waste rock and 11.1% of low-grade ore volume. The low-grade ore VB2 (TD2) stratigraphy comprises over 47% of the low-grade ore having total sulphur ranging from 0.1-0.3 wt%, with the reminder distributed across the WA2/1 and the N1-3 stratigraphies.
- Only an insignificant amount equal to 0.14% (6,000 m^3, WA2 and N3) of the total as-mined waste rock volumes have moderate total sulphur (0.5-1.0%).
- As-mined waste rock and low-grade ore have low ANC values with the 95th percentile values below 10 kg H_2SO_4/t and median values below 4 kg H_2SO_4/t. In particular, Marra Mamba Iron Formation (N3, N2, N1 and MM) is devoid of ANC with median values below 1 kg H_2SO_4/t for both waste rock and low-grade ore (Figure 3-11).
- A total volume of 11,589,200 m^3 (incl. 4,114,800 m^3 waste rock and 7,474,400 m^3 low-grade ore) of AMD0 waste has been mined out from B deposit, comprising 99.18% of as-mined waste rock and 92.46% of as-mined low-grade ore, as predicted by the MAC B deposit mining model.
- The as-mined block model does not contain AMD1 waste rock or low-grade ore blocks.
- A total volume of 34,000 m^3 as-mined waste rock and 595,200 m^3 as-mined low-grade ore are classed as AMD2, comprising 0.82% of as-mined waste rock and 7.36% of as-mined low-grade ore. AMD2 volumes are associated with the Wittenoom and Marra Mamba Iron Formations (Table 3-12).
- The 14,400 m^3 of as-mined AMD3 blocks are all associated with low-grade ore of ST3 stratigraphy, representing only 0.18% of as-mined low-grade ore volume.
- All materials mined-out (waste rock and low-grade ore) from B deposit are sourced from above the water table (Table 3-13).



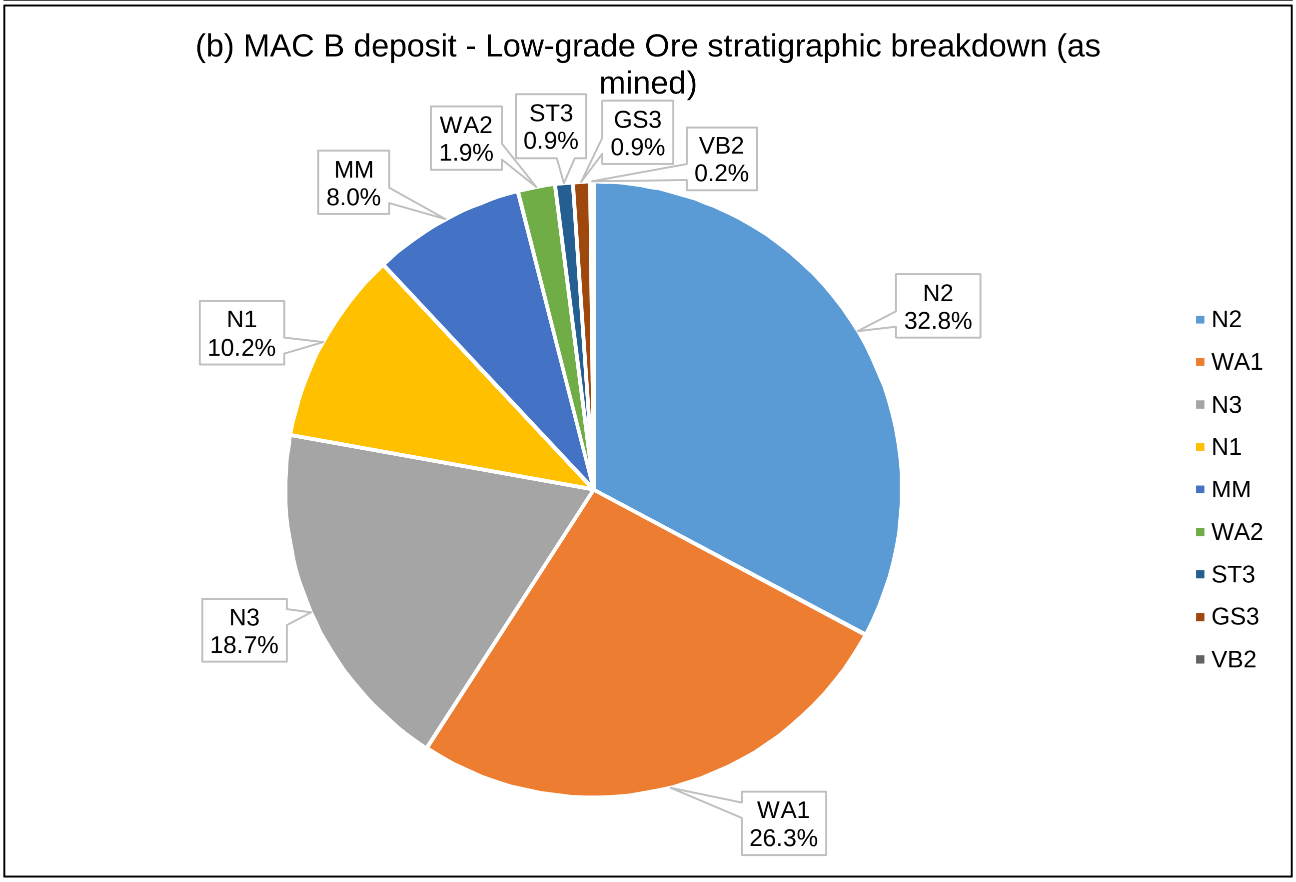


Figure 3-9 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC B deposit mining model

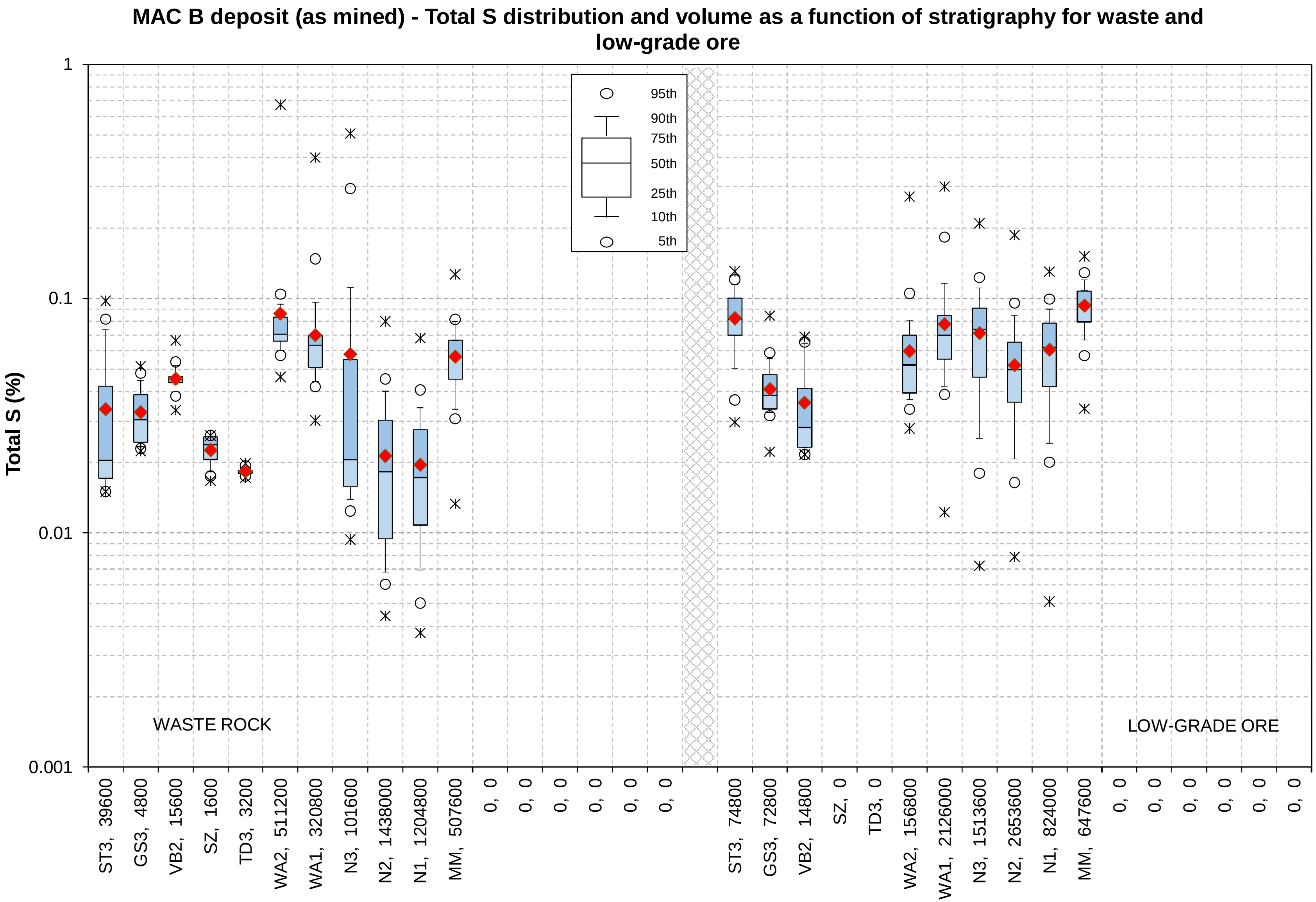


Figure 3-10 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC B deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

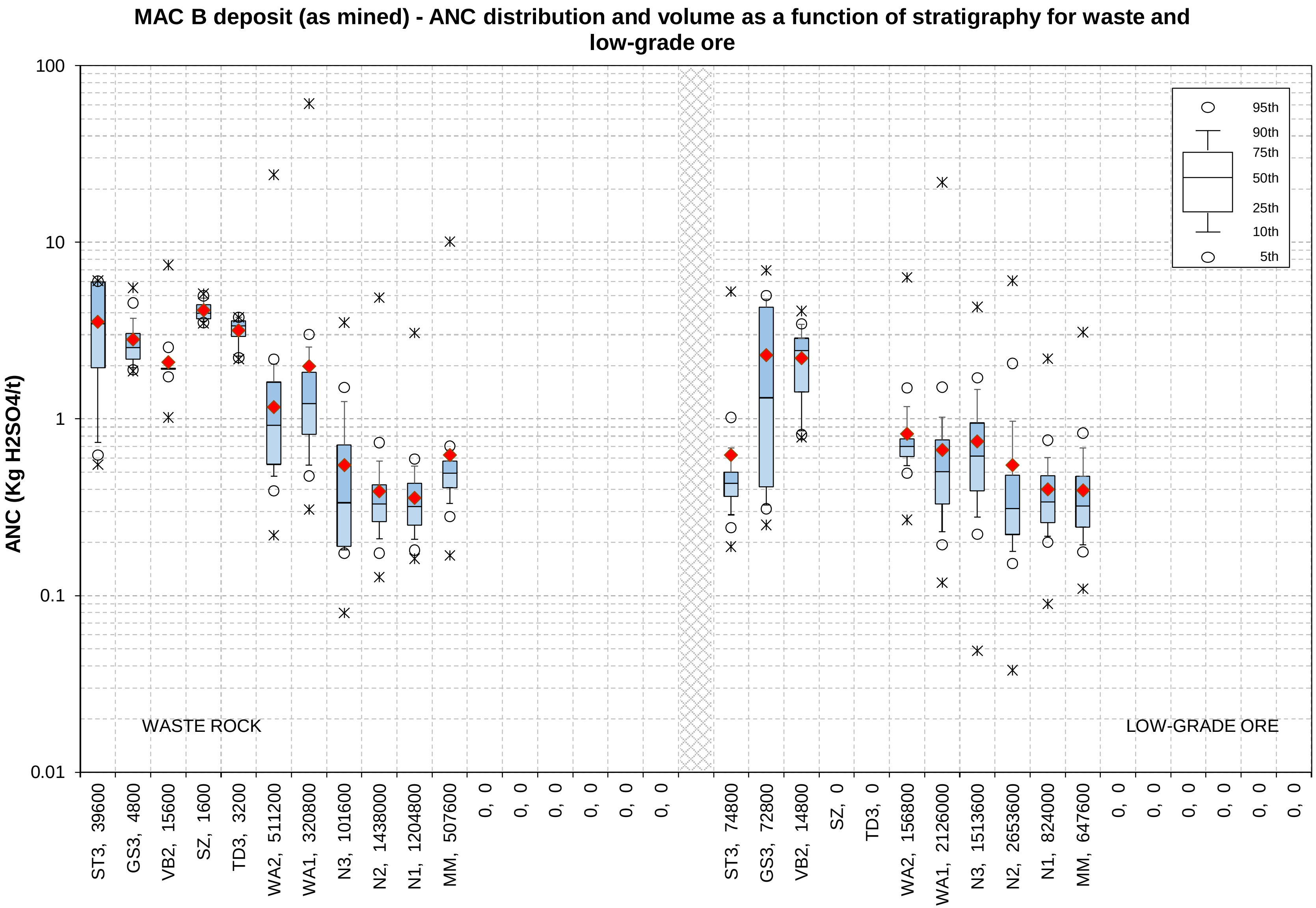


Figure 3-11 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC B deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-11 MAC B deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9190 - ST3	39,600	0.97%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9180 - GS3	4,800	0.12%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9140 - SD2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9130 - VB2	15,600	0.38%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9110 - HC1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	1,600	0.04%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	3,200	0.08%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	474,800	11.68%	20,400	37.78%	400	5.88%	10,000	62.50%	5,600	93.33%	0	N/A
4110 - WA1	291,600	7.17%	24,000	44.44%	3,600	52.94%	1,600	10.00%	0	0.00%	0	N/A
3430 - N3	90,400	2.22%	3,600	6.67%	2,800	41.18%	4,400	27.50%	400	6.67%	0	N/A
3420 - N2	1,438,000	35.37%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3410 - N1	1,204,800	29.63%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3300 - MM	501,600	12.34%	6,000	11.11%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**4,066,000**	**100.00%**	**54,000**	**100.00%**	**6,800**	**100.00%**	**16,000**	**100.00%**	**6,000**	**100.00%**	**0**	**N/A**
% of Total	**98.00%**		**1.30%**		**0.16%**		**0.39%**		**0.14%**		**0.00%**	
Low grade ore												
9200 - WP3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9190 - ST3	55,600	0.78%	19,200	2.13%	0	0.00%	0	0.00%	0	N/A	0	N/A
9180 - GS3	72,800	1.02%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9140 - SD2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9130 - VB2	14,800	0.21%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9110 - HC1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
4120 - WA2	147,600	2.07%	7,200	0.80%	2,000	2.98%	0	0.00%	0	N/A	0	N/A
4110 - WA1	1,838,000	25.83%	223,200	24.80%	64,400	95.83%	400	100.00%	0	N/A	0	N/A
3430 - N3	1,258,800	17.69%	254,000	28.22%	800	1.19%	0	0.00%	0	N/A	0	N/A
3420 - N2	2,548,000	35.80%	105,600	11.73%	0	0.00%	0	0.00%	0	N/A	0	N/A
3410 - N1	784,400	11.02%	39,600	4.40%	0	0.00%	0	0.00%	0	N/A	0	N/A
3300 - MM	396,400	5.57%	251,200	27.91%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**7,116,400**	**100.00%**	**900,000**	**100.00%**	**67,200**	**100.00%**	**400**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**88.03%**		**11.13%**		**0.83%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-12 MAC B deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9190 - ST3	39,600	0.96%	0	N/A	0	0.00%	0	N/A	39,600	0.95%
9180 - GS3	4,800	0.12%	0	N/A	0	0.00%	0	N/A	4,800	0.12%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9140 - SD2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9130 - VB2	15,600	0.38%	0	N/A	0	0.00%	0	N/A	15,600	0.38%
9110 - HC1	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	1,600	0.04%	0	N/A	0	0.00%	0	N/A	1,600	0.04%
8130 - TD3	3,200	0.08%	0	N/A	0	0.00%	0	N/A	3,200	0.08%
4120 - WA2	490,400	11.92%	0	N/A	20,800	61.18%	0	N/A	511,200	12.32%
4110 - WA1	319,200	7.76%	0	N/A	1,600	4.71%	0	N/A	320,800	7.73%
3430 - N3	95,600	2.32%	0	N/A	6,000	17.65%	0	N/A	101,600	2.45%
3420 - N2	1,438,000	34.95%	0	N/A	0	0.00%	0	N/A	1,438,000	34.66%
3410 - N1	1,204,800	29.28%	0	N/A	0	0.00%	0	N/A	1,204,800	29.04%
3300 - MM	502,000	12.20%	0	N/A	5,600	16.47%	0	N/A	507,600	12.23%
Total	**4,114,800**	**100.00%**	**0**	**N/A**	**34,000**	**100.00%**	**0**	**N/A**	**4,148,800**	**100.00%**
% of Total	**99.18%**		**0.00%**		**0.82%**		**0.00%**		**100.00%**	
Low grade ore										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	60,400	0.81%	0	N/A	0	0.00%	14,400	100.00%	74,800	0.93%
9180 - GS3	72,800	0.97%	0	N/A	0	0.00%	0	0.00%	72,800	0.90%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9140 - SD2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	14,800	0.20%	0	N/A	0	0.00%	0	0.00%	14,800	0.18%
9110 - HC1	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	156,800	2.10%	0	N/A	0	0.00%	0	0.00%	156,800	1.94%
4110 - WA1	1,896,400	25.37%	0	N/A	229,600	38.58%	0	0.00%	2,126,000	26.30%
3430 - N3	1,419,200	18.99%	0	N/A	94,400	15.86%	0	0.00%	1,513,600	18.72%
3420 - N2	2,588,000	34.62%	0	N/A	65,600	11.02%	0	0.00%	2,653,600	32.83%
3410 - N1	800,400	10.71%	0	N/A	23,600	3.97%	0	0.00%	824,000	10.19%
3300 - MM	465,600	6.23%	0	N/A	182,000	30.58%	0	0.00%	647,600	8.01%
Total	**7,474,400**	**100.00%**	**0**	**N/A**	**595,200**	**100.00%**	**14,400**	**100.00%**	**8,084,000**	**100.00%**
% of Total	**92.46%**		**0.00%**		**7.36%**		**0.18%**	0.00%	**100.00%**	

Table 3-13 MAC B deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	4,114,800	0	4,114,800	99.18%
1	0	0	0	0.00%
2	34,000	0	34,000	0.82%
3	0	0	0	0.00%
Total	**4,148,800**	**0**	**4,148,800**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	7,474,400	0	7,474,400	92.46%
1	0	0	0	0.00%
2	595,200	0	595,200	7.36%
3	14,400	0	14,400	0.18%
Total	**8,084,000**	**0**	**8,084,000**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

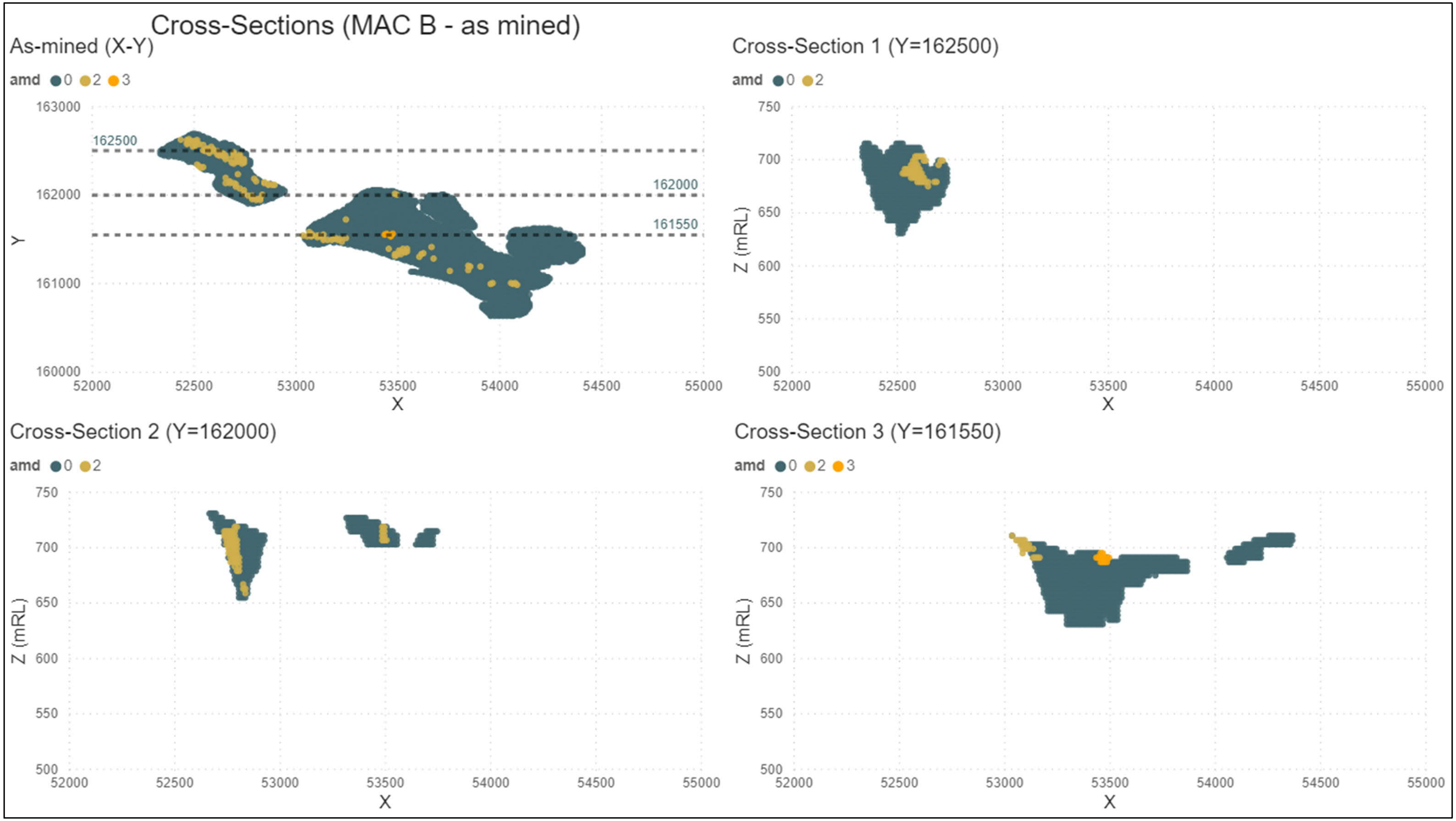


Figure 3-12 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC B deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.3.2 MAC B deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from B deposit as a function of stratigraphic unit is shown in Figure 3-13. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from B deposit are shown in Figure 3-14 and Figure 3-15, respectively.

Table 3-14 presents to-be-mined waste volume from B deposit split by total sulphur content per stratigraphy. Table 3-15 and Table 3-16 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC B deposit is presented in Figure 3-16.

The block model data indicate that:

- To-be-mined waste rock from B deposit includes 38.1% Tertiary Detritals (ST3, VB2, GS3, CY2, HC1 and SZ), 33.8% Wittenoom Formation (WA2 and WA1) and 28.1% Marra Mamba Iron Formation (N2, N3, N1 and MM). Tertiary Detritals (63.3%, incl. VB2, GS3, ST3, WP3 and CY2) dominate to-be-mined low-grade ore, with the reminder of the to-be-mined low grade ore split equally between Marra Mamba Iron Formation (18.9%), and Wittenoom Formation (17.8%).
- Consistent with the as-mined section of B deposit, all of the to-be-mined blocks have very low or low total sulphur with the median values well below or close to 0.1 wt% (e.g. MM low-grade ore).
- Table 3-14 shows the distribution of total sulphur as a function of stratigraphic unit. Available data show that very low sulphur blocks (<0.1%) comprise 99.91% to-be-mined waste rock and 96.52% of low-grade ore volume, while low sulphur blocks (0.1-0.2%) comprise 0.09% to-be-mined waste rock and 3.47% of low-grade ore volume. Only an inconsequential volume equal to 0.01% (4,400 m^3 VB2) of the total to-be-mined low-grade ore volumes have low to moderate total sulphur (0.2-0.5%).
- To-be-mined waste rock and low-grade ore from B deposit have low median ANC values near or below 10 kg H_2SO_4/t. In particular, Marra Mamba Iron Formation (N3, N2, N1 and MM) is devoid of ANC with median values below 0.3 kg H_2SO_4/t for both waste rock and low-grade ore (Figure 3-11).
- 32,811,200 m^3 to-be-mined waste rock and 37,946,000 m^3 to-be-mined low-grade ore from B deposit are classed as AMD0, representing 99.97% of total to-be-mined waste rock and 97.84% of to-be-mined low-grade ore volume, respectively.
- No AMD1 waste is predicted to be mined according to the current mining model for MAC B deposit.
- 10,800 m^3 to-be-mined waste rock and 135,600 m^3 to-be-mined low-grade ore from B deposit are classed as AMD2, representing 0.03% of total to-be-mined waste rock and 0.35% of to-be-mined low-grade ore volume, respectively.
- A total volume of 702,000 m^3 (or 1.81%) of to-be-mined low-grade ore AMD3 blocks are predicted from the block model. These are mostly associated with VB2 stratigraphy.
- The majority of the waste rock (96.45%) and low-grade ore (99.02%) to be mined will be sourced from the blocks above water table (Table 3-16).

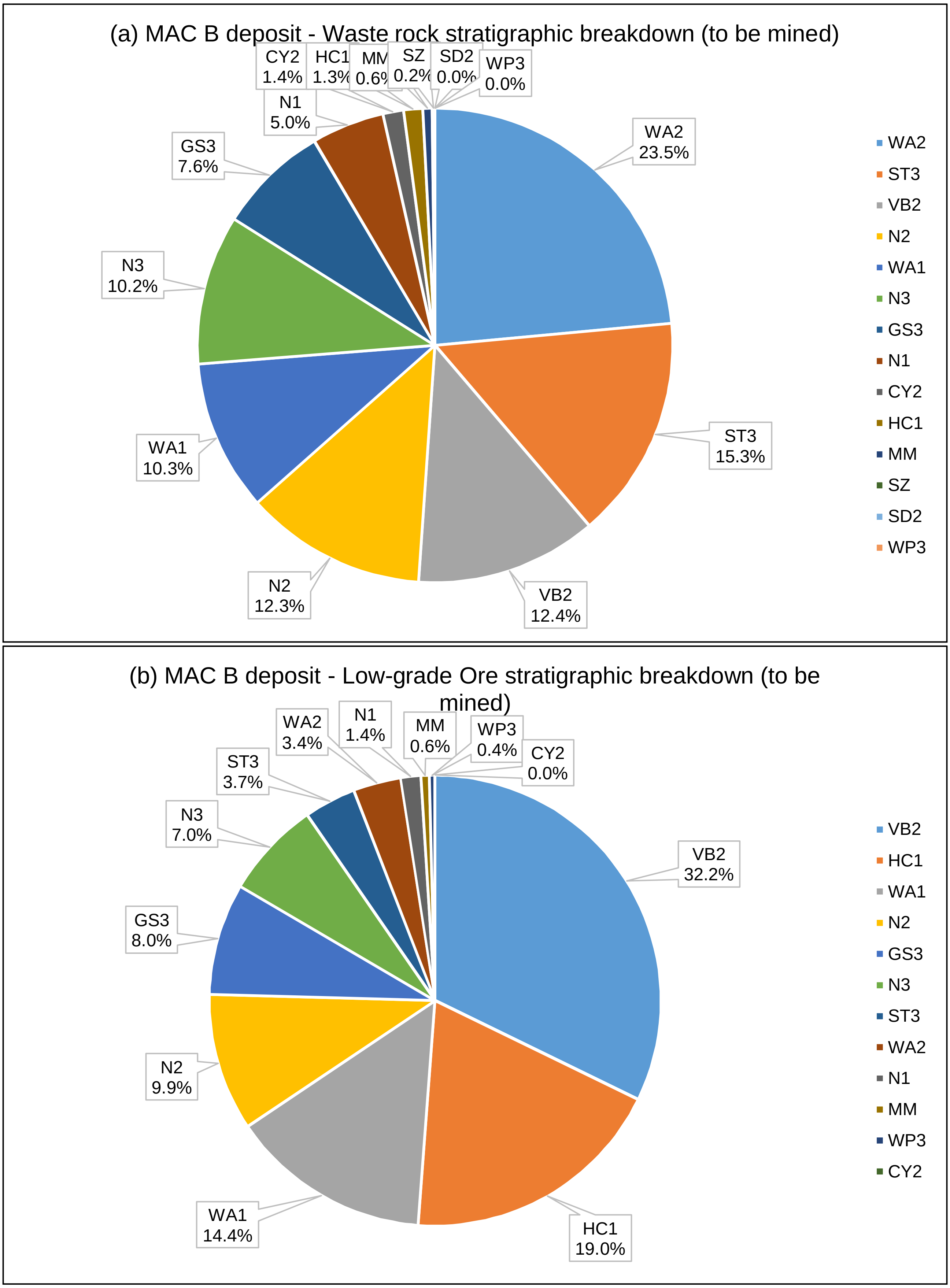


Figure 3-13 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC B deposit mining model

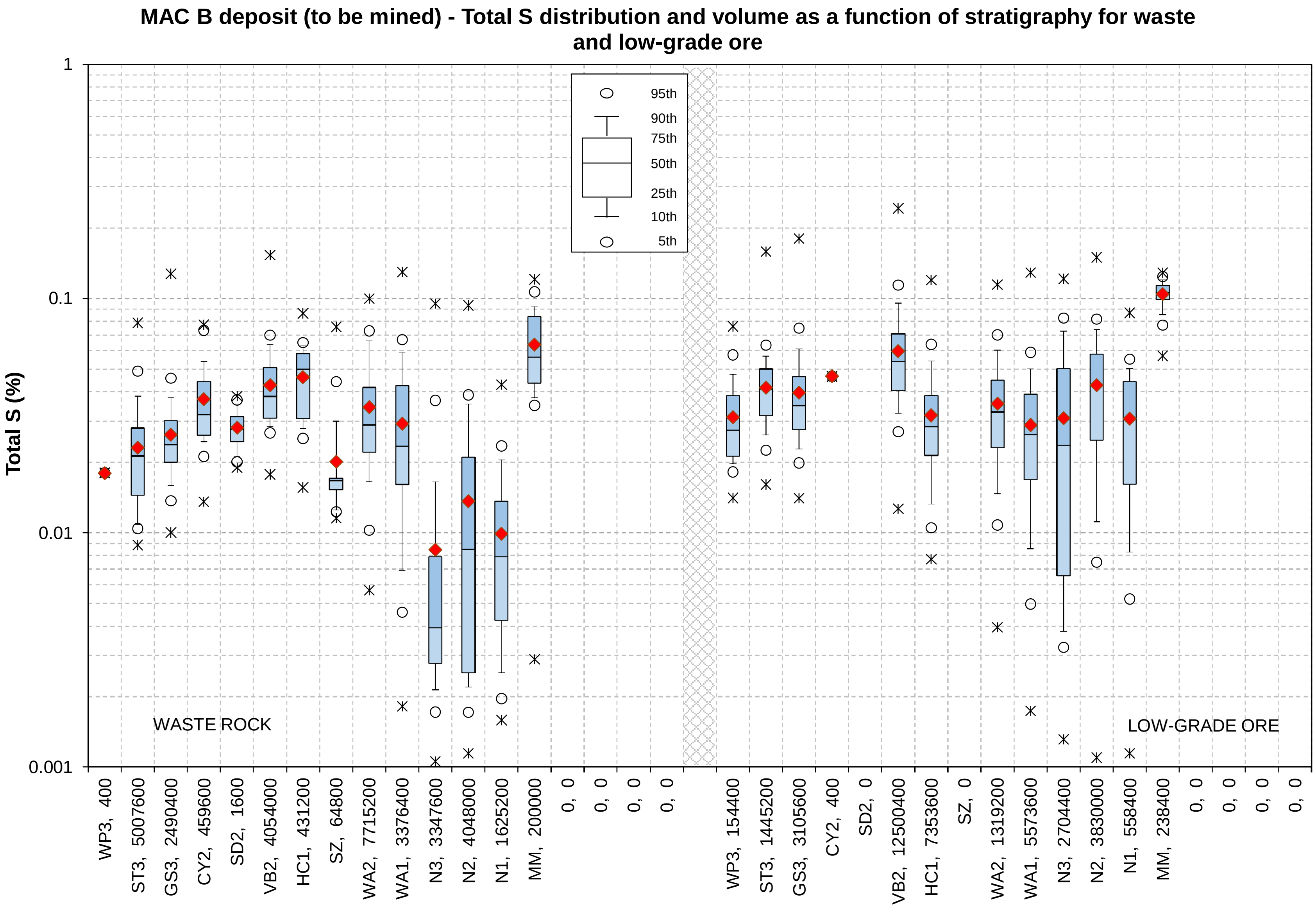


Figure 3-14 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC B deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

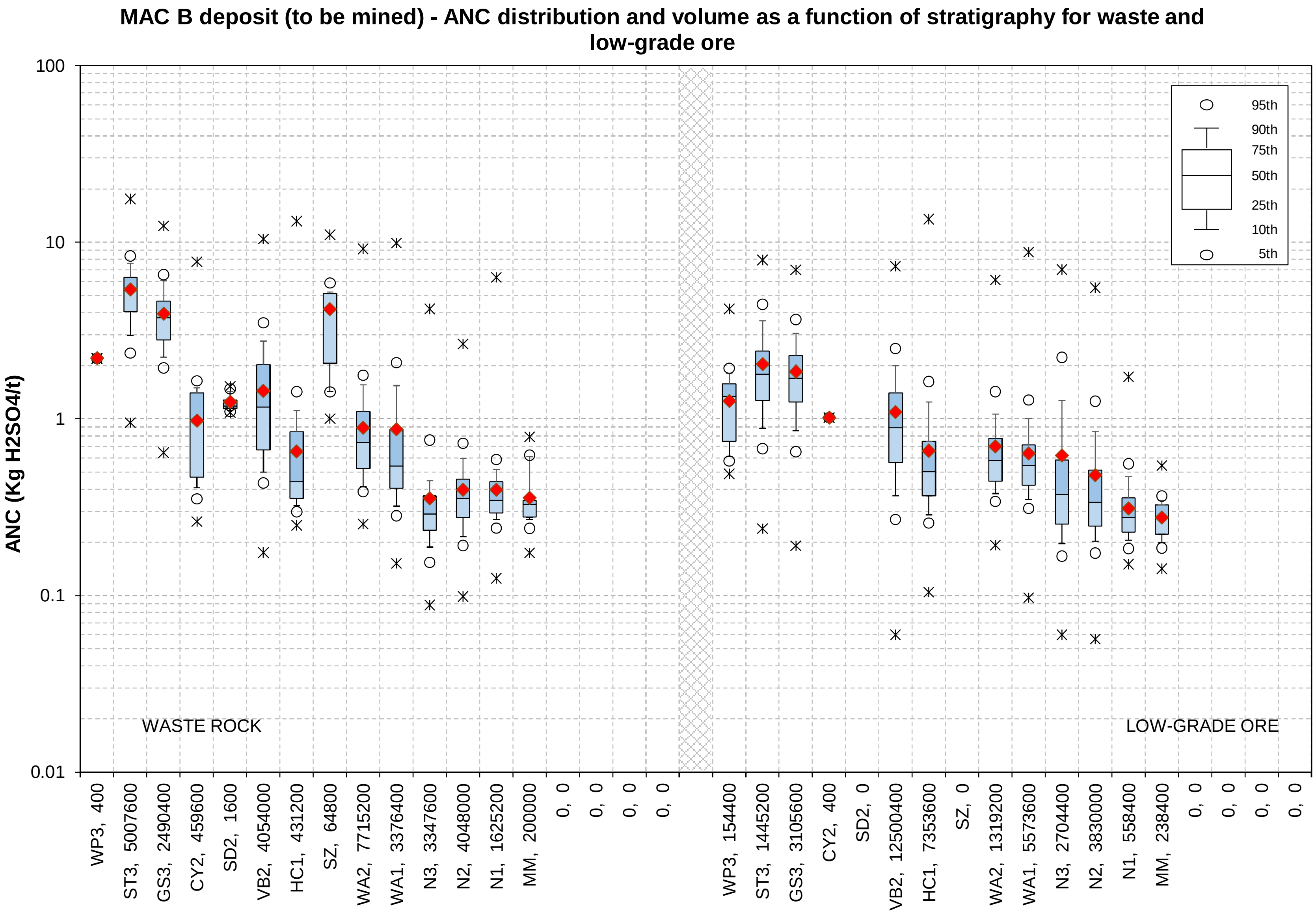


Figure 3-15 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC B deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-14 MAC B deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	400	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9190 - ST3	5,007,600	15.27%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	2,487,600	7.59%	2,800	9.09%	0	N/A	0	N/A	0	N/A	0	N/A
9150 - CY2	459,600	1.40%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9140 - SD2	1,600	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9130 - VB2	4,042,400	12.33%	11,600	37.66%	0	N/A	0	N/A	0	N/A	0	N/A
9110 - HC1	431,200	1.31%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	64,800	0.20%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	7,715,200	23.53%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	3,373,200	10.29%	3,200	10.39%	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	3,347,600	10.21%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	4,048,000	12.34%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	1,625,200	4.96%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	186,800	0.57%	13,200	42.86%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**32,791,200**	**100.00%**	**30,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.91%**		**0.09%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9200 - WP3	154,400	0.41%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9190 - ST3	1,440,400	3.85%	4,800	0.36%	0	0.00%	0	N/A	0	N/A	0	N/A
9180 - GS3	3,060,000	8.17%	45,600	3.38%	0	0.00%	0	N/A	0	N/A	0	N/A
9150 - CY2	400	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9140 - SD2	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9130 - VB2	11,437,600	30.56%	1,058,400	78.56%	4,400	100.00%	0	N/A	0	N/A	0	N/A
9110 - HC1	7,336,000	19.60%	17,600	1.31%	0	0.00%	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
4120 - WA2	1,315,600	3.51%	3,600	0.27%	0	0.00%	0	N/A	0	N/A	0	N/A
4110 - WA1	5,563,600	14.86%	10,000	0.74%	0	0.00%	0	N/A	0	N/A	0	N/A
3430 - N3	2,690,000	7.19%	14,400	1.07%	0	0.00%	0	N/A	0	N/A	0	N/A
3420 - N2	3,811,600	10.18%	18,400	1.37%	0	0.00%	0	N/A	0	N/A	0	N/A
3410 - N1	558,400	1.49%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
3300 - MM	64,000	0.17%	174,400	12.95%	0	0.00%	0	N/A	0	N/A	0	N/A
Total	**37,432,000**	**100.00%**	**1,347,200**	**100.00%**	**4,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**96.52%**		**3.47%**		**0.01%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-15 MAC B deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	400	0.00%	0	N/A	0	0.00%	0	N/A	400	0.00%
9190 - ST3	5,007,600	15.26%	0	N/A	0	0.00%	0	N/A	5,007,600	15.26%
9180 - GS3	2,490,400	7.59%	0	N/A	0	0.00%	0	N/A	2,490,400	7.59%
9150 - CY2	459,600	1.40%	0	N/A	0	0.00%	0	N/A	459,600	1.40%
9140 - SD2	1,600	0.00%	0	N/A	0	0.00%	0	N/A	1,600	0.00%
9130 - VB2	4,054,000	12.36%	0	N/A	0	0.00%	0	N/A	4,054,000	12.35%
9110 - HC1	431,200	1.31%	0	N/A	0	0.00%	0	N/A	431,200	1.31%
8150 - SZ	64,800	0.20%	0	N/A	0	0.00%	0	N/A	64,800	0.20%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
4120 - WA2	7,715,200	23.51%	0	N/A	0	0.00%	0	N/A	7,715,200	23.51%
4110 - WA1	3,376,400	10.29%	0	N/A	0	0.00%	0	N/A	3,376,400	10.29%
3430 - N3	3,347,600	10.20%	0	N/A	0	0.00%	0	N/A	3,347,600	10.20%
3420 - N2	4,048,000	12.34%	0	N/A	0	0.00%	0	N/A	4,048,000	12.33%
3410 - N1	1,625,200	4.95%	0	N/A	0	0.00%	0	N/A	1,625,200	4.95%
3300 - MM	189,200	0.58%	0	N/A	10,800	100.00%	0	N/A	200,000	0.61%
Total	**32,811,200**	**100.00%**	**0**	**N/A**	**10,800**	**100.00%**	**0**	**N/A**	**32,822,000**	**100.00%**
% of Total	**99.97%**		**0.00%**		**0.03%**		**0.00%**		**100.00%**	
Low grade ore										
9200 - WP3	154,400	0.41%	0	N/A	0	0.00%	0	0.00%	154,400	0.40%
9190 - ST3	1,443,200	3.80%	0	N/A	0	0.00%	2,000	0.28%	1,445,200	3.73%
9180 - GS3	3,094,400	8.15%	0	N/A	0	0.00%	11,200	1.60%	3,105,600	8.01%
9150 - CY2	400	0.00%	0	N/A	0	0.00%	0	0.00%	400	0.00%
9140 - SD2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	11,813,200	31.13%	0	N/A	0	0.00%	687,200	97.89%	12,500,400	32.23%
9110 - HC1	7,352,000	19.37%	0	N/A	0	0.00%	1,600	0.23%	7,353,600	18.96%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	1,318,800	3.48%	0	N/A	400	0.29%	0	0.00%	1,319,200	3.40%
4110 - WA1	5,568,000	14.67%	0	N/A	5,600	4.13%	0	0.00%	5,573,600	14.37%
3430 - N3	2,693,600	7.10%	0	N/A	10,800	7.96%	0	0.00%	2,704,400	6.97%
3420 - N2	3,817,600	10.06%	0	N/A	12,400	9.14%	0	0.00%	3,830,000	9.88%
3410 - N1	558,400	1.47%	0	N/A	0	0.00%	0	0.00%	558,400	1.44%
3300 - MM	132,000	0.35%	0	N/A	106,400	78.47%	0	0.00%	238,400	0.61%
Total	**37,946,000**	**100.00%**	**0**	**N/A**	**135,600**	**100.00%**	**702,000**	**100.00%**	**38,783,600**	**100.00%**
% of Total	**97.84%**		**0.00%**		**0.35%**		**1.81%**		**100.00%**	

Table 3-16 MAC B deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	31,647,200	1,164,000	32,811,200	99.97%
1	0	0	0	0.00%
2	10,800	0	10,800	0.03%
3	0	0	0	0.00%
Total	**31,658,000**	**1,164,000**	**32,822,000**	100.00%
% of Total	**96.45%**	**3.55%**	**100.00%**	
Low grade ore				
0	37,565,600	380,400	37,946,000	97.84%
1	0	0	0	0.00%
2	135,600	0	135,600	0.35%
3	702,000	0	702,000	1.81%
Total	**38,403,200**	**380,400**	**38,783,600**	100.00%
% of Total	**99.02%**	**0.98%**	**100.00%**	

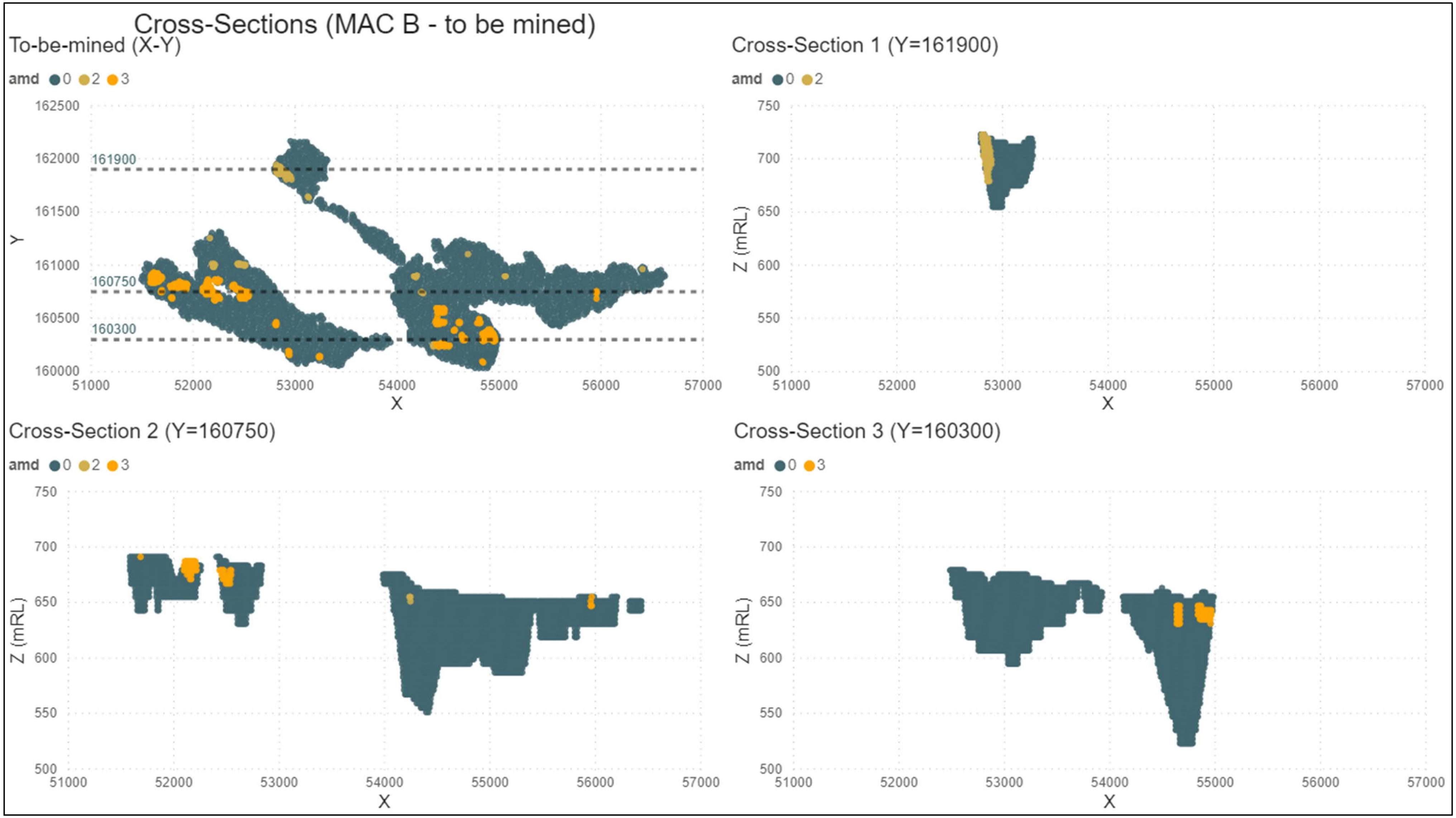


Figure 3-16 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC B deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.4 MAC C deposit

3.1.1.4.1 MAC C deposit (as-mined waste)

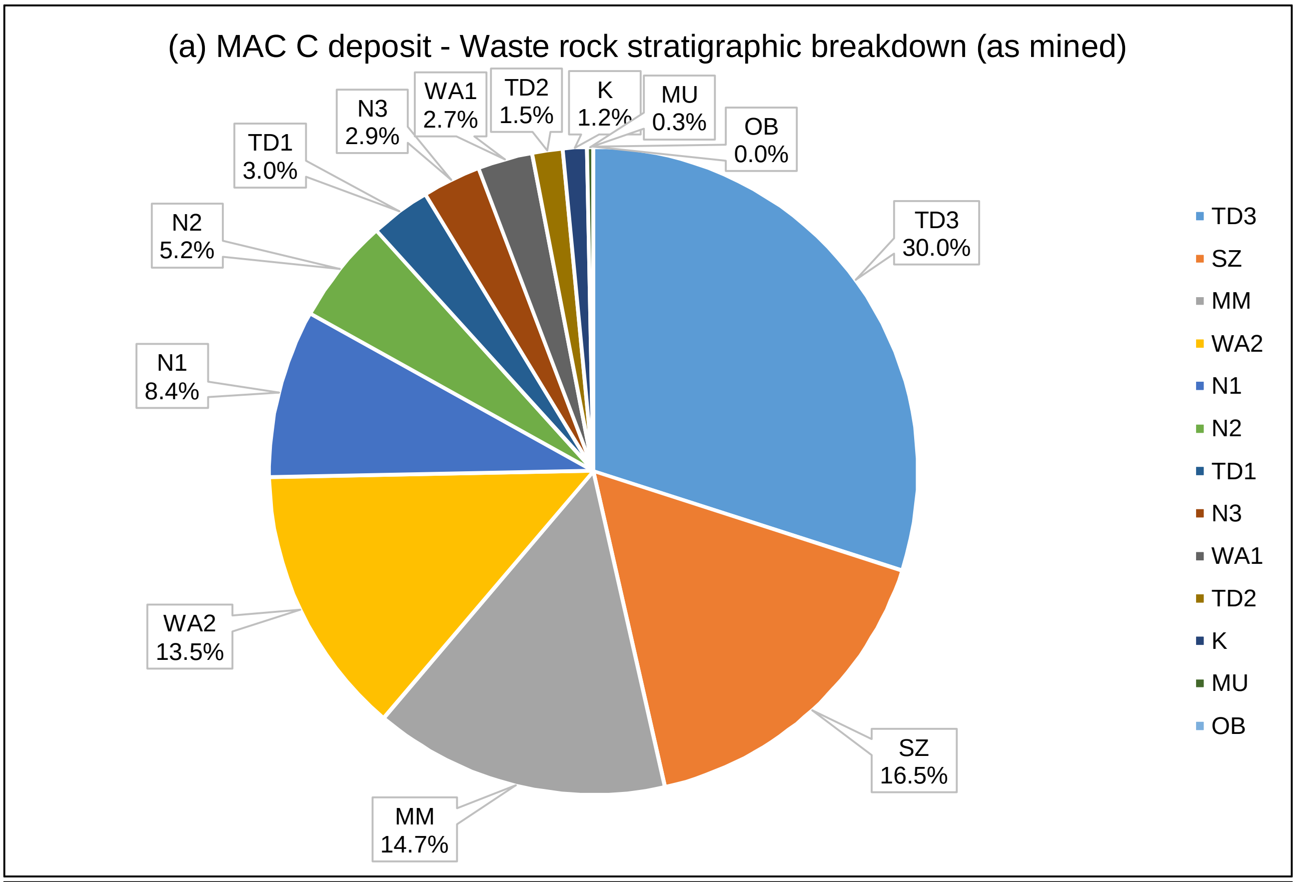
A pie chart showing the distribution of as-mined waste rock and low-grade ore from C deposit as a function of stratigraphic unit is shown in Figure 3-17. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from C deposit are shown in Figure 3-18 and Figure 3-19, respectively.

Table 3-17 presents as-mined waste volume from C deposit split by total sulphur content per stratigraphy. Table 3-18 and Table 3-19 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC C deposit is presented in Figure 3-20.

The block model data indicate that:

- As-mined waste rock from C deposit consists of 52.2% Tertiary Detritals (TD3, SZ, TD1, TD2 and K), 31.6% Marra Mamba Iron Formation (MM, N1, N2, N3 and MU) and 16.2% Wittenoom Formation (WA2, WA1 and OB). Similarly, as-mined low-grade ore consists of 43.8% Tertiary Detritals (TD1, TD3, TD2 and SZ), 31.3% Marra Mamba Iron Formation (MM, N1, N3 and N2) and 24.9% Wittenoom Formation (WA2, WA1 and OB).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the 90th percentile values below 0.1 wt% for all mined out blocks with the exception of MU waste rocks (Figure 3-18). For Marra Mamba Iron Formation (e.g. N3, N2 and N1), the median total sulphur is lower in waste rock than in low-grade ore. The MU waste rock has uncharacteristically higher S concentrations, with median of 0.6 wt%S and maximum under 1wt%S. However, this unit represents a small fraction of the total as-mined waste volume equal to approximately 0.23% or 176,000m^3.
- Table 3-17 confirms the low sulphur content in mined out waste as very low sulphur blocks (<0.1%) comprise 98.34% of as-mined waste rock and 97.94% of low-grade ore volume, and that low sulphur blocks (0.1-0.2%) comprise 1.16% of as-mined waste rock and 1.80% of low-grade ore volume. Only 0.23% (128,400 m^3 MU) of the total as-mined waste rock volumes have moderate total sulphur (0.5-1.0%).
- As-mined waste rock and low-grade ore have typically low ANC with the 95th percentile values below 10 kg H_2SO_4/t and median values below or near 5 kg H_2SO_4/t. The exception is for waste rock from K and MU that show comparatively higher ANC values with a median value of 14.9 kg H_2SO_4/t and 63.7 kg H_2SO_4/t, respectively. Four out of five stratigraphic units from Marra Mamba Iron Formation (N3, N2, N1 and MM) is devoid of ANC with median values below or near 1 kg H_2SO_4/t for both waste rock and low-grade ore (Figure 3-19).
- A total volume of 99,228,000 m^3 (incl. 56,190,800 m^3 waste rock and 43,037,200 m^3 low-grade ore) of AMD0 waste has been mined out from C deposit, comprising ~99.40% of as-mined waste rock and ~98.90% of as-mined low-grade ore, as predicted by the MAC C deposit mining model.
- The as-mined block model does not contain any AMD1 waste rock or low-grade ore blocks.
- A total volume of 817,600 m^3 (incl. 337,200 m^3 as-mined waste rock and 480,400 m^3 as-mined low-grade ore) are classed as AMD2, comprising 0.60% of as-mined waste rock and 1.10% of as-mined low-grade ore, which are associated with mostly with the Wittenoom Formation in the waste volumes and with the Wittenoom and Marra Mamba Iron Formation in low-grade ore (Table 3-18). In spite of the higher sulphur concentration seen in the MU stratigraphy, the majority of the MU waste blocks are classed as AMD0, with only 55,000m^3 classed as AMD2.
- No AMD3 waste has been mined from the MAC C deposit.
- Information in respect to water table location is not available for the majority of the mined out waste materials from C deposit (Table 3-19), however, the blocks with unknown water table location are predominately (99.42%) classed as AMD0.



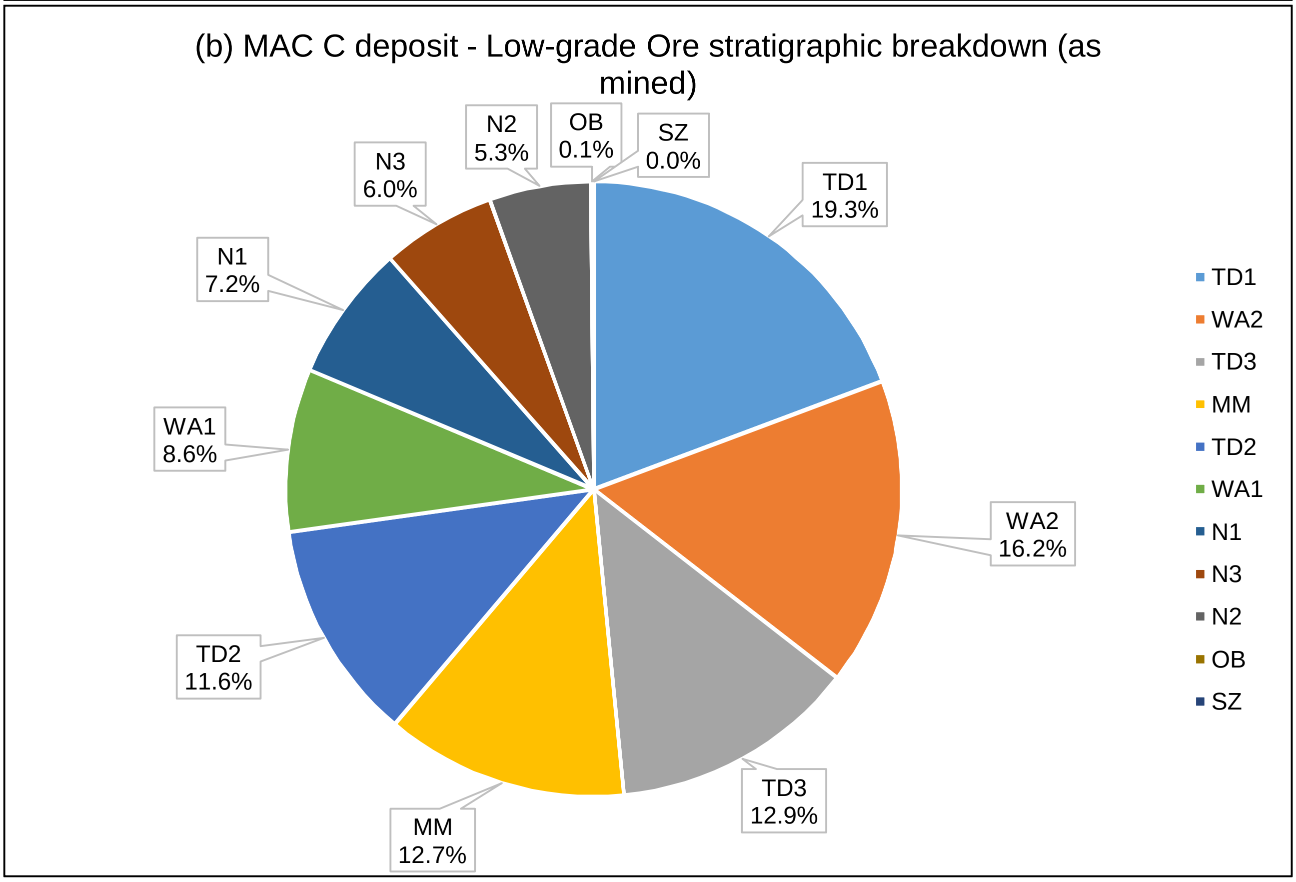


Figure 3-17 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC C deposit mining model

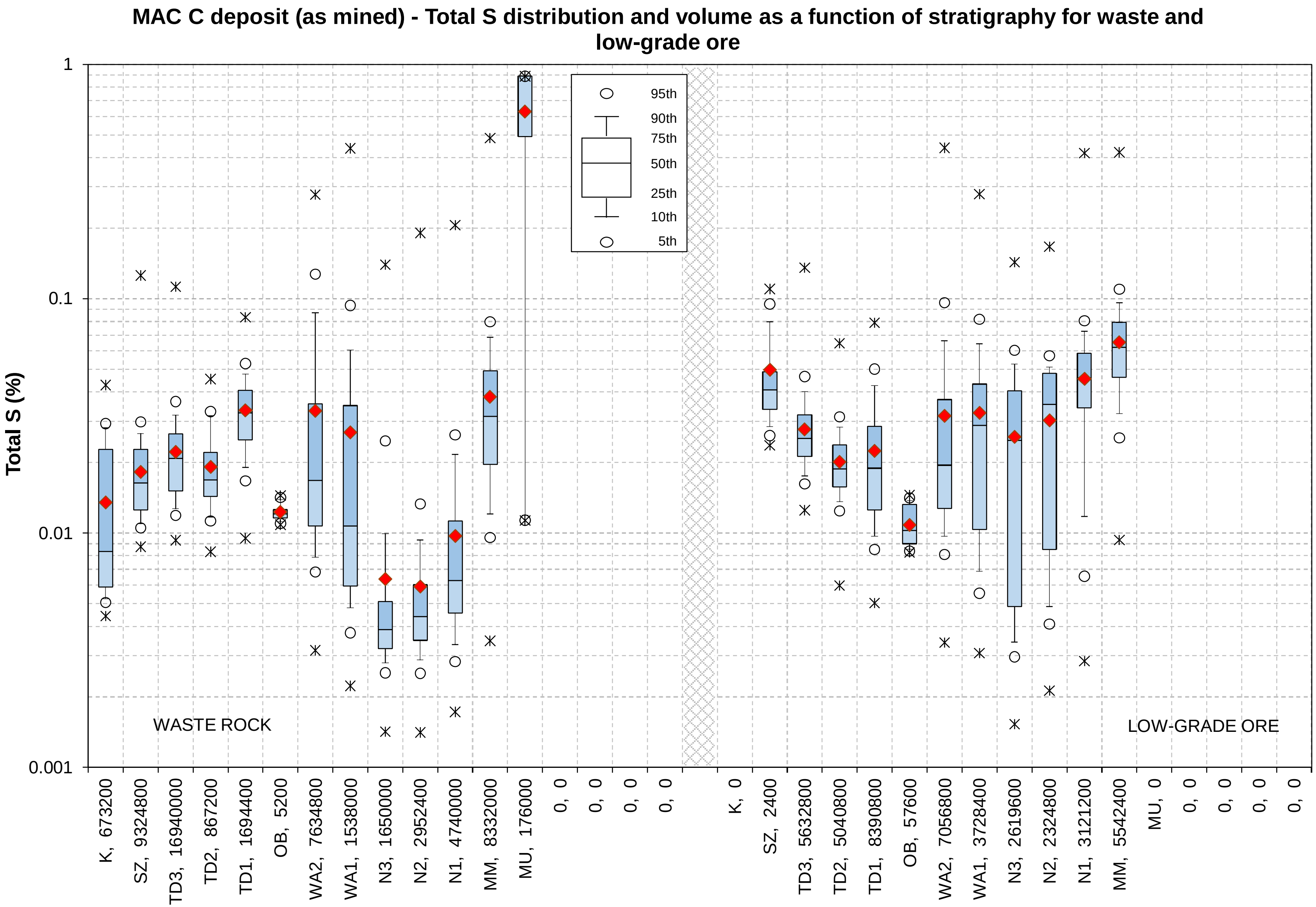


Figure 3-18 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC C deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

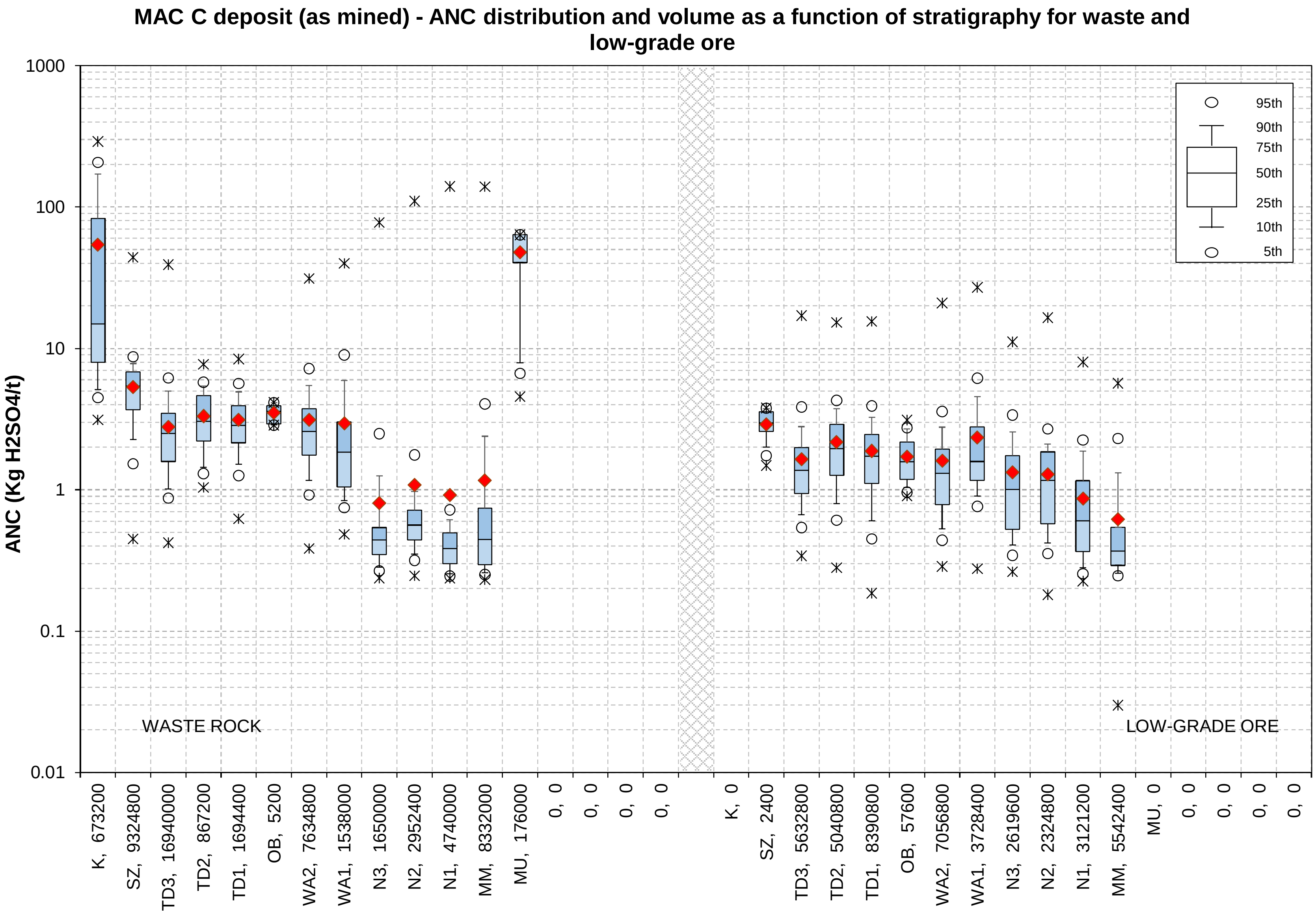


Figure 3-19 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC C deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-17 MAC C deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	673,200	1.21%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	9,321,600	16.77%	3,200	0.49%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	16,931,200	30.46%	8,800	1.34%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	867,200	1.56%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8110 - TD1	1,694,400	3.05%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4200 - OB	5,200	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	7,031,200	12.65%	525,600	80.22%	78,000	66.33%	0	0.00%	0	0.00%	0	N/A
4110 - WA1	1,464,800	2.64%	56,800	8.67%	11,600	9.86%	4,800	12.90%	0	0.00%	0	N/A
3430 - N3	1,646,400	2.96%	3,600	0.55%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3420 - N2	2,952,000	5.31%	400	0.06%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3410 - N1	4,736,400	8.52%	3,200	0.49%	400	0.34%	0	0.00%	0	0.00%	0	N/A
3300 - MM	8,223,200	14.79%	53,200	8.12%	27,600	23.47%	28,000	75.27%	0	0.00%	0	N/A
3200 - MU	42,800	0.08%	400	0.06%	0	0.00%	4,400	11.83%	128,400	100.00%	0	N/A
Total	**55,589,600**	**100.00%**	**655,200**	**100.00%**	**117,600**	**100.00%**	**37,200**	**100.00%**	**128,400**	**100.00%**	**0**	**N/A**
% of Total	**98.34%**		**1.16%**		**0.21%**		**0.07%**		**0.23%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	2,000	0.00%	400	0.05%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	5,631,200	13.21%	1,600	0.20%	0	0.00%	0	0.00%	0	N/A	0	N/A
8120 - TD2	5,040,800	11.83%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8110 - TD1	8,390,800	19.69%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
4200 - OB	57,600	0.14%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
4120 - WA2	6,737,600	15.81%	267,600	34.18%	43,200	47.79%	8,400	38.89%	0	N/A	0	N/A
4110 - WA1	3,638,000	8.54%	79,200	10.12%	11,200	12.39%	0	0.00%	0	N/A	0	N/A
3430 - N3	2,616,000	6.14%	3,600	0.46%	0	0.00%	0	0.00%	0	N/A	0	N/A
3420 - N2	2,320,000	5.44%	4,800	0.61%	0	0.00%	0	0.00%	0	N/A	0	N/A
3410 - N1	3,092,800	7.26%	24,000	3.07%	2,000	2.21%	2,400	11.11%	0	N/A	0	N/A
3300 - MM	5,096,000	11.96%	401,600	51.30%	34,000	37.61%	10,800	50.00%	0	N/A	0	N/A
3200 - MU	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**42,622,800**	**100.00%**	**782,800**	**100.00%**	**90,400**	**100.00%**	**21,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**97.94%**		**1.80%**		**0.21%**		**0.05%**		**0.00%**		**0.00%**	

Table 3-18 MAC C deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	673,200	1.20%	0	N/A	0	0.00%	0	N/A	673,200	1.19%
8150 - SZ	9,324,800	16.59%	0	N/A	0	0.00%	0	N/A	9,324,800	16.50%
8130 - TD3	16,940,000	30.15%	0	N/A	0	0.00%	0	N/A	16,940,000	29.97%
8120 - TD2	867,200	1.54%	0	N/A	0	0.00%	0	N/A	867,200	1.53%
8110 - TD1	1,694,400	3.02%	0	N/A	0	0.00%	0	N/A	1,694,400	3.00%
4200 - OB	5,200	0.01%	0	N/A	0	0.00%	0	N/A	5,200	0.01%
4120 - WA2	7,377,200	13.13%	0	N/A	257,600	76.39%	0	N/A	7,634,800	13.51%
4110 - WA1	1,514,000	2.69%	0	N/A	24,000	7.12%	0	N/A	1,538,000	2.72%
3430 - N3	1,649,600	2.94%	0	N/A	400	0.12%	0	N/A	1,650,000	2.92%
3420 - N2	2,952,400	5.25%	0	N/A	0	0.00%	0	N/A	2,952,400	5.22%
3410 - N1	4,740,000	8.44%	0	N/A	0	0.00%	0	N/A	4,740,000	8.39%
3300 - MM	8,276,800	14.73%	0	N/A	55,200	16.37%	0	N/A	8,332,000	14.74%
3200 - MU	176,000	0.31%	0	N/A	0	0.00%	0	N/A	176,000	0.31%
Total	**56,190,800**	**100.00%**	**0**	**N/A**	**337,200**	**100.00%**	**0**	**N/A**	**56,528,000**	**100.00%**
% of Total	**99.40%**		**0.00%**		**0.60%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	2,400	0.01%	0	N/A	0	0.00%	0	N/A	2,400	0.01%
8130 - TD3	5,632,800	13.09%	0	N/A	0	0.00%	0	N/A	5,632,800	12.94%
8120 - TD2	5,040,800	11.71%	0	N/A	0	0.00%	0	N/A	5,040,800	11.58%
8110 - TD1	8,390,800	19.50%	0	N/A	0	0.00%	0	N/A	8,390,800	19.28%
4200 - OB	57,600	0.13%	0	N/A	0	0.00%	0	N/A	57,600	0.13%
4120 - WA2	6,873,600	15.97%	0	N/A	183,200	38.13%	0	N/A	7,056,800	16.22%
4110 - WA1	3,711,600	8.62%	0	N/A	16,800	3.50%	0	N/A	3,728,400	8.57%
3430 - N3	2,616,800	6.08%	0	N/A	2,800	0.58%	0	N/A	2,619,600	6.02%
3420 - N2	2,323,200	5.40%	0	N/A	1,600	0.33%	0	N/A	2,324,800	5.34%
3410 - N1	3,107,600	7.22%	0	N/A	13,600	2.83%	0	N/A	3,121,200	7.17%
3300 - MM	5,280,000	12.27%	0	N/A	262,400	54.62%	0	N/A	5,542,400	12.74%
3200 - MU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**43,037,200**	**100.00%**	**0**	**N/A**	**480,400**	**100.00%**	**0**	**N/A**	**43,517,600**	**100.00%**
% of Total	**98.90%**		**0.00%**		**1.10%**		**0.00%**		**100.00%**	

Table 3-19 MAC C deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	* N/R (m^3)	Total Volume (m^3)	% of volume
Waste rock					
0	568,400	2,423,200	53,199,200	56,190,800	99.40%
1	0	0	0	0	0.00%
2	0	0	337,200	337,200	0.60%
3	0	0	0	0	0.00%
Total	**568,400**	**2,423,200**	**53,536,400**	**56,528,000**	100.00%
% of Total	**1.01%**	**4.29%**	**94.71%**	**100.00%**	
Low grade ore					
0	379,600	946,400	41,711,200	43,037,200	98.90%
1	0	0	0	0	0.00%
2	0	0	480,400	480,400	1.10%
3	0	0	0	0	0.00%
Total	**379,600**	**946,400**	**42,191,600**	**43,517,600**	100.00%
% of Total	**0.87%**	**2.17%**	**96.95%**	**100.00%**	

*Note: * water table location undetermined.*

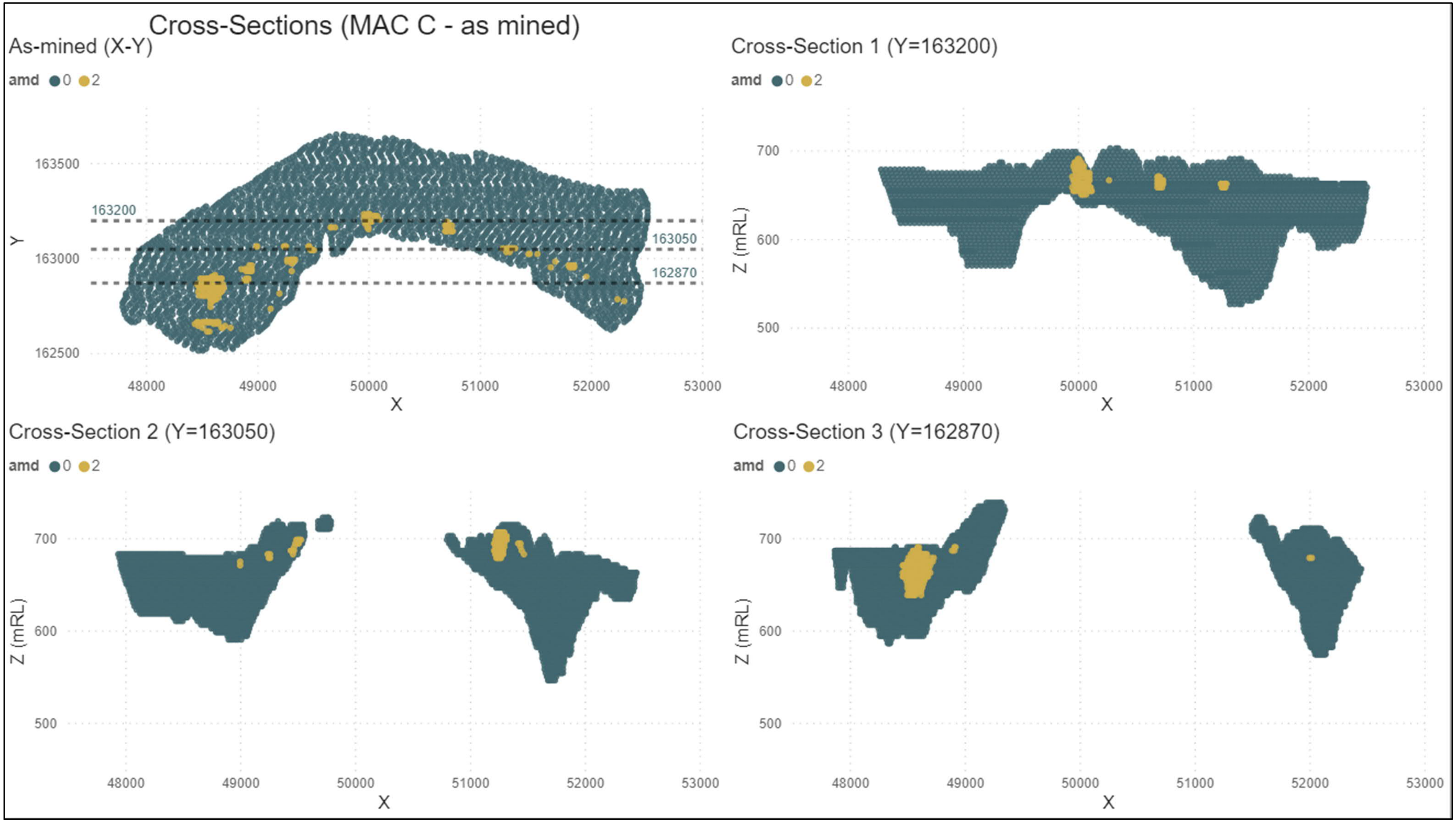


Figure 3-20 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC C deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.4.2 MAC C deposit (to-be-mined waste)

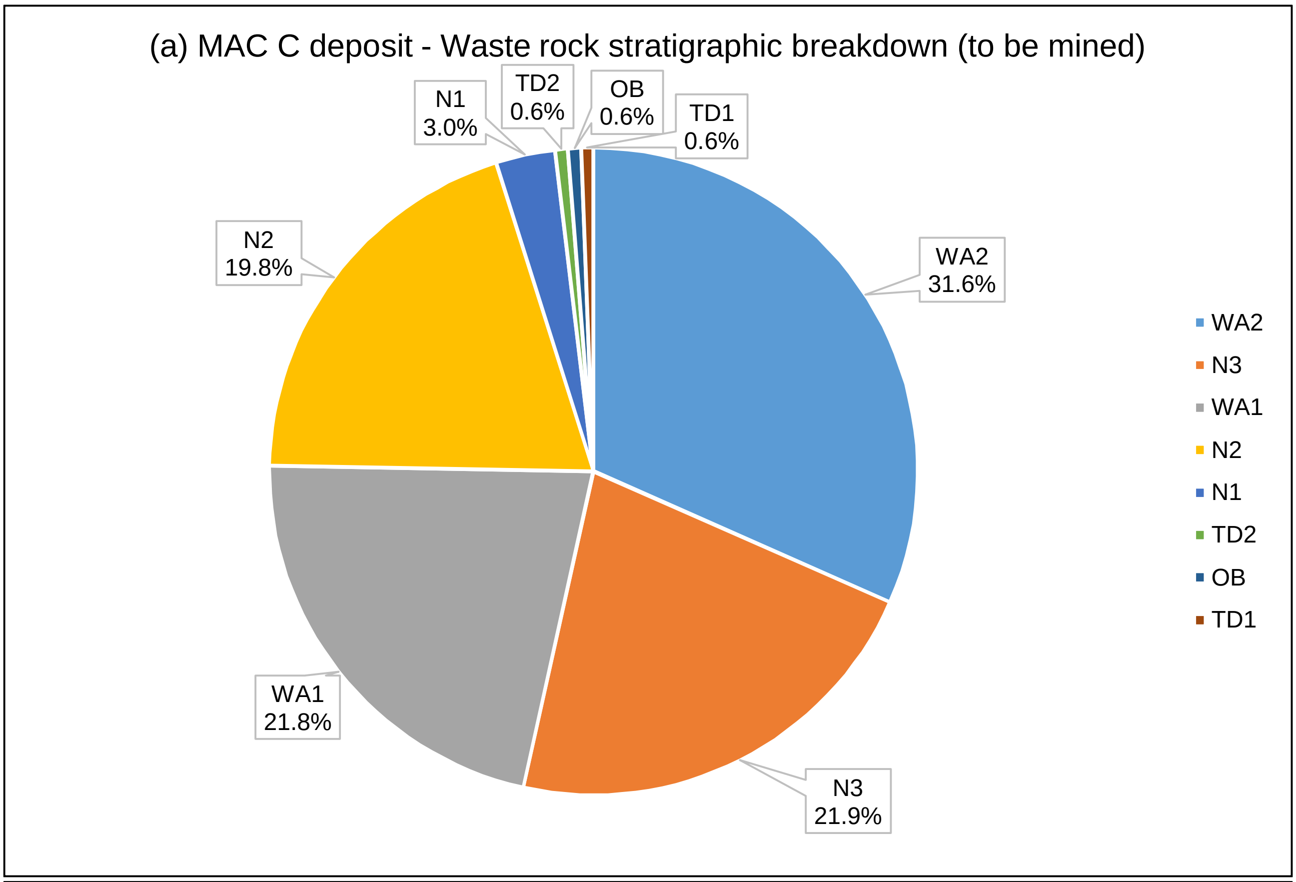
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from C deposit as a function of stratigraphic unit is shown in Figure 3-21. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from C deposit are shown in Figure 3-22 and Figure 3-23, respectively.

Table 3-20 presents to-be-mined waste volume from C deposit split by total sulphur content per stratigraphy. Table 3-21 and Table 3-22 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC C deposit is presented in **Figure 3-24**.

The block model data indicate that:

- To-be-mined waste rock from C deposit includes 54.1% Wittenoom Formation (WA2, WA1 and OB) and 44.7% Marra Mamba Iron Formation (N3, N2 and N1) with insignificant portion of Tertiary Detritals (1.9%, incl. TD2, OB and TD1). Wittenoom Formation (67.3%, incl. WA2, WA1 and OB) dominates to-be-mined low-grade ore with the reminder of the to-be-mined low grade ore split between Marra Mamba Iron Formation (27.9%) and Tertiary Detritals (4.8%).
- All of the to-be-mined waste rock and low-grade ore have very low total sulphur with the maximum sulphur contents well below 0.1 wt% (Figure 3-22, Table 3-20).
- To-be-mined waste rock and low-grade ore from C deposit have low ANC with the median values near or below 3 kg H_2SO_4/t for Tertiary Detritals and Wittenoom Formation, and below 1 kg H_2SO_4/t for Marra Mamba Iron Formation (Figure 3-23).
- The current mining block model for MAC C deposit predicts that the entire to-be-mined waste rock (3,417,600 m^3) and low-grade ore (3,758,400 m^3) is AMD0 (Table 3-21).
- The majority of the waste rock (83.08%) and low-grade ore (59.11%) to be mined will be sourced from the blocks below water table with some portion from blocks with unknown water table location (Table 3-22). However, all these to-be-mined waste blocks are classed as AMD0.



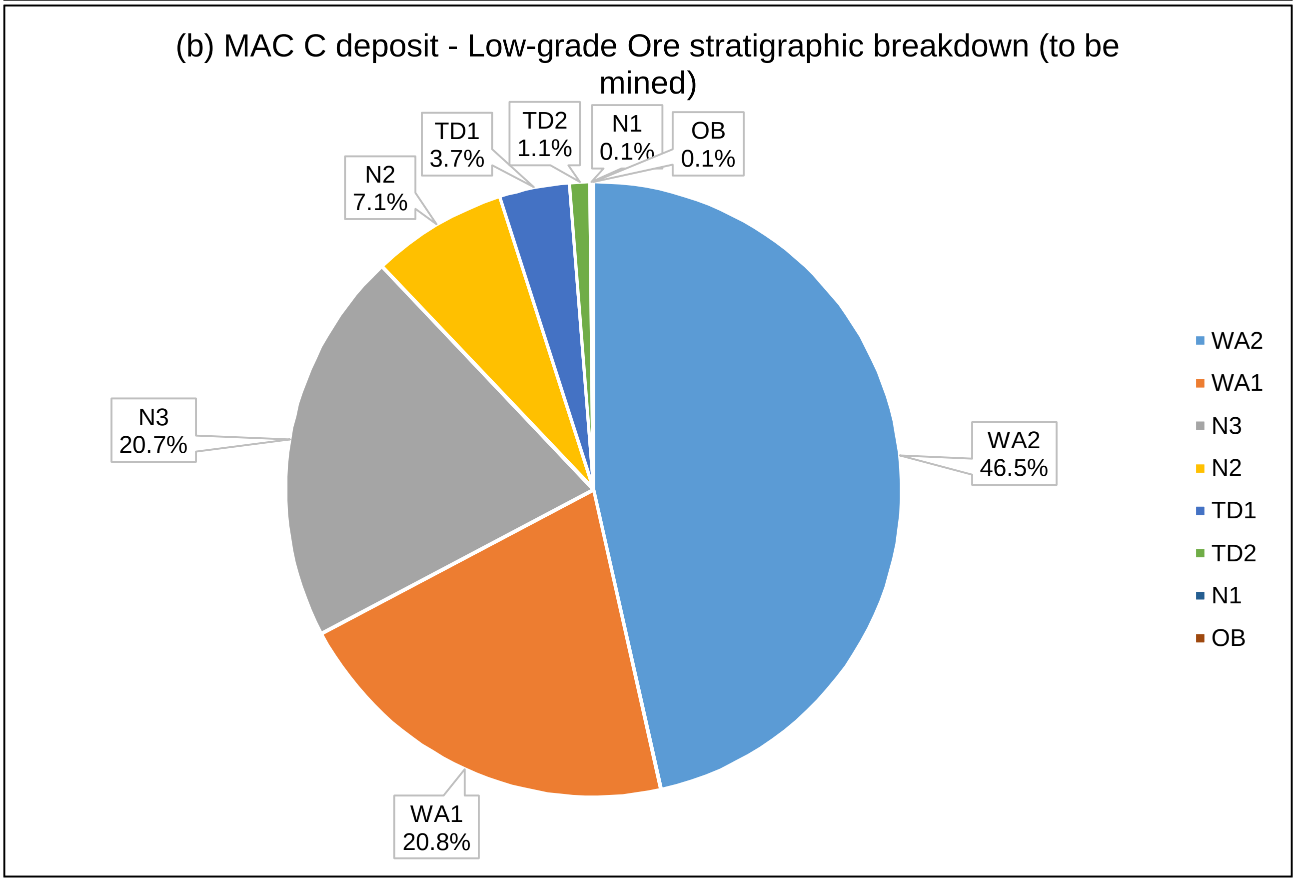


Figure 3-21 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC C deposit mining model

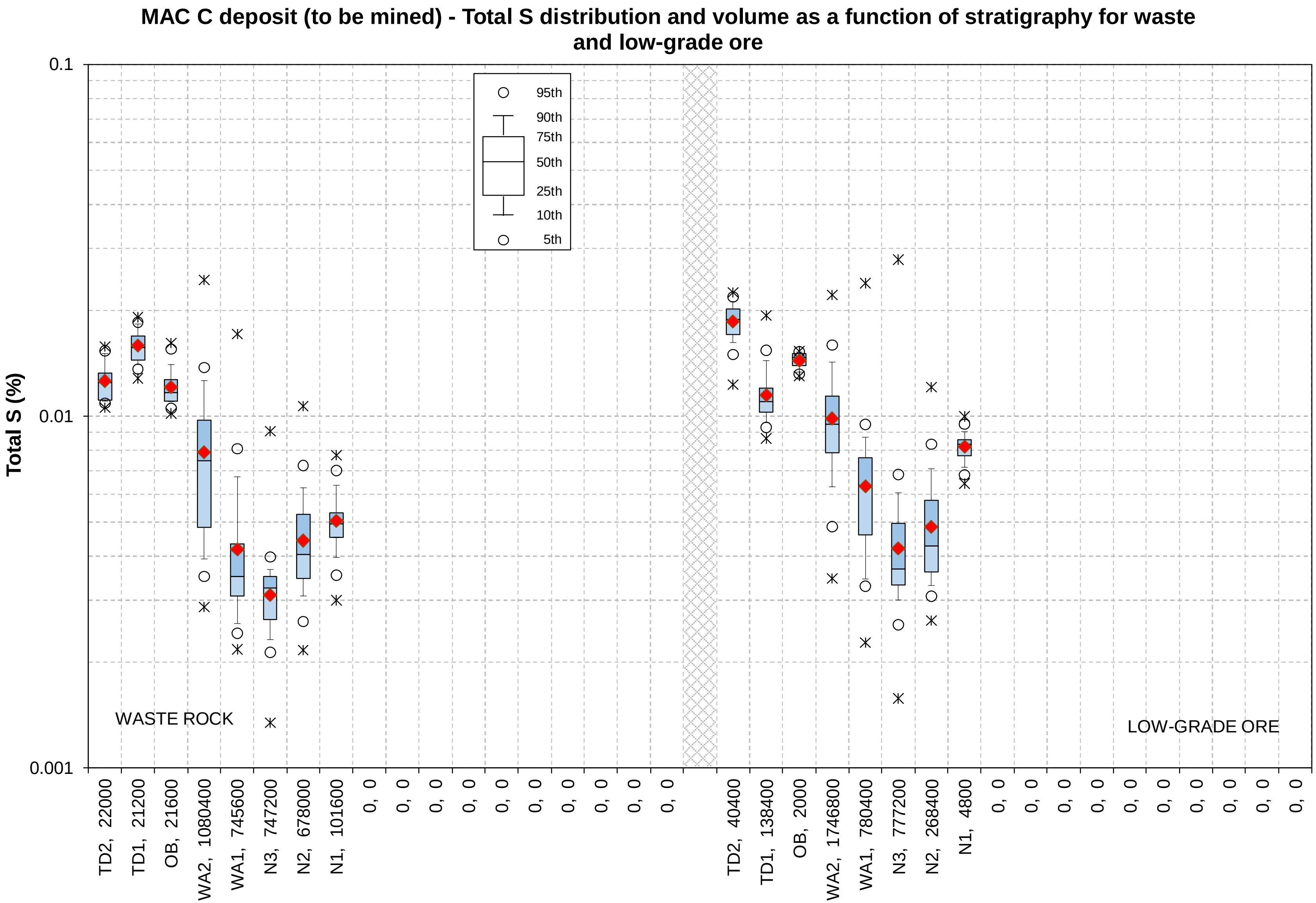


Figure 3-22 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC C deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

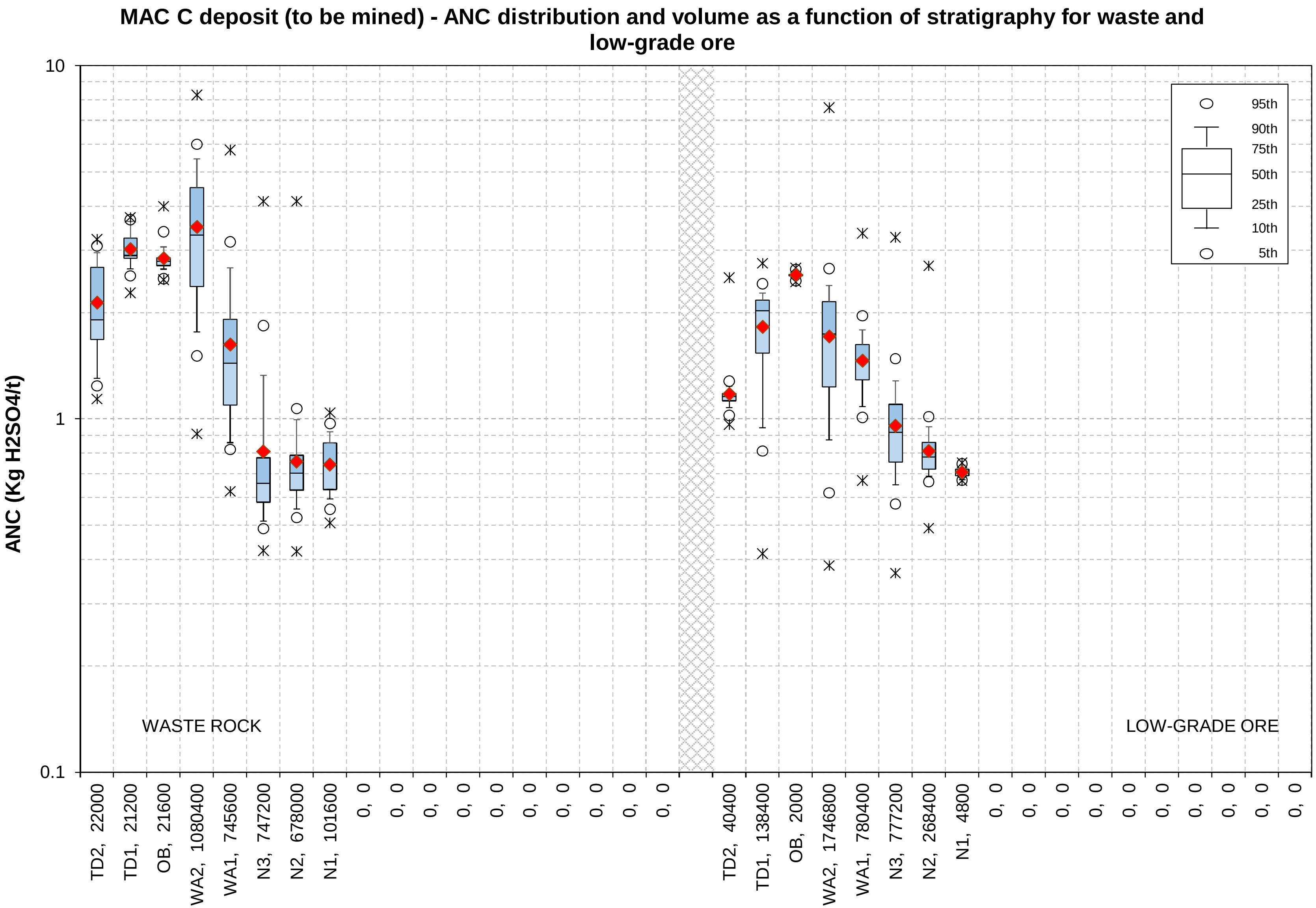


Figure 3-23 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC C deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-20 MAC C deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	22,000	0.64%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	21,200	0.62%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4200 - OB	21,600	0.63%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	1,080,400	31.61%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	745,600	21.82%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	747,200	21.86%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	678,000	19.84%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	101,600	2.97%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3200 - MU	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Total	**3,417,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	40,400	1.07%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	138,400	3.68%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4200 - OB	2,000	0.05%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	1,746,800	46.48%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	780,400	20.76%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	777,200	20.68%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	268,400	7.14%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	4,800	0.13%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3200 - MU	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Total	**3,758,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-21 MAC C deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8120 - TD2	22,000	0.64%	0	N/A	0	N/A	0	N/A	22,000	0.64%
8110 - TD1	21,200	0.62%	0	N/A	0	N/A	0	N/A	21,200	0.62%
4200 - OB	21,600	0.63%	0	N/A	0	N/A	0	N/A	21,600	0.63%
4120 - WA2	1,080,400	31.61%	0	N/A	0	N/A	0	N/A	1,080,400	31.61%
4110 - WA1	745,600	21.82%	0	N/A	0	N/A	0	N/A	745,600	21.82%
3430 - N3	747,200	21.86%	0	N/A	0	N/A	0	N/A	747,200	21.86%
3420 - N2	678,000	19.84%	0	N/A	0	N/A	0	N/A	678,000	19.84%
3410 - N1	101,600	2.97%	0	N/A	0	N/A	0	N/A	101,600	2.97%
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
3200 - MU	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**3,417,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**3,417,600**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8120 - TD2	40,400	1.07%	0	N/A	0	N/A	0	N/A	40,400	1.07%
8110 - TD1	138,400	3.68%	0	N/A	0	N/A	0	N/A	138,400	3.68%
4200 - OB	2,000	0.05%	0	N/A	0	N/A	0	N/A	2,000	0.05%
4120 - WA2	1,746,800	46.48%	0	N/A	0	N/A	0	N/A	1,746,800	46.48%
4110 - WA1	780,400	20.76%	0	N/A	0	N/A	0	N/A	780,400	20.76%
3430 - N3	777,200	20.68%	0	N/A	0	N/A	0	N/A	777,200	20.68%
3420 - N2	268,400	7.14%	0	N/A	0	N/A	0	N/A	268,400	7.14%
3410 - N1	4,800	0.13%	0	N/A	0	N/A	0	N/A	4,800	0.13%
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
3200 - MU	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**3,758,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**3,758,400**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-22 MAC C deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	* N/R (m^3)	Total Volume (m^3)	% of volume
Waste rock					
0	110,800	2,839,200	467,600	3,417,600	100.00%
1	0	0	0	0	0.00%
2	0	0	0	0	0.00%
3	0	0	0	0	0.00%
Total	**110,800**	**2,839,200**	**467,600**	**3,417,600**	100.00%
% of Total	**3.24%**	**83.08%**	**13.68%**	**100.00%**	
Low grade ore					
0	140,000	2,221,600	1,396,800	3,758,400	100.00%
1	0	0	0	0	0.00%
2	0	0	0	0	0.00%
3	0	0	0	0	0.00%
Total	**140,000**	**2,221,600**	**1,396,800**	**3,758,400**	100.00%
% of Total	**3.72%**	**59.11%**	**37.16%**	**100.00%**	

*Note: * water table location undetermined.*

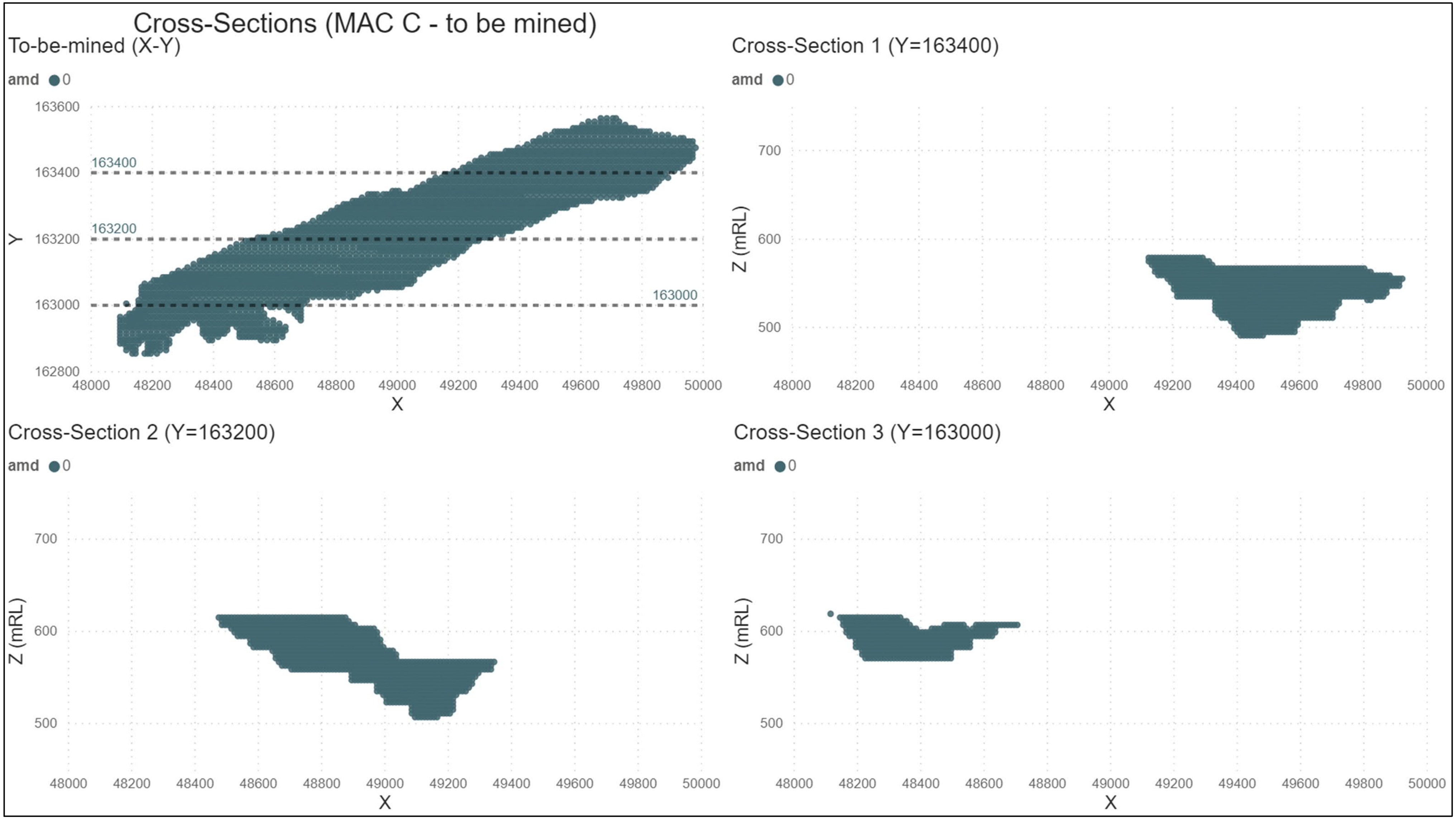


Figure 3-24 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC C deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.5 MAC D deposit

3.1.1.5.1 MAC D deposit (as-mined waste)

A pie chart showing the distribution of as-mined waste rock and low-grade ore from D deposit as a function of stratigraphic unit is shown in Figure 3-25. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from D deposit are shown in Figure 3-26 and

Figure **3-27**, respectively.

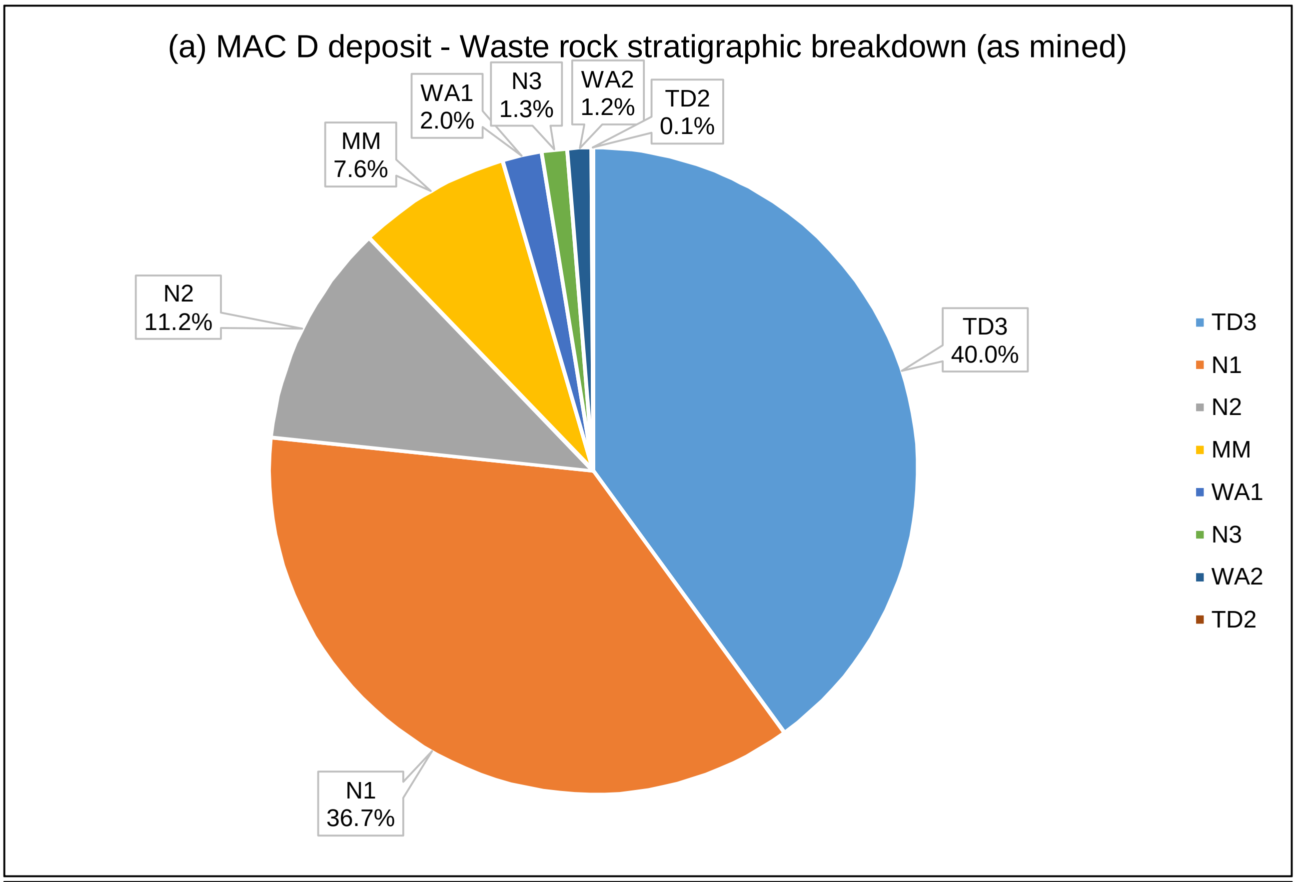
Table 3-23 presents as-mined waste volume from D deposit split by total sulphur content per stratigraphy. Table 3-24 and Table 3-25 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC D deposit is presented in Figure 3-28. Note that, unlike the other block models, the volumes of the mining blocks are inconsistent (varying from 25 m^3 to 1800 m^3) for D deposit model, which explains the "patchy" presentation in Figure 3-28.

The D deposit is fully mined out.

The block model data indicate that:

- As-mined waste rock from D deposit includes 56.8% Marra Mamba Iron Formation (N1, N2, MM and N3) and 40.1% Tertiary Detritals (TD3 and TD2) with insignificant contribution from Wittenoom Formation (3.2%, incl. WA2 and WA1). As-mined low-grade ore is dominated by Marra Mamba Iron Formation (76.5%, incl. N2, N3 and N1) with the reminder split between Tertiary Detritals (13.8%) and Wittenoom Formation (9.7%).
- All of the as-mined waste rock and low-grade ore have very low total sulphur with the maximum sulphur contents below or near 0.1 wt% and median sulphur values below 0.05 wt% (Figure 3-26, Table 3-23).
- As-mined waste rock and low-grade ore from D deposit typically have low ANC with the median values below 5 kg H_2SO_4/t. WA1 show a somewhat larger ANC range with 95th percentile at 30kg H_2SO_4/t and maximum values near 100 kg H_2SO_4/t (
- Figure **3-27**).
- The current mining block model for D deposit predicts that the entire as-mined waste rock (5,334,500 m^3) and low-grade ore (7,436,300 m^3) is AMD0 (Table 3-24).
- Approximately 99.95% of waste rock and 99.74% of low-grade ore blocks are predicted to have been mined out from above water table (Table 3-25).



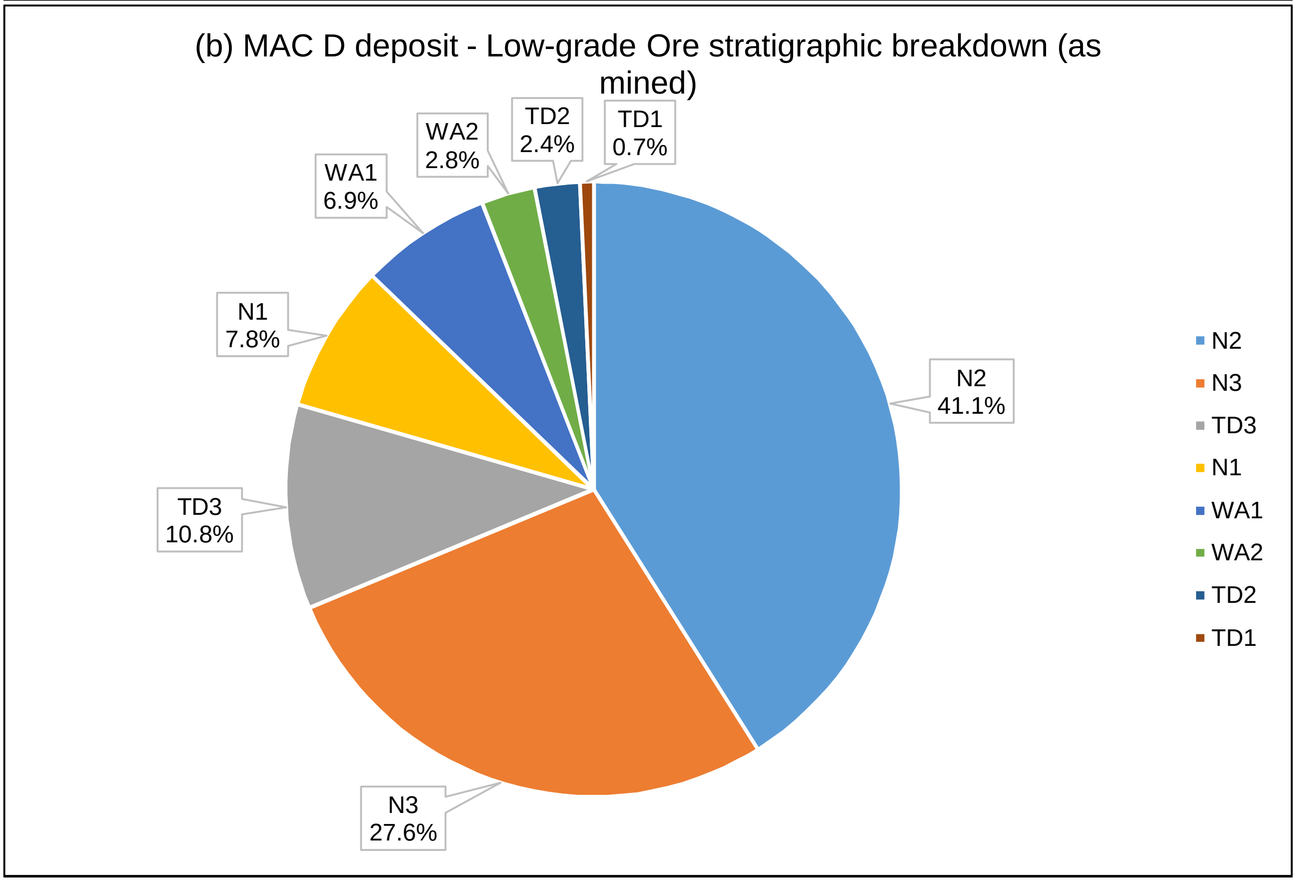


Figure 3-25 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC D deposit mining model

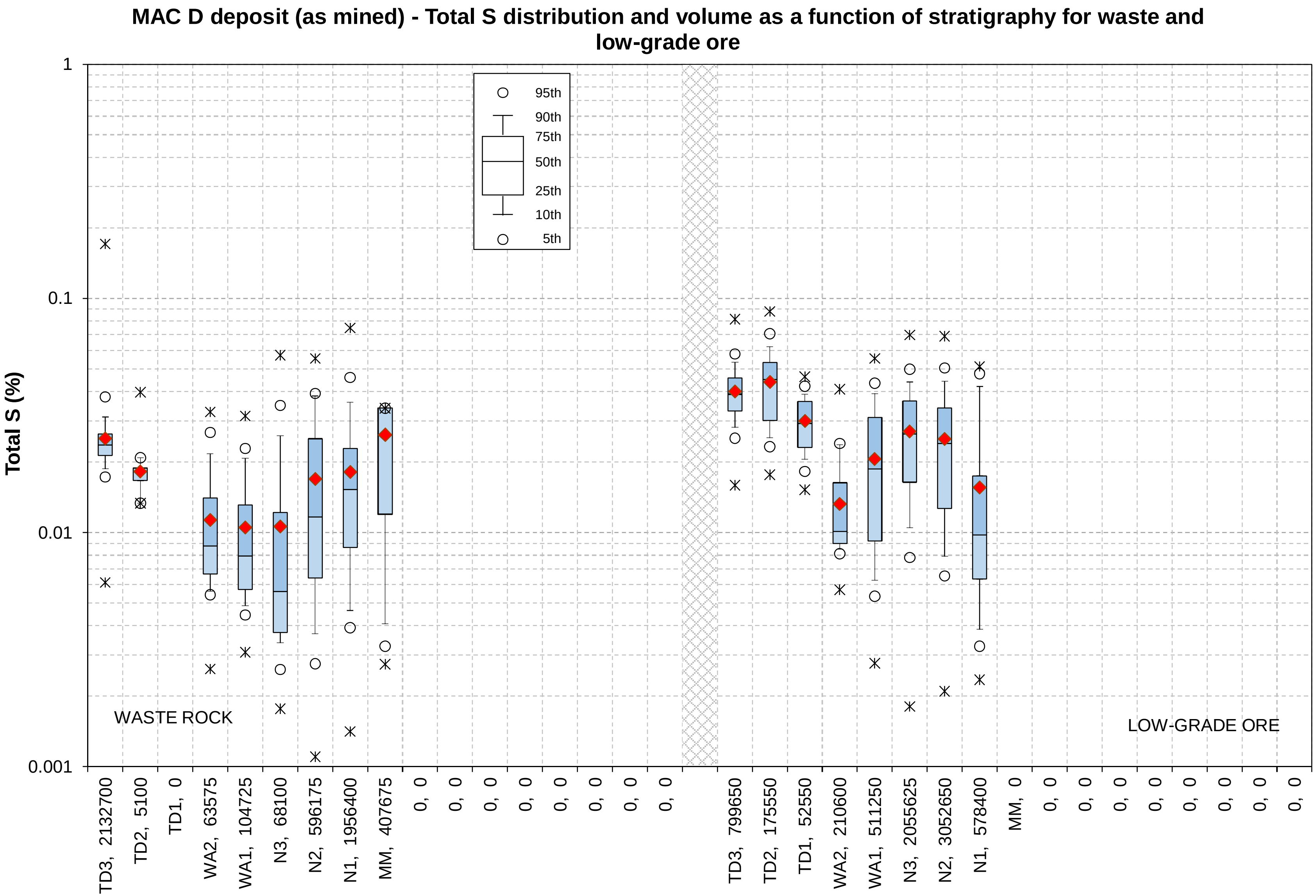


Figure 3-26 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC D deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

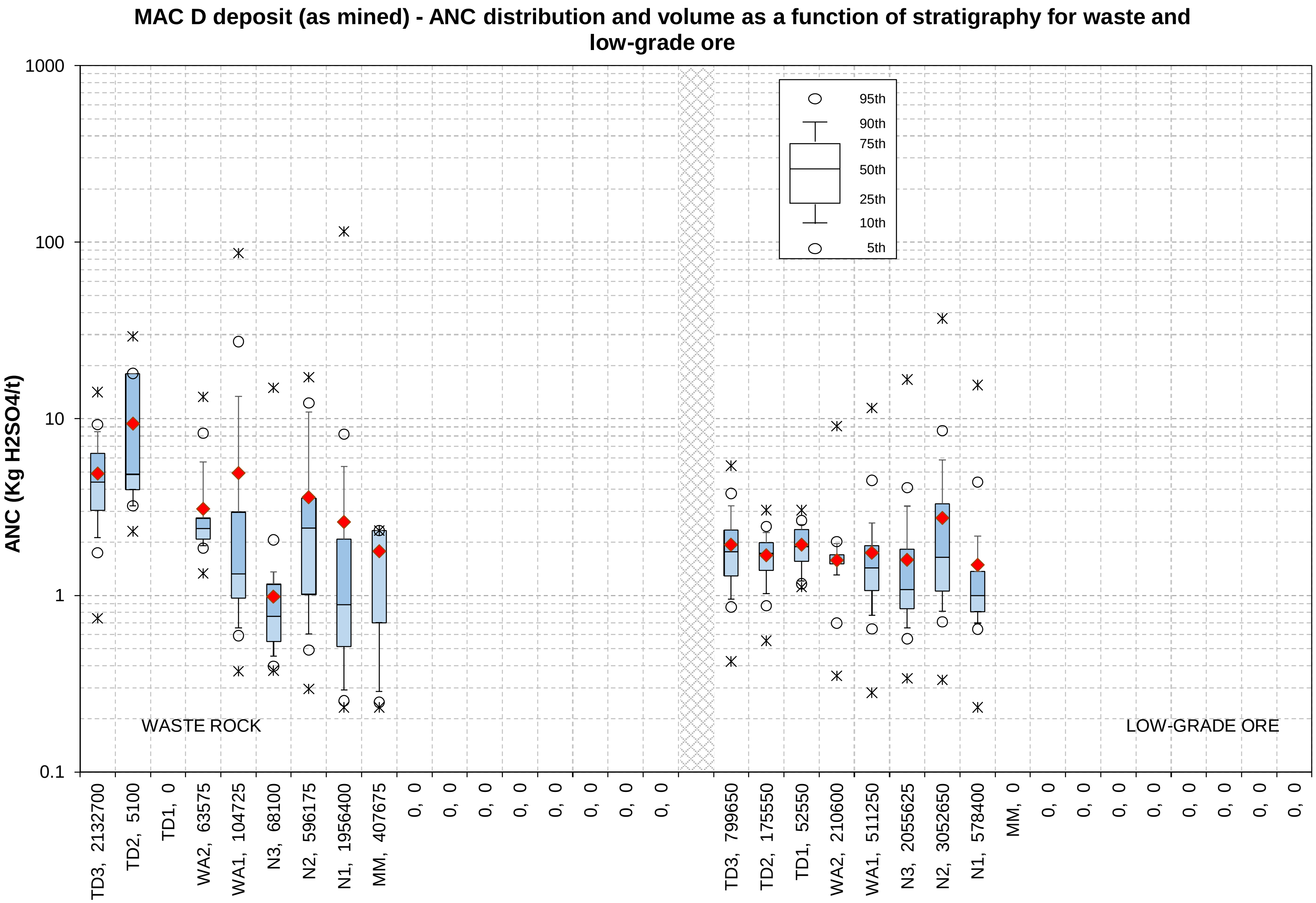


Figure 3-27 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC D deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-23 MAC D deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8130 - TD3	2,127,175	39.92%	5,525	100.00%	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	5,100	0.10%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	63,575	1.19%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	104,725	1.97%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	68,100	1.28%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	596,175	11.19%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	1,956,400	36.71%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	407,675	7.65%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**5,328,925**	**100.00%**	**5,525**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.90%**		**0.10%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
8130 - TD3	799,650	10.75%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	175,550	2.36%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	52,550	0.71%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	210,600	2.83%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	511,250	6.88%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	2,055,625	27.64%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	3,052,650	41.05%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	578,400	7.78%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A	0	N/A
Total	**7,436,275**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-24 MAC D deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8130 - TD3	2,132,700	39.98%	0	N/A	0	N/A	0	N/A	2,132,700	39.98%
8120 - TD2	5,100	0.10%	0	N/A	0	N/A	0	N/A	5,100	0.10%
8110 - TD1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
4120 - WA2	63,575	1.19%	0	N/A	0	N/A	0	N/A	63,575	1.19%
4110 - WA1	104,725	1.96%	0	N/A	0	N/A	0	N/A	104,725	1.96%
3430 - N3	68,100	1.28%	0	N/A	0	N/A	0	N/A	68,100	1.28%
3420 - N2	596,175	11.18%	0	N/A	0	N/A	0	N/A	596,175	11.18%
3410 - N1	1,956,400	36.67%	0	N/A	0	N/A	0	N/A	1,956,400	36.67%
3300 - MM	407,675	7.64%	0	N/A	0	N/A	0	N/A	407,675	7.64%
Total	**5,334,450**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**5,334,450**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
8130 - TD3	799,650	10.75%	0	N/A	0	N/A	0	N/A	799,650	10.75%
8120 - TD2	175,550	2.36%	0	N/A	0	N/A	0	N/A	175,550	2.36%
8110 - TD1	52,550	0.71%	0	N/A	0	N/A	0	N/A	52,550	0.71%
4120 - WA2	210,600	2.83%	0	N/A	0	N/A	0	N/A	210,600	2.83%
4110 - WA1	511,250	6.88%	0	N/A	0	N/A	0	N/A	511,250	6.88%
3430 - N3	2,055,625	27.64%	0	N/A	0	N/A	0	N/A	2,055,625	27.64%
3420 - N2	3,052,650	41.05%	0	N/A	0	N/A	0	N/A	3,052,650	41.05%
3410 - N1	578,400	7.78%	0	N/A	0	N/A	0	N/A	578,400	7.78%
3300 - MM	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**7,436,275**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**7,436,275**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-25 MAC D deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	5,331,900	2,550	5,334,450	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**5,331,900**	**2,550**	**5,334,450**	100.00%
% of Total	**99.95%**	**0.05%**	**100.00%**	
Low grade ore				
0	7,417,000	19,275	7,436,275	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**7,417,000**	**19,275**	**7,436,275**	100.00%
% of Total	**99.74%**	**0.26%**	**100.00%**	

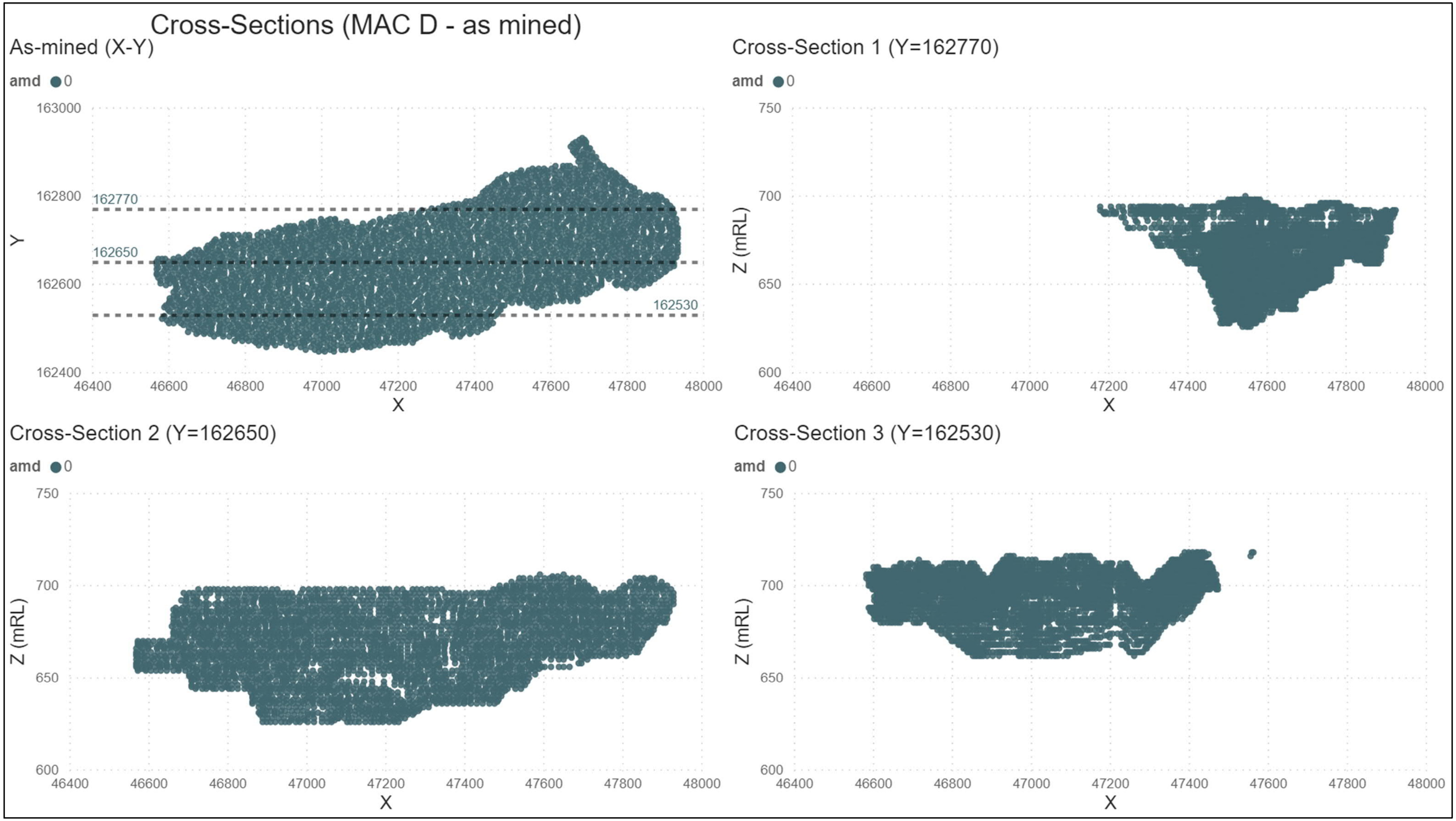


Figure 3-28 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC D deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.6 MAC E deposit

3.1.1.6.1 MAC E deposit (as-mined waste)

A pie chart showing the distribution of as-mined waste rock and low-grade ore from E deposit as a function of stratigraphic unit is shown in Figure 3-29. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from E deposit are shown in Figure 3-30 and Figure 3-31, respectively.

Table 3-26 presents as-mined waste volume from E deposit split by total sulphur content per stratigraphy. Table 3-27 and Table 3-28 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC E deposit is presented in Figure 3-32.

The block model data indicate that:

- The majority (67.9%) of as-mined waste rock from E deposit is from Tertiary Detritals (TD3, ST3, SZ, TD2, GS3, K, VB2 and TD1); the Marra Mamba Iron Formation (incl. N1, MM, N2 and N3) comprise 26.5% and the reminder (5.5%) is represented by the Wittenoom Formation (incl. WA1 and WA2). Similarly, half of as-mined low-grade ore is sourced from Tertiary Detritals (TD3, TD2, GS3, VB2, TD1, HC1, SZ, K and ST3) with smaller portion from Marra Mamba Iron Formation (38.3%, incl., N1, N2, MM and N3) and Wittenoom Formation (11.2%, incl. WA1 and WA2).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below or near 0.1 wt% and median value below or near 0.05 wt% for all mined out blocks (Figure 3-30).
- Very low sulphur blocks (<0.1%) comprise 99.60% of as-mined waste rock and 98.36% of low-grade ore volume, while low sulphur blocks (0.1-0.2%) comprise 0.32% of as-mined waste rock and 1.51% of low-grade ore volume (Table 3-26). An inconsequential amount equal to 0.04% (40,000 m^3 MM) of the total as-mined waste rock and 0.01% (3,600 m^3 N2) of the total as-mined low-grade ore have moderate total sulphur (0.5-1.0%).
- As-mined waste rock and low-grade ore have typically low ANC with the 90th percentile values below or close to 10 kg H_2SO_4/t. The exception is for TD2 waste rock that show relatively higher ANC values with a median value of 14.9 kg H_2SO_4/t and 75th percentile value of 63.7 kg H_2SO_4/t (Figure 3-31). Marra Mamba Iron Formation (N3, N2, N1 and MM) is devoid of ANC with median values below or near 1 kg H_2SO_4/t for waste rock and low-grade ore.
- A total volume of 129,735,600 m^3 (incl. 95,782,800 m^3 waste rock and 33,952,800 m^3 low-grade ore) of AMD0 waste has been mined out from E deposit, comprising ~99.90% of as-mined waste rock and ~99.08% of as-mined low-grade ore.
- The as-mined data does not show any indication of mining of AMD1 in waste rock or low-grade ore blocks at E deposit.
- A total volume of 406,000 m^3 (incl. 98,400 m^3 as-mined waste rock and 307,600 m^3 as-mined low-grade ore) are classed as AMD2, comprising 0.10% of as-mined waste rock and 0.90% of as-mined low-grade ore, which are mainly associated with Marra Mamba Iron Formation (Table 3-27).
- An inconsequential volume of 6,400 m^3 (or 0.02 %) of as-mined low-grade ore from TD3 was classed as AMD3.
- Approximately 93.21% of waste rock and 96.58% of low-grade ore blocks are predicted to have been mined out from above water table (Table 3-28).

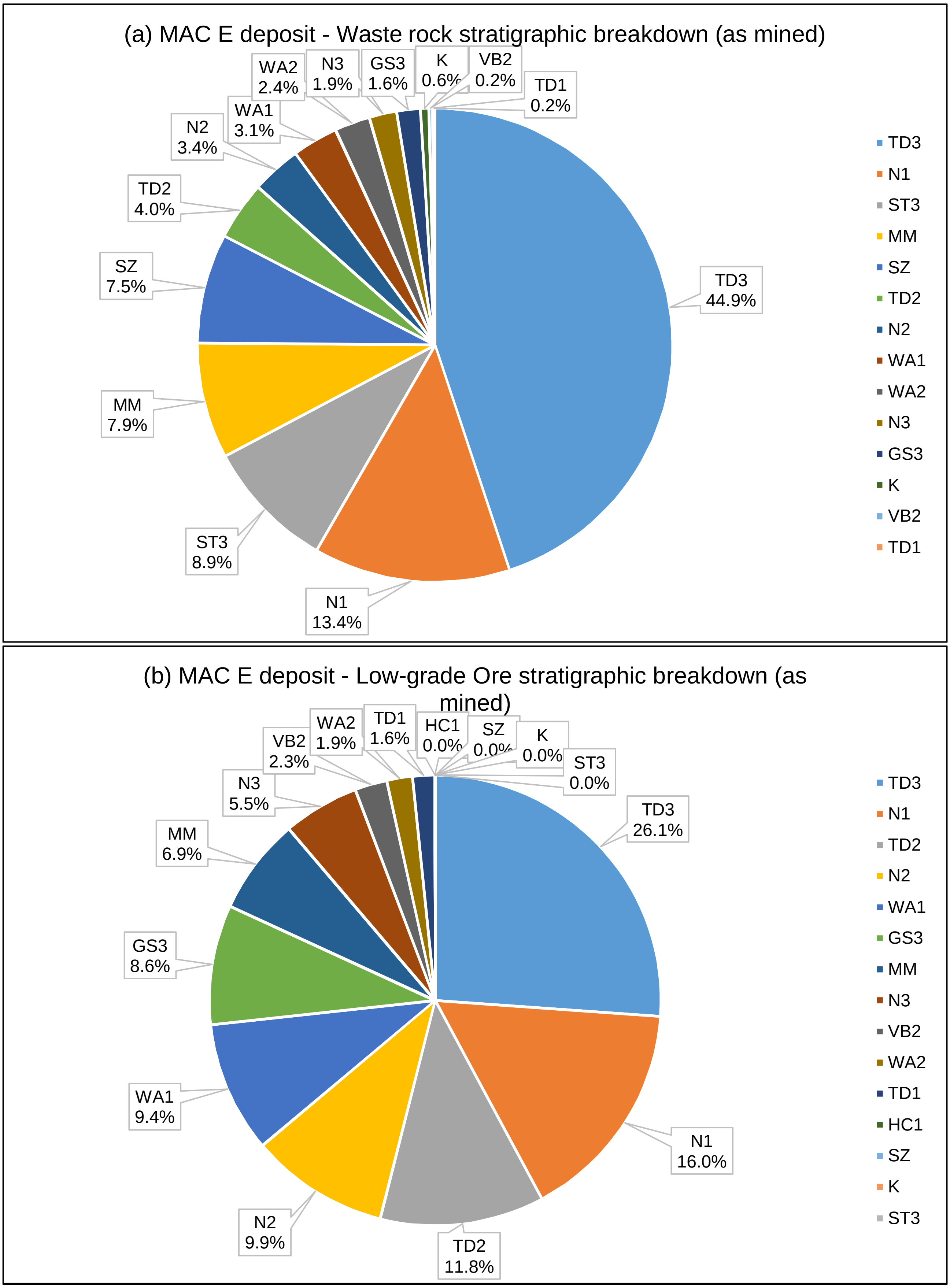


Figure 3-29 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC E deposit mining model

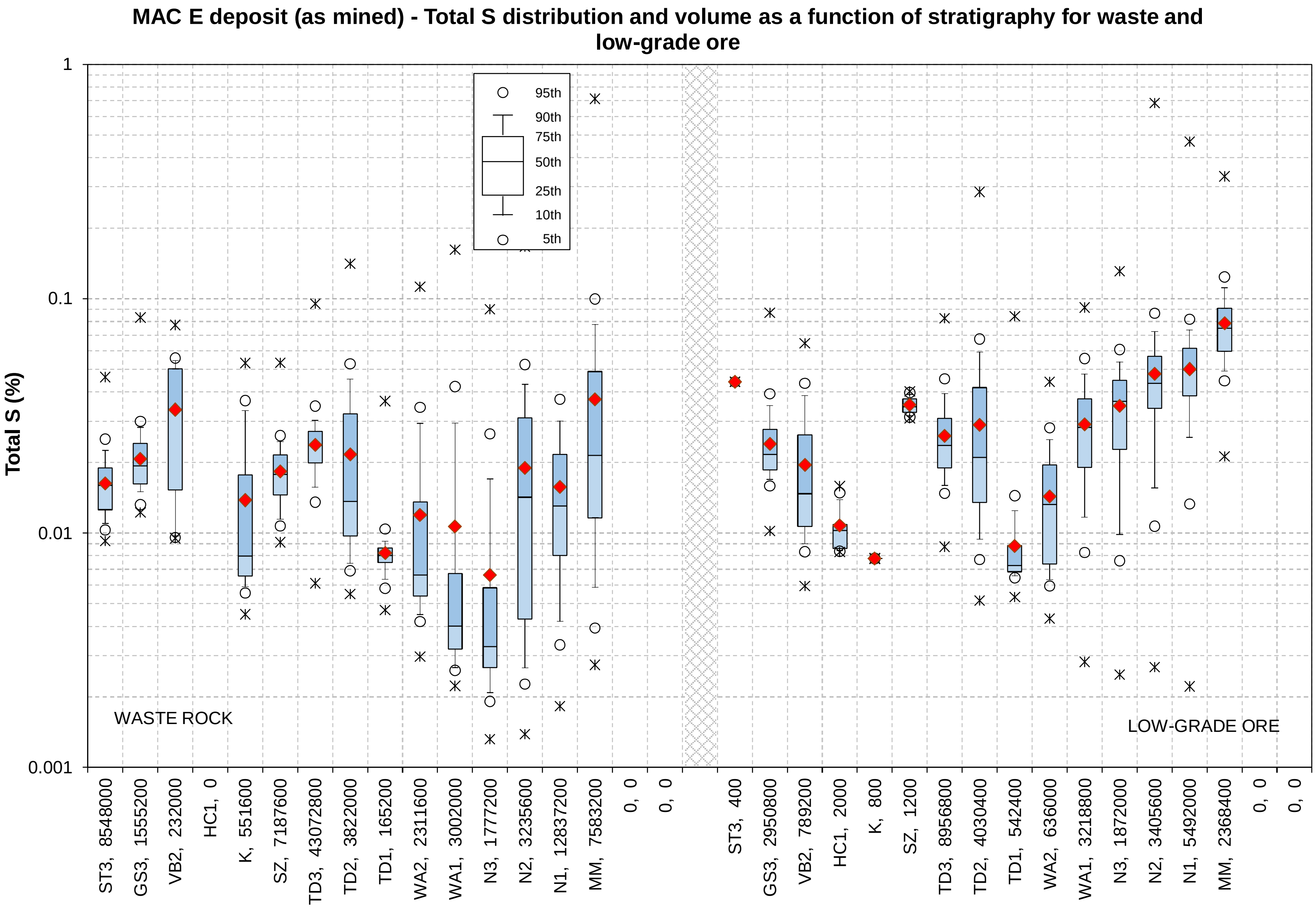


Figure 3-30 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC E deposit (the volume in m[3] of each stratigraphic unit is reported next to the rock type ID)

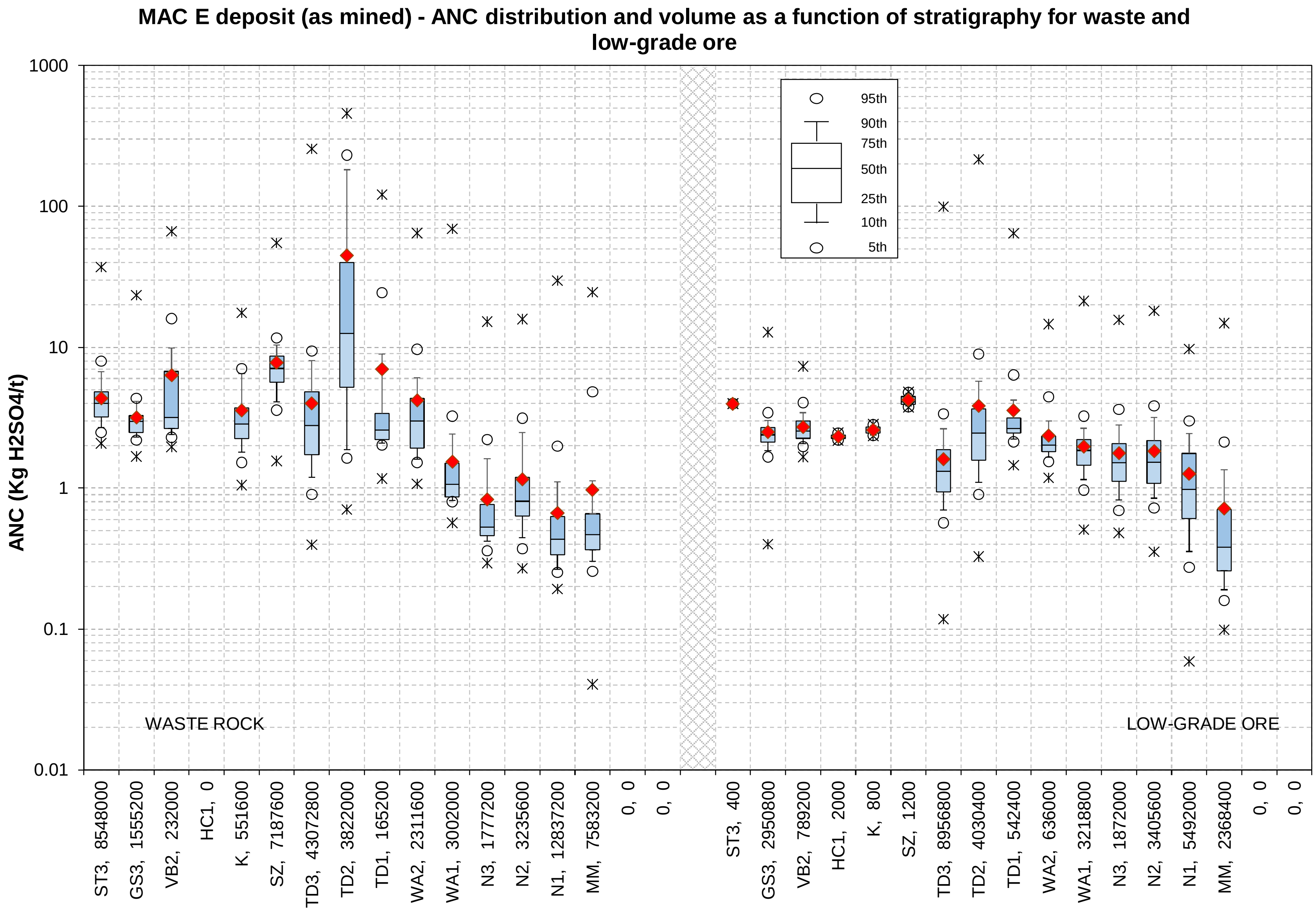


Figure 3-31 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC E deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-26 MAC E deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9190 - ST3	8,548,000	8.95%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9180 - GS3	1,555,200	1.63%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9130 - VB2	232,000	0.24%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9110 - HC1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8200 - K	551,600	0.58%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	7,187,600	7.53%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	43,072,800	45.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	3,820,800	4.00%	1,200	0.39%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8110 - TD1	165,200	0.17%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4200 - OB	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	2,310,800	2.42%	800	0.26%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4110 - WA1	2,963,200	3.10%	38,800	12.50%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3430 - N3	1,777,200	1.86%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3420 - N2	3,233,600	3.39%	2,000	0.64%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3410 - N1	12,836,400	13.44%	0	0.00%	400	3.57%	400	1.96%	0	0.00%	0	N/A
3300 - MM	7,244,800	7.59%	267,600	86.21%	10,800	96.43%	20,000	98.04%	40,000	100.00%	0	N/A
Total	**95,499,200**	**100.00%**	**310,400**	**100.00%**	**11,200**	**100.00%**	**20,400**	**100.00%**	**40,000**	**100.00%**	**0**	**N/A**
% of Total	**99.60%**		**0.32%**		**0.01%**		**0.02%**		**0.04%**		**0.00%**	
Low grade ore												
9200 - WP3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9190 - ST3	400	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9180 - GS3	2,950,800	8.75%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9130 - VB2	789,200	2.34%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9110 - HC1	2,000	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8200 - K	800	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	1,200	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	8,956,800	26.57%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	4,021,600	11.93%	6,000	1.16%	2,800	11.86%	0	0.00%	0	0.00%	0	N/A
8110 - TD1	542,400	1.61%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4200 - OB	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	636,000	1.89%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4110 - WA1	3,218,800	9.55%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3430 - N3	1,866,000	5.54%	6,000	1.16%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3420 - N2	3,315,600	9.84%	64,000	12.34%	8,000	33.90%	14,400	87.80%	3,600	100.00%	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
3410 - N1	5,441,200	16.14%	49,200	9.48%	800	3.39%	800	4.88%	0	0.00%	0	N/A
3300 - MM	1,961,600	5.82%	393,600	75.87%	12,000	50.85%	1,200	7.32%	0	0.00%	0	N/A
Total	**33,704,400**	**100.00%**	**518,800**	**100.00%**	**23,600**	**100.00%**	**16,400**	**100.00%**	**3,600**	**100.00%**	**0**	**N/A**
% of Total	**98.36%**		**1.51%**		**0.07%**		**0.05%**		**0.01%**		**0.00%**	

Table 3-27 MAC E deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9190 - ST3	8,548,000	8.92%	0	N/A	0	0.00%	0	N/A	8,548,000	8.92%
9180 - GS3	1,555,200	1.62%	0	N/A	0	0.00%	0	N/A	1,555,200	1.62%
9160 - CA2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9130 - VB2	232,000	0.24%	0	N/A	0	0.00%	0	N/A	232,000	0.24%
9110 - HC1	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8200 - K	551,600	0.58%	0	N/A	0	0.00%	0	N/A	551,600	0.58%
8150 - SZ	7,187,600	7.50%	0	N/A	0	0.00%	0	N/A	7,187,600	7.50%
8130 - TD3	43,072,800	44.97%	0	N/A	0	0.00%	0	N/A	43,072,800	44.92%
8120 - TD2	3,822,000	3.99%	0	N/A	0	0.00%	0	N/A	3,822,000	3.99%
8110 - TD1	165,200	0.17%	0	N/A	0	0.00%	0	N/A	165,200	0.17%
4200 - OB	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
4120 - WA2	2,311,600	2.41%	0	N/A	0	0.00%	0	N/A	2,311,600	2.41%
4110 - WA1	2,981,600	3.11%	0	N/A	20,400	20.73%	0	N/A	3,002,000	3.13%
3430 - N3	1,777,200	1.86%	0	N/A	0	0.00%	0	N/A	1,777,200	1.85%
3420 - N2	3,234,400	3.38%	0	N/A	1,200	1.22%	0	N/A	3,235,600	3.37%
3410 - N1	12,837,200	13.40%	0	N/A	0	0.00%	0	N/A	12,837,200	13.39%
3300 - MM	7,506,400	7.84%	0	N/A	76,800	78.05%	0	N/A	7,583,200	7.91%
Total	**95,782,800**	**100.00%**	**0**	**N/A**	**98,400**	**100.00%**	**0**	**N/A**	**95,881,200**	**100.00%**
% of Total	**99.90%**		**0.00%**		**0.10%**		**0.00%**		**100.00%**	
Low grade ore										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	400	0.00%	0	N/A	0	0.00%	0	0.00%	400	0.00%
9180 - GS3	2,950,800	8.69%	0	N/A	0	0.00%	0	0.00%	2,950,800	8.61%
9160 - CA2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	789,200	2.32%	0	N/A	0	0.00%	0	0.00%	789,200	2.30%
9110 - HC1	2,000	0.01%	0	N/A	0	0.00%	0	0.00%	2,000	0.01%
8200 - K	800	0.00%	0	N/A	0	0.00%	0	0.00%	800	0.00%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
8150 - SZ	1,200	0.00%	0	N/A	0	0.00%	0	0.00%	1,200	0.00%
8130 - TD3	8,956,800	26.38%	0	N/A	0	0.00%	0	0.00%	8,956,800	26.14%
8120 - TD2	4,024,000	11.85%	0	N/A	0	0.00%	6,400	100.00%	4,030,400	11.76%
8110 - TD1	542,400	1.60%	0	N/A	0	0.00%	0	0.00%	542,400	1.58%
4200 - OB	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	636,000	1.87%	0	N/A	0	0.00%	0	0.00%	636,000	1.86%
4110 - WA1	3,218,800	9.48%	0	N/A	0	0.00%	0	0.00%	3,218,800	9.39%
3430 - N3	1,872,000	5.51%	0	N/A	0	0.00%	0	0.00%	1,872,000	5.46%
3420 - N2	3,372,000	9.93%	0	N/A	33,600	10.92%	0	0.00%	3,405,600	9.94%
3410 - N1	5,480,400	16.14%	0	N/A	11,600	3.77%	0	0.00%	5,492,000	16.03%
3300 - MM	2,106,000	6.20%	0	N/A	262,400	85.31%	0	0.00%	2,368,400	6.91%
Total	**33,952,800**	**100.00%**	**0**	**N/A**	**307,600**	**100.00%**	**6,400**	**100.00%**	**34,266,800**	**100.00%**
% of Total	**99.08%**		**0.00%**		**0.90%**		**0.02%**		**100.00%**	

Table 3-28 MAC E deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	89,275,200	6,507,600	95,782,800	99.90%
1	0	0	0	0.00%
2	98,400	0	98,400	0.10%
3	0	0	0	0.00%
Total	**89,373,600**	**6,507,600**	**95,881,200**	100.00%
% of Total	**93.21%**	**6.79%**	**100.00%**	
Low grade ore				
0	32,779,600	1,173,200	33,952,800	99.08%
1	0	0	0	0.00%
2	307,600	0	307,600	0.90%
3	6,400	0	6,400	0.02%
Total	**33,093,600**	**1,173,200**	**34,266,800**	100.00%
% of Total	**96.58%**	**3.42%**	**100.00%**	

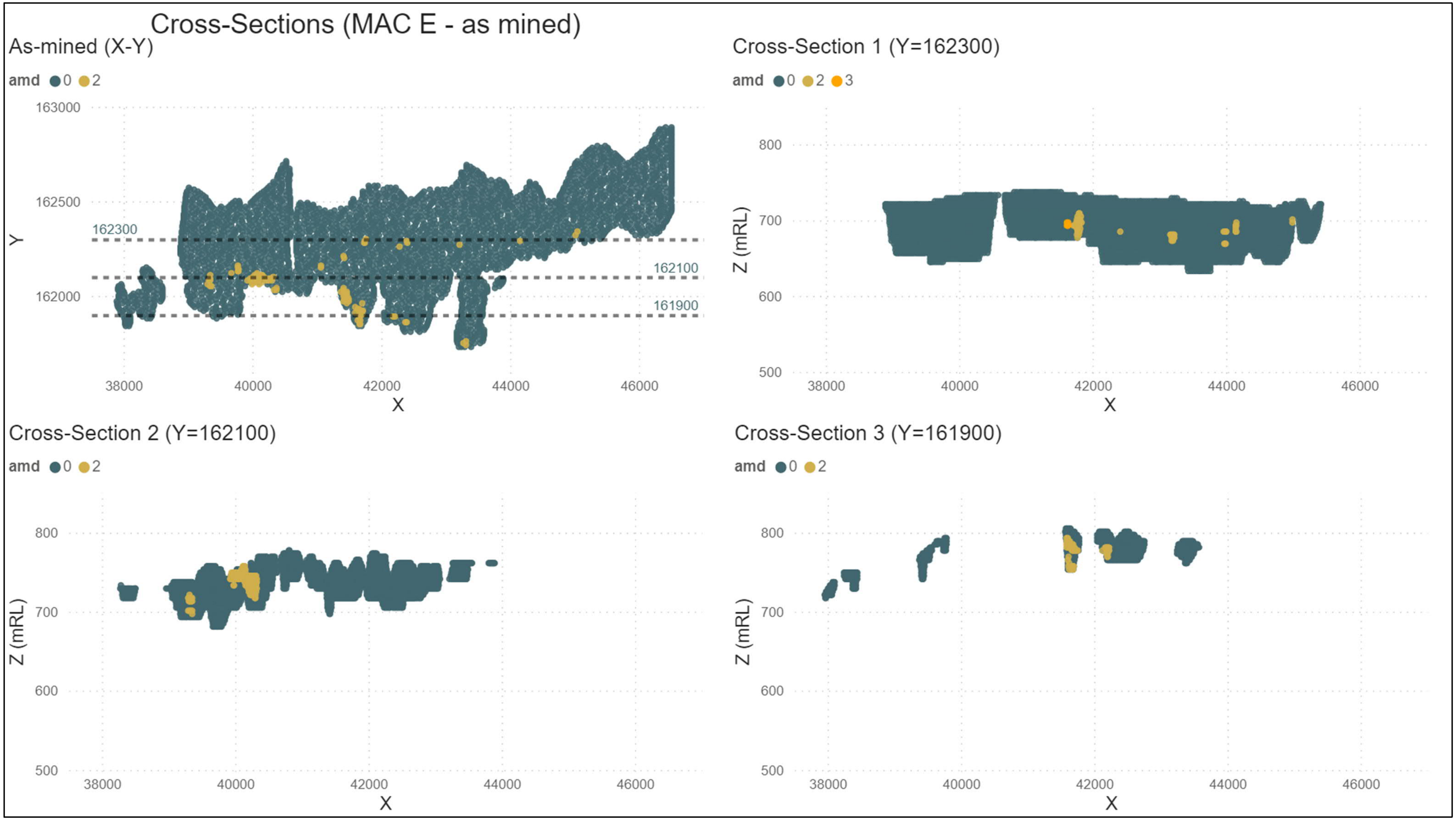


Figure 3-32 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC E deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.6.2 MAC E deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from E deposit as a function of stratigraphic unit is shown in Figure 3-33. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from E deposit are shown in Figure 3-34 and Figure 3-35, respectively.

Table 3-29 presents to-be-mined waste volume from E deposit split by total sulphur content per stratigraphy. Table 3-30 and Table 3-31 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC E deposit is presented in Figure 3-36.

The block model data indicate that:

- The majority (60.7%) of to-be-mined waste rock from E deposit is from Tertiary Detritals (TD3, ST3, TD2, SZ, VB2, GS3, TD1, CY2, HC1 and CA2) with minor contribution from Marra Mamba Iron Formation (28.2%, incl. N1, N2, MM and N3) and Wittenoom Formation (11.1%, incl. WA2, WA1 and OB). Similarly, 64.8% of to-be-mined low-grade ore is sourced from Tertiary Detritals (TD2, TD3, TD1, GS3, VB2, HC1 and CY2) with smaller portion from Marra Mamba Iron Formation (20.2%, incl., N1, N2, N3 and MM) and Wittenoom Formation (15.0%, incl. WA1, WA2 and OB).
- To-be-mined waste rock and low-grade ore show very low sulphur concentration with the 95th percentile values below 0.1 wt% and median values mostly below 0.02 wt% (Figure 3-34, Table 3-29).
- Very low sulphur blocks (<0.1%) comprise 99.98% of to-be-mined waste rock and 99.99% of to-be-mined low-grade ore volume, while low sulphur blocks (0.1-0.2%) comprise an inconsequential 0.02% of to-be-mined waste rock and 0.01% of to-be-mined low-grade ore volume. Only 800 m^3 WA1 waste rock have a total sulphur range of 0.3-0.5%, comprising 0.002% of to-be-mined waste rock volume.
- ANC distribution in to-be-mined waste is dependent on stratigraphy and waste type (Figure 3-35). Generally, median ANC values are low, at values below 10 kg H_2SO_4/t in all waste rock and low-grade ore and, as seen in all other deposits at North Flank. Marra Mamba Iron Formation is devoid of ANC. On the other hand, TD2 waste stratigraphies, and in particular CA2 (calcrete), have higher ANC with values in CA2 as high as 100 kg H_2SO_4/t. However, only approximately 58,000 m^3 of CA2 is yet to be mined from E deposit.
- The mining block model for E deposit predicts that virtually the entire to-be-mined waste rock (52,976,000 m^3) and low-grade ore (17,075,200 m^3) is AMD0 (Table 3-30).
- Approximately 62.08% of waste rock and 62.99% of low-grade ore blocks are predicted to be mined from above water table (Table 3-31).

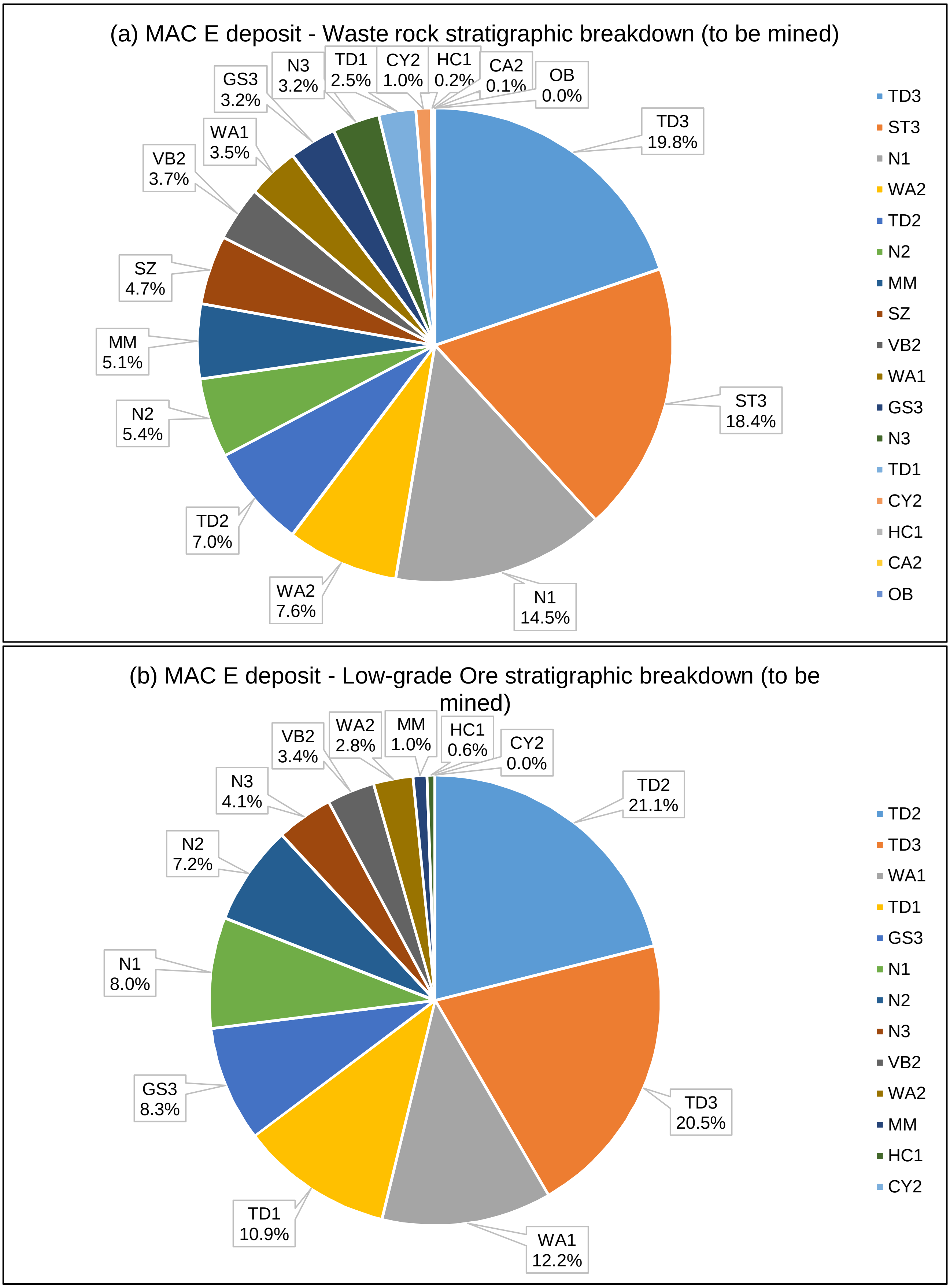


Figure 3-33 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC E deposit mining model

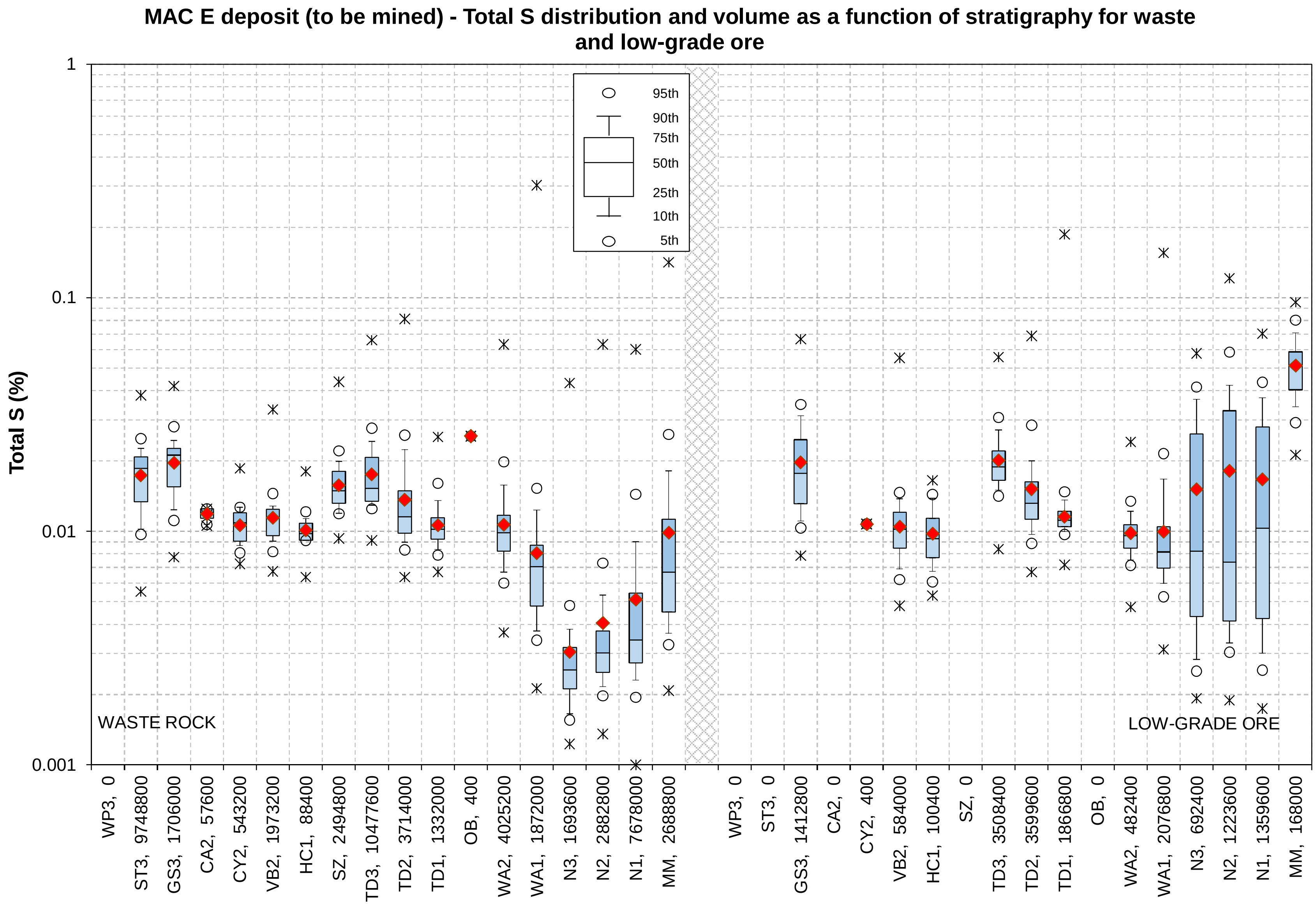


Figure 3-34 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC E deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

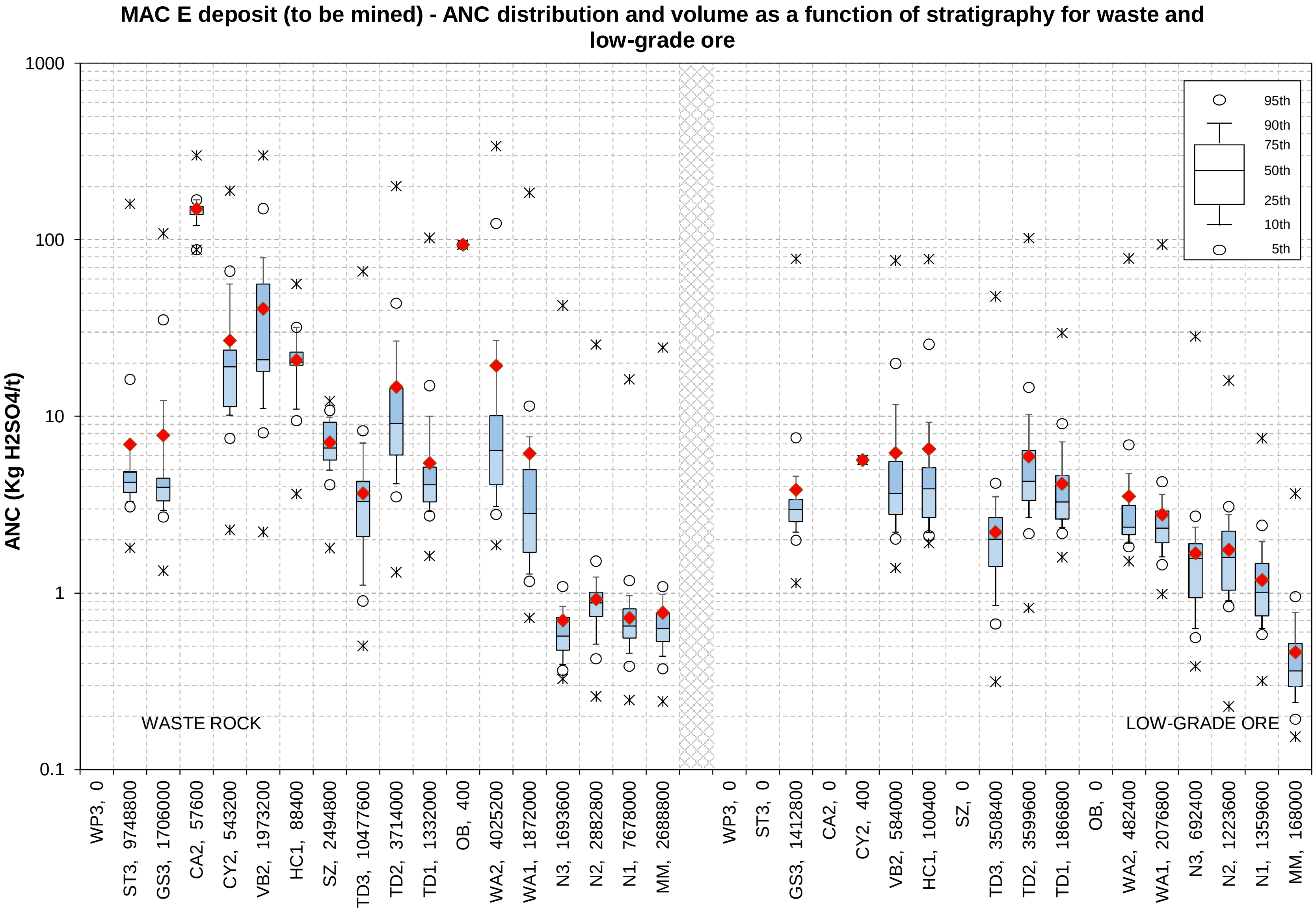


Figure 3-35 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC E deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-29 MAC E deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	0	0.00%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
9190 - ST3	9,748,800	18.41%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
9180 - GS3	1,706,000	3.22%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
9160 - CA2	57,600	0.11%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
9150 - CY2	543,200	1.03%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
9130 - VB2	1,973,200	3.73%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
9110 - HC1	88,400	0.17%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
8200 - K	0	0.00%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
8150 - SZ	2,494,800	4.71%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
8130 - TD3	10,477,600	19.78%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
8120 - TD2	3,714,000	7.01%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
8110 - TD1	1,332,000	2.51%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
4200 - OB	400	0.00%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
4120 - WA2	4,025,200	7.60%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
4110 - WA1	1,870,800	3.53%	400	3.70%	0	N/A	800	100.00%	0	N/A	0	N/A
3430 - N3	1,693,600	3.20%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
3420 - N2	2,882,800	5.44%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
3410 - N1	7,678,000	14.50%	0	0.00%	0	N/A	0	0.00%	0	N/A	0	N/A
3300 - MM	2,678,400	5.06%	10,400	96.30%	0	N/A	0	0.00%	0	N/A	0	N/A
Total	**52,964,800**	**100.00%**	**10,800**	**100.00%**	**0**	**N/A**	**800**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.98%**		**0.02%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9200 - WP3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9190 - ST3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	1,412,800	8.28%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9150 - CY2	400	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9130 - VB2	584,000	3.42%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9110 - HC1	100,400	0.59%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	3,508,400	20.55%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	3,599,600	21.08%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	1,866,400	10.93%	400	16.67%	0	N/A	0	N/A	0	N/A	0	N/A
4200 - OB	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	482,400	2.83%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	2,076,400	12.16%	400	16.67%	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	692,400	4.06%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	1,222,000	7.16%	1,600	66.67%	0	N/A	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
3410 - N1	1,359,600	7.96%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	168,000	0.98%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**17,072,800**	**100.00%**	**2,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.99%**		**0.01%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-30 MAC E deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9190 - ST3	9,748,800	18.40%	0	N/A	0	0.00%	0	N/A	9,748,800	18.40%
9180 - GS3	1,706,000	3.22%	0	N/A	0	0.00%	0	N/A	1,706,000	3.22%
9160 - CA2	57,600	0.11%	0	N/A	0	0.00%	0	N/A	57,600	0.11%
9150 - CY2	543,200	1.03%	0	N/A	0	0.00%	0	N/A	543,200	1.03%
9130 - VB2	1,973,200	3.72%	0	N/A	0	0.00%	0	N/A	1,973,200	3.72%
9110 - HC1	88,400	0.17%	0	N/A	0	0.00%	0	N/A	88,400	0.17%
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	2,494,800	4.71%	0	N/A	0	0.00%	0	N/A	2,494,800	4.71%
8130 - TD3	10,477,600	19.78%	0	N/A	0	0.00%	0	N/A	10,477,600	19.78%
8120 - TD2	3,714,000	7.01%	0	N/A	0	0.00%	0	N/A	3,714,000	7.01%
8110 - TD1	1,332,000	2.51%	0	N/A	0	0.00%	0	N/A	1,332,000	2.51%
4200 - OB	400	0.00%	0	N/A	0	0.00%	0	N/A	400	0.00%
4120 - WA2	4,025,200	7.60%	0	N/A	0	0.00%	0	N/A	4,025,200	7.60%
4110 - WA1	1,871,600	3.53%	0	N/A	400	100.00%	0	N/A	1,872,000	3.53%
3430 - N3	1,693,600	3.20%	0	N/A	0	0.00%	0	N/A	1,693,600	3.20%
3420 - N2	2,882,800	5.44%	0	N/A	0	0.00%	0	N/A	2,882,800	5.44%
3410 - N1	7,678,000	14.49%	0	N/A	0	0.00%	0	N/A	7,678,000	14.49%
3300 - MM	2,688,800	5.08%	0	N/A	0	0.00%	0	N/A	2,688,800	5.08%
Total	**52,976,000**	**100.00%**	**0**	**N/A**	**400**	**100.00%**	**0**	**N/A**	**52,976,400**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
9200 - WP3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9190 - ST3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9180 - GS3	1,412,800	8.27%	0	N/A	0	N/A	0	N/A	1,412,800	8.27%
9160 - CA2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
9150 - CY2	400	0.00%	0	N/A	0	N/A	0	N/A	400	0.00%
9130 - VB2	584,000	3.42%	0	N/A	0	N/A	0	N/A	584,000	3.42%
9110 - HC1	100,400	0.59%	0	N/A	0	N/A	0	N/A	100,400	0.59%
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
8150 - SZ	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8130 - TD3	3,508,400	20.55%	0	N/A	0	N/A	0	N/A	3,508,400	20.55%
8120 - TD2	3,599,600	21.08%	0	N/A	0	N/A	0	N/A	3,599,600	21.08%
8110 - TD1	1,866,800	10.93%	0	N/A	0	N/A	0	N/A	1,866,800	10.93%
4200 - OB	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
4120 - WA2	482,400	2.83%	0	N/A	0	N/A	0	N/A	482,400	2.83%
4110 - WA1	2,076,800	12.16%	0	N/A	0	N/A	0	N/A	2,076,800	12.16%
3430 - N3	692,400	4.06%	0	N/A	0	N/A	0	N/A	692,400	4.06%
3420 - N2	1,223,600	7.17%	0	N/A	0	N/A	0	N/A	1,223,600	7.17%
3410 - N1	1,359,600	7.96%	0	N/A	0	N/A	0	N/A	1,359,600	7.96%
3300 - MM	168,000	0.98%	0	N/A	0	N/A	0	N/A	168,000	0.98%
Total	**17,075,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**17,075,200**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-31 MAC E deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	32,884,800	20,091,200	52,976,000	100.00%
1	0	0	0	0.00%
2	400	0	400	0.00%
3	0	0	0	0.00%
Total	**32,885,200**	**20,091,200**	**52,976,400**	100.00%
% of Total	**62.08%**	**37.92%**	**100.00%**	
Low grade ore				
0	10,755,200	6,320,000	17,075,200	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**10,755,200**	**6,320,000**	**17,075,200**	100.00%
% of Total	**62.99%**	**37.01%**	**100.00%**	

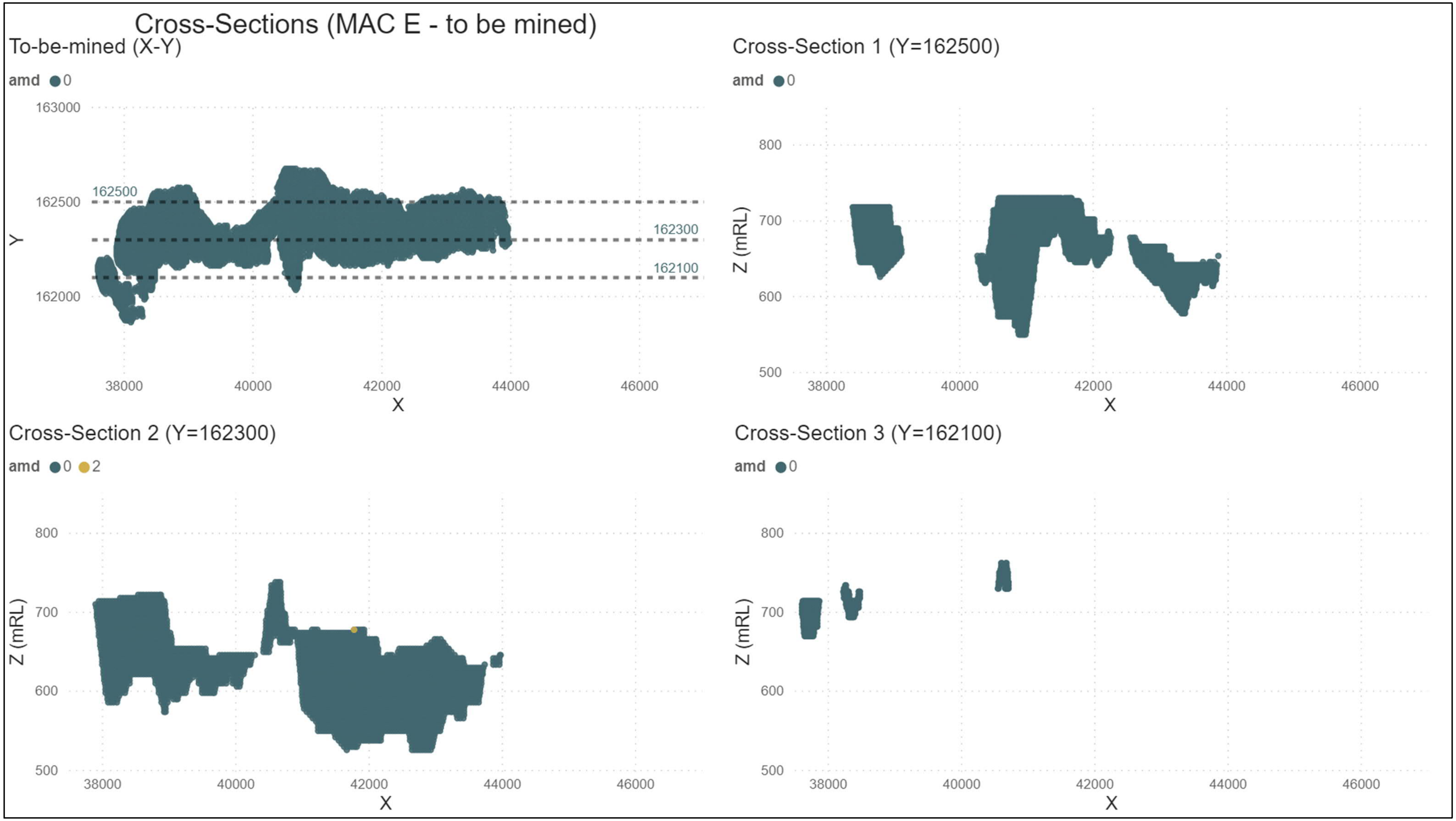


Figure 3-36 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC E deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.7 MAC F deposit

3.1.1.7.1 *MAC F* deposit (as-mined waste)

A pie chart showing the distribution of as-mined waste rock and low-grade ore from F deposit as a function of stratigraphic unit is shown in Figure 3-37. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from D deposit are shown in Figure 3-38 and Figure 3-39, respectively.

Table 3-32 presents as-mined waste volume from F deposit split by total sulphur content per stratigraphy. Table 3-33 and Table 3-34 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC F deposit is presented in Figure 3-40.

The F deposit is fully mined out.

The block model data indicate that:

- As-mined waste rock from F deposit is dominated by Marra Mamba Iron Formation (80.4%, incl. N1, MM, N2 and N3) with the reminder split between Tertiary Detritals (15.3%, incl. TD3, TD2, SZ and ST3) and Wittenoom Formation (4.4%, incl. WA1 and WA2). Similarly, Marra Mamba Iron Formation (81.5%, incl. N1, N2, N3 and MM) dominates as-mined low-grade ore with minor contributions from Wittenoom Formation (15.8%) and Tertiary Detritals (2.7%).
- All of the as-mined waste rock and low-grade ore have very low total sulphur with the 95th percentile sulphur contents below or near 0.1 wt% with the exception of WA2 and WA1 waste rock and low-grade ore (Figure 3-38). In particular, WA2 waste rock has the highest median sulphur content (0.28 wt%).
- Very low sulphur blocks (<0.1%) comprise 96.74% of as-mined waste rock and 81.46% of as-mined low-grade ore volume. Low sulphur blocks (0.1-0.2%) comprise 1.79% of as-mined waste rock and 15.39% of as-mined low-grade ore volume. Only 0.07% (9,200 m^3 WA2 and WA1) of the total as-mined waste rock and 0.01% (800 m^3 WA1) of the total as-mined low-grade ore volumes have moderate total sulphur (0.5-1.0%).
- As-mined waste rock and low-grade ore from F deposit typically have low ANC with the 95th percentile values below 10 kg H_2SO_4/t, although some stratigraphic units (e.g. WA2 and MM) show occasional blocks with ANC distribution to higher values (Figure 3-39).
- A total volume of 20,646,400 m^3 (incl. 12,368,000 m^3 waste rock and 8,278,400 m^3 low-grade ore) of AMD0 waste has been mined out from F deposit, comprising ~99.50% of as-mined waste rock and ~91.98% of as-mined low-grade ore, as predicted by the MAC F deposit mining model.
- No AMD1 waste rock or low-grade ore blocks have been mined out from the F deposit.
- A total volume of 784,000 m^3 (incl. 62,000 m^3 as-mined waste rock and 722,000 m^3 as-mined low-grade ore are classed as AMD2, comprising 0.50% of as-mined waste rock and 8.02% of as-mined low-grade ore (Table 3-33). Note that a volume of 505,200 m^3 AMD2 material is associated with Wittenoom Formation (WA1 and WA2) and the remainder 278,800 m^3 is from Marra Mamba Iron Formation.
- No AMD3 waste rock or low-grade ore blocks have been mined out from the F deposit..
- Approximately 99.68% of waste rock and 99.93% of low-grade ore blocks are predicted to have been mined out from above water table (Table 3-34).

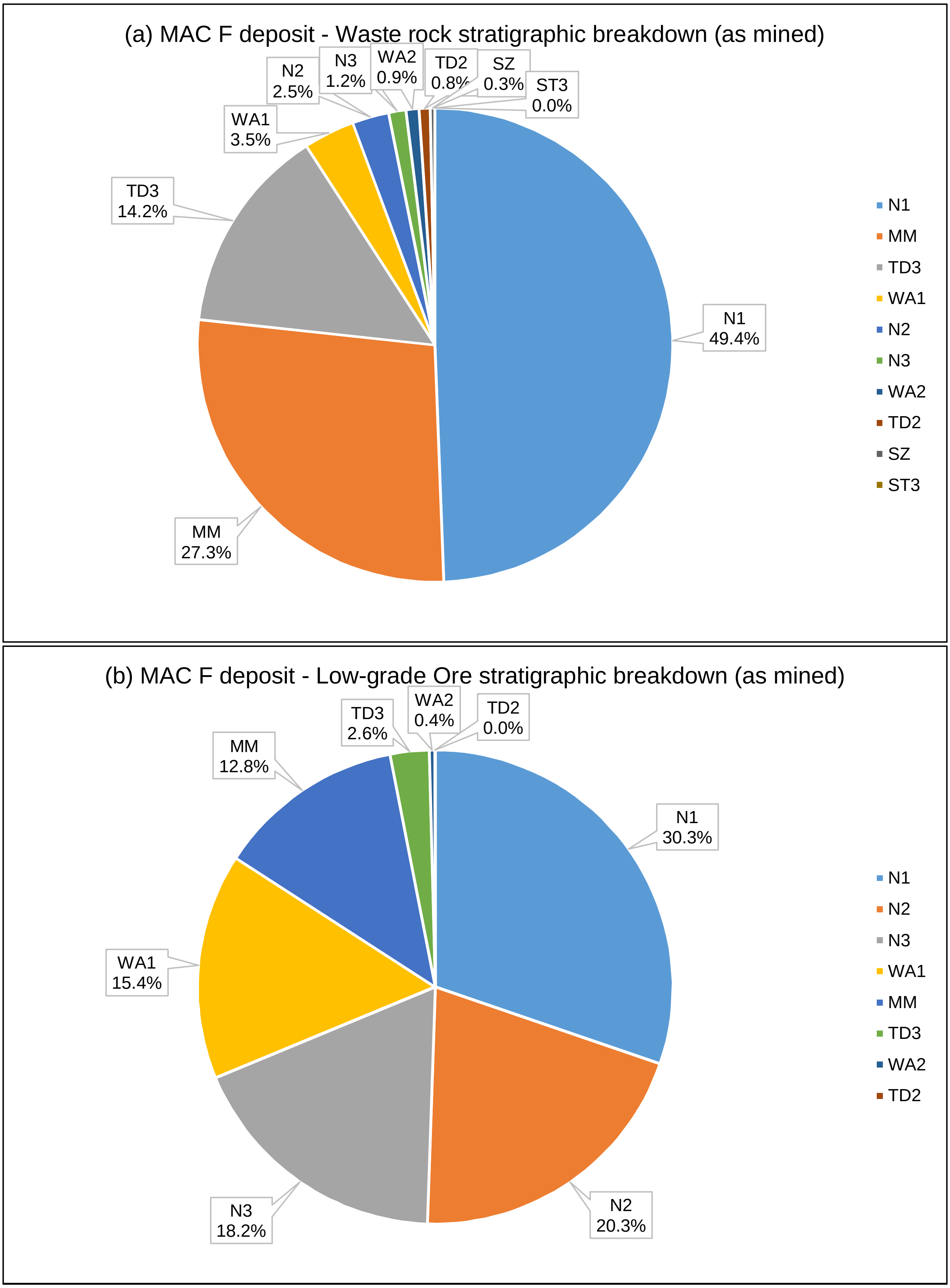


Figure 3-37 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC F deposit mining model

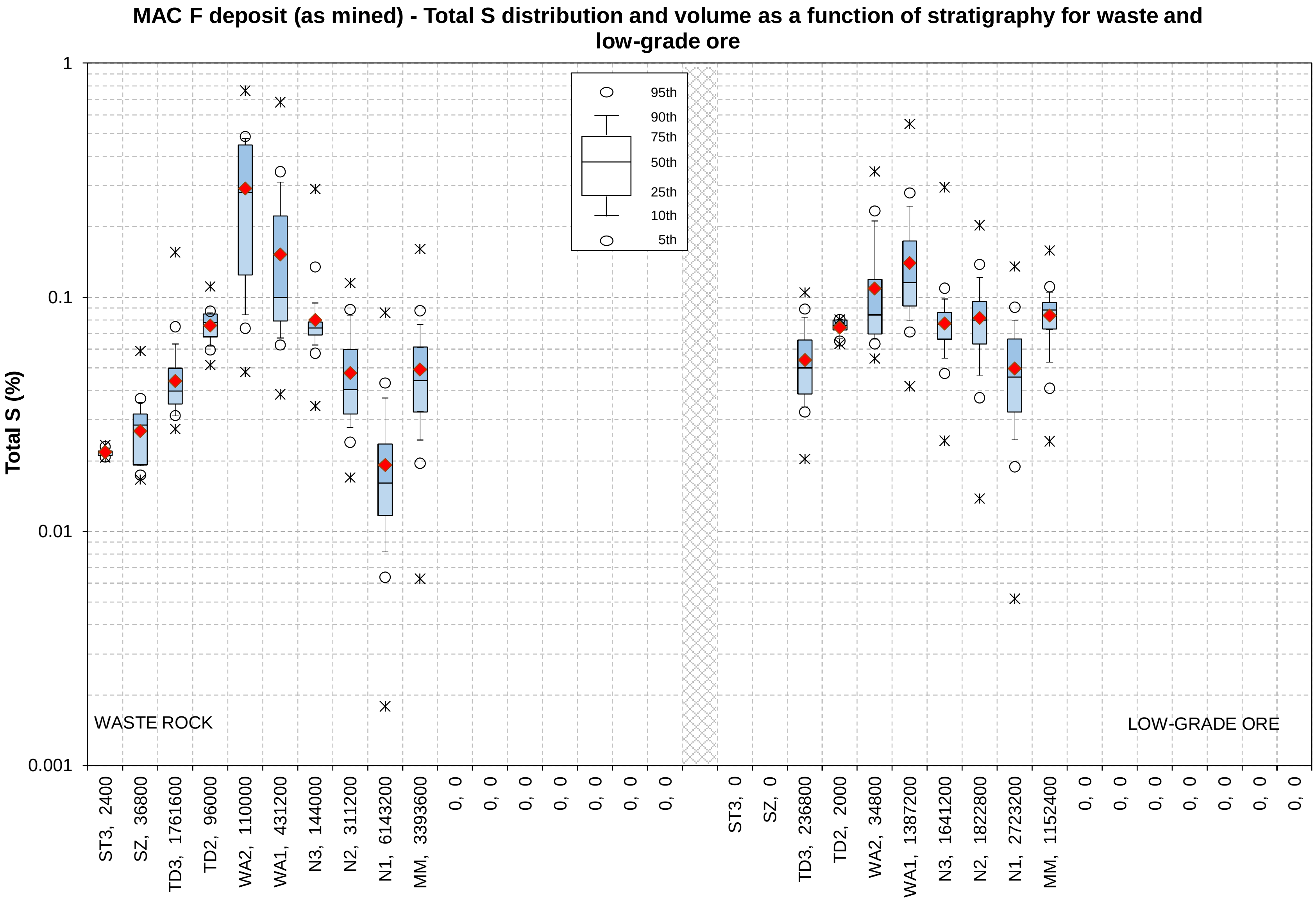


Figure 3-38 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC F deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

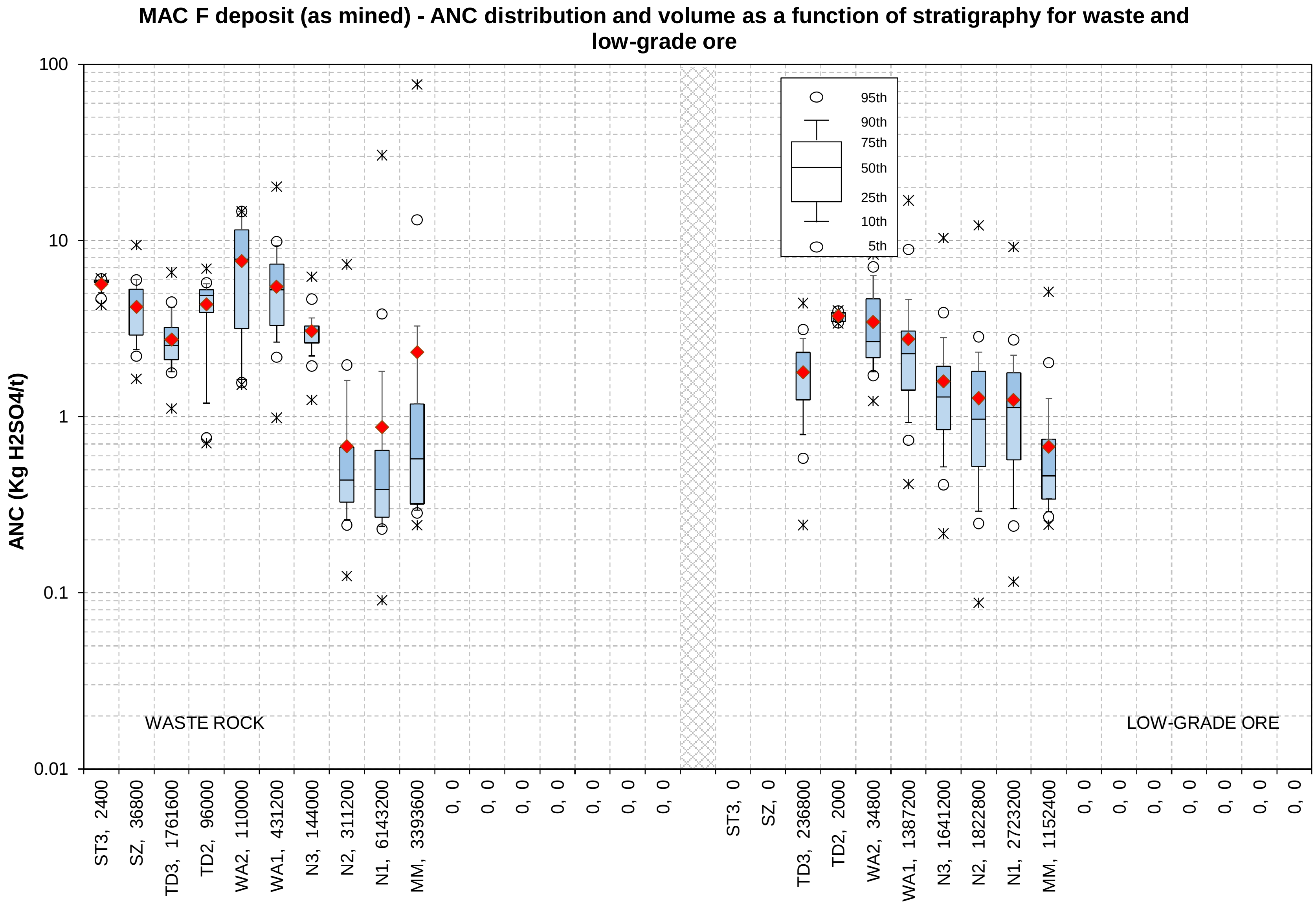


Figure 3-39 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC F deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-32 MAC F deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9190 - ST3	2,400	0.02%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	36,800	0.31%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	1,759,200	14.63%	2,400	1.08%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	95,600	0.80%	400	0.18%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	14,800	0.12%	33,600	15.08%	8,400	10.77%	48,000	50.42%	5,200	56.52%	0	N/A
4110 - WA1	216,000	1.80%	95,600	42.91%	68,400	87.69%	47,200	49.58%	4,000	43.48%	0	N/A
3430 - N3	131,200	1.09%	11,600	5.21%	1,200	1.54%	0	0.00%	0	0.00%	0	N/A
3420 - N2	308,800	2.57%	2,400	1.08%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3410 - N1	6,143,200	51.09%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3300 - MM	3,316,800	27.58%	76,800	34.47%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**12,024,800**	**100.00%**	**222,800**	**100.00%**	**78,000**	**100.00%**	**95,200**	**100.00%**	**9,200**	**100.00%**	**0**	**N/A**
% of Total	**96.74%**		**1.79%**		**0.63%**		**0.77%**		**0.07%**		**0.00%**	
Low grade ore												
9190 - ST3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	236,000	3.22%	800	0.06%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	2,000	0.03%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	21,600	0.29%	8,800	0.64%	4,000	1.64%	400	1.00%	0	0.00%	0	N/A
4110 - WA1	511,200	6.97%	602,400	43.50%	233,200	95.89%	39,600	99.00%	800	100.00%	0	N/A
3430 - N3	1,491,200	20.34%	144,800	10.46%	5,200	2.14%	0	0.00%	0	0.00%	0	N/A
3420 - N2	1,441,600	19.66%	380,400	27.47%	800	0.33%	0	0.00%	0	0.00%	0	N/A
3410 - N1	2,672,000	36.44%	51,200	3.70%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3300 - MM	956,000	13.04%	196,400	14.18%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**7,331,600**	**100.00%**	**1,384,800**	**100.00%**	**243,200**	**100.00%**	**40,000**	**100.00%**	**800**	**100.00%**	**0**	**N/A**
% of Total	**81.46%**		**15.39%**		**2.70%**		**0.44%**		**0.01%**		**0.00%**	

Table 3-33 MAC F deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9190 - ST3	2,400	0.02%	0	N/A	0	0.00%	0	N/A	2,400	0.02%
8150 - SZ	36,800	0.30%	0	N/A	0	0.00%	0	N/A	36,800	0.30%
8130 - TD3	1,761,600	14.24%	0	N/A	0	0.00%	0	N/A	1,761,600	14.17%
8120 - TD2	96,000	0.78%	0	N/A	0	0.00%	0	N/A	96,000	0.77%
4120 - WA2	84,400	0.68%	0	N/A	25,600	41.29%	0	N/A	110,000	0.88%
4110 - WA1	394,800	3.19%	0	N/A	36,400	58.71%	0	N/A	431,200	3.47%
3430 - N3	144,000	1.16%	0	N/A	0	0.00%	0	N/A	144,000	1.16%
3420 - N2	311,200	2.52%	0	N/A	0	0.00%	0	N/A	311,200	2.50%
3410 - N1	6,143,200	49.67%	0	N/A	0	0.00%	0	N/A	6,143,200	49.42%
3300 - MM	3,393,600	27.44%	0	N/A	0	0.00%	0	N/A	3,393,600	27.30%
Total	**12,368,000**	**100.00%**	**0**	**N/A**	**62,000**	**100.00%**	**0**	**N/A**	**12,430,000**	**100.00%**
% of Total	**99.50%**		**0.00%**		**0.50%**		**0.00%**		**100.00%**	
Low grade ore										
9190 - ST3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8130 - TD3	236,800	2.86%	0	N/A	0	0.00%	0	N/A	236,800	2.63%
8120 - TD2	2,000	0.02%	0	N/A	0	0.00%	0	N/A	2,000	0.02%
4120 - WA2	34,800	0.42%	0	N/A	0	0.00%	0	N/A	34,800	0.39%
4110 - WA1	944,000	11.40%	0	N/A	443,200	61.39%	0	N/A	1,387,200	15.41%
3430 - N3	1,617,600	19.54%	0	N/A	23,600	3.27%	0	N/A	1,641,200	18.23%
3420 - N2	1,647,200	19.90%	0	N/A	175,600	24.32%	0	N/A	1,822,800	20.25%
3410 - N1	2,704,400	32.67%	0	N/A	18,800	2.60%	0	N/A	2,723,200	30.26%
3300 - MM	1,091,600	13.19%	0	N/A	60,800	8.42%	0	N/A	1,152,400	12.80%
Total	**8,278,400**	**100.00%**	**0**	**N/A**	**722,000**	**100.00%**	**0**	**N/A**	**9,000,400**	**100.00%**
% of Total	**91.98%**		**0.00%**		**8.02%**		**0.00%**		**100.00%**	

Table 3-34 MAC F deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	12,328,000	40,000	12,368,000	99.50%
1	0	0	0	0.00%
2	62,000	0	62,000	0.50%
3	0	0	0	0.00%
Total	**12,390,000**	**40,000**	**12,430,000**	100.00%
% of Total	**99.68%**	**0.32%**	**100.00%**	
Low grade ore				
0	8,272,000	6,400	8,278,400	91.98%
1	0	0	0	0.00%
2	722,000	0	722,000	8.02%
3	0	0	0	0.00%
Total	**8,994,000**	**6,400**	**9,000,400**	100.00%
% of Total	**99.93%**	**0.07%**	**100.00%**	

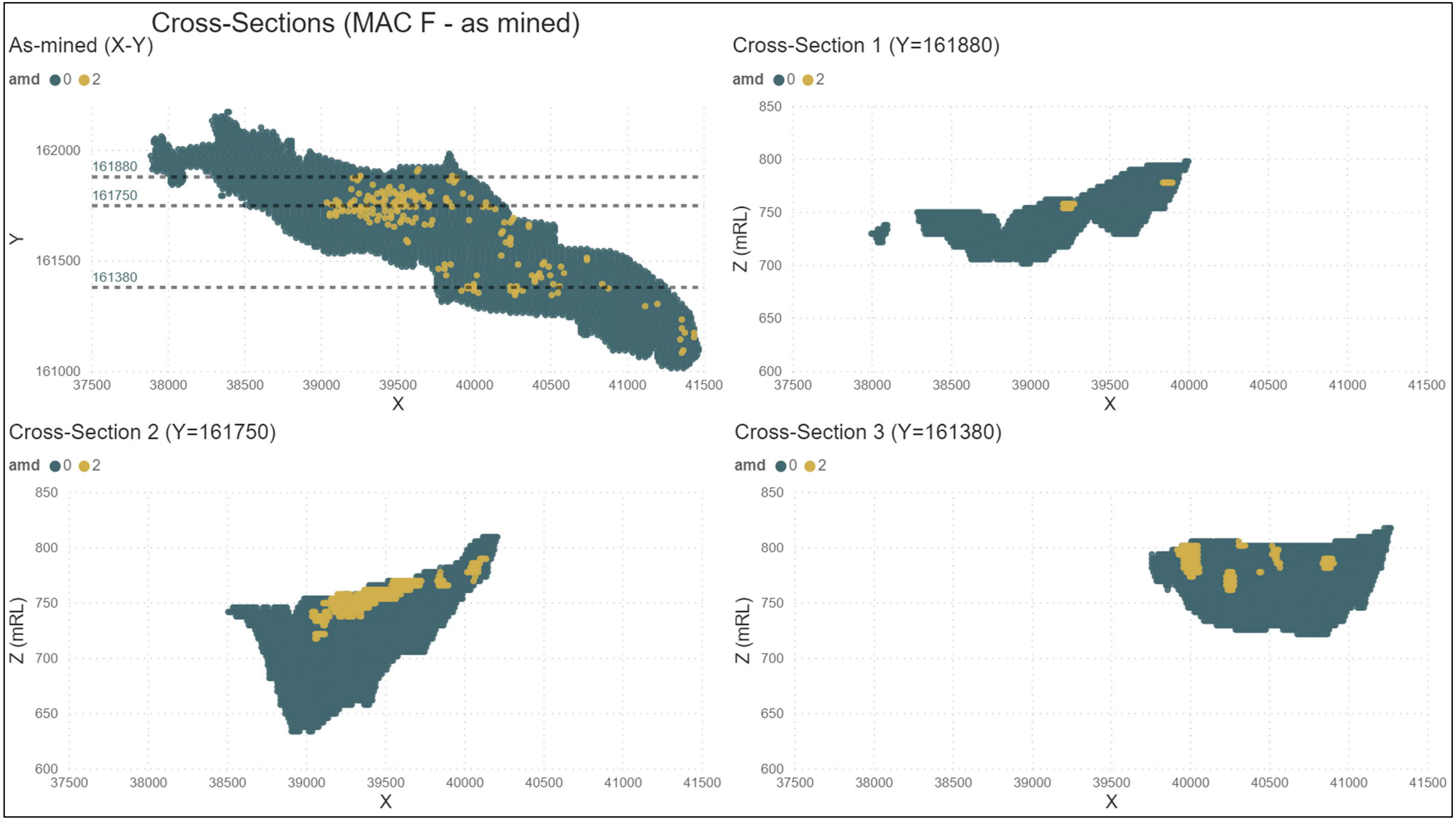


Figure 3-40 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC F deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.8 MAC Deadend deposit

3.1.1.8.1 MAC Deadend deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from Deadend deposit as a function of stratigraphic unit is shown in Figure 3-41. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from Deadend deposit are shown in Figure 3-42 and Figure 3-43, respectively.

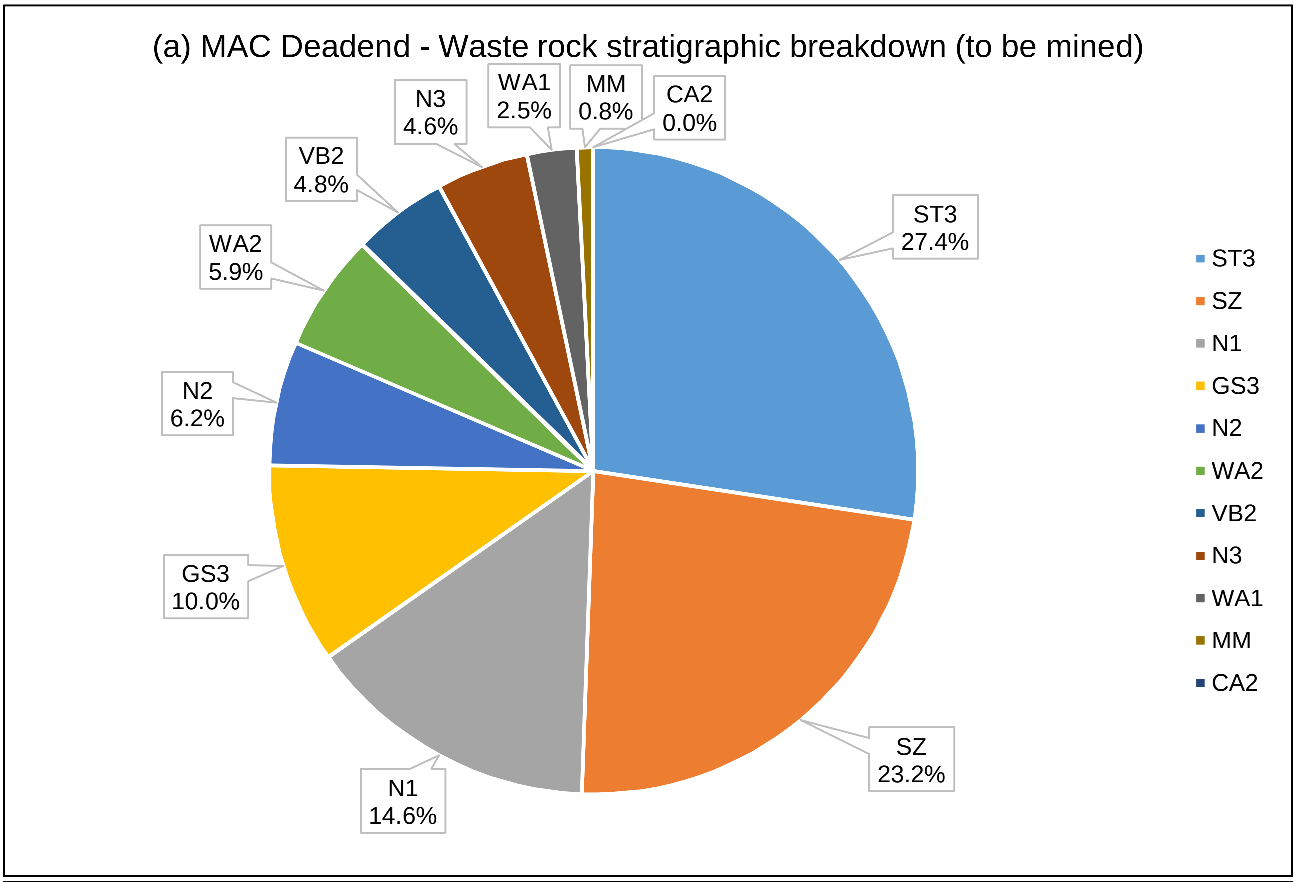
Table 3-35 presents as-mined waste volume from Deadend deposit split by total sulphur content per stratigraphy. Table 3-36 and Table 3-37 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC Deadend deposit is presented in Figure 3-44.

The Deadend deposit is yet to be mined.

The block model data indicate that:

- To-be-mined waste rock from Deadend deposit is dominated by Tertiary Detritals (65.4%, incl. ST3, SZ, GS3, VB2 and CA2) with the reminder split between Marra Mamba Iron Formation (26.3%, incl. N1, N2, N3 and MM) and Wittenoom Formation (8.3%, incl. WA2 and WA1). On contrast, the majority of to-be-mined low-grade ore is sourced from Marra Mamba Iron Formation (62.9%, incl. N2, N3, N1 and MM) with minor contributions from Wittenoom Formation (22.9%) and Tertiary Detritals (14.1%).
- All of the to-be-mined waste rock and low-grade ore have very low total sulphur with the 95th percentile sulphur contents below 0.1 wt% and median sulphur values below or near 0.05 wt% (Figure 3-42).
- Very low sulphur blocks (<0.1%) comprise 99.64% of to-be-mined waste rock and 98.08% of to-be-mined low-grade ore volume. Low sulphur blocks (0.1-0.2%) comprise 0.36% of to-be-mined waste rock and 1.90% of to-be-mined low-grade ore volume. Only 0.02% (2,000 m^3 N2) of the total to-be-mined low-grade ore volumes have total sulphur in the range of 0.2-0.3%.
- To-be-mined waste rock and low-grade ore from Deadend deposit typically have low ANC with the 95th percentile values below 10 kg H_2SO_4/t, with the exception of two stratigraphic units (CA2 and VB2). A small volume of 1600 m^3 CA2 waste rock have consistently elevated ANC values with the minimum above 170 kg H_2SO_4/t, while VB2 waste rock show somewhat elevated 95th ANC distribution of 40 kg H_2SO_4/t (Figure 3-43).
- 9,690,400 m^3 (or 99.98%) to-be-mined waste rock and 8,956,400 m^3 (99.98%) or to-be-mined low-grade ore from Deadend deposit are classed as AMD0.
- No AMD1 or AMD3 waste rock or low-grade ore blocks are predicted in the Deadend deposit
- A negligible volume of 2,400 m^3 (or 0.02%) to-be-mined waste rock and 75,600 m^3 (or 0.84%) to-be-mined low-grade ore from Deadend deposit are classed as AMD2.
- Approximately 93.40% of waste rock and 91.97% of low-grade ore blocks are predicted to be mined from above water table (Table 3-37).



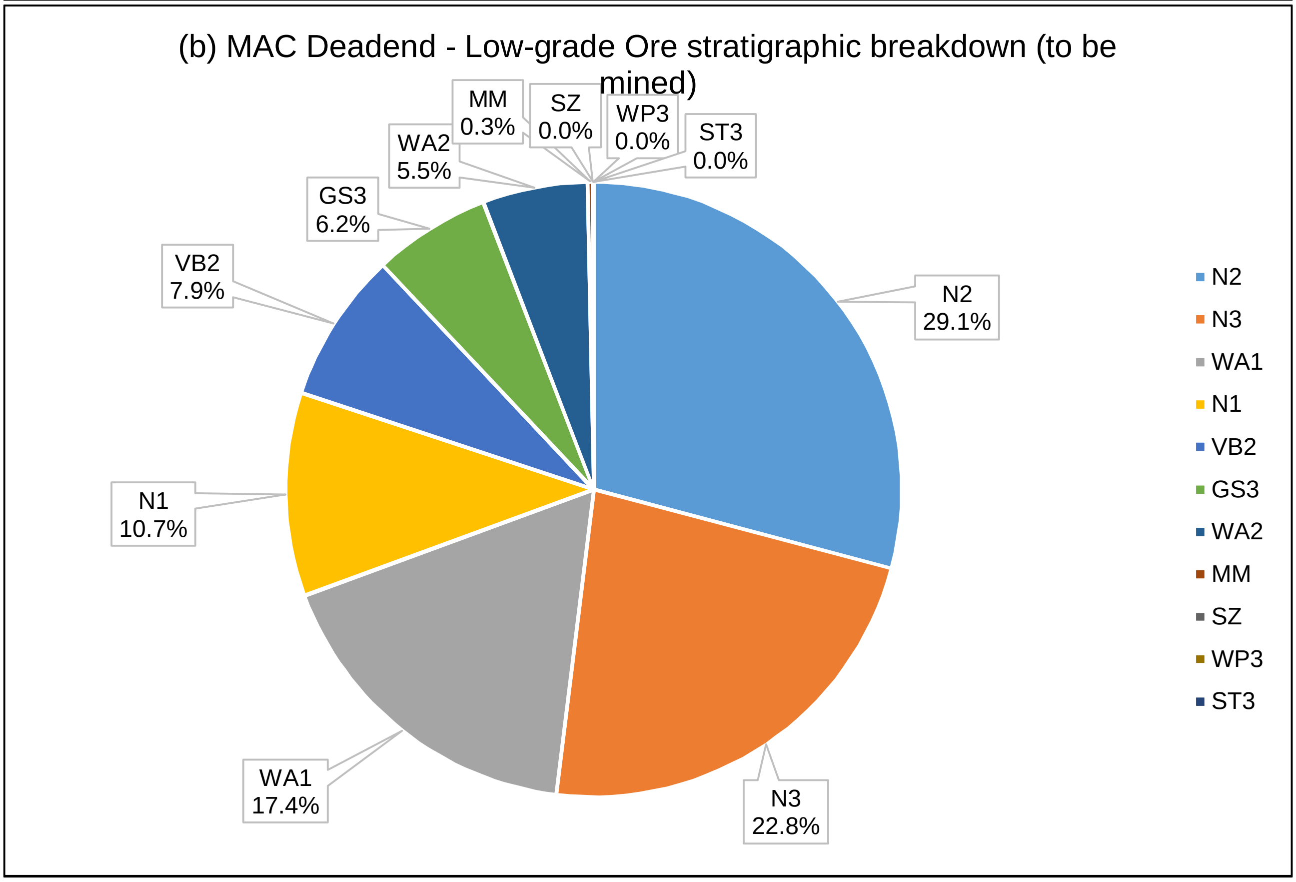


Figure 3-41 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC Deadend deposit mining model

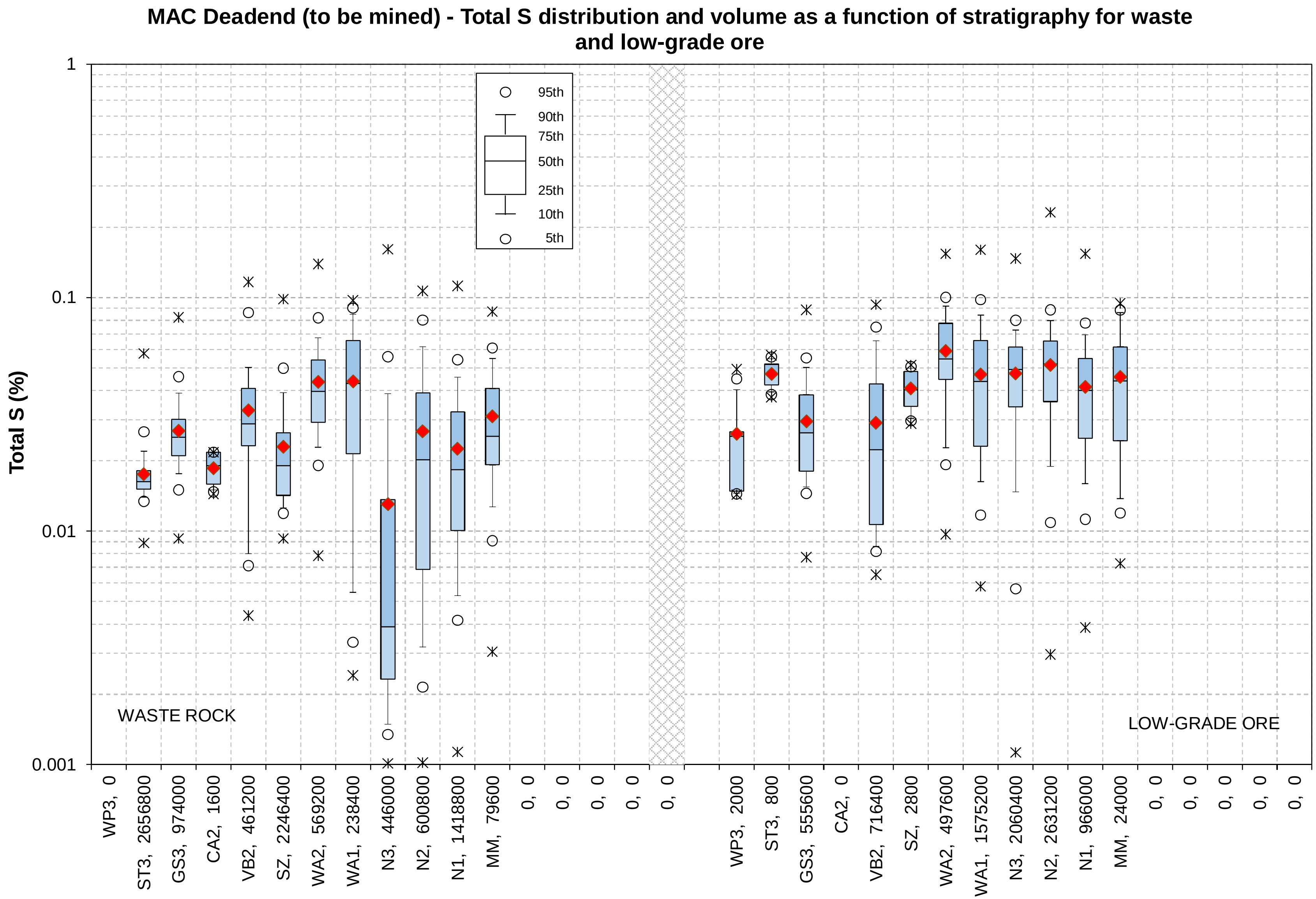


Figure 3-42 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC Deadend deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

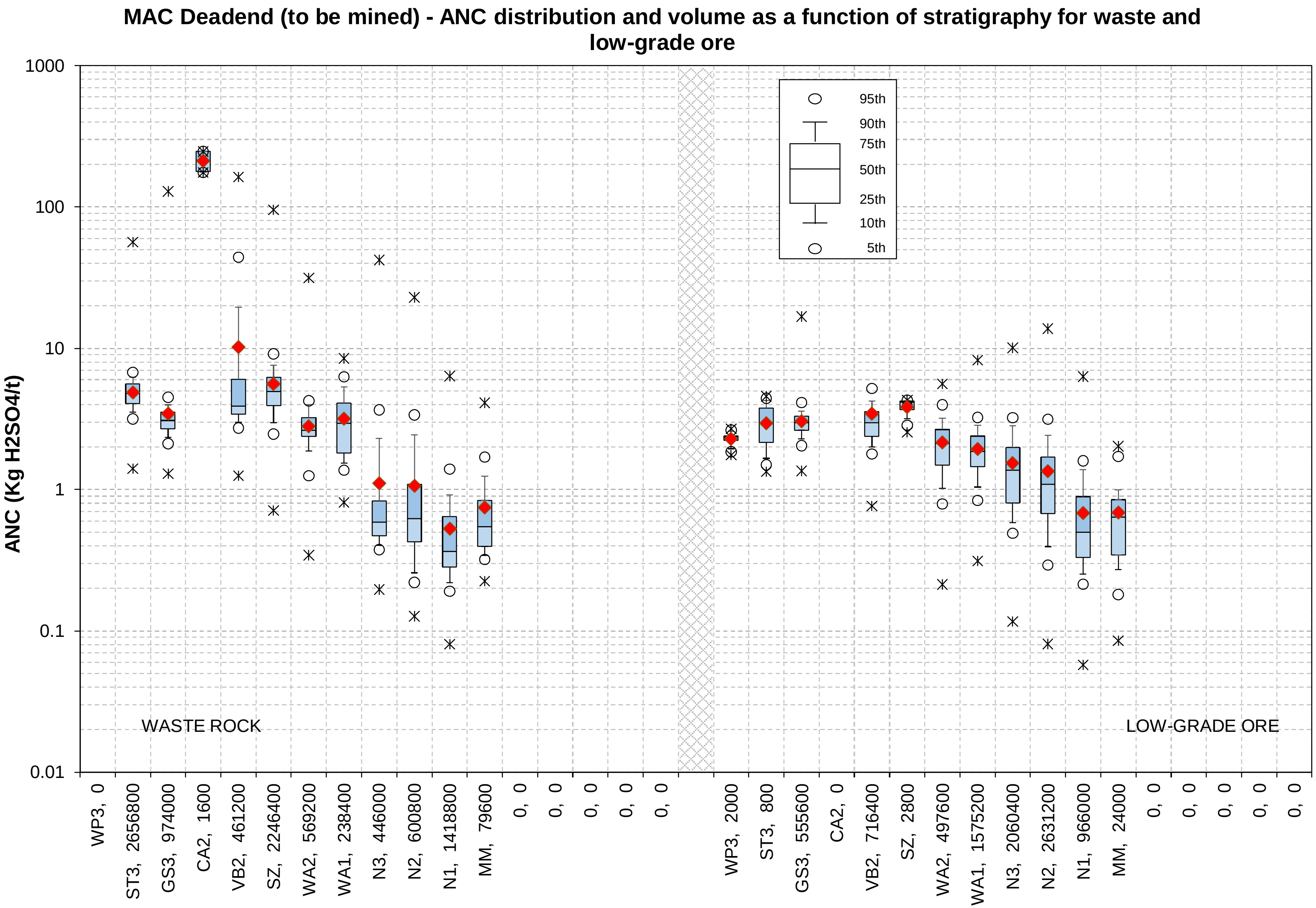


Figure 3-43 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC Deadend deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-35 MAC Deadend deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%
Waste rock												
9200 - WP3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9190 - ST3	2,656,800	27.51%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	974,000	10.08%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9160 - CA2	1,600	0.02%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9130 - VB2	448,400	4.64%	12,800	36.78%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	2,246,400	23.26%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	558,000	5.78%	11,200	32.18%	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	238,400	2.47%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	440,400	4.56%	5,600	16.09%	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	596,400	6.18%	4,400	12.64%	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	1,418,000	14.68%	800	2.30%	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	79,600	0.82%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**9,658,000**	**100.00%**	**34,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.64%**		**0.36%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9200 - WP3	2,000	0.02%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9190 - ST3	800	0.01%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9180 - GS3	555,600	6.27%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
9130 - VB2	716,400	8.09%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8150 - SZ	2,800	0.03%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
4120 - WA2	470,400	5.31%	27,200	15.85%	0	0.00%	0	N/A	0	N/A	0	N/A
4110 - WA1	1,506,800	17.01%	68,400	39.86%	0	0.00%	0	N/A	0	N/A	0	N/A
3430 - N3	2,048,400	23.12%	12,000	6.99%	0	0.00%	0	N/A	0	N/A	0	N/A
3420 - N2	2,569,200	29.00%	60,000	34.97%	2,000	100.00%	0	N/A	0	N/A	0	N/A
3410 - N1	962,000	10.86%	4,000	2.33%	0	0.00%	0	N/A	0	N/A	0	N/A
3300 - MM	24,000	0.27%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
Total	**8,858,400**	**100.00%**	**171,600**	**100.00%**	**2,000**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**98.08%**		**1.90%**		**0.02%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-36 MAC Deadend deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9190 - ST3	2,656,800	27.42%	0	N/A	0	0.00%	0	N/A	2,656,800	27.41%
9180 - GS3	974,000	10.05%	0	N/A	0	0.00%	0	N/A	974,000	10.05%
9160 - CA2	1,600	0.02%	0	N/A	0	0.00%	0	N/A	1,600	0.02%
9130 - VB2	461,200	4.76%	0	N/A	0	0.00%	0	N/A	461,200	4.76%
8150 - SZ	2,246,400	23.18%	0	N/A	0	0.00%	0	N/A	2,246,400	23.18%
4120 - WA2	568,800	5.87%	0	N/A	400	16.67%	0	N/A	569,200	5.87%
4110 - WA1	238,400	2.46%	0	N/A	0	0.00%	0	N/A	238,400	2.46%
3430 - N3	444,000	4.58%	0	N/A	2,000	83.33%	0	N/A	446,000	4.60%
3420 - N2	600,800	6.20%	0	N/A	0	0.00%	0	N/A	600,800	6.20%
3410 - N1	1,418,800	14.64%	0	N/A	0	0.00%	0	N/A	1,418,800	14.64%
3300 - MM	79,600	0.82%	0	N/A	0	0.00%	0	N/A	79,600	0.82%
Total	**9,690,400**	**100.00%**	**0**	**N/A**	**2,400**	**100.00%**	**0**	**N/A**	**9,692,800**	**100.00%**
% of Total	**99.98%**		**0.00%**		**0.02%**		**0.00%**		**100.00%**	
Low grade ore										
9200 - WP3	2,000	0.02%	0	N/A	0	0.00%	0	N/A	2,000	0.02%
9190 - ST3	800	0.01%	0	N/A	0	0.00%	0	N/A	800	0.01%
9180 - GS3	555,600	6.20%	0	N/A	0	0.00%	0	N/A	555,600	6.15%
9160 - CA2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9130 - VB2	716,400	8.00%	0	N/A	0	0.00%	0	N/A	716,400	7.93%
8150 - SZ	2,800	0.03%	0	N/A	0	0.00%	0	N/A	2,800	0.03%
4120 - WA2	493,200	5.51%	0	N/A	4,400	5.82%	0	N/A	497,600	5.51%
4110 - WA1	1,556,400	17.38%	0	N/A	18,800	24.87%	0	N/A	1,575,200	17.44%
3430 - N3	2,056,400	22.96%	0	N/A	4,000	5.29%	0	N/A	2,060,400	22.81%
3420 - N2	2,586,000	28.87%	0	N/A	45,200	59.79%	0	N/A	2,631,200	29.13%
3410 - N1	962,800	10.75%	0	N/A	3,200	4.23%	0	N/A	966,000	10.70%
3300 - MM	24,000	0.27%	0	N/A	0	0.00%	0	N/A	24,000	0.27%
Total	**8,956,400**	**100.00%**	**0**	**N/A**	**75,600**	**100.00%**	**0**	**N/A**	**9,032,000**	**100.00%**
% of Total	**99.16%**		**0.00%**		**0.84%**		**0.00%**		**100.00%**	

Table 3-37 MAC Deadend deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	9,050,400	640,000	9,690,400	99.98%
1	0	0	0	0.00%
2	2,400	0	2,400	0.02%
3	0	0	0	0.00%
Total	**9,052,800**	**640,000**	**9,692,800**	100.00%
% of Total	**93.40%**	**6.60%**	**100.00%**	
Low grade ore				
0	8,231,200	725,200	8,956,400	99.16%
1	0	0	0	0.00%
2	75,600	0	75,600	0.84%
3	0	0	0	0.00%
Total	**8,306,800**	**725,200**	**9,032,000**	100.00%
% of Total	**91.97%**	**8.03%**	**100.00%**	

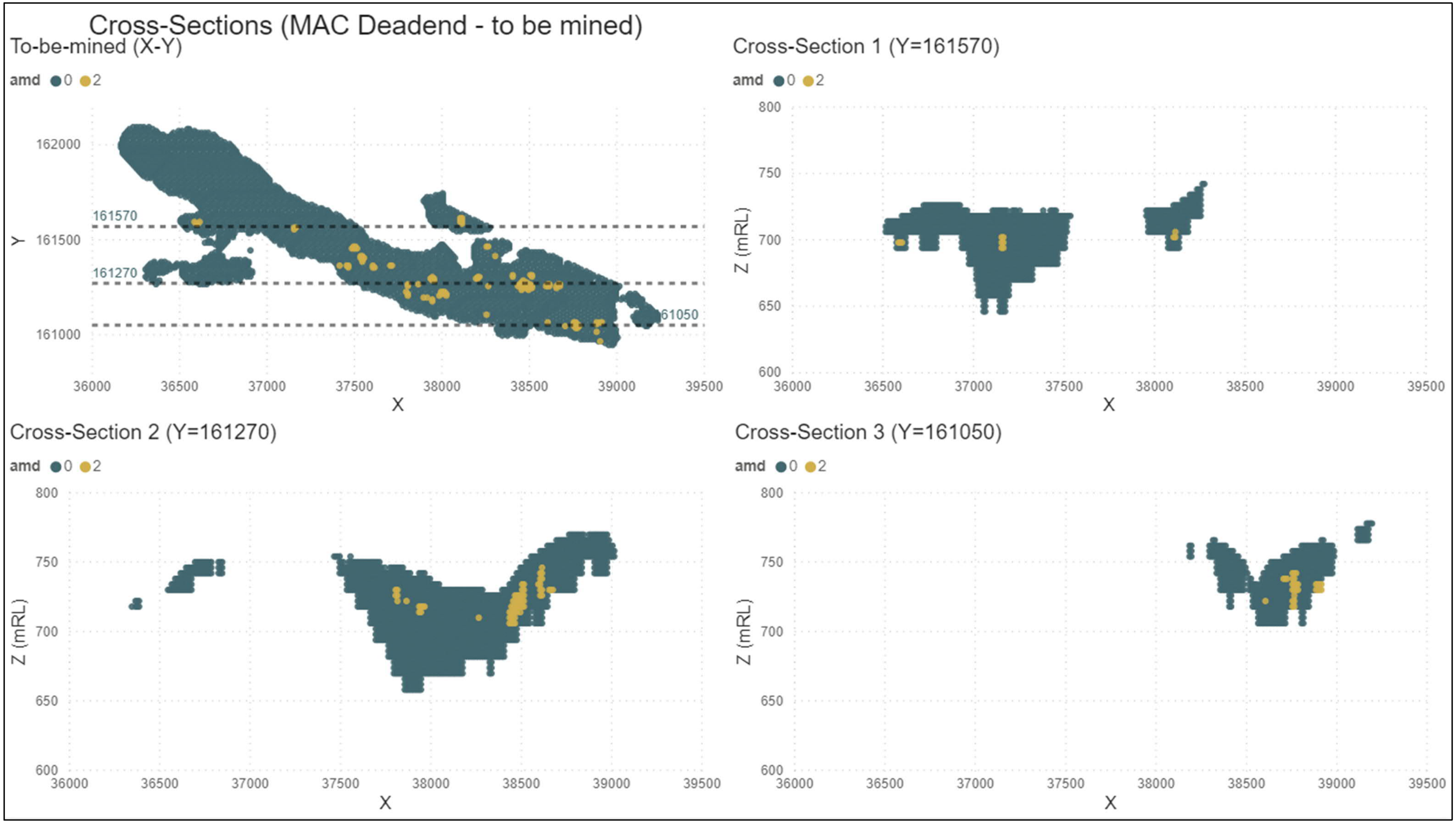


Figure 3-44 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC Deadend deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.9 MAC P1W

3.1.1.9.1 MAC P1W deposit (as-mined waste)

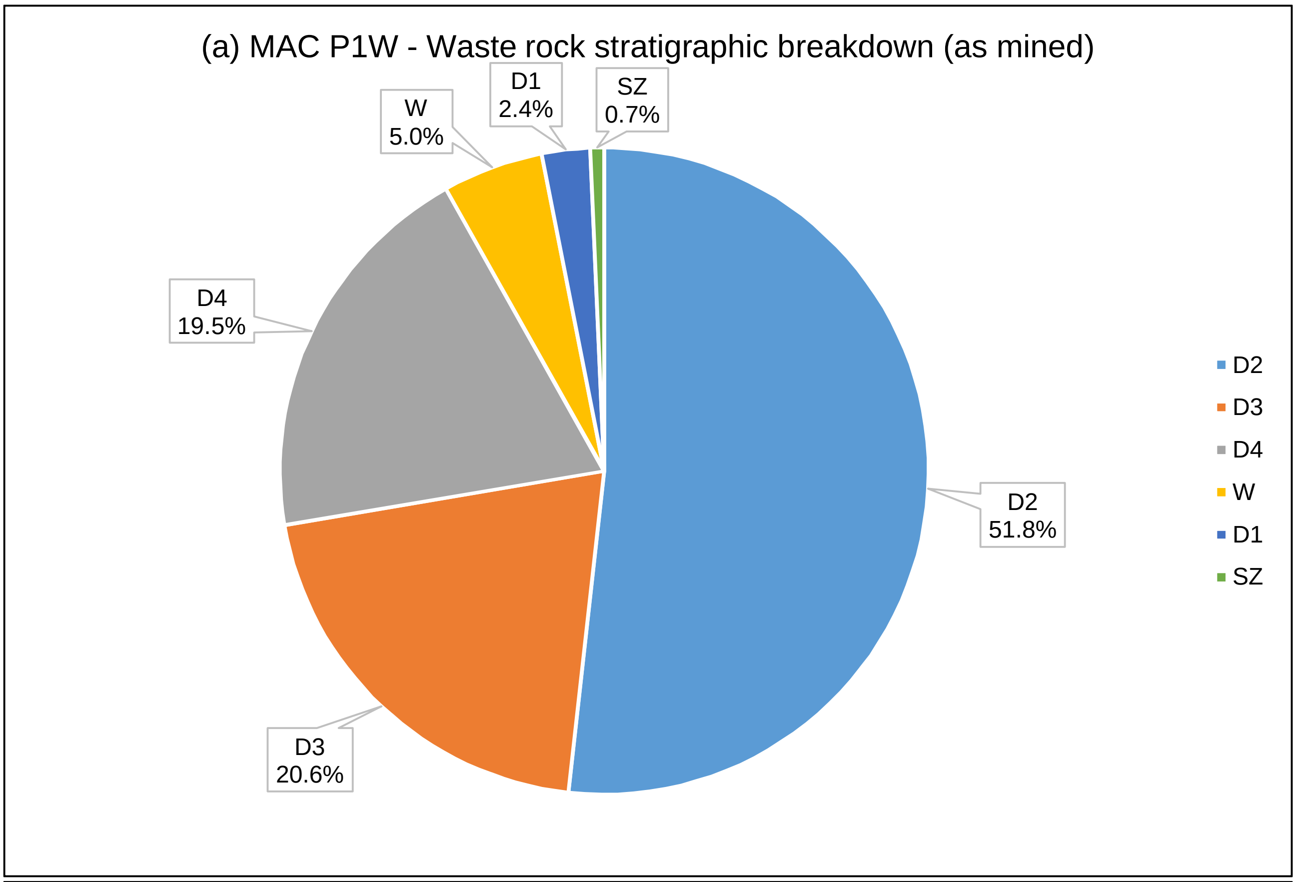
A pie chart showing the distribution of as-mined waste rock and low-grade ore from P1W deposit as a function of stratigraphic unit is shown in Figure 3-45. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from P1W deposit are shown in Figure 3-46 and Figure 3-47, respectively.

Table 3-38 presents as-mined waste volume from P1W deposit split by total sulphur content per stratigraphy. Table 3-39 and Table 3-40 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC P1W deposit is presented in Figure 3-48.

The block model data indicate that:

- As-mined waste rock from P1W deposit is mostly from Dales Gorge Member (94.3%, incl. D2, D3 and D4) with minor contribution from Whaleback Shale (5.0%, W) and Tertiary Detritals (0.7%, SZ). The entire as-mined low-grade ore is sourced from Dales Gorge Member (D4, D3, D2 and D1).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below or near 0.1 wt% and median value below or near 0.06 wt% for all mined out blocks (Figure 3-46, Table 3-38).
- Very low sulphur blocks (<0.1%) comprise 97.03% of as-mined waste rock and 98.37% of as-mined low-grade ore volume. Low sulphur blocks (0.1-0.2%) comprise 2.97% of as-mined waste rock and 1.63% of as-mined low-grade ore volume. No waste blocks show total sulphur more than 0.2 wt%.
- As-mined waste rock and low-grade ore have low ANC with the maximum values below 10 kg H_2SO_4/t and median values below 1 kg H_2SO_4/t (Figure 3-47).
- A total volume of 3,173,600 m^3 (incl. 345,600 m^3 waste rock and 2,828,000 m^3 low-grade ore) of AMD0 waste has been mined out from P1W deposit, comprising ~98.74% of as-mined waste rock and ~99.09% of as-mined low-grade ore, as predicted by the MAC P1W deposit block model.
- No AMD1 or AMD3 waste rock or low-grade ore blocks are predicted in the P1W deposit
- A total volume of 30,400 m^3 (incl. 4,400 m^3 as-mined waste rock and 26,000 m^3 as-mined low-grade ore) are classed as AMD2, comprising 1.26% of as-mined waste rock and 0.91% of as-mined low-grade ore, which are all associated with Dales Gorge Member (Table 3-39).
- All materials mined-out (waste rock and low-grade ore) from P1W deposit are sourced from above the water table (Table 3-40).



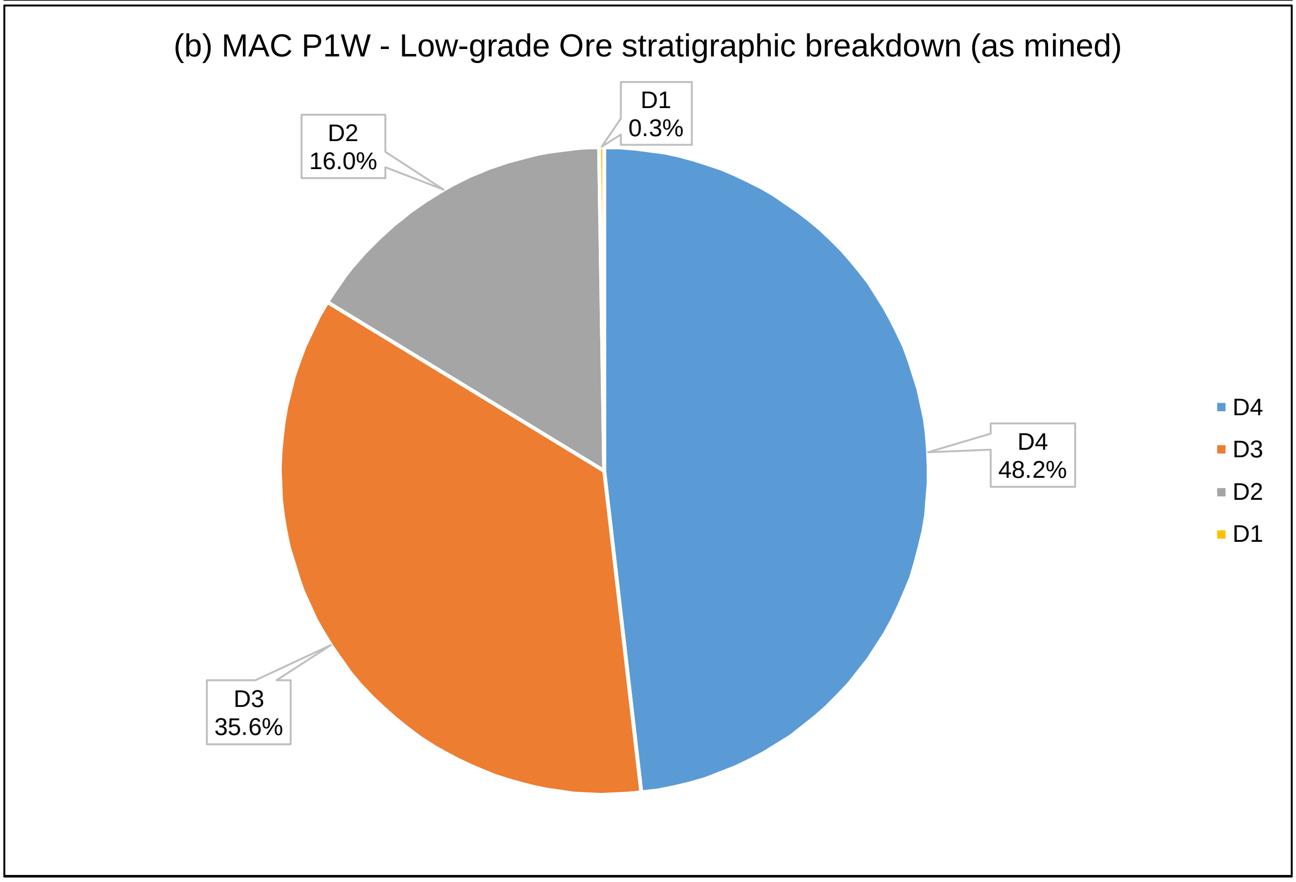


Figure 3-45 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P1W deposit mining model

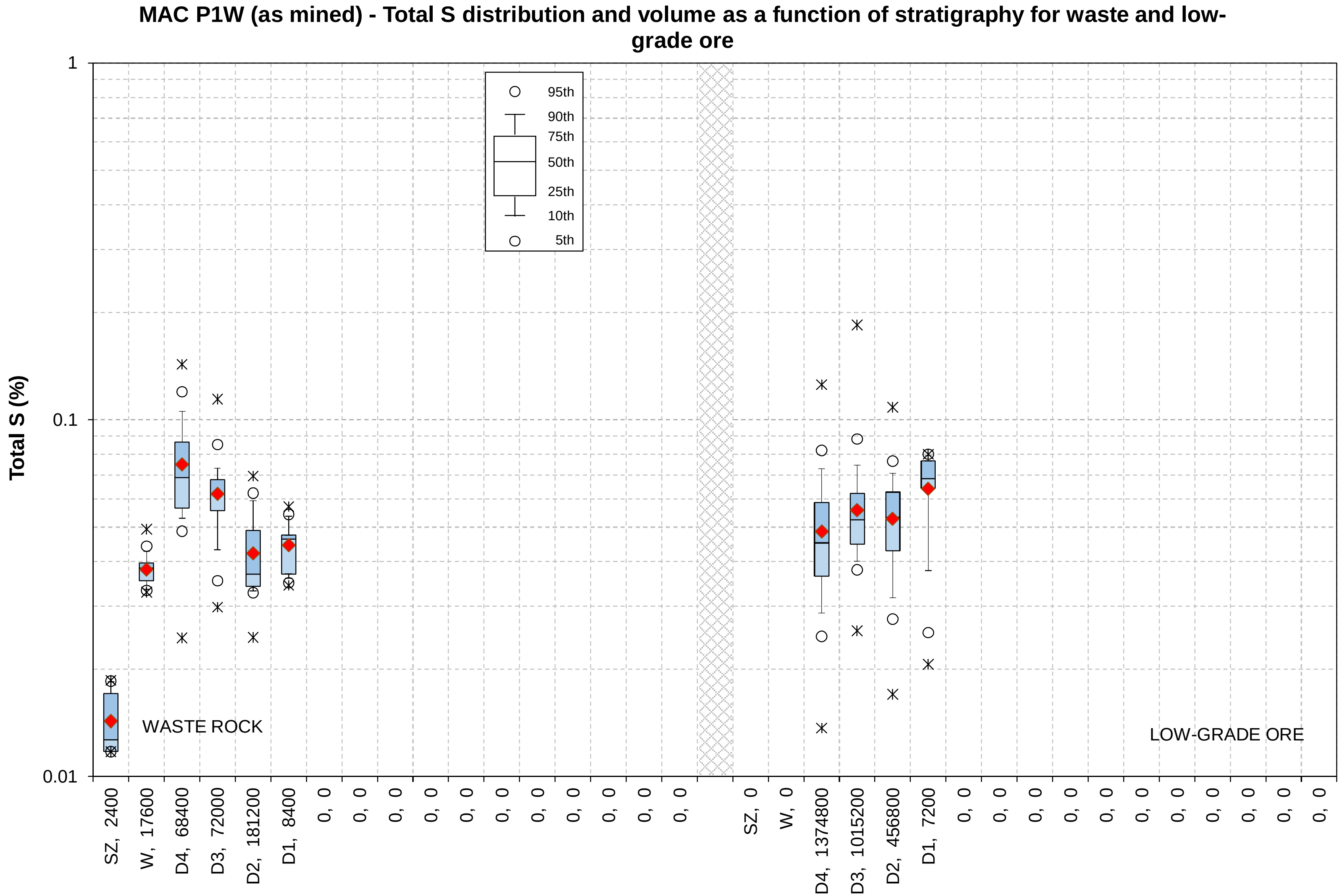


Figure 3-46 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC P1W deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

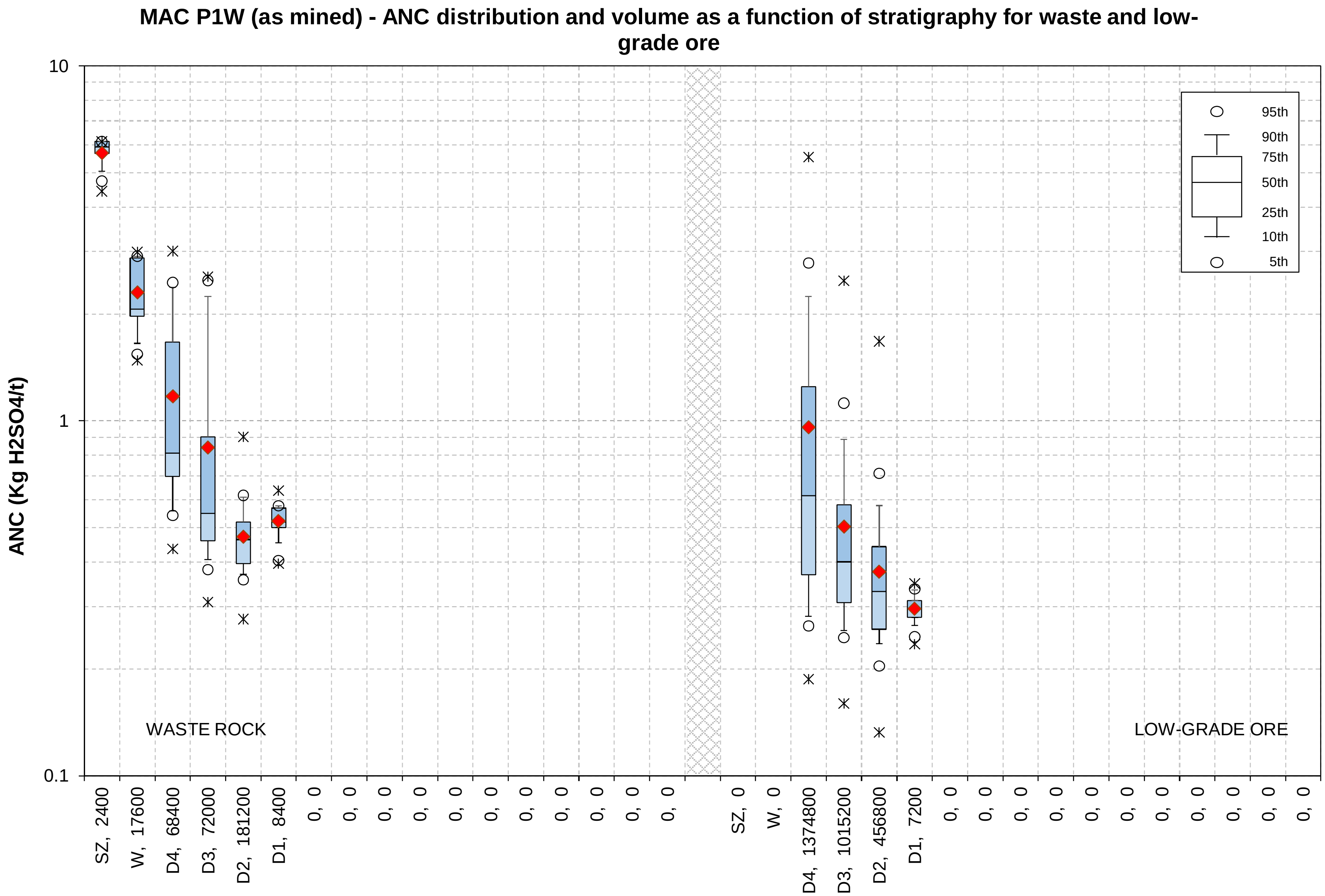


Figure 3-47 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC P1W deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-38 MAC P1W deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9180 - GS3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	2,400	0.71%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	17,600	5.18%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	60,800	17.90%	7,600	73.08%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	69,200	20.38%	2,800	26.92%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	181,200	53.36%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	8,400	2.47%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**339,600**	**100.00%**	**10,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**97.03%**		**2.97%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9180 - GS3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,359,600	48.43%	15,200	32.76%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	987,200	35.16%	28,000	60.34%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	453,600	16.16%	3,200	6.90%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	7,200	0.26%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**2,807,600**	**100.00%**	**46,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**98.37%**		**1.63%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-39 MAC P1W deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9180 - GS3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	2,400	0.69%	0	N/A	0	0.00%	0	N/A	2,400	0.69%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8120 - TD2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5860 - J6	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5850 - J5	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5840 - J4	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5830 - J3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5820 - J2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5810 - J1	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5700 - W	17,600	5.09%	0	N/A	0	0.00%	0	N/A	17,600	5.03%
5640 - D4	65,200	18.87%	0	N/A	3,200	72.73%	0	N/A	68,400	19.54%
5630 - D3	70,800	20.49%	0	N/A	1,200	27.27%	0	N/A	72,000	20.57%
5620 - D2	181,200	52.43%	0	N/A	0	0.00%	0	N/A	181,200	51.77%
5610 - D1	8,400	2.43%	0	N/A	0	0.00%	0	N/A	8,400	2.40%
Total	**345,600**	**100.00%**	**0**	**N/A**	**4,400**	**100.00%**	**0**	**N/A**	**350,000**	**100.00%**
% of Total	**98.74%**		**0.00%**		**1.26%**		**0.00%**		**100.00%**	
Low grade ore										
9180 - GS3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8120 - TD2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5860 - J6	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5850 - J5	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5840 - J4	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5830 - J3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5820 - J2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5810 - J1	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5700 - W	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5640 - D4	1,366,800	48.33%	0	N/A	8,000	30.77%	0	N/A	1,374,800	48.17%
5630 - D3	998,000	35.29%	0	N/A	17,200	66.15%	0	N/A	1,015,200	35.57%
5620 - D2	456,000	16.12%	0	N/A	800	3.08%	0	N/A	456,800	16.01%
5610 - D1	7,200	0.25%	0	N/A	0	0.00%	0	N/A	7,200	0.25%
Total	**2,828,000**	**100.00%**	**0**	**N/A**	**26,000**	**100.00%**	**0**	**N/A**	**2,854,000**	**100.00%**
% of Total	**99.09%**		**0.00%**		**0.91%**		**0.00%**		**100.00%**	

Table 3-40 MAC P1W deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	345,600	0	345,600	98.74%
1	0	0	0	0.00%
2	4,400	0	4,400	1.26%
3	0	0	0	0.00%
Total	**350,000**	**0**	**350,000**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	2,828,000	0	2,828,000	99.09%
1	0	0	0	0.00%
2	26,000	0	26,000	0.91%
3	0	0	0	0.00%
Total	**2,854,000**	**0**	**2,854,000**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

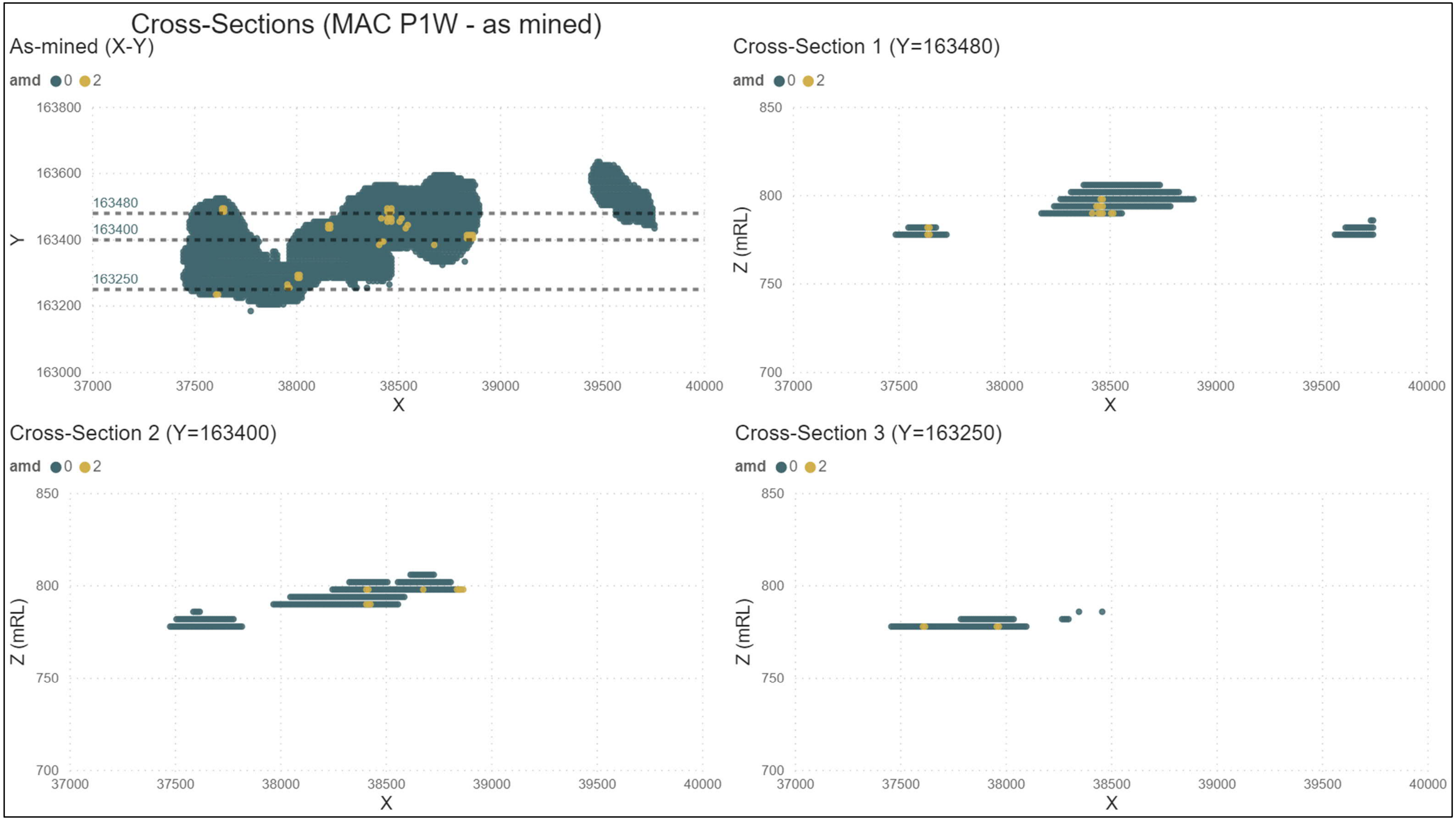


Figure 3-48 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC P1W deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.9.2 MAC P1W deposit (to-be-mined waste)

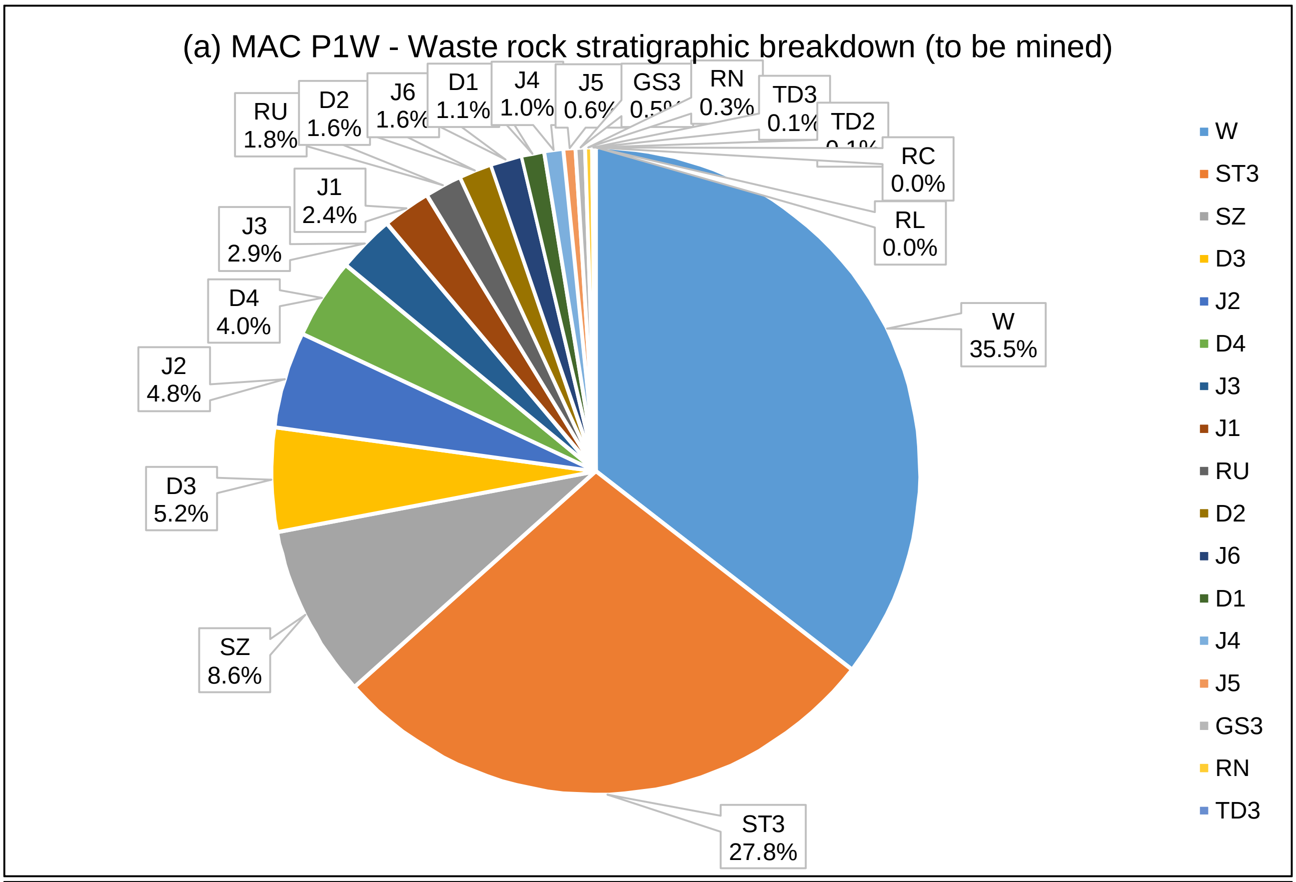
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P1W deposit as a function of stratigraphic unit is shown in Figure 3-49. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P1W deposit are shown in Figure 3-50 and Figure 3-51, respectively.

Table 3-41 presents to-be-mined waste volume from P1W deposit split by total sulphur content per stratigraphy. Table 3-42 and Table 3-43 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P1W deposit is presented in Figure 3-52.

The block model data indicate that:

- To-be-mined waste rock from P1W deposit is mainly from Tertiary Detritals (37.1%, incl. ST3, SZ, GS3, TD3 and TD2) and Whaleback Shale (35.5%, W), with minor contribution from Joffre Member (13.2%, incl. J2, J3, J1, J6, J4 and J5), Dales Gorge Member (12.0%, incl. D3, D4, D2 and D1) and Mt McRae Shale (2.2%, incl. RU, RN, RC and RL). To-be-mined low-grade ore is mainly sourced from Dales Gorge Member (71.9%) with minor contribution from Joffre Member (12.9%), Tertiary Detritals (4.1%) and Whaleback Shale (<0.01%).
- To-be-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below 0.1 wt% and median value below or near 0.03 wt% (Figure 3-50, Table 3-41). It is noted that Mt McRae Shale waste rock blocks have median sulphur contents of approximately 0.01 wt% and maximum sulphur value below 0.22 wt%.
- Very low sulphur blocks (<0.1%) comprise 98.41% of to-be-mined waste rock and 99.06% of to-be-mined low-grade ore volume. Low sulphur blocks (0.1-0.2%) comprise 1.47% of to-be-mined waste rock and 0.86% of to-be-mined low-grade ore volume. Only 1.2% to-be-mined waste rock and 0.07% of to-be-mined low-grade ore have total sulphur content in the range of 0.2-0.5 wt% and insignificant amount of to-be-mined low-grade ore (0.003%, 4,400 m^3 from D4) have moderate sulphur.
- To-be-mined waste rock and low-grade ore have low ANC with the 95th percentile values below or near 10 kg H_2SO_4/t (Figure 3-51). Tertiary Detritals waste rock (TD3) show slightly higher ANC distribution compared to other stratigraphic units.
- A total volume of 248,908,800 m^3 (incl. 78,187,200 m^3 waste rock and 170,721,600 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P1W deposit, representing 99.33% of to-be-mined waste rock and 99.46% of to-be-mined low-grade ore.
- No AMD1 waste rock or low-grade ore blocks are predicted to be mined out from the P1W deposit
- A total volume of 1,432,000 m^3 (incl. 527,200 m^3 to-be-mined waste rock and 904,800 m^3 to-be-mined low-grade ore) are classed as AMD2, representing 0.67% of to-be-mined waste rock and 0.53% of to-be-mined low-grade ore, which are associated with Joffre Member, Whaleback Shale and Dales Gorge Member (Table 3-42).
- Only a negligible volume equal to 18,000 m^3 (or 0.01%) of low-grade ore from SG3 and WP3 stratigraphic units is classed as AMD3.
- Approximately 94.63% of waste rock and 90.58% of low-grade ore are predicted to be mined from above water table (Table 3-43).



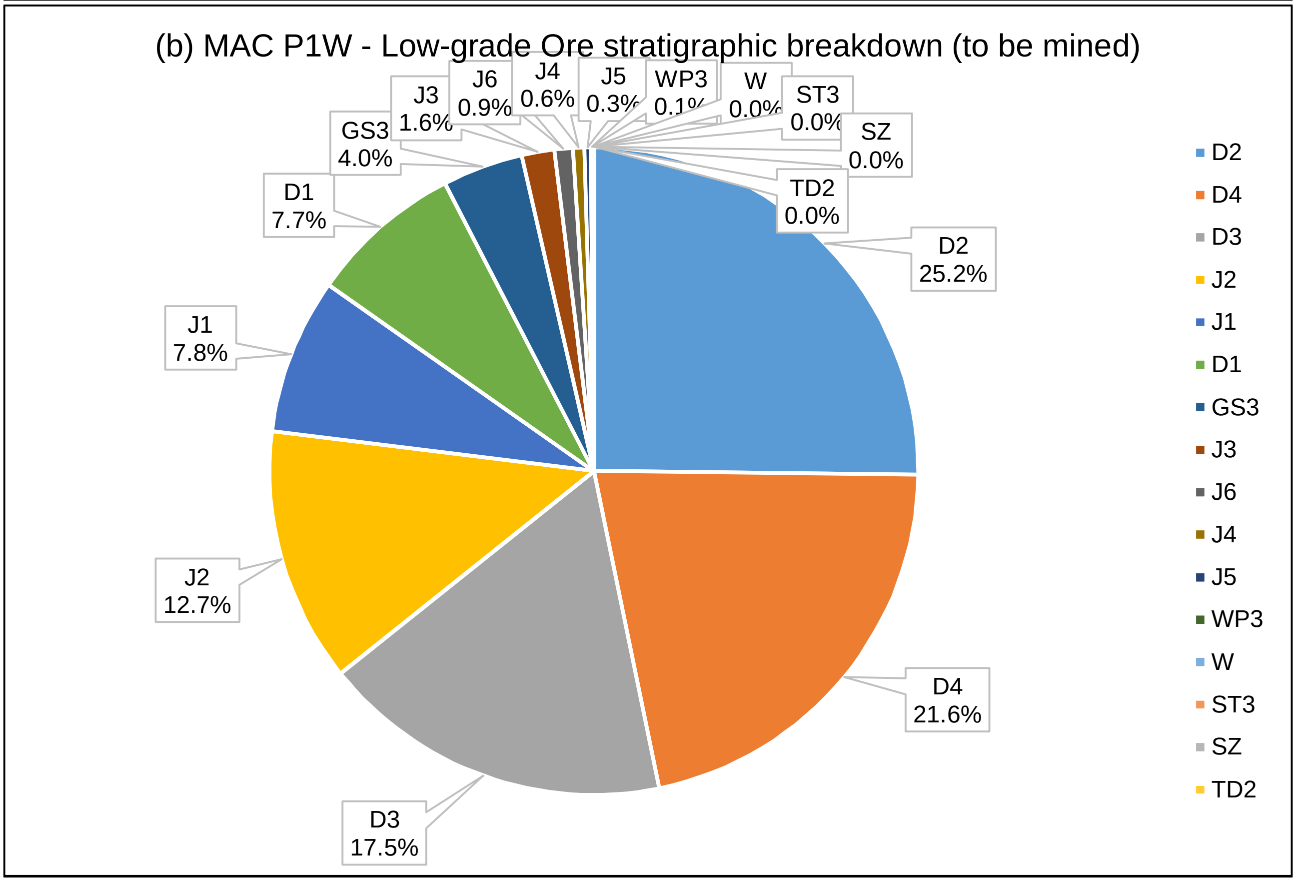


Figure 3-49 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P1W deposit mining model

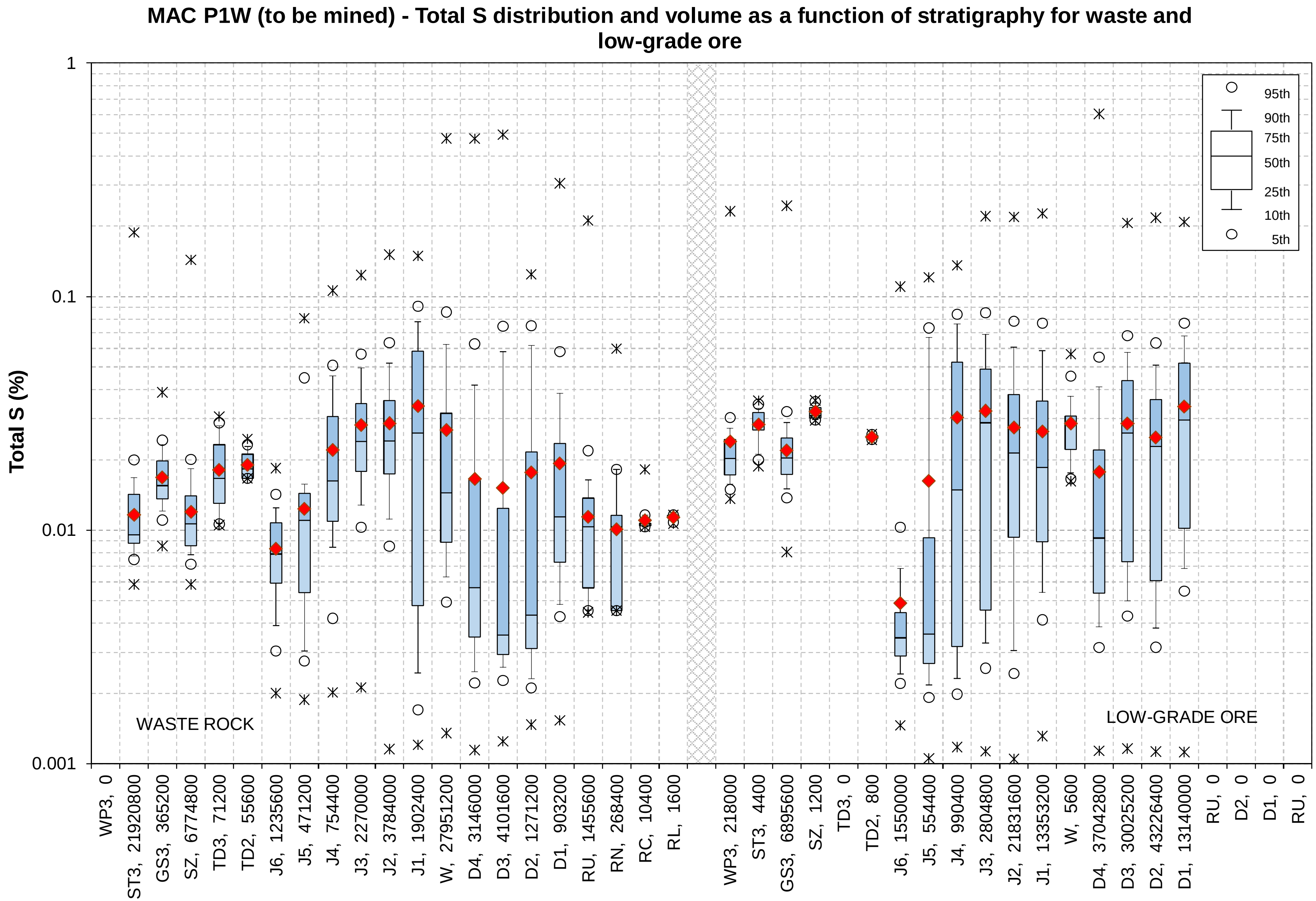


Figure 3-50 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P1W deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

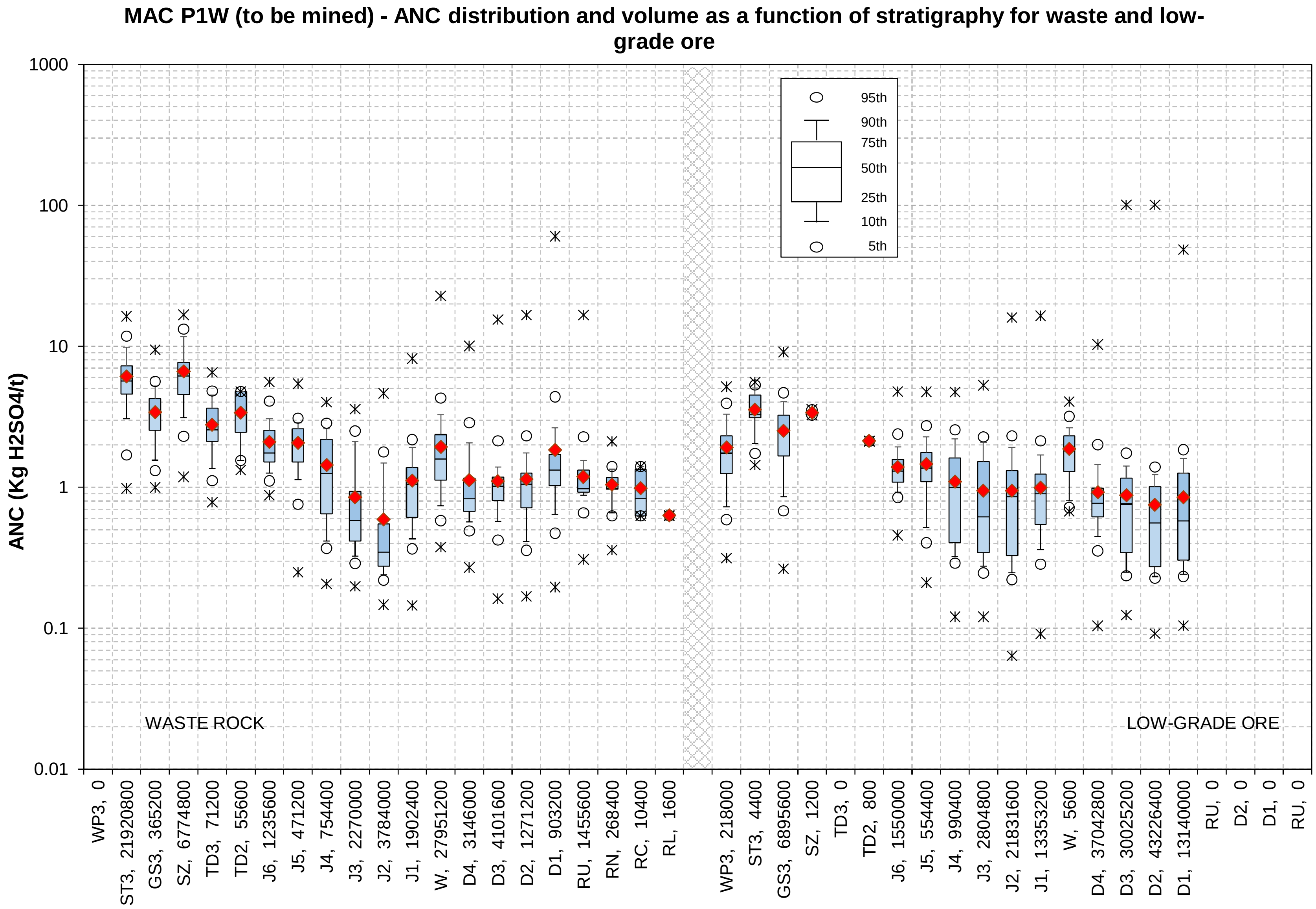


Figure 3-51 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P1W deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-41 MAC P1W deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9190 - ST3	21,912,000	28.29%	8,800	0.76%	0	0.00%	0	0.00%	0	N/A	0	N/A
9180 - GS3	365,200	0.47%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	6,774,000	8.74%	800	0.07%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	71,200	0.09%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8120 - TD2	55,600	0.07%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5860 - J6	1,235,600	1.60%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5850 - J5	471,200	0.61%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5840 - J4	752,000	0.97%	2,400	0.21%	0	0.00%	0	0.00%	0	N/A	0	N/A
5830 - J3	2,268,000	2.93%	2,000	0.17%	0	0.00%	0	0.00%	0	N/A	0	N/A
5820 - J2	3,780,400	4.88%	3,600	0.31%	0	0.00%	0	0.00%	0	N/A	0	N/A
5810 - J1	1,836,000	2.37%	66,400	5.75%	0	0.00%	0	0.00%	0	N/A	0	N/A
5700 - W	26,908,800	34.74%	973,600	84.25%	42,800	65.64%	26,000	83.33%	0	N/A	0	N/A
5640 - D4	3,091,200	3.99%	34,000	2.94%	17,600	26.99%	3,200	10.26%	0	N/A	0	N/A
5630 - D3	4,060,400	5.24%	36,400	3.15%	3,200	4.91%	1,600	5.13%	0	N/A	0	N/A
5620 - D2	1,250,400	1.61%	20,800	1.80%	0	0.00%	0	0.00%	0	N/A	0	N/A
5610 - D1	894,800	1.16%	6,800	0.59%	1,200	1.84%	400	1.28%	0	N/A	0	N/A
5440 - RU	1,455,200	1.88%	0	0.00%	400	0.61%	0	0.00%	0	N/A	0	N/A
5430 - RN	268,400	0.35%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5420 - RC	10,400	0.01%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5410 - RL	1,600	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**77,462,400**	**100.00%**	**1,155,600**	**100.00%**	**65,200**	**100.00%**	**31,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**98.41%**		**1.47%**		**0.08%**		**0.04%**		**0.00%**		**0.00%**	
Low grade ore												
9200 - WP3	214,400	0.13%	1,600	0.11%	2,000	2.23%	0	0.00%	0	0.00%	0	N/A
9190 - ST3	4,400	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9180 - GS3	6,881,200	4.05%	12,800	0.86%	1,600	1.79%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	1,200	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	800	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5860 - J6	1,546,800	0.91%	3,200	0.22%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5850 - J5	552,000	0.32%	2,400	0.16%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5840 - J4	984,400	0.58%	6,000	0.40%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5830 - J3	2,722,000	1.60%	82,000	5.52%	800	0.89%	0	0.00%	0	0.00%	0	N/A
5820 - J2	21,446,000	12.61%	384,800	25.92%	800	0.89%	0	0.00%	0	0.00%	0	N/A
5810 - J1	13,119,200	7.72%	233,200	15.71%	800	0.89%	0	0.00%	0	0.00%	0	N/A
5700 - W	5,600	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5640 - D4	36,695,200	21.58%	230,400	15.52%	76,400	85.27%	36,400	100.00%	4,400	100.00%	0	N/A
5630 - D3	29,851,600	17.56%	170,000	11.45%	3,600	4.02%	0	0.00%	0	0.00%	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5620 - D2	42,976,800	25.28%	247,200	16.65%	2,400	2.68%	0	0.00%	0	0.00%	0	N/A
5610 - D1	13,028,000	7.66%	110,800	7.46%	1,200	1.34%	0	0.00%	0	0.00%	0	N/A
5440 - RU	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5420 - RC	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5410 - RL	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**170,029,600**	**100.00%**	**1,484,400**	**100.00%**	**89,600**	**100.00%**	**36,400**	**100.00%**	**4,400**	**100.00%**	**0**	**N/A**
% of Total	**99.06%**		**0.86%**		**0.05%**		**0.02%**		**0.00%**		**0.00%**	

Table 3-42 MAC P1W deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
9190 - ST3	21,920,800	28.04%	0	N/A	0	0.00%	0	N/A	21,920,800	27.85%
9180 - GS3	365,200	0.47%	0	N/A	0	0.00%	0	N/A	365,200	0.46%
8150 - SZ	6,774,800	8.66%	0	N/A	0	0.00%	0	N/A	6,774,800	8.61%
8130 - TD3	71,200	0.09%	0	N/A	0	0.00%	0	N/A	71,200	0.09%
8120 - TD2	55,600	0.07%	0	N/A	0	0.00%	0	N/A	55,600	0.07%
5860 - J6	1,235,600	1.58%	0	N/A	0	0.00%	0	N/A	1,235,600	1.57%
5850 - J5	471,200	0.60%	0	N/A	0	0.00%	0	N/A	471,200	0.60%
5840 - J4	754,400	0.96%	0	N/A	0	0.00%	0	N/A	754,400	0.96%
5830 - J3	2,269,600	2.90%	0	N/A	400	0.08%	0	N/A	2,270,000	2.88%
5820 - J2	3,784,000	4.84%	0	N/A	0	0.00%	0	N/A	3,784,000	4.81%
5810 - J1	1,891,200	2.42%	0	N/A	11,200	2.12%	0	N/A	1,902,400	2.42%
5700 - W	27,514,800	35.19%	0	N/A	436,400	82.78%	0	N/A	27,951,200	35.51%
5640 - D4	3,119,200	3.99%	0	N/A	26,800	5.08%	0	N/A	3,146,000	4.00%
5630 - D3	4,072,800	5.21%	0	N/A	28,800	5.46%	0	N/A	4,101,600	5.21%
5620 - D2	1,248,800	1.60%	0	N/A	22,400	4.25%	0	N/A	1,271,200	1.61%
5610 - D1	902,000	1.15%	0	N/A	1,200	0.23%	0	N/A	903,200	1.15%
5440 - RU	1,455,600	1.86%	0	N/A	0	0.00%	0	N/A	1,455,600	1.85%
5430 - RN	268,400	0.34%	0	N/A	0	0.00%	0	N/A	268,400	0.34%
5420 - RC	10,400	0.01%	0	N/A	0	0.00%	0	N/A	10,400	0.01%
5410 - RL	1,600	0.00%	0	N/A	0	0.00%	0	N/A	1,600	0.00%
Total	**78,187,200**	**100.00%**	**0**	**N/A**	**527,200**	**100.00%**	**0**	**N/A**	**78,714,400**	**100.00%**
% of Total	**99.33%**		**0.00%**		**0.67%**		**0.00%**		**100.00%**	
Low grade ore										
9200 - WP3	214,400	0.13%	0	N/A	0	0.00%	3,600	20.00%	218,000	0.13%
9190 - ST3	4,400	0.00%	0	N/A	0	0.00%	0	0.00%	4,400	0.00%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%
9180 - GS3	6,881,200	4.03%	0	N/A	0	0.00%	14,400	80.00%	6,895,600	4.02%
8150 - SZ	1,200	0.00%	0	N/A	0	0.00%	0	0.00%	1,200	0.00%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8120 - TD2	800	0.00%	0	N/A	0	0.00%	0	0.00%	800	0.00%
5860 - J6	1,550,000	0.91%	0	N/A	0	0.00%	0	0.00%	1,550,000	0.90%
5850 - J5	553,600	0.32%	0	N/A	800	0.09%	0	0.00%	554,400	0.32%
5840 - J4	985,200	0.58%	0	N/A	5,200	0.57%	0	0.00%	990,400	0.58%
5830 - J3	2,753,200	1.61%	0	N/A	51,600	5.70%	0	0.00%	2,804,800	1.63%
5820 - J2	21,584,000	12.64%	0	N/A	247,600	27.37%	0	0.00%	21,831,600	12.72%
5810 - J1	13,220,800	7.74%	0	N/A	132,400	14.63%	0	0.00%	13,353,200	7.78%
5700 - W	5,600	0.00%	0	N/A	0	0.00%	0	0.00%	5,600	0.00%
5640 - D4	36,838,400	21.58%	0	N/A	204,400	22.59%	0	0.00%	37,042,800	21.58%
5630 - D3	29,954,000	17.55%	0	N/A	71,200	7.87%	0	0.00%	30,025,200	17.49%
5620 - D2	43,096,800	25.24%	0	N/A	129,600	14.32%	0	0.00%	43,226,400	25.18%
5610 - D1	13,078,000	7.66%	0	N/A	62,000	6.85%	0	0.00%	13,140,000	7.66%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
5420 - RC	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
5410 - RL	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
Total	**170,721,600**	**100.00%**	**0**	**N/A**	**904,800**	**100.00%**	**18,000**	**100.00%**	**171,644,400**	**100.00%**
% of Total	**99.46%**		**0.00%**		**0.53%**		**0.01%**		**100.00%**	

Table 3-43 MAC P1W deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m³)	BWT (m³)	Total Volume (m³)	% of volume
Waste rock				
0	73,956,800	4,230,400	78,187,200	99.33%
1	0	0	0	0.00%
2	527,200	0	527,200	0.67%
3	0	0	0	0.00%
Total	**74,484,000**	**4,230,400**	**78,714,400**	100.00%
% of Total	**94.63%**	**5.37%**	**100.00%**	
Low grade ore				
0	154,556,000	16,165,600	170,721,600	99.46%
1	0	0	0	0.00%
2	904,800	0	904,800	0.53%
3	18,000	0	18,000	0.01%
Total	**155,478,800**	**16,165,600**	**171,644,400**	100.00%
% of Total	**90.58%**	**9.42%**	**100.00%**	

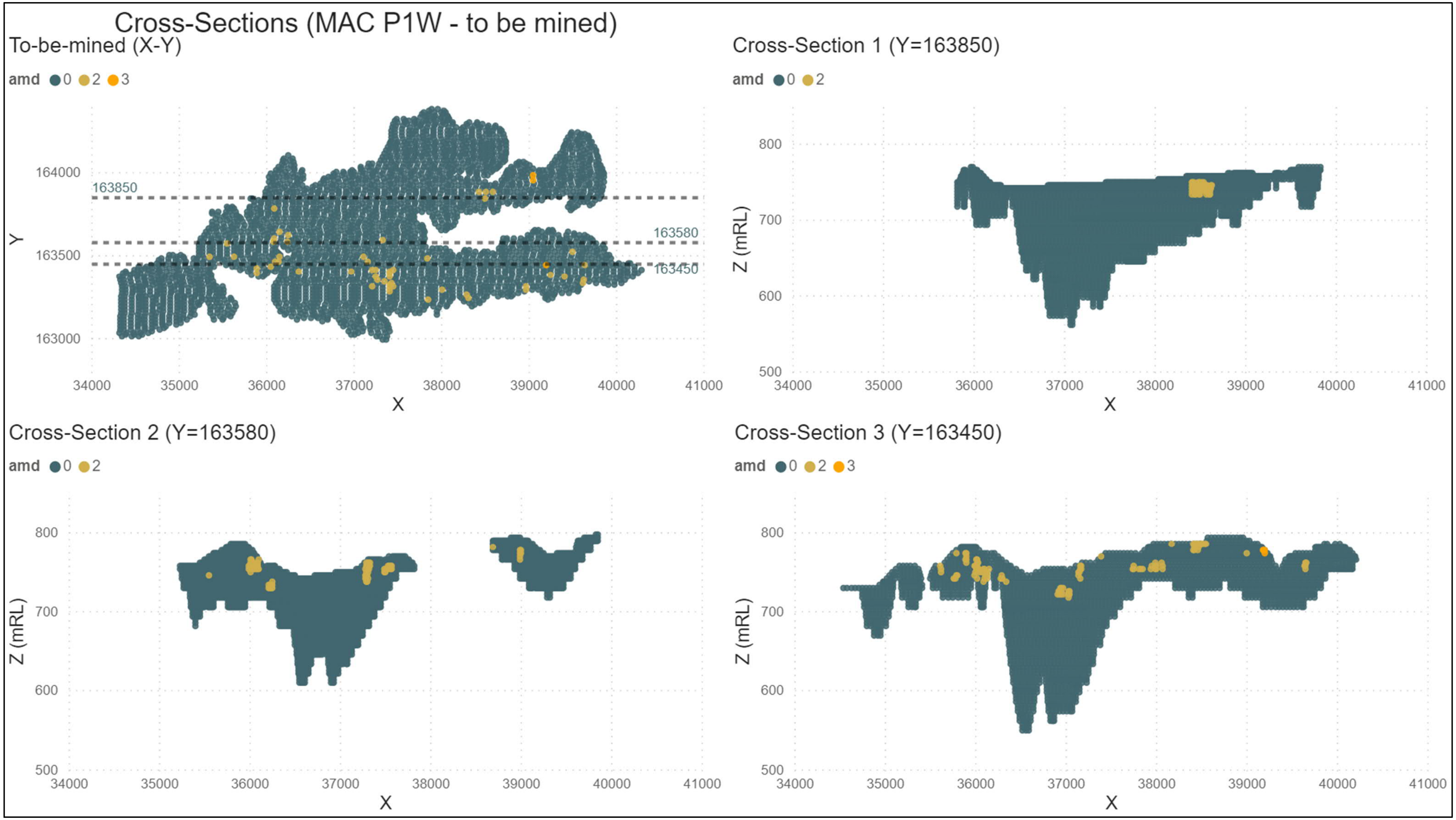


Figure 3-52 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P1W deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.10 MAC P1E deposit

3.1.1.10.1 MAC P1E deposit (as-mined waste)

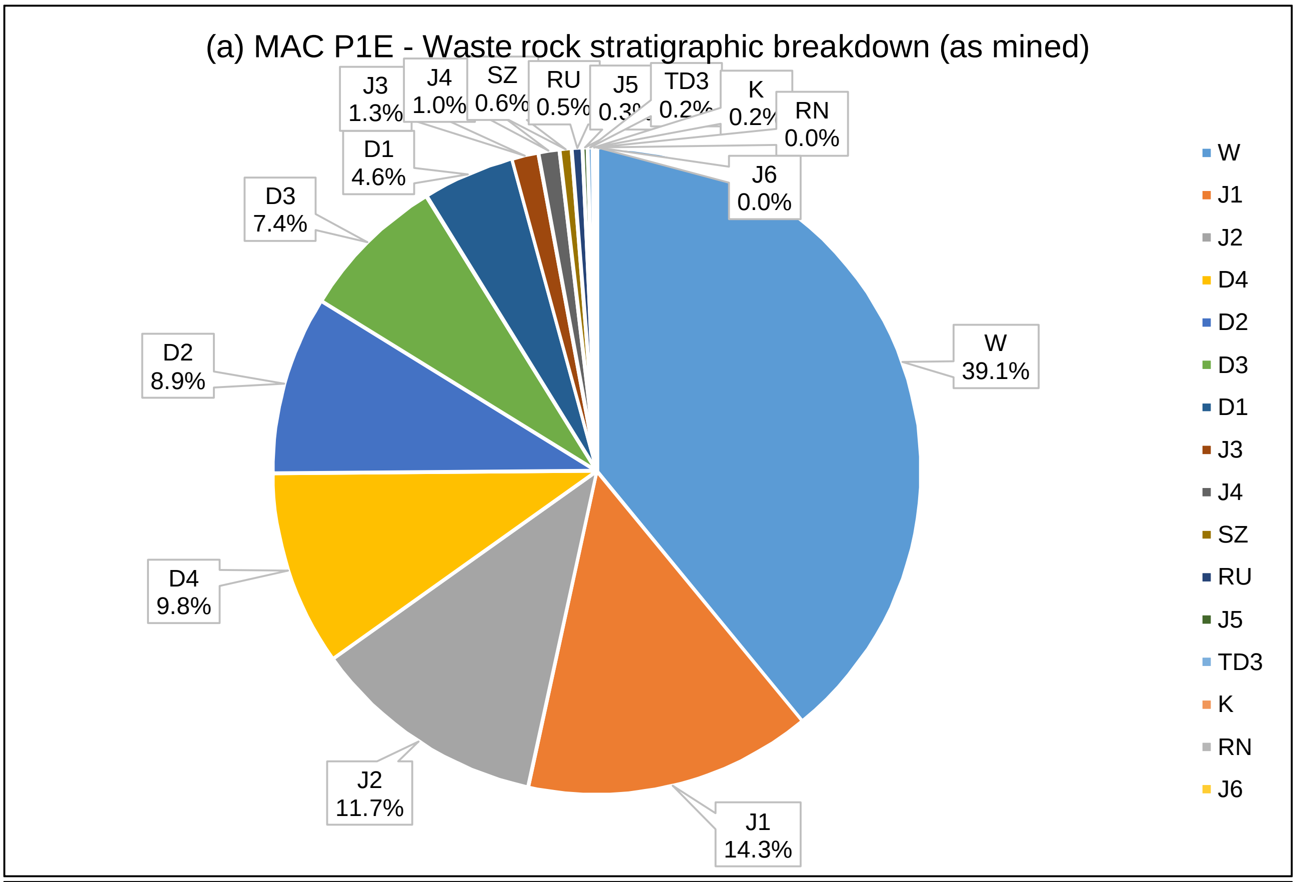
A pie chart showing the distribution of as-mined waste rock and low-grade ore from P1E deposit as a function of stratigraphic unit is shown in Figure 3-53. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from P1E deposit are shown in Figure 3-54 and Figure 3-55, respectively.

Table 3-44 presents as-mined waste volume from P1E deposit split by total sulphur content per stratigraphy. Table 3-45 and Table 3-46 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC P1E deposit is presented in Figure 3-56.

The block model data indicate that:

- As-mined waste rock from P1E deposit comprises Whaleback Shale (39.1% W), Dales Gorge Member (30.6%, incl. D4, D2, D3 and D1), and Joffre Member (28.7%, incl. J1, J2, J3, J4, J5 and J6) with minor contribution from Tertiary Detritals (1.0%, incl. SZ, TD3 and K) and Mt McRae Shale (0.6%, incl. RU and RN). The majority of as-mined low-grade ore is Dales Gorge Member (60.3%, incl. D2, D3, D1 and D4) followed by Joffre Member (34.7%, incl. J2, J1, J3, J4, J5 and J6), with minor portion from Whaleback Shale (3.6% W) and Tertiary Detritals (1.5% TD3).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the 90th percentile values below or near 0.1 wt% and median value below or near 0.07 wt% for all mined out blocks (Figure 3-54, Table 3-44). Mt McRae Shale waste rock blocks show very low sulphur concentration with the maximum value below 0.04 wt%, which is comparable or slightly lower than other stratigraphic units.
- Very low sulphur blocks (<0.1%) comprise 98.75% of as-mined waste rock and 94.69% of as-mined low-grade ore volume (Table 3-44). Low sulphur blocks (0.1-0.2%) comprise 1.00% of as-mined waste rock and 5.22% of as-mined low-grade ore volume. Only 0.26% as-mined waste rock and 0.09% of as-mined low-grade ore have total sulphur content in the range of 0.2-0.5 wt% and no waste blocks show total sulphur above 0.5 wt%.
- As-mined waste rock and low-grade ore have low ANC with 90th percentile values below or close to 10 kg H_2SO_4/t (Figure 3-55). Tertiary Detritals waste rock (TD3) show slightly higher ANC distribution with the median value at 9.9 kg H_2SO_4/t.
- A total volume of 21,224,800 m^3 (incl. 11,680,400 m^3 waste rock and 9,544,400 m^3 low-grade ore) of AMD0 waste has been mined out from P1E deposit, representing 99.21% of as-mined waste rock and 96.93% of as-mined low-grade ore.
- No AMD1 or AMD3 waste rock or low-grade ore blocks are predicted in the P1E deposit.
- A total volume of 395,600 m^3 (incl. 92,800 m^3 as-mined waste rock and 302,800 m^3 as-mined low-grade ore) are classed as AMD2, comprising 0.79% of as-mined waste rock and 3.07% of as-mined low-grade ore, which are all associated with Dales Gorge Member, Joffre Member and Whaleback Shale (Table 3-45).
- Approximately 99.76% of waste rock and 99.87% of low-grade ore blocks are predicted to have been mined out from above water table (Table 3-46).



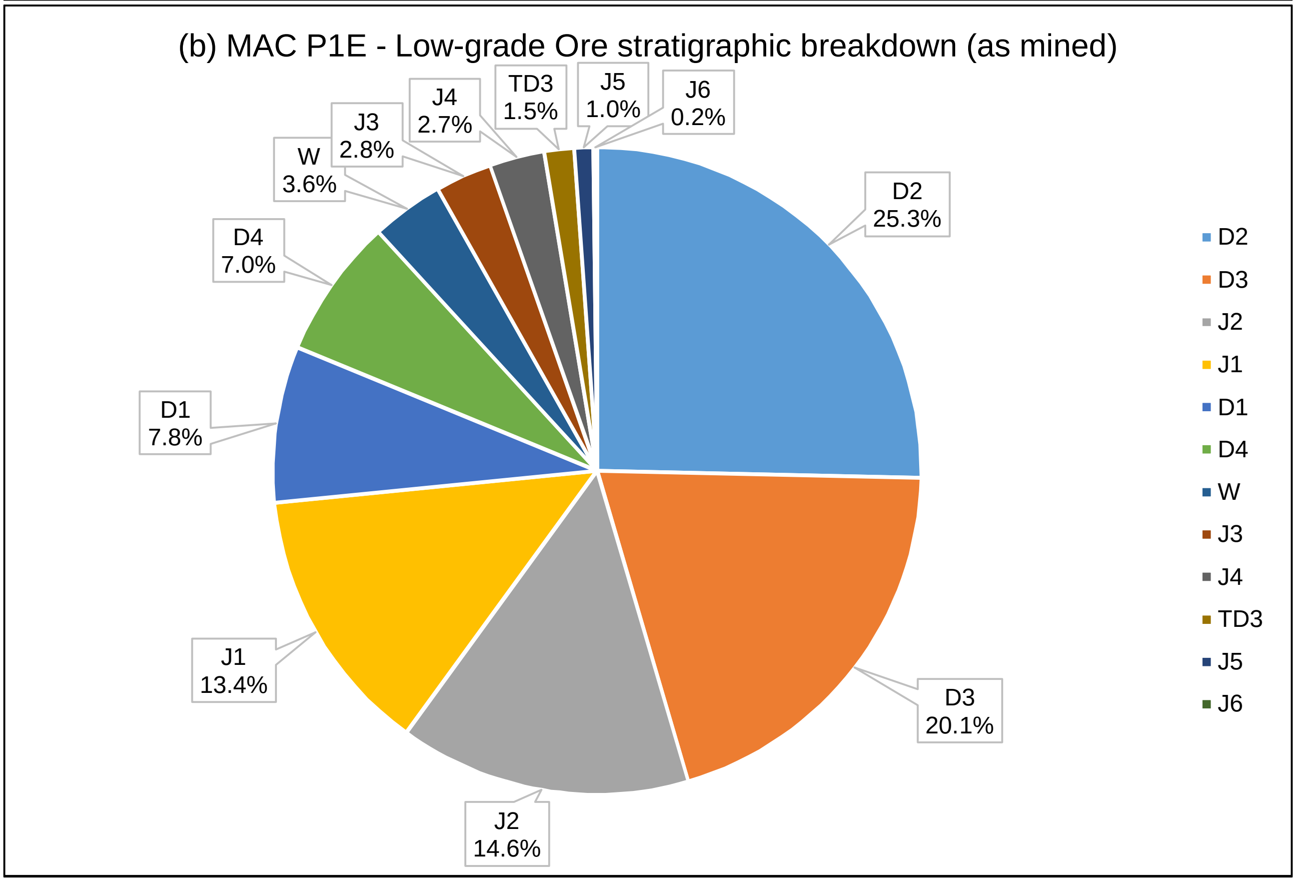


Figure 3-53 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P1E deposit mining model

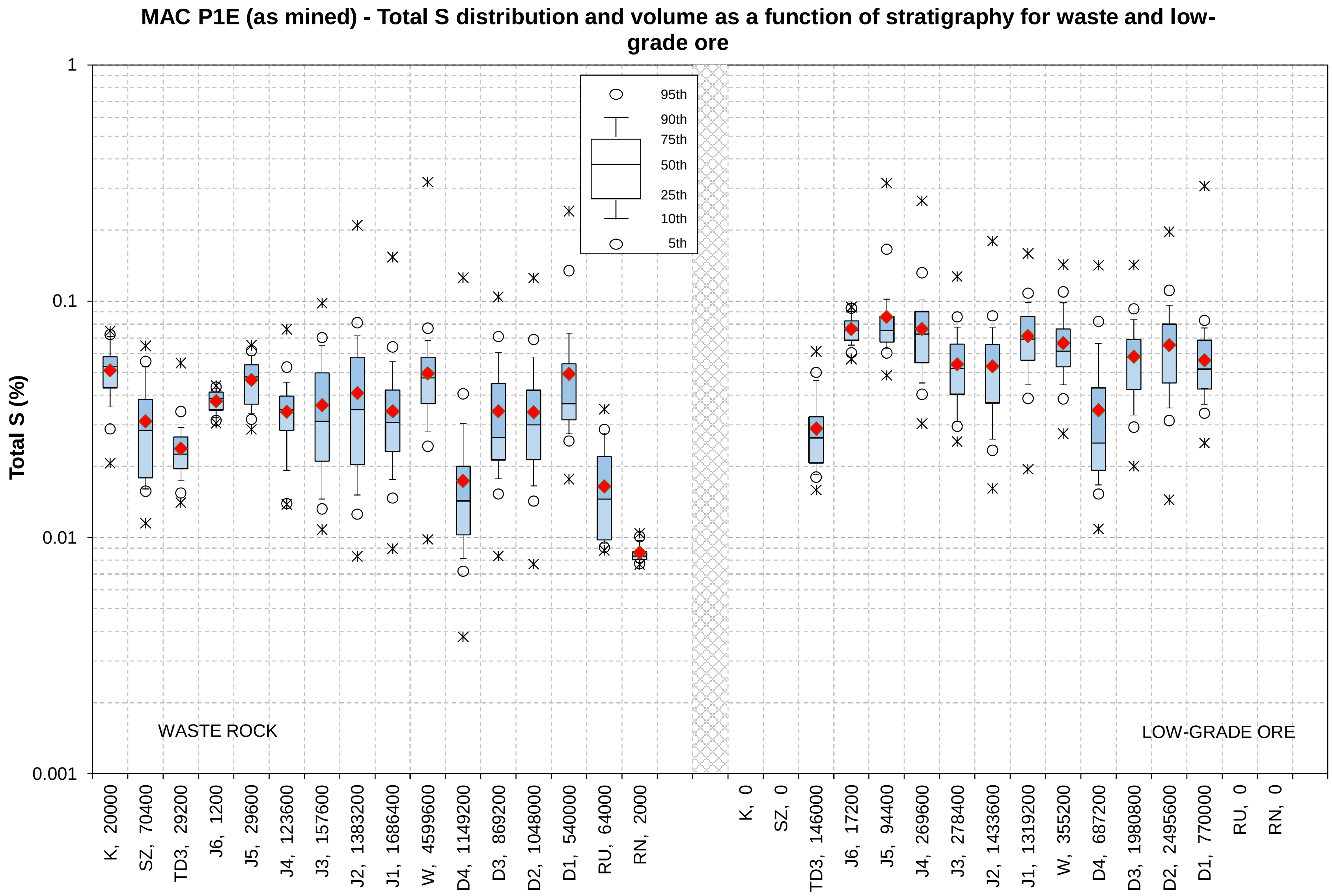


Figure 3-54 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC P1E deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

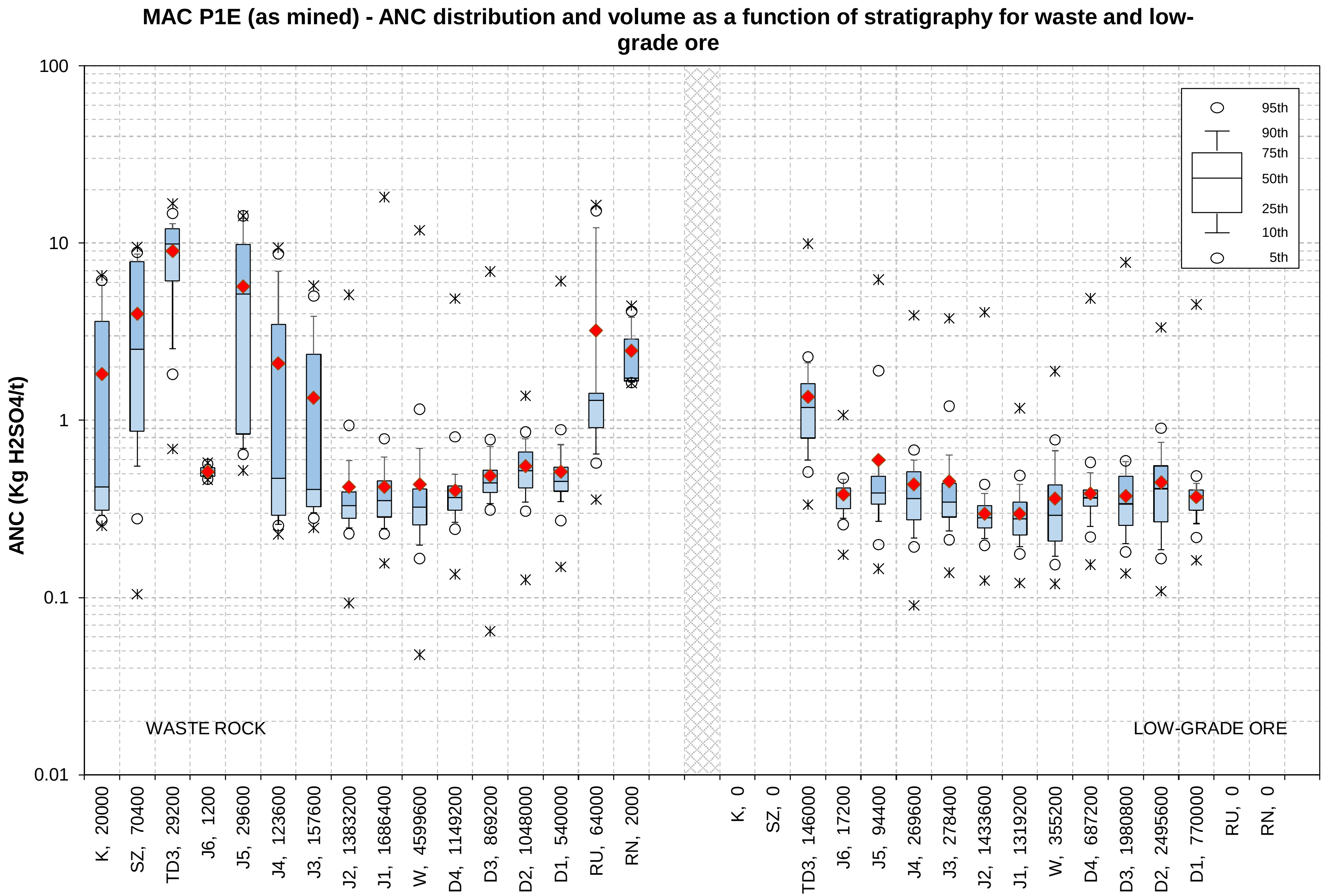


Figure 3-55 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC P1E deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-44 MAC P1E deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	20,000	0.17%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	70,400	0.61%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	29,200	0.25%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5860 - J6	1,200	0.01%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5850 - J5	29,600	0.25%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5840 - J4	123,600	1.06%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5830 - J3	157,600	1.36%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5820 - J2	1,357,600	11.68%	24,000	20.48%	1,600	5.48%	0	0.00%	0	N/A	0	N/A
5810 - J1	1,685,200	14.50%	1,200	1.02%	0	0.00%	0	0.00%	0	N/A	0	N/A
5700 - W	4,518,000	38.86%	61,600	52.56%	18,800	64.38%	1,200	100.00%	0	N/A	0	N/A
5640 - D4	1,148,800	9.88%	400	0.34%	0	0.00%	0	0.00%	0	N/A	0	N/A
5630 - D3	868,800	7.47%	400	0.34%	0	0.00%	0	0.00%	0	N/A	0	N/A
5620 - D2	1,043,600	8.98%	4,400	3.75%	0	0.00%	0	0.00%	0	N/A	0	N/A
5610 - D1	506,000	4.35%	25,200	21.50%	8,800	30.14%	0	0.00%	0	N/A	0	N/A
5440 - RU	64,000	0.55%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5430 - RN	2,000	0.02%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**11,625,600**	**100.00%**	**117,200**	**100.00%**	**29,200**	**100.00%**	**1,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**98.75%**		**1.00%**		**0.25%**		**0.01%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	146,000	1.57%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5860 - J6	17,200	0.18%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5850 - J5	84,400	0.91%	6,400	1.25%	3,200	38.10%	400	50.00%	0	N/A	0	N/A
5840 - J4	240,000	2.57%	26,400	5.14%	3,200	38.10%	0	0.00%	0	N/A	0	N/A
5830 - J3	275,200	2.95%	3,200	0.62%	0	0.00%	0	0.00%	0	N/A	0	N/A
5820 - J2	1,401,200	15.03%	32,400	6.30%	0	0.00%	0	0.00%	0	N/A	0	N/A
5810 - J1	1,197,600	12.84%	121,600	23.66%	0	0.00%	0	0.00%	0	N/A	0	N/A
5700 - W	321,600	3.45%	33,600	6.54%	0	0.00%	0	0.00%	0	N/A	0	N/A
5640 - D4	676,800	7.26%	10,400	2.02%	0	0.00%	0	0.00%	0	N/A	0	N/A
5630 - D3	1,924,400	20.64%	56,400	10.97%	0	0.00%	0	0.00%	0	N/A	0	N/A
5620 - D2	2,283,200	24.49%	212,400	41.32%	0	0.00%	0	0.00%	0	N/A	0	N/A
5610 - D1	756,400	8.11%	11,200	2.18%	2,000	23.81%	400	50.00%	0	N/A	0	N/A
5440 - RU	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**9,324,000**	**100.00%**	**514,000**	**100.00%**	**8,400**	**100.00%**	**800**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**94.69%**		**5.22%**		**0.09%**		**0.01%**		**0.00%**		**0.00%**	

Table 3-45 MAC P1E deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	20,000	0.17%	0	N/A	0	0.00%	0	N/A	20,000	0.17%
8150 - SZ	70,400	0.60%	0	N/A	0	0.00%	0	N/A	70,400	0.60%
8130 - TD3	29,200	0.25%	0	N/A	0	0.00%	0	N/A	29,200	0.25%
5860 - J6	1,200	0.01%	0	N/A	0	0.00%	0	N/A	1,200	0.01%
5850 - J5	29,600	0.25%	0	N/A	0	0.00%	0	N/A	29,600	0.25%
5840 - J4	123,600	1.06%	0	N/A	0	0.00%	0	N/A	123,600	1.05%
5830 - J3	157,600	1.35%	0	N/A	0	0.00%	0	N/A	157,600	1.34%
5820 - J2	1,369,600	11.73%	0	N/A	13,600	14.66%	0	N/A	1,383,200	11.75%
5810 - J1	1,685,200	14.43%	0	N/A	1,200	1.29%	0	N/A	1,686,400	14.32%
5700 - W	4,547,600	38.93%	0	N/A	52,000	56.03%	0	N/A	4,599,600	39.07%
5640 - D4	1,149,200	9.84%	0	N/A	0	0.00%	0	N/A	1,149,200	9.76%
5630 - D3	868,400	7.43%	0	N/A	800	0.86%	0	N/A	869,200	7.38%
5620 - D2	1,048,000	8.97%	0	N/A	0	0.00%	0	N/A	1,048,000	8.90%
5610 - D1	514,800	4.41%	0	N/A	25,200	27.16%	0	N/A	540,000	4.59%
5440 - RU	64,000	0.55%	0	N/A	0	0.00%	0	N/A	64,000	0.54%
5430 - RN	2,000	0.02%	0	N/A	0	0.00%	0	N/A	2,000	0.02%
Total	**11,680,400**	**100.00%**	**0**	**N/A**	**92,800**	**100.00%**	**0**	**N/A**	**11,773,200**	**100.00%**
% of Total	**99.21%**		**0.00%**		**0.79%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8130 - TD3	146,000	1.53%	0	N/A	0	0.00%	0	N/A	146,000	1.48%
5860 - J6	17,200	0.18%	0	N/A	0	0.00%	0	N/A	17,200	0.17%
5850 - J5	90,000	0.94%	0	N/A	4,400	1.45%	0	N/A	94,400	0.96%
5840 - J4	248,400	2.60%	0	N/A	21,200	7.00%	0	N/A	269,600	2.74%
5830 - J3	278,000	2.91%	0	N/A	400	0.13%	0	N/A	278,400	2.83%
5820 - J2	1,408,400	14.76%	0	N/A	25,200	8.32%	0	N/A	1,433,600	14.56%
5810 - J1	1,245,200	13.05%	0	N/A	74,000	24.44%	0	N/A	1,319,200	13.40%
5700 - W	331,200	3.47%	0	N/A	24,000	7.93%	0	N/A	355,200	3.61%
5640 - D4	680,400	7.13%	0	N/A	6,800	2.25%	0	N/A	687,200	6.98%
5630 - D3	1,949,200	20.42%	0	N/A	31,600	10.44%	0	N/A	1,980,800	20.12%
5620 - D2	2,388,000	25.02%	0	N/A	107,600	35.54%	0	N/A	2,495,600	25.34%
5610 - D1	762,400	7.99%	0	N/A	7,600	2.51%	0	N/A	770,000	7.82%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**9,544,400**	**100.00%**	**0**	**N/A**	**302,800**	**100.00%**	**0**	**N/A**	**9,847,200**	**100.00%**
% of Total	**96.93%**		**0.00%**		**3.07%**		**0.00%**		**100.00%**	

Table 3-46 MAC P1E deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	11,651,600	28,800	11,680,400	99.21%
1	0	0	0	0.00%
2	92,800	0	92,800	0.79%
3	0	0	0	0.00%
Total	**11,744,400**	**28,800**	**11,773,200**	100.00%
% of Total	**99.76%**	**0.24%**	**100.00%**	
Low grade ore				
0	9,531,200	13,200	9,544,400	96.93%
1	0	0	0	0.00%
2	302,800	0	302,800	3.07%
3	0	0	0	0.00%
Total	**9,834,000**	**13,200**	**9,847,200**	100.00%
% of Total	**99.87%**	**0.13%**	**100.00%**	

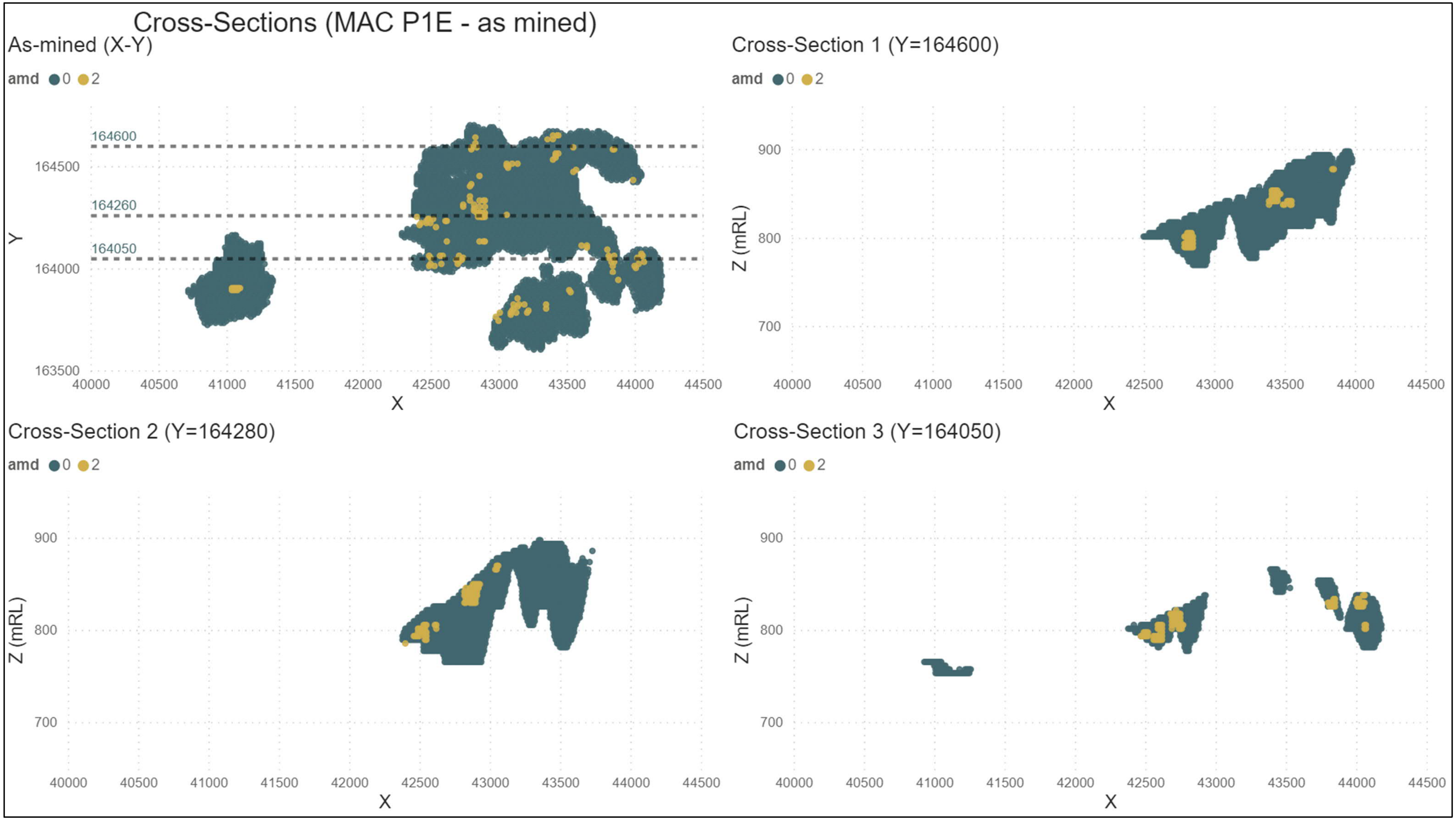


Figure 3-56 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC P1E deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.10.2 MAC P1E deposit (to-be-mined waste)

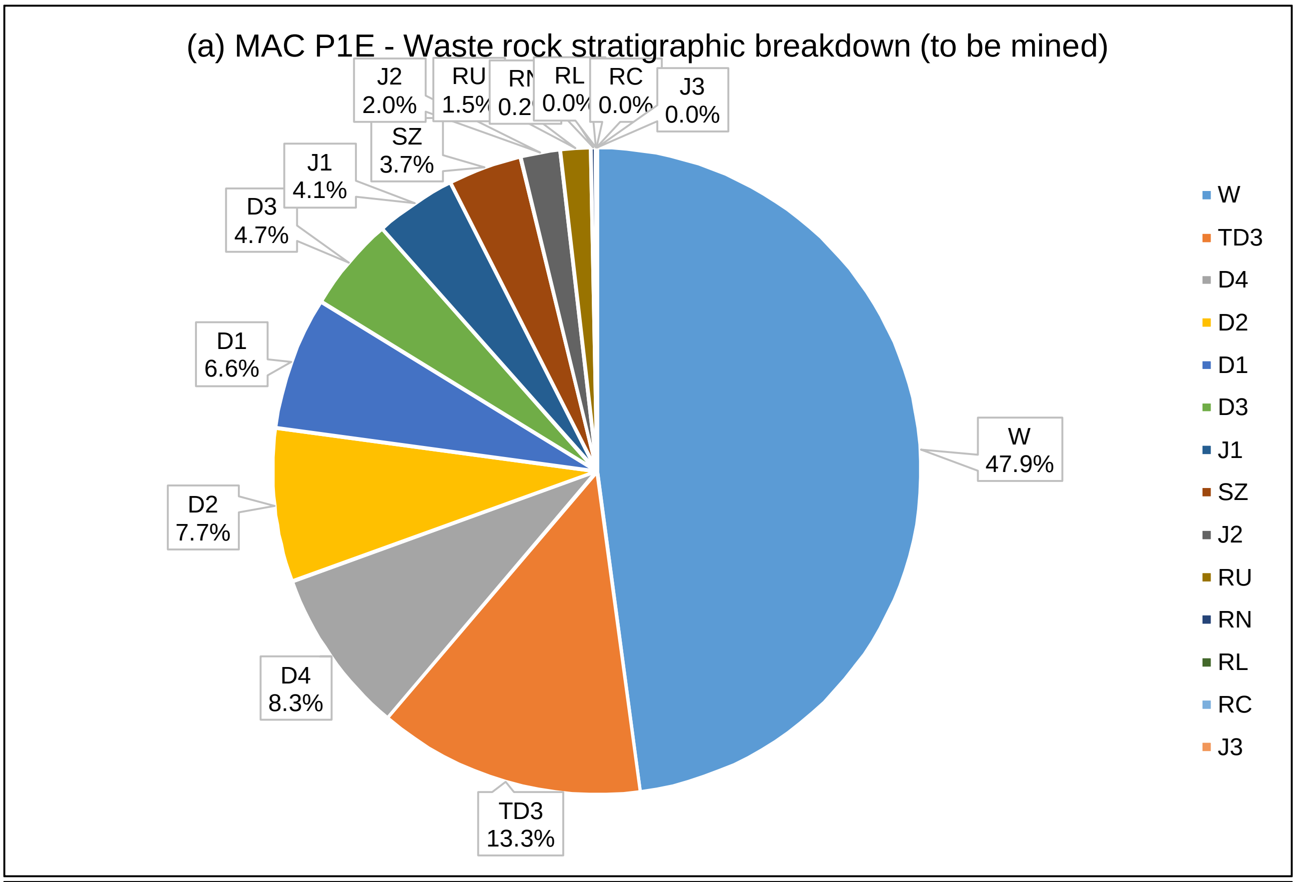
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P1E deposit as a function of stratigraphic unit is shown in Figure 3-57. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P1E deposit are shown in Figure 3-58 and Figure 3-59, respectively.

Table 3-47 presents to-be-mined waste volume from P1E deposit split by total sulphur content per stratigraphy. Table 3-48 and Table 3-49 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P1E deposit is presented in Figure 3-60.

The key attributes are listed as follows:

- To-be-mined waste rock from P1E deposit comprises mainly Whaleback Shale (47.9% W) and Dales Gorge Member (27.3%, incl. D4, D2, D1 and D3), with minor contribution from Tertiary Detritals (17.0%, incl. TD3 and SZ), Joffre Member (6.1%, incl. J1, J2 and J3), and Mt McRae Shale (1.8%, incl. RU, RN, RL and RC). To-be-mined low-grade ore is mainly sourced from Dales Gorge Member (79.5%) with minor contribution from Joffre Member (9.5%), Whaleback Shale (5.7%) and Tertiary Detritals (5.4%).
- To-be-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below 0.1 wt% and median value below 0.05 wt% (Figure 3-58, Table 3-47). It is noted that Mt McRae Shale waste rock blocks have maximum sulphur value below 0.05 wt%.
- Very low sulphur blocks (<0.1%) comprise 99.62% of to-be-mined waste rock and 98.25% of to-be-mined low-grade ore volume (Table 3-47). Low sulphur blocks (0.1-0.2%) comprise 0.38% of to-be-mined waste rock and 1.75% of to-be-mined low-grade ore volume. No waste blocks show total sulphur above 0.2 wt%.
- To-be-mined waste rock and low-grade ore have low ANC with the 95th percentile values below or near 10 kg H_2SO_4/t and median values below 4 kg H_2SO_4/t (Figure 3-59). Stratigraphic units in Brockman Iron Formation group are generally devoid of ANC with median values below 1 kg H_2SO_4/t.
- A total volume of 24,185,200 m^3 (incl. 13,280,800 m^3 waste rock and 10,904,400 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P1E deposit, representing 99.80% of to-be-mined waste rock and 99.07% of to-be-mined low-grade ore.
- No AMD1 waste is predicted to be mined according to the current MAC P1E block model.
- A total volume of 128,000 m^3 (incl. 25,600 m^3 to-be-mined waste rock and 102,400 m^3 to-be-mined low-grade ore) are classed as AMD2, representing 0.19% of to-be-mined waste rock and 0.93% of to-be-mined low-grade ore, which are associated with Dales Gorge Member, Joffre Member and Whaleback Shale (Table 3-48).
- A negligible volume of 400 m^3 SZ waste rock is classed as AMD3, comprising 0.003% of to-be-mined waste rock from P1E deposit.
- Approximately 99.85% of waste rock and 99.49% of low-grade ore are predicted to be mined from above water table (Table 3-49).



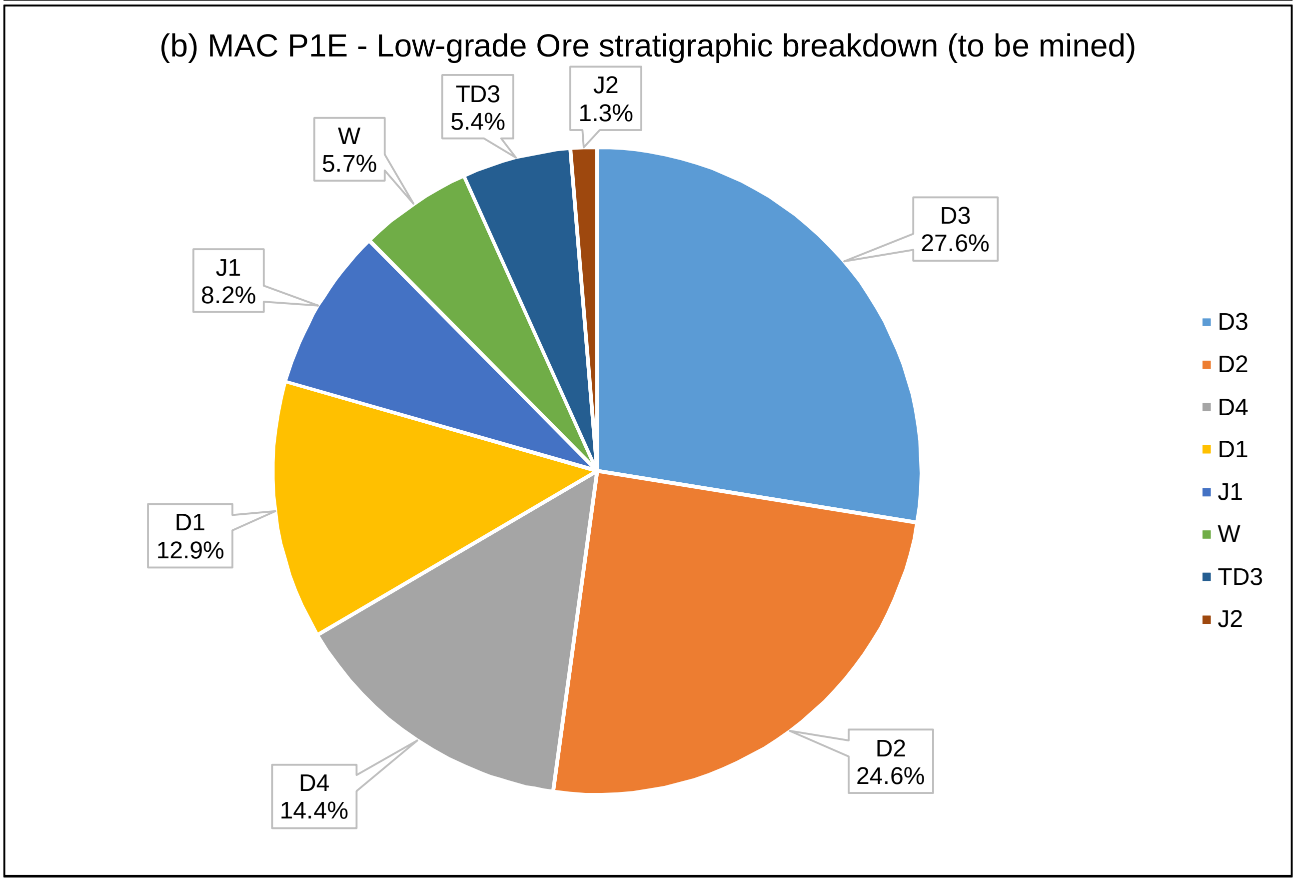


Figure 3-57 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P1E deposit mining model

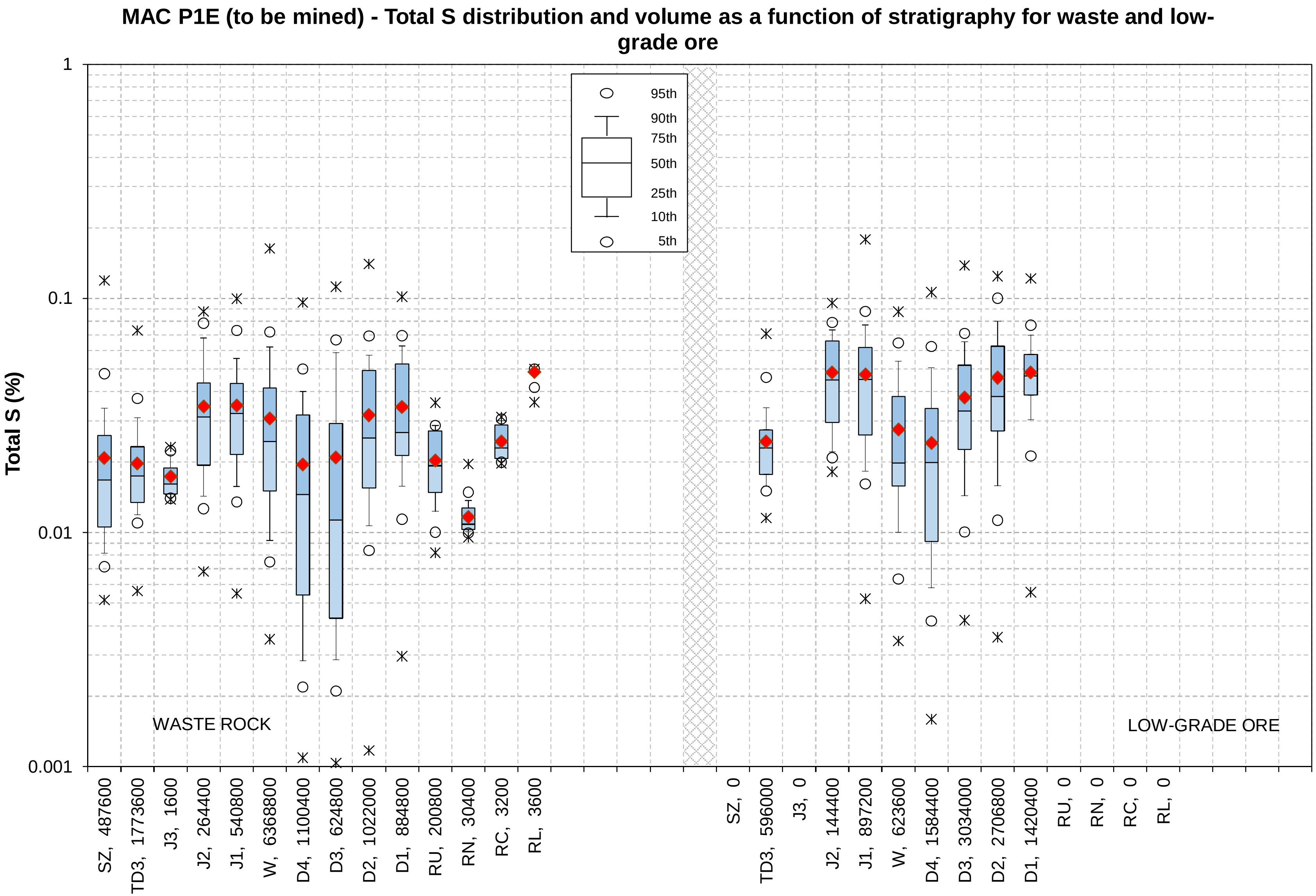


Figure 3-58 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P1E deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

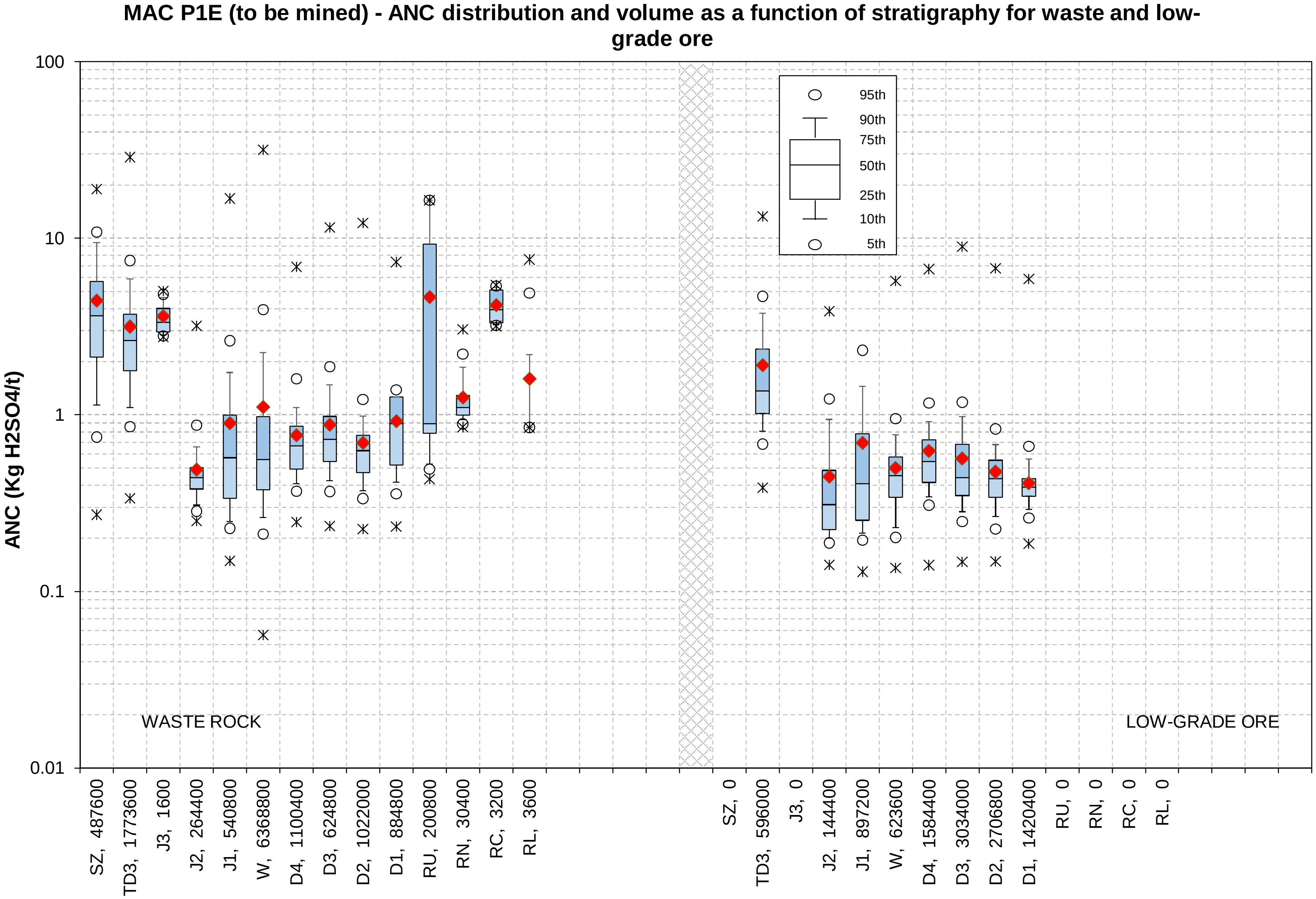


Figure 3-59 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P1E deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-47 MAC P1E deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	482,800	3.64%	4,800	9.60%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	1,773,600	13.38%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	1,600	0.01%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	264,400	1.99%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	540,800	4.08%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	6,334,800	47.79%	34,000	68.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,100,400	8.30%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	623,200	4.70%	1,600	3.20%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	1,012,800	7.64%	9,200	18.40%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	884,400	6.67%	400	0.80%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	200,800	1.51%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	30,400	0.23%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5420 - RC	3,200	0.02%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5410 - RL	3,600	0.03%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**13,256,800**	**100.00%**	**50,000**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.62%**		**0.38%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	596,000	5.51%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	144,400	1.34%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	869,200	8.04%	28,000	14.55%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	623,600	5.77%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,583,200	14.64%	1,200	0.62%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	3,018,000	27.91%	16,000	8.32%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	2,568,000	23.75%	138,800	72.14%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	1,412,000	13.06%	8,400	4.37%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5420 - RC	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5410 - RL	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**10,814,400**	**100.00%**	**192,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**98.25%**		**1.75%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-48 MAC P1E deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	487,200	3.67%	0	N/A	0	0.00%	400	100.00%	487,600	3.66%
8130 - TD3	1,773,600	13.35%	0	N/A	0	0.00%	0	0.00%	1,773,600	13.33%
5830 - J3	1,600	0.01%	0	N/A	0	0.00%	0	0.00%	1,600	0.01%
5820 - J2	264,400	1.99%	0	N/A	0	0.00%	0	0.00%	264,400	1.99%
5810 - J1	540,800	4.07%	0	N/A	0	0.00%	0	0.00%	540,800	4.06%
5700 - W	6,351,200	47.82%	0	N/A	17,600	68.75%	0	0.00%	6,368,800	47.86%
5640 - D4	1,100,400	8.29%	0	N/A	0	0.00%	0	0.00%	1,100,400	8.27%
5630 - D3	624,000	4.70%	0	N/A	800	3.13%	0	0.00%	624,800	4.70%
5620 - D2	1,014,800	7.64%	0	N/A	7,200	28.13%	0	0.00%	1,022,000	7.68%
5610 - D1	884,800	6.66%	0	N/A	0	0.00%	0	0.00%	884,800	6.65%
5440 - RU	200,800	1.51%	0	N/A	0	0.00%	0	0.00%	200,800	1.51%
5430 - RN	30,400	0.23%	0	N/A	0	0.00%	0	0.00%	30,400	0.23%
5420 - RC	3,200	0.02%	0	N/A	0	0.00%	0	0.00%	3,200	0.02%
5410 - RL	3,600	0.03%	0	N/A	0	0.00%	0	0.00%	3,600	0.03%
Total	**13,280,800**	**100.00%**	**0**	**N/A**	**25,600**	**100.00%**	**400**	**100.00%**	**13,306,800**	**100.00%**
% of Total	**99.80%**		**0.00%**		**0.19%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
8130 - TD3	596,000	5.47%	0	N/A	0	0.00%	0	#DIV/0!	596,000	5.41%
5830 - J3	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
5820 - J2	144,400	1.32%	0	N/A	0	0.00%	0	#DIV/0!	144,400	1.31%
5810 - J1	882,000	8.09%	0	N/A	15,200	14.84%	0	#DIV/0!	897,200	8.15%
5700 - W	623,600	5.72%	0	N/A	0	0.00%	0	#DIV/0!	623,600	5.67%
5640 - D4	1,584,400	14.53%	0	N/A	0	0.00%	0	#DIV/0!	1,584,400	14.39%
5630 - D3	3,022,000	27.71%	0	N/A	12,000	11.72%	0	#DIV/0!	3,034,000	27.56%
5620 - D2	2,636,400	24.18%	0	N/A	70,400	68.75%	0	#DIV/0!	2,706,800	24.59%
5610 - D1	1,415,600	12.98%	0	N/A	4,800	4.69%	0	#DIV/0!	1,420,400	12.90%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
5420 - RC	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
5410 - RL	0	0.00%	0	N/A	0	0.00%	0	#DIV/0!	0	0.00%
Total	**10,904,400**	**100.00%**	**0**	**N/A**	**102,400**	**100.00%**	**0**	**#DIV/0!**	**11,006,800**	**100.00%**
% of Total	**99.07%**		**0.00%**		**0.93%**		**0.00%**		**100.00%**	

Table 3-49 MAC P1E deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	13,261,200	19,600	13,280,800	99.80%
1	0	0	0	0.00%
2	25,600	0	25,600	0.19%
3	400	0	400	0.00%
Total	**13,287,200**	**19,600**	**13,306,800**	100.00%
% of Total	**99.85%**	**0.15%**	**100.00%**	
Low grade ore				
0	10,848,800	55,600	10,904,400	99.07%
1	0	0	0	0.00%
2	102,400	0	102,400	0.93%
3	0	0	0	0.00%
Total	**10,951,200**	**55,600**	**11,006,800**	100.00%
% of Total	**99.49%**	**0.51%**	**100.00%**	

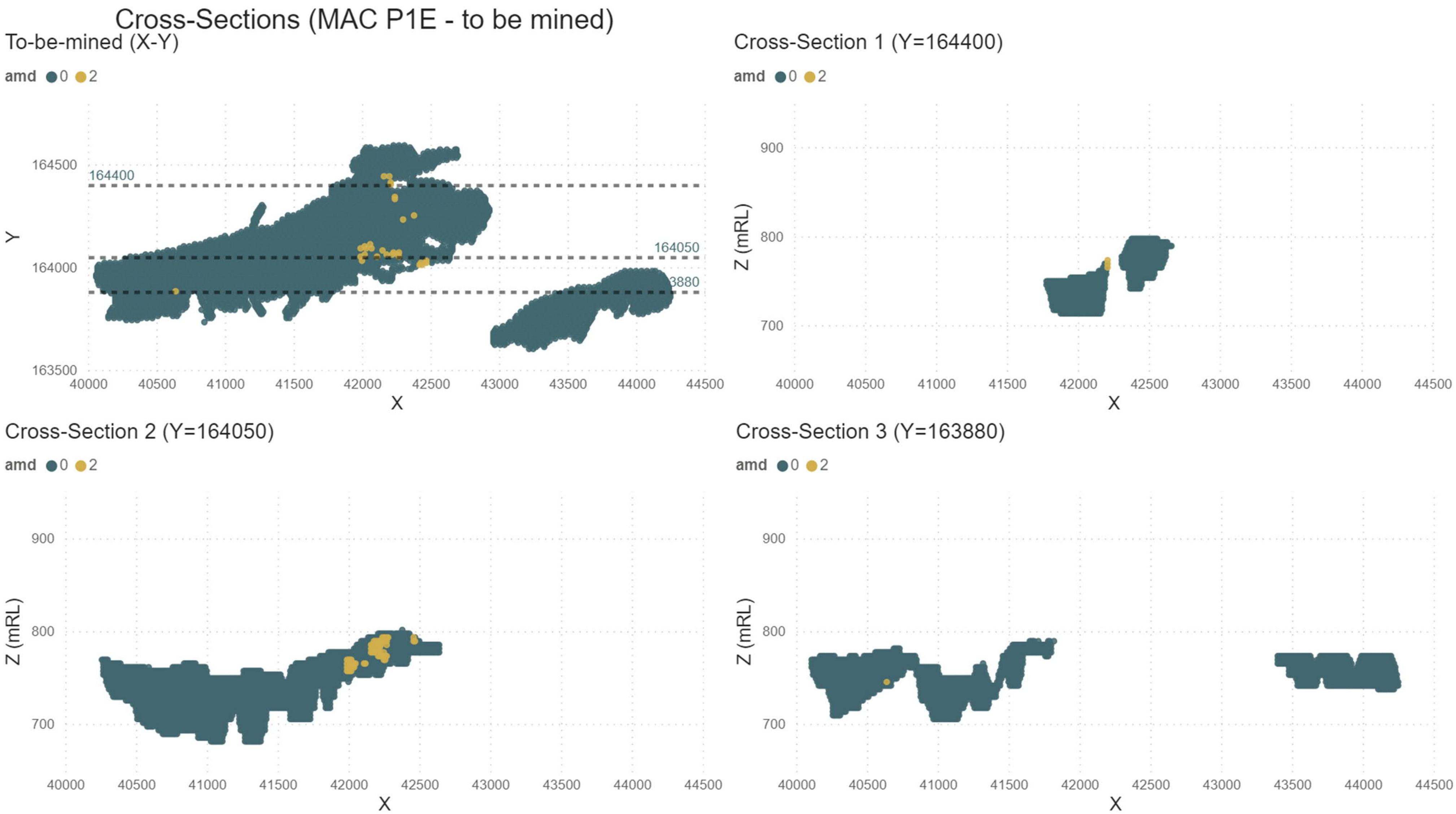


Figure 3-60 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P1E deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.11 MAC P2 deposit

3.1.1.11.1 MAC P2 deposit (as-mined waste)

A pie chart showing the distribution of as-mined waste rock and low-grade ore from P2 deposit as a function of stratigraphic unit is shown in Figure 3-61. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from P2 deposit are shown in Figure 3-62 and Figure 3-63, respectively.

Table 3-50 presents as-mined waste volume from P2 deposit split by total sulphur content per stratigraphy. Table 3-51 and Table 3-52 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC P2 deposit is presented in Figure 3-64.

The key findings are summarised as follows:

- As-mined waste rock from P2 deposit mainly comprises Joffre Member (28.7%, incl. J2, J1, J3, J4 and J5) with minor contribution from Whaleback Shale (19.0% W) and Dales Gorge Member (0.3% D4). As-mined low-grade ore is dominated by 99.9% Joffre Member (99.9%, incl. J2, J3, J1, J4, J5 and J6) with negligible contribution from Whaleback Shale (0.1% W).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the maximum values below or near 0.1 wt% and median values below or near 0.07 wt% for all mined out blocks (Figure 3-62, Table 3-50).
- Very low sulphur blocks (<0.1%) comprise 99.59% of as-mined waste rock and 99.82% of as-mined low-grade ore volume (Table 3-50). Low sulphur blocks (0.1-0.2%) comprise 0.41% of as-mined waste rock and 0.18% of as-mined low-grade ore volume. No waste blocks show total sulphur above 0.2 wt%.
- As-mined waste rock and low-grade ore are both devoid of ANC with the maximum values below or close to 1 kg H_2SO_4/t and the median values below or close to 0.5 kg H_2SO_4/t (Figure 3-63).
- A total volume of 1,218,000 m^3 (incl. 781,200 m^3 waste rock and 436,800 m^3 low-grade ore) of AMD0 waste has been mined out from P2 deposit, representing 99.49% of as-mined waste rock and 100% of as-mined low-grade ore.
- No AMD1 or AMD3 waste rock or low-grade ore blocks are predicted in the P2 deposit.
- A total volume of 4,000 m^3 as-mined waste rock is classed as AMD2, representing 0.51% of as-mined waste rock, which are all associated with Joffre Member (Table 3-51).
- All materials mined-out (waste rock and low-grade ore) from P2 deposit are sourced from above the water table (Table 3-52).

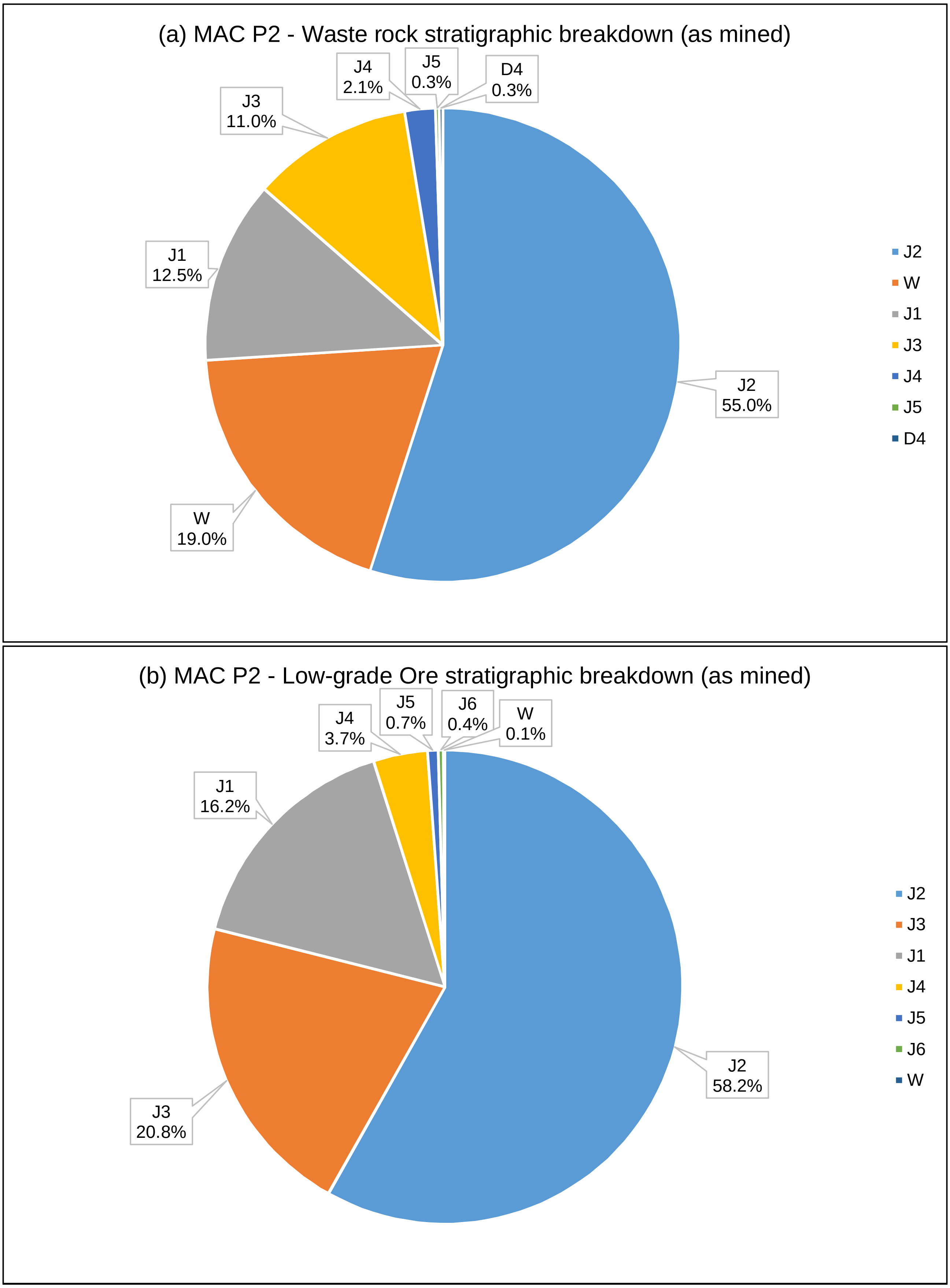


Figure 3-61 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P2 deposit mining model

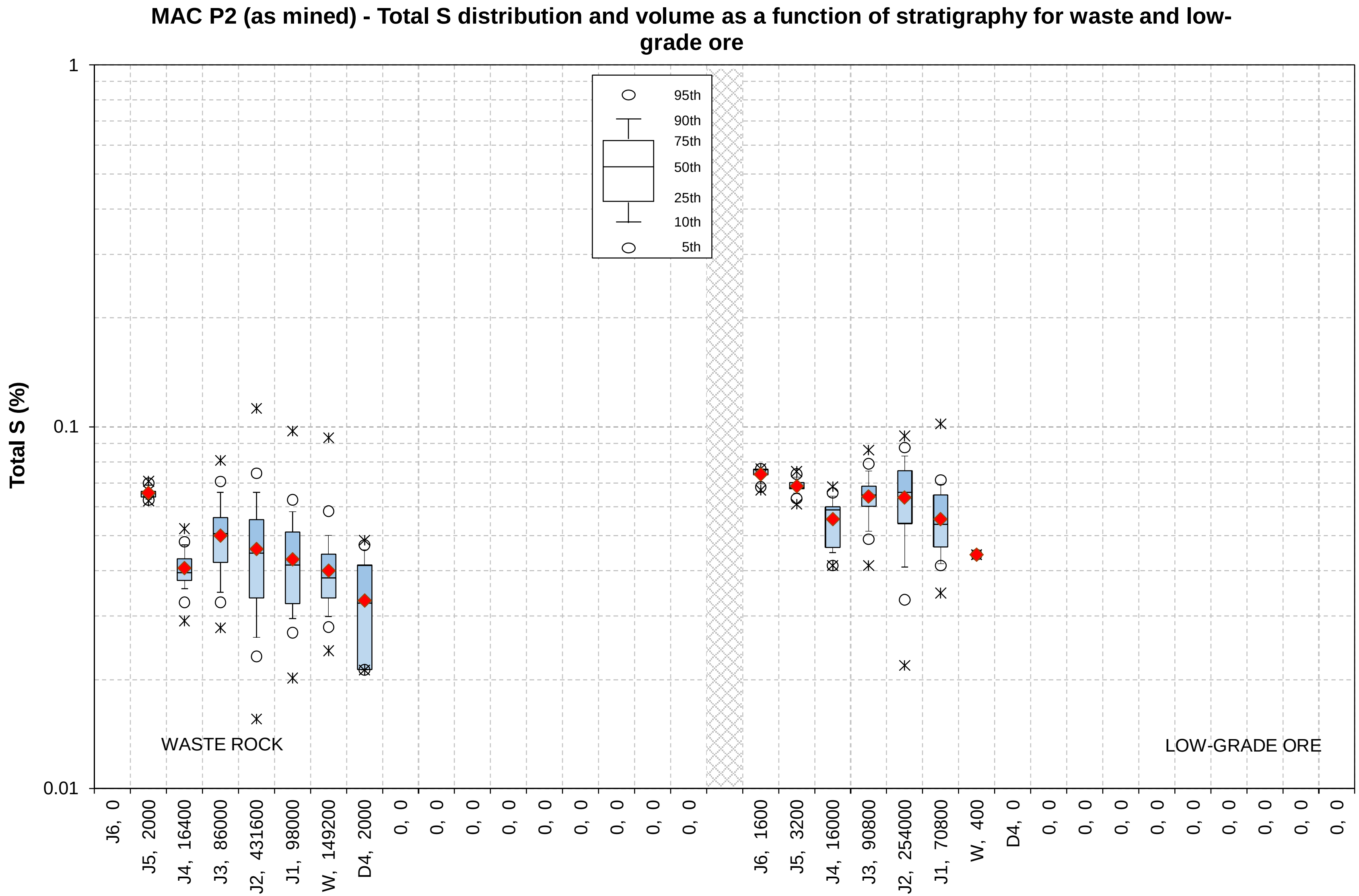


Figure 3-62 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC P2 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

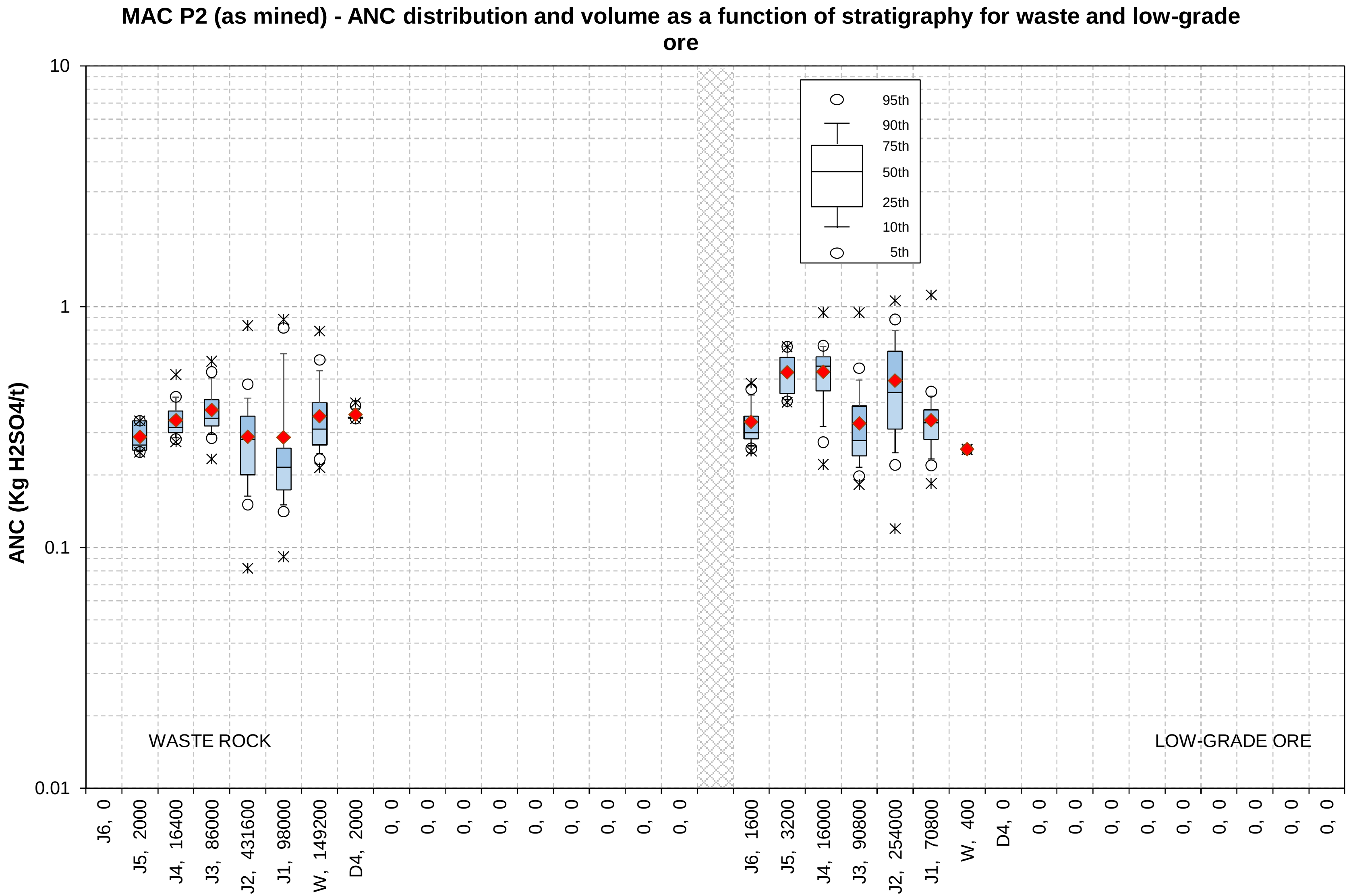


Figure 3-63 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC P2 deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-50 MAC P2 deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
5860 - J6	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	2,000	0.26%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	16,400	2.10%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	86,000	11.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	428,400	54.78%	3,200	100.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	98,000	12.53%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	149,200	19.08%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	2,000	0.26%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**782,000**	**100.00%**	**3,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.59%**		**0.41%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
5860 - J6	1,600	0.37%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	3,200	0.73%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	16,000	3.67%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	90,800	20.83%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	254,000	58.26%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	70,000	16.06%	800	100.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	400	0.09%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**436,000**	**100.00%**	**800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.82%**		**0.18%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-51 MAC P2 deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
5860 - J6	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5850 - J5	2,000	0.26%	0	N/A	0	0.00%	0	N/A	2,000	0.25%
5840 - J4	16,400	2.10%	0	N/A	0	0.00%	0	N/A	16,400	2.09%
5830 - J3	86,000	11.01%	0	N/A	0	0.00%	0	N/A	86,000	10.95%
5820 - J2	427,600	54.74%	0	N/A	4,000	100.00%	0	N/A	431,600	54.97%
5810 - J1	98,000	12.54%	0	N/A	0	0.00%	0	N/A	98,000	12.48%
5700 - W	149,200	19.10%	0	N/A	0	0.00%	0	N/A	149,200	19.00%
5640 - D4	2,000	0.26%	0	N/A	0	0.00%	0	N/A	2,000	0.25%
5630 - D3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5620 - D2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5610 - D1	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**781,200**	**100.00%**	**0**	**N/A**	**4,000**	**100.00%**	**0**	**N/A**	**785,200**	**100.00%**
% of Total	**99.49%**		**0.00%**		**0.51%**		**0.00%**		**100.00%**	
Low grade ore										
5860 - J6	1,600	0.37%	0	N/A	0	N/A	0	N/A	1,600	0.37%
5850 - J5	3,200	0.73%	0	N/A	0	N/A	0	N/A	3,200	0.73%
5840 - J4	16,000	3.66%	0	N/A	0	N/A	0	N/A	16,000	3.66%
5830 - J3	90,800	20.79%	0	N/A	0	N/A	0	N/A	90,800	20.79%
5820 - J2	254,000	58.15%	0	N/A	0	N/A	0	N/A	254,000	58.15%
5810 - J1	70,800	16.21%	0	N/A	0	N/A	0	N/A	70,800	16.21%
5700 - W	400	0.09%	0	N/A	0	N/A	0	N/A	400	0.09%
5640 - D4	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5630 - D3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5620 - D2	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5610 - D1	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5440 - RU	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**436,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**436,800**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-52 MAC P2 deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	781,200	0	781,200	99.49%
1	0	0	0	0.00%
2	4,000	0	4,000	0.51%
3	0	0	0	0.00%
Total	**785,200**	**0**	**785,200**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	436,800	0	436,800	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**436,800**	**0**	**436,800**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

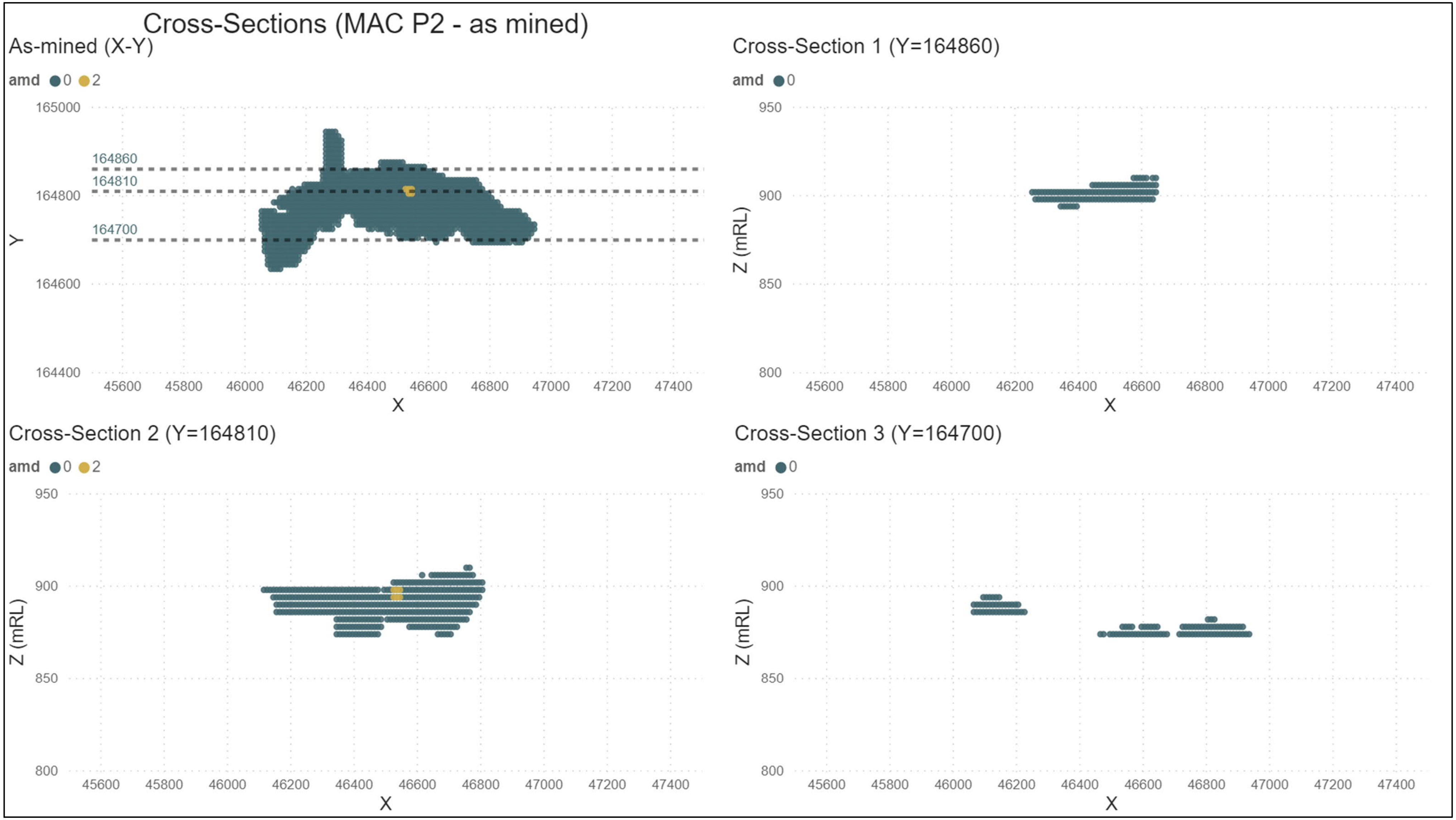


Figure 3-64 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC P2 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.11.2 MAC P2 deposit (to-be-mined waste)

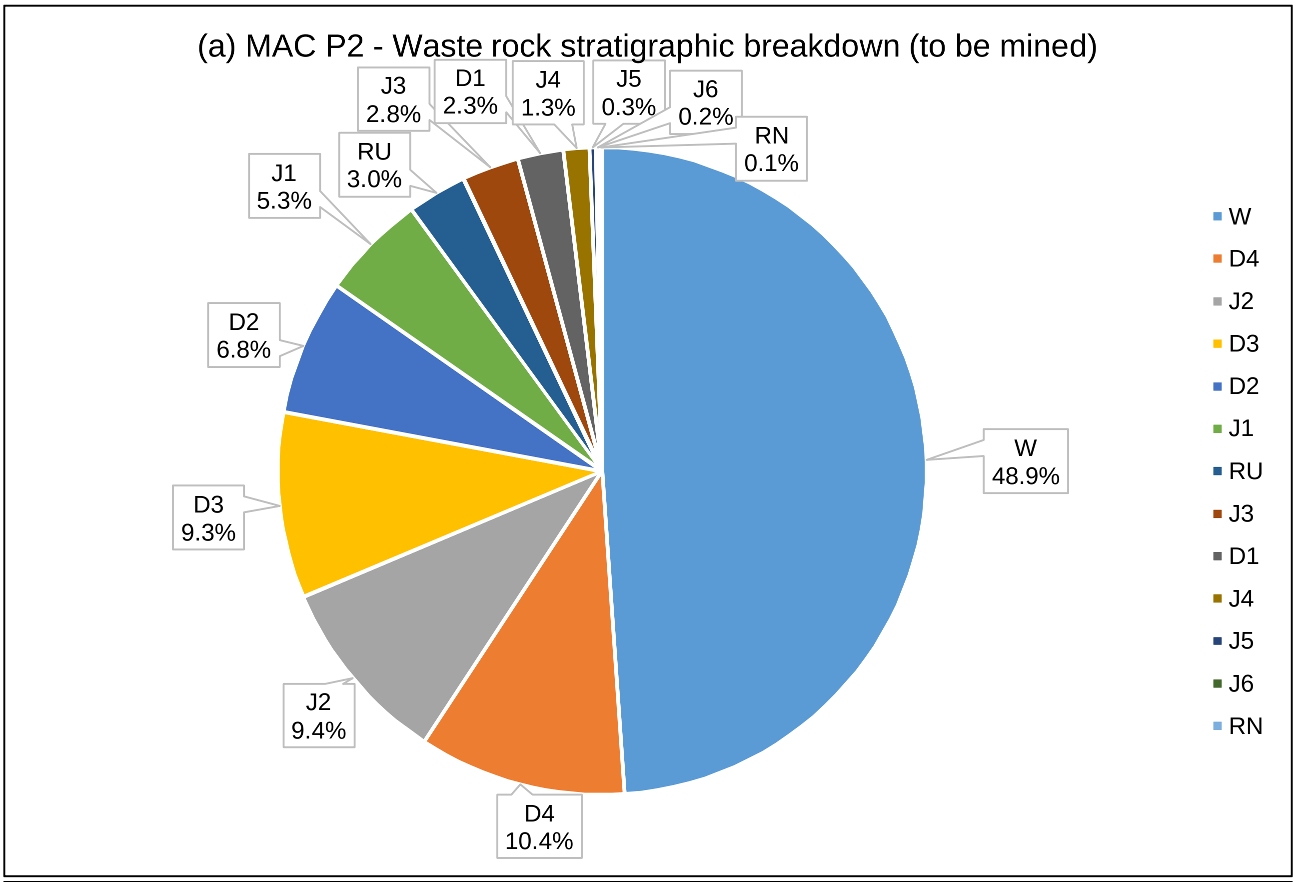
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P2 deposit as a function of stratigraphic unit is shown in Figure 3-65. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P2 deposit are shown in Figure 3-66 and Figure 3-67, respectively.

Table 3-53 presents to-be-mined waste volume from P2 deposit split by total sulphur content per stratigraphy. Table 3-54 and Table 3-55 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P2 deposit is presented in Figure 3-68.

The key attributes are listed as follows:

- To-be-mined waste rock from P2 deposit mainly comprises Whaleback Shale (48.9% W) and Dales Gorge Member (28.7%, incl. D4, D3, D2 and D1), with minor contribution from Joffre Member (19.3%, incl. J2, J1, J3, J4, J5 and J6), and Mt McRae Shale (3.1%, incl. RU and RN). To-be-mined low-grade ore is mainly sourced from Dales Gorge Member (70.2%) and Joffre Member (29.8%), with negligible contribution from Whaleback Shale (0.01%).
- To-be-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below 0.1 wt% (Figure 3-66, Table 3-53). Mt McRae Shale waste rock blocks have maximum sulphur value below 0.08 wt%.
- Very low sulphur blocks (<0.1%) comprise 99.03% of to-be-mined waste rock and 98.89% of to-be-mined low-grade ore volume (Table 3-53). Low sulphur blocks (0.1-0.2%) comprise 0.97% of to-be-mined waste rock and 1.11% of to-be-mined low-grade ore volume. No waste blocks show total sulphur above 0.2 wt%.
- To-be-mined waste rock and low-grade ore generally have low ANC with the 95th percentile values below or near 1 kg H_2SO_4/t and median values below 0.5 kg H_2SO_4/t (Figure 3-67). The exception is from Mt McRae Shale (RN), which has higher ANC distribution with a median value of 13.9 kg H_2SO_4/t and a 75th percentile value of 47.8 kg H_2SO_4/t.
- A total volume of 27,394,400 m^3 (incl. 12,096,000 m^3 waste rock and 15,298,400 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P2 deposit, representing 99.41% of to-be-mined waste rock and 99.21% of to-be-mined low-grade ore.
- No AMD1 or AMD3 waste is predicted to be mined from MAC P2 deposit.
- A total volume of 192,800 m^3 (incl. 71,200 m^3 to-be-mined waste rock and 121,600 m^3 to-be-mined low-grade ore) are classed as AMD2, representing 0.59% of to-be-mined waste rock and 0.79% of to-be-mined low-grade ore (Table 3-54).
- All waste rock and low-grade ore from P2 deposit are predicted to be mined from above water table (Table 3-55).



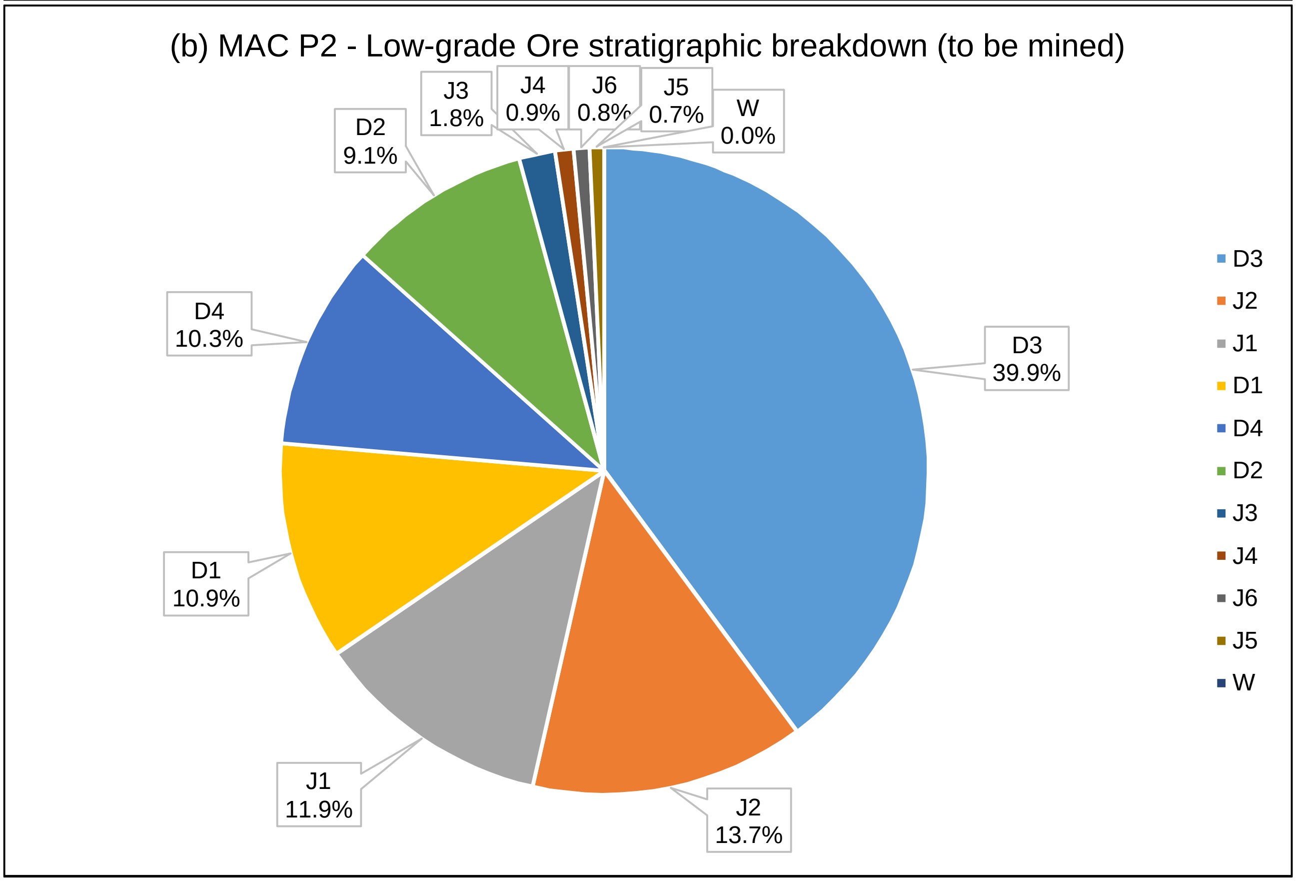


Figure 3-65 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P2 deposit mining model

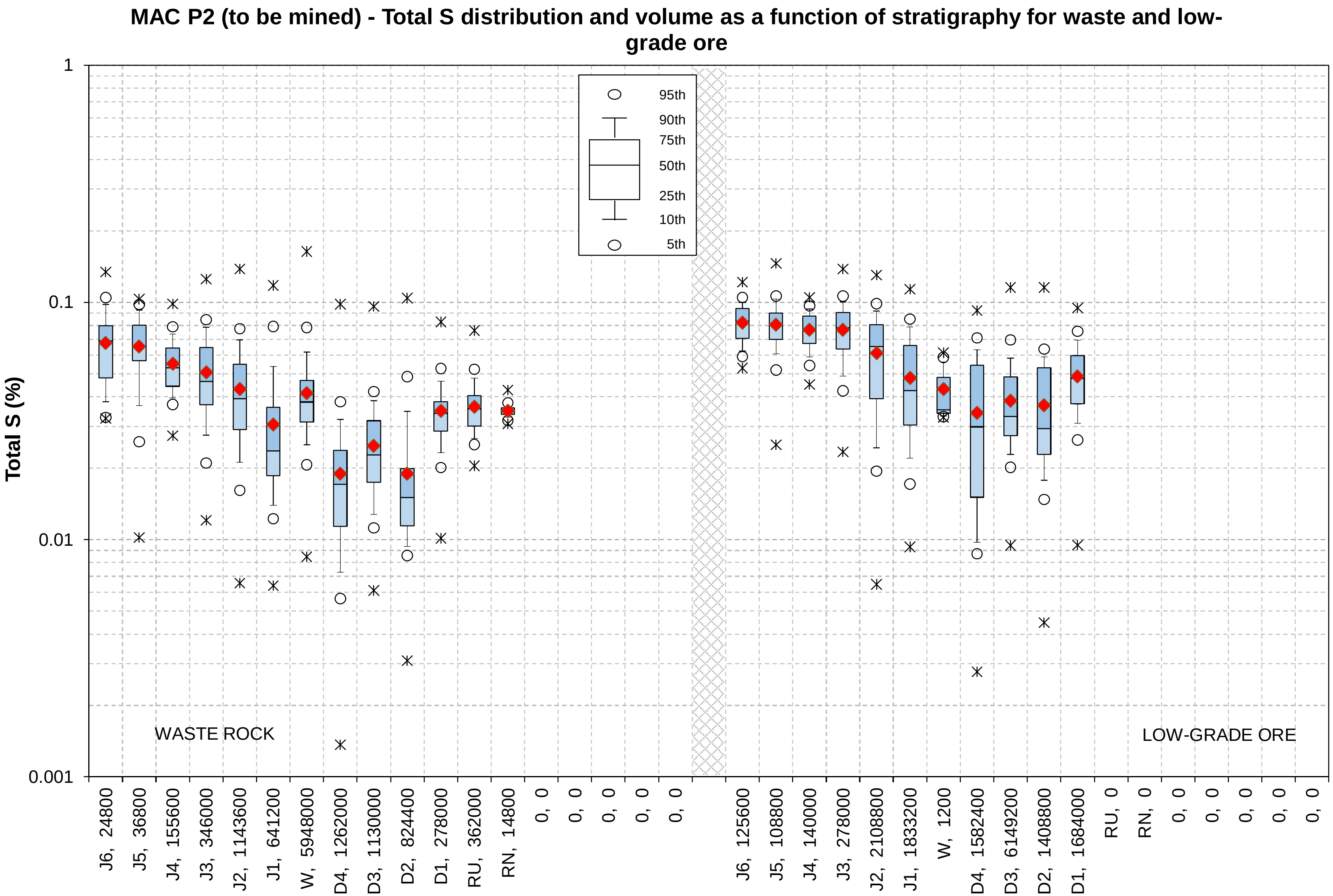


Figure 3-66 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P2 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

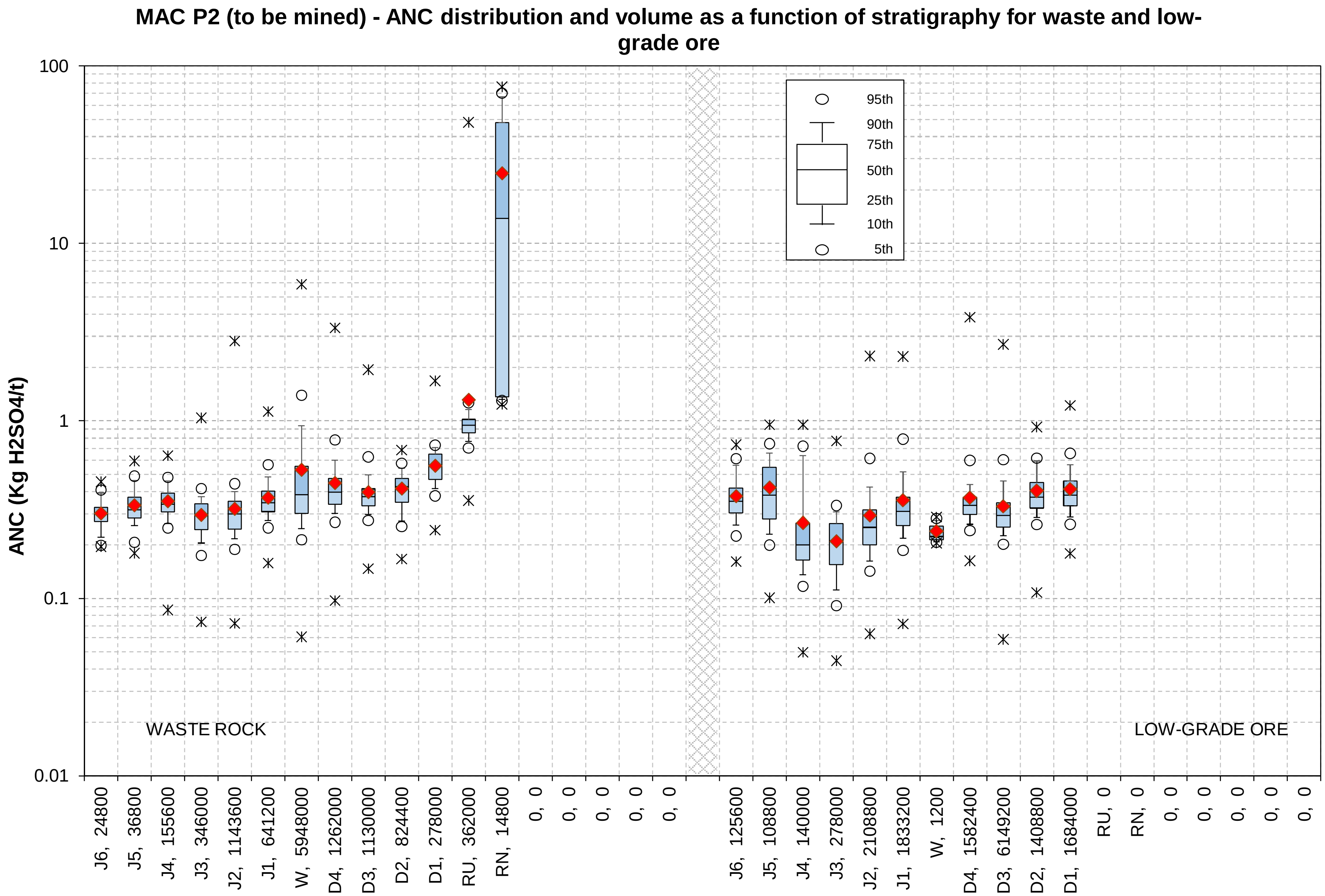


Figure 3-67 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P2 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-53 MAC P2 deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
5860 - J6	22,800	0.19%	2,000	1.69%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	35,200	0.29%	1,600	1.36%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	155,600	1.29%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	343,200	2.85%	2,800	2.37%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	1,127,200	9.35%	16,400	13.90%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	634,400	5.27%	6,800	5.76%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	5,862,000	48.65%	86,000	72.88%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,262,000	10.47%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	1,130,000	9.38%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	822,000	6.82%	2,400	2.03%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	278,000	2.31%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	362,000	3.00%	0	0.00%	0	**N/A**	0	**N/A**	0	**N/A**	0	N/A
5430 - RN	14,800	0.12%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**12,049,200**	**100.00%**	**118,000**	**100.00%**	**0**	N/A	**0**	N/A	**0**	N/A	**0**	**N/A**
% of Total	**99.03%**		**0.97%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
5860 - J6	113,600	0.74%	12,000	6.99%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	95,600	0.63%	13,200	7.69%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	138,000	0.91%	2,000	1.17%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	248,800	1.63%	29,200	17.02%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	2,019,200	13.24%	89,600	52.21%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	1,818,400	11.93%	14,800	8.62%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	1,200	0.01%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,582,400	10.38%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	6,140,000	40.27%	9,200	5.36%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	1,407,200	9.23%	1,600	0.93%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	1,684,000	11.04%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	0	0.00%	0	0.00%	0	**N/A**	0	**N/A**	0	**N/A**	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**15,248,400**	**100.00%**	**171,600**	**100.00%**	**0**	N/A	**0**	N/A	**0**	N/A	**0**	**N/A**
% of Total	**98.89%**		**1.11%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-54 MAC P2 deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
5860 - J6	24,000	0.20%	0	N/A	800	1.12%	0	N/A	24,800	0.20%
5850 - J5	35,600	0.29%	0	N/A	1,200	1.69%	0	N/A	36,800	0.30%
5840 - J4	155,600	1.29%	0	N/A	0	0.00%	0	N/A	155,600	1.28%
5830 - J3	344,000	2.84%	0	N/A	2,000	2.81%	0	N/A	346,000	2.84%
5820 - J2	1,130,800	9.35%	0	N/A	12,800	17.98%	0	N/A	1,143,600	9.40%
5810 - J1	636,800	5.26%	0	N/A	4,400	6.18%	0	N/A	641,200	5.27%
5700 - W	5,898,400	48.76%	0	N/A	49,600	69.66%	0	N/A	5,948,000	48.89%
5640 - D4	1,262,000	10.43%	0	N/A	0	0.00%	0	N/A	1,262,000	10.37%
5630 - D3	1,130,000	9.34%	0	N/A	0	0.00%	0	N/A	1,130,000	9.29%
5620 - D2	824,000	6.81%	0	N/A	400	0.56%	0	N/A	824,400	6.78%
5610 - D1	278,000	2.30%	0	N/A	0	0.00%	0	N/A	278,000	2.28%
5440 - RU	362,000	2.99%	0	**N/A**	0	0.00%	0	**N/A**	362,000	2.98%
5430 - RN	14,800	0.12%	0	N/A	0	0.00%	0	N/A	14,800	0.12%
Total	**12,096,000**	**100.00%**	**0**	N/A	**71,200**	**100.00%**	**0**	N/A	**12,167,200**	**100.00%**
% of Total	**99.41%**		**0.00%**		**0.59%**		**0.00%**		**100.00%**	
Low grade ore										
5860 - J6	121,600	0.79%	0	N/A	4,000	3.29%	0	N/A	125,600	0.81%
5850 - J5	100,800	0.66%	0	N/A	8,000	6.58%	0	N/A	108,800	0.71%
5840 - J4	137,200	0.90%	0	N/A	2,800	2.30%	0	N/A	140,000	0.91%
5830 - J3	253,200	1.66%	0	N/A	24,800	20.39%	0	N/A	278,000	1.80%
5820 - J2	2,042,000	13.35%	0	N/A	66,800	54.93%	0	N/A	2,108,800	13.68%
5810 - J1	1,822,000	11.91%	0	N/A	11,200	9.21%	0	N/A	1,833,200	11.89%
5700 - W	1,200	0.01%	0	N/A	0	0.00%	0	N/A	1,200	0.01%
5640 - D4	1,582,400	10.34%	0	N/A	0	0.00%	0	N/A	1,582,400	10.26%
5630 - D3	6,146,400	40.18%	0	N/A	2,800	2.30%	0	N/A	6,149,200	39.88%
5620 - D2	1,407,600	9.20%	0	N/A	1,200	0.99%	0	N/A	1,408,800	9.14%
5610 - D1	1,684,000	11.01%	0	N/A	0	0.00%	0	N/A	1,684,000	10.92%
5440 - RU	0	0.00%	0	**N/A**	0	0.00%	0	**N/A**	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**15,298,400**	**100.00%**	**0**	N/A	**121,600**	**100.00%**	**0**	N/A	**15,420,000**	**100.00%**
% of Total	**99.21%**		**0.00%**		**0.79%**		**0.00%**		**100.00%**	

Table 3-55 MAC P2 deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	12,096,000	0	12,096,000	99.41%
1	0	0	0	0.00%
2	71,200	0	71,200	0.59%
3	0	0	0	0.00%
Total	**12,167,200**	**0**	**12,167,200**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	15,298,400	0	15,298,400	99.21%
1	0	0	0	0.00%
2	121,600	0	121,600	0.79%
3	0	0	0	0.00%
Total	**15,420,000**	**0**	**15,420,000**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

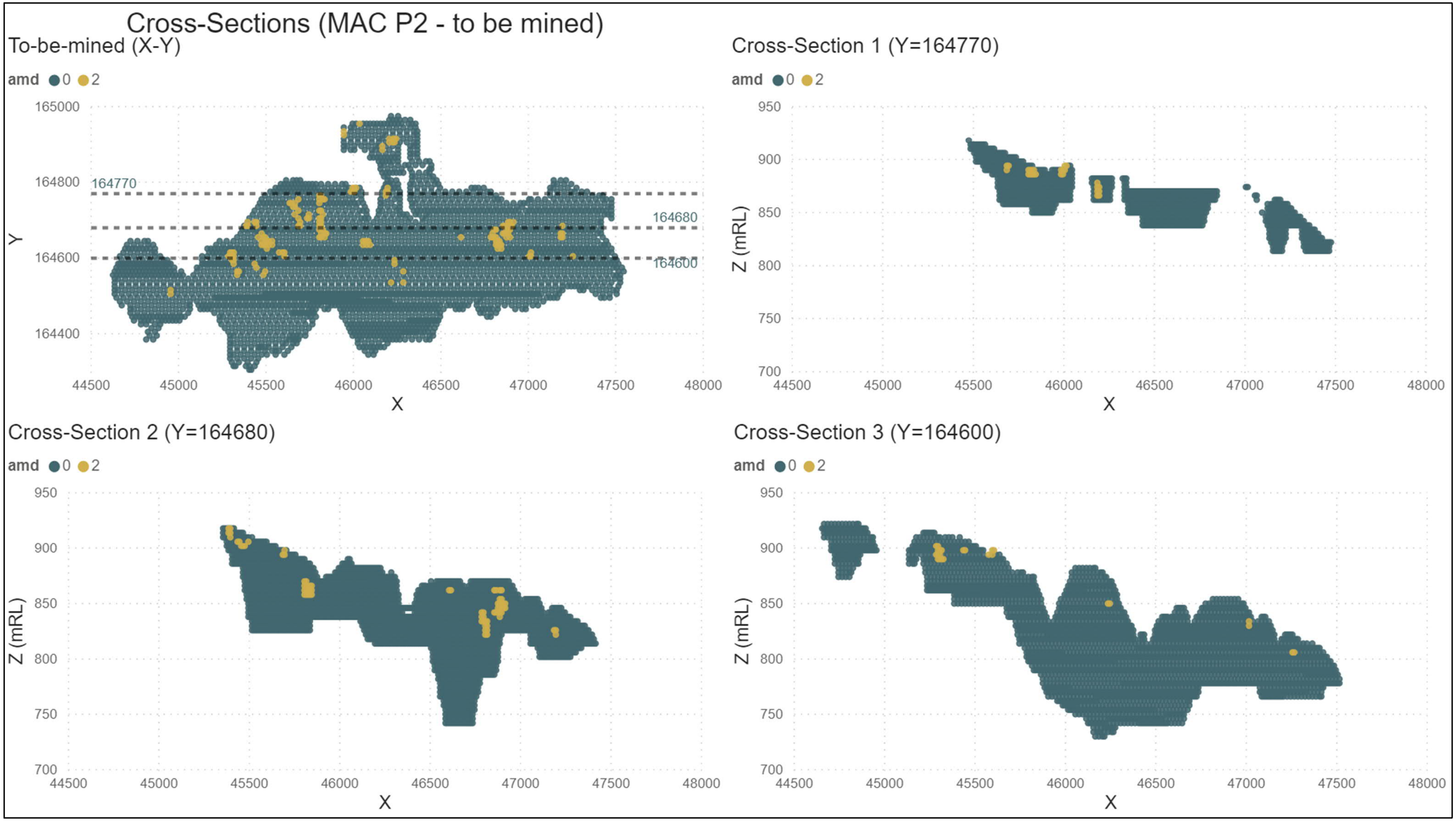


Figure 3-68 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P2 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.12 MAC P3 deposit

3.1.1.12.1 MAC P3 deposit (as-mined waste)

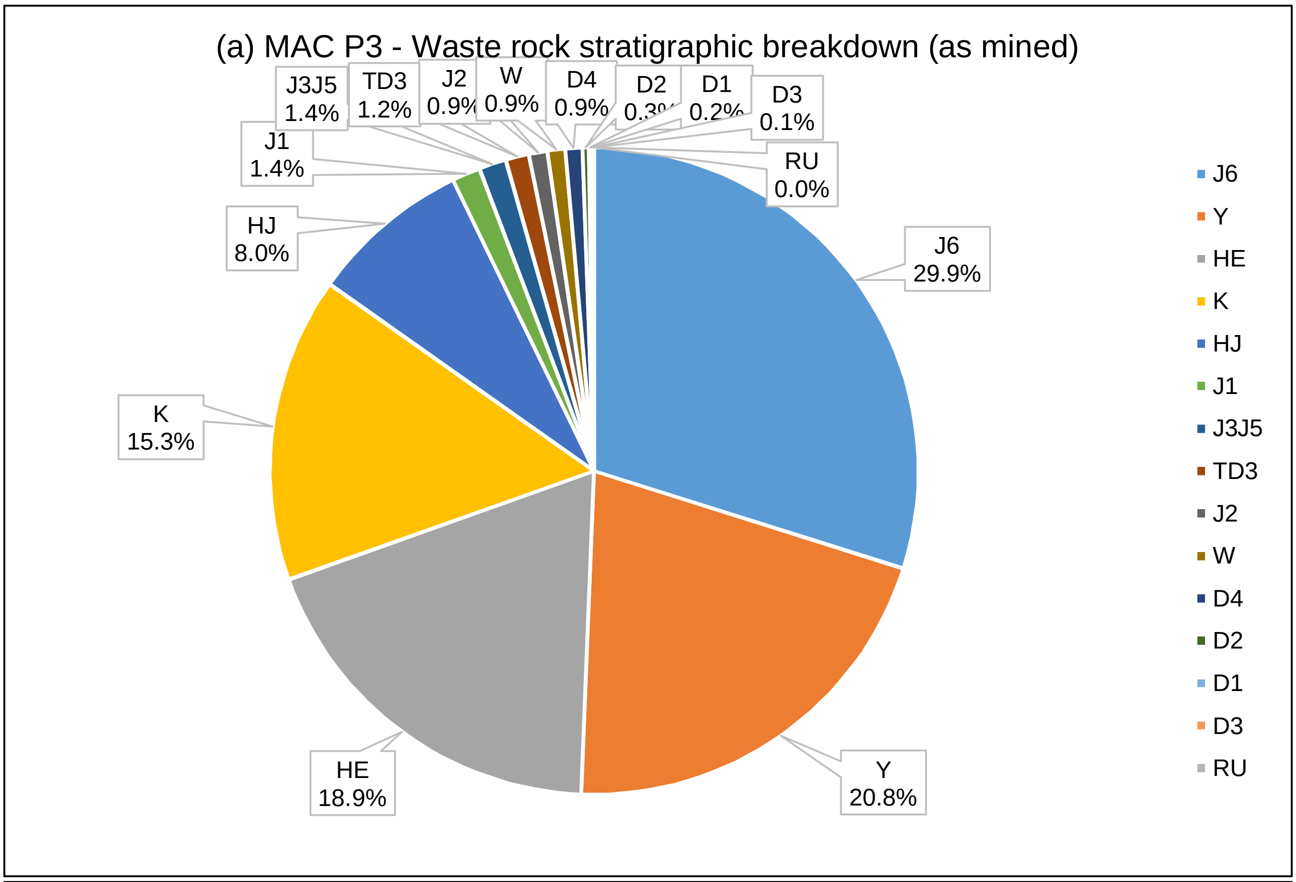
A pie chart showing the distribution of as-mined waste rock and low-grade ore from P3 deposit as a function of stratigraphic unit is shown in Figure 3-69. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from P3 deposit are shown in Figure 3-70 and Figure 3-71, respectively.

Table 3-56 presents as-mined waste volume from P3 deposit split by total sulphur content per stratigraphy. Table 3-57 and Table 3-58 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC P3 deposit is presented in Figure 3-72.

The key findings are summarised as follows:

- As-mined waste rock from P3 deposit has multiple sources such as Joffre Member (33.6%, incl. J6, J1, J3J5 and J2), Weeli Wolli Formation (26.9%, incl. HE and HJ), Yandicoogina Shale Member (20.8% Y) and Tertiary Detritals (16.4% incl. K and TD3), with minor contribution from Dales Gorge Member (1.4%), Whaleback Shale (0.9% W) and Mt McRae Shale (0.003%). As-mined low-grade ore mainly consists of 51.3% Joffre Member (J6, J3J5, J2 and J1) and 34.7% Yandicoogina Shale Member with small contribution from Weeli Wolli Formation (5.8%) and Tertiary Detritals (0.9%).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below 0.1 wt% and median values below or near 0.05 wt% for all mined out blocks (Figure 3-70, Table 3-56).
- Very low sulphur blocks (<0.1%) comprise 99.40% of as-mined waste rock and 98.60% of as-mined low-grade ore volume (Table 3-56). Low sulphur blocks (0.1-0.2%) comprise 0.50% of as-mined waste rock and 1.40% of as-mined low-grade ore volume. Only 0.10% as-mined waste rock have total sulphur content in the range of 0.2-0.5 wt% and no waste blocks show total sulphur above 0.5 wt%.
- As-mined waste rock and low-grade ore are generally devoid of ANC with the 95th percentile values below 4 kg H_2SO_4/t and the median values below or close to 0.5 kg H_2SO_4/t for the majority of the stratigraphic units (Figure 3-71). Although HE shows a slightly higher ANC distribution, its 75th percentile value is still below 8 kg H_2SO_4/t.
- A total volume of 50,735,200 m^3 (incl. 31,198,800 m^3 waste rock and 19,536,400 m^3 low-grade ore) of AMD0 waste has been mined out from P3 deposit, representing 99.94% of as-mined waste rock and 99.53% of as-mined low-grade ore.
- No AMD1 or AMD3 waste rock or low-grade ore blocks have been mined out from the P3 deposit.
- A total volume of 110,000 m^3 waste (incl. 17,200 m^3 waste rock and 92,800 m^3 low-grade ore) is classed as AMD2, representing 0.06% of as-mined waste rock and 0.47% of as-mined low-grade ore, which are predominately associated with Joffre Member (J6, Table 3-57).
- All materials mined-out (waste rock and low-grade ore) from P3 deposit are sourced from above the water table (Table 3-58).



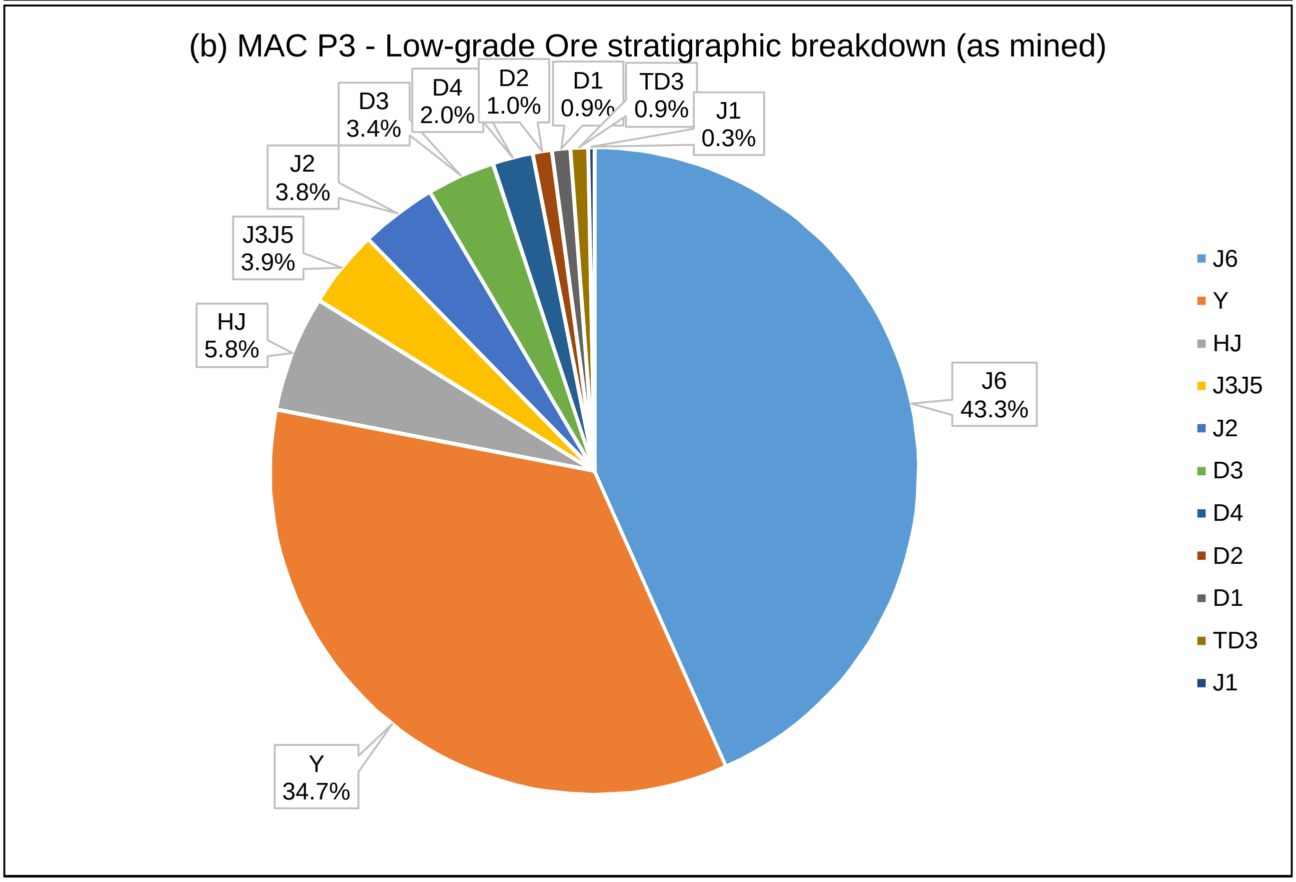


Figure 3-69 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P3 deposit mining model

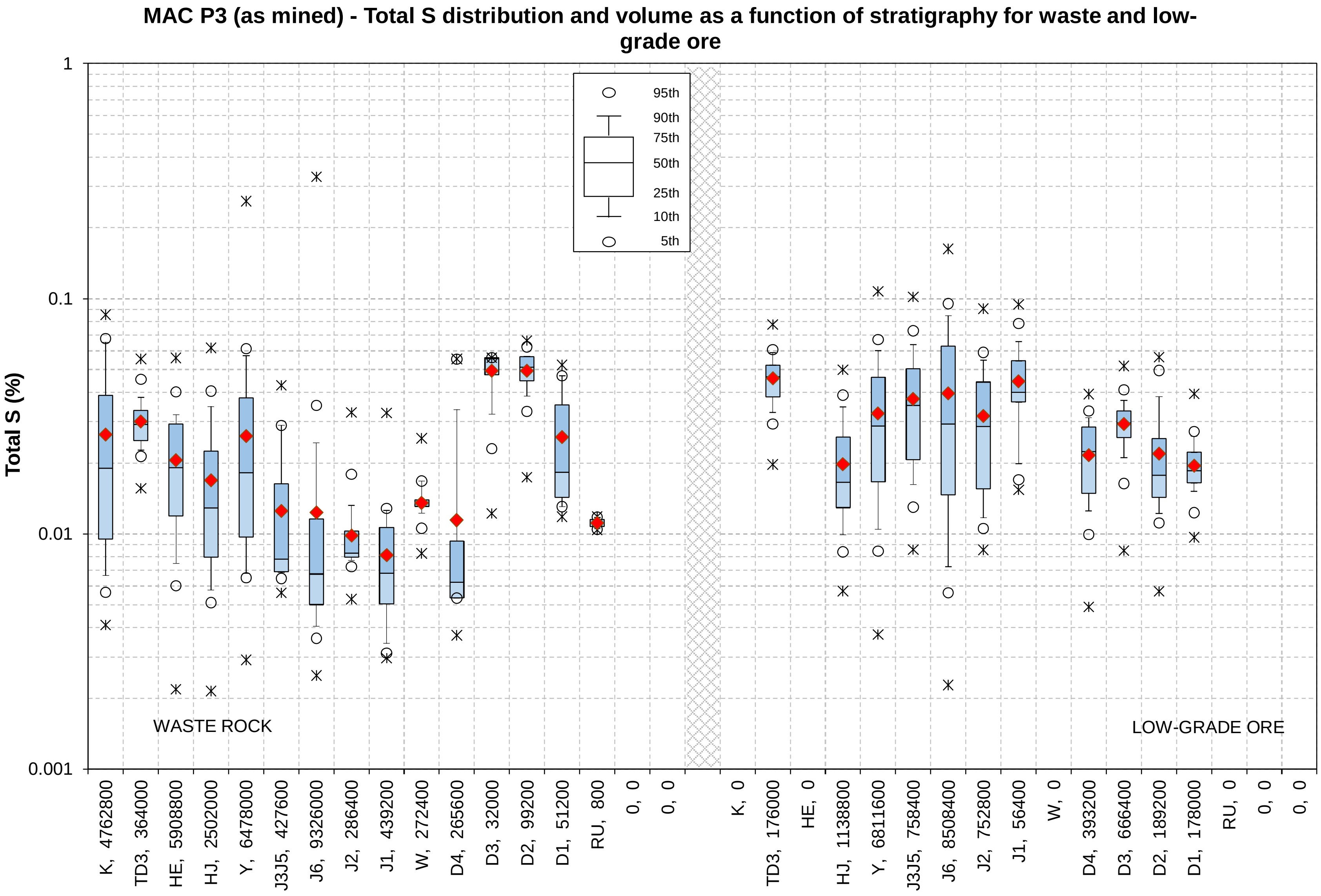


Figure 3-70 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC P3 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

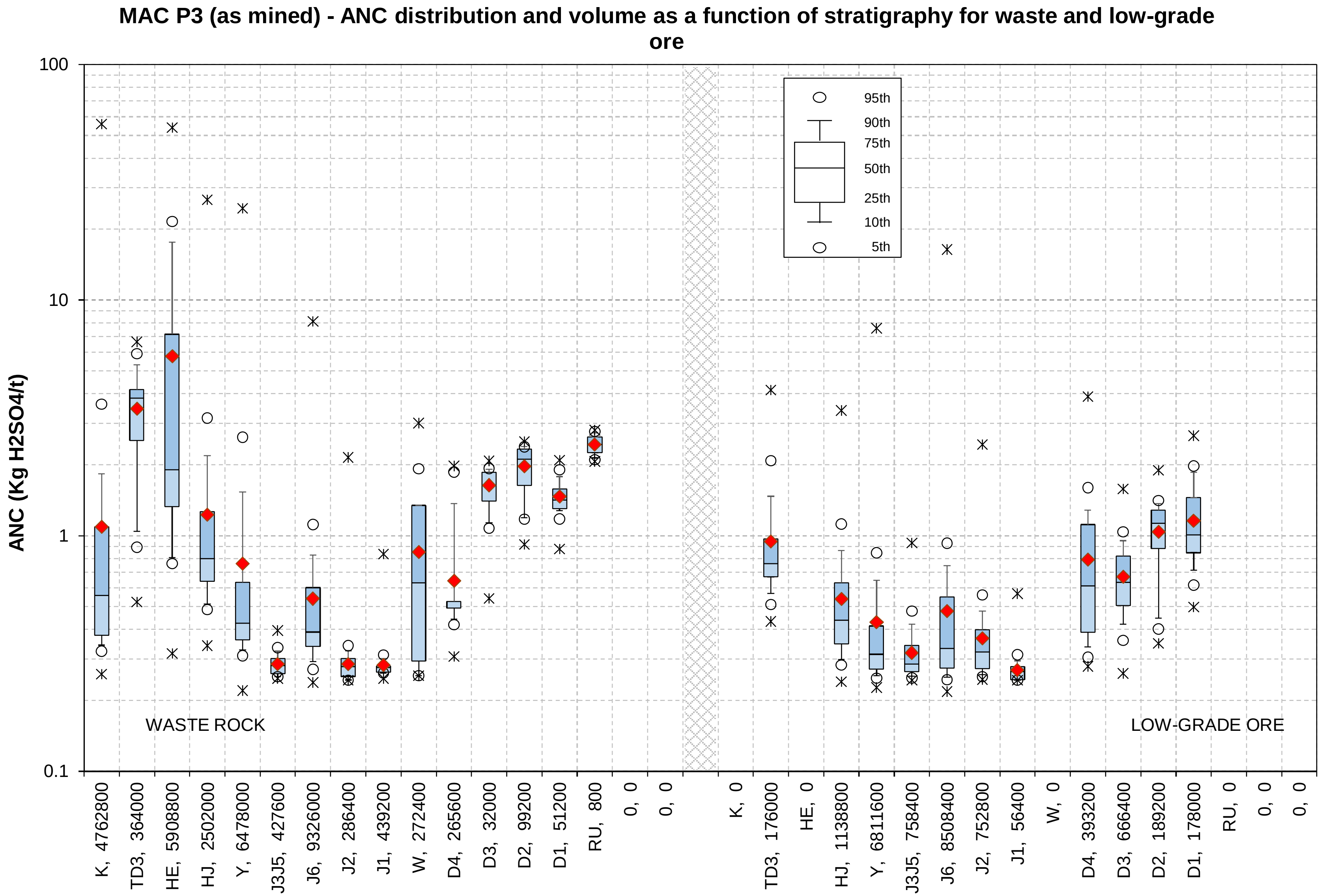


Figure 3-71 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC P3 deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-56 MAC P3 deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	4,762,800	15.35%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	364,000	1.17%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
6120 - HE	5,908,800	19.04%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
6110 - HJ	2,502,000	8.06%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5900 - Y	6,409,200	20.66%	52,000	33.51%	16,800	55.26%	0	0.00%	0	N/A	0	N/A
5870 - J3J5	427,600	1.38%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5860 - J6	9,208,400	29.68%	103,200	66.49%	13,600	44.74%	800	100.00%	0	N/A	0	N/A
5850 - J5	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5840 - J4	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5830 - J3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5820 - J2	286,400	0.92%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5810 - J1	439,200	1.42%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5700 - W	272,400	0.88%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5640 - D4	265,600	0.86%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5630 - D3	32,000	0.10%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5620 - D2	99,200	0.32%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5610 - D1	51,200	0.17%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5440 - RU	800	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**31,029,600**	**100.00%**	**155,200**	**100.00%**	**30,400**	**100.00%**	**800**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.40%**		**0.50%**		**0.10%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	176,000	0.91%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
6120 - HE	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
6110 - HJ	1,138,800	5.88%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5900 - Y	6,806,000	35.17%	5,600	2.03%	0	N/A	0	N/A	0	N/A	0	N/A
5870 - J3J5	757,600	3.91%	800	0.29%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	8,239,200	42.57%	269,200	97.68%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	752,800	3.89%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	56,400	0.29%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	393,200	2.03%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	666,400	3.44%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	189,200	0.98%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	178,000	0.92%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5440 - RU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**19,353,600**	**100.00%**	**275,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**98.60%**		**1.40%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-57 MAC P3 deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	4,762,800	15.27%	0	N/A	0	0.00%	0	N/A	4,762,800	15.26%
8130 - TD3	364,000	1.17%	0	N/A	0	0.00%	0	N/A	364,000	1.17%
6120 - HE	5,908,800	18.94%	0	N/A	0	0.00%	0	N/A	5,908,800	18.93%
6110 - HJ	2,502,000	8.02%	0	N/A	0	0.00%	0	N/A	2,502,000	8.02%
5900 - Y	6,478,000	20.76%	0	N/A	0	0.00%	0	N/A	6,478,000	20.75%
5870 - J3J5	427,600	1.37%	0	N/A	0	0.00%	0	N/A	427,600	1.37%
5860 - J6	9,308,800	29.84%	0	N/A	17,200	100.00%	0	N/A	9,326,000	29.88%
5850 - J5	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5840 - J4	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5830 - J3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5820 - J2	286,400	0.92%	0	N/A	0	0.00%	0	N/A	286,400	0.92%
5810 - J1	439,200	1.41%	0	N/A	0	0.00%	0	N/A	439,200	1.41%
5700 - W	272,400	0.87%	0	N/A	0	0.00%	0	N/A	272,400	0.87%
5640 - D4	265,600	0.85%	0	N/A	0	0.00%	0	N/A	265,600	0.85%
5630 - D3	32,000	0.10%	0	N/A	0	0.00%	0	N/A	32,000	0.10%
5620 - D2	99,200	0.32%	0	N/A	0	0.00%	0	N/A	99,200	0.32%
5610 - D1	51,200	0.16%	0	N/A	0	0.00%	0	N/A	51,200	0.16%
5440 - RU	800	0.00%	0	N/A	0	0.00%	0	N/A	800	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**31,198,800**	**100.00%**	**0**	**N/A**	**17,200**	**100.00%**	**0**	**N/A**	**31,216,000**	**100.00%**
% of Total	**99.94%**		**0.00%**		**0.06%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8130 - TD3	176,000	0.90%	0	N/A	0	0.00%	0	N/A	176,000	0.90%
6120 - HE	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
6110 - HJ	1,138,800	5.83%	0	N/A	0	0.00%	0	N/A	1,138,800	5.80%
5900 - Y	6,811,200	34.86%	0	N/A	400	0.43%	0	N/A	6,811,600	34.70%
5870 - J3J5	758,400	3.88%	0	N/A	0	0.00%	0	N/A	758,400	3.86%
5860 - J6	8,416,000	43.08%	0	N/A	92,400	99.57%	0	N/A	8,508,400	43.35%
5850 - J5	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5840 - J4	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5830 - J3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5820 - J2	752,800	3.85%	0	N/A	0	0.00%	0	N/A	752,800	3.84%
5810 - J1	56,400	0.29%	0	N/A	0	0.00%	0	N/A	56,400	0.29%
5700 - W	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5640 - D4	393,200	2.01%	0	N/A	0	0.00%	0	N/A	393,200	2.00%
5630 - D3	666,400	3.41%	0	N/A	0	0.00%	0	N/A	666,400	3.39%
5620 - D2	189,200	0.97%	0	N/A	0	0.00%	0	N/A	189,200	0.96%
5610 - D1	178,000	0.91%	0	N/A	0	0.00%	0	N/A	178,000	0.91%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**19,536,400**	**100.00%**	**0**	**N/A**	**92,800**	**100.00%**	**0**	**N/A**	**19,629,200**	**100.00%**
% of Total	**99.53%**		**0.00%**		**0.47%**		**0.00%**		**100.00%**	

Table 3-58 MAC P3 deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	31,198,800	0	31,198,800	99.94%
1	0	0	0	0.00%
2	17,200	0	17,200	0.06%
3	0	0	0	0.00%
Total	**31,216,000**	**0**	**31,216,000**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	19,536,400	0	19,536,400	99.53%
1	0	0	0	0.00%
2	92,800	0	92,800	0.47%
3	0	0	0	0.00%
Total	**19,629,200**	**0**	**19,629,200**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

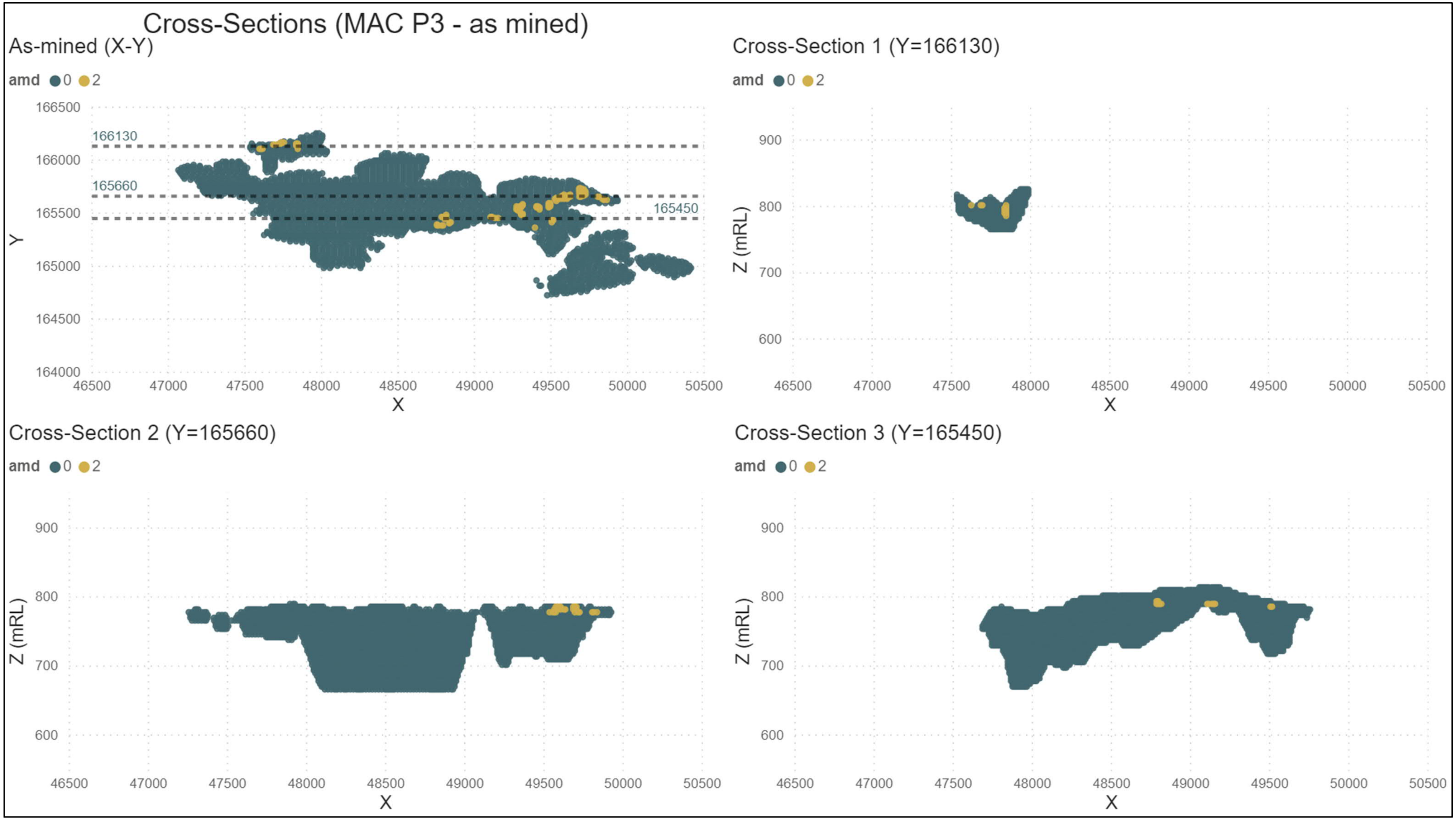


Figure 3-72 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC P3 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.12.2 MAC P3 deposit (to-be-mined waste)

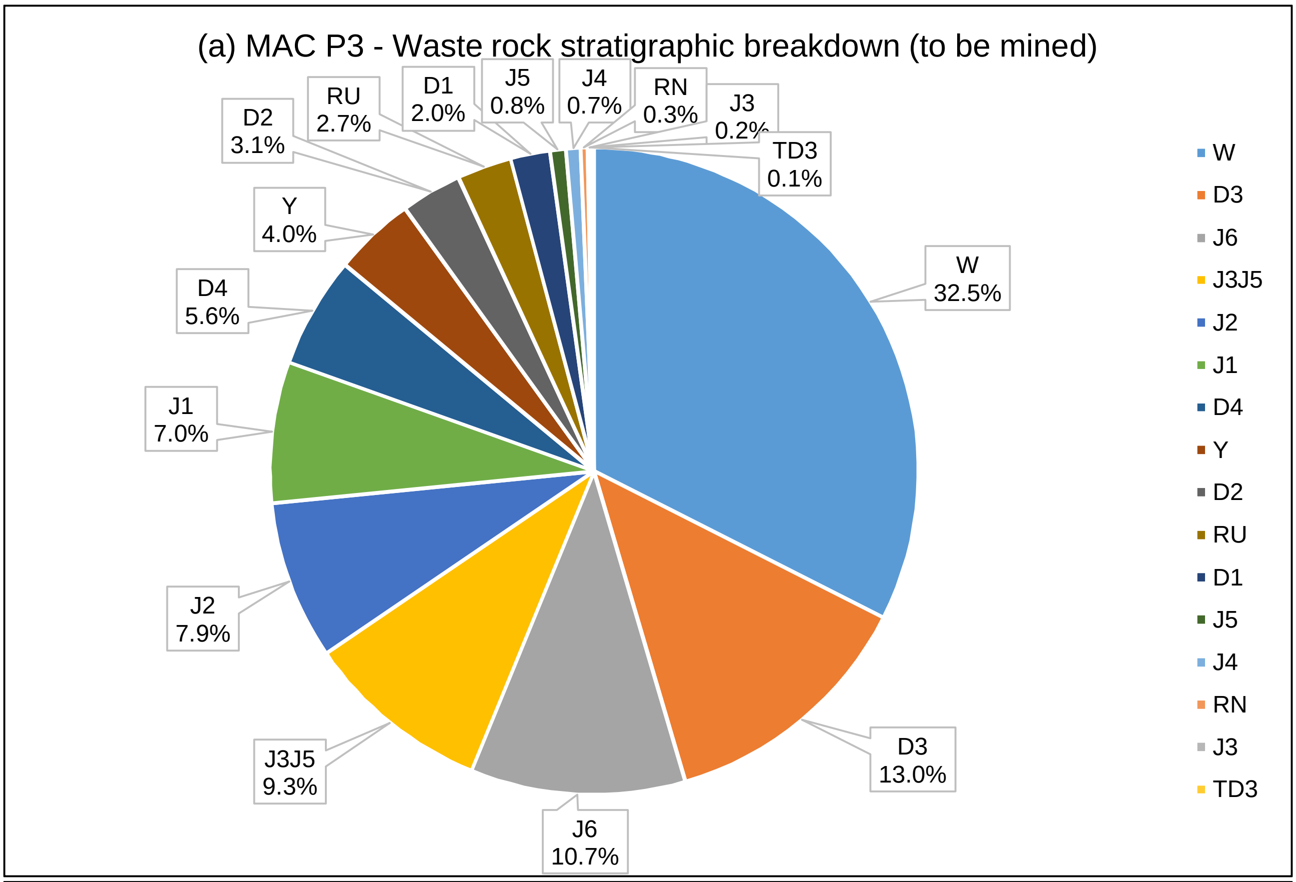
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P3 deposit as a function of stratigraphic unit is shown in Figure 3-73. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P3 deposit are shown in Figure 3-74 and Figure 3-75, respectively.

Table 3-59 presents to-be-mined waste volume from P3 deposit split by total sulphur content per stratigraphy. Table 3-60 and Table 3-61 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P3 deposit is presented in Figure 3-76.

The key attributes are listed as follows:

- To-be-mined waste rock from P3 deposit is mainly sourced from Joffre Member (36.7%, incl. J6, J3J5, J2, J1, J5 and J4), Whaleback Shale (32.5% W) and Dales Gorge Member (23.6%, incl. D3, D4, D2 and D1), with minor contribution from Yandicoogina Shale Member (4.0% Y), Mt McRae Shale (3.0%, incl. RU and RN) and Tertiary Detritals (0.1% TD3). To-be-mined low-grade ore is dominated by Joffre Member (52.5%, incl. J6, J3J5, J2, J1, J5, J4 and J3) and Dales Gorge Member (42.2%, incl. D1, D3, D2 and D4), with a small portion from Yandicoogina Shale Member (5.3% Y).
- To-be-mined waste rock and low-grade ore show very low sulphur concentration with the 95^{th} percentile values below 0.1 wt% and the median values below or close to 0.05 wt% (Figure 3-74, Table 3-59). Mt McRae Shale waste rock blocks have maximum sulphur value below 0.05 wt%.
- Very low sulphur blocks (<0.1%) comprise 99.99% of to-be-mined waste rock and 99.42% of to-be-mined low-grade ore volume (Table 3-59). Low sulphur blocks (0.1-0.2%) comprise 0.01% of to-be-mined waste rock and 0.54% of to-be-mined low-grade ore volume. Only 0.05% to-be-mined low-grade ore have total sulphur content in the range of 0.2-0.3 wt% and no waste blocks show total sulphur above 0.3 wt%.
- To-be-mined waste rock and low-grade ore generally have low ANC with the 95^{th} percentile values below or near 10 kg H_2SO_4/t and median values below 3 kg H_2SO_4/t (Figure 3-75).
- A total volume of 48,032,400 m^3 (incl. 25,810,400 m^3 waste rock and 22,222,000 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P3 deposit, representing the entire to-be-mined waste rock and 99.63% of to-be-mined low-grade ore.
- No AMD1 or AMD3 waste is predicted to be mined from MAC P3 deposit.
- A total volume of 83,200 m^3 to-be-mined low-grade ore (from J6) is classed as AMD2, representing 0.37% of to-be-mined low-grade ore (Table 3-60).
- Approximately 99.38% of waste rock and 99.43% of low-grade ore are predicted to be mined from above water table (Table 3-61).



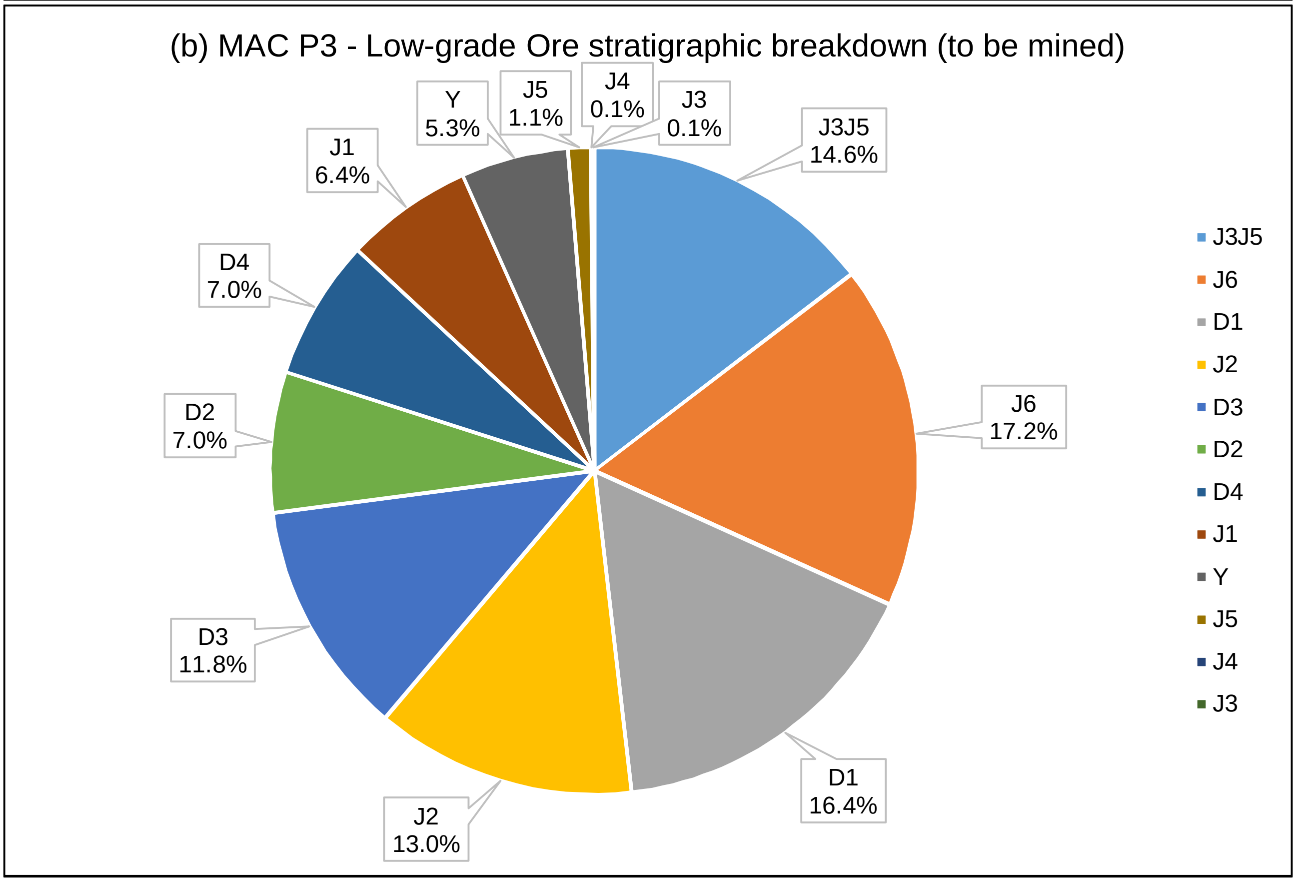


Figure 3-73 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P3 deposit mining model

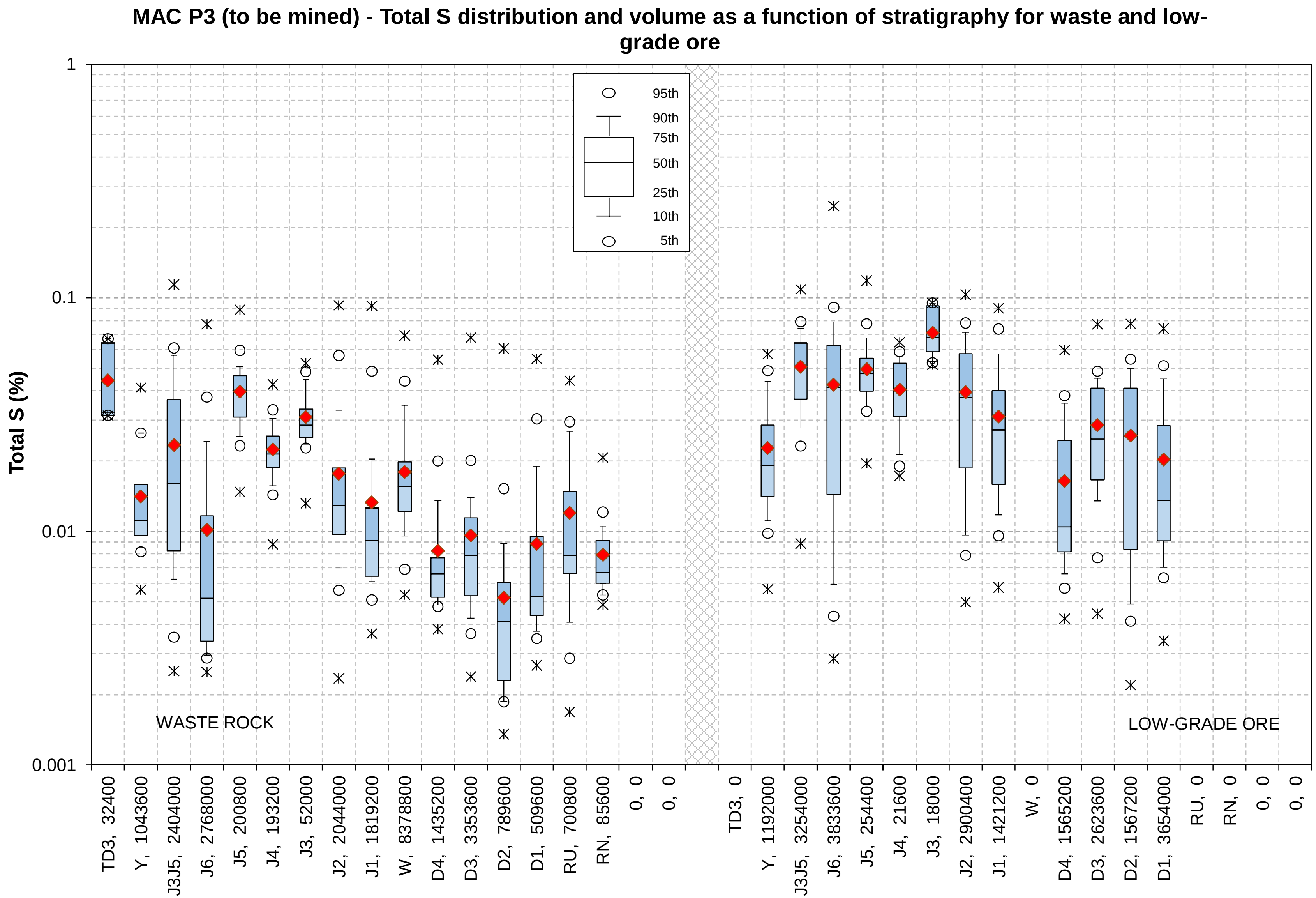


Figure 3-74 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P3 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

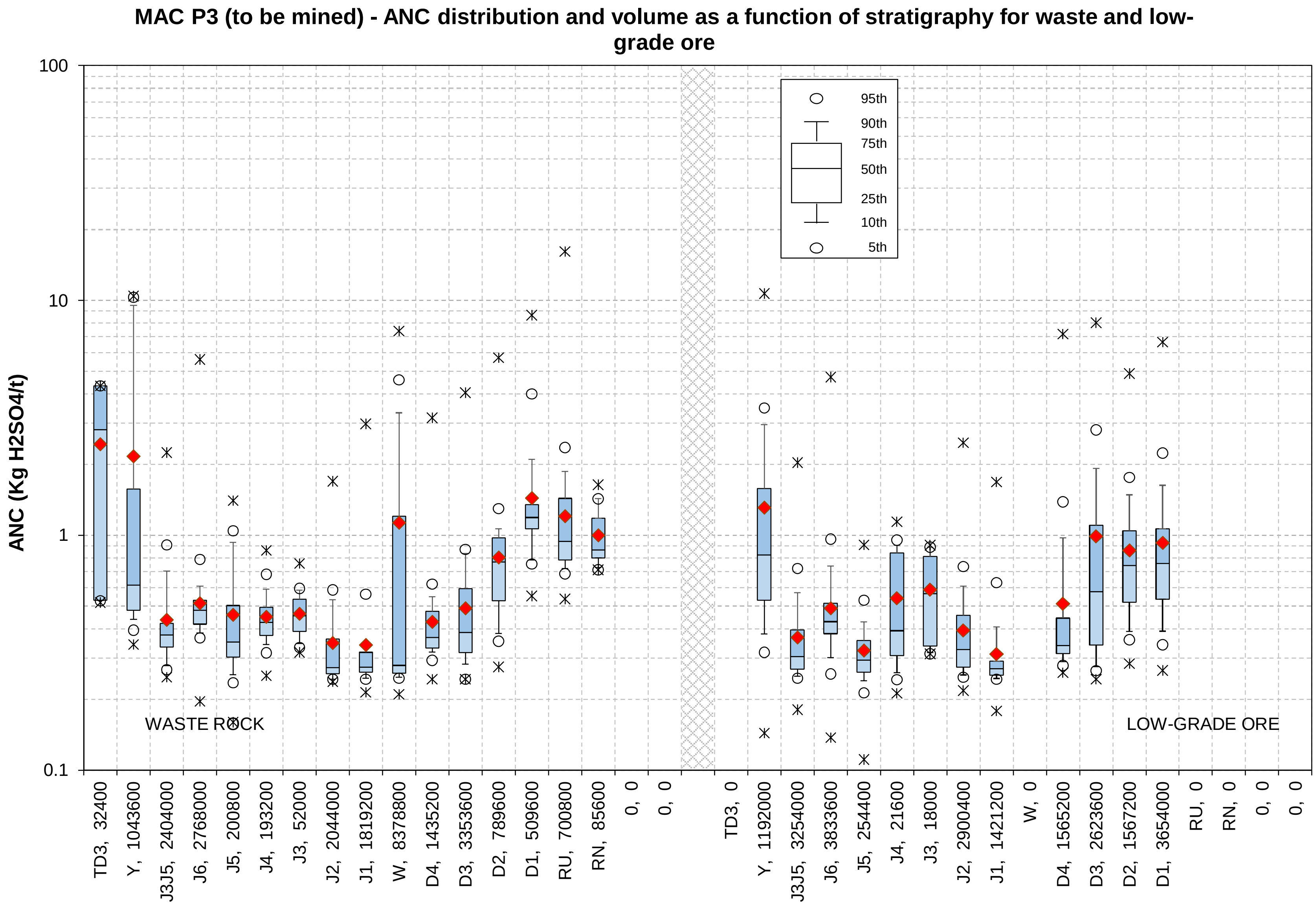


Figure 3-75 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P3 deposit (the volume in m³ of each stratigraphic unit is reported next to the rock type ID)

Table 3-59 MAC P3 deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	32,400	0.13%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
6120 - HE	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
6110 - HJ	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5900 - Y	1,043,600	4.04%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5870 - J3J5	2,400,400	9.30%	3,600	100.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	2,768,000	10.73%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	200,800	0.78%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	193,200	0.75%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	52,000	0.20%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	2,044,000	7.92%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	1,819,200	7.05%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	8,378,800	32.47%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,435,200	5.56%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	3,353,600	13.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	789,600	3.06%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	509,600	1.97%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	700,800	2.72%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	85,600	0.33%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**25,806,800**	**100.00%**	**3,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.99%**		**0.01%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
6120 - HE	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
6110 - HJ	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5900 - Y	1,192,000	5.38%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5870 - J3J5	3,250,800	14.66%	3,200	2.67%	0	0.00%	0	N/A	0	N/A	0	N/A
5860 - J6	3,712,000	16.74%	111,200	92.67%	10,400	100.00%	0	N/A	0	N/A	0	N/A
5850 - J5	251,600	1.13%	2,800	2.33%	0	0.00%	0	N/A	0	N/A	0	N/A
5840 - J4	21,600	0.10%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5830 - J3	18,000	0.08%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5820 - J2	2,897,600	13.07%	2,800	2.33%	0	0.00%	0	N/A	0	N/A	0	N/A
5810 - J1	1,421,200	6.41%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5700 - W	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5640 - D4	1,565,200	7.06%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5630 - D3	2,623,600	11.83%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5620 - D2	1,567,200	7.07%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5610 - D1	3,654,000	16.48%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5440 - RU	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A
Total	**22,174,800**	**100.00%**	**120,000**	**100.00%**	**10,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.42%**		**0.54%**		**0.05%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-60 MAC P3 deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8130 - TD3	32,400	0.13%	0	N/A	0	N/A	0	N/A	32,400	0.13%
6120 - HE	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
6110 - HJ	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5900 - Y	1,043,600	4.04%	0	N/A	0	N/A	0	N/A	1,043,600	4.04%
5870 - J3J5	2,404,000	9.31%	0	N/A	0	N/A	0	N/A	2,404,000	9.31%
5860 - J6	2,768,000	10.72%	0	N/A	0	N/A	0	N/A	2,768,000	10.72%
5850 - J5	200,800	0.78%	0	N/A	0	N/A	0	N/A	200,800	0.78%
5840 - J4	193,200	0.75%	0	N/A	0	N/A	0	N/A	193,200	0.75%
5830 - J3	52,000	0.20%	0	N/A	0	N/A	0	N/A	52,000	0.20%
5820 - J2	2,044,000	7.92%	0	N/A	0	N/A	0	N/A	2,044,000	7.92%
5810 - J1	1,819,200	7.05%	0	N/A	0	N/A	0	N/A	1,819,200	7.05%
5700 - W	8,378,800	32.46%	0	N/A	0	N/A	0	N/A	8,378,800	32.46%
5640 - D4	1,435,200	5.56%	0	N/A	0	N/A	0	N/A	1,435,200	5.56%
5630 - D3	3,353,600	12.99%	0	N/A	0	N/A	0	N/A	3,353,600	12.99%
5620 - D2	789,600	3.06%	0	N/A	0	N/A	0	N/A	789,600	3.06%
5610 - D1	509,600	1.97%	0	N/A	0	N/A	0	N/A	509,600	1.97%
5440 - RU	700,800	2.72%	0	N/A	0	N/A	0	N/A	700,800	2.72%
5430 - RN	85,600	0.33%	0	N/A	0	N/A	0	N/A	85,600	0.33%
Total	**25,810,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**25,810,400**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
8130 - TD3	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
6120 - HE	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
6110 - HJ	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5900 - Y	1,192,000	5.36%	0	N/A	0	N/A	0	N/A	1,192,000	5.34%
5870 - J3J5	3,254,000	14.64%	0	N/A	0	N/A	0	N/A	3,254,000	14.59%
5860 - J6	3,750,400	16.88%	0	N/A	83,200	N/A	0	N/A	3,833,600	17.19%
5850 - J5	254,400	1.14%	0	N/A	0	N/A	0	N/A	254,400	1.14%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5840 - J4	21,600	0.10%	0	N/A	0	N/A	0	N/A	21,600	0.10%
5830 - J3	18,000	0.08%	0	N/A	0	N/A	0	N/A	18,000	0.08%
5820 - J2	2,900,400	13.05%	0	N/A	0	N/A	0	N/A	2,900,400	13.00%
5810 - J1	1,421,200	6.40%	0	N/A	0	N/A	0	N/A	1,421,200	6.37%
5700 - W	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5640 - D4	1,565,200	7.04%	0	N/A	0	N/A	0	N/A	1,565,200	7.02%
5630 - D3	2,623,600	11.81%	0	N/A	0	N/A	0	N/A	2,623,600	11.76%
5620 - D2	1,567,200	7.05%	0	N/A	0	N/A	0	N/A	1,567,200	7.03%
5610 - D1	3,654,000	16.44%	0	N/A	0	N/A	0	N/A	3,654,000	16.38%
5440 - RU	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**22,222,000**	**100.00%**	**0**	**N/A**	**83,200**	**N/A**	**0**	**N/A**	**22,305,200**	**100.00%**
% of Total	**99.63%**		**0.00%**		**0.37%**		**0.00%**		**100.00%**	

Table 3-61 MAC P3 deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	25,650,400	160,000	25,810,400	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**25,650,400**	**160,000**	**25,810,400**	100.00%
% of Total	**99.38%**	**0.62%**	**100.00%**	
Low grade ore				
0	22,094,800	127,200	22,222,000	99.63%
1	0	0	0	0.00%
2	83,200	0	83,200	0.37%
3	0	0	0	0.00%
Total	**22,178,000**	**127,200**	**22,305,200**	100.00%
% of Total	**99.43%**	**0.57%**	**100.00%**	

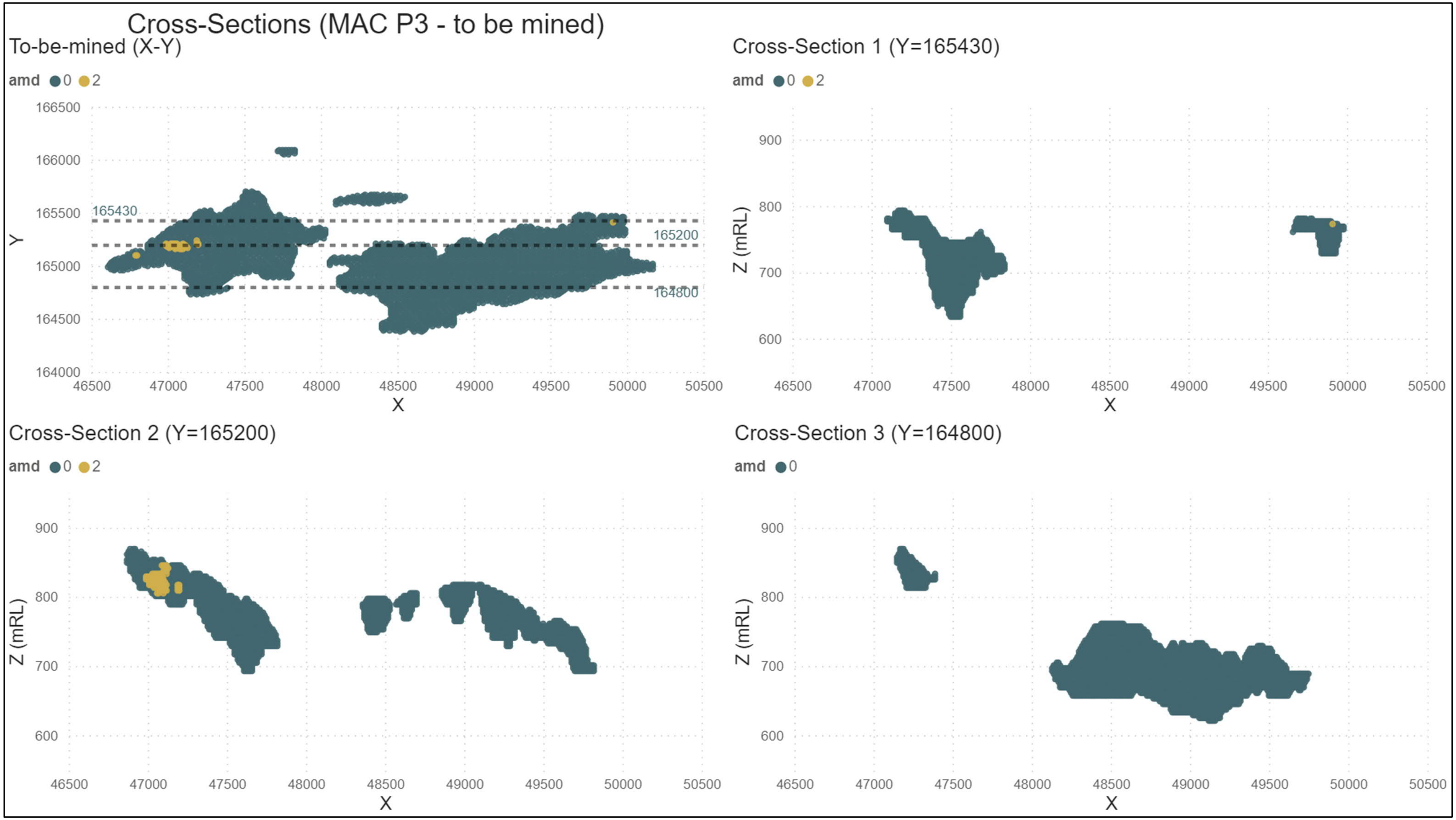


Figure 3-76 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P3 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.13 *MAC P4* deposit

3.1.1.13.1 MAC P4 deposit (as-mined waste)

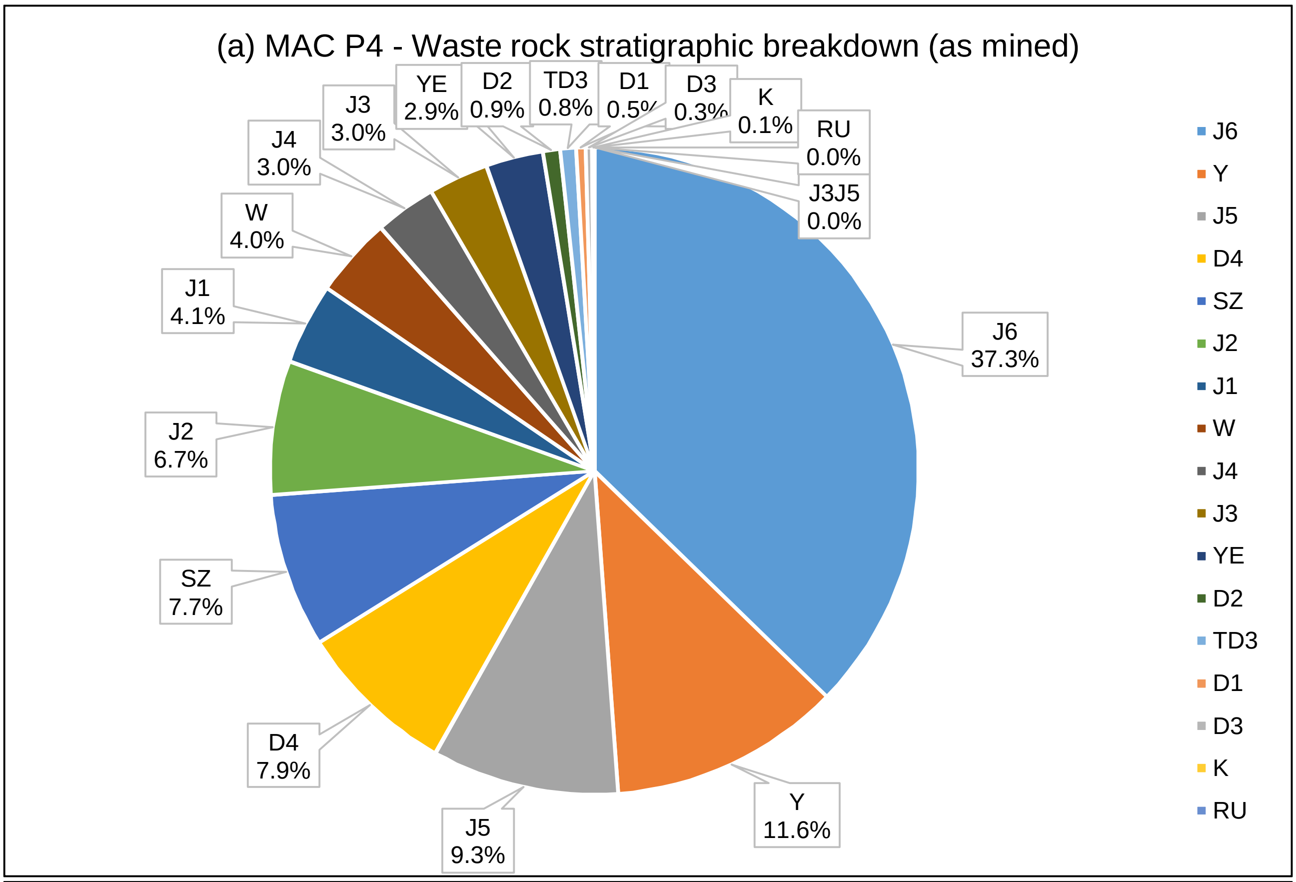
A pie chart showing the distribution of as-mined waste rock and low-grade ore from P4 deposit as a function of stratigraphic unit is shown in Figure 3-77. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from P4 deposit are shown in Figure 3-78 and Figure 3-79, respectively.

Table 3-62 presents as-mined waste volume from P4 deposit split by total sulphur content per stratigraphy. Table 3-63 and Table 3-64 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the MAC P4 deposit is presented in Figure 3-80.

The key findings are summarised as follows:

- As-mined waste rock from P4 deposit is mainly from Joffre Member (63.4%, incl. J6, J5, J2, J1, J4 and J3), Weeli Wolli Formation (26.9%, incl. HE and HJ), with minor contribution from Yandicoogina Shale Member (14.4% Y and YE), Dales Gorge Member (9.6%, incl. D4, D2, D1 and D3) and Tertiary Detritals (8.5% incl. K and TD3), Whaleback Shale (4.0% W) and Mt McRae Shale (0.03%). As-mined low-grade ore is dominated by 83.0% Joffre Member (J6, J5, J2, J4, J3, J3J5 and J1) with smaller contribution from Dales Gorge Member (16.8%, incl. D3, D4, D2 and D1) and Tertiary Detritals (0.2% TD3 and SZ).
- As-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below 0.1 wt% and median values below or near 0.05 wt% for all mined out blocks (Figure 3-78, Table 3-62).
- Very low sulphur blocks (<0.1%) comprise 99.99% of as-mined waste rock and 99.06% of as-mined low-grade ore volume (Table 3-62). Low sulphur blocks (0.1-0.2%) comprise 0.01% of as-mined waste rock and 0.94% of as-mined low-grade ore volume. No waste blocks show total sulphur above 0.2 wt%.
- As-mined waste rock and low-grade ore are generally devoid of ANC with the 95th percentile values below 10 kg H_2SO_4/t (Figure 3-79). In particular, stratigraphic units of Joffre Member have the median ANC values below 0.5 kg H_2SO_4/t.
- A total volume of 29,733,200 m^3 (incl. 12,019,200 m^3 waste rock and 17,714,000 m^3 low-grade ore) of AMD0 waste has been mined out from P4 deposit, representing the entire as-mined waste rock and 99.56% of as-mined low-grade ore.
- No AMD1 or AMD3 waste rock or low-grade ore blocks have been mined out from the P4 deposit.
- A total volume of 78,400 m^3 as-mined low-grade ore (from J6 and J5) is classed as AMD2, representing 0.44% of as-mined low-grade ore (Table 3-63).
- All materials mined-out (waste rock and low-grade ore) from P4 deposit are sourced from above the water table (Table 3-64).



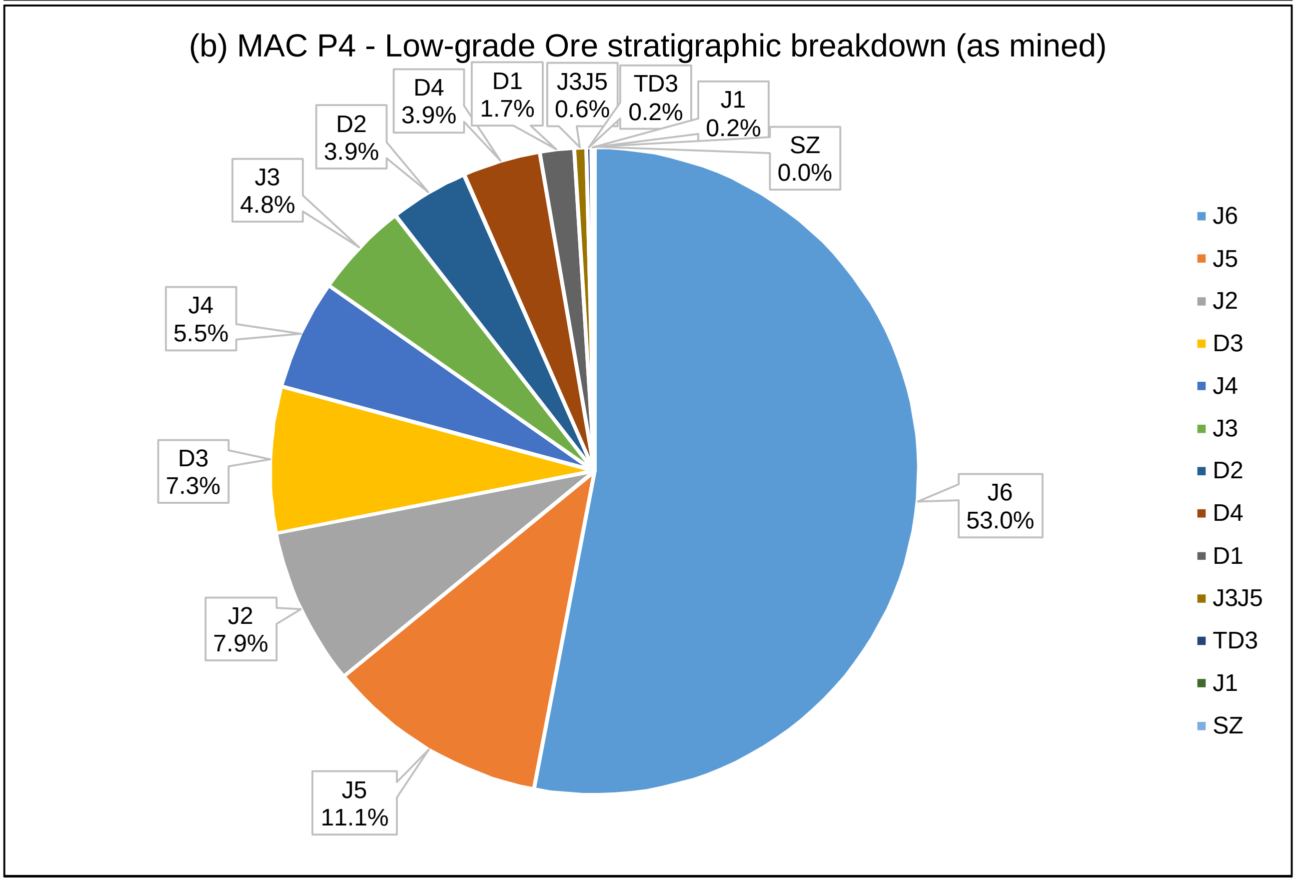


Figure 3-77 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P4 deposit mining model

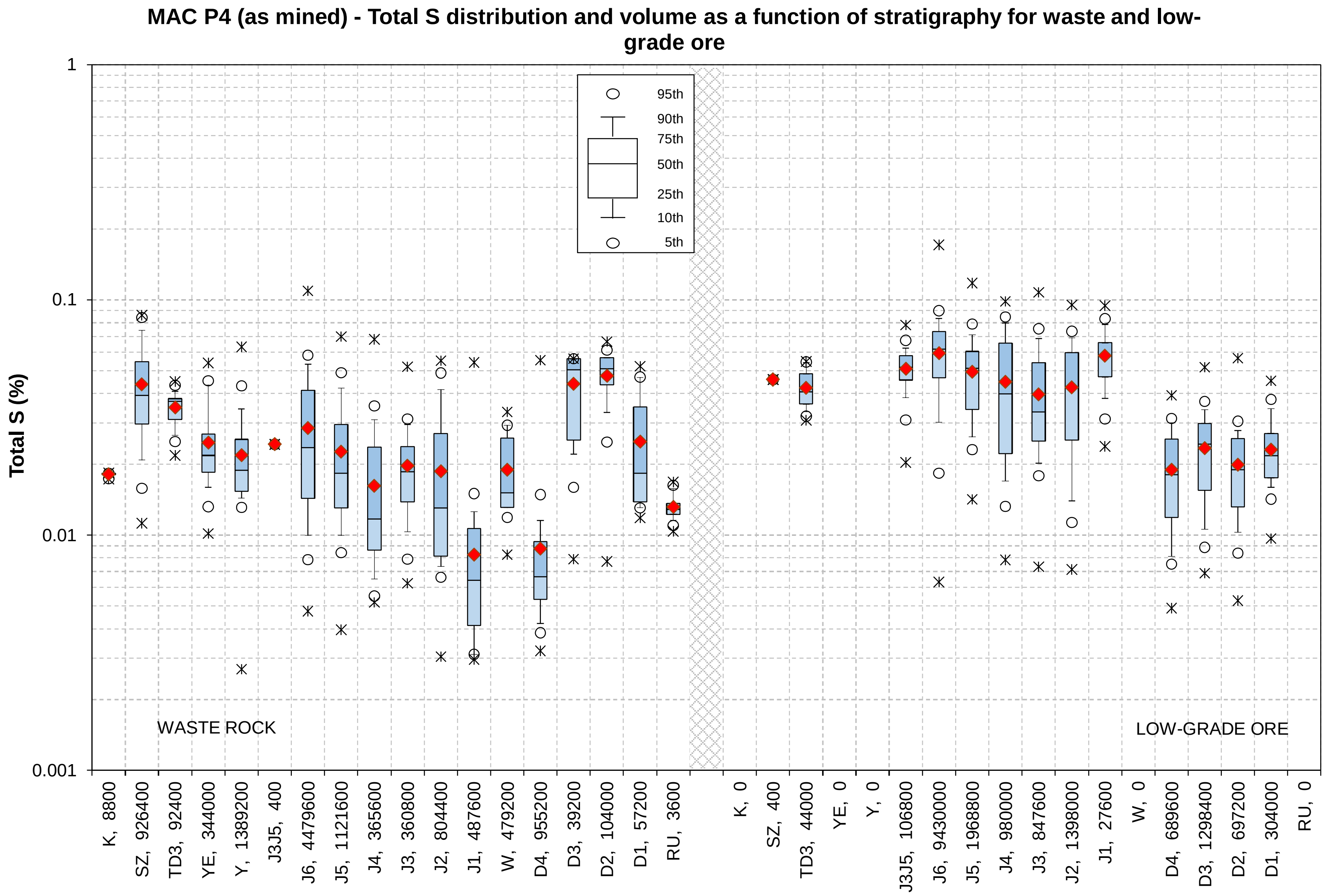


Figure 3-78 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of MAC P4 deposit (the volume in m[3] of each stratigraphic unit is reported next to the rock type ID)

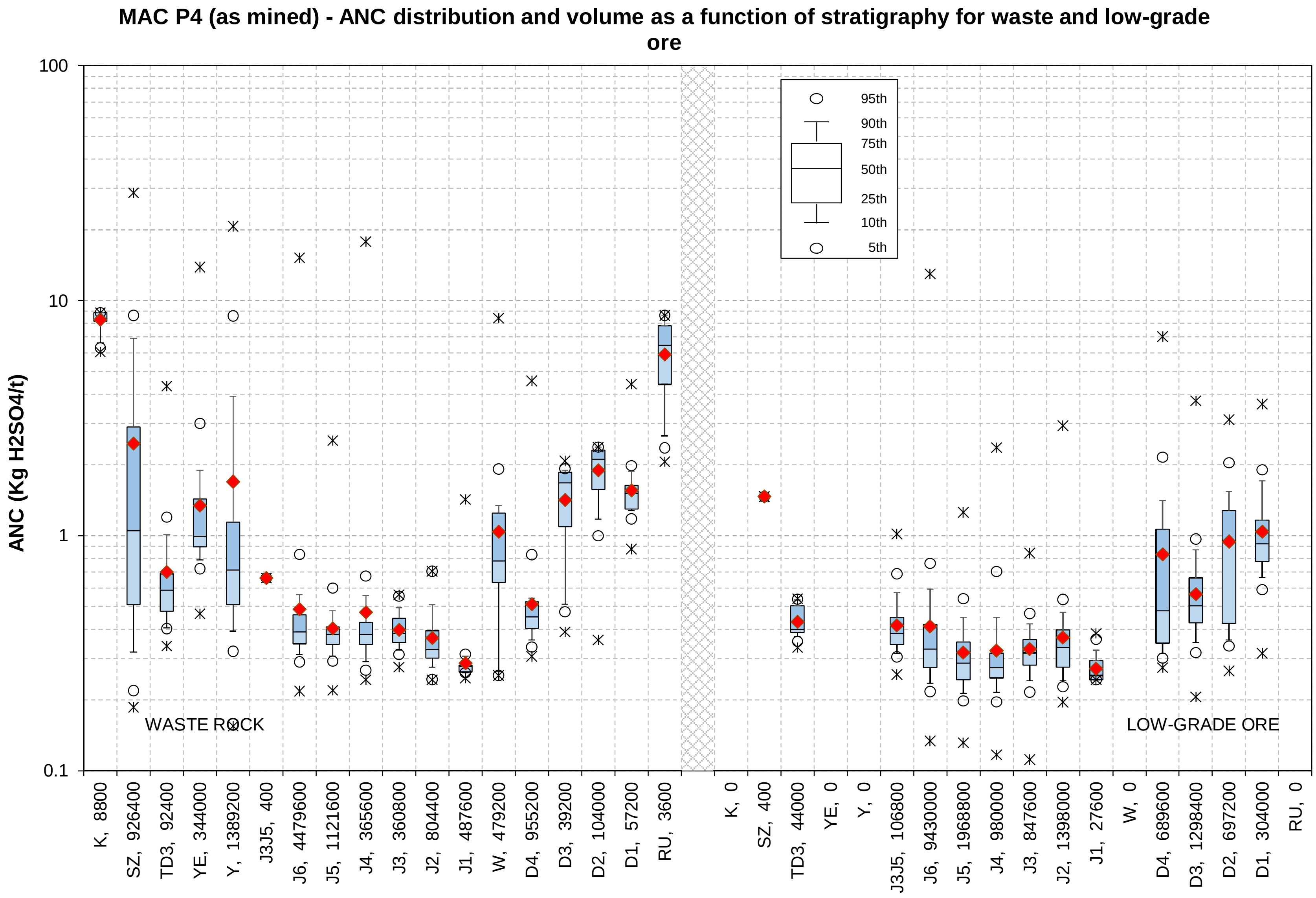


Figure 3-79 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of MAC P4 deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-62 MAC P4 deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	8,800	0.07%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	926,400	7.71%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	92,400	0.77%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5910 - YE	344,000	2.86%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5900 - Y	1,389,200	11.56%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5870 - J3J5	400	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	4,478,000	37.26%	1,600	100.00%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	1,121,600	9.33%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	365,600	3.04%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	360,800	3.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	804,400	6.69%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	487,600	4.06%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	479,200	3.99%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	955,200	7.95%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	39,200	0.33%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	104,000	0.87%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	57,200	0.48%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5440 - RU	3,600	0.03%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**12,017,600**	**100.00%**	**1,600**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.99%**		**0.01%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	400	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	44,000	0.25%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5910 - YE	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5900 - Y	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5870 - J3J5	106,800	0.61%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	9,271,600	52.60%	158,400	94.74%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	1,962,400	11.13%	6,400	3.83%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	980,000	5.56%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	845,200	4.80%	2,400	1.44%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	1,398,000	7.93%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	27,600	0.16%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	689,600	3.91%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	1,298,400	7.37%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	697,200	3.96%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	304,000	1.72%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5440 - RU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**17,625,200**	**100.00%**	**167,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.06%**		**0.94%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-63 MAC P4 deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8200 - K	8,800	0.07%	0	N/A	0	N/A	0	N/A	8,800	0.07%
8150 - SZ	926,400	7.71%	0	N/A	0	N/A	0	N/A	926,400	7.71%
8130 - TD3	92,400	0.77%	0	N/A	0	N/A	0	N/A	92,400	0.77%
5910 - YE	344,000	2.86%	0	N/A	0	N/A	0	N/A	344,000	2.86%
5900 - Y	1,389,200	11.56%	0	N/A	0	N/A	0	N/A	1,389,200	11.56%
5870 - J3J5	400	0.00%	0	N/A	0	N/A	0	N/A	400	0.00%
5860 - J6	4,479,600	37.27%	0	N/A	0	N/A	0	N/A	4,479,600	37.27%
5850 - J5	1,121,600	9.33%	0	N/A	0	N/A	0	N/A	1,121,600	9.33%
5840 - J4	365,600	3.04%	0	N/A	0	N/A	0	N/A	365,600	3.04%
5830 - J3	360,800	3.00%	0	N/A	0	N/A	0	N/A	360,800	3.00%
5820 - J2	804,400	6.69%	0	N/A	0	N/A	0	N/A	804,400	6.69%
5810 - J1	487,600	4.06%	0	N/A	0	N/A	0	N/A	487,600	4.06%
5700 - W	479,200	3.99%	0	N/A	0	N/A	0	N/A	479,200	3.99%
5640 - D4	955,200	7.95%	0	N/A	0	N/A	0	N/A	955,200	7.95%
5630 - D3	39,200	0.33%	0	N/A	0	N/A	0	N/A	39,200	0.33%
5620 - D2	104,000	0.87%	0	N/A	0	N/A	0	N/A	104,000	0.87%
5610 - D1	57,200	0.48%	0	N/A	0	N/A	0	N/A	57,200	0.48%
5440 - RU	3,600	0.03%	0	N/A	0	N/A	0	N/A	3,600	0.03%
5430 - RN	0	0.00%	0	N/A	0	N/A	0	N/A	0	0.00%
Total	**12,019,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**12,019,200**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	400	0.00%	0	N/A	0	0.00%	0	N/A	400	0.00%
8130 - TD3	44,000	0.25%	0	N/A	0	0.00%	0	N/A	44,000	0.25%
5910 - YE	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5900 - Y	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5870 - J3J5	106,800	0.60%	0	N/A	0	0.00%	0	N/A	106,800	0.60%
5860 - J6	9,354,400	52.81%	0	N/A	75,600	96.43%	0	N/A	9,430,000	53.00%
5850 - J5	1,966,000	11.10%	0	N/A	2,800	3.57%	0	N/A	1,968,800	11.07%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5840 - J4	980,000	5.53%	0	N/A	0	0.00%	0	N/A	980,000	5.51%
5830 - J3	847,600	4.78%	0	N/A	0	0.00%	0	N/A	847,600	4.76%
5820 - J2	1,398,000	7.89%	0	N/A	0	0.00%	0	N/A	1,398,000	7.86%
5810 - J1	27,600	0.16%	0	N/A	0	0.00%	0	N/A	27,600	0.16%
5700 - W	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5640 - D4	689,600	3.89%	0	N/A	0	0.00%	0	N/A	689,600	3.88%
5630 - D3	1,298,400	7.33%	0	N/A	0	0.00%	0	N/A	1,298,400	7.30%
5620 - D2	697,200	3.94%	0	N/A	0	0.00%	0	N/A	697,200	3.92%
5610 - D1	304,000	1.72%	0	N/A	0	0.00%	0	N/A	304,000	1.71%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**17,714,000**	**100.00%**	**0**	**N/A**	**78,400**	**100.00%**	**0**	**N/A**	**17,792,400**	**100.00%**
% of Total	**99.56%**		**0.00%**		**0.44%**		**0.00%**		**100.00%**	

Table 3-64 MAC P4 deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	12,019,200	0	12,019,200	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**12,019,200**	**0**	**12,019,200**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	17,714,000	0	17,714,000	99.56%
1	0	0	0	0.00%
2	78,400	0	78,400	0.44%
3	0	0	0	0.00%
Total	**17,792,400**	**0**	**17,792,400**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

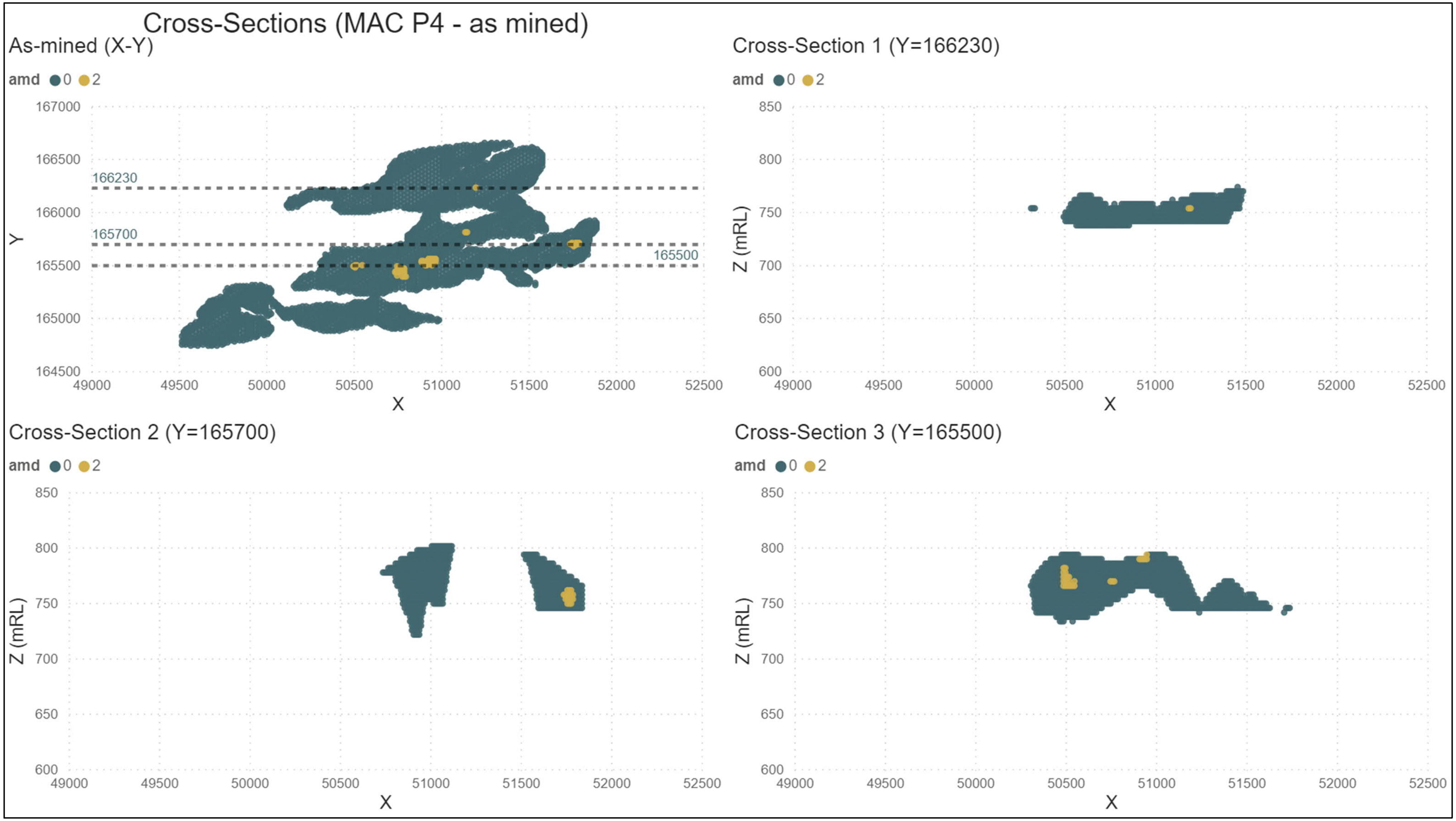


Figure 3-80 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by MAC P4 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.13.2 MAC P4 deposit (to-be-mined waste)

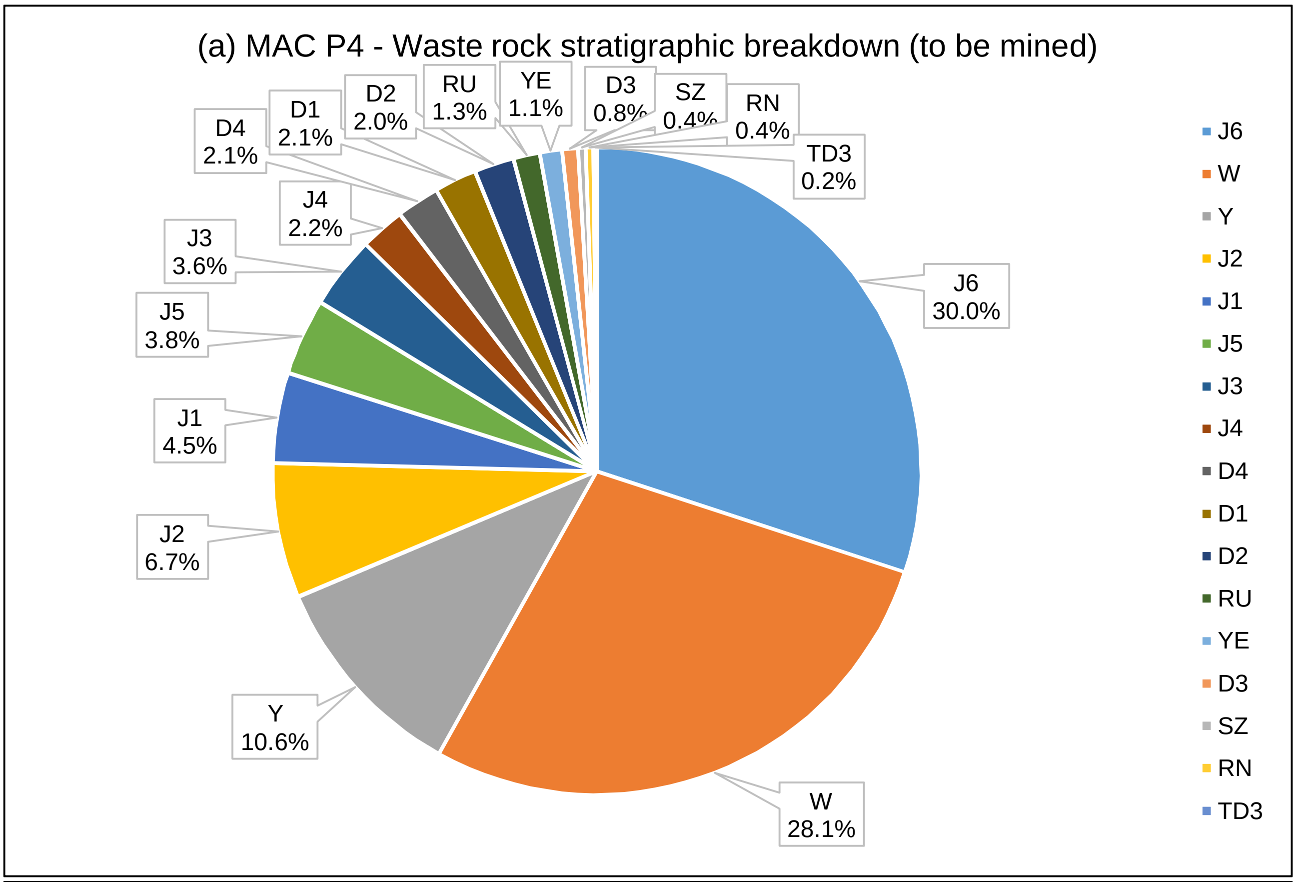
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P4 deposit as a function of stratigraphic unit is shown in Figure 3-81. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P4 deposit are shown in Figure 3-82 and Figure 3-83, respectively.

Table 3-65 presents to-be-mined waste volume from P4 deposit split by total sulphur content per stratigraphy. Table 3-66 and Table 3-67 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P4 deposit is presented in Figure 3-84.

The key attributes are listed as follows:

- To-be-mined waste rock from P4 deposit is mainly sourced from Joffre Member (51.0%, incl. J6, J2, J1, J5, J3 and J4) and Whaleback Shale (28.1% W), with minor contribution from Yandicoogina Shale Member (11.6% Y and YE), Dales Gorge Member (7.0%, incl. D4, D1, D2 and D3), Mt McRae Shale (1.7%, incl. RU and RN) and Tertiary Detritals (0.6% SZ andTD3). To-be-mined low-grade ore is dominated by Joffre Member (71.2%, incl. J2, J6, J1, J3, J5 and J4) and Dales Gorge Member (28.8%, incl. D3, D2, D4 and D1), with negligible portion from Tertiary Detritals (0.001% TD3).
- To-be-mined waste rock and low-grade ore show very low sulphur concentration with the 95th percentile values below 0.1 wt% and the median values below or close to 0.06 wt% (Figure 3-74, Table 3-65). Mt McRae Shale waste rock blocks have maximum sulphur value below 0.03 wt%.
- Very low sulphur blocks (<0.1%) comprise 99.42% of to-be-mined waste rock and 99.67% of to-be-mined low-grade ore volume (Table 3-65). Low sulphur blocks (0.1-0.2%) comprise 0.07% of to-be-mined waste rock and 0.33% of to-be-mined low-grade ore volume. Only 0.51% to-be-mined waste rock have total sulphur content in the range of 0.2-0.5 wt% and no waste blocks show total sulphur above 0.5 wt%.
- To-be-mined waste rock and low-grade ore generally have low ANC with the 95th percentile values below or well below 10 kg H_2SO_4/t and the majority of stratigraphic units show median values below or near 0.5 kg H_2SO_4/t (Figure 3-83).
- A total volume of 56,279,200 m^3 (incl. 27,818,800 m^3 waste rock and 28,460,400 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P4 deposit, representing 99.98% of to-be-mined waste rock and 99.78% of to-be-mined low-grade ore.
- No AMD1 or AMD3 waste (waste rock and low-grade ore) is predicted to be mined from MAC P4 deposit.
- A total volume of 70,400 m^3 (incl. 6,800 m^3 to-be-mined waste rock and 63,600 m^3 to-be-mined low-grade ore) are classed as AMD2, representing 0.02% of to-be-mined waste rock and 0.22% of to-be-mined low-grade ore (Table 3-66).
- Approximately 99.99% of waste rock and 99.98% of low-grade ore are predicted to be mined from above water table (Table 3-67).



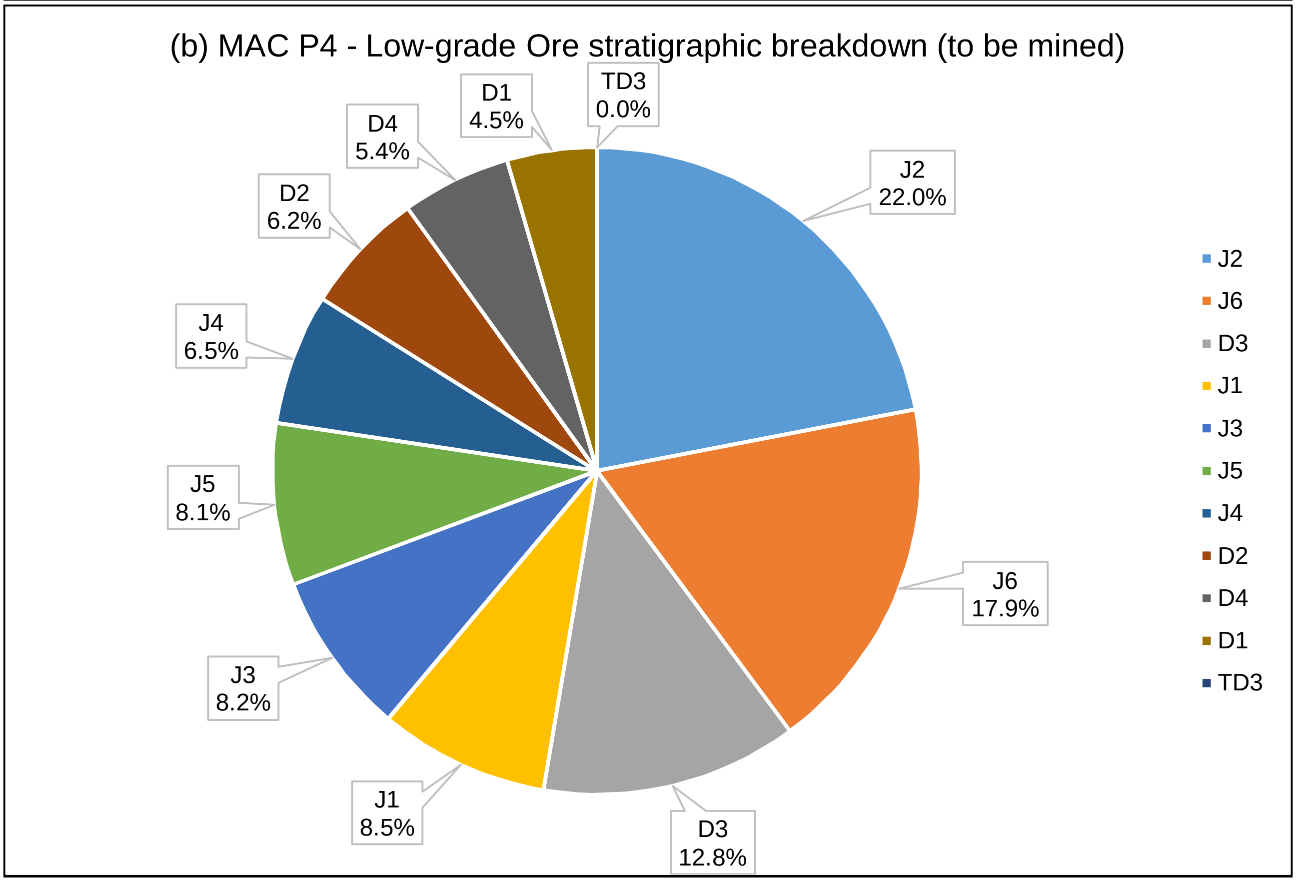


Figure 3-81 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P4 deposit mining model

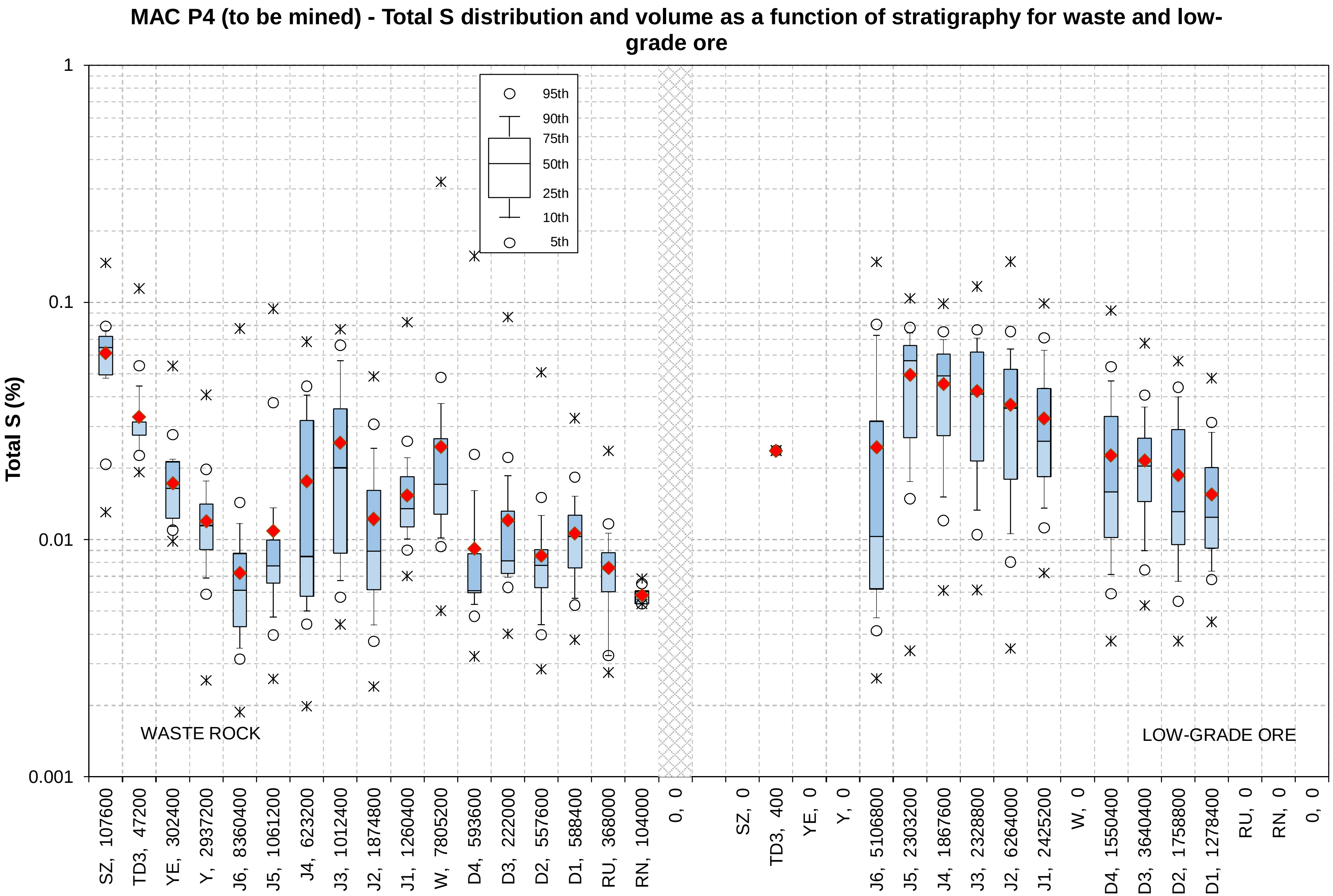


Figure 3-82 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P4 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

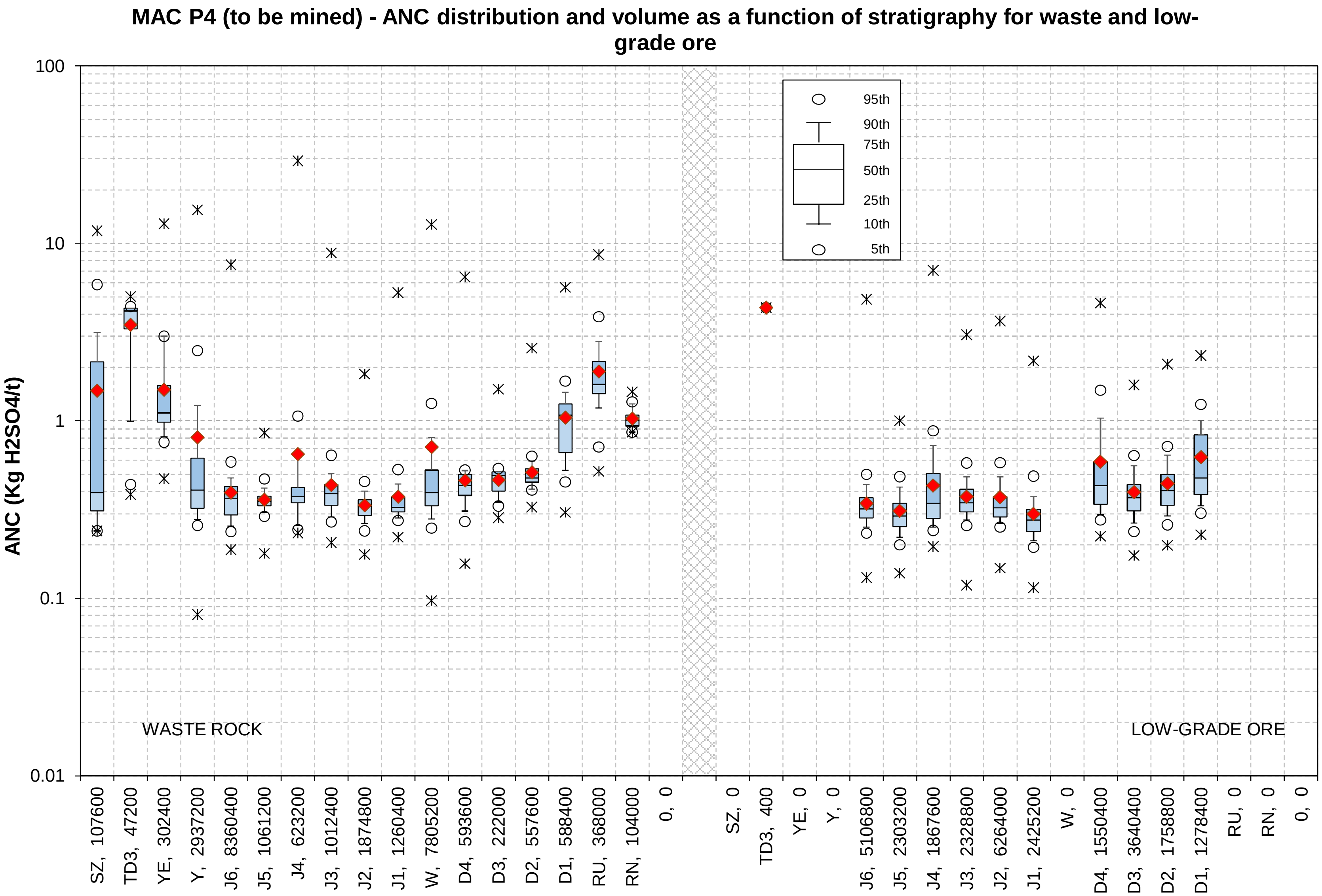


Figure 3-83 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P4 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-65 MAC P4 deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8200 - K	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	105,600	0.38%	2,000	10.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8130 - TD3	46,800	0.17%	400	2.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5910 - YE	302,400	1.09%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5900 - Y	2,937,200	10.62%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5870 - J3J5	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5860 - J6	8,360,400	30.22%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5850 - J5	1,061,200	3.84%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5840 - J4	623,200	2.25%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5830 - J3	1,012,400	3.66%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5820 - J2	1,874,800	6.78%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5810 - J1	1,260,400	4.56%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5700 - W	7,648,000	27.65%	16,000	80.00%	124,000	100.00%	17,200	100.00%	0	N/A	0	N/A
5640 - D4	592,000	2.14%	1,600	8.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5630 - D3	222,000	0.80%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5620 - D2	557,600	2.02%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5610 - D1	588,400	2.13%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5440 - RU	368,000	1.33%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
5430 - RN	104,000	0.38%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**27,664,400**	**100.00%**	**20,000**	**100.00%**	**124,000**	**100.00%**	**17,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.42%**		**0.07%**		**0.45%**		**0.06%**		**0.00%**		**0.00%**	
Low grade ore												
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	400	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5910 - YE	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5900 - Y	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5870 - J3J5	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	5,053,200	17.77%	53,600	56.78%	0	N/A	0	N/A	0	N/A	0	N/A
5850 - J5	2,300,400	8.09%	2,800	2.97%	0	N/A	0	N/A	0	N/A	0	N/A
5840 - J4	1,867,600	6.57%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5830 - J3	2,318,800	8.16%	10,000	10.59%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	6,236,000	21.93%	28,000	29.66%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	2,425,200	8.53%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	1,550,400	5.45%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	3,640,400	12.80%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	1,758,800	6.19%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	1,278,400	4.50%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%
5440 - RU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5430 - RN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**28,429,600**	**100.00%**	**94,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.67%**		**0.33%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-66 MAC P4 deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%	Volume (m³)	%
Waste rock										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	107,600	0.39%	0	N/A	0	0.00%	0	N/A	107,600	0.39%
8130 - TD3	47,200	0.17%	0	N/A	0	0.00%	0	N/A	47,200	0.17%
5910 - YE	302,400	1.09%	0	N/A	0	0.00%	0	N/A	302,400	1.09%
5900 - Y	2,937,200	10.56%	0	N/A	0	0.00%	0	N/A	2,937,200	10.56%
5870 - J3J5	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5860 - J6	8,360,400	30.05%	0	N/A	0	0.00%	0	N/A	8,360,400	30.05%
5850 - J5	1,061,200	3.81%	0	N/A	0	0.00%	0	N/A	1,061,200	3.81%
5840 - J4	623,200	2.24%	0	N/A	0	0.00%	0	N/A	623,200	2.24%
5830 - J3	1,012,400	3.64%	0	N/A	0	0.00%	0	N/A	1,012,400	3.64%
5820 - J2	1,874,800	6.74%	0	N/A	0	0.00%	0	N/A	1,874,800	6.74%
5810 - J1	1,260,400	4.53%	0	N/A	0	0.00%	0	N/A	1,260,400	4.53%
5700 - W	7,798,400	28.03%	0	N/A	6,800	100.00%	0	N/A	7,805,200	28.05%
5640 - D4	593,600	2.13%	0	N/A	0	0.00%	0	N/A	593,600	2.13%
5630 - D3	222,000	0.80%	0	N/A	0	0.00%	0	N/A	222,000	0.80%
5620 - D2	557,600	2.00%	0	N/A	0	0.00%	0	N/A	557,600	2.00%
5610 - D1	588,400	2.12%	0	N/A	0	0.00%	0	N/A	588,400	2.11%
5440 - RU	368,000	1.32%	0	N/A	0	0.00%	0	N/A	368,000	1.32%
5430 - RN	104,000	0.37%	0	N/A	0	0.00%	0	N/A	104,000	0.37%
Total	**27,818,800**	**100.00%**	**0**	**N/A**	**6,800**	**100.00%**	**0**	**N/A**	**27,825,600**	**100.00%**
% of Total	**99.98%**		**0.00%**		**0.02%**		**0.00%**		**100.00%**	
Low grade ore										
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8130 - TD3	400	0.00%	0	N/A	0	0.00%	0	N/A	400	0.00%
5910 - YE	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5900 - Y	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5870 - J3J5	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5860 - J6	5,059,200	17.78%	0	N/A	47,600	74.84%	0	N/A	5,106,800	17.90%
5850 - J5	2,303,200	8.09%	0	N/A	0	0.00%	0	N/A	2,303,200	8.07%

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
5840 - J4	1,867,600	6.56%	0	N/A	0	0.00%	0	N/A	1,867,600	6.55%
5830 - J3	2,323,200	8.16%	0	N/A	5,600	8.81%	0	N/A	2,328,800	8.16%
5820 - J2	6,253,600	21.97%	0	N/A	10,400	16.35%	0	N/A	6,264,000	21.96%
5810 - J1	2,425,200	8.52%	0	N/A	0	0.00%	0	N/A	2,425,200	8.50%
5700 - W	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5640 - D4	1,550,400	5.45%	0	N/A	0	0.00%	0	N/A	1,550,400	5.44%
5630 - D3	3,640,400	12.79%	0	N/A	0	0.00%	0	N/A	3,640,400	12.76%
5620 - D2	1,758,800	6.18%	0	N/A	0	0.00%	0	N/A	1,758,800	6.17%
5610 - D1	1,278,400	4.49%	0	N/A	0	0.00%	0	N/A	1,278,400	4.48%
5440 - RU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5430 - RN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**28,460,400**	**100.00%**	**0**	**N/A**	**63,600**	**100.00%**	**0**	**N/A**	**28,524,000**	**100.00%**
% of Total	**99.78%**		**0.00%**		**0.22%**		**0.00%**		**100.00%**	

Table 3-67 MAC P4 deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	27,815,200	3,600	27,818,800	99.98%
1	0	0	0	0.00%
2	6,800	0	6,800	0.02%
3	0	0	0	0.00%
Total	**27,822,000**	**3,600**	**27,825,600**	100.00%
% of Total	**99.99%**	**0.01%**	**100.00%**	
Low grade ore				
0	28,455,200	5,200	28,460,400	99.78%
1	0	0	0	0.00%
2	63,600	0	63,600	0.22%
3	0	0	0	0.00%
Total	**28,518,800**	**5,200**	**28,524,000**	100.00%
% of Total	**99.98%**	**0.02%**	**100.00%**	

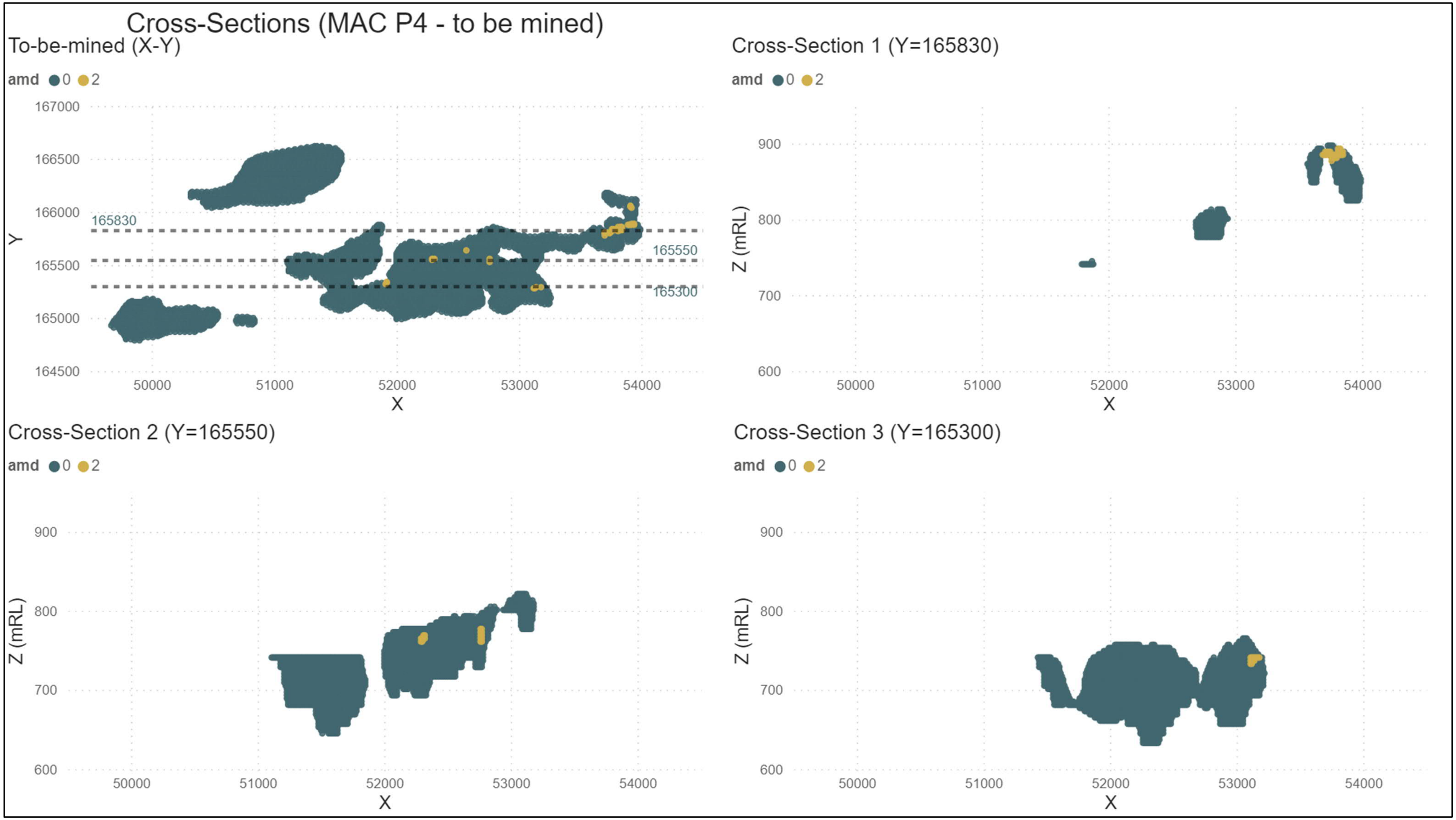


Figure 3-84 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P4 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.14 MAC P5 deposit

3.1.1.14.1 MAC P5 deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P5 deposit as a function of stratigraphic unit is shown in Figure 3-85. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P5 deposit are shown in Figure 3-86 and Figure 3-87, respectively.

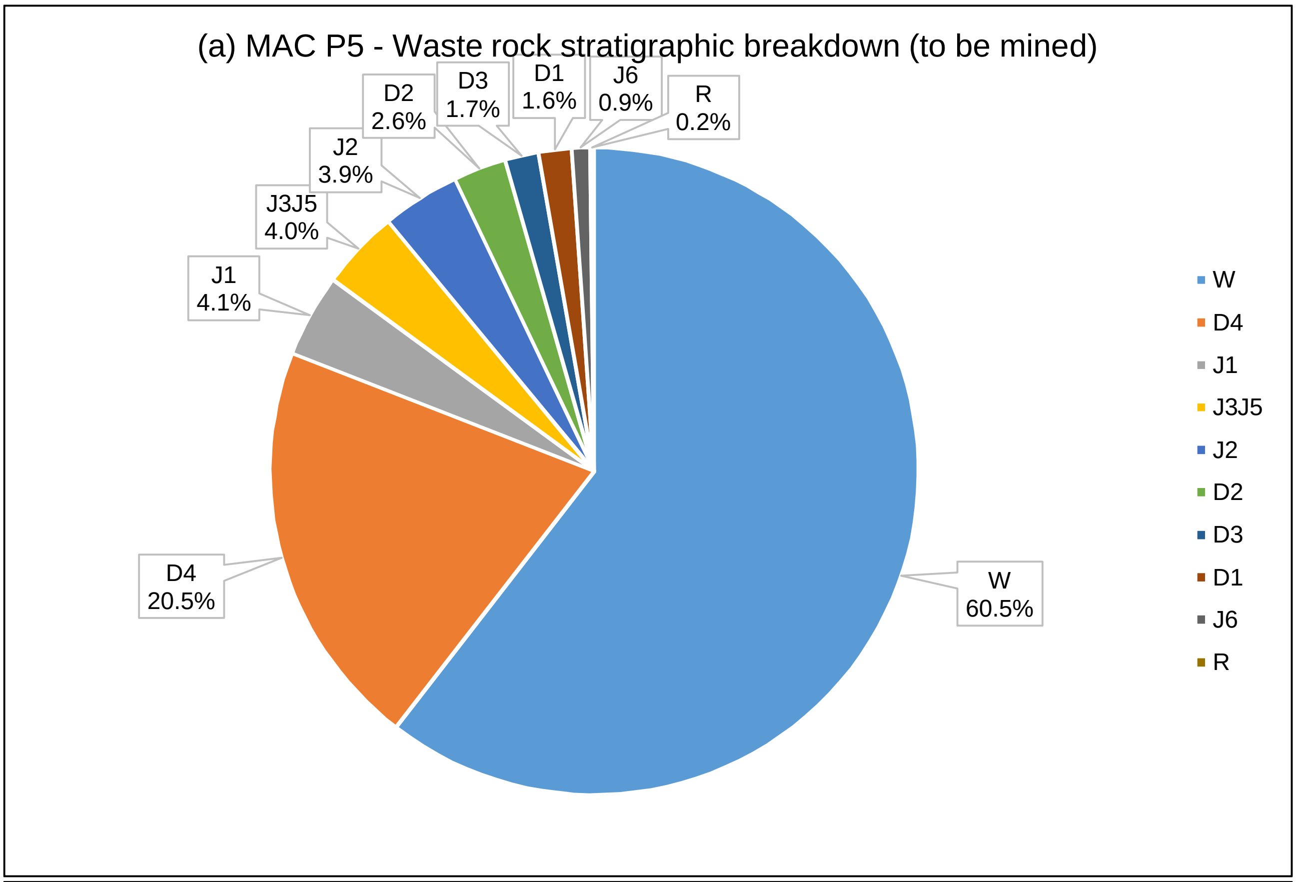
Table 3-68 presents to-be-mined waste volume from P5 deposit split by total sulphur content per stratigraphy. Table 3-69 and Table 3-70 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P5 deposit is presented in Figure 3-88.

The P5 deposit is yet to be mined.

The key attributes are listed as follows:

- To-be-mined waste rock from P5 deposit mainly comprises Whaleback Shale (60.5% W) and Dales Gorge Member (20.5%, incl. D4, D2, D3 and D1), with small contribution from Joffre Member (12.9%, incl. J1, J3J5, J2 and J6) and Mt McRae Shale (0.2% R). To-be-mined low-grade ore is dominated by Dales Gorge Member (52.6%, incl. J2, J3J5, J1 and J6) and Joffre Member (47.4%, incl. D4, D2, D3 and D1), with negligible contribution from Whaleback Shale (0.001%).
- To-be-mined waste rock and low-grade ore have very low sulphur concentration with the 95th percentile values below or close to 0.1 wt% and median value below or close to 0.06 wt% (Figure 3-86, Table 3-68).
- Very low sulphur blocks (<0.1%) comprise 99.51% of to-be-mined waste rock and 97.94% of to-be-mined low-grade ore volume (Table 3-68). Low sulphur blocks (0.1-0.2%) comprise 0.49% of to-be-mined waste rock and 2.06% of to-be-mined low-grade ore volume. No waste blocks show total sulphur above 0.2 wt%.
- To-be-mined waste rock and low-grade ore have low ANC with the 95th percentile values below 10 kg H_2SO_4/t and median values below 0.7 kg H_2SO_4/t (Figure 3-87).
- A total volume of 47,630,700 m^3 (incl. 18,192,000 m^3 waste rock and 29,438,700 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P5 deposit, representing the entire to-be-mined waste rock and 98.58% of to-be-mined low-grade ore.
- No AMD1 or AMD3 waste rock or low-grade ore blocks is predicted to occur in the P5 deposit.
- A total volume of 424,800 m^3 to-be-mined low-grade ore is classed as AMD2, representing 1.42% of to-be-mined low-grade ore, which are predominately associated with Joffre Member (Table 3-69).
- Approximately 99.93% of waste rock and 99.54% of low-grade ore are predicted to be mined from above water table (Table 3-70).



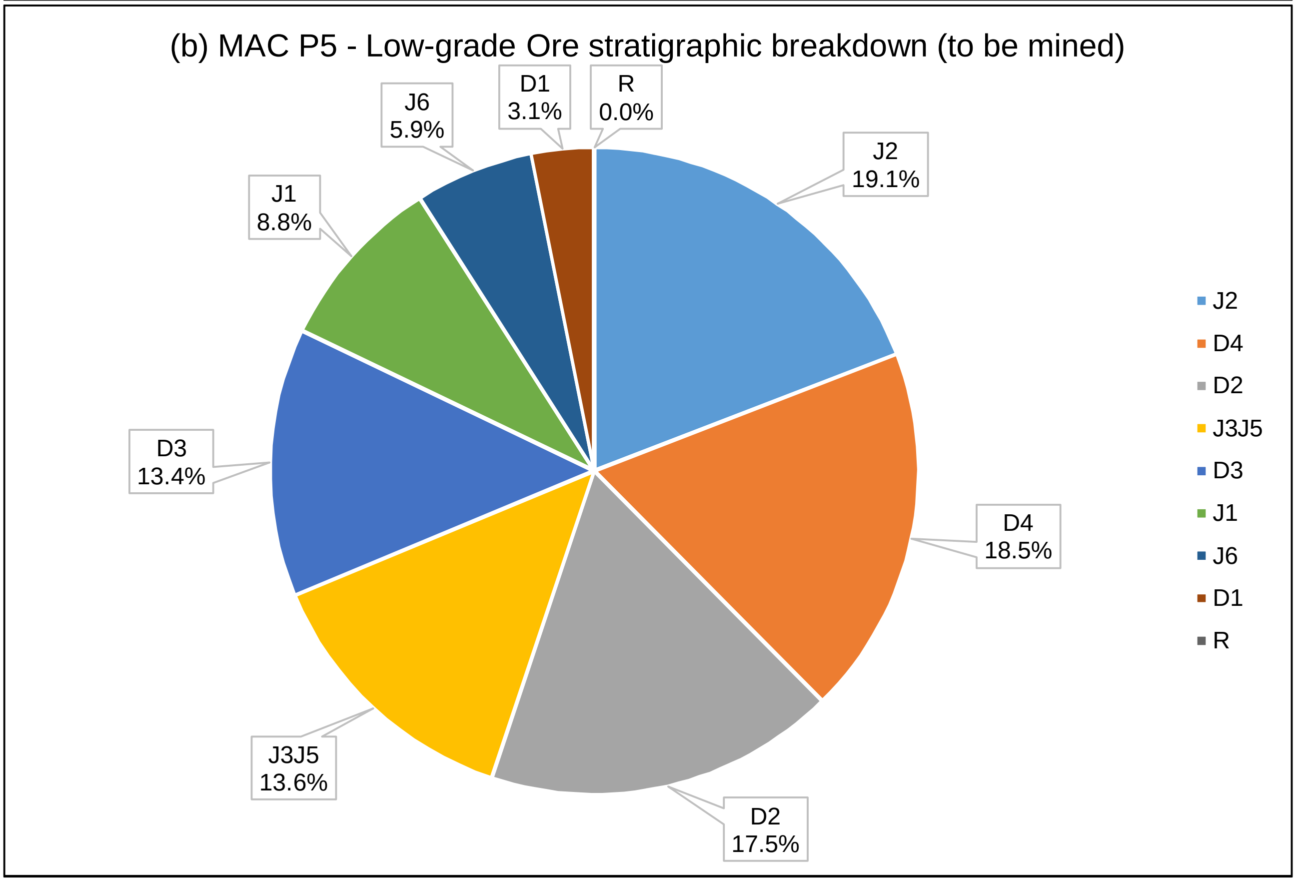


Figure 3-85 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P5 deposit mining model

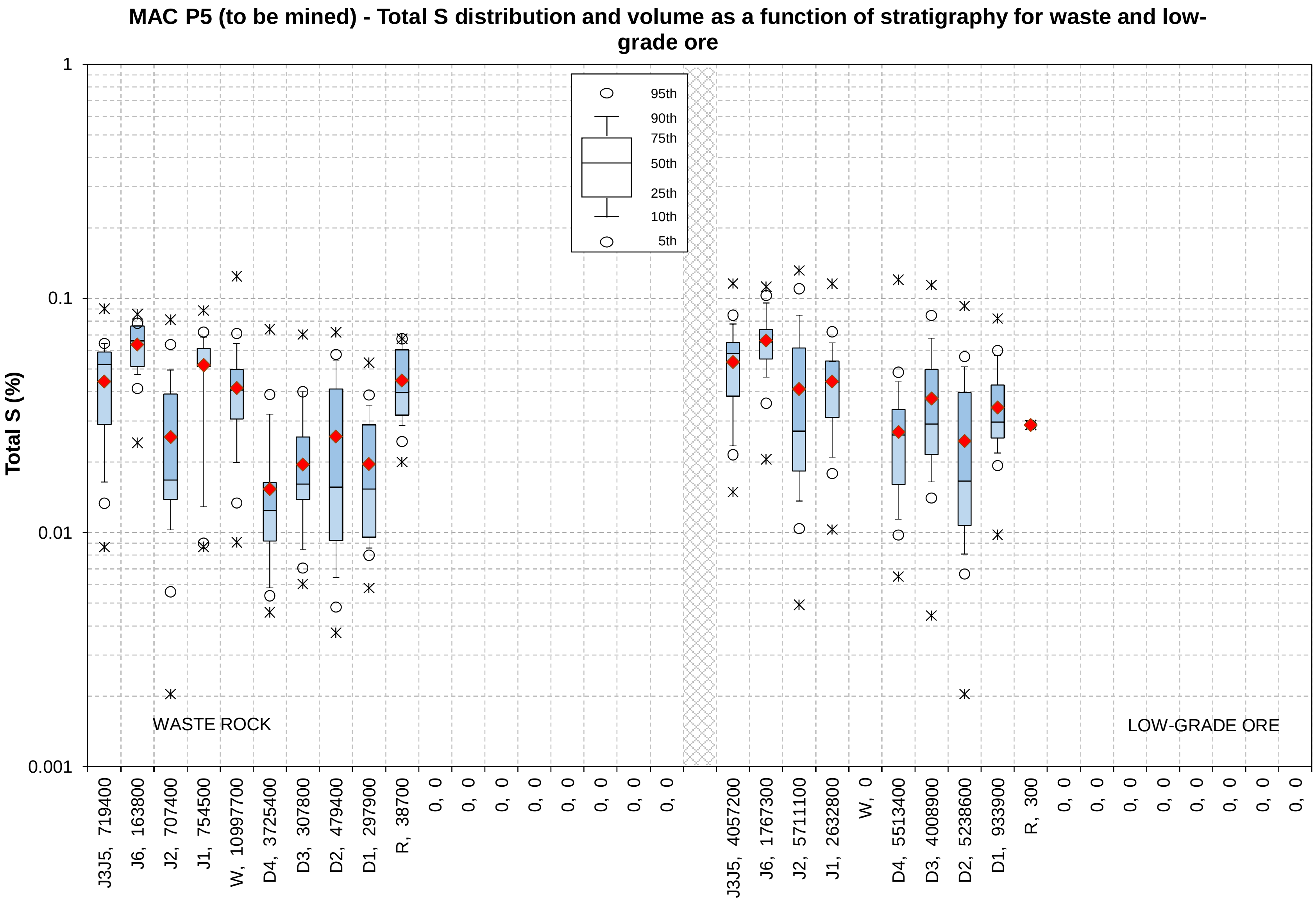


Figure 3-86 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P5 deposit (the volume in m[3] of each stratigraphic unit is reported next to the rock type ID)

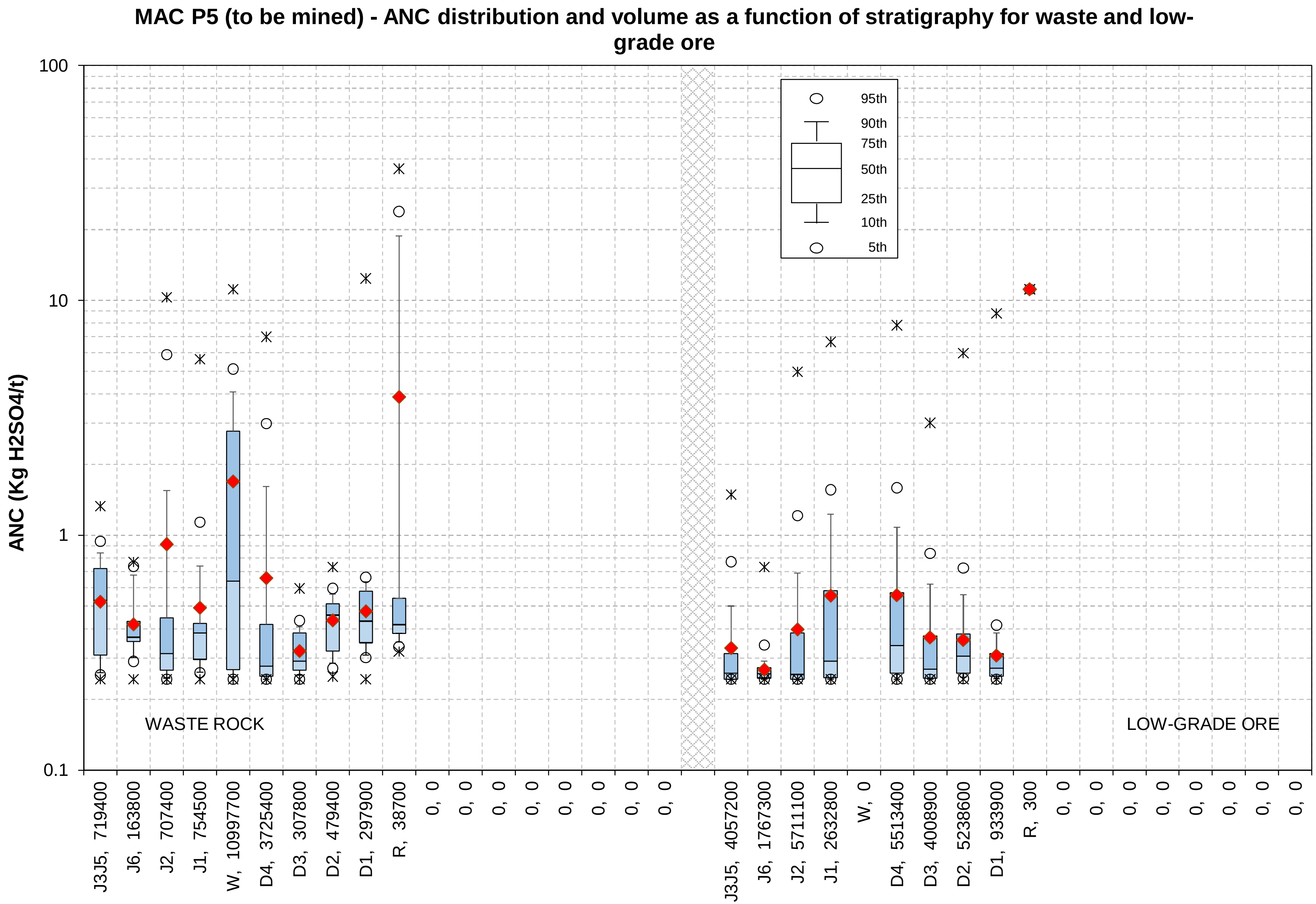


Figure 3-87 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P5 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-68 MAC P5 deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
5870 - J3J5	719,400	3.97%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	163,800	0.90%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	707,400	3.91%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	754,500	4.17%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	10,908,600	60.26%	89,100	100.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	3,725,400	20.58%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	307,800	1.70%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	479,400	2.65%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	297,900	1.65%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5400 - R	38,700	0.21%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**18,102,900**	**100.00%**	**89,100**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.51%**		**0.49%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
5870 - J3J5	4,036,200	13.80%	21,000	3.41%	0	N/A	0	N/A	0	N/A	0	N/A
5860 - J6	1,639,200	5.60%	128,100	20.79%	0	N/A	0	N/A	0	N/A	0	N/A
5820 - J2	5,313,600	18.17%	397,500	64.51%	0	N/A	0	N/A	0	N/A	0	N/A
5810 - J1	2,604,900	8.91%	27,900	4.53%	0	N/A	0	N/A	0	N/A	0	N/A
5700 - W	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5640 - D4	5,512,200	18.85%	1,200	0.19%	0	N/A	0	N/A	0	N/A	0	N/A
5630 - D3	3,968,400	13.57%	40,500	6.57%	0	N/A	0	N/A	0	N/A	0	N/A
5620 - D2	5,238,600	17.91%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5610 - D1	933,900	3.19%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
5400 - R	300	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**29,247,300**	**100.00%**	**616,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**97.94%**		**2.06%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-69 MAC P5 deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
5870 - J3J5	719,400	3.95%	0	N/A	0	N/A	0	N/A	719,400	3.95%
5860 - J6	163,800	0.90%	0	N/A	0	N/A	0	N/A	163,800	0.90%
5820 - J2	707,400	3.89%	0	N/A	0	N/A	0	N/A	707,400	3.89%
5810 - J1	754,500	4.15%	0	N/A	0	N/A	0	N/A	754,500	4.15%
5700 - W	10,997,700	60.45%	0	N/A	0	N/A	0	N/A	10,997,700	60.45%
5640 - D4	3,725,400	20.48%	0	N/A	0	N/A	0	N/A	3,725,400	20.48%
5630 - D3	307,800	1.69%	0	N/A	0	N/A	0	N/A	307,800	1.69%
5620 - D2	479,400	2.64%	0	N/A	0	N/A	0	N/A	479,400	2.64%
5610 - D1	297,900	1.64%	0	N/A	0	N/A	0	N/A	297,900	1.64%
5400 - R	38,700	0.21%	0	N/A	0	N/A	0	N/A	38,700	0.21%
Total	**18,192,000**	**100.00%**	0	N/A	0	N/A	0	N/A	**18,192,000**	**100.00%**
% of Total	**100.00%**		0	N/A	0	N/A	0	N/A	**100.00%**	
Low grade ore										
5870 - J3J5	4,041,000	13.73%	0	N/A	16,200	3.81%	0	N/A	4,057,200	13.59%
5860 - J6	1,739,100	5.91%	0	N/A	28,200	6.64%	0	N/A	1,767,300	5.92%
5820 - J2	5,358,000	18.20%	0	N/A	353,100	83.12%	0	N/A	5,711,100	19.12%
5810 - J1	2,625,600	8.92%	0	N/A	7,200	1.69%	0	N/A	2,632,800	8.82%
5700 - W	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5640 - D4	5,513,400	18.73%	0	N/A	0	0.00%	0	N/A	5,513,400	18.46%
5630 - D3	3,988,800	13.55%	0	N/A	20,100	4.73%	0	N/A	4,008,900	13.42%
5620 - D2	5,238,600	17.79%	0	N/A	0	0.00%	0	N/A	5,238,600	17.54%
5610 - D1	933,900	3.17%	0	N/A	0	0.00%	0	N/A	933,900	3.13%
5400 - R	300	0.00%	0	N/A	0	0.00%	0	N/A	300	0.00%
Total	**29,438,700**	**100.00%**	0	N/A	**424,800**	**100.00%**	0	N/A	**29,863,500**	**100.00%**
% of Total	**98.58%**		0	N/A	**1.42%**		0	N/A	**100.00%**	

Table 3-70 MAC P5 deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	18,179,700	12,300	18,192,000	100.00%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	0	0	0.00%
Total	**18,179,700**	**12,300**	**18,192,000**	100.00%
% of Total	**99.93%**	**0.07%**	**100.00%**	
Low grade ore				
0	29,300,700	138,000	29,438,700	98.58%
1	0	0	0	0.00%
2	424,800	0	424,800	1.42%
3	0	0	0	0.00%
Total	**29,725,500**	**138,000**	**29,863,500**	100.00%
% of Total	**99.54%**	**0.46%**	**100.00%**	

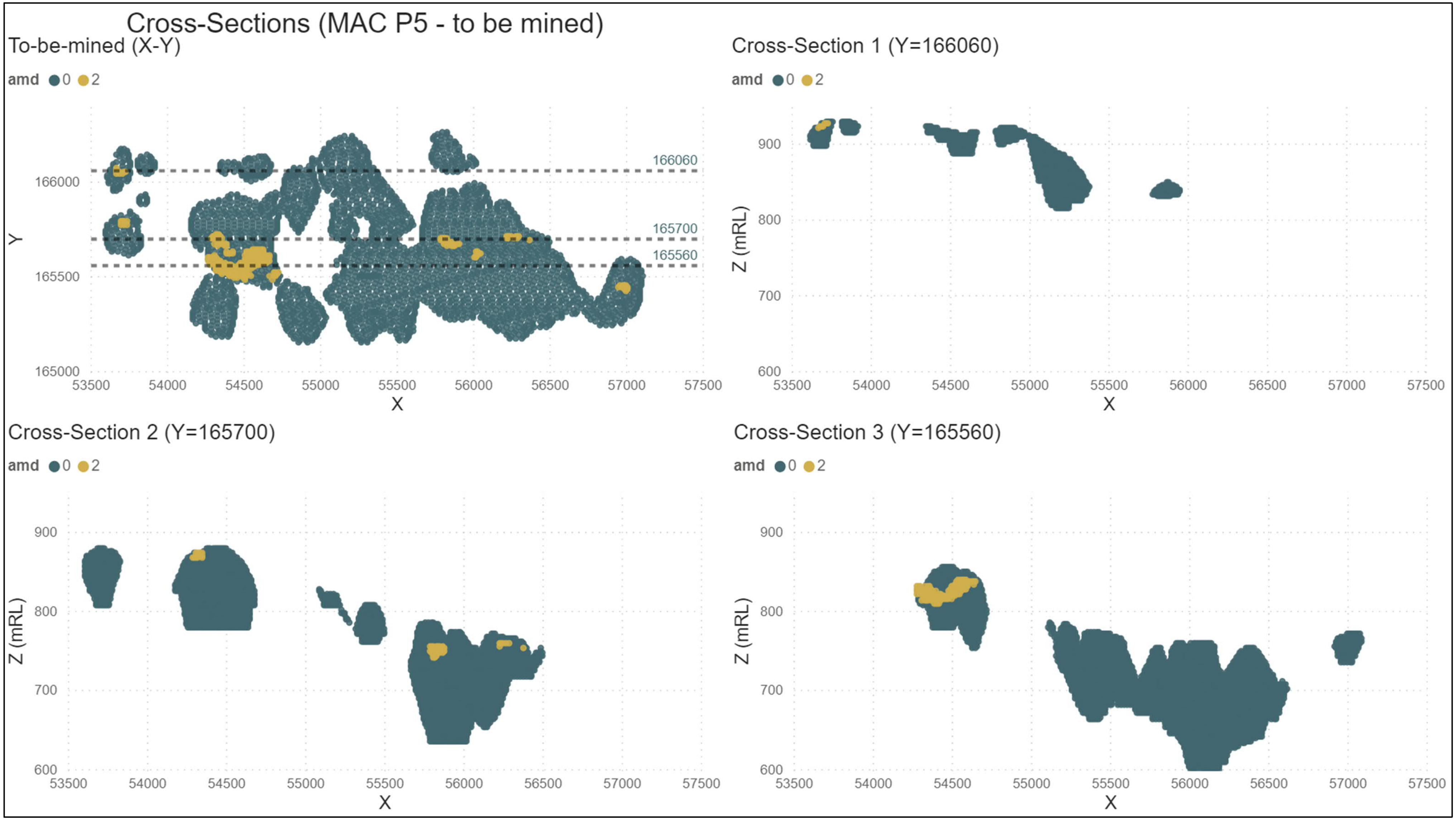


Figure 3-88 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P5 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.15 MAC P6 deposit

3.1.1.15.1 MAC P6 deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from P6 deposit as a function of stratigraphic unit is shown in Figure 3-89. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from P6 deposit are shown in Figure 3-90 and Figure 3-91, respectively.

Table 3-71 presents to-be-mined waste volume from P6 deposit split by total sulphur content per stratigraphy. Table 3-72 and Table 3-73 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the MAC P6 deposit is presented in Figure 3-92.

The P6 deposit is yet to be mined.

The key attributes are listed as follows:

- To-be-mined waste rock from P6 deposit mainly comprises Whaleback Shale (52.9% W), Dales Gorge Member (20.5%, incl. D2, D4, D3 and D1) and Joffre Member (19.3%, incl. J2, J3J5 and J1), with small contribution from Tertiary Detritals (5.5%, incl. TD3, SZ and TD2) and Mt McRae Shale (0.2% R). To-be-mined low-grade ore is dominated by Dales Gorge Member (58.4%, incl. D3, D2, D4 and D1) and Joffre Member (31.2%, incl. J2, J1, J3J5 and J6), with small contribution from Tertiary Detritals (10.3%, incl. TD3, TD2 and SZ) and Whaleback Shale (0.01%).
- To-be-mined waste rock and low-grade ore have very low sulphur concentration with the 95th percentile values below or close to 0.1 wt% and median value below or near 0.06 wt% (Figure 3-90, Table 3-71).
- Very low sulphur blocks (<0.1%) comprise 96.75% of to-be-mined waste rock and 97.02% of to-be-mined low-grade ore volume (Table 3-71). Low sulphur blocks (0.1-0.2%) comprise 2.87% of to-be-mined waste rock and 2.80% of to-be-mined low-grade ore volume. Only 0.30% to-be-mined waste rock and 0.15% of to-be-mined low-grade ore have total sulphur content in the range of 0.2-0.5 wt%, and 0.07% to-be-mined waste rock and 0.03% of to-be-mined low-grade ore have moderate total sulphur content (0.5-1.0 wt%).
- To-be-mined waste rock and low-grade ore have low ANC with the 95th percentile values below 10 kg H_2SO_4/t (Figure 3-91). In particular, stratigraphic units from Joffre Member and Dales Gorge Member are devoid of ANC with the median values below 0.6 kg H_2SO_4/t.
- A total volume of 43,974,400 m^3 (incl. 15,675,200 m^3 waste rock and 28,299,200 m^3 low-grade ore) of AMD0 waste is predicted to be mined from P6 deposit, representing 97.41% of to-be-mined waste rock and 98.24% of to-be-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to be mined from the MAC P6 deposit.
- A total volume of 918,800 m^3 (incl. 417,600 m^3 to-be-mined waste rock and 501,200 m^3 to-be-mined low-grade ore) are classed as AMD2, representing 2.59% of to-be-mined waste rock and 1.74% of to-be-mined low-grade ore (Table 3-72).
- A negligible volume of 6,800 m^3 to-be-mined low-grade ore (TD3 and SZ) is classed as AMD3, comprising 0.02% of to-be-mined low-grade ore from P6 deposit.
- All waste rock and low-grade ore from P6 deposit are predicted to be mined from above water table (Table 3-73).

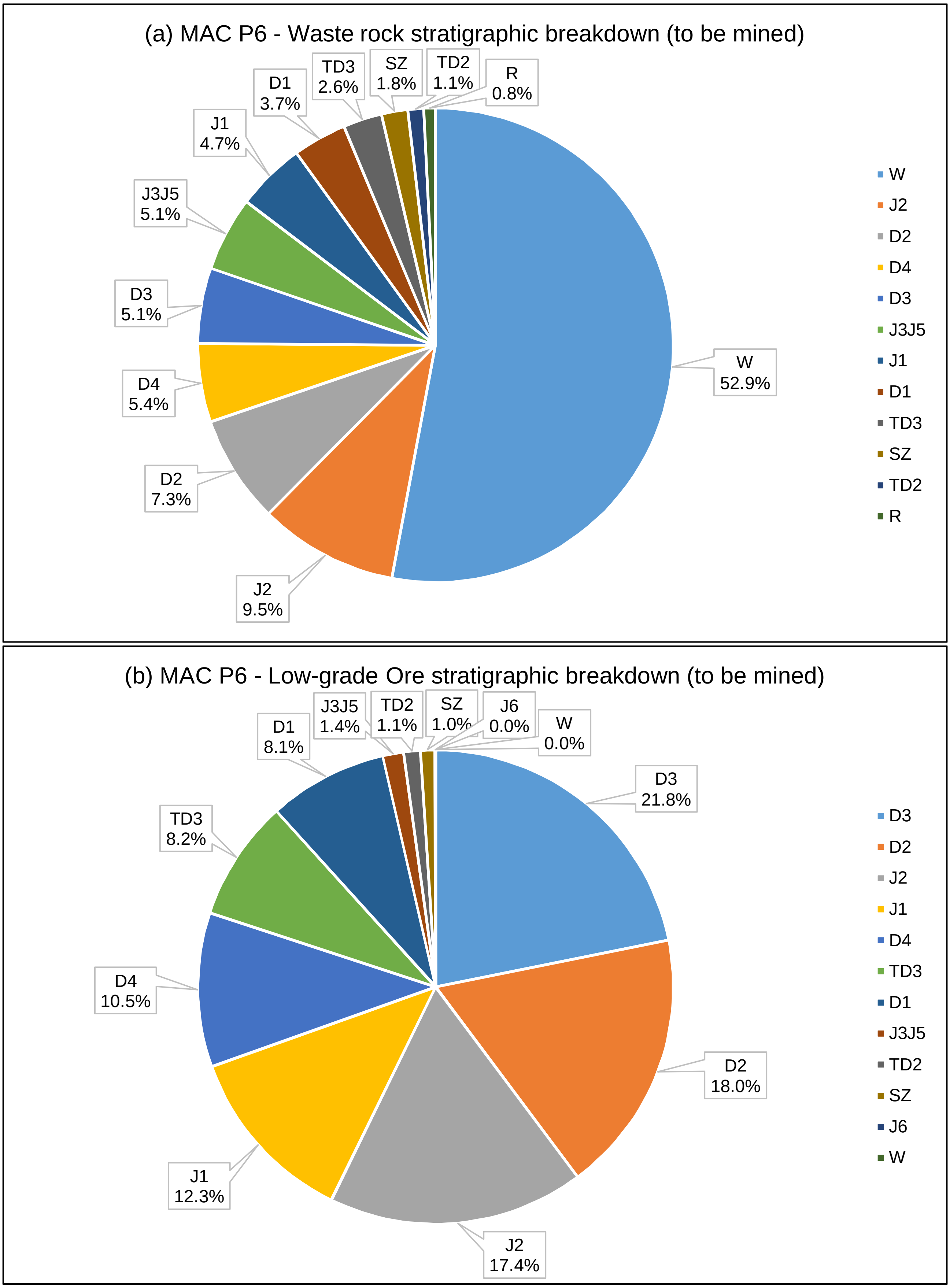


Figure 3-89 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the MAC P6 deposit mining model

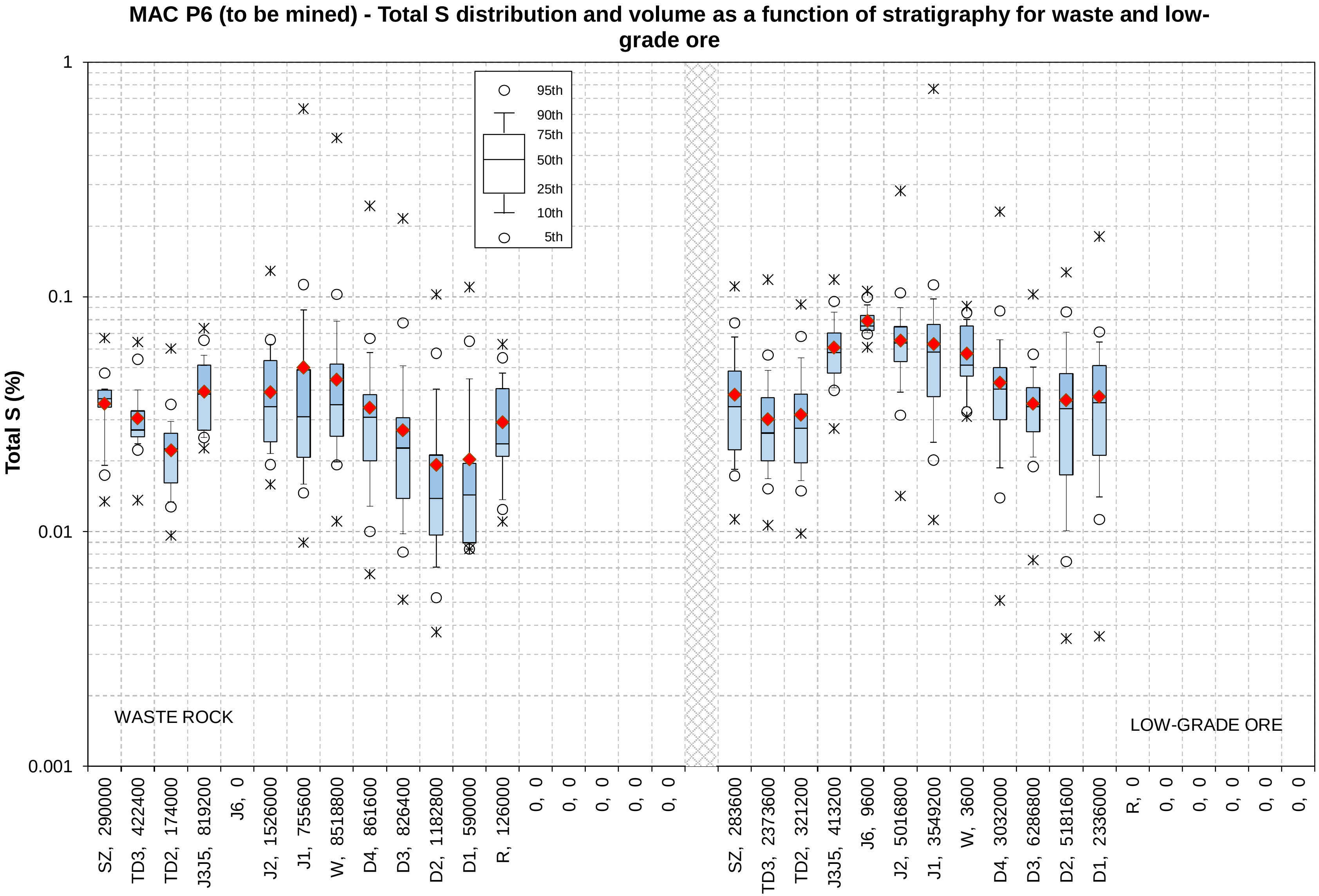


Figure 3-90 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P6 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

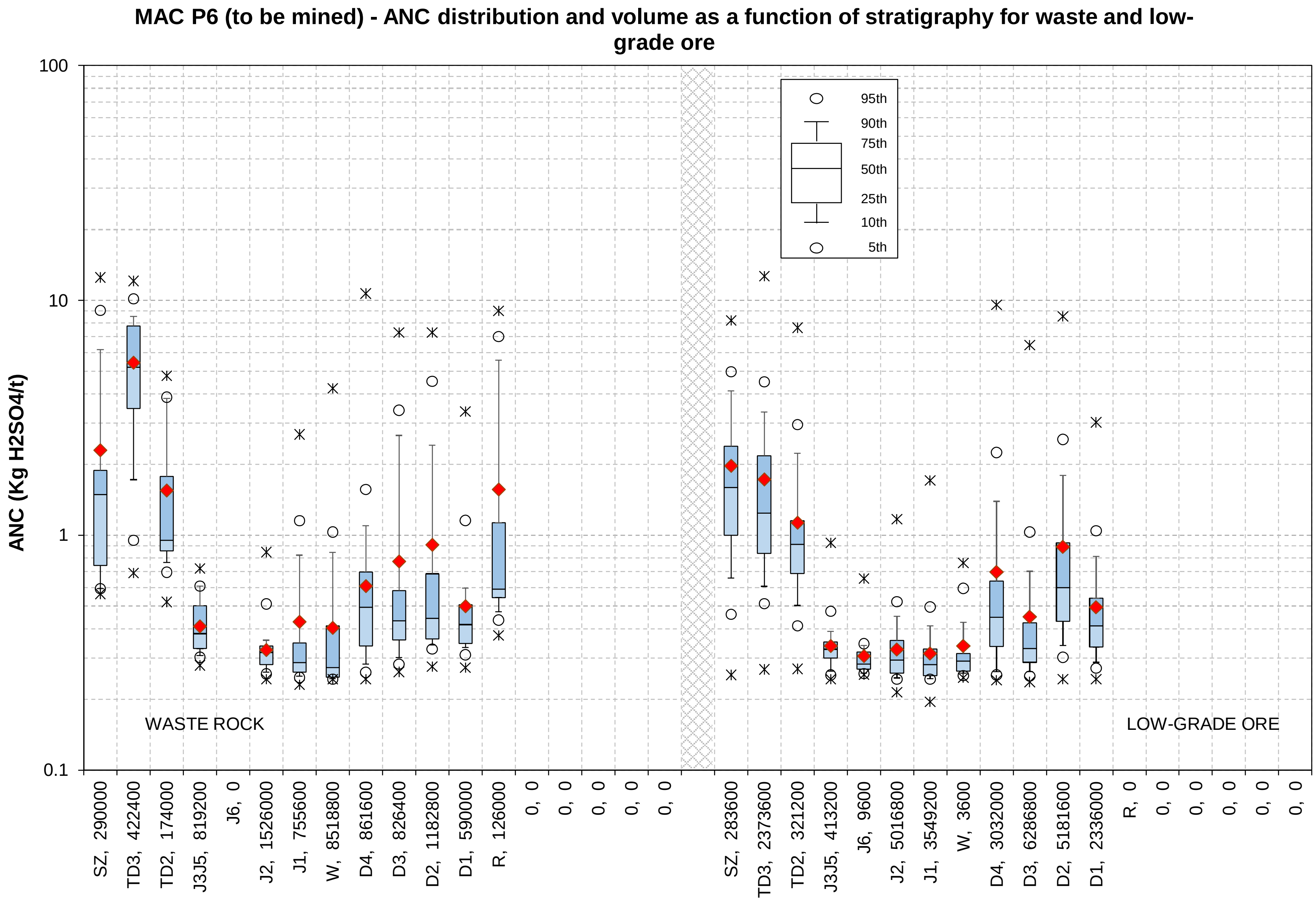


Figure 3-91 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of MAC P6 deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-71 MAC P6 deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
8150 - SZ	290,000	1.86%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	422,400	2.71%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	174,000	1.12%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5870 - J3J5	819,200	5.26%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5860 - J6	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5820 - J2	1,525,600	9.80%	400	0.09%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5810 - J1	702,800	4.51%	32,400	7.01%	6,000	23.08%	2,800	12.28%	11,600	100.00%	0	N/A
5700 - W	8,083,200	51.91%	397,600	86.06%	18,000	69.23%	20,000	87.72%	0	0.00%	0	N/A
5640 - D4	845,200	5.43%	14,800	3.20%	1,600	6.15%	0	0.00%	0	0.00%	0	N/A
5630 - D3	813,600	5.23%	12,400	2.68%	400	1.54%	0	0.00%	0	0.00%	0	N/A
5620 - D2	1,179,600	7.58%	3,200	0.69%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5610 - D1	588,800	3.78%	1,200	0.26%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5400 - R	126,000	0.81%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**15,570,400**	**100.00%**	**462,000**	**100.00%**	**26,000**	**100.00%**	**22,800**	**100.00%**	**11,600**	**100.00%**	**0**	**N/A**
% of Total	**96.75%**		**2.87%**		**0.16%**		**0.14%**		**0.07%**		**0.00%**	
Low grade ore												
8150 - SZ	279,600	1.00%	4,000	0.50%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8130 - TD3	2,368,800	8.48%	4,800	0.59%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8120 - TD2	321,200	1.15%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5870 - J3J5	398,000	1.42%	15,200	1.88%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5860 - J6	8,800	0.03%	800	0.10%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5820 - J2	4,718,000	16.88%	294,000	36.44%	4,800	22.22%	0	0.00%	0	0.00%	0	N/A
5810 - J1	3,226,800	11.55%	277,600	34.41%	14,400	66.67%	22,800	100.00%	7,600	100.00%	0	N/A
5700 - W	3,600	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5640 - D4	2,928,800	10.48%	100,800	12.49%	2,400	11.11%	0	0.00%	0	0.00%	0	N/A
5630 - D3	6,285,600	22.49%	1,200	0.15%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5620 - D2	5,089,600	18.21%	92,000	11.40%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5610 - D1	2,319,600	8.30%	16,400	2.03%	0	0.00%	0	0.00%	0	0.00%	0	N/A
5400 - R	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**27,948,400**	**100.00%**	**806,800**	**100.00%**	**21,600**	**100.00%**	**22,800**	**100.00%**	**7,600**	**100.00%**	**0**	**N/A**
% of Total	**97.02%**		**2.80%**		**0.07%**		**0.08%**		**0.03%**		**0.00%**	

Table 3-72 MAC P6 deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
8150 - SZ	290,000	1.85%	0	N/A	0	0.00%	0	N/A	290,000	1.80%
8130 - TD3	422,400	2.69%	0	N/A	0	0.00%	0	N/A	422,400	2.62%
8120 - TD2	174,000	1.11%	0	N/A	0	0.00%	0	N/A	174,000	1.08%
5870 - J3J5	819,200	5.23%	0	N/A	0	0.00%	0	N/A	819,200	5.09%
5860 - J6	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
5820 - J2	1,526,000	9.74%	0	N/A	0	0.00%	0	N/A	1,526,000	9.48%
5810 - J1	714,800	4.56%	0	N/A	40,800	9.77%	0	N/A	755,600	4.70%
5700 - W	8,156,800	52.04%	0	N/A	362,000	86.69%	0	N/A	8,518,800	52.94%
5640 - D4	861,200	5.49%	0	N/A	400	0.10%	0	N/A	861,600	5.35%
5630 - D3	812,000	5.18%	0	N/A	14,400	3.45%	0	N/A	826,400	5.14%
5620 - D2	1,182,800	7.55%	0	N/A	0	0.00%	0	N/A	1,182,800	7.35%
5610 - D1	590,000	3.76%	0	N/A	0	0.00%	0	N/A	590,000	3.67%
5400 - R	126,000	0.80%	0	N/A	0	0.00%	0	N/A	126,000	0.78%
Total	**15,675,200**	**100.00%**	**0**	N/A	**417,600**	**100.00%**	**0**	N/A	**16,092,800**	**100.00%**
% of Total	**97.41%**		**0.00%**		**2.59%**		**0.00%**		**100.00%**	
Low grade ore										
8150 - SZ	281,200	0.99%	0	N/A	0	0.00%	2,400	35.29%	283,600	0.98%
8130 - TD3	2,369,200	8.37%	0	N/A	0	0.00%	4,400	64.71%	2,373,600	8.24%
8120 - TD2	321,200	1.14%	0	N/A	0	0.00%	0	0.00%	321,200	1.11%
5870 - J3J5	409,600	1.45%	0	N/A	3,600	0.72%	0	0.00%	413,200	1.43%
5860 - J6	9,600	0.03%	0	N/A	0	0.00%	0	0.00%	9,600	0.03%
5820 - J2	4,835,200	17.09%	0	N/A	181,600	36.23%	0	0.00%	5,016,800	17.42%
5810 - J1	3,334,800	11.78%	0	N/A	214,400	42.78%	0	0.00%	3,549,200	12.32%
5700 - W	3,200	0.01%	0	N/A	400	0.08%	0	0.00%	3,600	0.01%
5640 - D4	2,968,800	10.49%	0	N/A	63,200	12.61%	0	0.00%	3,032,000	10.53%
5630 - D3	6,286,400	22.21%	0	N/A	400	0.08%	0	0.00%	6,286,800	21.82%
5620 - D2	5,156,800	18.22%	0	N/A	24,800	4.95%	0	0.00%	5,181,600	17.99%
5610 - D1	2,323,200	8.21%	0	N/A	12,800	2.55%	0	0.00%	2,336,000	8.11%
5400 - R	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
Total	**28,299,200**	**100.00%**	**0**	N/A	**501,200**	**100.00%**	**6,800**	**100.00%**	**28,807,200**	**100.00%**
% of Total	**98.24%**		**0.00%**		**1.74%**		**0.02%**		**100.00%**	

Table 3-73 MAC P6 deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	15,675,200	0	15,675,200	97.41%
1	0	0	0	0.00%
2	417,600	0	417,600	2.59%
3	0	0	0	0.00%
Total	**16,092,800**	**0**	**16,092,800**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	28,299,200	0	28,299,200	98.24%
1	0	0	0	0.00%
2	501,200	0	501,200	1.74%
3	6,800	0	6,800	0.02%
Total	**28,807,200**	**0**	**28,807,200**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

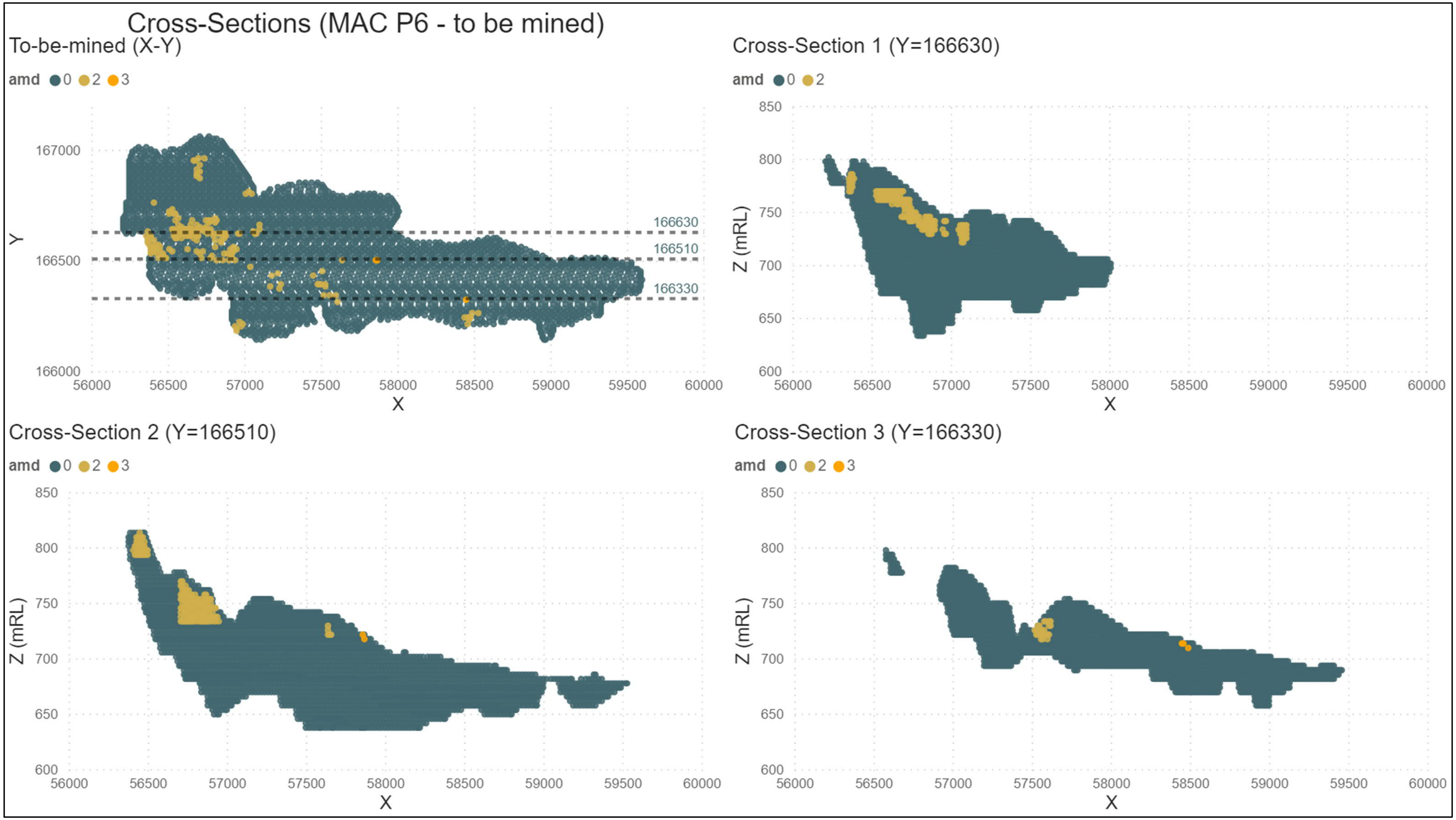


Figure 3-92 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by MAC P6 deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.16 SF Highway deposit

3.1.1.16.1 SF Highway deposit (as-mined waste)

A pie chart showing the distribution of as-mined waste rock and low-grade ore from SF Highway deposit as a function of stratigraphic unit is shown in Figure 3-93Figure 3-9. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from Highway deposit are shown in Figure 3-94 and Figure 3-95

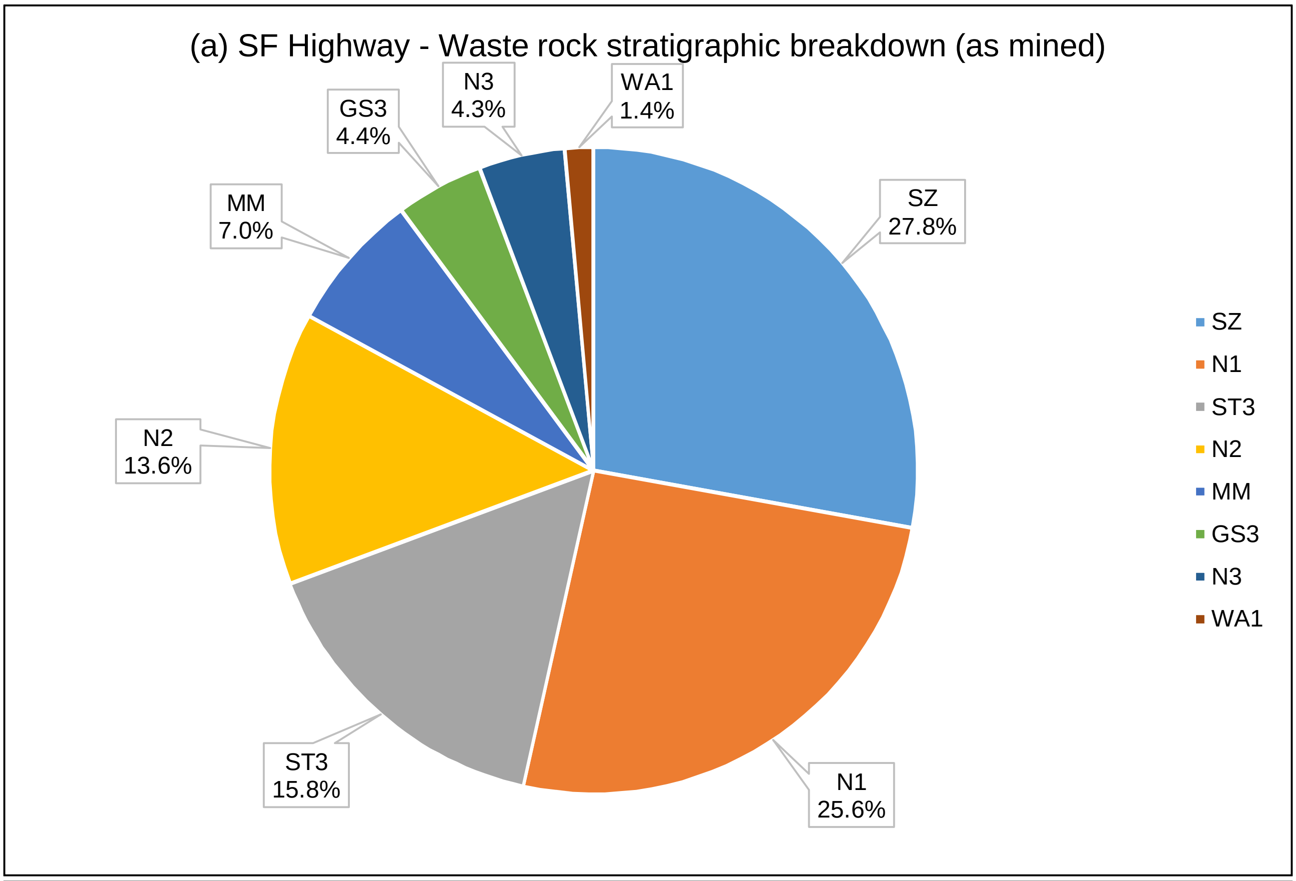
Figure 3-27, respectively.

Table 3-74 presents as-mined waste volume from SF Highway deposit split by total sulphur content per stratigraphy. Table 3-75 and Table 3-76 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the Highway deposit is presented in Figure 3-96.

The key findings are presented as follows:

- As-mined waste rock from Highway deposit is evenly split between Tertiary Detritals (48.0%, incl. SZ, ST3 and GS3) and Marra Mamba Iron Formation (50.5%, incl. N1, N2, MM and N3) with minor contribution from Wittenoom Formation (1.4% WA1). The majority of as-mined low-grade ore is sourced from Marra Mamba Iron Formation (75.2%, incl., N2, N1, N3 and MM) with smaller portion from Tertiary Detritals (23.8% GS3 and SZ) and Wittenoom Formation (1.0% WA1).
- As-mined waste rock and low-grade ore generally show low sulphur concentration with the maximum values below 0.2 wt% and the 75th percentile values below or near 0.1 wt% (Figure 3-94, Table 3-74). WA1 waste rock and N1/MM low-grade ore stratigraphic units show slightly total S concentrations compared to other materials, having median values close to 0.1%S compared to
- Very low sulphur blocks (<0.1%) comprise 99.24% of as-mined waste rock and 77.21% of low-grade ore volume (Table 3-74). Low sulphur blocks (0.1-0.2%) comprise 0.76% of as-mined waste rock and 22.79% of low-grade ore volume. No waste blocks show total sulphur above 0.2 wt%.
- As-mined waste rock and low-grade ore have typically low ANC with the 90th percentile values below or close to 10 kg H_2SO_4/t. The exception is for N3 waste rock that show relatively higher ANC values with a median value of 16.4 kg H_2SO_4/t and a 90th percentile value of 23.4 kg H_2SO_4/t (Figure 3-95).
- A total volume of 1,093,600 m^3 (incl. 417,600 m^3 waste rock and 676,000 m^3 low-grade ore) of AMD0 waste has been mined out from Highway deposit, comprising 99.52% of as-mined waste rock and 81.09% of as-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to have been mined out from the Highway deposit.
- A total volume of 122,800 m^3 (incl. 2,000 m^3 as-mined waste rock and 120,800 m^3 as-mined low-grade ore) is classed as AMD2, comprising 0.48% of as-mined waste rock and 14.49% of as-mined low-grade ore, which is mainly associated with Marra Mamba Iron Formation (Table 3-75).
- A total volume of 36,800 m^3 as-mined low-grade ore is classed as AMD3, which is from GS3, SZ and N2 stratigraphies, comprising 4.41% of as-mined low-grade ore volume.
- All materials mined-out (waste rock and low-grade ore) from Highway deposit are sourced from above the water table (Table 3-76).



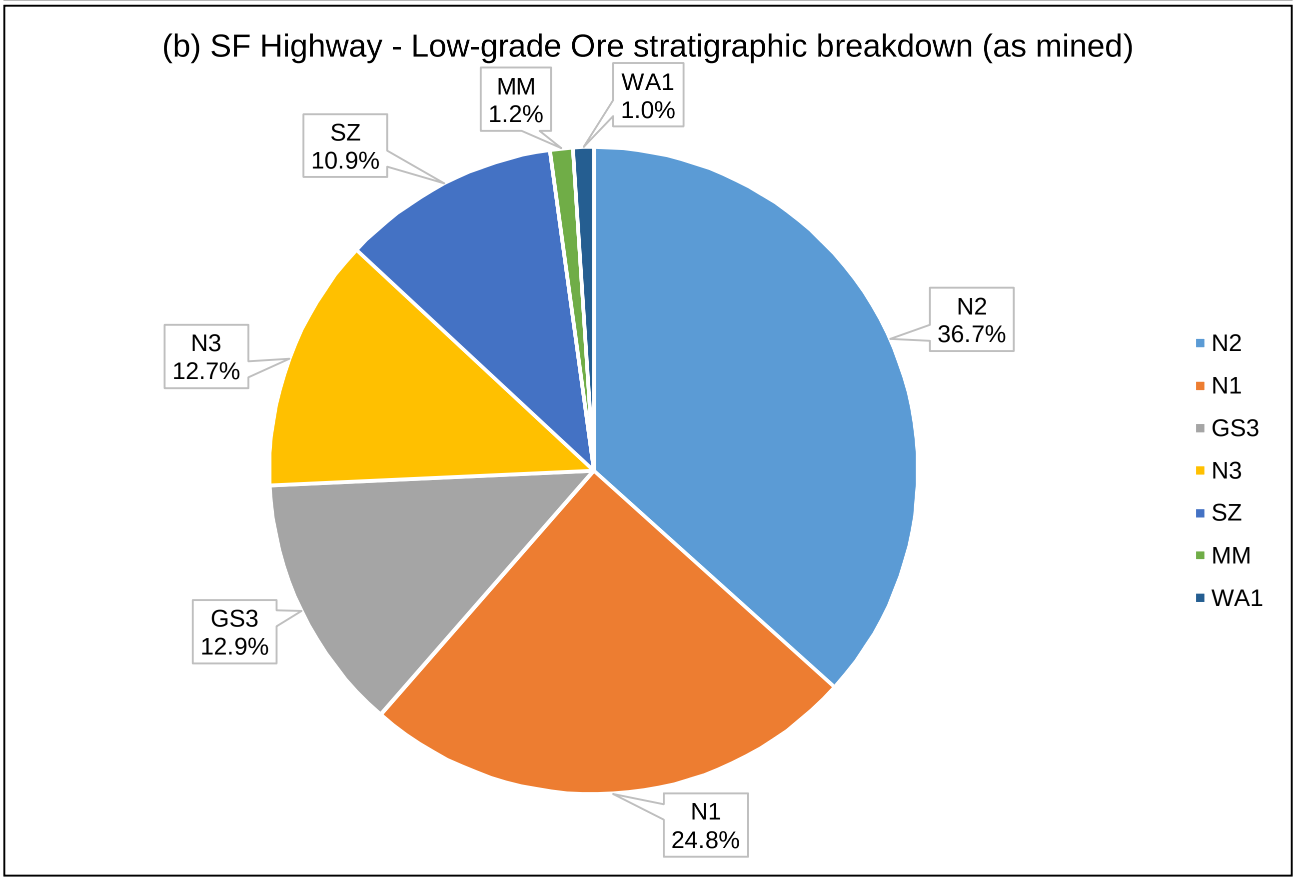


Figure 3-93 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the SF Highway deposit mining model

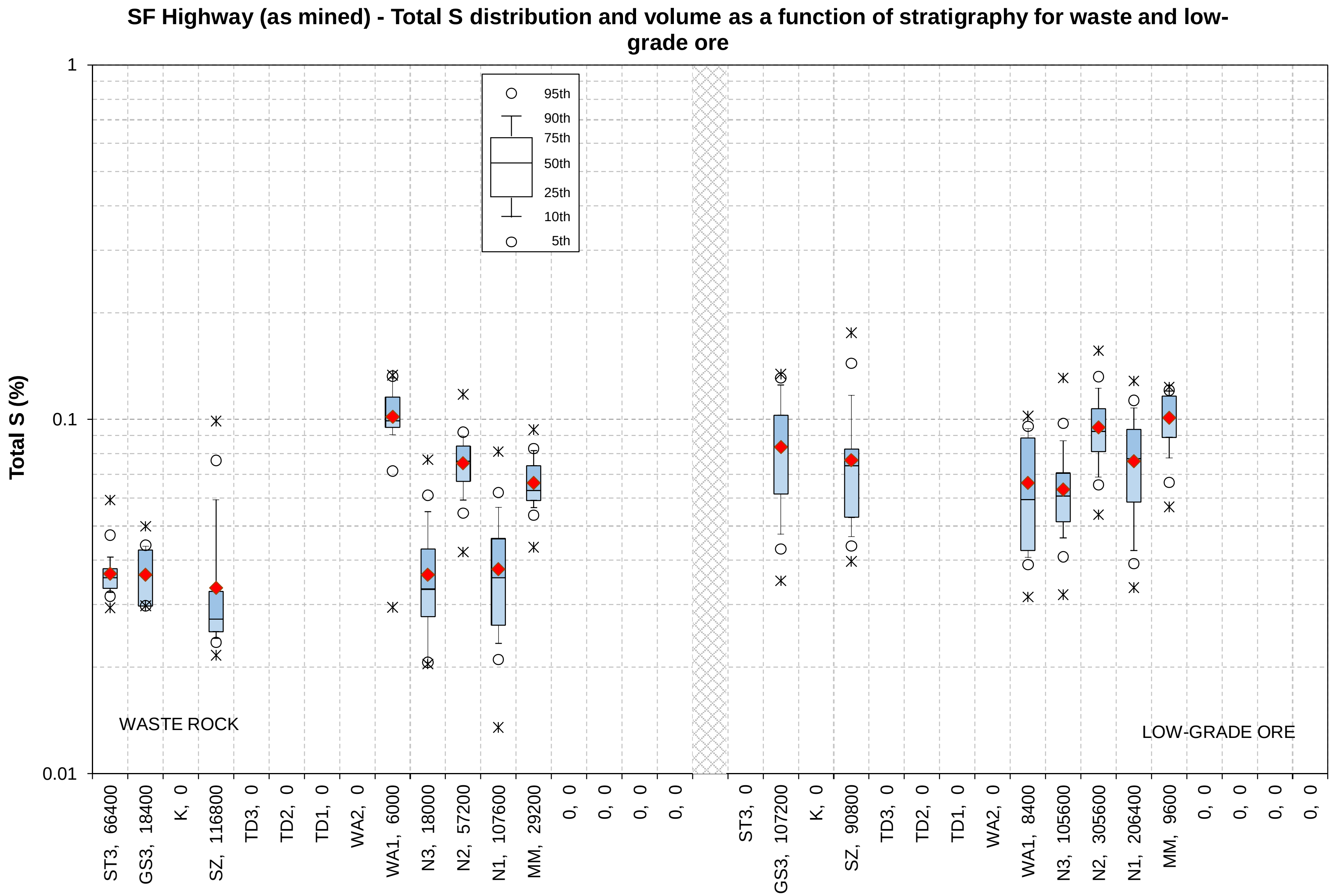


Figure 3-94 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of SF Highway deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

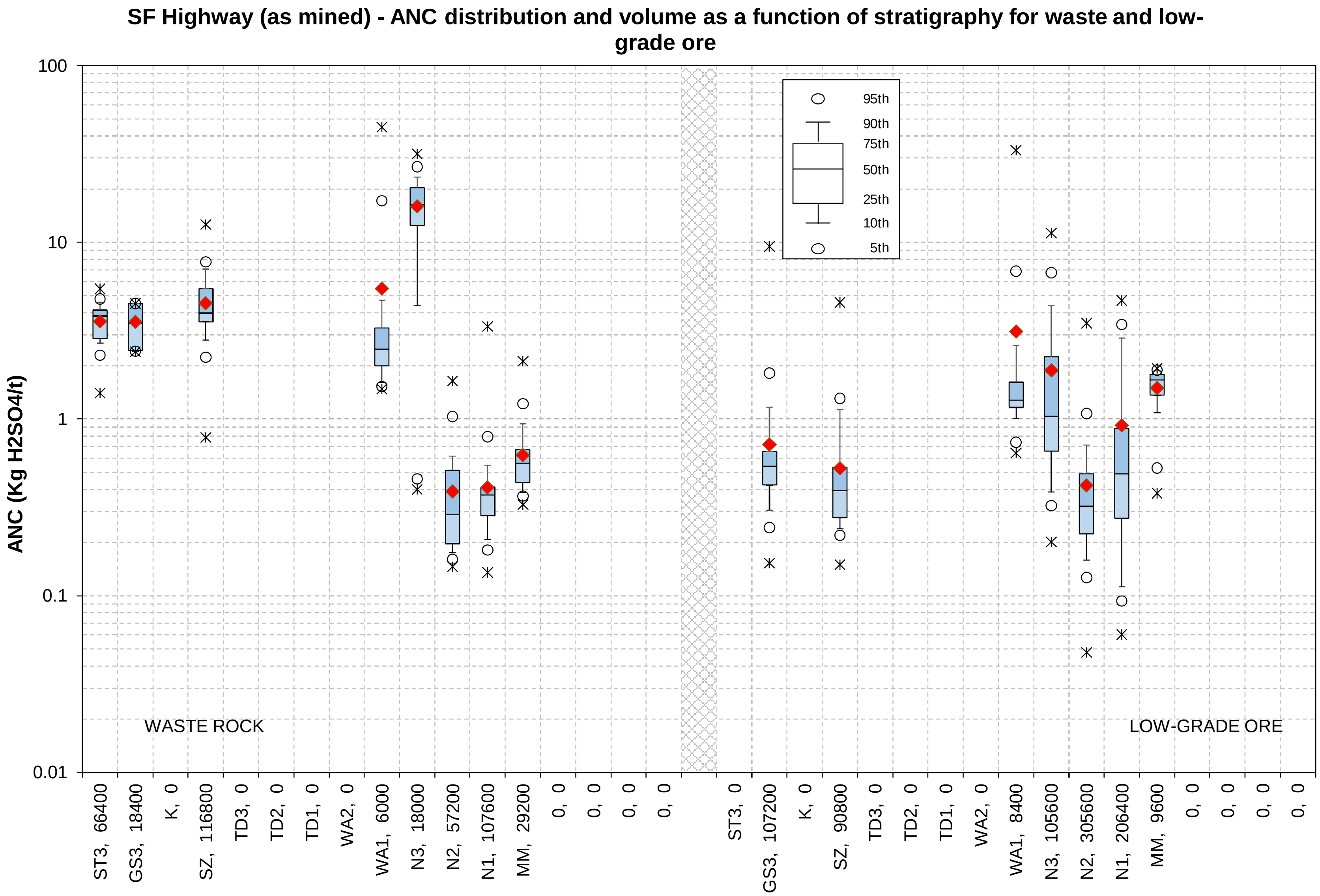


Figure 3-95 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of SF Highway deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-74 SF Highway deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9190 - ST3	66,400	15.95%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	18,400	4.42%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	116,800	28.05%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	3,200	0.77%	2,800	87.50%	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	18,000	4.32%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	56,800	13.64%	400	12.50%	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	107,600	25.84%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	29,200	7.01%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
3200 - MU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
2100 - JN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**416,400**	**100.00%**	**3,200**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**99.24%**		**0.76%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	
Low grade ore												
9190 - ST3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
9180 - GS3	78,800	12.24%	28,400	14.95%	0	N/A	0	N/A	0	N/A	0	N/A
8200 - K	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8150 - SZ	76,000	11.81%	14,800	7.79%	0	N/A	0	N/A	0	N/A	0	N/A
8130 - TD3	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8120 - TD2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
8110 - TD1	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4120 - WA2	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
4110 - WA1	8,000	1.24%	400	0.21%	0	N/A	0	N/A	0	N/A	0	N/A
3430 - N3	100,800	15.66%	4,800	2.53%	0	N/A	0	N/A	0	N/A	0	N/A
3420 - N2	205,200	31.88%	100,400	52.84%	0	N/A	0	N/A	0	N/A	0	N/A
3410 - N1	170,000	26.41%	36,400	19.16%	0	N/A	0	N/A	0	N/A	0	N/A
3300 - MM	4,800	0.75%	4,800	2.53%	0	N/A	0	N/A	0	N/A	0	N/A
3200 - MU	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
2100 - JN	0	0.00%	0	0.00%	0	N/A	0	N/A	0	N/A	0	N/A
Total	**643,600**	**100.00%**	**190,000**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**	**0**	**N/A**
% of Total	**77.21%**		**22.79%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-75 SF Highway deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9190 - ST3	66,400	15.90%	0	N/A	0	0.00%	0	N/A	66,400	15.82%
9180 - GS3	18,400	4.41%	0	N/A	0	0.00%	0	N/A	18,400	4.39%
8200 - K	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8150 - SZ	116,800	27.97%	0	N/A	0	0.00%	0	N/A	116,800	27.84%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8120 - TD2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
8110 - TD1	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
4120 - WA2	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
4110 - WA1	4,000	0.96%	0	N/A	2,000	100.00%	0	N/A	6,000	1.43%
3430 - N3	18,000	4.31%	0	N/A	0	0.00%	0	N/A	18,000	4.29%
3420 - N2	57,200	13.70%	0	N/A	0	0.00%	0	N/A	57,200	13.63%
3410 - N1	107,600	25.77%	0	N/A	0	0.00%	0	N/A	107,600	25.64%
3300 - MM	29,200	6.99%	0	N/A	0	0.00%	0	N/A	29,200	6.96%
3200 - MU	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
2100 - JN	0	0.00%	0	N/A	0	0.00%	0	N/A	0	0.00%
Total	**417,600**	**100.00%**	**0**	**N/A**	**2,000**	**100.00%**	**0**	**N/A**	**419,600**	**100.00%**
% of Total	**99.52%**		**0.00%**		**0.48%**		**0.00%**		**100.00%**	
Low grade ore										
9190 - ST3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	81,600	12.07%	0	N/A	0	0.00%	25,600	69.57%	107,200	12.86%
8200 - K	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	80,800	11.95%	0	N/A	0	0.00%	10,000	27.17%	90,800	10.89%
8130 - TD3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8120 - TD2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8110 - TD1	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
4110 - WA1	8,000	1.18%	0	N/A	400	0.33%	0	0.00%	8,400	1.01%
3430 - N3	102,000	15.09%	0	N/A	3,600	2.98%	0	0.00%	105,600	12.67%
3420 - N2	208,800	30.89%	0	N/A	95,600	79.14%	1,200	3.26%	305,600	36.66%
3410 - N1	185,200	27.40%	0	N/A	21,200	17.55%	0	0.00%	206,400	24.76%
3300 - MM	9,600	1.42%	0	N/A	0	0.00%	0	0.00%	9,600	1.15%
3200 - MU	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
2100 - JN	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
Total	**676,000**	**100.00%**	**0**	**N/A**	**120,800**	**100.00%**	**36,800**	**100.00%**	**833,600**	**100.00%**
% of Total	**81.09%**		**0.00%**		**14.49%**		**4.41%**		**100.00%**	

Table 3-76 SF Highway deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	417,600	0	417,600	99.52%
1	0	0	0	0.00%
2	2,000	0	2,000	0.48%
3	0	0	0	0.00%
Total	**419,600**	**0**	**419,600**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	676,000	0	676,000	81.09%
1	0	0	0	0.00%
2	120,800	0	120,800	14.49%
3	36,800	0	36,800	4.41%
Total	**833,600**	**0**	**833,600**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

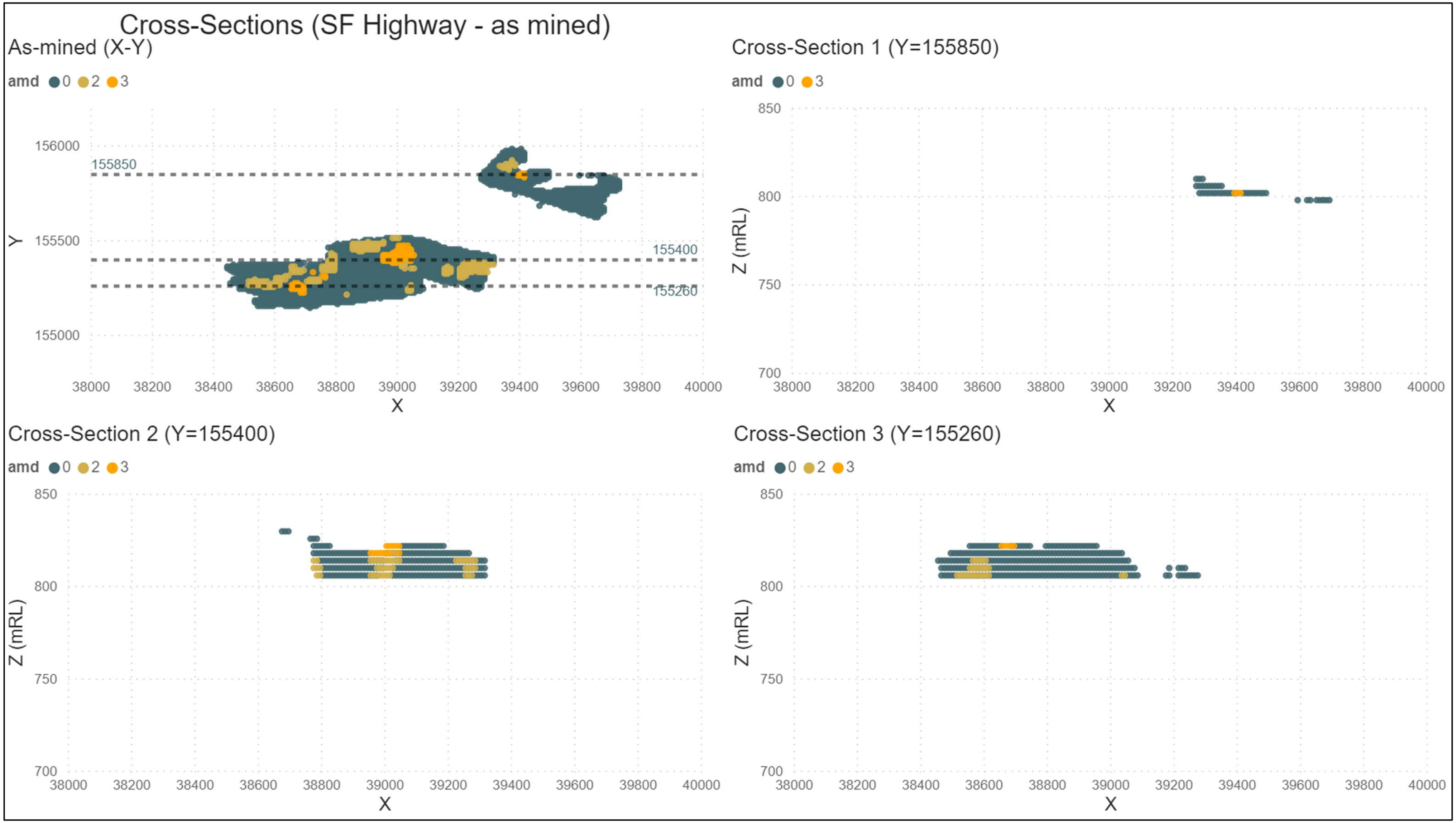


Figure 3-96 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by SF Highway deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.16.2 SF Highway deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from SF Highway deposit as a function of stratigraphic unit is shown in Figure 3-97. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from Highway deposit are shown in Figure 3-98 and Figure 3-99, respectively.

Table 3-77 presents to-be-mined waste volume from SF Highway deposit split by total sulphur content per stratigraphy. Table 3-78 and Table 3-79 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the Highway deposit is presented in Figure 3-100.

The key attributes are listed as follows:

- The majority of to-be-mined waste rock from Highway deposit is from Marra Mamba Iron Formation (48.4%, incl. N1, N2, MM and N3) and Tertiary Detritals (35.8%, incl. TD3, SZ, TD2, ST3, K, GS3 and TD1) and a minor contribution is from Wittenoom Formation (15.8% WA1 and WA2). The Marra Mamba Iron Formation (61.6%, incl., N2, N3, N1 and MM) is the main source low-grade ore stratigraphy with Tertiary Detritals (24.3% incl. TD3, SZ, TD2, GS3, TD1 and ST3) and Wittenoom Formation (14.1% WA1 and WA2) contributing a subordinate amount.
- To-be-mined waste rock and low-grade ore generally show very low sulphur concentration with the 95th percentile values below or close to 0.1 wt% and median values below or near 0.05 wt% (Figure 3-98, Table 3-77).
- Very low sulphur blocks (<0.1%) comprise 98.80% of to-be-mined waste rock and 93.22% of to-be-mined low-grade ore volume (Table 3-77). Low sulphur blocks (0.1-0.2%) comprise 0.96% of to-be-mined waste rock and 6.32% of to-be-mined low-grade ore volume. Only 0.04% to-be-mined waste rock and 0.03% of to-be-mined low-grade ore have moderate sulphur content (0.5-1.0 wt%), and 0.02% to-be-mined waste rock and 0.01% of to-be-mined low-grade ore have high sulphur content (≥ 1.0 wt%).
- To-be-mined waste rock and low-grade ore generally have low ANC with the 90th percentile values below or near 10 kg H_2SO_4/t and the median values below or near 5 kg H_2SO_4/t for the majority of stratigraphies (Figure 3-99). The exception is for TD2 and N3 waste rock that show higher ANC with the median value of 11.8 kg H_2SO_4/t and 18.4 kg H_2SO_4/t, respectively.
- A total volume of 136,928,000 m^3 (incl. 82,945,600 m^3 waste rock and 53,982,400 m^3 low-grade ore) of AMD0 waste is predicted to be mined from Highway deposit, representing 99.58% of to-be-mined waste rock and 96.09% of to-be-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to be mined out from the Highway deposit.
- A total volume of 2,378,400 m^3 (incl. 230,000 m^3 to-be-mined waste rock and 2,148,400 m^3 to-be-mined low-grade ore) are classed as AMD2, representing 0.28% of to-be-mined waste rock and 3.82% of to-be-mined low-grade ore (Table 3-78).
- A total volume of 167,200 m^3 (incl. 119,200 m^3 to-be-mined waste rock and 48,000 m^3 to-be-mined low-grade ore) are classed as AMD3, representing 0.14% of to-be-mined waste rock and 0.09% of to-be-mined low-grade ore (Table 3-78).
- Approximately 86.17% of waste rock and 93.73% of low-grade ore blocks are predicted to be mined from above water table (Table 3-79).

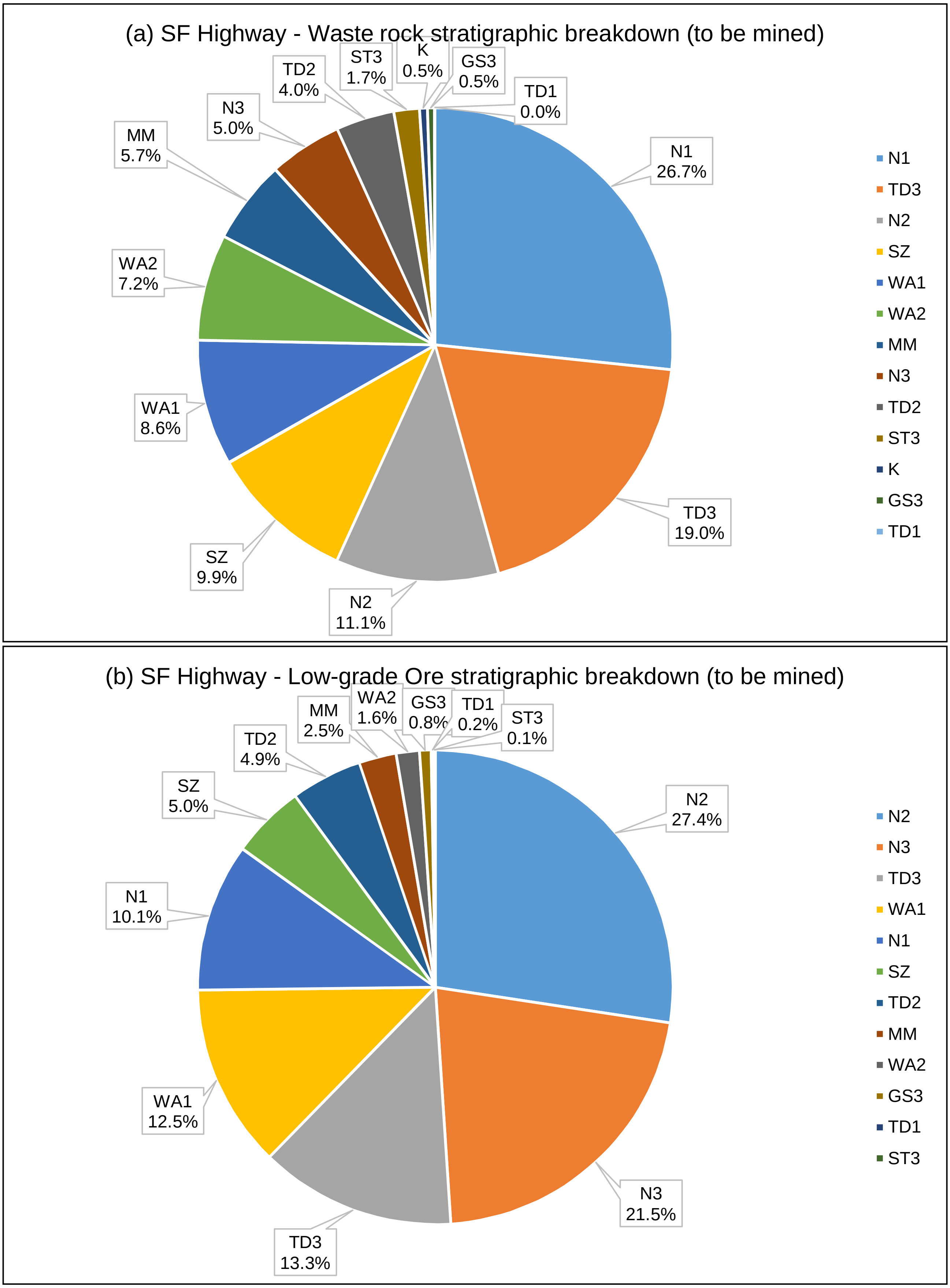


Figure 3-97 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the SF Highway deposit mining model

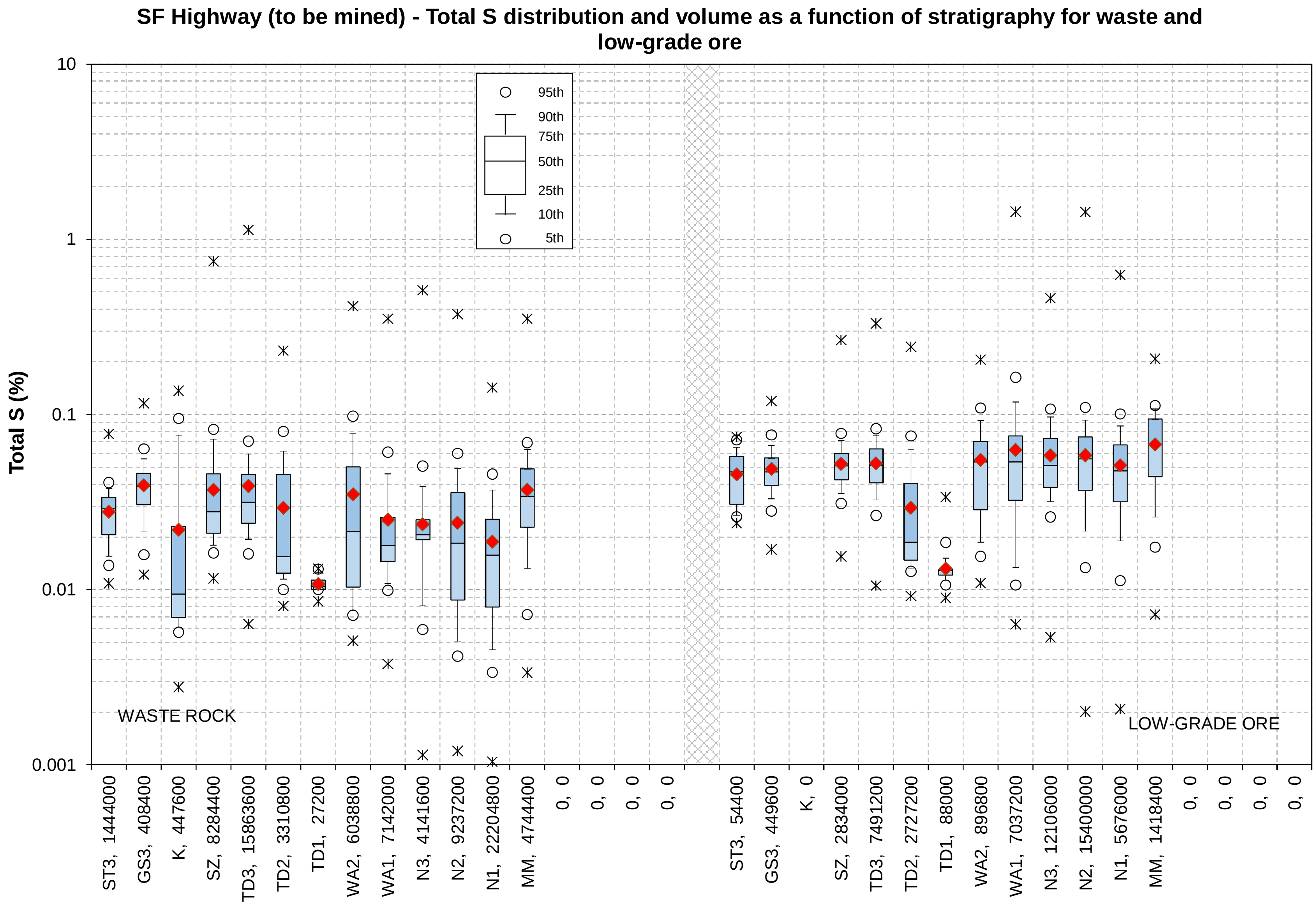


Figure 3-98 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of SF Highway deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

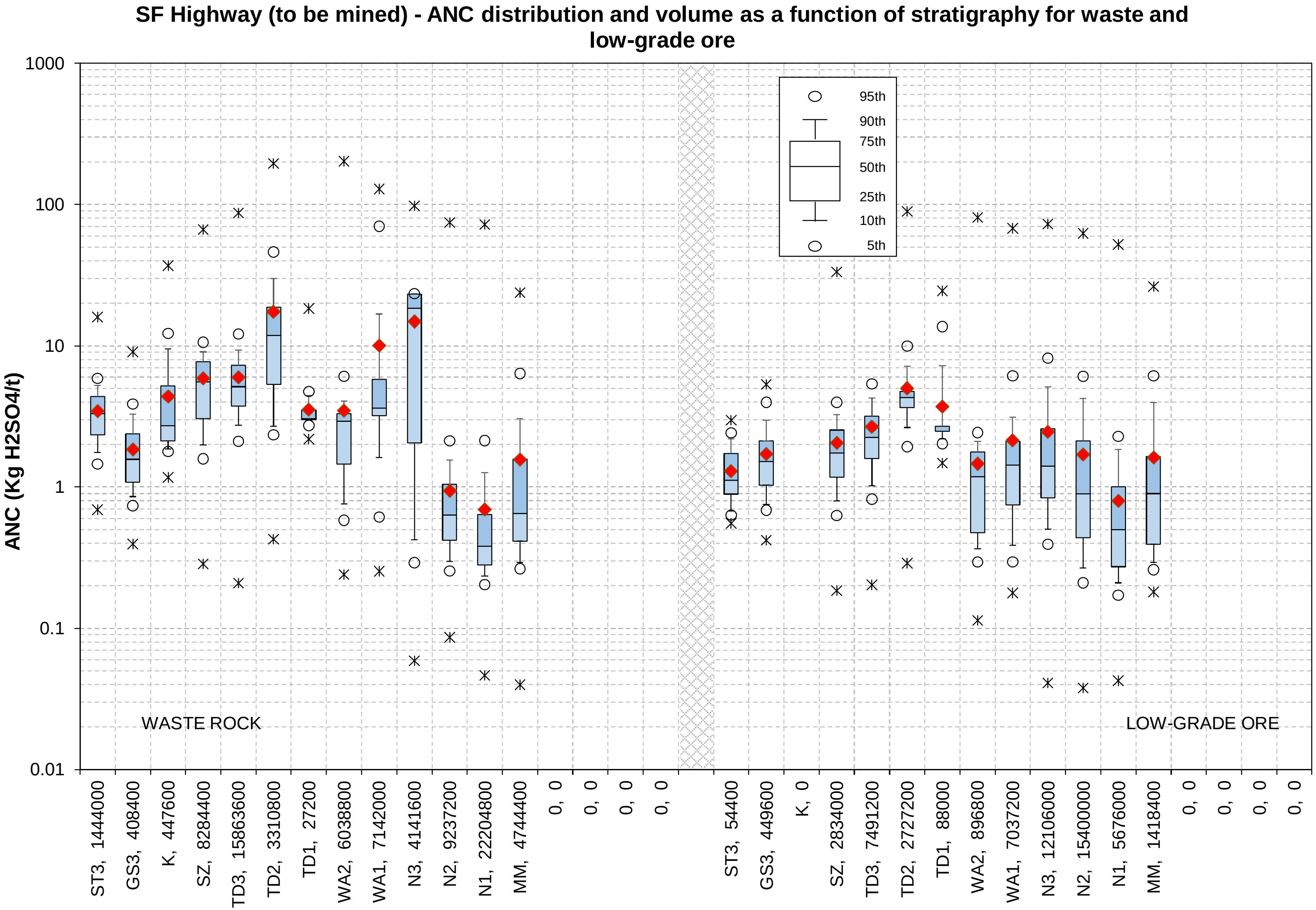


Figure 3-99 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of SF Highway deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-77 SF Highway deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

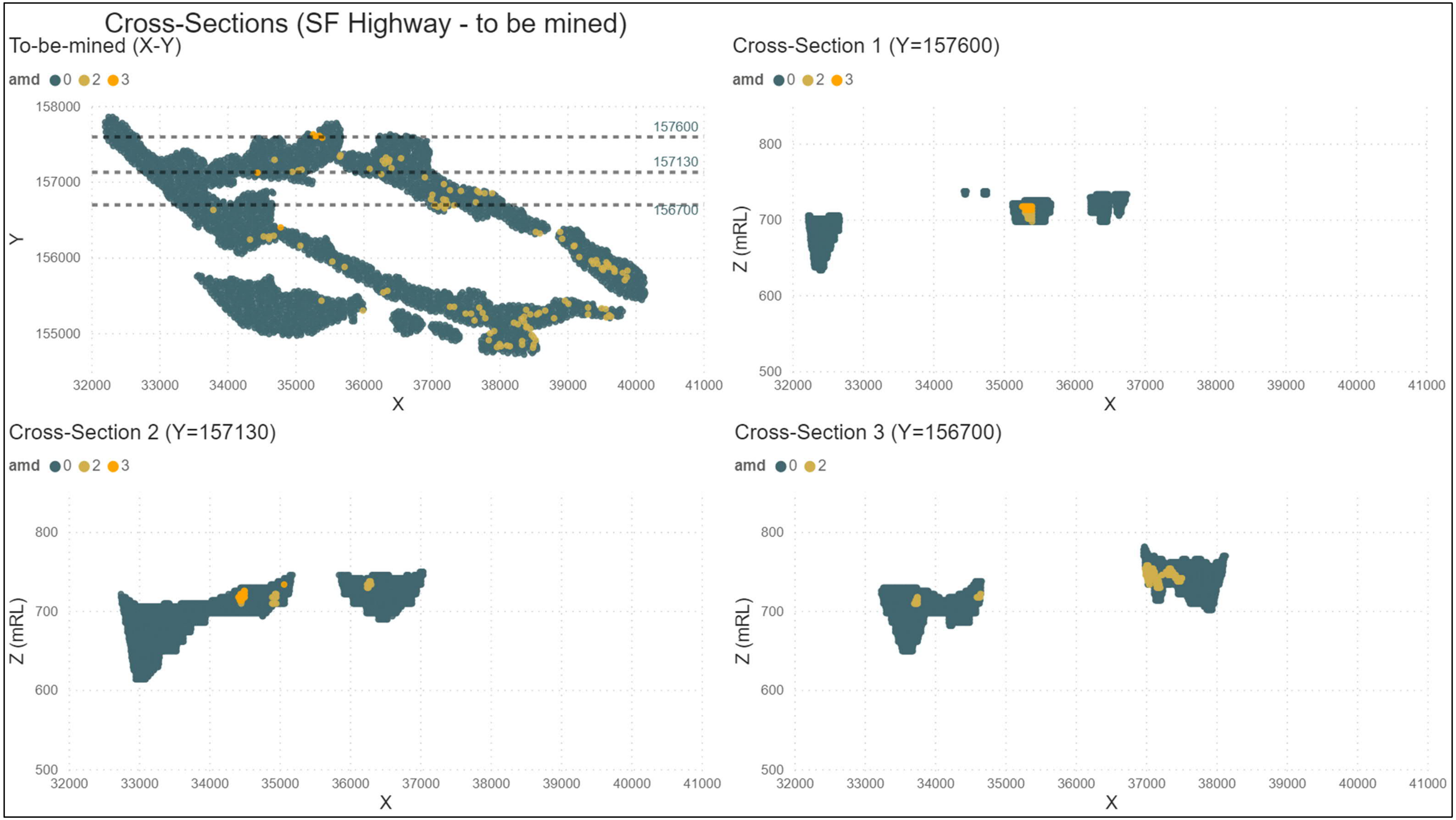
Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9190 - ST3	1,444,000	1.75%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	405,600	0.49%	2,800	0.35%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8200 - K	434,400	0.53%	13,200	1.65%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	8,104,000	9.85%	158,800	19.82%	13,600	11.30%	6,000	18.75%	2,000	6.58%	0	0.00%
8130 - TD3	15,640,800	19.01%	146,000	18.22%	20,800	17.28%	14,000	43.75%	28,000	92.11%	14,000	100.00%
8120 - TD2	3,245,600	3.94%	43,600	5.44%	21,600	17.94%	0	0.00%	0	0.00%	0	0.00%
8110 - TD1	27,200	0.03%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	5,758,400	7.00%	250,800	31.30%	24,800	20.60%	4,800	15.00%	0	0.00%	0	0.00%
4110 - WA1	7,023,600	8.53%	86,400	10.78%	29,200	24.25%	2,800	8.75%	0	0.00%	0	0.00%
3430 - N3	4,125,200	5.01%	11,200	1.40%	2,400	1.99%	2,400	7.50%	400	1.32%	0	0.00%
3420 - N2	9,202,400	11.18%	33,200	4.14%	400	0.33%	1,200	3.75%	0	0.00%	0	0.00%
3410 - N1	22,183,200	26.96%	21,600	2.70%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3300 - MM	4,702,400	5.71%	33,600	4.19%	7,600	6.31%	800	2.50%	0	0.00%	0	0.00%
3200 - MU	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2100 - JN	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	**82,296,800**	**100.00%**	**801,200**	**100.00%**	**120,400**	**100.00%**	**32,000**	**100.00%**	**30,400**	**100.00%**	**14,000**	**100.00%**
% of Total	**98.80%**		**0.96%**		**0.14%**		**0.04%**		**0.04%**		**0.02%**	
Low grade ore												
9190 - ST3	54,400	0.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	449,200	0.86%	400	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8200 - K	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	2,802,000	5.35%	31,200	0.88%	800	0.40%	0	0.00%	0	0.00%	0	0.00%
8130 - TD3	7,431,200	14.19%	58,800	1.66%	800	0.40%	400	1.11%	0	0.00%	0	0.00%
8120 - TD2	2,705,600	5.17%	17,600	0.50%	4,000	2.00%	0	0.00%	0	0.00%	0	0.00%
8110 - TD1	88,000	0.17%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	832,400	1.59%	63,600	1.79%	800	0.40%	0	0.00%	0	0.00%	0	0.00%
4110 - WA1	6,020,400	11.50%	879,600	24.76%	127,600	63.67%	4,000	11.11%	4,000	27.03%	1,600	50.00%
3430 - N3	11,197,600	21.38%	862,000	24.27%	34,400	17.17%	12,000	33.33%	0	0.00%	0	0.00%
3420 - N2	14,260,400	27.23%	1,078,400	30.36%	31,200	15.57%	18,800	52.22%	9,600	64.86%	1,600	50.00%
3410 - N1	5,381,200	10.27%	292,400	8.23%	400	0.20%	800	2.22%	1,200	8.11%	0	0.00%
3300 - MM	1,149,600	2.20%	268,400	7.56%	400	0.20%	0	0.00%	0	0.00%	0	0.00%
3200 - MU	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
2100 - JN	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	**52,372,000**	**100.00%**	**3,552,400**	**100.00%**	**200,400**	**100.00%**	**36,000**	**100.00%**	**14,800**	**100.00%**	**3,200**	**100.00%**
% of Total	**93.22%**		**6.32%**		**0.36%**		**0.06%**		**0.03%**		**0.01%**	

Table 3-78 SF Highway deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9190 - ST3	1,444,000	1.74%	0	N/A	0	0.00%	0	0.00%	1,444,000	1.73%
9180 - GS3	406,800	0.49%	0	N/A	0	0.00%	1,600	1.34%	408,400	0.49%
8200 - K	447,600	0.54%	0	N/A	0	0.00%	0	0.00%	447,600	0.54%
8150 - SZ	8,279,200	9.98%	0	N/A	0	0.00%	5,200	4.36%	8,284,400	9.95%
8130 - TD3	15,796,800	19.04%	0	N/A	0	0.00%	66,800	56.04%	15,863,600	19.05%
8120 - TD2	3,266,800	3.94%	0	N/A	0	0.00%	44,000	36.91%	3,310,800	3.97%
8110 - TD1	27,200	0.03%	0	N/A	0	0.00%	0	0.00%	27,200	0.03%
4120 - WA2	5,901,200	7.11%	0	N/A	137,600	59.83%	0	0.00%	6,038,800	7.25%
4110 - WA1	7,098,800	8.56%	0	N/A	42,400	18.43%	800	0.67%	7,142,000	8.57%
3430 - N3	4,140,000	4.99%	0	N/A	1,600	0.70%	0	0.00%	4,141,600	4.97%
3420 - N2	9,218,400	11.11%	0	N/A	18,000	7.83%	800	0.67%	9,237,200	11.09%
3410 - N1	22,199,600	26.76%	0	N/A	5,200	2.26%	0	0.00%	22,204,800	26.66%
3300 - MM	4,719,200	5.69%	0	N/A	25,200	10.96%	0	0.00%	4,744,400	5.70%
3200 - MU	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
2100 - JN	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
Total	**82,945,600**	**100.00%**	**0**	**N/A**	**230,000**	**100.00%**	**119,200**	**100.00%**	**83,294,800**	**100.00%**
% of Total	**99.58%**		**0.00%**		**0.28%**		**0.14%**		**100.00%**	
Low grade ore										
9190 - ST3	54,400	0.10%	0	N/A	0	0.00%	0	0.00%	54,400	0.10%
9180 - GS3	449,200	0.83%	0	N/A	0	0.00%	400	0.83%	449,600	0.80%
8200 - K	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	2,823,600	5.23%	0	N/A	0	0.00%	10,400	21.67%	2,834,000	5.04%
8130 - TD3	7,464,400	13.83%	0	N/A	0	0.00%	26,800	55.83%	7,491,200	13.33%
8120 - TD2	2,717,600	5.03%	0	N/A	0	0.00%	9,600	20.00%	2,727,200	4.85%
8110 - TD1	88,000	0.16%	0	N/A	0	0.00%	0	0.00%	88,000	0.16%
4120 - WA2	865,200	1.60%	0	N/A	31,600	1.47%	0	0.00%	896,800	1.60%
4110 - WA1	6,406,800	11.87%	0	N/A	630,400	29.34%	0	0.00%	7,037,200	12.53%
3430 - N3	11,826,000	21.91%	0	N/A	280,000	13.03%	0	0.00%	12,106,000	21.55%
3420 - N2	14,576,800	27.00%	0	N/A	822,400	38.28%	800	1.67%	15,400,000	27.41%
3410 - N1	5,424,400	10.05%	0	N/A	251,600	11.71%	0	0.00%	5,676,000	10.10%
3300 - MM	1,286,000	2.38%	0	N/A	132,400	6.16%	0	0.00%	1,418,400	2.52%
3200 - MU	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
2100 - JN	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
Total	**53,982,400**	**100.00%**	**0**	**N/A**	**2,148,400**	**100.00%**	**48,000**	**100.00%**	**56,178,800**	**100.00%**
% of Total	**96.09%**		**0.00%**		**3.82%**		**0.09%**		**100.00%**	

Table 3-79 SF Highway deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	71,422,800	11,522,800	82,945,600	99.58%
1	0	0	0	0.00%
2	230,000	0	230,000	0.28%
3	119,200	0	119,200	0.14%
Total	**71,772,000**	**11,522,800**	**83,294,800**	100.00%
% of Total	**86.17%**	**13.83%**	**100.00%**	
Low grade ore				
0	50,462,000	3,520,400	53,982,400	96.09%
1	0	0	0	0.00%
2	2,148,400	0	2,148,400	3.82%
3	48,000	0	48,000	0.09%
Total	**52,658,400**	**3,520,400**	**56,178,800**	100.00%
% of Total	**93.73%**	**6.27%**	**100.00%**	


Cross-Sections (SF Highway - to be mined)
To-be-mined (X-Y)
amd 0 2 3
158000
157000
156000
155000
Y
157600
157130
156700
32000 33000 34000 35000 36000 37000 38000 39000 40000 41000
X
Cross-Section 1 (Y=157600)
amd 0 2 3
800
700
600
500
Z (mRL)
32000 33000 34000 35000 36000 37000 38000 39000 40000 41000
X
Cross-Section 2 (Y=157130)
amd 0 2 3
800
700
600
500
Z (mRL)
32000 33000 34000 35000 36000 37000 38000 39000 40000 41000
X
Cross-Section 3 (Y=156700)
amd 0 2
800
700
600
500
Z (mRL)
32000 33000 34000 35000 36000 37000 38000 39000 40000 41000
X

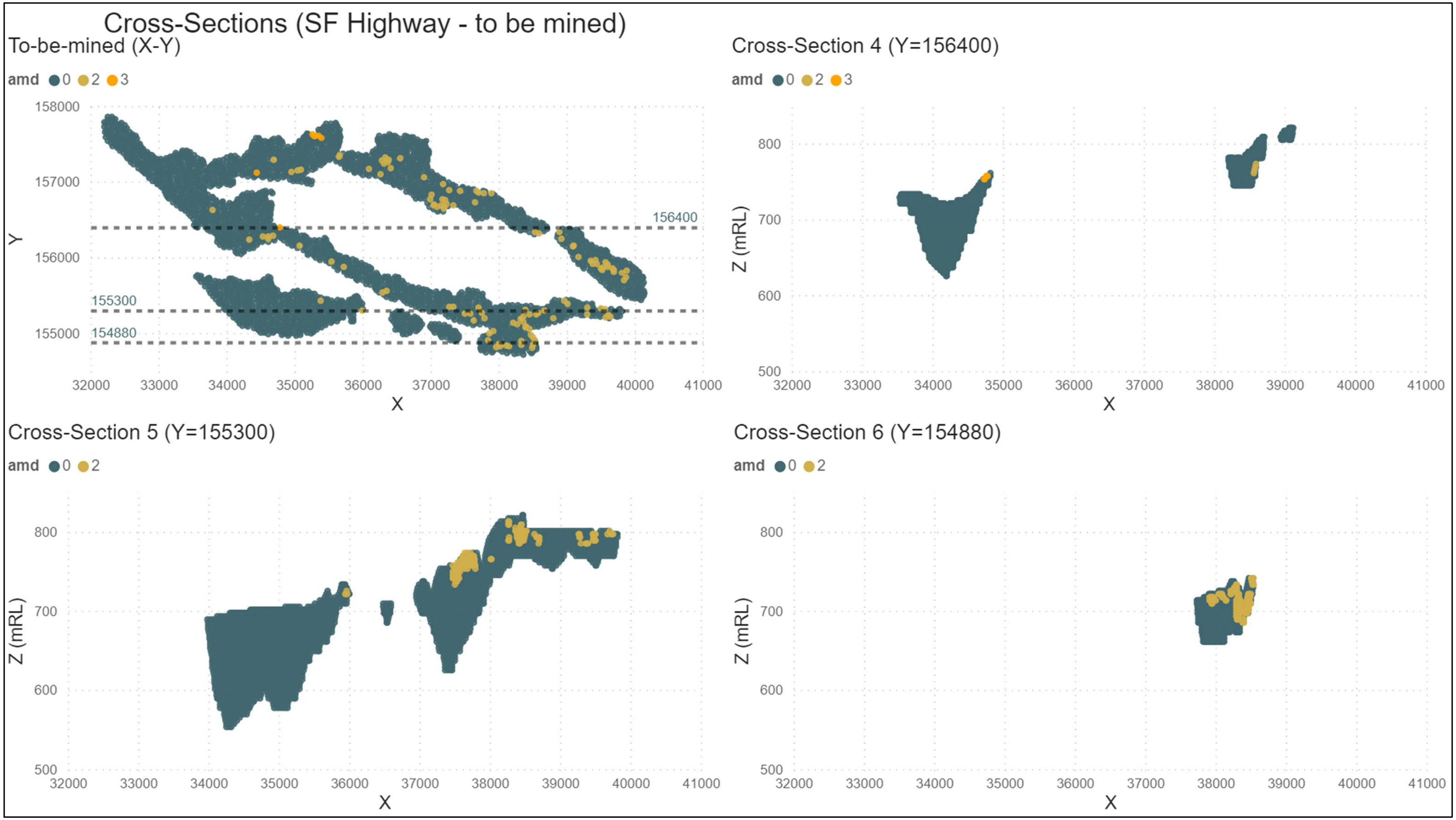


Figure 3-100 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by SF Highway deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.17 SF Grand Central deposit

3.1.1.17.1 SF Grand Central deposit (as-mined waste)

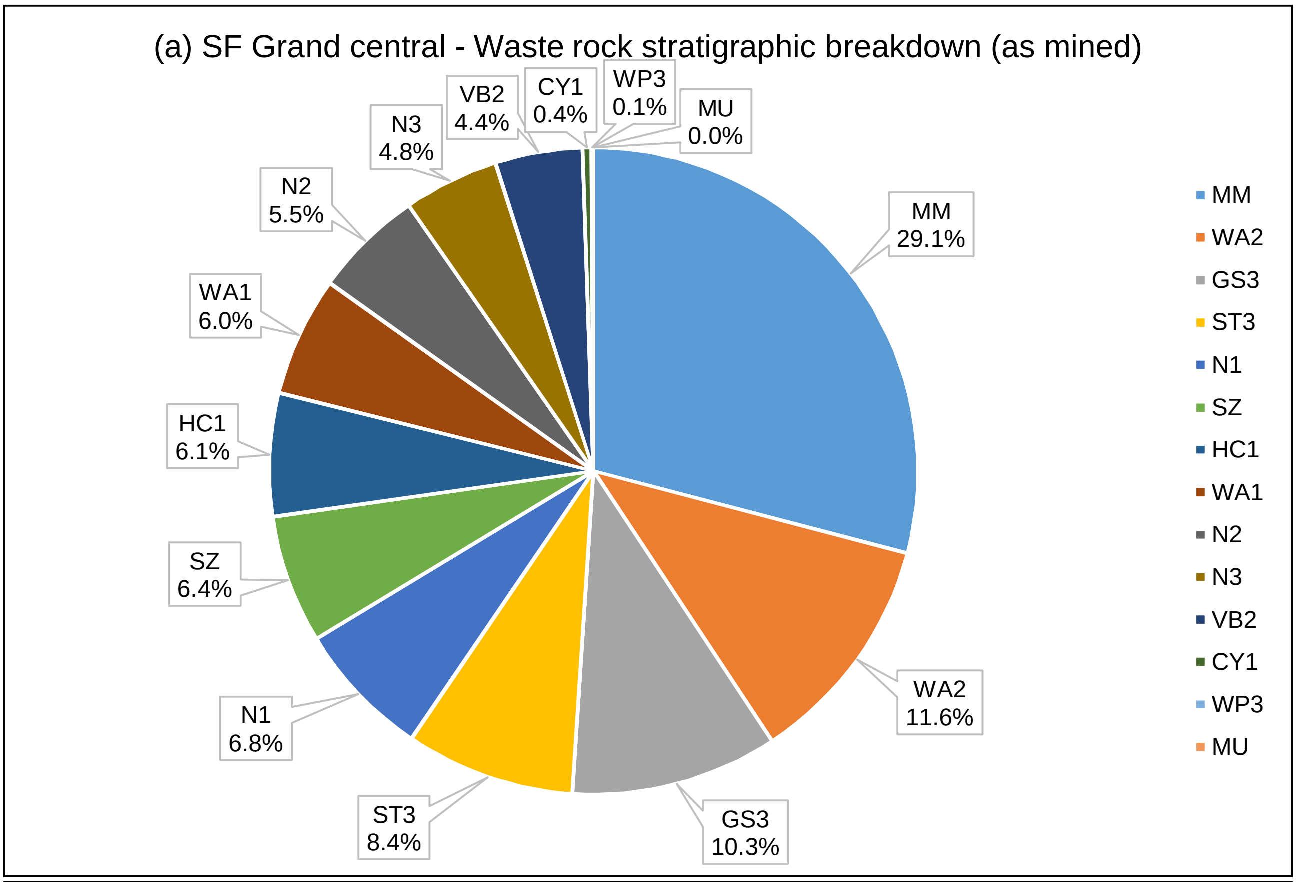
A pie chart showing the distribution of as-mined waste rock and low-grade ore from SF Grand Central deposit as a function of stratigraphic unit is shown in Figure 3-101. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from Grand Central deposit are shown in Figure 3-102 and Figure 3-103, respectively.

Table 3-80 presents as-mined waste volume from SF Grand Central deposit split by total sulphur content per stratigraphy. Table 3-81 and Table 3-82 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the Grand Central deposit is presented in Figure 3-104.

The key findings are presented as follows:

- As-mined waste rock from Grand Central deposit is mainly sourced from Marra Mamba Iron Formation (46.2%, incl. MM, N1, N2, N3 and MU) and Tertiary Detritals (36.2%, incl. GS3, ST3, SZ, HC1, VB2, CY1 and WP3), with a smaller contribution from Wittenoom Formation (17.6% WA2 and WA1). The majority of as-mined low-grade ore is sourced from Marra Mamba Iron Formation (64.0%, incl., MM, N2, N3, N1 and MU) with smaller portion from Tertiary Detritals (27.2% incl. GS3, VB2, HC1, WP3 and SZ) and Wittenoom Formation (8.8% WA1 and WA2).
- As-mined waste rock and low-grade ore have variable sulphur concentrations (Figure 3-102). As mined waste rock and low-grade ore typically show the 95th percentile sulphur concentrations below or close to 0.2 wt% and the median values below or close to 0.1 wt%, with the exception of CY1 and HC1 waste rock and WA2 and WA1 waste rock and low-grade ore. HC1, WA2 and WA1 have median sulphur values between 0.1% and 0.2%. CY1, on the other hand, shows elevated median total sulphur concentrations of 1%, however, this stratigraphic unit represent only 0.5% of the waste mined out from Grand Central to date.
- Marra Mamba Iron Formation generally show lower sulphur contents than Wittenoom Formation. Marra Mamba Iron Formation generally show lower sulphur contents than Wittenoom Formation.
- Table 3-80 show that very low (<0.1%) and low (0.1-0.2%) sulphur blocks comprise the majority of as-mined waste rock (90.57%) and low-grade ore (96.60%) volume, and that moderate (0.5-1.0%) and high (≥1.0%) sulphur blocks comprise 5.14% of as-mined waste rock and 0.59% of as-mined low-grade ore volume. The high sulphur waste rock is predominantly associated with WA2 and CY1.
- As-mined waste rock and low-grade ore have typically low ANC with the 90th percentile values below or close to 10 kg H_2SO_4/t and the median values below 4 kg H_2SO_4/t (Figure 3-103). The exception is for 3,200 m^3 WP3 waste rock that show slightly higher ANC values with a median value of 15.5 kg H_2SO_4/t.
- A total volume of 9,432,000 m^3 (incl. 4,354,400 m^3 waste rock and 5,077,600 m^3 low-grade ore) of AMD0 waste has been mined out from Grand Central deposit, comprising 88.17% of as-mined waste rock and 88.23% of as-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to have been mined out from the Grand Central deposit.
- A total volume of 889,200 m^3 (incl. 383,600 m^3 as-mined waste rock and 505,600 m^3 as-mined low-grade ore) is classed as AMD2, comprising 7.77% of as-mined waste rock and 8.79% of as-mined low-grade ore, which is mostly associated with Wittenoom Formation and Marra Mamba Iron Formation (Table 3-81).
- A total volume of 372,400 m^3 (incl. 200,400 m^3 as-mined waste rock and 172,000 m^3 as-mined low-grade ore) is classed as AMD3, comprising 4.06% of as-mined waste rock and 2.99% of as-mined low-grade ore, which is mostly associated with HC1 and VB2, respectively (Table 3-81).
- All materials mined-out (waste rock and low-grade ore) from Grand Central deposit are sourced from above the water table (Table 3-82).



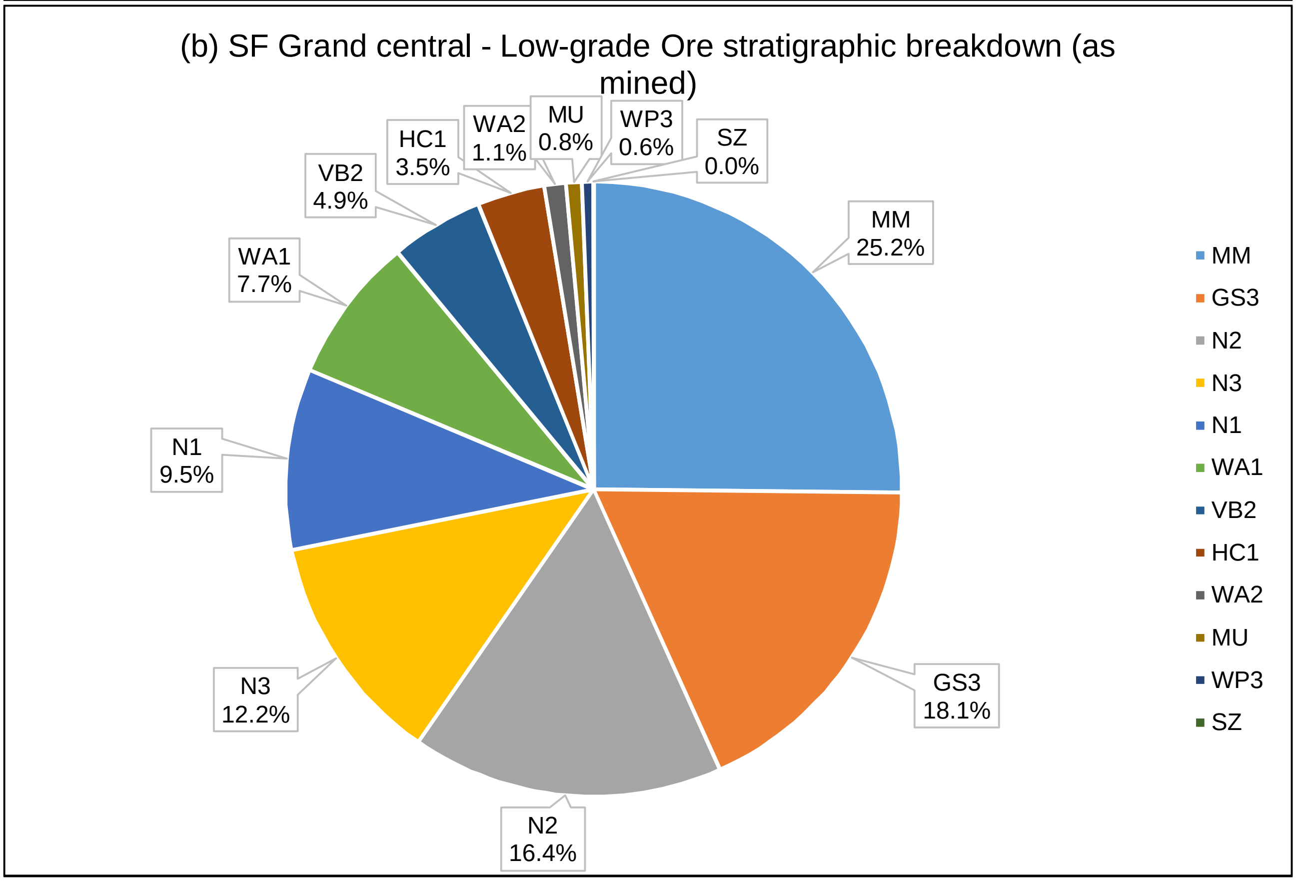


Figure 3-101 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the SF Grand Central deposit mining model

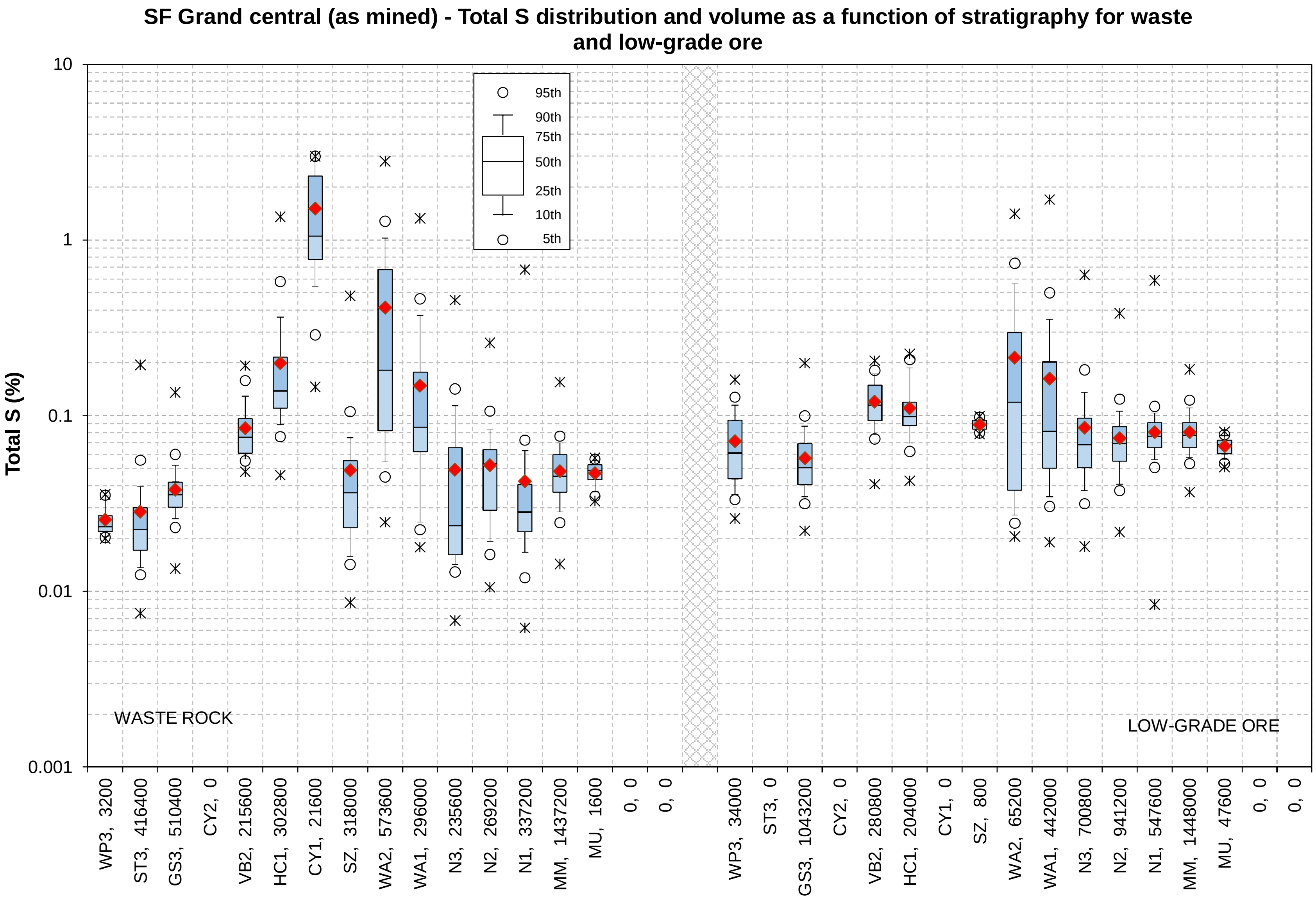


Figure 3-102 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of SF Grand Central deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

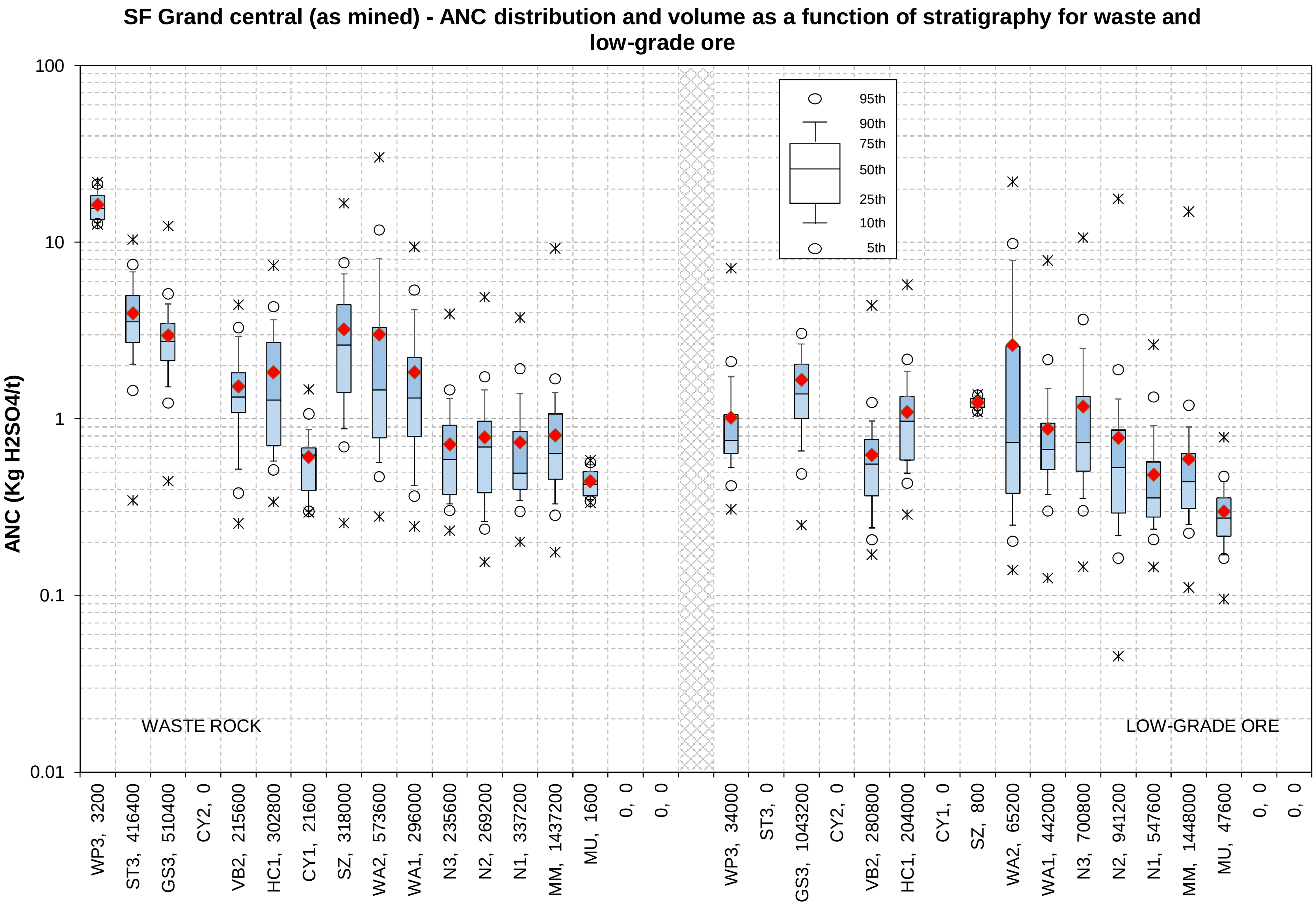


Figure 3-103 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of SF Grand Central deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-80 SF Grand Central deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	3,200	0.08%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	404,400	10.10%	12,000	2.55%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	508,000	12.69%	2,400	0.51%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	173,200	4.33%	42,400	9.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9110 - HC1	52,000	1.30%	164,400	34.92%	40,000	39.22%	28,000	25.45%	16,000	8.93%	2,400	3.23%
9100 - CY1	0	0.00%	800	0.17%	1,200	1.18%	0	0.00%	8,800	4.91%	10,800	14.52%
8150 - SZ	297,200	7.43%	13,600	2.89%	1,600	1.57%	5,600	5.09%	0	0.00%	0	0.00%
4120 - WA2	176,800	4.42%	123,200	26.17%	30,400	29.80%	44,800	40.73%	138,400	77.23%	60,000	80.65%
4110 - WA1	170,400	4.26%	59,600	12.66%	25,200	24.71%	28,400	25.82%	11,200	6.25%	1,200	1.61%
3430 - N3	201,600	5.04%	30,800	6.54%	1,200	1.18%	2,000	1.82%	0	0.00%	0	0.00%
3420 - N2	252,800	6.32%	15,200	3.23%	1,200	1.18%	0	0.00%	0	0.00%	0	0.00%
3410 - N1	329,600	8.24%	400	0.08%	1,200	1.18%	1,200	1.09%	4,800	2.68%	0	0.00%
3300 - MM	1,431,200	35.76%	6,000	1.27%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3200 - MU	1,600	0.04%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	**4,002,000**	**100.00%**	**470,800**	**100.00%**	**102,000**	**100.00%**	**110,000**	**100.00%**	**179,200**	**100.00%**	**74,400**	**100.00%**
% of Total	**81.04%**		**9.53%**		**2.07%**		**2.23%**		**3.63%**		**1.51%**	
Low grade ore												
9200 - WP3	27,200	0.59%	6,800	0.71%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	992,400	21.57%	50,800	5.30%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	86,000	1.87%	191,600	19.97%	3,200	3.56%	0	0.00%	0	0.00%	0	0.00%
9110 - HC1	104,800	2.28%	84,000	8.76%	15,200	16.89%	0	0.00%	0	0.00%	0	0.00%
9100 - CY1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	800	0.02%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	29,200	0.63%	17,200	1.79%	2,800	3.11%	6,800	9.50%	7,200	30.51%	2,000	19.23%
4110 - WA1	272,400	5.92%	57,600	6.01%	45,600	50.67%	44,000	61.45%	14,000	59.32%	8,400	80.77%
3430 - N3	543,600	11.82%	126,800	13.22%	13,200	14.67%	16,400	22.91%	800	3.39%	0	0.00%
3420 - N2	811,600	17.64%	118,400	12.34%	7,600	8.44%	3,600	5.03%	0	0.00%	0	0.00%
3410 - N1	470,000	10.22%	72,800	7.59%	2,400	2.67%	800	1.12%	1,600	6.78%	0	0.00%
3300 - MM	1,214,800	26.41%	233,200	24.31%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3200 - MU	47,600	1.03%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	**4,600,400**	**100.00%**	**959,200**	**100.00%**	**90,000**	**100.00%**	**71,600**	**100.00%**	**23,600**	**100.00%**	**10,400**	**100.00%**
% of Total	**79.93%**		**16.67%**		**1.56%**		**1.24%**		**0.41%**		**0.18%**	

Table 3-81 SF Grand Central deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	3,200	0.07%	0	N/A	0	0.00%	0	0.00%	3,200	0.06%
9190 - ST3	404,400	9.29%	0	N/A	0	0.00%	12,000	5.99%	416,400	8.43%
9180 - GS3	510,400	11.72%	0	N/A	0	0.00%	0	0.00%	510,400	10.34%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	192,800	4.43%	0	N/A	0	0.00%	22,800	11.38%	215,600	4.37%
9110 - HC1	169,600	3.89%	0	N/A	0	0.00%	133,200	66.47%	302,800	6.13%
9100 - CY1	400	0.01%	0	N/A	0	0.00%	21,200	10.58%	21,600	0.44%
8150 - SZ	307,600	7.06%	0	N/A	0	0.00%	10,400	5.19%	318,000	6.44%
4120 - WA2	287,200	6.60%	0	N/A	286,400	74.66%	0	0.00%	573,600	11.62%
4110 - WA1	237,200	5.45%	0	N/A	58,800	15.33%	0	0.00%	296,000	5.99%
3430 - N3	216,800	4.98%	0	N/A	18,400	4.80%	400	0.20%	235,600	4.77%
3420 - N2	256,400	5.89%	0	N/A	12,800	3.34%	0	0.00%	269,200	5.45%
3410 - N1	331,600	7.62%	0	N/A	5,600	1.46%	0	0.00%	337,200	6.83%
3300 - MM	1,435,200	32.96%	0	N/A	1,600	0.42%	400	0.20%	1,437,200	29.10%
3200 - MU	1,600	0.04%	0	N/A	0	0.00%	0	0.00%	1,600	0.03%
Total	**4,354,400**	**100.00%**	**0**	**N/A**	**383,600**	**100.00%**	**200,400**	**100.00%**	**4,938,400**	**100.00%**
% of Total	**88.17%**		**0.00%**		**7.77%**		**4.06%**		**100.00%**	
Low grade ore										
9200 - WP3	32,400	0.64%	0	N/A	0	0.00%	1,600	0.93%	34,000	0.59%
9190 - ST3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	1,030,400	20.29%	0	N/A	0	0.00%	12,800	7.44%	1,043,200	18.13%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	148,400	2.92%	0	N/A	0	0.00%	132,400	76.98%	280,800	4.88%
9110 - HC1	180,000	3.54%	0	N/A	0	0.00%	24,000	13.95%	204,000	3.54%
9100 - CY1	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	800	0.02%	0	N/A	0	0.00%	0	0.00%	800	0.01%
4120 - WA2	30,000	0.59%	0	N/A	35,200	6.96%	0	0.00%	65,200	1.13%
4110 - WA1	290,000	5.71%	0	N/A	152,000	30.06%	0	0.00%	442,000	7.68%
3430 - N3	628,400	12.38%	0	N/A	72,400	14.32%	0	0.00%	700,800	12.18%
3420 - N2	858,000	16.90%	0	N/A	83,200	16.46%	0	0.00%	941,200	16.35%
3410 - N1	505,200	9.95%	0	N/A	42,400	8.39%	0	0.00%	547,600	9.51%
3300 - MM	1,326,400	26.12%	0	N/A	120,400	23.81%	1,200	0.70%	1,448,000	25.16%
3200 - MU	47,600	0.94%	0	N/A	0	0.00%	0	0.00%	47,600	0.83%
Total	**5,077,600**	**100.00%**	**0**	**N/A**	**505,600**	**100.00%**	**172,000**	**100.00%**	**5,755,200**	**100.00%**
% of Total	**88.23%**		**0.00%**		**8.79%**		**2.99%**		**100.00%**	

Table 3-82 SF Grand Central deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	4,354,400	0	4,354,400	88.17%
1	0	0	0	0.00%
2	383,600	0	383,600	7.77%
3	200,400	0	200,400	4.06%
Total	**4,938,400**	**0**	**4,938,400**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	5,077,600	0	5,077,600	88.23%
1	0	0	0	0.00%
2	505,600	0	505,600	8.79%
3	172,000	0	172,000	2.99%
Total	**5,755,200**	**0**	**5,755,200**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

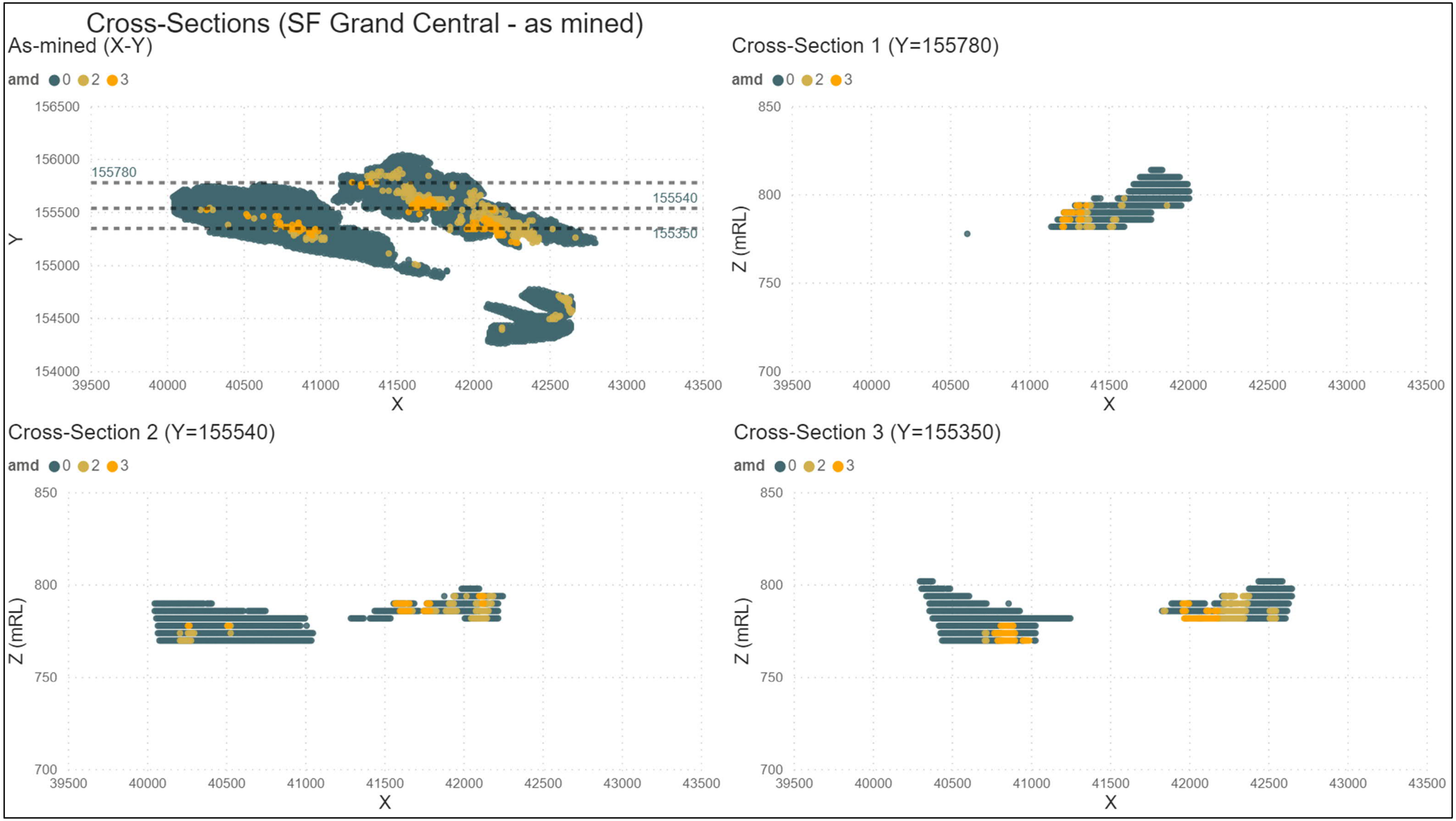


Figure 3-104 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by SF Grand Central deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.17.2 SF Grand Central deposit (to-be-mined waste)

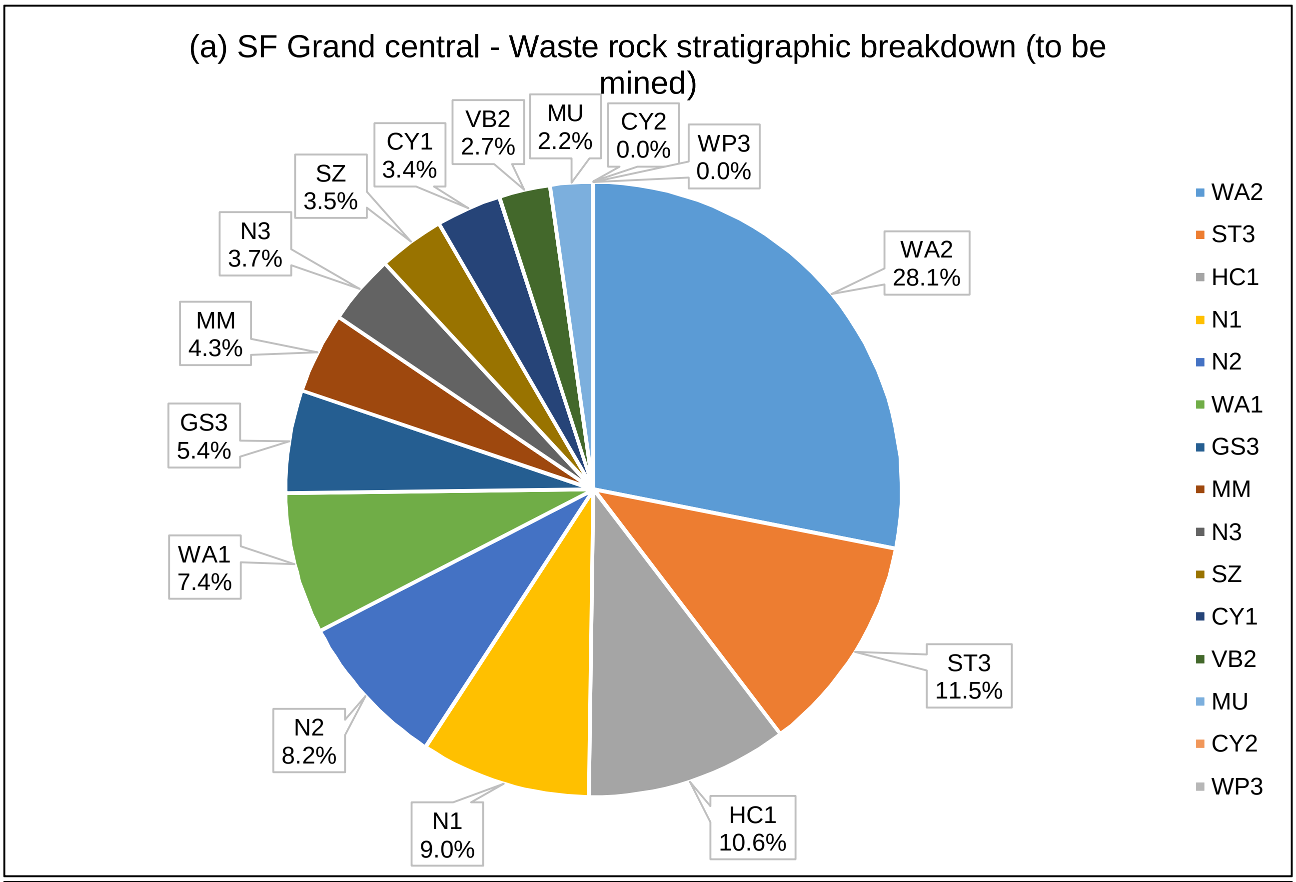
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from SF Grand Central deposit as a function of stratigraphic unit is shown in Figure 3-105. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from Grand Central deposit are shown in Figure 3-106 and Figure 3-107, respectively.

Table 3-83 presents to-be-mined waste volume from SF Grand Central deposit split by total sulphur content per stratigraphy. Table 3-84 and Table 3-85 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the Grand Central deposit is presented in Figure 3-108.

The key attributes are listed as follows:

- To-be-mined waste rock from Grand Central deposit consists of 37.2% Tertiary Detritals (ST3, HC1, GS3, SZ, CY1, VB2, CY2 and WP3), 35.5% Wittenoom Formation (WA1 and WA2) and 27.3% Marra Mamba Iron Formation (N1, N2, MM, N3 and MU). The majority of to-be-mined low-grade ore is evenly split between Marra Mamba Iron Formation (39.9%, incl., N2, MM, N3 and N1) and Tertiary Detritals (39.4% incl. HC1, GS3, VB2, WP3, SZ and ST3), and a smaller portion is from Wittenoom Formation (20.7% WA1 and WA2).
- To-be-mined waste rock and low-grade ore generally show low sulphur concentration with the 90th percentile values below or close to 0.2 wt% and median values below 0.1 wt% (Figure 3-106, Table 3-83).
- Very low (<0.1%) and low (0.1-0.2%) sulphur blocks comprise the majority of to-be-mined waste rock (98.23%) and low-grade ore (97.96%) volume, and that moderate (0.5-1.0%) and high (≥1.0%) sulphur blocks comprise 0.40% of to-be-mined waste rock and 0.13% of to-be-mined low-grade ore volume (Table 3-83).
- To-be-mined waste rock and low-grade ore generally have low ANC with the 90th percentile values below 10 kg H_2SO_4/t and the median values below or near 5 kg H_2SO_4/t for the majority of stratigraphies (Figure 3-107). The exception is for WP3 and SZ waste rock that show slightly higher ANC with the median value of 11.8 kg H_2SO_4/t and 7.2 kg H_2SO_4/t, respectively.
- A total volume of 166,121,200 m^3 (incl. 104,517,600 m^3 waste rock and 61,603,600 m^3 low-grade ore) of AMD0 waste is predicted to be mined from Grand Central deposit, representing 95.14% of to-be-mined waste rock and 91.30% of to-be-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to be mined out from the Grand Central deposit.
- A total volume of 7,340,400 m^3 (incl. 3,273,600 m^3 to-be-mined waste rock and 4,066,800 m^3 to-be-mined low-grade ore) is classed as AMD2, representing 2.98% of to-be-mined waste rock and 6.03% of to-be-mined low-grade ore (Table 3-84).
- A total volume of 3,862,800 m^3 (incl. 2,061,200 m^3 to-be-mined waste rock and 1,801,600 m^3 to-be-mined low-grade ore) is classed as AMD3, representing 1.88% of to-be-mined waste rock and 2.67% of to-be-mined low-grade ore (Table 3-84).
- Approximately 93.51% of waste rock and 97.44% of low-grade ore blocks are predicted to be mined from above water table (Table 3-85).



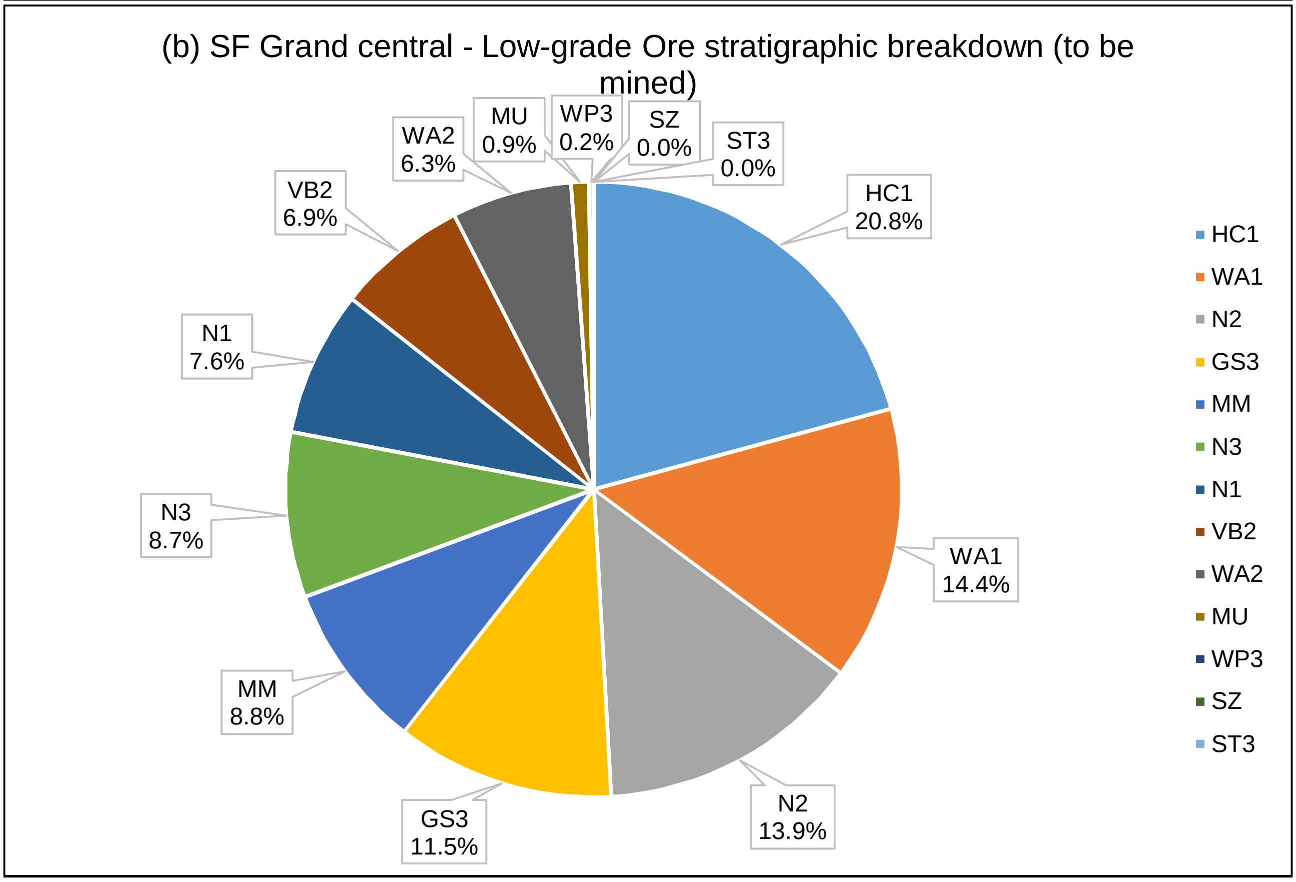


Figure 3-105 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the SF Grand Central deposit mining model

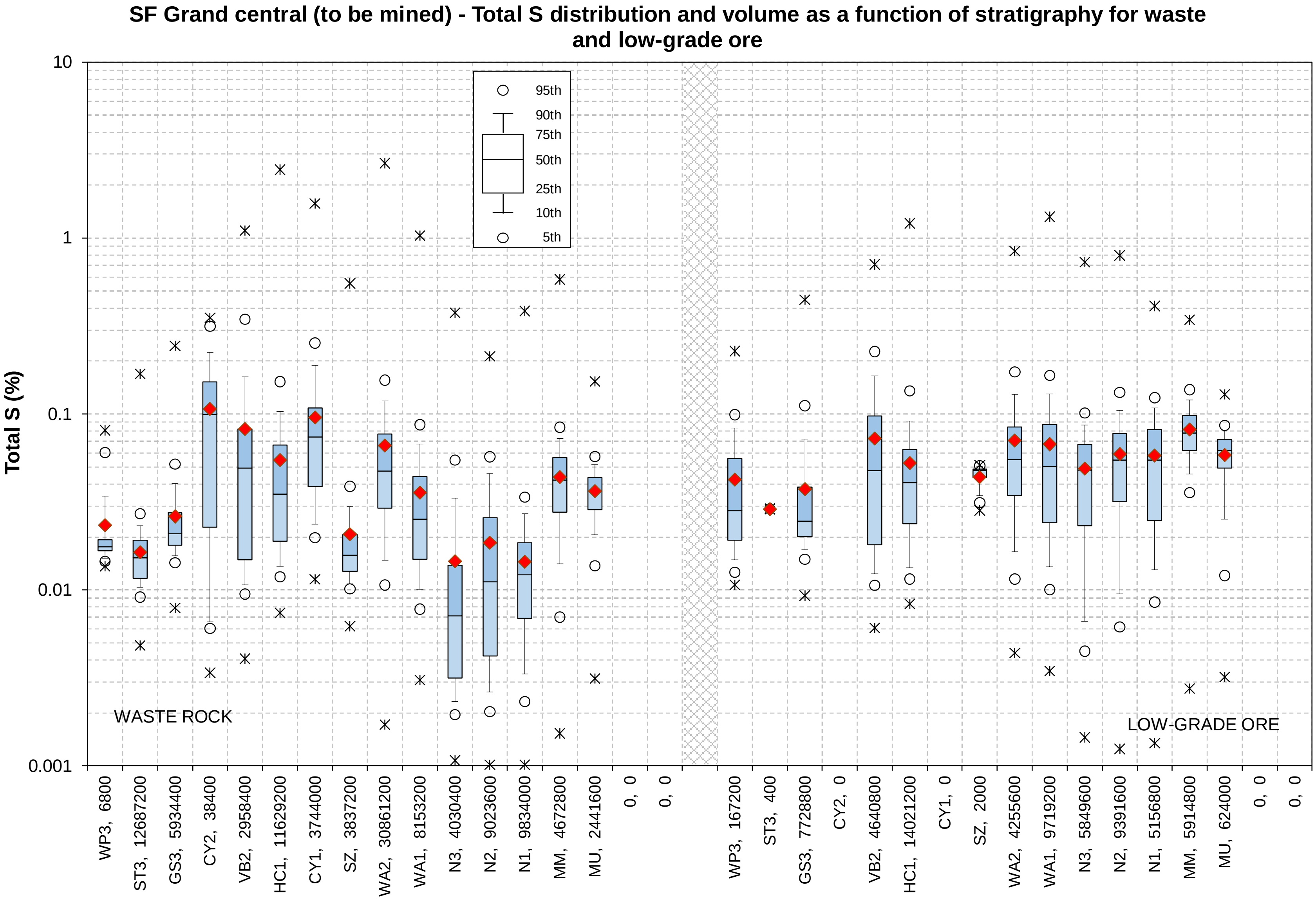


Figure 3-106 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of SF Grand Central deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

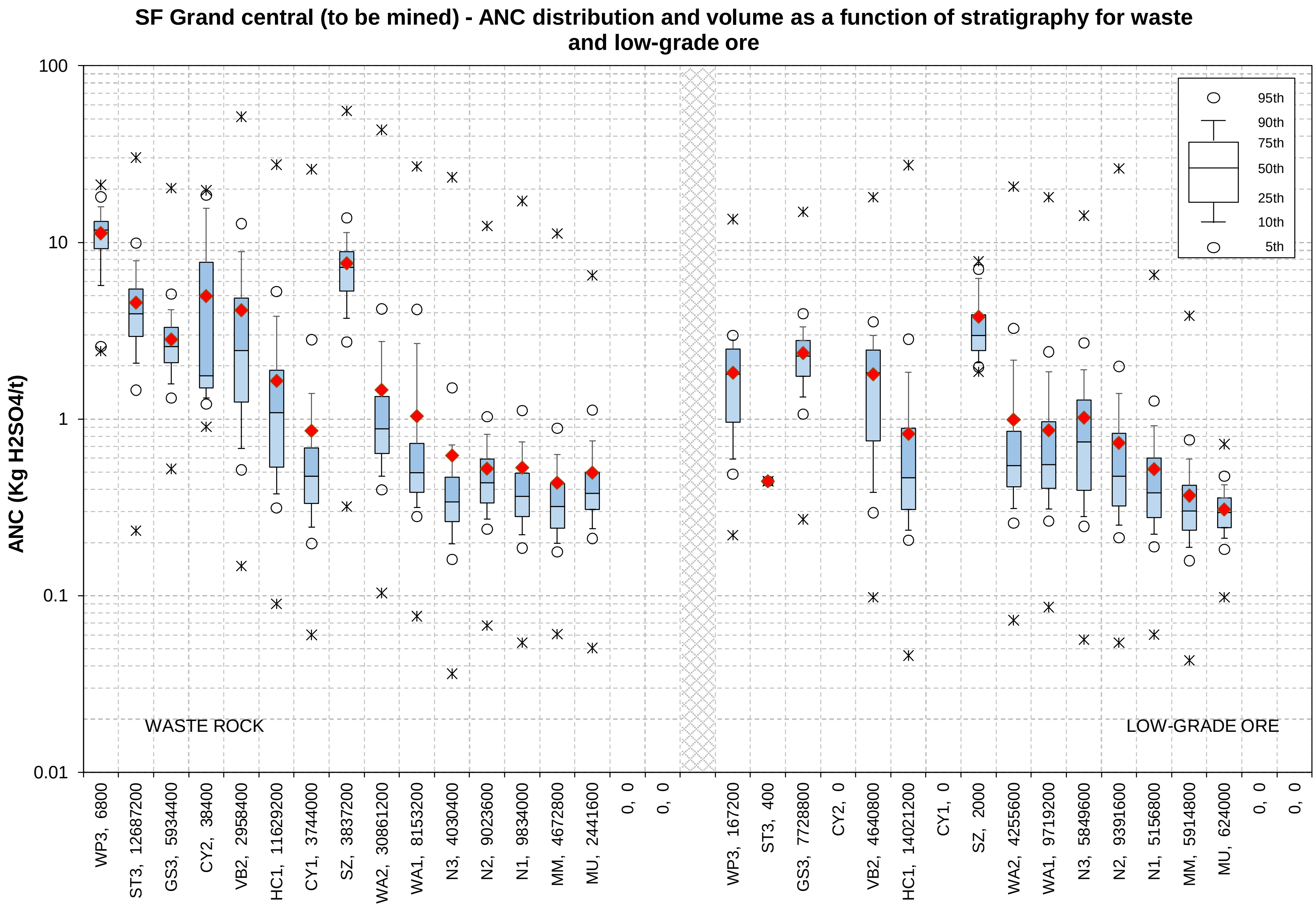


Figure 3-107 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of SF Grand Central deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-83 SF Grand Central deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

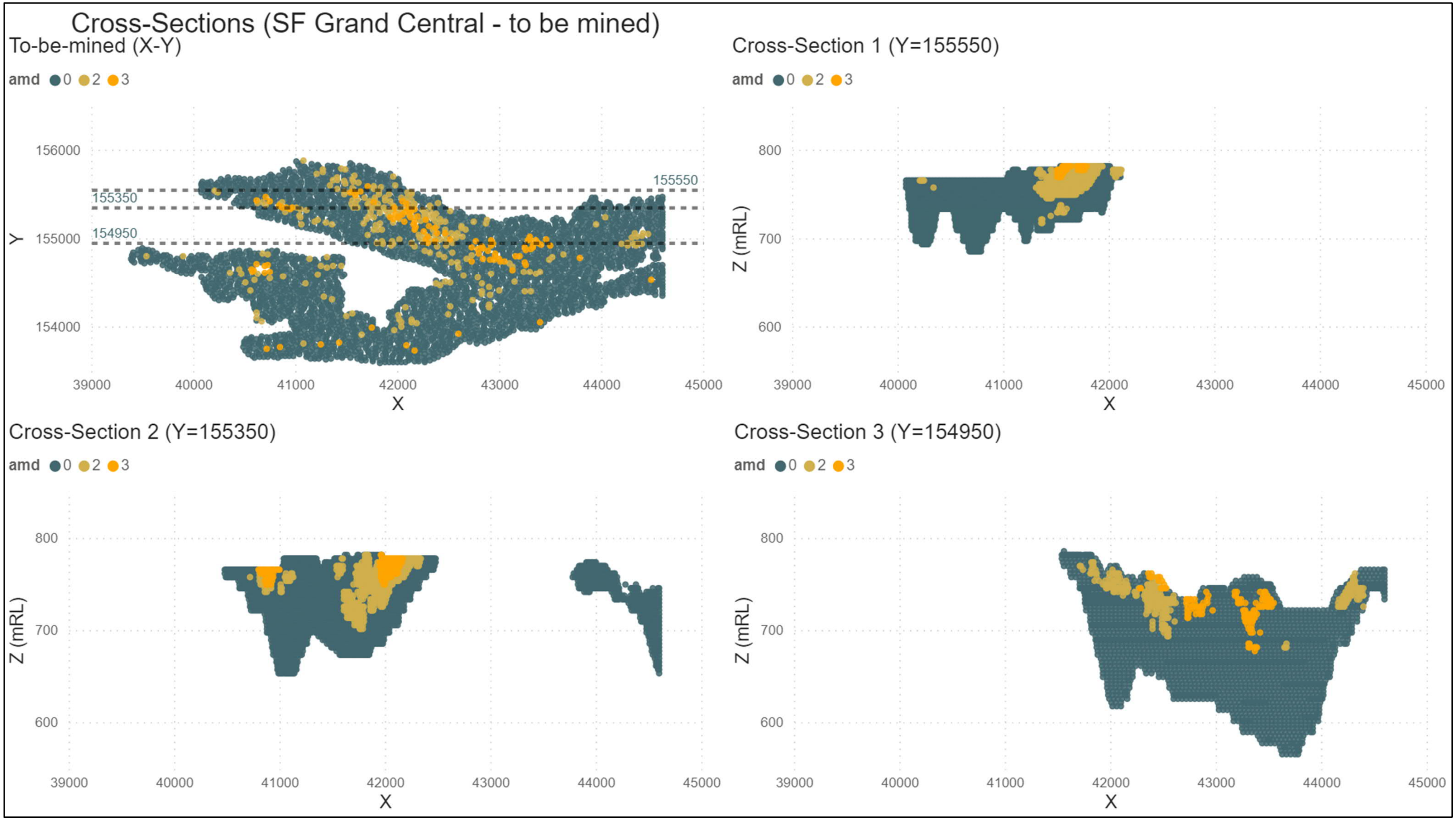
Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	6,800	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	12,681,200	12.47%	6,000	0.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	5,856,000	5.76%	69,200	1.12%	9,200	0.98%	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	19,200	0.02%	14,800	0.24%	2,000	0.21%	2,400	0.43%	0	0.00%	0	0.00%
9130 - VB2	2,384,800	2.34%	361,600	5.85%	47,600	5.05%	72,800	12.94%	89,200	22.99%	2,400	4.51%
9110 - HC1	10,391,200	10.21%	893,200	14.45%	196,000	20.80%	118,400	21.04%	25,200	6.49%	5,200	9.77%
9100 - CY1	2,632,400	2.59%	783,600	12.68%	208,400	22.11%	77,200	13.72%	40,400	10.41%	2,000	3.76%
8150 - SZ	3,784,400	3.72%	42,800	0.69%	7,200	0.76%	2,400	0.43%	400	0.10%	0	0.00%
4120 - WA2	26,330,000	25.88%	3,560,800	57.61%	447,600	47.50%	260,400	46.27%	219,200	56.49%	43,200	81.20%
4110 - WA1	7,865,600	7.73%	233,600	3.78%	17,600	1.87%	23,600	4.19%	12,400	3.20%	400	0.75%
3430 - N3	3,956,000	3.89%	66,800	1.08%	4,800	0.51%	2,800	0.50%	0	0.00%	0	0.00%
3420 - N2	8,982,800	8.83%	39,600	0.64%	1,200	0.13%	0	0.00%	0	0.00%	0	0.00%
3410 - N1	9,818,800	9.65%	14,400	0.23%	0	0.00%	800	0.14%	0	0.00%	0	0.00%
3300 - MM	4,582,400	4.50%	86,400	1.40%	800	0.08%	2,000	0.36%	1,200	0.31%	0	0.00%
3200 - MU	2,434,000	2.39%	7,600	0.12%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	**101,725,600**	**100.00%**	**6,180,400**	**100.00%**	**942,400**	**100.00%**	**562,800**	**100.00%**	**388,000**	**100.00%**	**53,200**	**100.00%**
% of Total	**92.60%**		**5.63%**		**0.86%**		**0.51%**		**0.35%**		**0.05%**	
Low grade ore												
9200 - WP3	159,200	0.27%	6,800	0.09%	1,200	0.14%	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	400	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	7,260,000	12.37%	396,000	5.34%	64,800	7.40%	8,000	1.94%	0	0.00%	0	0.00%
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	3,518,400	6.00%	808,400	10.90%	197,200	22.51%	104,000	25.17%	12,800	14.68%	0	0.00%
9110 - HC1	12,850,000	21.90%	816,400	11.01%	226,800	25.89%	119,200	28.85%	8,400	9.63%	400	16.67%
9100 - CY1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	2,000	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	3,504,800	5.97%	589,200	7.95%	97,600	11.14%	48,000	11.62%	16,000	18.35%	0	0.00%
4110 - WA1	7,894,400	13.45%	1,494,000	20.15%	174,000	19.86%	116,000	28.07%	38,800	44.50%	2,000	83.33%
3430 - N3	5,541,200	9.44%	290,800	3.92%	15,600	1.78%	1,600	0.39%	400	0.46%	0	0.00%
3420 - N2	8,306,000	14.16%	1,014,400	13.68%	48,400	5.53%	12,000	2.90%	10,800	12.39%	0	0.00%
3410 - N1	4,508,400	7.68%	639,600	8.63%	5,600	0.64%	3,200	0.77%	0	0.00%	0	0.00%
3300 - MM	4,519,600	7.70%	1,349,200	18.20%	44,800	5.11%	1,200	0.29%	0	0.00%	0	0.00%
3200 - MU	613,600	1.05%	10,400	0.14%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	**58,678,000**	**100.00%**	**7,415,200**	**100.00%**	**876,000**	**100.00%**	**413,200**	**100.00%**	**87,200**	**100.00%**	**2,400**	**100.00%**
% of Total	**86.97%**		**10.99%**		**1.30%**		**0.61%**		**0.13%**		**0.00%**	

Table 3-84 SF Grand Central deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	6,800	0.01%	0	N/A	0	0.00%	0	0.00%	6,800	0.01%
9190 - ST3	12,685,600	12.14%	0	N/A	0	0.00%	1,600	0.08%	12,687,200	11.55%
9180 - GS3	5,921,200	5.67%	0	N/A	0	0.00%	13,200	0.64%	5,934,400	5.40%
9150 - CY2	34,000	0.03%	0	N/A	0	0.00%	4,400	0.21%	38,400	0.03%
9130 - VB2	2,548,400	2.44%	0	N/A	400	0.01%	409,600	19.87%	2,958,400	2.69%
9110 - HC1	10,891,200	10.42%	0	N/A	5,600	0.17%	732,400	35.53%	11,629,200	10.59%
9100 - CY1	2,858,800	2.74%	0	N/A	400	0.01%	884,800	42.93%	3,744,000	3.41%
8150 - SZ	3,829,600	3.66%	0	N/A	0	0.00%	7,600	0.37%	3,837,200	3.49%
4120 - WA2	27,852,800	26.65%	0	N/A	3,002,400	91.72%	6,000	0.29%	30,861,200	28.09%
4110 - WA1	7,998,800	7.65%	0	N/A	153,600	4.69%	800	0.04%	8,153,200	7.42%
3430 - N3	3,985,200	3.81%	0	N/A	44,400	1.36%	800	0.04%	4,030,400	3.67%
3420 - N2	8,998,000	8.61%	0	N/A	25,600	0.78%	0	0.00%	9,023,600	8.21%
3410 - N1	9,824,800	9.40%	0	N/A	9,200	0.28%	0	0.00%	9,834,000	8.95%
3300 - MM	4,642,800	4.44%	0	N/A	30,000	0.92%	0	0.00%	4,672,800	4.25%
3200 - MU	2,439,600	2.33%	0	N/A	2,000	0.06%	0	0.00%	2,441,600	2.22%
Total	**104,517,600**	**100.00%**	**0**	**N/A**	**3,273,600**	**100.00%**	**2,061,200**	**100.00%**	**109,852,400**	**100.00%**
% of Total	**95.14%**		**0.00%**		**2.98%**		**1.88%**		**100.00%**	
Low grade ore										
9200 - WP3	160,400	0.26%	0	N/A	0	0.00%	6,800	0.38%	167,200	0.25%
9190 - ST3	400	0.00%	0	N/A	0	0.00%	0	0.00%	400	0.00%
9180 - GS3	7,609,200	12.35%	0	N/A	0	0.00%	119,600	6.64%	7,728,800	11.45%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	3,812,800	6.19%	0	N/A	1,200	0.03%	826,800	45.89%	4,640,800	6.88%
9110 - HC1	13,172,000	21.38%	0	N/A	4,000	0.10%	845,200	46.91%	14,021,200	20.78%
9100 - CY1	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	2,000	0.00%	0	N/A	0	0.00%	0	0.00%	2,000	0.00%
4120 - WA2	3,709,600	6.02%	0	N/A	545,200	13.41%	800	0.04%	4,255,600	6.31%
4110 - WA1	8,410,000	13.65%	0	N/A	1,308,800	32.18%	400	0.02%	9,719,200	14.40%
3430 - N3	5,700,800	9.25%	0	N/A	148,000	3.64%	800	0.04%	5,849,600	8.67%
3420 - N2	8,665,600	14.07%	0	N/A	726,000	17.85%	0	0.00%	9,391,600	13.92%
3410 - N1	4,751,600	7.71%	0	N/A	404,400	9.94%	800	0.04%	5,156,800	7.64%
3300 - MM	4,991,600	8.10%	0	N/A	922,800	22.69%	400	0.02%	5,914,800	8.77%
3200 - MU	617,600	1.00%	0	N/A	6,400	0.16%	0	0.00%	624,000	0.92%
Total	**61,603,600**	**100.00%**	**0**	**N/A**	**4,066,800**	**100.00%**	**1,801,600**	**100.00%**	**67,472,000**	**100.00%**
% of Total	**91.30%**		**0.00%**		**6.03%**		**2.67%**		**100.00%**	

Table 3-85 SF Grand Central deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	97,388,000	7,129,600	104,517,600	95.14%
1	0	0	0	0.00%
2	3,273,600	0	3,273,600	2.98%
3	2,061,200	0	2,061,200	1.88%
Total	**102,722,800**	**7,129,600**	**109,852,400**	100.00%
% of Total	**93.51%**	**6.49%**	**100.00%**	
Low grade ore				
0	59,878,800	1,724,800	61,603,600	91.30%
1	0	0	0	0.00%
2	4,066,800	0	4,066,800	6.03%
3	1,801,600	0	1,801,600	2.67%
Total	**65,747,200**	**1,724,800**	**67,472,000**	100.00%
% of Total	**97.44%**	**2.56%**	**100.00%**	


Cross-Sections (SF Grand Central - to be mined)
To-be-mined (X-Y)
amd 0 2 3
156000
155000
154000
Y
155550
155350
154950
39000
40000
41000
42000
43000
44000
45000
X
Cross-Section 1 (Y=155550)
amd 0 2 3
800
700
600
Z (mRL)
39000
40000
41000
42000
43000
44000
45000
X
Cross-Section 2 (Y=155350)
amd 0 2 3
800
700
600
Z (mRL)
39000
40000
41000
42000
43000
44000
45000
X
Cross-Section 3 (Y=154950)
amd 0 2 3
800
700
600
Z (mRL)
39000
40000
41000
42000
43000
44000
45000
X

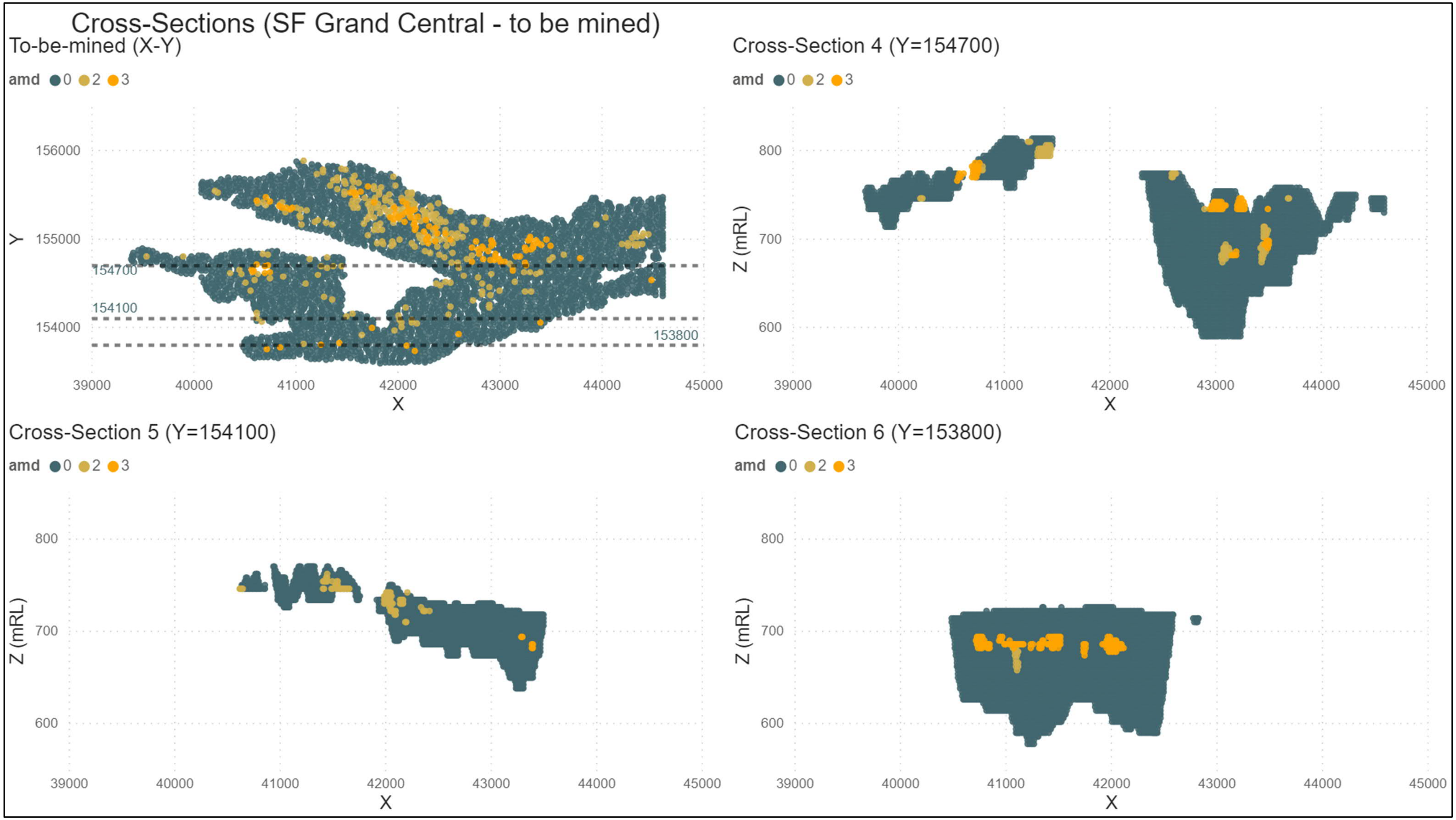


Figure 3-108 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by SF Grand Central deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.18 SF Vista Oriental deposit

3.1.1.18.1 SF Vista Oriental deposit (as-mined waste)

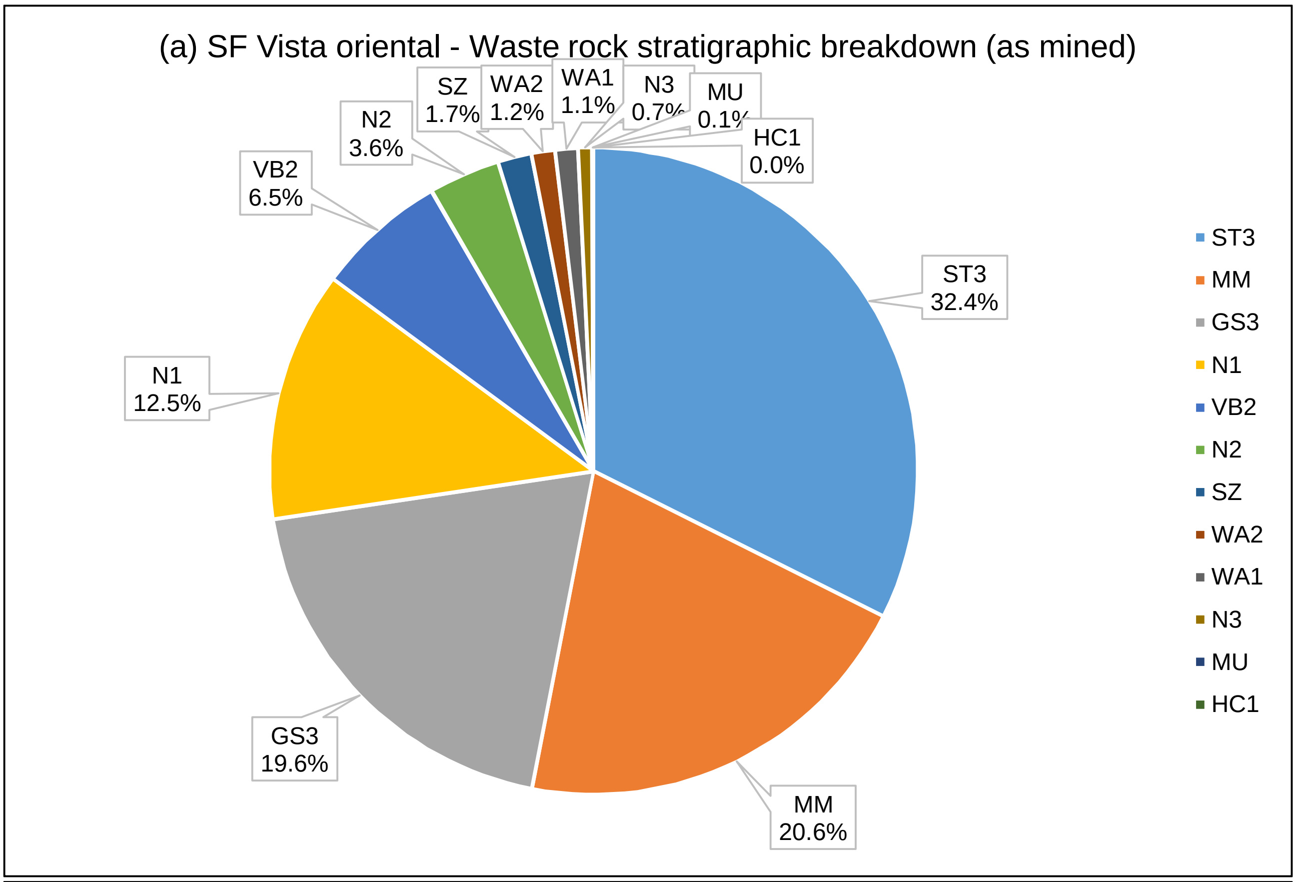
A pie chart showing the distribution of as-mined waste rock and low-grade ore from SF Vista Oriental deposit as a function of stratigraphic unit is shown in Figure 3-109. Distribution of total sulphur and ANC as a function of stratigraphy for as-mined waste rock and low-grade ore from Vista Oriental deposit are shown in Figure 3-110 and Figure 3-111, respectively.

Table 3-86 presents as-mined waste volume from SF Vista Oriental deposit split by total sulphur content per stratigraphy. Table 3-87 and Table 3-88 present as-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of as-mined AMD materials defined by the mining model within the Vista Oriental deposit is presented in Figure 3-112.

The key findings are presented as follows:

- The majority of as-mined waste rock from Vista Oriental deposit is from Tertiary Detritals (60.2%, incl. ST3, GS3, VB2, SZ and HC1) and Marra Mamba Iron Formation (37.5%, incl. MM, N1, N2, N3 and MU), with a smaller contribution from Wittenoom Formation (2.3% WA2 and WA1). Similarly, as-mined low-grade ore is mainly sourced from Tertiary Detritals (50.0% incl. VB2, GS3, HC1, WP3 and SZ) and Marra Mamba Iron Formation (46.5%, incl., N2, N1, N3, MM and MU) with smaller portion from Wittenoom Formation (3.5% WA1 and WA2).
- Overall, as-mined waste rock and low-grade ore have low sulphur concentrations, with the 95th percentile sulphur concentrations below 0.2 wt% and the median values below or close to 0.08 wt% (Figure 3-110, Table 3-86). VB2 stratigraphy shows slightly higher sulphur range than other stratigraphic units, but 95th percentile sulphur is still contained at values near 0.2 %.
- Very low (<0.1%) and low (0.1-0.2%) sulphur blocks comprise the majority of as-mined waste rock (99.82%) and low-grade ore (98.97%) volume (Table 3-86). Low-moderate (0.2-0.5%) sulphur blocks comprise 0.18% of as-mined waste rock and 1.03% of as-mined low-grade ore volume. No waste blocks show total sulphur above 0.5 wt%.
- As-mined waste rock and low-grade ore have typically low ANC with the 90th percentile values below or near 10 kg H_2SO_4/t and the median values below 5 kg H_2SO_4/t (Figure 3-111).
- A total volume of 13,970,400 m^3 (incl. 7,443,600 m^3 waste rock and 6,526,800 m^3 low-grade ore) of AMD0 waste has been mined out from Vista Oriental deposit, comprising 98.52% of as-mined waste rock and 92.70% of as-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to have been mined out from the Vista Oriental deposit.
- A total volume of 156,800 m^3 (incl. 12,400 m^3 as-mined waste rock and 144,400 m^3 as-mined low-grade ore) is classed as AMD2, comprising 0.16% of as-mined waste rock and 2.05% of as-mined low-grade ore, which is associated with Wittenoom Formation and Marra Mamba Iron Formation (Table 3-87).
- A total volume of 468,800 m^3 (incl. 99,600 m^3 as-mined waste rock and 369,200 m^3 as-mined low-grade ore) are classed as AMD3, comprising 1.32% of as-mined waste rock and 5.24% of as-mined low-grade ore (Table 3-87).
- All materials mined-out (waste rock and low-grade ore) from Vista Oriental deposit are sourced from above the water table (Table 3-88).



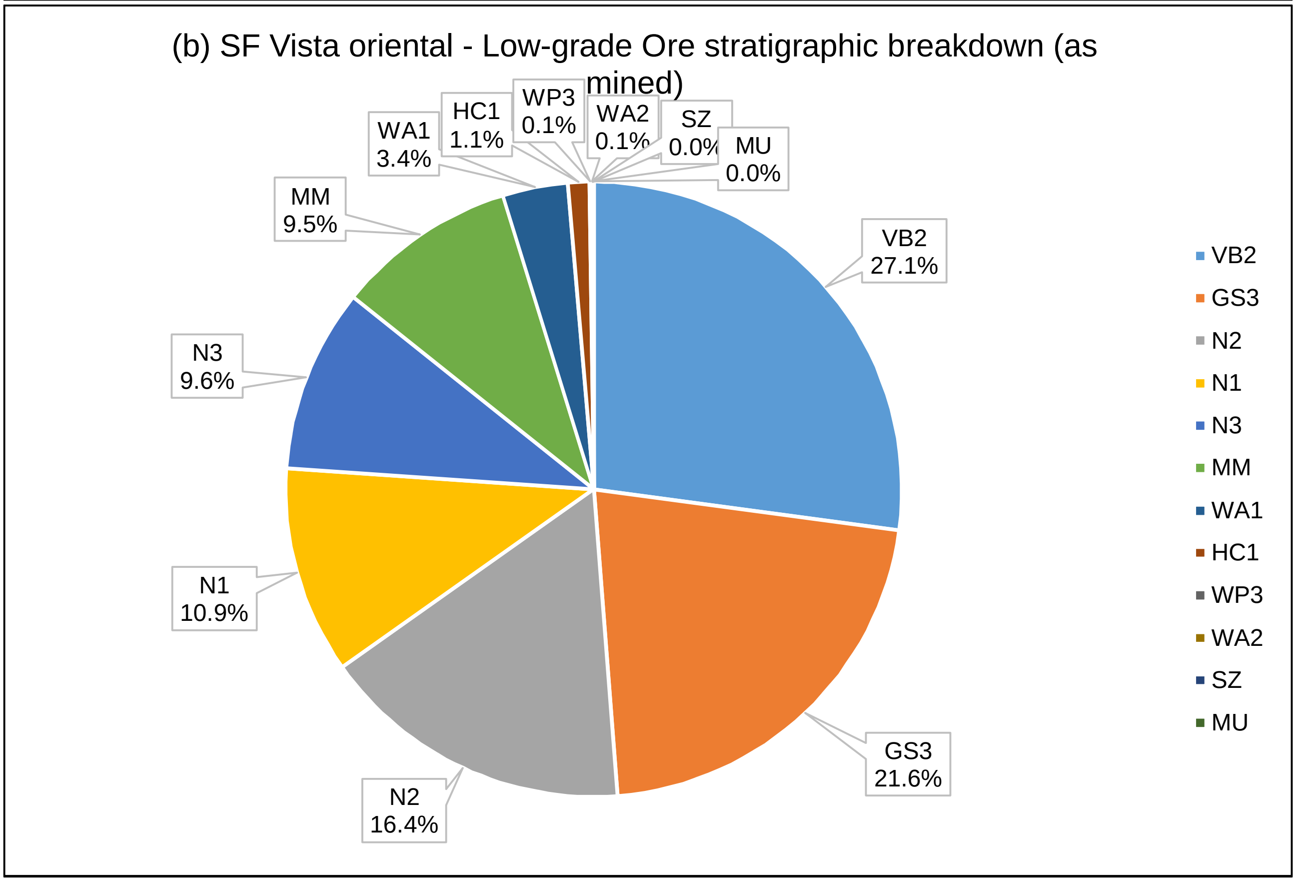


Figure 3-109 Proportion of as-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the SF Vista Oriental deposit mining model

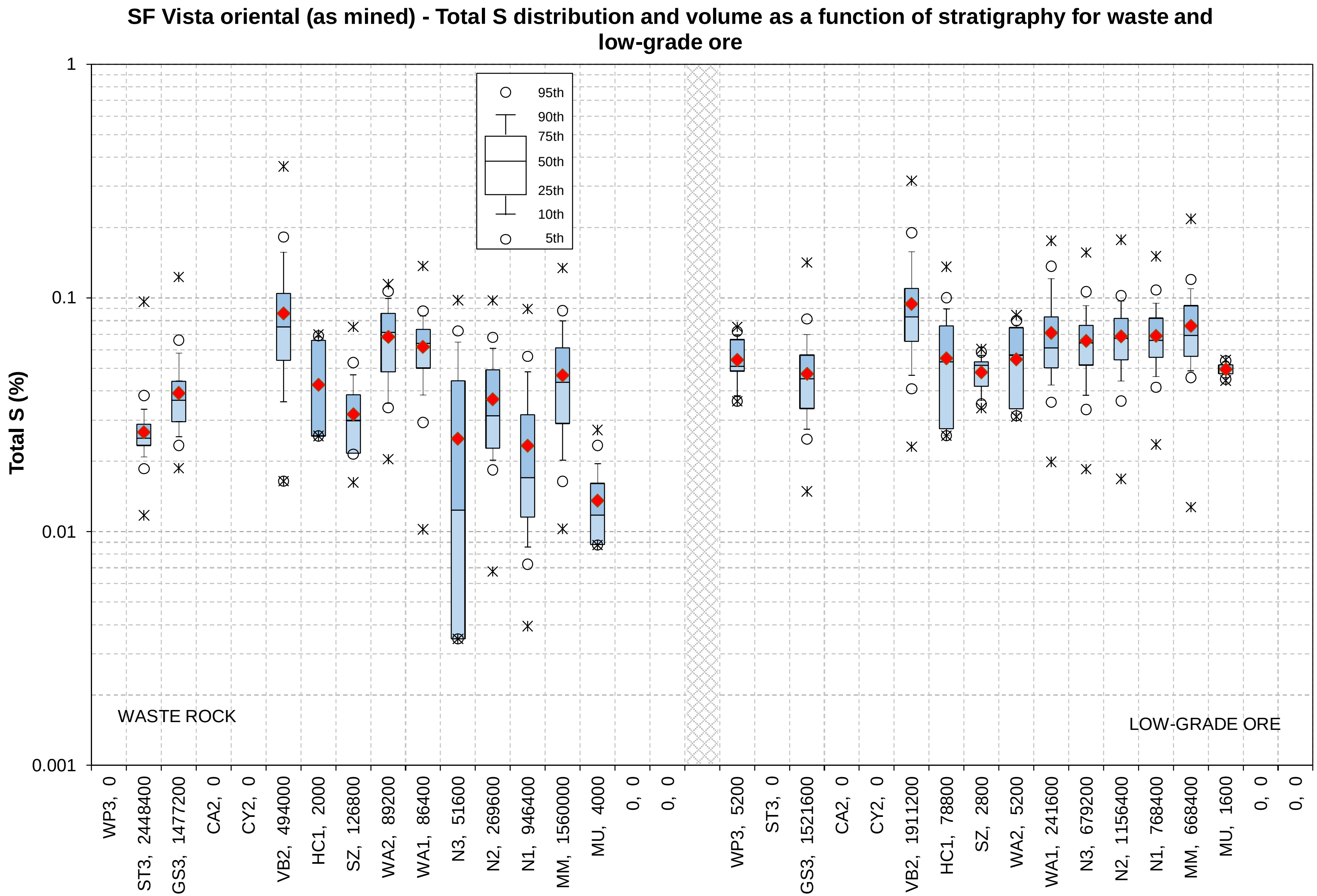


Figure 3-110 Distribution of total-S as a function of stratigraphy for as-mined waste rock and LGO of SF Vista Oriental deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

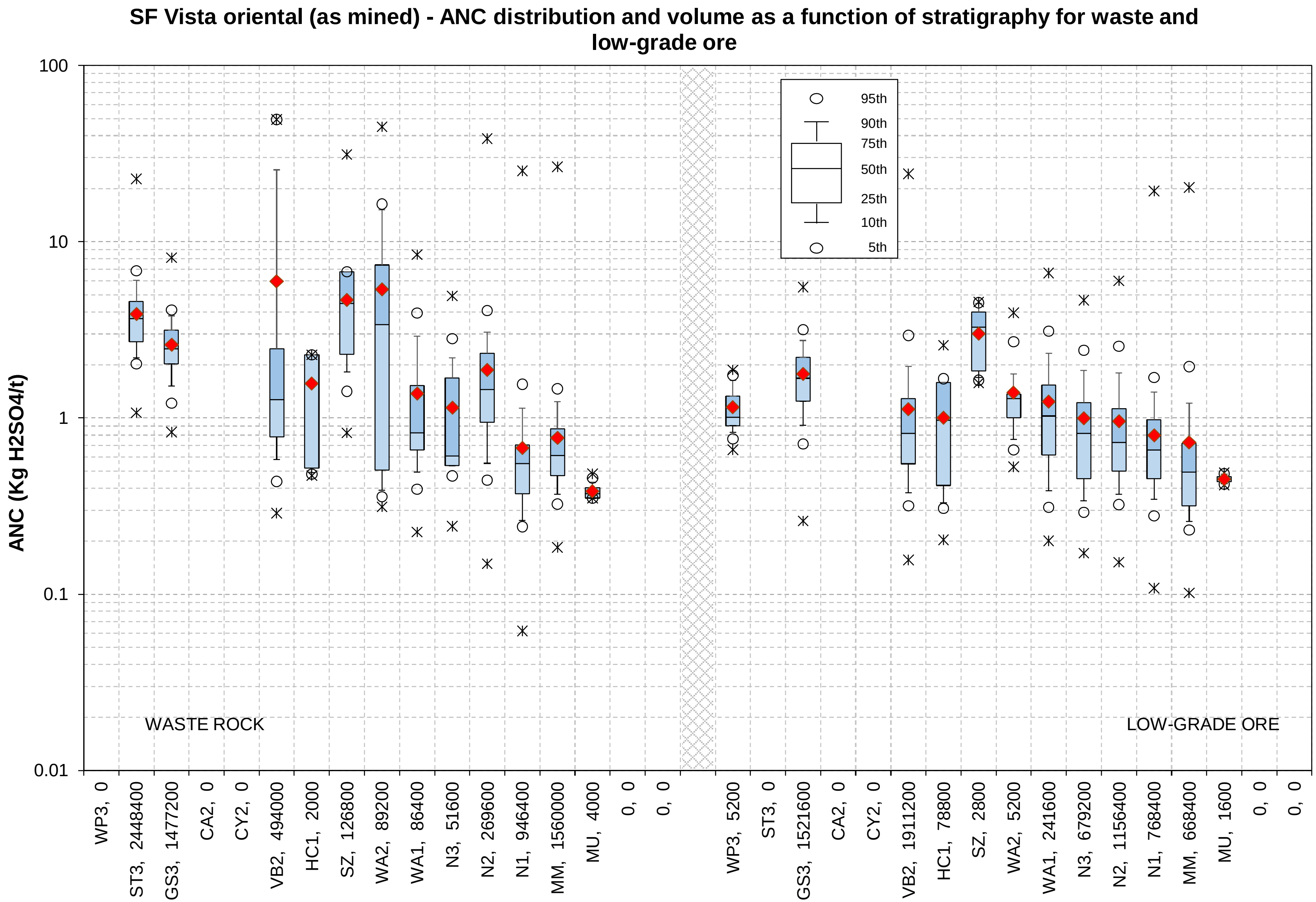


Figure 3-111 Distribution of ANC as a function of stratigraphy for as-mined waste rock and LGO of SF Vista Oriental deposit (the volume in m3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-86 SF Vista Oriental deposit as-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9190 - ST3	2,448,400	33.20%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9180 - GS3	1,470,800	19.94%	6,400	3.83%	0	0.00%	0	0.00%	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9130 - VB2	354,400	4.81%	126,000	75.36%	6,800	100.00%	6,800	100.00%	0	N/A	0	N/A
9110 - HC1	2,000	0.03%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	126,800	1.72%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
4120 - WA2	80,800	1.10%	8,400	5.02%	0	0.00%	0	0.00%	0	N/A	0	N/A
4110 - WA1	85,600	1.16%	800	0.48%	0	0.00%	0	0.00%	0	N/A	0	N/A
3430 - N3	51,600	0.70%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
3420 - N2	269,600	3.66%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
3410 - N1	946,400	12.83%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
3300 - MM	1,534,400	20.81%	25,600	15.31%	0	0.00%	0	0.00%	0	N/A	0	N/A
3200 - MU	4,000	0.05%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**7,374,800**	**100.00%**	**167,200**	**100.00%**	**6,800**	**100.00%**	**6,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**97.61%**		**2.21%**		**0.09%**		**0.09%**		**0.00%**		**0.00%**	
Low grade ore												
9200 - WP3	5,200	0.09%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9190 - ST3	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9180 - GS3	1,497,200	24.75%	24,400	2.65%	0	0.00%	0	0.00%	0	N/A	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
9130 - VB2	1,294,800	21.41%	546,400	59.44%	67,600	96.02%	2,400	100.00%	0	N/A	0	N/A
9110 - HC1	74,800	1.24%	4,000	0.44%	0	0.00%	0	0.00%	0	N/A	0	N/A
8150 - SZ	2,800	0.05%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
4120 - WA2	5,200	0.09%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
4110 - WA1	197,600	3.27%	44,000	4.79%	0	0.00%	0	0.00%	0	N/A	0	N/A
3430 - N3	634,800	10.50%	44,400	4.83%	0	0.00%	0	0.00%	0	N/A	0	N/A
3420 - N2	1,078,800	17.84%	77,600	8.44%	0	0.00%	0	0.00%	0	N/A	0	N/A
3410 - N1	709,600	11.73%	58,800	6.40%	0	0.00%	0	0.00%	0	N/A	0	N/A
3300 - MM	546,000	9.03%	119,600	13.01%	2,800	3.98%	0	0.00%	0	N/A	0	N/A
3200 - MU	1,600	0.03%	0	0.00%	0	0.00%	0	0.00%	0	N/A	0	N/A
Total	**6,048,400**	**100.00%**	**919,200**	**100.00%**	**70,400**	**100.00%**	**2,400**	**100.00%**	**0**	**N/A**	**0**	**N/A**
% of Total	**85.91%**		**13.06%**		**1.00%**		**0.03%**		**0.00%**		**0.00%**	

Table 3-87 SF Vista Oriental deposit as-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	2,448,400	32.89%	0	N/A	0	0.00%	0	0.00%	2,448,400	32.41%
9180 - GS3	1,477,200	19.85%	0	N/A	0	0.00%	0	0.00%	1,477,200	19.55%
9160 - CA2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	394,400	5.30%	0	N/A	0	0.00%	99,600	100.00%	494,000	6.54%
9110 - HC1	2,000	0.03%	0	N/A	0	0.00%	0	0.00%	2,000	0.03%
8150 - SZ	126,800	1.70%	0	N/A	0	0.00%	0	0.00%	126,800	1.68%
4120 - WA2	79,200	1.06%	0	N/A	10,000	80.65%	0	0.00%	89,200	1.18%
4110 - WA1	85,600	1.15%	0	N/A	800	6.45%	0	0.00%	86,400	1.14%
3430 - N3	51,600	0.69%	0	N/A	0	0.00%	0	0.00%	51,600	0.68%
3420 - N2	269,600	3.62%	0	N/A	0	0.00%	0	0.00%	269,600	3.57%
3410 - N1	946,400	12.71%	0	N/A	0	0.00%	0	0.00%	946,400	12.53%
3300 - MM	1,558,400	20.94%	0	N/A	1,600	12.90%	0	0.00%	1,560,000	20.65%
3200 - MU	4,000	0.05%	0	N/A	0	0.00%	0	0.00%	4,000	0.05%
Total	**7,443,600**	**100.00%**	**0**	**N/A**	**12,400**	**100.00%**	**99,600**	**100.00%**	**7,555,600**	**100.00%**
% of Total	**98.52%**		**0.00%**		**0.16%**		**1.32%**		**100.00%**	
Low grade ore										
9200 - WP3	5,200	0.08%	0	N/A	0	0.00%	0	0.00%	5,200	0.07%
9190 - ST3	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	1,521,600	23.31%	0	N/A	0	0.00%	0	0.00%	1,521,600	21.61%
9160 - CA2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	1,546,400	23.69%	0	N/A	0	0.00%	364,800	98.81%	1,911,200	27.15%
9110 - HC1	76,400	1.17%	0	N/A	0	0.00%	2,400	0.65%	78,800	1.12%
8150 - SZ	2,800	0.04%	0	N/A	0	0.00%	0	0.00%	2,800	0.04%
4120 - WA2	5,200	0.08%	0	N/A	0	0.00%	0	0.00%	5,200	0.07%
4110 - WA1	217,600	3.33%	0	N/A	23,200	16.07%	800	0.22%	241,600	3.43%
3430 - N3	671,600	10.29%	0	N/A	7,200	4.99%	400	0.11%	679,200	9.65%
3420 - N2	1,135,200	17.39%	0	N/A	20,800	14.40%	400	0.11%	1,156,400	16.43%
3410 - N1	746,800	11.44%	0	N/A	21,600	14.96%	0	0.00%	768,400	10.91%
3300 - MM	596,400	9.14%	0	N/A	71,600	49.58%	400	0.11%	668,400	9.49%
3200 - MU	1,600	0.02%	0	N/A	0	0.00%	0	0.00%	1,600	0.02%
Total	**6,526,800**	**100.00%**	**0**	**N/A**	**144,400**	**100.00%**	**369,200**	**100.00%**	**7,040,400**	**100.00%**
% of Total	**92.70%**		**0.00%**		**2.05%**		**5.24%**		**100.00%**	

Table 3-88 SF Vista Oriental deposit as-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	7,443,600	0	7,443,600	98.52%
1	0	0	0	0.00%
2	12,400	0	12,400	0.16%
3	99,600	0	99,600	1.32%
Total	**7,555,600**	**0**	**7,555,600**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	
Low grade ore				
0	6,526,800	0	6,526,800	92.70%
1	0	0	0	0.00%
2	144,400	0	144,400	2.05%
3	369,200	0	369,200	5.24%
Total	**7,040,400**	**0**	**7,040,400**	100.00%
% of Total	**100.00%**	**0.00%**	**100.00%**	

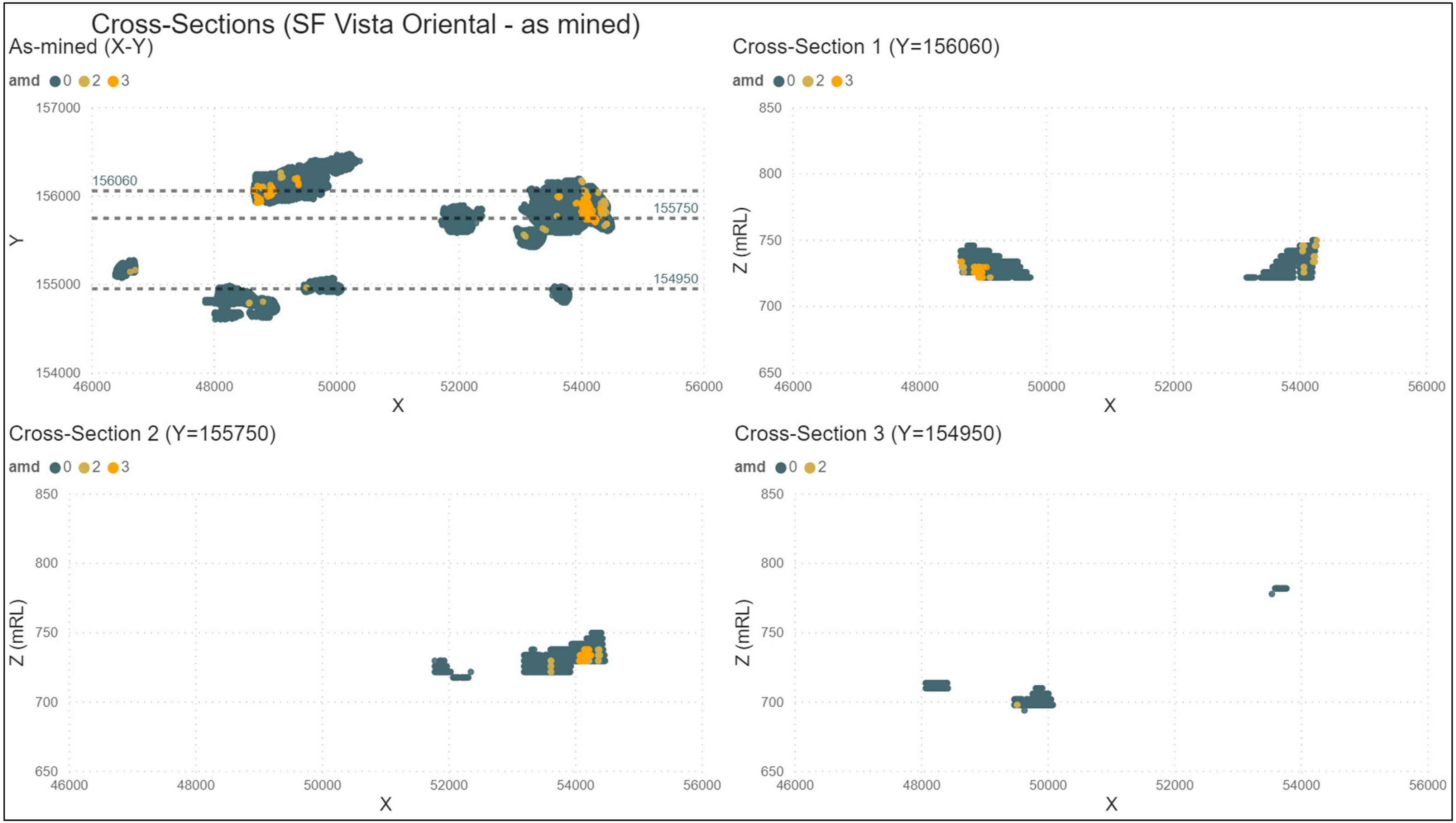


Figure 3-112 Spatial variability (2D X-Y view and cross sections) of as-mined AMD material predicted by SF Vista Oriental deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.18.2 SF Vista Oriental deposit (to-be-mined waste)

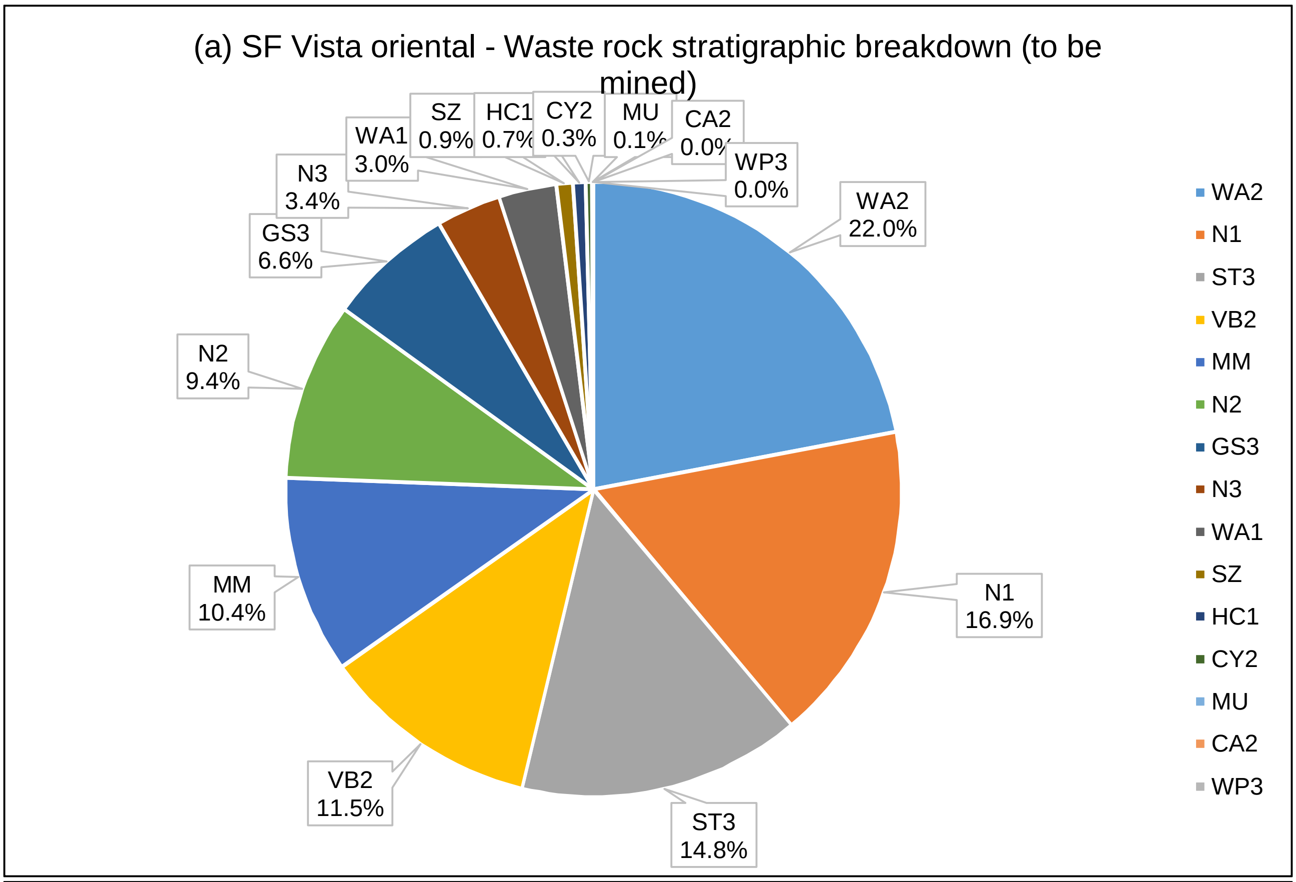
A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from SF Vista Oriental deposit as a function of stratigraphic unit is shown in Figure 3-113. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from Vista Oriental deposit are shown in Figure 3-114 and Figure 3-115, respectively.

Table 3-89 presents to-be-mined waste volume from SF Vista Oriental deposit split by total sulphur content per stratigraphy. Table 3-90 and Table 3-91 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the Vista Oriental deposit is presented in Figure 3-116.

The key attributes are listed as follows:

- To-be-mined waste rock from Vista Oriental deposit consists of 40.2% Marra Mamba Iron Formation (N1, MM, N2, N3 and MU), 34.8% Tertiary Detritals (ST3, VB2, GS3, SZ, HC1, CY2, CA2 and WP3) and 25.0% Wittenoom Formation (WA2 and WA1). The majority of to-be-mined low-grade ore is split between Marra Mamba Iron Formation (43.3%, incl., N2, MM, N1, N3 and MU) and Tertiary Detritals (37.3% incl. VB2, GS3, HC1, WP3, ST3, SZ and CY2), and a smaller portion is from Wittenoom Formation (19.4% WA1 and WA2).
- To-be-mined waste rock and low-grade ore generally show low sulphur concentration with the 95th percentile values below or near 0.1 wt% and median values below or near 0.05 wt% (Figure 3-114, Table 3-89). Only HC1 stratigraphy has higher 95th percentile sulphur concentrations (0.55% for waste rock and 0.20% for low-grade ore), however, the 75th percentile and median values are well below 0.1 wt%.
- Very low (<0.1%) and low (0.1-0.2%) sulphur blocks comprise the majority of to-be-mined waste rock (99.59%); while low-grade ore (99.80%) volume and moderate (0.5-1.0%) and high (≥1.0%) sulphur blocks comprise only 0.06% of to-be-mined waste rock and 0.04% of to-be-mined low-grade ore volume (Table 3-89).
- To-be-mined waste rock and low-grade ore generally have low ANC with the 90th percentile values below or near 10 kg H_2SO_4/t and the median values below or near 5 kg H_2SO_4/t for the majority of stratigraphies (Figure 3-115). The exception is for 23,600 m^3 CA2 waste rock that show elevated ANC with the minimum and median value of 139.1 kg H_2SO_4/t and 303.2 kg H_2SO_4/t, respectively. Some CY2 and VB2 waste rock blocks also have elevated ANC (e.g. >30 kg H_2SO_4/t), however their median ANC values are still below 10 kg H_2SO_4/t.
- A total volume of 205,836,400 m^3 (incl. 122,277,200 m^3 waste rock and 83,559,200 m^3 low-grade ore) of AMD0 waste is predicted to be mined from Vista Oriental deposit, representing 98.79% of to-be-mined waste rock and 96.45% of to-be-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to be mined out from the Vista Oriental deposit.
- A total volume of 3,893,200 m^3 (incl. 1,267,200 m^3 to-be-mined waste rock and 2,626,000 m^3 to-be-mined low-grade ore) is classed as AMD2, representing 1.02% of to-be-mined waste rock and 3.03% of to-be-mined low-grade ore (Table 3-90).
- A total volume of 676,800 m^3 (incl. 226,800 m^3 to-be-mined waste rock and 450,000 m^3 to-be-mined low-grade ore) are classed as AMD3, representing 0.18% of to-be-mined waste rock and 0.52% of to-be-mined low-grade ore (Table 3-90).
- Approximately 86.61% of waste rock and 95.88% of low-grade ore blocks are predicted to be mined from above water table (Table 3-91).



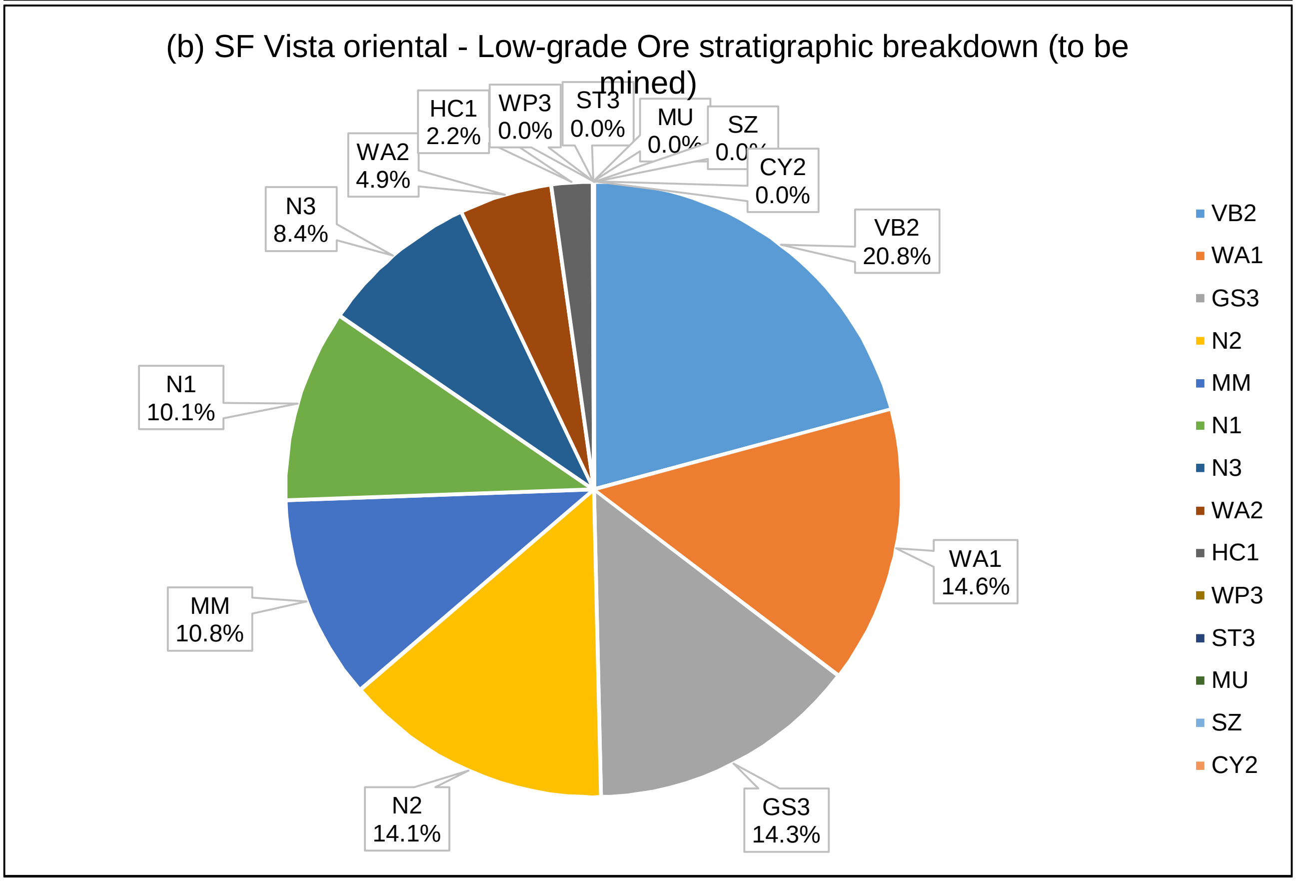


Figure 3-113 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the SF Vista Oriental deposit mining model

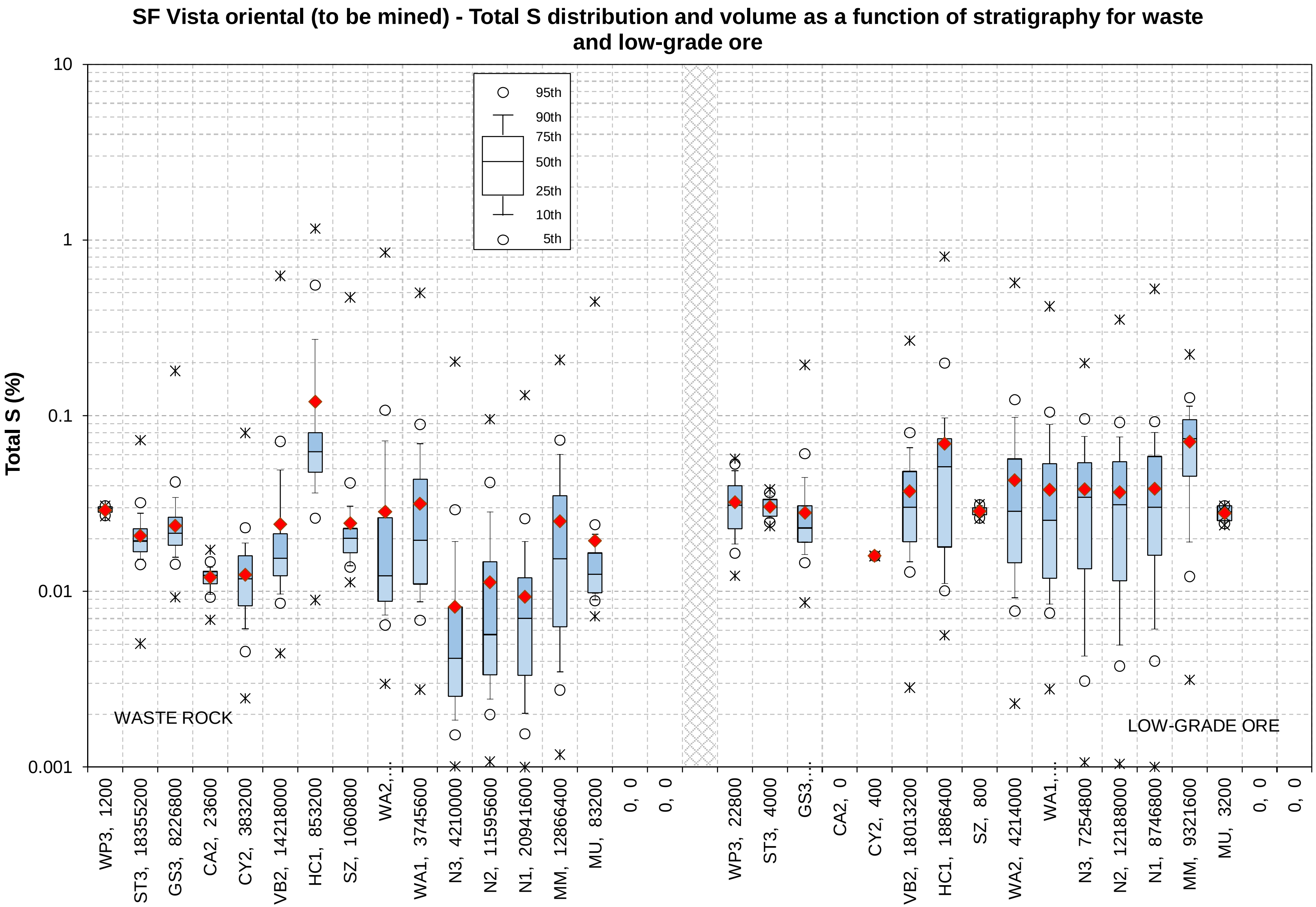


Figure 3-114 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of SF Vista Oriental deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

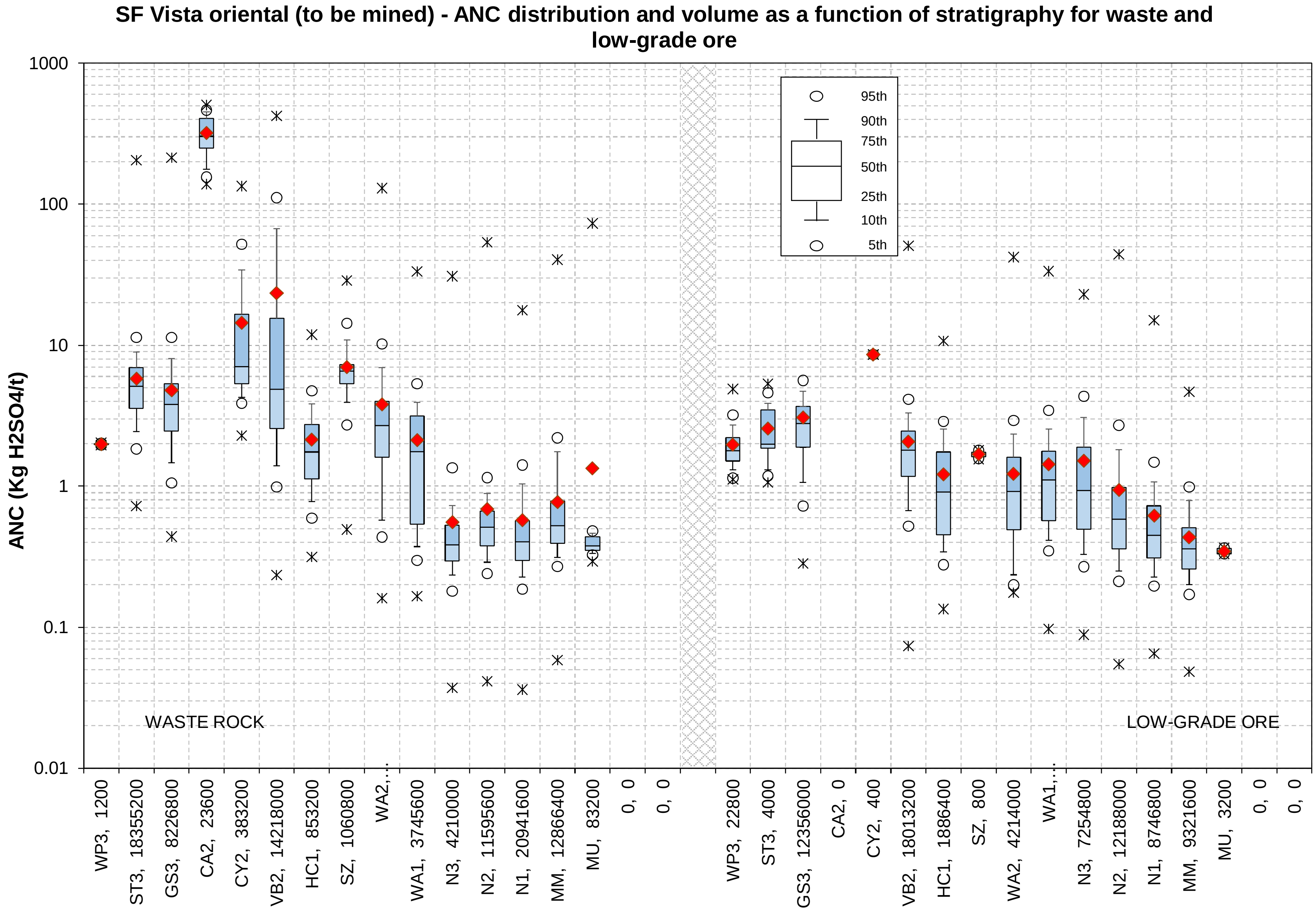


Figure 3-115 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of SF Vista Oriental deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-89 SF Vista Oriental deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

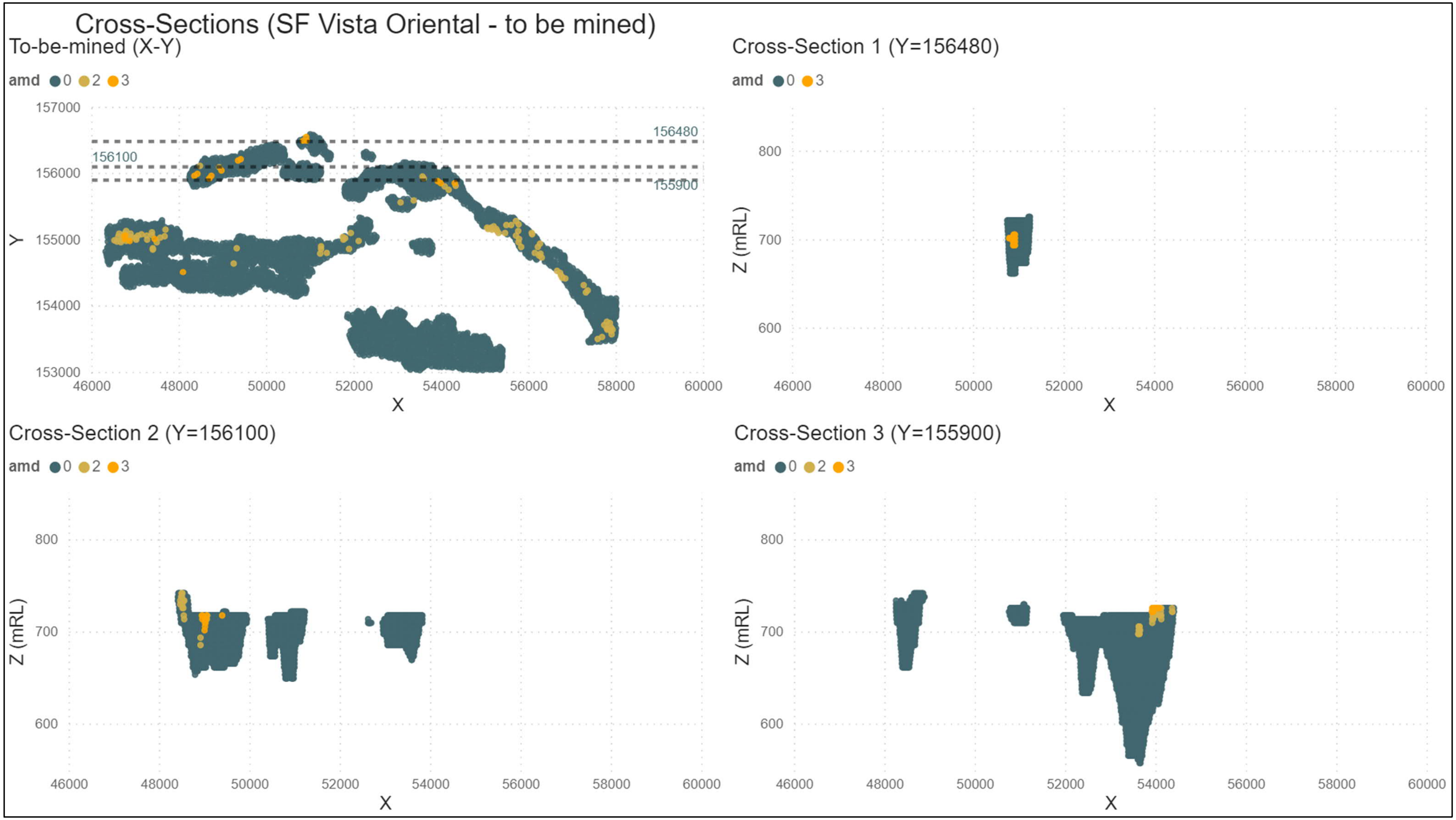
Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9200 - WP3	1,200	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9190 - ST3	18,355,200	15.14%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	8,225,600	6.78%	1,200	0.06%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9160 - CA2	23,600	0.02%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	383,200	0.32%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	13,923,600	11.48%	210,800	10.58%	58,400	22.29%	20,400	11.81%	4,800	8.33%	0	0.00%
9110 - HC1	690,800	0.57%	57,600	2.89%	33,200	12.67%	26,400	15.28%	34,400	59.72%	10,800	100.00%
8150 - SZ	1,051,200	0.87%	1,200	0.06%	3,600	1.37%	4,800	2.78%	0	0.00%	0	0.00%
4120 - WA2	25,530,400	21.05%	1,379,600	69.22%	159,600	60.92%	119,200	68.98%	18,000	31.25%	0	0.00%
4110 - WA1	3,616,800	2.98%	124,000	6.22%	3,200	1.22%	1,200	0.69%	400	0.69%	0	0.00%
3430 - N3	4,203,200	3.47%	5,600	0.28%	1,200	0.46%	0	0.00%	0	0.00%	0	0.00%
3420 - N2	11,595,600	9.56%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3410 - N1	20,940,800	17.27%	800	0.04%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3300 - MM	12,652,000	10.43%	212,400	10.66%	2,000	0.76%	0	0.00%	0	0.00%	0	0.00%
3200 - MU	81,600	0.07%	0	0.00%	800	0.31%	800	0.46%	0	0.00%	0	0.00%
Total	**121,274,800**	**100.00%**	**1,993,200**	**100.00%**	**262,000**	**100.00%**	**172,800**	**100.00%**	**57,600**	**100.00%**	**10,800**	**100.00%**
% of Total	**97.98%**		**1.61%**		**0.21%**		**0.14%**		**0.05%**		**0.01%**	
Low grade ore												
9200 - WP3	22,800	0.03%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9190 - ST3	4,000	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9180 - GS3	12,241,200	14.96%	114,800	2.47%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9160 - CA2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9150 - CY2	400	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9130 - VB2	17,515,600	21.41%	477,200	10.25%	20,400	22.27%	0	0.00%	0	0.00%	0	N/A
9110 - HC1	1,710,000	2.09%	82,800	1.78%	26,400	28.82%	32,800	67.77%	34,400	96.63%	0	N/A
8150 - SZ	800	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	3,812,400	4.66%	369,200	7.93%	20,800	22.71%	10,800	22.31%	800	2.25%	0	N/A
4110 - WA1	11,822,800	14.45%	784,800	16.86%	11,600	12.66%	4,000	8.26%	0	0.00%	0	N/A
3430 - N3	6,950,000	8.50%	304,800	6.55%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3420 - N2	11,793,600	14.42%	390,000	8.38%	4,000	4.37%	400	0.83%	0	0.00%	0	N/A
3410 - N1	8,486,400	10.37%	259,200	5.57%	400	0.44%	400	0.83%	400	1.12%	0	N/A
3300 - MM	7,440,800	9.10%	1,872,800	40.23%	8,000	8.73%	0	0.00%	0	0.00%	0	N/A
3200 - MU	3,200	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**81,804,000**	**100.00%**	**4,655,600**	**100.00%**	**91,600**	**100.00%**	**48,400**	**100.00%**	**35,600**	**100.00%**	**0**	**N/A**
% of Total	**94.42%**		**5.37%**		**0.11%**		**0.06%**		**0.04%**		**0.00%**	

Table 3-90 SF Vista Oriental deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9200 - WP3	1,200	0.00%	0	N/A	0	0.00%	0	0.00%	1,200	0.00%
9190 - ST3	18,355,200	15.01%	0	N/A	0	0.00%	0	0.00%	18,355,200	14.83%
9180 - GS3	8,226,400	6.73%	0	N/A	0	0.00%	400	0.18%	8,226,800	6.65%
9160 - CA2	23,600	0.02%	0	N/A	0	0.00%	0	0.00%	23,600	0.02%
9150 - CY2	383,200	0.31%	0	N/A	0	0.00%	0	0.00%	383,200	0.31%
9130 - VB2	14,116,000	11.54%	0	N/A	0	0.00%	102,000	44.97%	14,218,000	11.49%
9110 - HC1	734,800	0.60%	0	N/A	800	0.06%	117,600	51.85%	853,200	0.69%
8150 - SZ	1,054,400	0.86%	0	N/A	0	0.00%	6,400	2.82%	1,060,800	0.86%
4120 - WA2	26,155,600	21.39%	0	N/A	1,050,800	82.92%	400	0.18%	27,206,800	21.98%
4110 - WA1	3,692,000	3.02%	0	N/A	53,600	4.23%	0	0.00%	3,745,600	3.03%
3430 - N3	4,208,800	3.44%	0	N/A	1,200	0.09%	0	0.00%	4,210,000	3.40%
3420 - N2	11,595,600	9.48%	0	N/A	0	0.00%	0	0.00%	11,595,600	9.37%
3410 - N1	20,941,600	17.13%	0	N/A	0	0.00%	0	0.00%	20,941,600	16.92%
3300 - MM	12,705,600	10.39%	0	N/A	160,800	12.69%	0	0.00%	12,866,400	10.40%
3200 - MU	83,200	0.07%	0	N/A	0	0.00%	0	0.00%	83,200	0.07%
Total	**122,277,200**	**100.00%**	**0**	**N/A**	**1,267,200**	**100.00%**	**226,800**	**100.00%**	**123,771,200**	**100.00%**
% of Total	**98.79%**		**0.00%**		**1.02%**		**0.18%**		**100.00%**	
Low grade ore										
9200 - WP3	22,800	0.03%	0	N/A	0	0.00%	0	0.00%	22,800	0.03%
9190 - ST3	4,000	0.00%	0	N/A	0	0.00%	0	0.00%	4,000	0.00%
9180 - GS3	12,321,600	14.75%	0	N/A	400	0.02%	34,000	7.56%	12,356,000	14.26%
9160 - CA2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	400	0.00%	0	N/A	0	0.00%	0	0.00%	400	0.00%
9130 - VB2	17,727,200	21.22%	0	N/A	0	0.00%	286,000	63.56%	18,013,200	20.79%
9110 - HC1	1,757,200	2.10%	0	N/A	0	0.00%	129,200	28.71%	1,886,400	2.18%
8150 - SZ	800	0.00%	0	N/A	0	0.00%	0	0.00%	800	0.00%
4120 - WA2	3,882,800	4.65%	0	N/A	331,200	12.61%	0	0.00%	4,214,000	4.86%
4110 - WA1	12,144,000	14.53%	0	N/A	479,200	18.25%	0	0.00%	12,623,200	14.57%
3430 - N3	7,078,800	8.47%	0	N/A	176,000	6.70%	0	0.00%	7,254,800	8.37%
3420 - N2	11,932,000	14.28%	0	N/A	255,600	9.73%	400	0.09%	12,188,000	14.07%
3410 - N1	8,569,600	10.26%	0	N/A	176,800	6.73%	400	0.09%	8,746,800	10.10%
3300 - MM	8,114,800	9.71%	0	N/A	1,206,800	45.96%	0	0.00%	9,321,600	10.76%
3200 - MU	3,200	0.00%	0	N/A	0	0.00%	0	0.00%	3,200	0.00%
Total	**83,559,200**	**100.00%**	**0**	**N/A**	**2,626,000**	**100.00%**	**450,000**	**100.00%**	**86,635,200**	**100.00%**
% of Total	**96.45%**		**0.00%**		**3.03%**		**0.52%**		**100.00%**	

Table 3-91 SF Vista Oriental deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	105,701,600	16,575,200	122,277,200	98.79%
1	0	0	0	0.00%
2	1,267,200	0	1,267,200	1.02%
3	226,800	0	226,800	0.18%
Total	**107,195,600**	**16,575,200**	**123,771,200**	100.00%
% of Total	**86.61%**	**13.39%**	**100.00%**	
Low grade ore				
0	79,991,600	3,567,600	83,559,200	96.45%
1	0	0	0	0.00%
2	2,626,000	0	2,626,000	3.03%
3	450,000	0	450,000	0.52%
Total	**83,067,600**	**3,567,600**	**86,635,200**	100.00%
% of Total	**95.88%**	**4.12%**	**100.00%**	


Cross-Sections (SF Vista Oriental - to be mined)
To-be-mined (X-Y)
amd 0 2 3
157000
156000
155000
154000
153000
Y
156480
156100
155900
46000 48000 50000 52000 54000 56000 58000 60000
X
Cross-Section 1 (Y=156480)
amd 0 3
800
700
600
Z (mRL)
46000 48000 50000 52000 54000 56000 58000 60000
X
Cross-Section 2 (Y=156100)
amd 0 2 3
800
700
600
Z (mRL)
46000 48000 50000 52000 54000 56000 58000 60000
X
Cross-Section 3 (Y=155900)
amd 0 2 3
800
700
600
Z (mRL)
46000 48000 50000 52000 54000 56000 58000 60000
X

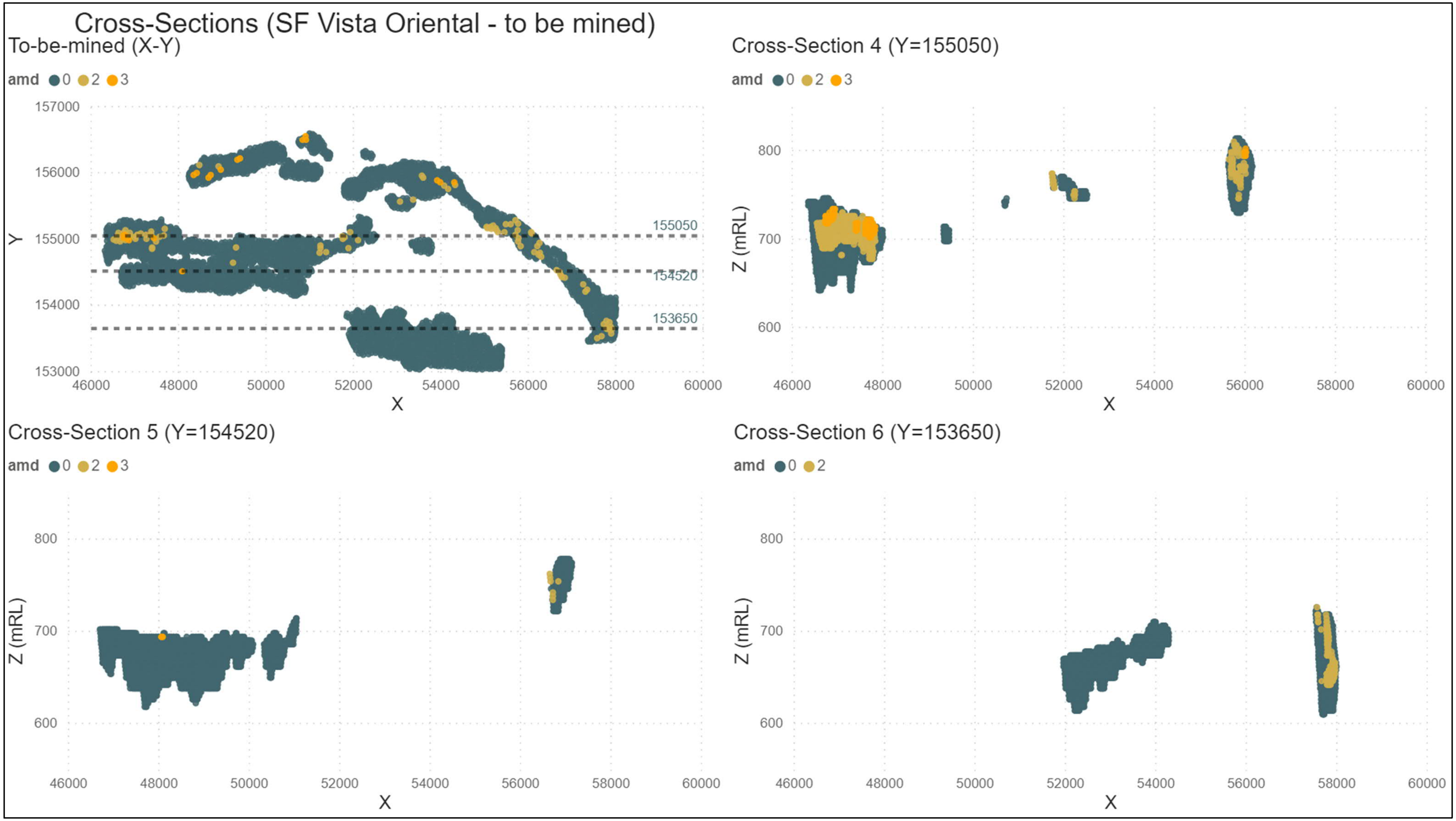


Figure 3-116 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by SF Vista Oriental deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.1.19 R deposit

3.1.1.19.1 R deposit (to-be-mined waste)

A pie chart showing the distribution of to-be-mined waste rock and low-grade ore from R deposit as a function of stratigraphic unit is shown in Figure 3-117. Distribution of total sulphur and ANC as a function of stratigraphy for to-be-mined waste rock and low-grade ore from R deposit are shown in Figure 3-118 and Figure 3-119, respectively.

Table 3-92 presents to-be-mined waste volume from R deposit split by total sulphur content per stratigraphy. Table 3-93 and Table 3-94 present to-be-mined waste volumes split by stratigraphic unit and by water table location for each AMD class, respectively.

The location of to-be-mined AMD materials defined by the mining model within the R deposit is presented in Figure 3-120.

The R deposit is yet to be mined.

The key attributes are listed as follows:

- To-be-mined waste rock from R deposit is dominated by Tertiary Detritals (75.2%, incl. ST3, SZ, GS3, VB2, HC1, K, CY2, CY1 and LT2), and smaller contribution is from Marra Mamba Iron Formation (15.1%, incl. MM, N1, N2, N3 and MU) and Wittenoom Formation (9.9%, incl. WA2, WA1 and OB). Similarly, the majority of to-be-mined low-grade ore is sourced from Tertiary Detritals (89.4% incl. VB2, GS3, HC1, SZ, ST3 and K), with smaller contribution from Marra Mamba Iron Formation (7.9%, incl., N3, N2, MM and N1) and Wittenoom Formation (2.8% WA1 and WA2).
- To-be-mined waste rock and low-grade ore generally show low sulphur concentration with the 95th percentile values below or near 0.1 wt% and median values below or near 0.05 wt% for the majority of stratigraphic units (Figure 3-118, Table 3-92). A negligible volume of 2400 m^3 LT2 waste rock has elevated sulphur concentrations (minimum = 0.76% and median = 0.97%), and MU waste rock also has appreciable sulphur concentration with the median value of 0.35 wt%.
- Very low (<0.1%) and low (0.1-0.2%) sulphur blocks comprise the majority of to-be-mined waste rock (98.37%) and low-grade ore (99.99%) volume (Table 3-92). Moderate (0.5-1.0%) and high (≥1.0%) sulphur blocks comprise only 0.28% of to-be-mined waste rock and 0.001% of to-be-mined low-grade ore volume.
- All low-grade ore blocks have low ANC with the 90th percentile values below 10 kg H_2SO_4/t and the median values below or near 5 kg H_2SO_4/t. For waste rock, all CY2 and OB blocks show elevated ANC with minimum values above 70 kg H_2SO_4/t; all MU waste rock blocks and some ST3 and CY1 blocks also have appreciable ANC (e.g. > 30 kg H_2SO_4/t); the other stratigraphies generally have low ANC with the 75th percentile values below or near 10 kg H_2SO_4/t (Figure 3-119).
- A total volume of 127,629,600 m^3 (incl. 64,476,800 m^3 waste rock and 63,152,800 m^3 low-grade ore) of AMD0 waste is predicted to be mined from R deposit, representing 99.90% of to-be-mined waste rock and virtually 100% of to-be-mined low-grade ore.
- No AMD1 waste (waste rock and low-grade ore) is predicted to be mined out from the R deposit.
- An irrelevant volume equal to 2,000 m^3 to-be-mined low-grade ore is classed as AMD2, representing 0.003% of to-be-mined low-grade ore (Table 3-93).
- A total volume of 68,000 m^3 (incl. 67,600 m^3 to-be-mined waste rock and 400 m^3 to-be-mined low-grade ore) are classed as AMD3, representing 0.10% of to-be-mined waste rock and 0.001% of to-be-mined low-grade ore (Table 3-93).
- Approximately 92.32% of waste rock and 90.56% of low-grade ore blocks are predicted to be mined from above water table (Table 3-94).

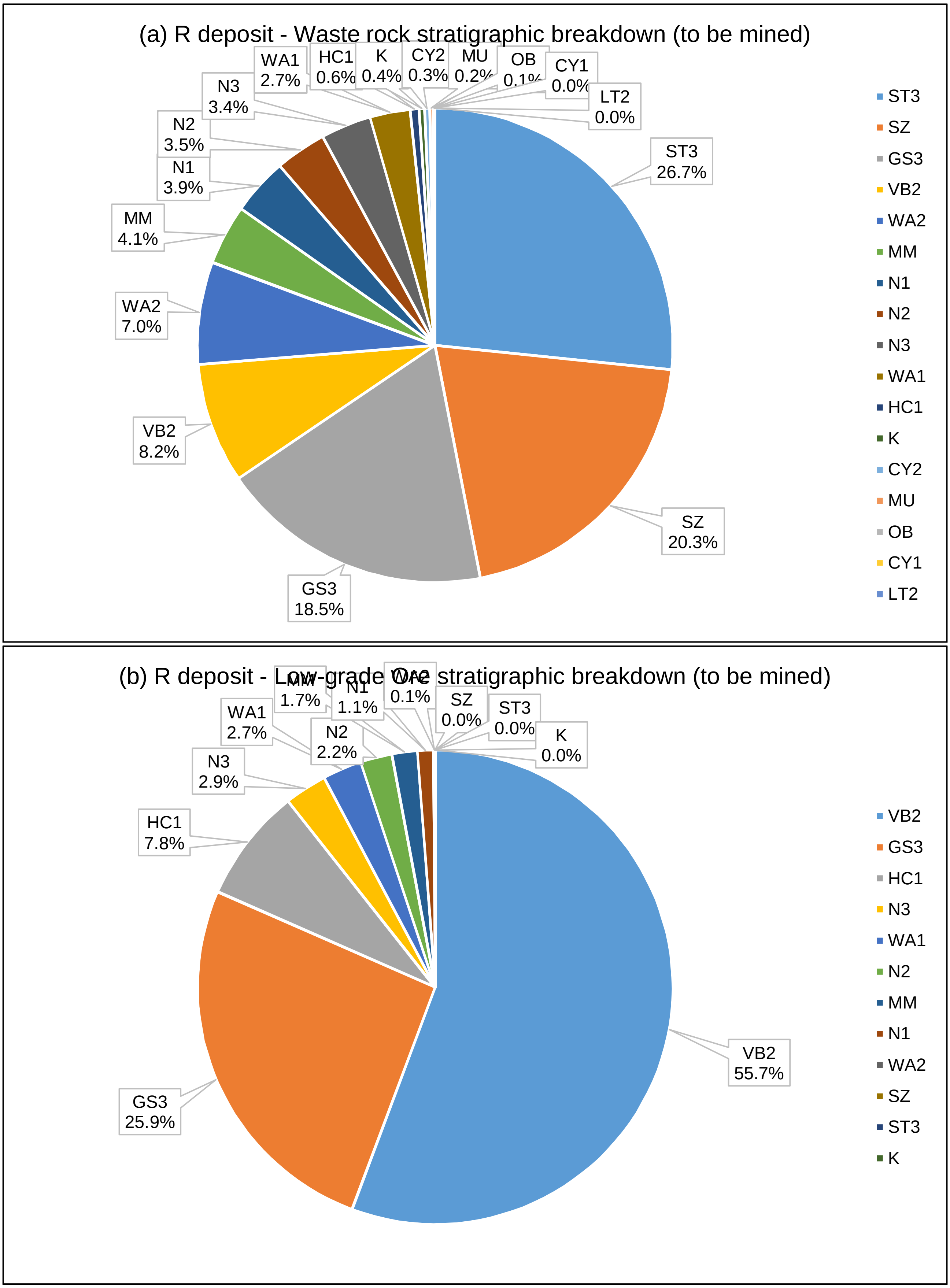


Figure 3-117 Proportion of to-be-mined waste rock (a) and low-grade ore (b) stratigraphic units based on the R deposit mining model

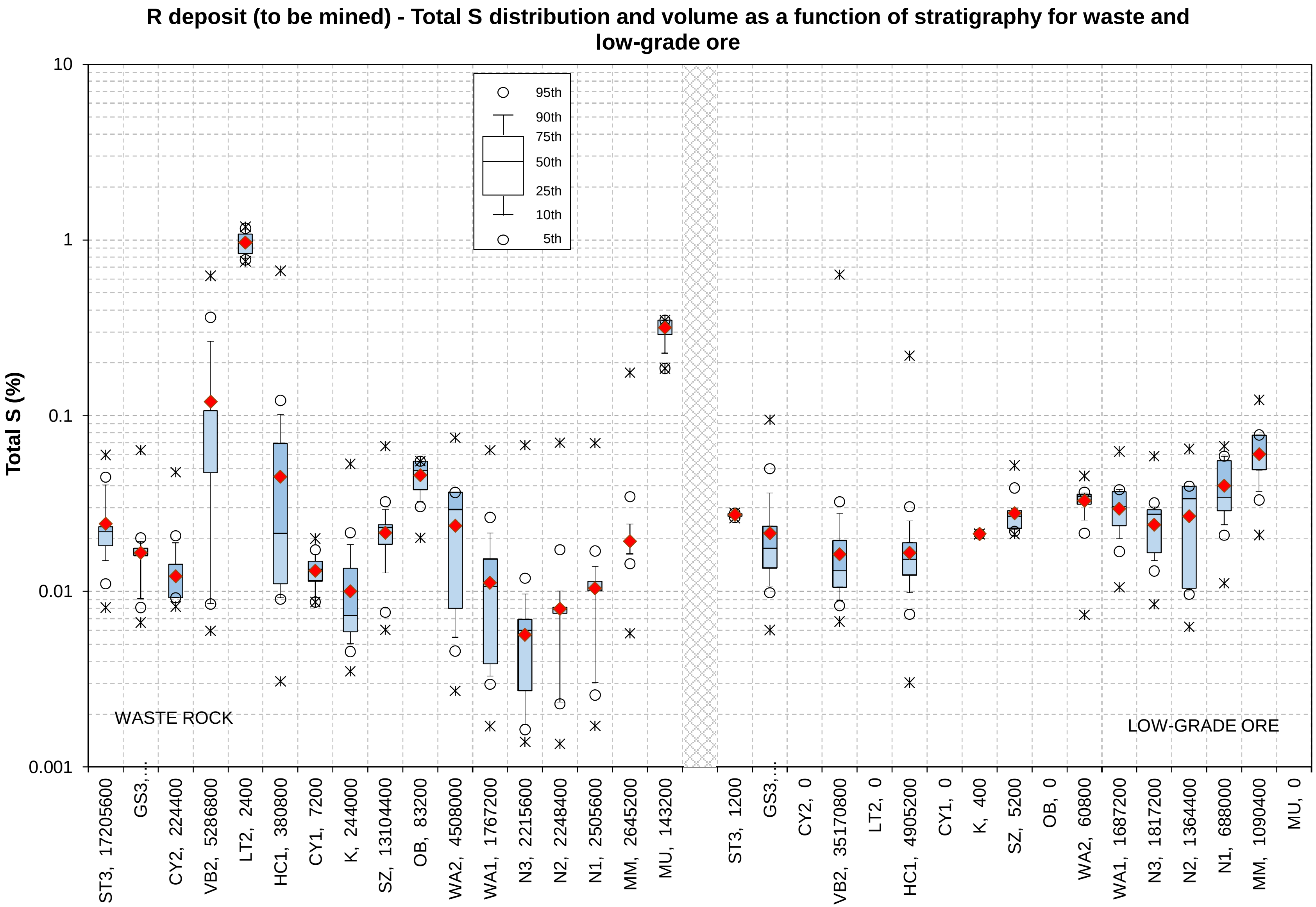


Figure 3-118 Distribution of total-S as a function of stratigraphy for to-be-mined waste rock and LGO of R deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

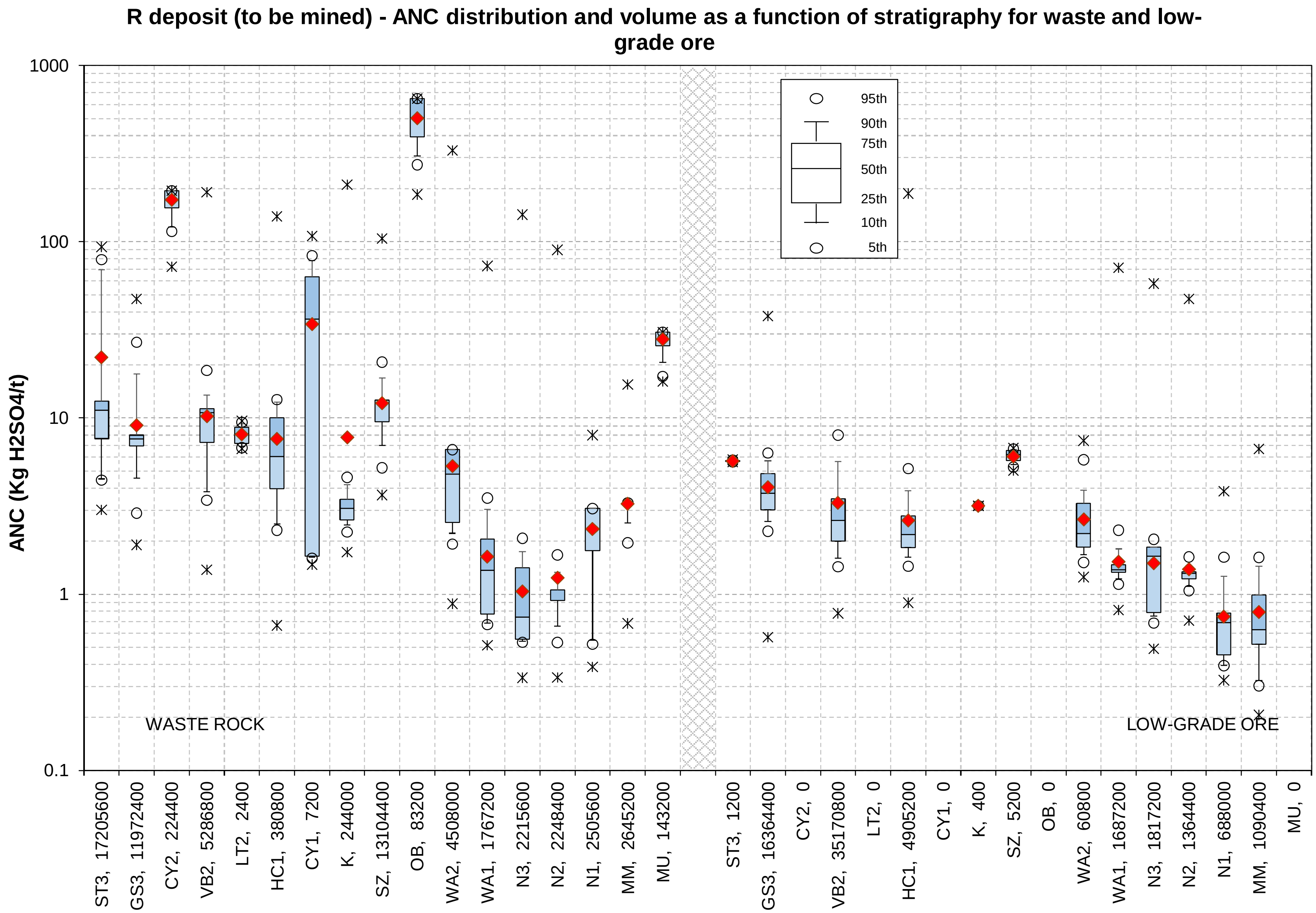


Figure 3-119 Distribution of ANC as a function of stratigraphy for to-be-mined waste rock and LGO of R deposit (the volume in m^3 of each stratigraphic unit is reported next to the rock type ID)

Table 3-92 R deposit to-be-mined waste rock and low grade ore volume split by total sulphur content per stratigraphy

Strat	<0.1%S		0.1-0.2%S		0.2-0.3%S		0.3-0.5%S		0.5-1.0%S		≥1.0%S	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock												
9190 - ST3	17,205,600	28.02%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9180 - GS3	11,972,400	19.50%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9150 - CY2	224,400	0.37%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	2,380,400	3.88%	1,995,600	95.91%	474,400	93.53%	258,800	70.87%	177,600	99.11%	0	0.00%
9120 - LT2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1,200	0.67%	1,200	100.00%
9110 - HC1	328,000	0.53%	48,400	2.33%	2,000	0.39%	2,000	0.55%	400	0.22%	0	0.00%
9100 - CY1	7,200	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8200 - K	244,000	0.40%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
8150 - SZ	13,104,400	21.34%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4200 - OB	83,200	0.14%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	4,508,000	7.34%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
4110 - WA1	1,767,200	2.88%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3430 - N3	2,215,600	3.61%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3420 - N2	2,248,400	3.66%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3410 - N1	2,505,600	4.08%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3300 - MM	2,616,400	4.26%	28,800	1.38%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
3200 - MU	0	0.00%	8,000	0.38%	30,800	6.07%	104,400	28.59%	0	0.00%	0	0.00%
Total	**61,410,800**	**100.00%**	**2,080,800**	**100.00%**	**507,200**	**100.00%**	**365,200**	**100.00%**	**179,200**	**100.00%**	**1,200**	**100.00%**
% of Total	**95.15%**		**3.22%**		**0.79%**		**0.57%**		**0.28%**		**0.00%**	
Low grade ore												
9190 - ST3	1,200	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9180 - GS3	16,364,400	25.92%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9150 - CY2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9130 - VB2	35,159,200	55.68%	7,200	66.67%	800	66.67%	2,800	100.00%	800	100.00%	0	N/A
9120 - LT2	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
9110 - HC1	4,904,800	7.77%	0	0.00%	400	33.33%	0	0.00%	0	0.00%	0	N/A
9100 - CY1	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8200 - K	400	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
8150 - SZ	5,200	0.01%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4200 - OB	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4120 - WA2	60,800	0.10%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
4110 - WA1	1,687,200	2.67%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3430 - N3	1,817,200	2.88%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3420 - N2	1,364,400	2.16%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3410 - N1	688,000	1.09%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3300 - MM	1,086,800	1.72%	3,600	33.33%	0	0.00%	0	0.00%	0	0.00%	0	N/A
3200 - MU	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	N/A
Total	**63,139,600**	**100.00%**	**10,800**	**100.00%**	**1,200**	**100.00%**	**2,800**	**100.00%**	**800**	**100.00%**	**0**	**N/A**
% of Total	**99.98%**		**0.02%**		**0.00%**		**0.00%**		**0.00%**		**0.00%**	

Table 3-93 R deposit to-be-mined waste rock and low grade ore volume split by AMD class per stratigraphy

Strat	AMD Class 0		AMD Class 1		AMD Class 2		AMD Class 3		Total	
	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	%
Waste rock										
9190 - ST3	17,205,600	26.68%	0	N/A	0	N/A	0	0.00%	17,205,600	26.66%
9180 - GS3	11,972,400	18.57%	0	N/A	0	N/A	0	0.00%	11,972,400	18.55%
9150 - CY2	224,400	0.35%	0	N/A	0	N/A	0	0.00%	224,400	0.35%
9130 - VB2	5,221,600	8.10%	0	N/A	0	N/A	65,200	96.45%	5,286,800	8.19%
9120 - LT2	0	0.00%	0	N/A	0	N/A	2,400	3.55%	2,400	0.00%
9110 - HC1	380,800	0.59%	0	N/A	0	N/A	0	0.00%	380,800	0.59%
9100 - CY1	7,200	0.01%	0	N/A	0	N/A	0	0.00%	7,200	0.01%
8200 - K	244,000	0.38%	0	N/A	0	N/A	0	0.00%	244,000	0.38%
8150 - SZ	13,104,400	20.32%	0	N/A	0	N/A	0	0.00%	13,104,400	20.30%
4200 - OB	83,200	0.13%	0	N/A	0	N/A	0	0.00%	83,200	0.13%
4120 - WA2	4,508,000	6.99%	0	N/A	0	N/A	0	0.00%	4,508,000	6.98%
4110 - WA1	1,767,200	2.74%	0	N/A	0	N/A	0	0.00%	1,767,200	2.74%
3430 - N3	2,215,600	3.44%	0	N/A	0	N/A	0	0.00%	2,215,600	3.43%
3420 - N2	2,248,400	3.49%	0	N/A	0	N/A	0	0.00%	2,248,400	3.48%
3410 - N1	2,505,600	3.89%	0	N/A	0	N/A	0	0.00%	2,505,600	3.88%
3300 - MM	2,645,200	4.10%	0	N/A	0	N/A	0	0.00%	2,645,200	4.10%
3200 - MU	143,200	0.22%	0	N/A	0	N/A	0	0.00%	143,200	0.22%
Total	**64,476,800**	**100.00%**	**0**	**N/A**	**0**	**N/A**	**67,600**	**100.00%**	**64,544,400**	**100.00%**
% of Total	**99.90%**		**0.00%**		**0.00%**		**0.10%**		**100.00%**	
Low grade ore										
9190 - ST3	1,200	0.00%	0	N/A	0	0.00%	0	0.00%	1,200	0.00%
9180 - GS3	16,364,400	25.91%	0	N/A	0	0.00%	0	0.00%	16,364,400	25.91%
9150 - CY2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9130 - VB2	35,170,400	55.69%	0	N/A	0	0.00%	400	100.00%	35,170,800	55.69%
9120 - LT2	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
9110 - HC1	4,905,200	7.77%	0	N/A	0	0.00%	0	0.00%	4,905,200	7.77%
9100 - CY1	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
8200 - K	400	0.00%	0	N/A	0	0.00%	0	0.00%	400	0.00%
8150 - SZ	5,200	0.01%	0	N/A	0	0.00%	0	0.00%	5,200	0.01%
4200 - OB	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
4120 - WA2	60,800	0.10%	0	N/A	0	0.00%	0	0.00%	60,800	0.10%
4110 - WA1	1,687,200	2.67%	0	N/A	0	0.00%	0	0.00%	1,687,200	2.67%
3430 - N3	1,817,200	2.88%	0	N/A	0	0.00%	0	0.00%	1,817,200	2.88%
3420 - N2	1,364,400	2.16%	0	N/A	0	0.00%	0	0.00%	1,364,400	2.16%
3410 - N1	688,000	1.09%	0	N/A	0	0.00%	0	0.00%	688,000	1.09%
3300 - MM	1,088,400	1.72%	0	N/A	2,000	100.00%	0	0.00%	1,090,400	1.73%
3200 - MU	0	0.00%	0	N/A	0	0.00%	0	0.00%	0	0.00%
Total	**63,152,800**	**100.00%**	**0**	**N/A**	**2,000**	**100.00%**	**400**	**100.00%**	**63,155,200**	**100.00%**
% of Total	**100.00%**		**0.00%**		**0.00%**		**0.00%**		**100.00%**	

Table 3-94 R deposit to-be-mined waste rock and low grade ore volume split by water table location per AMD class

AMD Class	AWT (m^3)	BWT (m^3)	Total Volume (m^3)	% of volume
Waste rock				
0	59,587,200	4,889,600	64,476,800	99.90%
1	0	0	0	0.00%
2	0	0	0	0.00%
3	0	67,600	67,600	0.10%
Total	**59,587,200**	**4,957,200**	**64,544,400**	100.00%
% of Total	**92.32%**	**7.68%**	**100.00%**	
Low grade ore				
0	57,190,400	5,962,400	63,152,800	100.00%
1	0	0	0	0.00%
2	2,000	0	2,000	0.00%
3	0	400	400	0.00%
Total	**57,192,400**	**5,962,800**	**63,155,200**	100.00%
% of Total	**90.56%**	**9.44%**	**100.00%**	

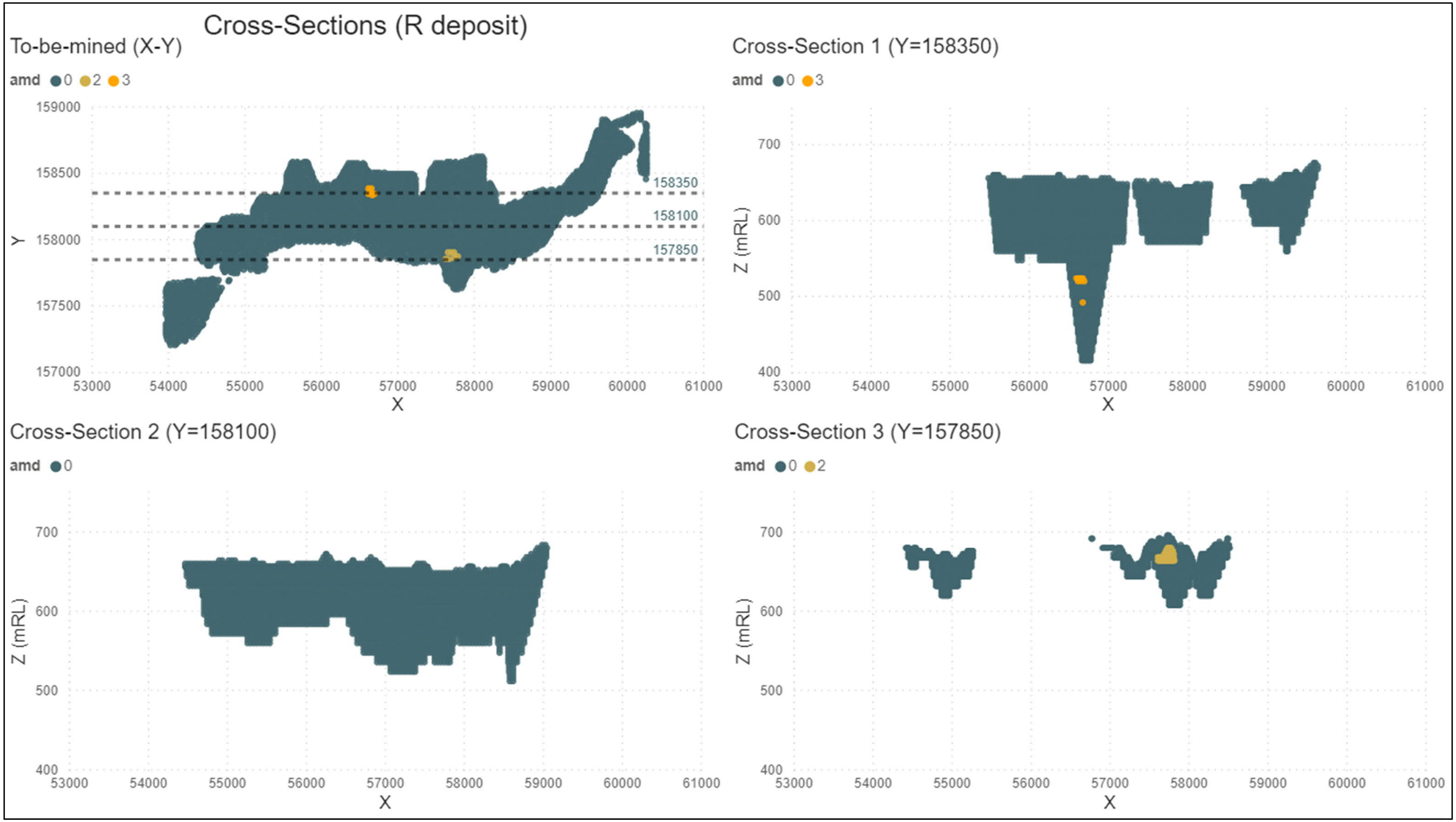


Figure 3-120 Spatial variability (2D X-Y view and cross sections) of to-be-mined AMD material predicted by R deposit mining model (including all waste rock, low grade ore and ore blocks)

3.1.2 Environmental Geochemistry Data

3.1.2.1 Environmental geochemistry samples

The environmental geochemistry database for MAC and SF comprise a total of 975 samples. Of these, 276 are sourced from within the bounds of the current pit shells (in-pit), with the reminder outside of the pit shells. Samples for environmental geochemical testwork are collected during exploration activities; while there is a general understanding of where the orezone may be located, there is generally an uncertainty around the exact location of the pitshell and its depth.

All the 276 samples within the pit shell were used for this assessment; however, where stratigraphic units were undersampled (less than 5 samples) or not represented in-pit, the in-pit dataset was augmented with an additional 117 samples located outside of and adjacent to the pitshell. The reminder 581 data points were not assessed as either too far from the pit shells (in depth) or were not required as the in-pit data set was sufficiently representative of the stratigraphies to be mined from the MAC hub. It is expected that the geochemical properties for waste samples within and outside the pitshell are comparable for similar sulphur and ANC grades. Generally speaking, sample selection for environmental testwork is biased towards higher sulphur and low ANC. This means that proportion of NAF/PAF samples in the sample set are not representative of the distribution of such materials in-pit.

All samples assessed for this risk assessment have ABA data and other environmental geochemical test results for subset of samples (Figure 3-121 and Table 3-95). Overall, these ABA samples are considered representative of the as-mined and to-be-mined waste materials due to the following:

- The ABA samples spanned a range of stratigraphic units (Table 3-95), which largely represent the stratigraphies of the mining blocks in section 3.1.1, especially for Brockman Iron formation (Joffre, Whaleback shale and Dale Gorge), Wittenoom Formation and Marra Mamba Iron Formation groups.
- Of the 393 ABA samples, 263 were waste rock samples and 129 were low-grade ore and high-grade ore samples with one sample unknown with respect to ore grade.
- With respect to weathering, 107 samples were taken from the fresh zone, 202 from transition zone, and 84 from weathered zone.
- With respect to water table location, 241 samples were above water table, and 76 samples below water table, with the rest 76 samples unknown.

In the sections below the geochemical characteristics of the sample tested are described as a function of geologic formation (Section 3.1.2.2) and of stratigraphic units (Section 3.1.2.4). A high level summary presenting the key geochemical features of the mine waste at the MAC hub is found in Section 3.1.2.3.

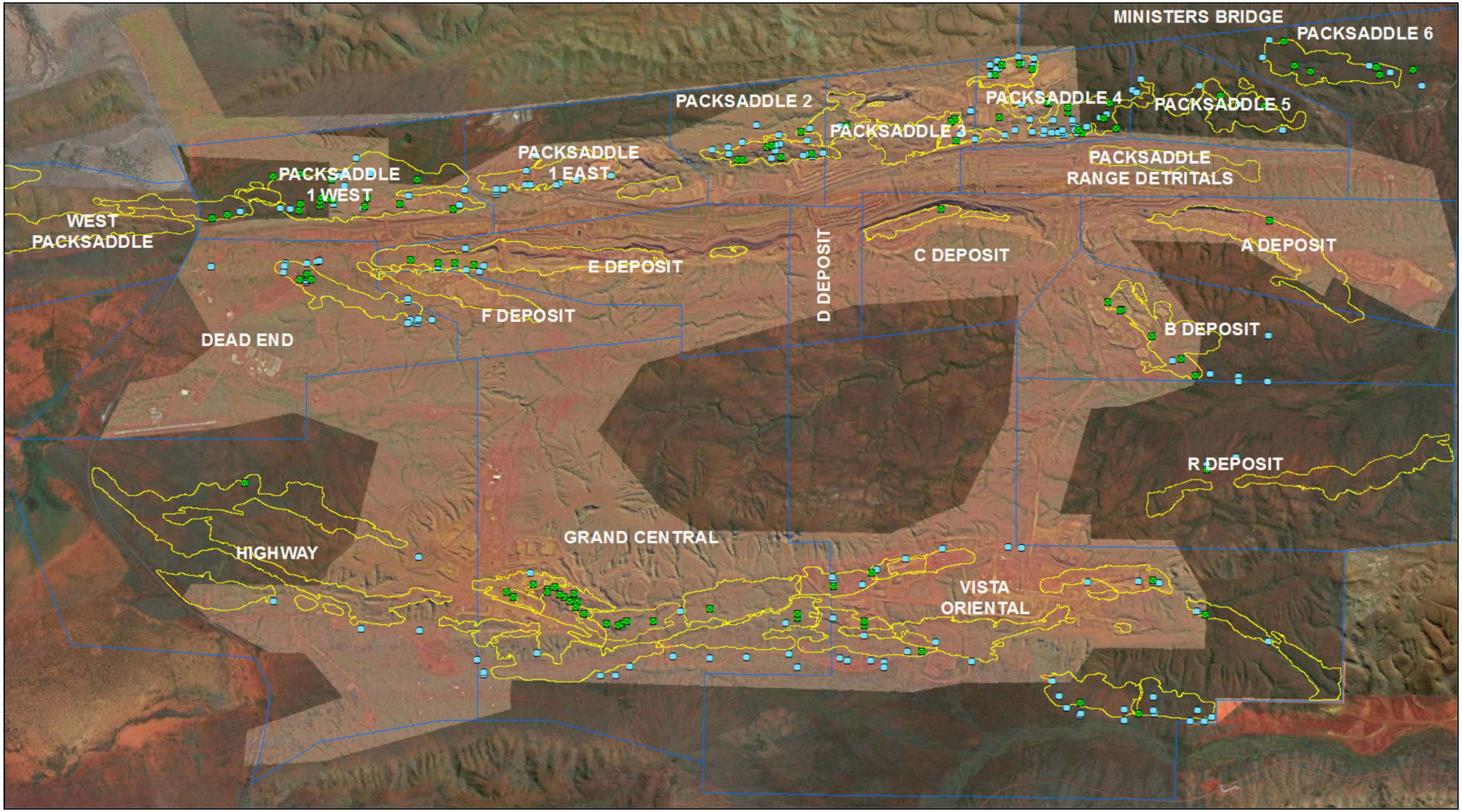


Figure 3-121 Locations of environmental geochemistry samples (in-pit samples in green and ex-pit samples in blue)

Table 3-95 ABA samples split by material type, weathering domain and water table location per stratigraphy group

STRAT group		Count		Material type				Weathering domain			Water table location		
		total #	in-pit #	Waste rock	LGO	Ore	N/R *	Fresh	Transitional	Weathered	AWT	BWT	N/R *
Tertiary Detritals	9200 - WP3	1	1	0	0	1	0	1	0	0	1	0	0
	9190 - ST3	9	9	9	0	0	0	9	0	0	9	0	0
	9180 - GS3	17	4	7	10	0	0	17	0	0	17	0	0
	9160 - CA2	1	0	1	0	0	0	1	0	0	1	0	0
	9150 - CY2	10	1	10	0	0	0	10	0	0	1	6	3
	9130 - VB2	20	20	8	12	0	0	18	0	2	20	0	0
	9120 - LT2	7	0	7	0	0	0	7	0	0	0	7	0
	9110 - HC1	18	18	2	16	0	0	18	0	0	18	0	0
	9100 - CY1	11	11	11	0	0	0	11	0	0	11	0	0
	8150 - SZ	4	1	4	0	0	0	4	0	0	4	0	0
	8130 - TD3	3	3	3	0	0	0	3	0	0	3	0	0
BIF,Yandicoogina	5900 - Y	4	3	3	1	0	0	0	1	3	4	0	0
BIF, Joffre Member	5860 - J6	8	8	1	4	3	0	0	1	7	8	0	0
	5850 - J5	9	2	6	3	0	0	0	6	3	9	0	0
	5840 - J4	11	2	10	1	0	0	0	10	1	7	1	3
	5830 - J3	7	7	4	1	2	0	0	4	3	4	0	3
	5820 - J2	11	11	5	5	1	0	0	6	5	8	0	3
	5810 - J1	23	4	16	7	0	0	0	21	2	8	4	11
BIF, Whaleback	5700 - W	20	20	20	0	0	0	0	15	5	16	0	4
BIF, Dales Gorge Member	5640 - D4	17	3	12	1	4	0	0	17	0	5	9	3
	5630 - D3	17	17	6	6	5	0	0	15	2	4	8	5
	5620 - D2	10	10	2	5	3	0	0	5	5	7	1	2
	5610 - D1	11	11	2	7	2	0	0	10	1	5	1	5
Mt McRae Shale	5440 - RU	7	7	7	0	0	0	0	7	0	5	0	2
	5430 - RN	20	0	20	0	0	0	2	18	0	2	6	12
	5420 - RC	7	0	7	0	0	0	4	3	0	0	3	4
	5410 - RL	7	0	7	0	0	0	2	5	0	0	3	4
Wittenoom Formation	4200 - OB	6	6	6	0	0	0	0	0	6	3	3	0
	4120 - WA2	51	51	46	3	2	0	0	25	26	33	13	5
	4110 - WA1	11	11	3	5	3	0	0	7	4	8	2	1
Marra Mamba Iron Formation	3430 - N3	6	6	3	2	1	0	0	6	0	0	6	0
	3420 - N2	13	13	7	2	3	1	0	8	5	9	0	4
	3410 - N1	11	11	7	1	3	0	0	10	1	6	3	2
	3300 - MM	5	5	1	3	1	0	0	2	3	5	0	0
Total		**393**	**276**	**263**	**95**	**34**	**1**	**107**	**202**	**84**	**241**	**76**	**76**

*Note: * N/R: unknown with respect to ore grade or water table location.*

3.1.2.2 Geochemical description by geological formation

3.1.2.2.1 Tertiary Detritals

The stratigraphic units that are captured in the environmental database (within the SF / MAC pit shells) and belong to the Tertiary Detritals include:

- Welded Pisolites - **WP3** (*n*=1) – comprising 0.03% of the LoA mine waste.
- Siltstone – **ST3** (*n*=9) – comprising 5.9% of the LoA mine waste.
- Gravelly Siltstone – **GS3** (*n*=17) - comprising 5.4% of the LoA mine waste.
- Calcrete – **CA2** (n=1) - comprising 0.4% of the LoA mine waste.
- Clay – **CY2** (*n*=10) - comprising 0.1% of the LoA mine waste.
- Vuggy Breccia – **VB2** (*n*=20) - comprising 6.5% of the LoA mine waste.
- Lignite Clay – **LT2** (n=7) - comprising a negligible quantity of the LoA mine waste, i.e. 2,800 m^3.
- Hematite Conglomerate – **HC1** (*n*=18) - comprising 2.7% of the LoA mine waste.
- Ferruginous Clay – **CY1** (*n*=11) - comprising 0.2% of the LoA mine waste.
- Quaternary Detritals / Surface Scree - **SZ** (*n*=4) - comprising 3.6% of the LoA mine waste.
- Tertiary Detritals 3 – **TD3** (*n*=3) - comprising 7.2% of the LoA mine waste (note TD3 is undifferentiated mine waste comprising WP3, ST3, GS3 stratigraphies).

Stratigraphies not included in the environmental data set include SD2 (expected LoA mine waste 1,600 m^3), TD2 (expected 1.8% of the LoA mine waste; TD2 is undifferentiated mine waste comprising CA2, CY2, WB2, LT2, and VB2 stratigraphies), and TD1 (expected 0.8% of the LoA mine waste; TD1 is undifferentiated mine waste comprising HC1, and CY1 stratigraphies).

The statistics provided below consider samples from within the pit shells, as well as samples from adjacent to the pit shells for stratigraphic units CY2 and GS3.

- <u>Acid Base Accounting</u>

In total 182 Tertiary Detrital samples were included in the environmental database, with 101 suitable for use in this description.

The total sulphur distribution of the 101 samples ranged from below detection limits to 3.28 %, with an average value of 0.15 %. The samples tested from the TD3 stratigraphy had higher total S concentrations compared to the other Tertiary Detrital units (averaging 1.23% S; up to 2.89%), followed by the HC1 (averaging 0.28% S; up to 3.28%) and LT2 (averaging 0.22% S; up to 0.5%) samples. The WP3, CY2, and VB2 samples have similar (moderate) total S concentrations (averaging 0.14, 0.12, and 0.11%, respectively). The CY1, SZ, ST3, GS3, and CA2 samples have similar (very low) total S concentrations (all individually averaging <0.05%).

These Tertiary Detrital samples have ANC contents that range from 0.1 to 225 kg H_2SO_4/t (averaging 7.84 kg H_2SO_4/t). Based on the available data the single CA2 sample has a significantly higher ANC value than the other stratigraphic units (124 84 kg H_2SO_4/t), which is expected as this sample is associated with calcrete units. The CY2 and ST3 samples have higher ANC contents than most other Tertiary Detrital samples (averaging 31 and 15.4 kg H_2SO_4/t, respectively). The LT2, SZ, GS3, and TD3 samples have broadly similar (moderate) ANC contents (averaging 7.23, 5.48, 5.24, and 2.70 kg H_2SO_4/t, respectively). Whereas the VB2, HC1, CY1, and WP3 samples all have consistently lower ANC contents (all averaging <1.50 kg H_2SO_4/t).

The block models for the Tertiary Detritals predicts that approximately 98% of the mine waste is overwhelmingly low sulphur, with approximately 99% of the mine waste predicted to have S <0.2%. ANC distribution predicted in the block modes are also consistent with that observed in the sample set, with generally low-moderate ANC, but occasional volumes with high ANC values (i.e. > 50 kg H_2SO_4/t). Statistically the sample set is representative of the Tertiary Detritals total S and ANC range.

- <u>Paste pH/EC and NAG suite</u>

For the 101 samples considered the paste EC values range from very slightly to highly saline (14 – 2,856 µS/cm), with average values of approximately 418 µS/cm. Based on the available data, the TD3, LT2, and HC1 samples have the highest EC values (averaging 805, 673, and 632 µS/cm, respectively). The WP3, ST3, CY2, VB2, and

CA2 samples have broadly similar, moderately to highly saline EC values (averaging between approximately 370 and 410 µS/cm). The CY1, GS3, and SZ samples have broadly similar, slightly to moderately saline EC values (averaging between approximately 230 and 340 µS/cm).

Paste pH values of approximately 64% of the samples considered were near neutral, with pH values greater than 5.5. The WP3, VB2, and HC1 stratigraphic units has 65% of their samples characterised by paste pH <5.5. The CY1 stratigraphic unit has only 36% of samples having a pH <5.5. The LT2, TD3, CY2, GS3, SZ, CA2, and ST3 stratigraphic unit all have average paste pH values >6.0 with few individual samples displaying acidic paste pH values.

The NAG pH values for approximately 85% of the samples tested display non-acid values greater than pH 4.5. Approximately 60% of the samples tested from the LT2 stratigraphy are acidic with pH values less than 4.5. All other stratigraphic units have average NAG pH values >4.5.

- Mineralogy and Sulphur Speciation

Mineralogy data was available for 37 Tertiary Detrital samples. The mineralogy data covered the SZ (n = 1), CY1 (n = 10), HC1 (n = 8), VB2 (n = 11), ST3 (n = 5), LT2 (n = 2) stratigraphic units. The key minerals in these samples include variable proportions of hematite, goethite, kaolinite, an amorphous phase, and quartz. Hematite is the most abundant phase in all; stratigraphic units except for VB2 and LT2, where goethite is more abundant. Minor alunite was identified in samples from the CY1 and VB2 stratigraphic units, and was the only sulphur bearing phase detected. Minor dolomite and calcite were identified in samples from the ST3 stratigraphic unit. No pyrite has been detected in these samples.

Sulphur speciation data (i.e. chromium reducible sulphide sulphur (S_{Cr}) or HCl extractable sulphate sulphur (S_{HCl})) was available for 55 samples. These data show that the sulphur budget of most samples tested is dominated by sulphate minerals. Only 3 samples out of 55 had a sulphur budget dominated by sulphide minerals, all of which belong to the LT2 stratigraphic unit. LT2 (lignite) is a known AMD hazard, due to the potential occurrence of pyrite within this stratigraphic unit.

- AMD Classification

Of the 101 Tertiary Detrital samples considered, 60 (approximately 59%) are classified as NAF (AMIRA). When samples from each stratigraphic unit tested are considered individually they contain the following proportion of NAF material: SZ (4 of 4 samples NAF); ST3 (9 of 9 samples NAF), CA2 (1 out of 1 NAF), GS3 (16 of 17 samples NAF), CY2 (9 of 10 NAF), LT2 (4 of 7 NAF), VB2 (8 of 20 samples NAF), CY1 (4 of 11 samples NAF), TD3 (1 out of 3 NAF) and HC1 (4 of 18 NAF).

Of the 101 Tertiary Detrital samples considered, 28 (approximately 28%) are classified as UC(NAF) (AMIRA). These UC(NAF) samples are derived from the HC1, TD3, CY1, and VB2 stratigraphic units, where represent 72% (13 samples of 18), 66% (2 samples out of 3), 64% (7 samples of 11), and 30% (6 samples of 20) of the total number of samples from the respective stratigraphic unit. Many of these samples contain moderate to high total sulphur (averaging 0.34%; up to 3.28%), positive NAPP, but NAG pH values above 4.5. Sulphur speciation data and mineralogical testwork suggest sulphate as the key sulphur bearing phase, which together with a NAG pH value > 4.5, justifies a UC(NAF) classification for these samples.

Of the 101 Tertiary Detrital samples considered, 13 (approximately 13%) are classified as PAF (AMIRA). These PAF samples are derived from the WP3 (1 out of 1 sample PAF), LT2 (3 of 7 samples PAF), VB2 (6 of 20 samples PAF), CY2 (1 of 10 samples PAF), HC1 (1 of 18 samples PAF), and GS3 (1 out of 17 samples PAF) stratigraphic units. For these samples NAPP values were > 0 and NAG pH < 4.5, however, with the potential exception of the LT2 stratigraphy, NAG pH values <4.5 are likely associated with residual acidity from peroxide used in the NAG tests rather than sulphide oxidation. This can occur in samples dominated by sulphate minerals with low to nil ANC. On the other hand, acidic paste pH is likely associated with leaching of sparingly soluble acid sulphate salts, such as alunite.

In summary, according to the AMIRA testwork approximately 87% of Tertiary Detrital are classified as NAF/UC(NAF) and approximately 13% are classified as PAF. In contrast, the BHP WAIO classification predicts that 78% of samples are AMD0 (i.e. NAF/UC(NAF)), with the remaining 22% classified as AMD3 (PAF). Thus, the BHP classification is conservative, as it predicts a higher proportion of AMD3 (PAF) samples.

- Geochemical Abundance Index (GAI)

Forty-seven (47) Tertiary Detrital samples were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment (i.e. GAI enrichment factors >3) in:

- Ag (GAI = 3) for 3 samples of the ST3 stratigraphy and 2 samples of CY1; (GAI = 4) for 1 sample of the HC1 stratigraphy; (GAI = 5) for 1 sample of the HC1 stratigraphy and 1 sample of the SZ stratigraphy; and (GAI = 6) for 1 sample of the HC1 stratigraphy and 1 sample of the LT2 stratigraphy.
- As (GAI = 3) for 8 samples of the CY1 stratigraphy, 4 samples of the HC1 stratigraphy, and 1 sample of the GS3 stratigraphy.
- Co (GAI = 3) for 1 sample of the LT2 stratigraphy, and (GAI = 4) for 1 sample of the LT2 stratigraphy.
- Fe (GAI = 3) for 2 samples of the VB2 stratigraphy, 1 sample of the HC1 stratigraphy, 1 sample of the LT2 stratigraphy; and 1 sample of the SZ stratigraphy.
- Mn (GAI = 3) for 1 sample of the LT2 stratigraphy.
- Hg (GAI = 3) for 1 sample of the HC1 stratigraphy, and 2 samples of the ST3 stratigraphy; and (GAI = 4) for 1 sample of the HC1 stratigraphy.
- Se (GAI = 3) for 1 sample of the LT2 stratigraphy; (GAI = 4) for 1 sample of the LT2 stratigraphy; and (GAI = 6) for 1 sample of the GS3 stratigraphy.

• Leaching Tests

Leach tests were conducted on a total of 11 Tertiary Detrital samples, of which 7 (approximately 64%) were classified as NAF (AMIRA), 1 (approximately 9%) was classified as UC(NAF), and 3 (approximately 27%) were classified as PAF.

The NAF samples had moderate-high ANC values (averaging 25.36 kg H_2SO_4/t) and low total S concentrations (averaging 0.02%). The leachate from these samples was slightly-saline (average EC of 344 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.13 mg/L), Fe (ave. 0.09 mg/L), and Mn (ave. 0.05 mg/L). The average dissolved sulphate within the leached NAF samples was 39.1 mg/L.

The UC(NAF) sample had low ANC values below detection limit of <1 kg H_2SO_4/t and moderate total S concentrations of 0.21%. The leachate from this sample was saline (EC of 1,292 µS/cm) and contained low dissolved concentration of metals, such as Al (1.48 mg/L), Fe (0.11 mg/L), Ni (0.03 mg/L), Zn (0.01 mg/L), and Mn (2.66 mg/L). The dissolved sulphate within the leached UC(NAF) sample was 242.3 mg/L.

The PAF samples had low ANC values (averaging 1.93 kg H_2SO_4/t), moderate total S concentrations (averaging 0.56%). The leachate from these samples was moderately to highly saline (average EC of 1,218 µS/cm) and contained low dissolved concentration of metals, such as Al (ave. 2.1 mg/L), Fe (ave. 0.24 mg/L), Ni (ave. 0.14 mg/L), and Mn (ave. 4.09 mg/L). The average dissolved sulphate within the leached PAF samples was 399 mg/L.

• Implication for Tertiary Detritals Waste Mined at MAC/SF

The Tertiary Detritals constitutes 34.72% of the LoA waste material at MAC/SF. Of the samples considered approximately 87% are classified as NAF/UC(NAF), with the remaining samples classified as PAF (13%) (AMIRA). Available XRD mineralogy suggests sulphur is predominantly associated with alunite, however, sulphur speciation also indicates the occasional presence of minor sulphide minerals particularly in LT2.

The key acid generating mineral in the Tertiary Detritals, with the likely exception of some of the LT2 volumes, is alunite. Alunite represent a lesser AMD hazard than pyrite due to its low dissolution rates and low acid generating capacity.

All Tertiary Detrital stratigraphic units but WP3, VB2, LT2, HC1, and CY1 have more than 99% of the LoA mine waste characterised by sulphur content <0.1%, while VB2, LT2, HC1, and CY1 are the only stratigraphic units having more than 1% of the LoA mine waste with sulphur concentration >0.2%. Finally, only 0.4% of the LoA mine waste from the Tertiary Detrital is expected to have total sulphur concentrations >0.2%.

Based on a combined assessment of the above data, it is concluded that Tertiary Detrital mine waste characterised by very low (<0.1%) to low sulphur content (<0.2 %) are likely to have low potential for AMD (inclusive of NMD) generation upon leaching. Samples associated with higher sulphur grades may have potential to generate or release AMD associated with alunite leaching (and pyrite oxidation for some LT2 volumes). However, there is likely to be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads generated by alunite leaching.

NMD generation and release may occur in high sulphur and high ANC samples which, however, constitute a negligible proportion of the total LoA mine waste.

3.1.2.2.2 Brockman Iron Formation

The geological members and stratigraphic units that are captured in the environmental database and belonging to the Brockman Iron Formation include:

- The Joffre Member – **J1** (*n*=23), **J2** (*n*=11), **J3** (*n*=7), **J4** (*n*=11), **J5** (*n*=10), **J6** (*n*=8) - comprising 10% of the LoA mine waste.
- The Whaleback Shale – **W** (*n*=20) – comprising 4.5% of the LoA mine waste
- Dales Gorge Member – **D1** (*n*=11), **D2** (*n*=10), **D3** (*n*=17), **D4** (*n*=17) – comprising 13% of the LoA mine waste.
- Yandicoogina Shale Member – **Y** (*n*=4) – comprising 1.1% of the LoA mine waste.

Stratigraphies not included in the environmental data set include J3J5 which is undifferentiated mine waste comprising J3 to J5 units; HE, HJ, and YE (Wolli Wooli Formation) comprising less than 0.6% of the LoA mine waste. Of note is that the MAC/SF block model predicts all of the mine waste from HE, HJ, and YE to be characterised by very low sulphur of <0.12%.

The statistics provided below consider samples from within the pit shells, as well as samples from adjacent to the pit shells for stratigraphic units J1, J5, D4, and Y.

- Acid Base Accounting

In total 308 samples from the Brockman Iron Formation were included in the environmental database, with 149 derived from within the pit shells suitable for use in this description.

The total sulphur distribution of the 149 samples ranged from below detection limits to 0.90 %, with an average value of 0.04 wt%. The Whaleback Shale (W) samples display the highest total sulphur concentrations (averaging 0.09 %S; up to 0.90 %S), compared with samples from the stratigraphic units of the Dales Gorge Member (D1, D2, D3, D4 – averaging 0.03 %; up to 0.36 %), the Joffre Member (J1, J2, J3, J4, J5, J6 – averaging 0.03 %; up to 0.16 %), and the Yandicoogina Shale Member (Y – averaging 0.04 %; up to 0.06 %).

This 149 sample set displays ANC contents that range from below detection limits to 32.6 kg H_2SO_4/t (averaging 1.79 H_2SO_4/t). The Dales Gorge Member samples (particularly the D2 stratigraphic unit) have the highest average ANC contents (averaging 2.53 kg H_2SO_4/t). The Whaleback Shale samples displays slightly lower ANC values (2.13 kg H_2SO_4 /t), followed by the Yandicoogina Shale Member samples (averaging 1.5 kg H_2SO_4 /t), with the Joffre Member samples having the lowest ANC values (averaging 1.17 kg H_2SO_4 /t).

The block models for the Brockman Iron Formation predicts that approximately 99% of the mine waste is overwhelmingly low sulphur, with virtually all mine waste 99.99% predicted to have S <0.2%. ANC distribution predicted in the block modes are also consistent with that observed in the sample set, with generally low ANC, but occasional volumes with moderate to high ANC values (i.e. > 20-50 kg H_2SO_4/t).

Statistically the sample set is representative of the Brockman Iron Formation total S and ANC range.

- Paste pH/EC and NAG suite

For the 149 samples considered the paste EC values range from low to slightly saline, with average values of approximately 141 µS/cm. Based on the available data the Whaleback Shale displays the highest paste EC values (averaging 341 µS/cm). The Yandicoogina Shale Member has the next highest paste EC values (averaging 193 µS/cm), with the Dales Gorge Member (averaging 118 µS/cm) and the Joffre Member (averaging 100 µS/cm) both displaying lower EC values.

Paste pH values of approximately 64% of the samples considered were near neutral, with pH values greater than 5.5. The Whaleback Shale samples have the greater proportion of paste pH values of (60% with a pH <5.5), compared with all stratigraphic units from the Joffre Member (44% with pH <5.5) and the Dales Gorge Member (20% <5.5). Samples with acidic paste pH were characterised by very low ANC and higher S concentrations, with sulphur associated with sulphate species (see below)

It is noteworthy that no samples from the Yandicoogina Shale Member have a paste pH <5.5 consistent with samples from this stratigraphy having the lowest total sulphur concentrations within the Brockman Iron Formation sample set.

The NAG pH values for approximately 90% of the samples tested are near neutral with values greater than pH 4.5.

Mineralogy and Sulphur Speciation

Limited mineralogy data was available for the Brockman Iron Formation (*n* = 3). Mineralogy data covered the J2 stratigraphic unit (n = 2; Joffre Member) and the Y stratigraphic unit (n = 1; Yandicoogina Shale Member). These samples are dominated by goethite, an amorphous phase, quartz, hematite, and kaolinite. No sulphur bearing phases were identified.

Sulphur speciation data (i.e. chromium reducible sulphide sulphur (S_{Cr}) or HCl extractable sulphate sulphur (S_{HCl})) was available for 42 samples, including for most samples characterised by total sulphur >0.1%. These data show that the sulphur budget of most samples tested is dominated by sulphate minerals, with no sample showing detectable sulphur associated with sulphide forms.

- AMD Classification

Of the 149 samples of the Brockman Iron Formation, 116 (approximately 78%, or 90 samples) are classified as NAF (AMIRA). When geological members / stratigraphic units are considered individually, 100% (or 4 samples of 4) of Yandicoogina shale samples, approximately 85% (or 47 samples of 55) of Dales Gorge Member samples, approximately 74% (or 92 samples of 124) of Joffre Member samples, and approximately 65% (or 13 samples of 20) of Whaleback Shale samples are classified as NAF.

Of the 149 samples of the Brockman Iron Formation, 21 (approximately 14%) are classified as UC(NAF) (AMIRA). When geological members / stratigraphic units are considered individually, approximately 5% of Dales Gorge Member samples (or 3 samples of 55), approximately 20% (or 24 samples of 124) of Joffre Member samples, and approximately 20% (or 4 samples of 20) of Whaleback Shale samples are classified as (UC)NAF. These samples contain very low to moderate to sulphur (averaging 0.08%; up to 0.355%), slightly positive NAPP, but NAG pH values above 4.5. Sulphur speciation data suggest sulphate as the key sulphur bearing phase, which together with a NAG pH value > 4.5, justifies a UC(NAF) classification for these samples.

Of the 149 samples of the Brockman Iron Formation, 12 (approximately 8%) are classified as PAF/UC(PAF) (AMIRA). When geological members / stratigraphic units are considered individually, approximately 15% (3 samples) of Whaleback Shale samples, 6% (4 samples) of Joffre Member samples are classed as PAF, while 9% (or 5 samples) of Dales Gorge Member are classified as UC(PAF). For the PAF/UC(PAF) samples NAPP values near 0 kg H_2SO_4/t and NAG pH < 4.5; however, NAG pH values <4.5 are likely associated with residual acidity from peroxide used in the NAG tests rather than sulphide oxidation. This can occur in samples dominated by sulphate minerals with low to nil ANC. On the other hand, acidic paste pH is likely associated with leaching of sparingly soluble acid sulphate salts, such as alunite.

In summary, according to the AMIRA testwork approximately 92% (or 187 samples of 203) of samples from the Brockman Iron Formation mine waste are classified as NAF, approximately 8% are PAF/UC(PAF). Whereas the BHP WAIO classification predicts that 95% of samples are AMD0, with the remaining 5% classified as either AMD1 [2%] or AMD2 [3%]. Note that of the samples that are not consistent between the two classifications, 4 out of 5 had total S concentrations <0.09% with all sulphur detected associated with sulphates, reiterating that these samples NAG pH results may not be reflective of the actual acidity generating potential of the samples, but rather reflect residual acidity from the peroxide used in the testwork.

- Position Relative to the Water Table

Of the 149 samples of the Brockman Iron Formation considered, the following stratigraphic units have samples derived from both above and below the water table: D1, D2, D3, D4, J1, J4. Only these stratigraphic units are considered here, which in total consist of 36 samples are from above the water table, and 24 samples from below the water table.

- Geochemical Abundance Index (GAI)

Thirty-one (31) samples of the Brockman Iron Formation were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in:

  – As (GAI = 3) for 3 samples of the D1 stratigraphy, and 1 sample of the J4 stratigraphy.
  – Fe (GAI = 3) for 1 sample of the J1 stratigraphy, 3 samples of the J2 stratigraphy, 1 sample of the J5 stratigraphy, 2 samples of the J6 stratigraphy; and 1 sample of the D2 stratigraphy.
  – Se (GAI = 3) for one sample of the J5 stratigraphy; and (GAI = 7) for one sample of the J4 stratigraphy.

- Leaching Tests

Leach tests were conducted on a total of 27 samples of from the Brockman Iron Formation, of which 16 (59%) were NAF, 8 (30%) were UC(NAF), 1 (4%) was (UC)PAF, and 2 (7%) were PAF.

The NAF samples had moderate ANC values (averaging 3.06 kg H_2SO_4/t) and low total S concentrations (averaging 0.02 wt%). The leachate from these samples was slightly-saline (average EC of 164 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.01 mg/L), Fe (ave. 0.13 mg/L), Zn (0.04 mg/L) and Mn (0.09 mg/L). The average dissolved sulphate within the leached NAF samples was 38.2 mg/L.

The UC(NAF) samples had low ANC values (near of below detection limit of 1 kg H_2SO_4/t) and very low-low total S concentrations (averaging 0.07 wt%). The leachate from these samples was slightly-saline (average EC of 124 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.03 mg/L), Fe (ave. 0.20 mg/L), Ni (ave. 0.06 mg/L), Zn (ave. 0.02 mg/L), and Mn (ave. 0.14 mg/L). The dissolved sulphate within the leached UC(NAF) samples was 19.0 mg/L.

The UC(PAF) sample had low ANC values below detection limit of 1 kg H_2SO_4/t and very low total S concentrations of 0.01 wt%. The leachate from this sample was non saline (EC of 14 µS/cm) and contained very low dissolved concentration of metals, such as Fe (3.31 mg/L), Co (0.01 mg/L) and Mn (0.07 mg/L), Ni (0.01 mg/L), Zn (0.01 mg/L). The average dissolved sulphate within the leached UC(PAF) samples was 31.1 mg/L.

The PAF samples had low ANC values (near of below detection limit of 1.0 kg H_2SO_4 /t) and total S concentrations of 0.16% and 0.90%. The leachate from these samples was slightly-saline (average EC of 457 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.45 mg/L), Fe (ave. 2.09 mg/L), Ni (0.01 mg/L), Zn (ave. 0.07 mg/L) and Mn (ave. 0.14 mg/L). The average dissolved sulphate within the leached NAF samples was 50.5 mg/L.

- Implication for Brockman Iron Formation Waste Mined at MAC/SF

The Brockman Iron Formation constitutes 30% of the LoA waste material at MAC/SF. Of the samples considered (within or adjacent to the pit shells) approximately 78% of samples are classified as NAF, with the remaining 22% split between UC(NAF) (14%), UC(PAF) (3%), and PAF (5%).

The key acid generating mineral in the Brockman Iron Formation is alunite, with none of the samples tested reporting sulphide minerals (sulphur speciation and mineralogy). The likely sulphur species is alunite as inferred by the slightly acidic paste pH observed in some samples, which is indicative of naturally acidic materials. Alunite represent a lesser AMD hazard than pyrite due to its low dissolution rates and low acid generating capacity.

The Brockman Iron Formation stratigraphic units HE, HJ, YE, Y, J3J5, J5, J4, JD4, D3, and D1 have more than 99% of the LoA mine waste characterised by sulphur content <0.1%, with no stratigraphic unit having more than 1% of the LoA mine waste with sulphur concentration >0.2%. Finally, only 0.1% of the LoA mine waste from the Brockman Iron Formation mine waste is expected to have total sulphur concentrations >0.2%. Note that no Brockman Iron Formation stratigraphic unit in the block model is predicted to have total sulphur in excess of 1%.

The key acid generating mineral in the Marra Mamba Iron Formation is most likely alunite. Alunite represents a lesser AMD hazard than pyrite due to its low dissolution rates and low acid generating capacity.

Based on a combined assessment of the above data, it is concluded that Brockman Iron Formation mine waste characterised by very low (<0.1%) to low sulphur content (<0.2 %) are likely to have low potential for AMD (inclusive of NMD) generation upon leaching. Samples associated with higher sulphur grades may have potential to generate or release AMD associated with alunite leaching. However, there is likely to be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads generated by alunite leaching.

NMD generation and release may occur in high sulphur and high ANC samples which, however, constitute a negligible proportion of the total LoA mine waste.

3.1.2.2.3 Mt McRae Shale Formation

The stratigraphic units that are captured in the environmental database that belong to the Mt McRae Shale Formation include:

- The Mt McRae Shale (Upper) – **RU** (n = 7) – comprising 0.17% of the LoA mine waste.
- The Mt McRae Shale (Nodule Zone) – **RN** (n = 20) – comprising 0.03% of the LoA mine waste.
- The Mt McRae Shale (Chert) – **RC** (n = 7) – comprising an inconsequential volume of the LoA mine waste equal to 13,600 m^3.
- The Mt McRae Shale (Lower) – **RL** (n = 7) – comprising an inconsequential volume of the LoA mine waste equal to 5,200 m^3.

A stratigraphy not included in the environmental data set is R which is undifferentiated mine waste comprising RU, RN, RC, and RL. The R stratigraphy represents 0.01 of the LoA mine waste, with all material predicted by the block model to be characterised by very low total sulphur of <0.1%.

The geochemical summaries provided below consider samples from within the pit shells (RU), as well as samples from adjacent to the pit shells (but appropriate for describing the relevant unit) for stratigraphic units RC, RL, RN.

- Acid Base Accounting

In total 116 samples from the Mt McRae Shale Formation were included in the environmental database, with 41 suitable for use in this description.

The total sulphur distribution of these 41 samples ranged from below detection limits to 0.28%, with an average value of 0.05%. This set of 41 samples displays ANC contents that range from 0.50 to 265.6 kg H_2SO_4/t (averaging 16.21 H_2SO_4/t). The Nodule Zone Mt McRae Shale (RN) and the Chert Mt McRae Shale (RC) samples display higher ANC values (averaging 16.40 and 40.77 kg H_2SO_4/t, respectively), compared with the Lower Mt McRae Shale (RL) and the Upper Mt McRae Shale (RC) samples (averaging 3.2 and 4.0 kg H_2SO_4/t, respectively).

The block models for the Mt MacRae Shale Formation predicts that virtually all of the LoA mine waste, with the exception of 400 m^3, is predicted to have very low sulphur of <0.1%. ANC distribution predicted in the block modes are also consistent with that observed in the sample set, with generally low ANC, but occasional volumes with moderate to high ANC values (i.e. > 20-50 kg H_2SO_4/t). Statistically the sample set is representative of the Mt MacRae Shale Formation ANC range, but has a greater sulphur range.

- Paste pH/EC and NAG suite

For the 41 samples considered the paste EC values range from very low to moderately saline (60 – 483 µS/cm), with average values of approximately 194 µS/cm. All units of the Mt McRae Shale Formation have broadly similar average paste EC values (ranging from 168 to 210 µS/cm).

Paste pH values of approximately 95% of the samples considered were near neutral, with values greater than 5.5. All stratigraphic units of the Mt McRae Shale Formation have average paste pH values >5.5, with only 2 samples from the RN unit displaying a slightly acidic paste pH. These samples are characterised by very low sulphur, which is all associated with sulphate forms.

The NAG pH values of all samples of the Mt McRae Shale Formation are non-acidic with values greater than pH 4.5 (averaging 7.16).

- Mineralogy and Sulphur Speciation

No mineralogy data was available for Mt McRae Shale Formation samples.

Sulphur speciation data (i.e. chromium reducible sulphide sulphur (S_{Cr}) and HCl extractable sulphate sulphur (S_{HCl})) was available for 17 Mt McRae Shale Formation samples. The sulphur budget of 76% of samples is dominated by sulphates. The remaining 24% of samples are dominated by sulphide sulphur, which constitutes between 58% and 78% of the total sulphur budget. The samples containing sulphide-sulphur have total sulphur concentrations greater than approximately 0.2%. These higher sulphur samples are not fully representative of the in-pit material predicted by the block models.

- AMD Classification

Of the 41 samples of the Mt McRae Shale Formation, 34 (approximately 83%) are classified as NAF (AMIRA), while the reminder 7 samples are classed as UC(NAF). The UC(NAF) classification of these samples (i.e. positive NAPP values, but non acidic NAG pH) likely reflects overestimation of the NAPP value due to the predominance of sulphate sulphur, which may generate less acid than sulphide minerals (e.g. alunite / jarosite) or may not be acid generating (e.g. gypsum).

In summary, according to the AMIRA testwork approximately all samples are NAF/UC(NAF). Whereas the BHP WAIO classification predicts that 95% of samples are AMD0, with the remaining 5% classified as AMD1. The two AMD1 samples have total sulphur > 0.2%.

- Position Relative to the Water Table

Of the 41 samples of the Mt McRae Shale Formation considered, only the RN stratigraphic unit has samples that derive from above and below the water table. Hence this data is not discussed here (see descriptions of individual stratigraphic units).

- Geochemical Abundance Index (GAI)

A total of (13) samples of the Mt McRae Shale Formation were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment (GAI enrichment factors >3) in:

- As (GAI = 3) for 2 samples of the RN stratigraphic unit and 2 samples of the RU stratigraphic unit; As (GAI = 4) for 3 samples of the RN stratigraphic unit, 1 sample of the RU stratigraphic unit, and 1 sample of the RC stratigraphic unit.
- Cd (GAI = 3) for 1 sample of the RN stratigraphic unit and 1 sample of the RC stratigraphic unit.
- Co (GAI = 4) for 1 sample of the RN stratigraphic unit.
- Hg (GAI = 3) for 1 sample of the RC stratigraphic unit.
- Mn (GAI = 3) for 1 sample of the RN stratigraphic unit and 1 sample of the RC stratigraphic unit; Mn (GAI = 5) for 1 sample of the RN stratigraphic unit.
- Mo (GAI = 3) for 2 samples of the RN stratigraphic unit.
- Sb (GAI = 3) for 2 samples of the RN stratigraphic unit and 1 sample of the RU stratigraphic unit.

Leaching Tests

Leach tests were conducted on a total of 10 samples from the Mt McRae Shale Formation, of which 8 (80%) were NAF and 2 (20%) were UC(NAF) based on AMIRA methods.

The NAF samples had moderate ANC values (averaging 4.54 kg H_2SO_4/t) and very low total S concentrations (averaging 0.02%). The leachate from these samples was slightly to moderately saline (average EC of 251 µS/cm) and contained low dissolved concentration of metals, such as Se (ave. 0.01 mg/L), Al (ave. 0.01 mg/L), Fe (ave. 0.01 mg/L), Co (ave. 0.02 mg/L), Mn (ave. 1.66 mg/L), Ni (ave. 0.01 mg/L), Zn (ave. 0.08 mg/L). The average dissolved sulphate within the leached NAF samples was 24.68 mg/L.

The UC(NAF) samples had low ANC values (averaging 1.15 kg H_2SO_4/t) and low total S concentrations (averaging 0.07%). The leachate from these samples was only slightly saline (average EC of 105 µS/cm) and contained very low dissolved concentration of metals, such as Se (ave. 0.03 mg/L), Al (ave. 0.01 mg/L), Mn (ave. 0.06 mg/L), Ni (ave. 0.01 mg/L), Zn (ave. 0.01 mg/L). The dissolved sulphate within the leached UC(NAF) samples was 18.1 mg/L.

- Implication for Mt McRae Shale Formation Waste Mined at MAC/SF

The Mt McRae Shale constitutes 0.21% of the LoA waste material at MAC/SF. Of the samples considered (within or adjacent to the pit shells) approximately 83% of samples are classified as NAF, with the remaining 17% classified as UC(NAF).

Based on the samples tested from the Mt McRae Shale Formation, the majority of the sulphur present is in the form of sulphate minerals (with only minor contribution from sulphide minerals in higher sulphur samples). Based on the geochemical properties of very low sulphur samples, it is predicted that none of the Mt McRae Shale Formation stratigraphic units are likely to release or generate AMD or NMD upon leaching.

3.1.2.2.4 Wittenoom Formation

The stratigraphic units captured in the environmental database and belonging to the Wittenoom Formation include:

- Paraburdoo Member – **OB** (*n* = 6) – comprising 0.01% of the LoA mine waste.
- West Angela Member – **WA1** (n = 11), and **WA2** (n = 51) – comprising 12,3% of the LoA mine waste.

Acid Base Accounting

In total 174 samples from the Wittenoom Formation were included in the environmental database, with 68 samples suitable for use in this description.

The total sulphur distribution of these 68 samples ranged from below detection limits to 3.89 wt%, with an average value of 0.29 wt%. The West Angela Member samples display higher total sulphur concentrations (WA1 averaging

0.18 wt% S; and WA2 averaging 0.34 wt% S), compared with the Paraburdoo Member samples (OB – averaging 0.01wt% S), consistently with the distribution predicted by the block model.

The in-pit samples have ANC contents that range from below detection limits to 21.8 kg H_2SO_4 /t (averaging 2.37 H_2SO_4 /t). The in-pit Wittenoom Formation samples generally display low ANC values. The WA2 stratigraphy has the highest ANC contents (averaging 2.71 kg H_2SO_4 /t), followed by the OB (averaging 2.07 kg H_2SO_4 /t), and WA1 stratigraphic units (averaging 0.96 kg H_2SO_4 /t).

The block models for the Wittenoom Formation predicts that approximately 93% of the mine waste is overwhelmingly low sulphur, with approximately 98.5% of the mine waste predicted to have S <0.2%. ANC distribution predicted in the block modes are also consistent with that observed in the sample set, with generally low-moderate ANC, but occasional volumes with high ANC values (i.e. > 50 kg H_2SO_4/t).

- Paste pH/EC and NAG suite

The paste EC values of the selected sample set are low to high salinity, with average values of approximately 335 µS/cm. Samples from the West Angela Member have consistent and generally higher paste EC values (WA1 and WA2 average 361 µS/cm) compared with the Paraburdoo Member (averaging 78 µS/cm).

Paste pH values of approximately 47% of the samples tested are near neutral, with pH values greater than 5.5. Samples from the West Angela Member have consistently lower paste pH values, with all WA1 samples having a paste pH <5.5 and 50% of WA2 samples have a paste pH <5.5. Samples from the Paraburdoo Member have higher paste pH values, with no samples returning a paste pH <5.5.

NAG data was only available for the West Angela Member, and hence this data is not discussed here (see descriptions of individual stratigraphic units below).

- Mineralogy and Sulphur Speciation

Mineralogy data was only available for the West Angela Member (n = 39). It is noteworthy that alunite was the only sulphur bearing phase identified in these samples. Further details of the mineralogy can be found in descriptions of the individual stratigraphic units below.

Sulphur speciation data (i.e. chromium reducible sulphide sulphur (S_{Cr}) and HCl extractable sulphate sulphur (S_{HCl})) was available for 47 WA2 and WA1 samples. The data show that virtually all sulphur is associated with sulphate forms, including in high sulphur samples.

- AMD Classification

Of the 68 samples of the Wittenoom Formation from within the pit shells, 33 (approximately 49%) were classified as NAF (AMIRA). When the geological members / stratigraphic units are considered individually, 18% of WA1 samples, and 49% of WA2 samples are classified as NAF, whereas 100% of OB samples are classified as NAF.

Of the 68 samples of the Wittenoom Formation tested from within the pit shells, 9 (approximately 13%) were classified as UC(NAF) (AMIRA). All the UC(NAF) samples are derived from the West Angela Member, with 3 being derived from WA1 (27% of WA1 samples) and 6 being derived from WA2 (12% of WA2 samples).

Of the 68 samples of the Wittenoom Formation tested, 26 (approximately 38%) were classified as PAF (AMIRA). All the PAF samples are derived from the West Angela Member, with 6 being derived from WA1 (55% of WA1 samples) and 20 being derived from WA2 (39% of WA2 samples). None of the tested OB samples were classified as PAF. However, in these PAF samples, all sulphur was fully associated with sulphate forms, alunite was detected as the sole sulphur bearing minerals, ANC was nil, paste pH acidic, and NAG pH was just below pH 4.5. The NAG pH values <4.5 in these samples are likely associated with residual acidity from peroxide used in the NAG tests rather than sulphide oxidation. This can occur in samples dominated by sulphate minerals with low to nil ANC, such as those tested. On the other hand, acidic paste pH is likely associated with leaching of sparingly soluble acid sulphate salts, such as alunite.

In summary, according to the AMIRA testwork 71% of samples from the Wittenoom Formation are classified as NAF/UC(NAF, and 38% as PAF. On the other hand, the BHP WAIO classification predicts 43% of samples to be AMD2, which is somewhat higher compared to the AMIRA classification.

- Position Relative to the Water Table

Samples from below the water table have lower average total sulphur concentrations (e.g. WA1 = 0.02 wt% [n = 2]; WA2 <0.01 [n = 13]) compared with samples from above the water table (eg. WA1 = 0.24 wt% [n = 8]; WA2 = 0.52

[n = 33]). The opposite appears to be true for ANC contents, where samples from below the water table tend to have higher ANC (e.g. WA1 = 3.25 kg H_2SO_4 /t [n = 2]; WA2 3.70 kg H_2SO_4 /t [n = 13]) compared with samples from above the water table (eg. WA1 = 0.45 kg H_2SO_4 /t [n = 8]; WA2 = 2.30 kg H_2SO_4 /t [n = 33]).

- Geochemical Abundance Index (GAI)

Forty-five (45) samples of the Wittenoom Formation (WA1 and WA2) were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment (i.e. GAI enrichment factors >3) in:

  – Ag (GAI = 3) for 3 samples of the WA2 stratigraphic unit.
  – As (GAI = 3) for 2 samples of the WA2 stratigraphic unit.
  – Fe (GAI = 3) for 1 sample of the WA1 stratigraphic unit.
  – Hg (GAI = 3) for 3 samples of the WA2 stratigraphic unit.
  – Mn (GAI = 3) for 1 sample of the WA2 stratigraphic unit.
  – Se (GAI = 6) for 1 sample of the WA2 stratigraphic unit.

- Leaching Tests

Leach data was only available for samples of the WA2 stratigraphic unit of the West Angela Member (n = 4). Hence this data is not discussed here (see descriptions of individual stratigraphic units below).

- Implication for Wittenoom Formation Waste Mined at MAC/SF

The Wittenoom Formation constitutes 12.28% of the LoA waste material at MAC/SF. Of the samples considered 47% are classified as NAF/UC((NAF), with the remaining 38% classed as PAF.

Based on a combined assessment of the above data, it is concluded that Wittenoom Formation mine waste characterised by very low (<0.1%) to low sulphur content (<0.2 %) are likely to have low potential for AMD (inclusive of NMD) generation upon leaching. Samples associated with higher sulphur grades may have potential to generate or release AMD associated with alunite leaching. However, there is likely to be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads generated by alunite leaching.

The key acid generating mineral in the Marra Mamba Iron Formation is most likely alunite. Alunite represents a lesser AMD hazard than pyrite due to its low dissolution rates and low acid generating capacity.

NMD generation and release may occur in high sulphur and high ANC samples which, however, constitute a negligible proportion of the total LoA mine waste.

The OB stratigraphy in particular is unlikely to generate AMD (inclusive of NMD) due to the negligible sulphur content predicted for this unit)

3.1.2.2.5 Marra Mamba Iron Formation

The geological members and stratigraphic units captured in the environmental database and belonging to the Marra Mamba Iron Formation include:

- The Mount Newman Member – **N1** (n = 11), **N2** (n = 13), and **N3** (n =6) – comprising 18% of the LoA mine waste.
- The MacLeod Member – **MM** (n = 5) – comprising 0.2% of the LoA mine waste.

Acid Base Accounting

In total 192 samples from the Marra Mamba Iron Formation were included in the environmental database, 35 were suitable for this assessment.

The total sulphur distribution of these 35 samples ranged from below detection limits to 0.22 wt%, with an average value of 0.04 wt%. The MacLeod Member samples displays higher total sulphur concentrations (averaging 0.12 wt% S), compared with samples form the Mt Newman Member (N1, N2, and N3 – averaging 0.01, 0.01, and 0.05 wt% S, respectively).

The in-pit samples have ANC contents that range from 0.04 to 5.6 kg H_2SO_4 /t (averaging 1.1 H_2SO_4 /t). The MacLeod Member has even lower ANC values (averaging <1 kg H_2SO_4 /t), compared with stratigraphic units from the Mt Newman Member (N1, N2, and N3 – averaging 1.10, 1.52, and 0.63 kg H_2SO_4 /t, respectively).

The block models for the Marra Mamba Iron Formation predicts that 97% of the mine waste is overwhelmingly very low sulphur, with approximately 99.8% of the mine waste predicted to have S <0.2%. ANC distribution predicted in the block modes are also consistent with that observed in the sample set, with generally low-moderate ANC, but occasional volumes with moderate ANC values (i.e. < 50 kg H_2SO_4/t). Statistically the sample set is representative of the Marra Mamba Iron Formation total S and ANC range.

- Paste pH/EC and NAG suite

The paste EC values for the samples used for this assessment are slightly to moderately saline, with average values of approximately 235 µS/cm. Samples from the MacLeod Member have higher paste EC values (averaging 553 µS/cm), compared with samples from the stratigraphic units from the Mt Newman Member (N1, N2, and N3 – averaging 102, 107, and 283 µS/cm, respectively).

Paste pH values of approximately 60% of the samples tested are near neutral, with pH values greater than 5.5. The MacLeod Member (MM) has lower paste pH values (80% with a pH <5.5), compared with all stratigraphic units from the Mt Newman Member, N1 (27% <5.5), N2 (46% < 5.5), and N3 (17% <5.5).

The NAG pH values for approximately 87% of the samples tested are near neutral with values greater than pH 4.5.

- Mineralogy and Sulphur Speciation

Limited mineralogy data was available for the Marra Mamba Iron Formation (*n* = 1). Hence this data is not discussed here (see descriptions of individual stratigraphic units below). No sulphur bearing phases were detected in this sample.

Sulphur speciation data (i.e. chromium reducible sulphide sulphur (S_{Cr}) and HCl extractable sulphate sulphur (S_{HCl})) was available for 9 samples, including all but one having total sulphur >0.1%. The data show that virtually all sulphur is associated with sulphate forms, with sulphide-sulphur not detected in any of the sample tested.

- AMD Classification

Of the 35 samples of the Marra Mamba Iron Formation from, 25 were classified as NAF (AMIRA). All NAF samples are derived from the Mount Newman Member (N1, N2, and N3).

Seven (7) samples were classified as UC(NAF). The UC(NAF) samples derive from both the MacLeod Member (*n* = 3), and the Mount Newman Member – N1 (*n*=2) and N2 (*n*=2).

Three (3) samples were classified as PAF. These PAF samples are predominantly from the MacLeod Member (*n*=2), with only one sample from the Mount Newman Member (N2 stratigraphic unit). However, in these PAF samples, all sulphur was fully associated with sulphate forms, ANC was nil, and paste pH acidic. The NAG pH values <4.5 in these samples are likely associated with residual acidity from peroxide used in the NAG tests rather than sulphide oxidation. This can occur in samples dominated by sulphate minerals with low to nil ANC, such as those tested. On the other hand, acidic paste pH is likely associated with leaching of sparingly soluble acid sulphate salts, such as alunite.

In summary, according to the AMIRA testwork the samples from the Marra Mamba Formation comprise 8% (3 samples) classed as PAF, and the reminder NAF/UC(NAF). The BHP WAIO classification predicts that 17% of the samples to be AMD2 (i.e. PAF), correctly identifying those classed as PAF by the AMIRA system. The BHP WAIO classification overestimates the proportion of PAF mine waste, demonstrating, once again, its conservativism.

- Position Relative to the Water Table

Of the 35 samples of the Marra Mamba Iron Formation tested from within the pit shells, only the N1 stratigraphy contains samples from both above and below the water table. Hence this data is not discussed here (see the description of individual stratigraphic units below).

- Geochemical Abundance Index (GAI)

Eleven (11) samples of the Marra Mamba Iron Formation were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in:

  - Fe (GAI = 3) for 3 samples of the N2 stratigraphy, and 2 samples of the MM stratigraphy.
  - Se (GAI = 6) for one sample of the N2 stratigraphy.

- Leaching Tests

Leach tests were conducted on a total of 8 samples of from the Marra Mamba Iron Formation, of which 4 (50%) were NAF (N1 and N2), 3 (37.5%) were UC(NAF) (N2 and MM), and 1 (12.5%) was PAF (MM).

The NAF (Mount Newman Member) samples had moderate ANC values (averaging 2.58 kg H_2SO_4 /t) and very low total S concentrations (≤0.04 %). The leachate from these samples was slightly-saline (average EC of 245 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.08 mg/L), Fe (ave. 0.03 mg/L), and Mn (0.02 mg/L). The average dissolved sulphate within the leached NAF samples was 14.9 mg/L.

The NAF(UC) samples had very low ANC values (averaging <1 kg H_2SO_4 /t) and low total S concentrations (averaging 0.07 wt%). The leachate from these samples was slightly-saline (average EC of 246 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.50 mg/L), Fe (ave. 3.56 mg/L), and Mn (0.46 mg/L). The average dissolved sulphate within the leached UC(NAF) samples was 31.1 mg/L.

The PAF sample (MacLeod Member) had a low ANC values (0.80 kg H_2SO_4 /t) and moderate total S concentrations (0.13 %). The leachate from this samples was slightly-saline (EC of 261 µS/cm) and contained moderate dissolved concentration of metals such as Al (4.0 mg/L), Fe (23.8 mg/L), Co (0.02 mg/L), Zn (0.03 mg/L) and Mn (1.69 mg/L), Ni (0.07 mg/L), sulphate (75 mg/L). This sample had no sulphide-sulphur, low sulphate concentrations, and thus it is unclear how such elevated concentrations in Al, Fe and Mn reported to the leachate. It is assumed that this sample might have been poorly prepared and/or that it might be affected by colloidal reporting to the filtered fraction of the leachate.

- Implication for Marra Mamba Iron Formation Waste Mined at MAC/SF

The Marra Mamba Iron Formation constitutes 22.71% of the LoA waste material at MAC/SF. Of the samples tested (within the pit shells) 91% is classified as NAF/UC(NAF), with the 9% classed as PAF.

Based on limited data it appears that samples from the South Flank deposit generally have higher average S concentrations (e.g. MM = 0.14 wt% [n = 4]; N2 = 0.07 wt% [n =8]) compared with samples from the same stratigraphy at the North Flank deposit (MM = 0.04 wt% [n = 1]; N2 = 0.03 wt% [n =5]). The opposite appears to be true for ANC contents, where samples from the South Flank deposit generally have lower average ANC contents (e.g. N1 = 0.47 kg H_2SO_4 /t [n = 3]; N2 = 1.14 kg H_2SO_4 /t [n =8]) compared with samples from the same stratigraphy at the North Flank deposit (N1 = 1.34 kg H_2SO_4 /t [n = 8]; N2 = 2.14 kg H_2SO_4 /t [n=5]).

The key acid generating mineral in the Marra Mamba Iron Formation is most likely alunite. Alunite represents a lesser AMD hazard than pyrite due to its low dissolution rates and low acid generating capacity.

Based on a combined assessment of the above data, it is concluded that Marra Mamba Iron Formation mine waste characterised by very low (<0.1%) to low sulphur content (<0.2 %) are likely to have low potential for AMD (inclusive of NMD) generation upon leaching. Samples associated with higher sulphur grades may have potential to generate or release AMD associated with alunite leaching. However, there is likely to be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads generated by alunite leaching.

NMD generation and release may occur in high sulphur and high ANC samples which, however, constitute a negligible proportion of the total LoA mine waste.

3.1.2.3 Summary

Overall, the 393 environmental geochemistry samples provided a good representation of the majority of stratigraphical units and geological formations that have been captured by the mining block models of MAC/SF.

The median ABA-NAG test results per stratigraphy group and AMD classification results are summarised in Table 3-96 and the box plots of key parameters by AMD classification are presented in Figure 3-122.

The implications of environmental geochemistry data include but are not limited to:

- WAIO classification results for each geological formation and stratigraphic unit are in broad agreement with the AMIRA AMD classification, with WAIO classification slightly more conservative. In particular, the BHP WAIO classification predicts 21% of the samples to be PAF (i.e. AMD1, AMD2 and AMD3), while the AMIRA classification based on environmental testwork predicts 13% of the samples to be PAF. Seven (7) samples classed AMD0 (NAF) by the BHP WAIO classification are classed as PAF by the AMIRA system, these samples with the exception of two, had very low to low total sulphur. On the other hand, 38 samples classed as NAF by the AMIRA classification were classified as AMD1/AMD2 or AMD3 by the WAIO classification.
- All the stratigraphic units are represented in the geochemical database, with the exception of SD2, K, HE, HJ, YE, MU and JN. However, these units represent approx. 1% of the LoA mine waste, with virtually all the mine

waste associated with these stratigraphic units predicted to have very low sulphur. As such this gap in the environmental data base is not considered material.

- The vast majority of the samples tested are classified under the AMIRA system as NAF or UC(NAF) (uncertain NAF) with low AMD risk potential. Leach testwork for these samples show that the potential from metal and salinity mobilisation from waste similar to the samples tested is low.
- Fifty-three (or 13%) of the samples tested were classed as PAF by the AMIRA system, due to positive NAPP and NAG pH values <4.5. However, in all samples but 3 (all associated with LT2 – lignite), all sulphur was associated with sulphate species, and where XRD data were available, alunite was the only sulphur bearing mineral phase identified. The majority of these samples were also characterised by acidic paste pH and nil to low ANC. This means that NAPP values are overestimated, but also that the NAG pH acidity is likely associated with residual acidity from peroxide used in the NAG tests rather than sulphide oxidation. Samples similar to these are likely representative of naturally occurring acid soils.
- The MAC hub is characteristically a low sulphur, low ANC hub. The vast majority of the LoA mine waste is sourced from above the pre-mining water table, which means that sulphur is likely associated with sulphate forms rather than sulphide forms, with the potential exception of some known stratigraphic units within the LT2 and CY2 units in the Tertiary Detritals.
- Geochemical and mineralogical testwork indicate that all sulphur is overwhelmingly associated with sulphate minerals, and in particular alunite. Pyrite was observed only in one sample, with sulphide-sulphur likely associated with some samples from the LT2 (lignite) unit. The occasional presence of alunite in samples characterised by very low ANC results in slightly acidic paste pH, suggesting naturally acidic terrain. Alunite occurs sporadically across the MAC hub orebodies with more frequent occurrences at the South Flank deposits and within Marra Mamba Formation stratigraphic units such as WA2 and WA1.
- Alunite is a sparingly soluble sulphate salt, which naturally occurs in weathered horizons within the Pilbara's Iron Ore Formations. Ongoing testwork (BHP improvement projects) and available literature (Linklater et al., 2012, Acero et al. 2015) demonstrate that the acid generating potential of alunite is very small due to its low dissolution rates. The slow dissolution rate of alunite results in very small amount of acidity released through leaching (< 10 mg/L $CaCO_3$). Ongoing testwork (BHP improvement projects) is suggesting that there should be sufficient ANC within silicates and/or carbonates in the bulk of the waste material to buffer alunite acidity.
- Leach testwork conducted on alunite bearing samples characterised by higher sulphur content (i.e. 11 samples with average sulphur of 0.4%) indicated some potential for metals and salinity mobilisation. In particular, average EC is moderate with average of 740 µS/cm, but sulphate concentration is generally low with average of 113 mg/L. Trace metal concentrations are also low, for example Se averages at 0.003 mg/L, Zn at 0.02 mg/L, Ni at 0.03 mg/L, Mn at 1.2 mg/L, Co at 0.01, and As at <0.001mg/L. These samples are not representative of the bulk of the mine waste.
- Leach testwork conducted on samples not showing indications of alunite activity (i.e. 40 samples with paste pH >5.5) and characterised by low sulphur (representative of the bulk of the LoA mine waste) suggest that materials similar to the samples tested have very low capacity to mobilise metals and/or salinity upon leaching. For example, the leachate is characterised by average EC of low salinity with values of 200 µS/cm and very low average sulphate concentration of 31 mg/L. Trace metal concentrations are near or below detection limit; for example average Se is below detection limit at <0.001 mg/L, Zn at 0.01 mg/L (although 27 samples have concentrations below detection limit), Ni at 0.005 mg/L, Mn at 0.4 mg/L, Co at 0.003 mg/L, and As <0.001 mg/L. Notably, these samples have also excess average alkalinity of 14 mg/L as $CaCO_3$.
- There is not one specific stratigraphic unit that has higher potential for AMD generation, with the specific exception of LT2. Generally speaking, testwork suggest that low sulphur materials (i.e. <0.1%S) have low capacity to mobilise salinity and metals, while occasional materials with higher sulphur and low ANC can be slightly acidic due to naturally occurring alunite and may, in a laboratory setting, mobilise some salinity and metals. However, in the field, it is expected that the bulk of the waste would have sufficient ANC to buffer in-situ potential acidity released by alunite leaching, if any.
- Alunite bearing waste with NAPP > 3 kg H_2SO_4/t is classed by the BHP WAIO classification system as AMD2, when these materials are associated with mine waste located above the water table, or as AMD3 class when associated with Tertiary Detritals.
- BHP manages all AMD2 and AMD3 waste (in addition to AMD1), when present. Management controls require that all AMD2 and AMD3 waste will be encapsulated and not placed near the final landform surface or on natural ground, which further reduces the AMD hazard.

- NMD / SD is associated with materials with elevated sulphur and high ANC. These type of wastes are not commonly encountered in the LoA mine waste from the MAC Hub, thus the potential for NMD/SD generation and release is considered low.
- The leachability of elements that are enriched in solid waste is generally low in response to rapid leach event regardless of the sample stratigraphical origin.
- Beneficial waste is associated with CA2, OB, and WA2. These stratigraphies are characterised by elevated ANC at values generally > 100 kg H_2SO_4/t. However, the volumes predicted to be mined from these units is limited.

Table 3-96 Median value of ABA-NAG parameters per stratigraphy group and AMD classification results

STRAT group		Count	Paste pH	Paste EC	Total-S	Sulphate-S	ANC	MPA	NAPP	*NPR	NAG pH	AMIRA AMD Classification			
			pH unit	µS/cm	wt%	wt%	kg H_2SO_4/t	kg H_2SO_4/t	kg H_2SO_4/t	unitless	pH unit	NAF	UC (NAF)	UC (PAF)	PAF
Tertiary Detritals	9200 - WP3	1	4.5	407	0.14	N/A	0.5	4.3	3.8	0.1	4.3	0	0	0	1
	9190 - ST3	9	7.3	341	0.02	0.010	3.3	0.5	-2.8	7.2	6.7	9	0	0	0
	9180 - GS3	17	6.8	193	0.02	0.005	3.5	0.6	-3.1	5.9	6.2	16	0	0	1
	9160 - CA2	1	7.2	375	0.01	N/A	124.0	0.2	-123.8	810.5	N/A	1	0	0	0
	9150 - CY2	10	6.5	187	0.01	N/A	5.3	0.3	-5.1	13.4	6.0	9	0	0	1
	9130 - VB2	20	4.7	265	0.09	0.082	0.5	2.6	2.1	0.2	4.8	8	6	0	6
	9120 - LT2	7	6.3	980	0.14	0.085	5.0	4.3	-1.8	2.7	4.0	4	0	0	3
	9110 - HC1	18	5.1	522	0.06	0.129	0.5	1.8	1.3	0.3	5.0	4	13	0	1
	9100 - CY1	11	6.3	59	0.01	0.005	0.5	0.4	0.0	0.8	5.7	4	7	0	0
	8150 - SZ	4	7.2	314	0.02	N/A	5.8	0.6	-5.2	9.5	7.2	4	0	0	0
	8130 - TD3	3	5.8	735	0.66	N/A	1.0	20.2	19.7	0.0	5.0	1	2	0	0
BIF, Yandi	5900 - Y	4	6.3	122	0.04	0.050	1.5	1.1	-0.4	1.5	6.3	4	0	0	0
BIF, Joffre Member	5860 - J6	8	5.3	153	0.05	0.105	1.7	1.5	-0.2	1.1	4.9	4	3	0	1
	5850 - J5	9	5.8	104	0.06	0.020	0.6	1.9	0.9	0.2	5.8	5	3	0	1
	5840 - J4	11	5.6	89	0.01	0.016	0.6	0.4	-0.4	1.6	5.4	9	2	0	0
	5830 - J3	7	6.9	107	0.01	N/A	1.0	0.3	-0.7	2.1	5.4	6	1	0	0
	5820 - J2	11	5.8	72	0.02	0.053	0.5	0.6	-0.2	1.3	5.8	6	5	0	0
	5810 - J1	23	5.1	53	0.01	0.005	1.3	0.2	-0.8	4.2	5.3	22	0	0	1
BIF, Whale-	5700 - W	20	5.4	270	0.04	0.137	1.4	1.3	-0.4	2.5	4.9	13	4	0	3
BIF, Dales Gorge Member	5640 - D4	17	5.9	36	0.01	0.175	1.5	0.2	-1.0	4.7	6.0	14	1	2	0
	5630 - D3	17	6.0	102	0.01	0.100	2.0	0.4	-1.4	4.6	5.7	16	1	0	0
	5620 - D2	10	6.4	125	0.01	0.043	1.5	0.2	-1.1	6.5	6.3	9	1	0	0
	5610 - D1	11	6.2	156	0.02	0.005	0.6	0.6	-0.3	3.3	6.8	8	0	3	0
Mt McRae Shale	5440 - RU	7	6.5	199	0.01	0.005	3.1	0.2	-2.9	20.3	6.9	6	1	0	0
	5430 - RN	20	6.7	179	0.03	0.027	3.3	0.8	-2.7	3.1	7.8	17	3	0	0
	5420 - RC	7	7.2	172	0.03	0.061	2.8	0.9	-2.1	6.0	7.4	5	2	0	0
	5410 - RL	7	6.8	178	0.05	0.183	3.2	1.5	-1.3	1.9	6.1	6	1	0	0
Wittenoom Formation	4200 - OB	6	5.9	77	0.01	N/A	2.3	0.2	-2.0	9.3	N/A	6	0	0	0
	4120 - WA2	51	5.3	318	0.03	0.135	0.5	0.9	0.1	0.5	4.8	25	6	0	20
	4110 - WA1	11	4.2	268	0.11	0.187	0.5	3.5	3.3	0.1	4.4	2	3	0	6
Marra Mamba Formation	3430 - N3	6	6.8	110	0.00	N/A	0.5	0.1	-0.4	6.7	N/A	6	0	0	0
	3420 - N2	13	5.6	283	0.02	0.172	1.0	0.6	-0.4	3.3	5.1	10	2	0	1
	3410 - N1	11	6.5	92	0.01	N/A	0.5	0.2	-0.3	4.6	5.7	9	2	0	0
	3300 - MM	5	4.4	261	0.13	N/A	0.5	4.0	3.2	0.2	4.6	0	3	0	2
Total		**393**										**268**	**72**	**5**	**48**

*Note: * NPR = ANC/MPA; N/A indicates no data.*

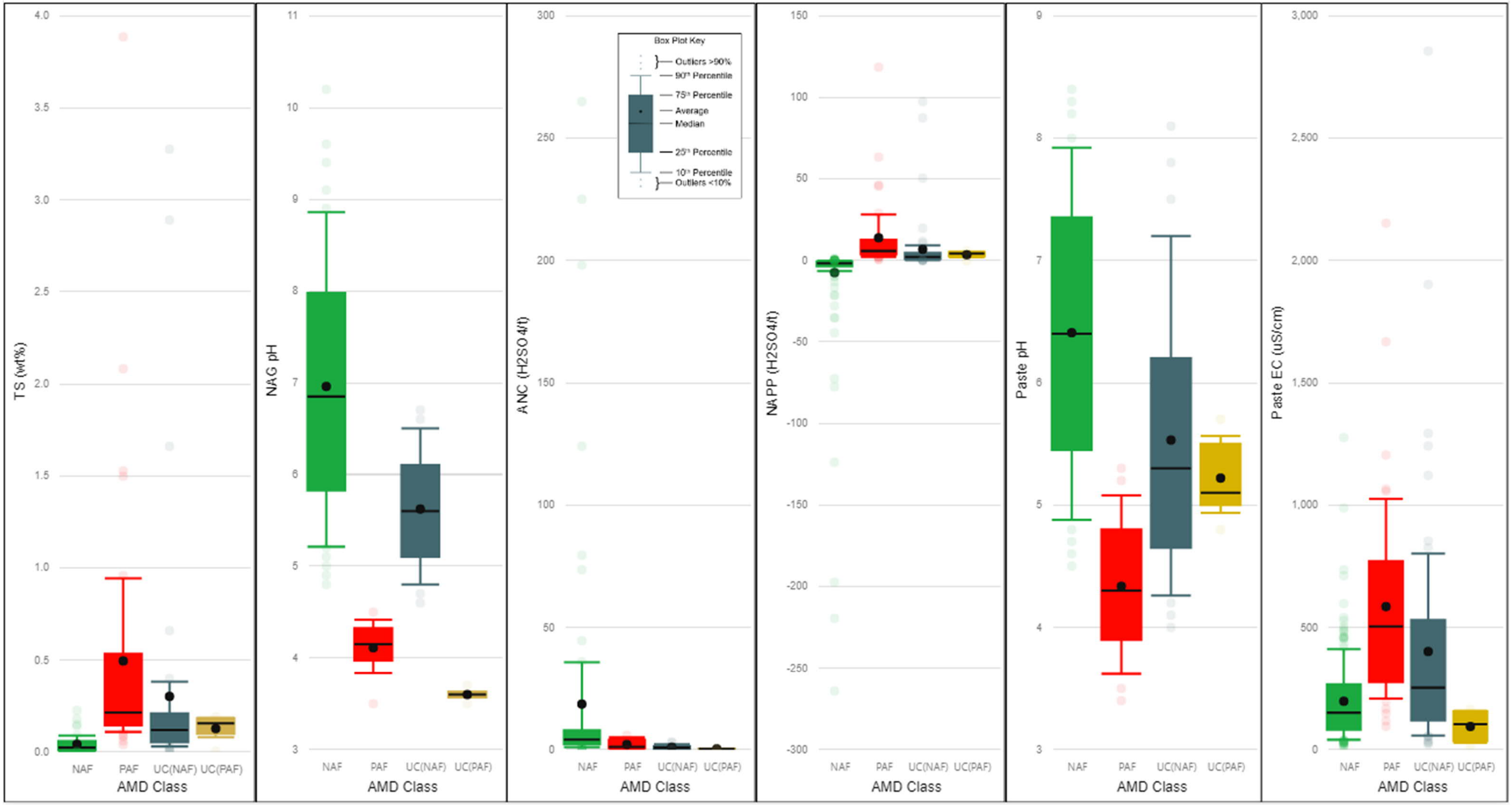


Figure 3-122 Box plots of key ABA parameters by AMD classification (generated by PowerBI Dashboard)

3.1.2.4 Geochemical description by stratigraphy

This section presents the geochemical properties and the implications to AMD hazard as a function of stratigraphic units based on the available environmental geochemistry data.

The detailed environmental geochemistry dataset and the PowerBI dashboard are presented in Appendix F and G.

3.1.2.4.1 Welded Pisolites – WP3 (Tertiary Detritals – TD3)

- Acid Base Accounting

One (1) sample from the WP3 stratigraphic unit was included in the environmental database, with this sample derived from within the pit shell. This sample is classified as high-grade ore. The total sulphur of this samples is 0.14 wt%, slightly higher than the common sulphur content of the overall WP3 material based on MAC/SF block model data (i.e. 95% of the total mine waste having total sulphur < 0.1 wt%).

The sample tested has an ANC content below detection limits (<1 kg H_2SO_4/t).

The majority of the WP3 sourced from NF and SF is associated with low-grade ore.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 407 µS/cm. Paste pH values of the sample tested is acidic with pH values less than 5.5 (pH 4.5). The NAG pH value for this sample is acidic with a value less than pH 4.5 (pH 4.3). NAG testwork indicates moderate capacity to release acidity in this sample with a NAG7 acidity of 2.6 kg H_2SO_4/t.

- Mineralogy and Sulphur Speciation

No mineralogy is available for WP3. Insufficient data is available to determine the sulphur speciation (sulphide / sulphate).

- AMD Classification

The sample of the WP3 stratigraphy tested from within the pit shell, is classified as PAF. This sample is characterised by a low total S concentration (0.14 wt%), a low ANC value (<1 kg H_2SO_4/t), an acidic paste pH value (pH 4.5), and an acidic NAG pH value of 4.3

BHP WAIO classification predicts the sample to be AMD3. This agrees with the AMIRA testwork which classifies the sample as PAF.

- Geochemical Abundance Index (GAI)

The sample of the WP3 stratigraphic unit has not been analysed for major and trace element bulk chemistry.

- Leaching Tests

Leach tests were not conducted on this sample of WP3.

- Implication for WP3 Waste Mined at MAC/SF

The WP3 stratigraphic unit constitutes 0.03% of the LoA waste material at MAC/SF, and is mainly associated with low-grade ore. The expected volume of WP3 low-grade ore is inconsequential even if all the low-grade ore were to report to the OSAs.

3.1.2.4.2 Siltstone – ST3 (Tertiary Detritals – TD3)

- Acid Base Accounting

Nine (9) samples from the ST3 stratigraphic unit were included in the environmental database, with all derived from within the pit shell. Of these 9 samples, all are classified as waste. The total sulphur distribution of the tested samples ranged from 0.01 to 0.06 wt%, with an average value of 0.02 %, which is consistent with the overall sulphur distribution of ST3 material based on MAC/SF block model data, as virtually all mine waste (waste rock and low-grade ore) is expected to have total sulphur < 0.1 %.

The samples tested have ANC contents that range from 1.80 to 79.40 kg H_2SO_4/t, with an average value of 15.4 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is variable, ranging from 58 µS/cm to 1,275 µS/cm. Paste pH values of all samples tested are near neutral (≥6.4). The NAG pH values for all samples are near neutral and greater than pH 4.5 (averaging 7.2).

Mineralogy and Sulphur Speciation

For the ST3 stratigraphic unit the key minerals identified by XRD in the 5 samples tested are hematite, an amorphous phase, kaolinite, goethite, and quartz. Minor calcite and dolomite were detected in some samples. The near neutral paste pH and NAG values suggests that the sulphur is likely to be associated with low concentrations of sulphates, not sulphides.

- AMD Classification

Of the 9 samples of the ST3 stratigraphy tested from within the pit shell, all were classified as NAF (AMD0).

- Position Relative to the Water Table

Of the 9 samples from within the pit shell all are derived from above the water table.

- Geochemical Abundance Index (GAI)

Five (5) samples of the ST3 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Ag for 3 samples (GAI = 3) and Hg for 2 samples (GAI = 3).

- Leaching Tests

Leach tests were conducted on a single sample of ST3, which was classified as NAF (AMD0).

This NAF sample had a moderate ANC value (2 kg H_2SO_4 /t) and a low total S concentration (0.01 %). The leachate from this samples was moderately-saline (EC of 376 µS/cm), near neutral pH (6.5), had alkalinity of 22 CaCO3 mg/L eq. and contained very low dissolved concentration of metals (near detection limit). The dissolved sulphate within the leached NAF samples was 32 mg/L.

- Implication for ST3 Waste Mined at MAC/SF

The ST3 stratigraphic unit constitutes 5.89% of the LoA waste material at MAC/SF. Of the samples tested (within the pit shell) 100% is classified as NAF (AMD0).

Based on low sulphur contents and near neutral paste pH and NAG values ST3 is unlikely to generate or release AMD/NMD upon leaching.

This stratigraphic unit can be considered inert/barren.

3.1.2.4.3 Gravelly Siltstone – GS3 (Tertiary Detritals – TD3)

- Acid Base Accounting

Seventeen (17) samples from the GS3 stratigraphic unit were included in the environmental database, with 4 derived from within the pit shell and 13 derived from outside the pit shell. Of the 17 samples from within the pit shell (or adjacent to the pit shell and suitable for use in describing this stratigraphic unit), 7 are classified as waste, and 10 are classified as low-grade ore. All samples will be discussed in this section.

The total sulphur distribution of the tested samples ranged from 0.01 to 0.04 %, with an average value of 0.02%. The average sulphur content of the GS3 stratigraphy is consistent with the overall sulphur distribution of GS3 material based on MAC/SF block model data (i.e. 95% of the total mine waste having total sulphur < 0.1%).

The samples tested have ANC contents that range from 0.50 to 36.03 kg H_2SO_4 /t, with an average value of 5.24 kg H_2SO_4 /t. This is general consistent with the distribution of ANC in the block model, with samples having ANC generally below 10 kg H_2SO_4/t, however, the ANC range of the GS3 stratigraphy in the block model is greater ranging up to 100 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 236 µS/cm. Paste pH values for all samples but one have values >5.5, with near neutral median pH of 6.75. The NAG pH values for approximately are greater than 4.5, but for one sample from SF Grand Central deposit. This specific sample has acidic paste pH (pH 5.3) and has very low sulphur concentration (0.04%).

- Mineralogy and Sulphur Speciation

For the GS3 stratigraphic unit no mineralogy data was available.

- AMD Classification

Of the 17 samples of the GS3 stratigraphy tested from within the pit shell, or adjacent to the pit shell, 94% (or 16 samples) are classified as NAF (AMD0). These are characterised by low total S concentrations (≤0.04 %), moderate-high ANC values averaging 5.54 kg H_2SO_4 /t, near neutral paste pH values and NAG pH values >4.5. Only one (1) sample characterised by low total S concentration of 0.04 %, a low ANC value of 0.5 kg H_2SO_4 /t, a slightly acidic paste pH value of 5.3, had an acidic NAG pH value of 4.0. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. This sample may represent naturally acidic, barren materials.

The BHP WAIO classification predicts 100% of the samples to be AMD0 which is consistent with the interpretation on the testwork results from the AMIRA tests.

- Position Relative to the Water Table

Of the 17 samples from within the pit shell, or adjacent to the pit shell, all are derived from above the water table.

- Geochemical Abundance Index (GAI)

Three (3) samples of the GS3 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in As for 1 sample (GAI = 3) and Se for 1 sample (GAI = 6).

- Leaching Tests

Leach tests were conducted on 3 samples of GS3, of which all were classed as NAF.

The NAF samples had moderate to high ANC values (3.0 - 36 kg H_2SO_4 /t) and low total S concentrations (0.02 - 0.04 t%). The leachate from this samples was moderately-saline (average EC of 358 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.19 mg/L), Fe (av 0.11 mg/L), and Ni (ave. 0.01 mg/L). The average dissolved sulphate within the leached NAF samples was 50.1 mg/L.

- Implication for GS3 Waste Mined at MAC/SF

The GS3 stratigraphic unit constitutes 5.44% of the LoA waste material at MAC/SF. Of the samples tested (within and adjacent to the pit shell) all but one is classified as NAF (AMD0).

It appears that GS3 samples from the South Flank deposit (n=8; ave. 7.37 kg H_2SO_4 /t) have slightly higher ANC values than those from the North Flank Deposit (n=9; ave. 3.36 kg H_2SO_4 /t), at similarly low total sulphur concentrations.

The vast majority of the GS3 material is expected to be inert, while it is assumed that a small proportion might release low level of acidity upon leaching. This acidity is assumed to be associated with low levels of alunite and/or gibbsite which usually occurs in highly weathered samples. However, there may be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads. Due to the very low S concentration, it is predicted that the capacity to generate NMD is such sample is also very low.

Furthermore, based on BHP waste management procedure, AMD3 (PAF) waste is encapsulated and stored at least 10 m from the final surface, limiting the potential for leaching.

3.1.2.4.4 Calcrete – CA2 (Tertiary Detritals – TD2)

- Acid Base Accounting

One (1) sample from the CA2 stratigraphic unit was included in the environmental database, which was derived from adjacent to the pit shell. This sample was classified as waste. The total sulphur concentration of the sample was very low (0.01%). The sulphur content of the CA2 sample is consistent with the MAC/SF block model data as 100% of the CA2 blocks have total sulphur < 0.1 wt%.

The CA2 sample has an ANC content of 124.0 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

The paste EC of this sample is moderately saline (375 µS/cm) and the paste pH value was near neutral (7.20). No NAG data was available for this sample.

- Mineralogy and Sulphur Speciation

No mineralogy or sulphur speciation data was available for the CA2 sample.

- AMD Classification

The CA2 sample tested was classified as NAF based on the AMIRA testwork, which is consistent with the AMD0 BHP WAIO classification.

- Position Relative to the Water Table

The CA2 sample was derived from above the water table.

- Geochemical Abundance Index (GAI)

The CA2 sample was analysed for major and trace element bulk chemistry. However, did not show significant enrichment in any element.

- Leaching Tests

Leach tests were conducted on the CA2 sample from adjacent to the pit shell, which was classified as NAF (AMD0).

The NAF samples had an elevated ANC value (124 kg H_2SO_4/t) and very low total S concentrations (0.01%). The leachate from this samples was moderately-saline (EC of 375 µS/cm) and contained very low dissolved concentration of metals, such as Al (0.22 mg/L) and Cu (0.02 mg/L). The dissolved sulphate within the leached NAF sample was 11.5 mg/L.

- Implication for CA2 Waste Mined at MAC/SF

The CA2 stratigraphic unit constitutes 0.04% of the LoA waste material at MAC/SF. The sample tested (adjacent to the pit shell) is classified as NAF.

CA2 is not expected to generate or release AMD / NMD upon leaching. This stratigraphy may represent a resource in terms of acid neutralisation due to elevated ANC contents, if significant volumes are excavated.

3.1.2.4.5 Clay – CY2 (Tertiary Detritals – TD2)

- Acid Base Accounting

Eleven (11) samples from the CY2 stratigraphic unit were included in the environmental database, with 1 derived from within the pit shell and 10 derived from outside the pit shell, and are identified as waste. All samples will be discussed in this section.

The total sulphur distribution of the tested samples ranged from below detection limits to 0.88 %, with an average value of 0.12 %. The sulphur distribution of the CY2 samples is comparable with the overall sulphur distribution of CY2 material based on MAC/SF block model data, although the maximum average weighted sulphur concentration in the block model is 0.38 %, thus lower that the range associated with the samples tested.

The samples tested have ANC contents that range from below detection limits to 225 kg H_2SO_4 /t, with an average value of 31 kg H_2SO_4 /t. The ANC range of the sample suite is generally consistent with the ANC range predicted in the block model for this stratigraphic unit.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 391 µS/cm. Paste pH values for 1 of the samples tested are slightly acidic with pH values less than 5.5 (SF323/3-PAF). The NAG pH values for 2 samples tested, are acidic with values less than pH 4.5. NAG testwork indicates low capacity to release acidity in these samples with NAG7 acidity generally less than 13 kg H_2SO_4/t. Notably the two samples with NAG pH < 4.5 had the highest sulphur levels among the samples tested, namely 0.34% (samples B/42PAF) and 0.88% (sample SF323/3-PAF).

- Mineralogy and Sulphur Speciation

No mineralogy is available for CY2. However, sulphur speciation (sulphide / sulphate) date suggest that for sample SF323/3-PAF most sulphur is likely associated with sulphates, while in the sample B/42PAF most sulphur is associated with sulphides.

- AMD Classification

Of the 11 samples of the CY2 stratigraphy tested from within, or adjacent to the pit shell, 9 were classified as NAF. These are characterised by low total S concentrations (<0.18 %), moderate ANC values averaging 34 kg H_2SO_4 /t, near neutral paste pH values generally >5.5, and NAG pH values >4.5.

Of the samples of the CY2 stratigraphy with total sulphur range comparable to that predicted by the block model all were classed as NAF but for sample samples B/42PAF. This sample in WAIO AMD classification is classed as AMD0 in contrast with the AMIRA classification.

Sample SF323/3-PAF sourced from above the water table, is classed as PAF, consistently with the BHP WAIO classification (AMD3). This sample has slightly acidic pH, with all sulphur associated with sulphates, ANC below detection limit and slightly acidic NAG pH. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. This sample may represent naturally acidic materials.

- Position Relative to the Water Table

Of the 11 samples from within, or adjacent to the pit shell, 1 is from above the water table and 6 from below, the position of the water table for 3 of the samples was unknown.

- Geochemical Abundance Index (GAI)

One (1) sample of the CY2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show no significant enrichment in any of the analysed elements.

- Leaching Tests

Leach tests were conducted on 2 sample, which was classed as PAF, which represent the highest sulphur sample in the sample suite (sample SF323/3-PAF, 0.88%S; sample B/42PAF, 0.34%S). The leachate from sample was SF323/3-PAF slightly acidic pH, highly-saline (EC of 2,152 µS/cm) and contained dissolved concentration of metals such as Mn (0.23 mg/L) and Al (4.75 mg/L), As (0.003 mg/L), Ca (11 mg/L), K (20.9 mg/L), Mg (107 mg/L), Na (322 mg/L), Ni (0.12 mg/L), Se (0.01 mg/L), Co (0.04 mg/L). EC was dominated by dissolved sulphate (453 mg/L) and chloride (515mg/L). Metal mobilisation in this samples is likely associated with dissolution of readily soluble sulphate such as gypsum and sparingly soluble alunite.

Leachate from sample B/42PAF had slightly acidic pH, and moderate salinity of 246 µS/cm. Major ions were Ca (15.74 mg/L), Mg (21.28 mg/L), Na (8.1 mg/L), chloride (4 mg/L) and sulphate (89.9). Most trace metals showing minor mobilisation include Al (0.07 mg/L), Co (0.008 mg/L), Fe (0.03 mg/L), Mg (4.5 mg/L), Ni (0.01 mg/L), and Se (0.004 mg/L).

- Implication for CY2 Waste Mined at MAC/SF

The CY2 stratigraphic unit constitutes 0.11% of the LoA waste material at MAC/SF. Virtually all of the CY2 stratigraphy (or 99.5%) has total sulphur values <0.1 wt%. Based on the data available, very low sulphur samples are likely to be NAF, with low potential to generate AMD or NMD.

Based on limited data high sulphur samples (i.e. > 0.34%) comparable to those tested (i.e. low ANC) might generate or release low levels of acidity and salinity upon leaching mostly due to the natural acidity of the materials. However, there may be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads. Where samples are classed as AMD3, however, these will be managed according to BHP waste management guidance, which requires such material to be encapsulated and not stored near the final surface.

3.1.2.4.6 Vuggy Breccia – VB2 (Tertiary Detritals – TD2)

- Acid Base Accounting

Sixty-eight (68) samples from the VB2 stratigraphic unit were included in the environmental database, with 20 derived from within the pit shell and 48 derived from outside the pit shell. Only in-pit samples will be discussed in this section.

Of the 20 samples from within the pit shell, 8 are classified as waste, and 12 are classified as low-grade ore. The total sulphur distribution of the tested samples from within the pit shell ranged from below detection limits to 0.35%, with an average value of 0.11%. The sulphur content of the VB2 samples is overall consistent with the sulphur distribution of VB2 material based on MAC/SF block model data, with approximately 95% of the mine waste having total sulphur less than 0.1%, and 99% less than 0.2% S.

The samples tested have ANC contents that range from below detection limits to 3.9 kg H_2SO_4/t, with an average value of 1.38 kg H_2SO_4/t. This is also generally consistent with the median ANC predicted from the block model for this stratigraphic unit, which tends to be low (approximately 5 kg H_2SO_4/t), however the range in ANC for VB2 is large ranging from below detection limit to over 100 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 377 µS/cm. Paste pH values of approximately 65% of the samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for approximately 26% of the samples tested are slightly acidic with values less than pH 4.5. NAG testwork indicates moderate capacity to release acidity from these samples with NAG7 acidity generally less than 5.1 kg H_2SO_4/t.

- Mineralogy and Sulphur Speciation

For the VB2 stratigraphic unit the key minerals identified by XRD in the 11 samples tested are goethite, an amorphous phase, hematite, kaolinite, quartz, and gibbsite. Minor alunite was detected in one sample. Mineralogical and sulphur speciation testwork conducted on these samples, combined with weakly acidic to near neutral paste pH and NAG values suggests that the majority of the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 20 samples of the VB2 stratigraphy tested from within the pit shell, 8 were classified as NAF. These are characterised by low total S concentrations (approximately <0.1 %), ANC values averaging 2.71 kg H_2SO_4 /t, near neutral paste pH values generally >5.6 (single value at pH 5.2), and NAG pH values >4.5. The mineralogy of these NAF samples is dominated by goethite, an amorphous phase, hematite, and kaolinite. Alunite was not detected.

Of the 20 samples of the VB2 stratigraphy tested from within the pit shell, 6 were classified as UC(NAF). These are characterised by moderate total S concentrations (<0.20 wt%, averaging 0.13 wt%), low ANC values averaging 0.47 kg H_2SO_4/t, slightly acidic paste pH values between 4.0 and 5.0, positive NAPP but NAG pH values >4.5. The mineralogy of these (UC)NAF samples is dominated by goethite, an amorphous phase, hematite, kaolinite, and quartz. Alunite was identified as the only sulphur-bearing phase (in one sample) while sulphur speciation suggested presence of sulphates and not sulphides, thus supporting a UC(NAF) classification.

Of the 20 samples of the VB2 stratigraphy tested from within the pit shell, 6 were characterised by NAG pH values less than but close to 4.5. These samples are characterised by slightly elevated total S concentrations (averaging 0.20 %), no buffering capacity with ANC values of 0.5 kg H_2SO_4/t, and acidic paste pH values <4.7. The mineralogy of these samples is dominated by goethite, an amorphous phase, kaolinite, hematite, and quartz. Alunite was not detected. However, sulphur speciation suggest that sulphate is the dominant form of sulphur. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/ or gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. Samples similar to these, may represent naturally acidic materials.

The BHP WAIO classification predicts 40% of the samples to be AMD3 with the remaining samples classified as AMD0. In contrast, the AMIRA testwork suggests that 30% of the studied samples are classified as PAF. This suggest that the BHP WAIO classification is conservative.

- Position Relative to the Water Table

Of the 20 VB2 samples from within the pit shell, all are derived from above the water table.

- Geochemical Abundance Index (GAI)

Thirteen (13) samples of the VB2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 2 samples (GAI = 3).

- Leaching Tests

Leach tests were conducted on 2 samples of VB2, of which one sample was classed as NAF and the other as PAF.

The NAF sample had a slightly elevated ANC value (3 kg H_2SO_4 /t) and a low total S concentration (0.05 wt%). The leachate from this samples was moderately-saline (EC of 301 µS/cm) and contained very low dissolved concentration of metals. The dissolved sulphate within the leached NAF sample was 29.9 mg/L.

The PAF samples had very low ANC values (0.5 kg H_2SO_4 /t) and moderate total S concentrations (0.35 wt%). The leachate from this samples was moderately-saline (EC of 522 µS/cm) and contained low dissolved concentration of metals such as Mn (0.63 mg/L), Al (1.35 mg/L), and Ni (0.07 mg/L). The average dissolved sulphate within the leached PAF sample was 69 mg/L.

- Implication for VB2 Waste Mined at MAC/SF

The VB2 stratigraphic unit constitutes 6.46% of the LoA waste material at MAC/SF. Of the samples tested (within the pit shell) 60% is classified as NAF/UC(NAF) (AMD0), and 30% PAF (naturally acidic). The samples classed as PAF (due to natural acidity) had negligible ANC and total sulphur generally greater than 0.15%.

The environmental geochemical data available suggest that sulphur is generally associated with sulphates, with alunite being the only sulphur bearing phase identified in some of samples submitted for XRD analysis. Samples with alunite and low ANC can generate acidic pH when leached (although generally with low acidity values). In addition, gibbsite can also generate acidic pH when leached. High sulphur, low ANC samples similar to those tested might generate or release low levels of AMD / NMD upon leaching. However, there may be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads. Furthermore, based on BHP waste management procedure, AMD3 (PAF) waste is encapsulated and stored at least 10 m from the final surface, limiting the potential for leaching.

3.1.2.4.7 Lignite Clay – LT2 (Tertiary Detritals – TD2)

- Acid Base Accounting

Seven (7) samples from the LT2 stratigraphic unit were included in the environmental database, with all derived from adjacent to the pit shells (but suitable for describing the LT2 stratigraphy). All of the 7 samples from adjacent to the pit shells are classified as waste. The total sulphur distribution of the tested samples ranged from 0.01 to 0.50%, with an average value of 0.22%. The sulphur range of the LT2 samples is lower than that of the MAC/SF block model data as 85% of the LT2 blocks have total sulphur ≥0.5%.

The samples tested have ANC contents that range from 2.0 to 21.0 kg H_2SO_4/t, with an average value of 7.23 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately to highly saline, with average values of approximately 673 µS/cm. Paste pH values of approximately 43% of the samples tested are slightly acidic with pH values less than 5.5 (ranging from 4.9 to 7.0). The NAG pH values for approximately 60% of the samples tested are acidic with values less than pH 4.5 (ranging from 3.5 to 7.0). NAG testwork indicates a moderate-high capacity to release acidity from these samples with NAG7 acidity generally less than 23.43 kg H_2SO_4/t.

- Mineralogy and Sulphur Speciation

For the LT2 stratigraphic unit the key minerals identified by XRD in the 2 samples tested are goethite, kaolinite, an amorphous phase (likely ligneous material), and hematite. Whilst no sulphur bearing phases were identified, the acidic NAG pH values suggest that at least some sulphur is likely to be associated with sulphide minerals.

Sulphur speciation data (i.e. chromium reducible sulphide sulphur (S_{Cr}) and HCl extractable sulphate sulphur (S_{HCl})) was available for five samples of the LT2 stratigraphy. The sulphur budget of most samples (60%) is dominated by sulphides (i.e. S_{Cr} constitutes >50% of the total sulphur). This sulphur speciation data is consistent with NAG pH data, where the samples dominated by sulphide sulphur exhibit acidic NAG pH values, and those dominated by sulphate sulphur have near neutral NAG pH values.

- AMD Classification

Of the 7 samples of the LT2 stratigraphy tested from adjacent to the pit shells, 4 (57%) were classified as NAF. These are characterised by low to moderate total S concentrations (0.01 – 0.14%, averaging 0.05%), moderate ANC values averaging 8.75 kg H_2SO_4/t, near neutral paste pH values (6.3 – 7.0), and NAG pH values >6.7. The mineralogy of these NAF samples is dominated by goethite, kaolinite, an amorphous phase (likely ligneous material), and hematite. No sulphur bearing phases were identified. As these samples contain slightly elevated total sulphur, combined with NAG pH above 4.5 there is minor potential for NMD generation.

Of the 7 samples of the LT2 stratigraphy tested from adjacent to the pit shells, 3 (43%) were classified as PAF. These are characterised by moderate total S concentrations (≥0.39%, averaging 0.45%), ANC values averaging 5.2 kg H_2SO_4/t, slightly acidic paste pH values (4.9 – 5.3) and NAG pH values <4.0.

The BHP WAIO classification predicts 43% of the samples to be AMD3 with the remaining samples classified as AMD0. The BHP WAIO classifications are consistent with the AMIRA testwork (described above), which suggests that 43% of the studied samples are classified as PAF, and the remaining 57% are NAF.

- Position Relative to the Water Table

Of the 7 samples of LT2 from adjacent to the pit shells all are derived from below the water table.

- Geochemical Abundance Index (GAI)

Four (4) samples of the LT2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment (i.e. GAI enrichment factors >3) in Ag for 1 sample (GAI = 6), Co for 2 samples (GAI = 3 and 4), Fe for 1 sample (GAI = 3), Mn for 1 sample (GAI = 4), and Se for 2 samples (GAI = 3 and 4).

- Leaching Tests

A leach test was conducted on 1 sample of LT2, which was classified as PAF based on the AMIRA testwork procedure.

The PAF sample had moderate ANC values (4.8 kg H_2SO_4/t) and a moderate total S concentration (0.46%) likely associated with sulphide sulphur. The leachate from this sample was highly-saline (EC of 980 µS/cm) and contained low dissolved concentration of metals such as, Se (0.06 mg/L), Al (0.22 mg/L), Fe (0.01 mg/L), Co (0.21 mg/L), Mn (11.41 mg/L), Ni (0.23 mg/L), Zn (0.03 mg/L). The dissolved sulphate within the leached PAF sample was 675 mg/L.

- Implication for LT2 Waste Mined at MAC/SF

The LT2 stratigraphic unit constitutes <0.01% of the LoA waste material at MAC/SF. Of the samples tested (adjacent to the pit shells) 57% is classified as NAF (AMD0), with the remaining 43% classified as PAF.

Based on limited data there is a systematic difference between the South Flank (n=3) and North Flank (n=4) deposits, with the latter containing lower average S concentrations (South Flank averages 0.45%; and North Flank averages 0.05%). In addition, North Flank samples have slightly higher ANC values (averaging 8.75 kg H_2SO_4/t) compared to South Flank samples (averaging 5.2 kg H_2SO_4/t). These differences result in all the South Flank LT2 samples being classified as PAF, whereas all the North Flank LT2 samples are classified as NAF.

The environmental geochemical data available suggests that sulphur is generally associated with sulphide minerals (with minor sulphate minerals). LT2 is expected to generate or release AMD / NMD upon leaching. However, the mass of LT2 to be mined is volumetrically small, and hence there may be sufficient ANC in the remaining waste to neutralise the acidity loads produced by LT2.

3.1.2.4.8 Hematite Conglomerate – HC1 (Tertiary Detritals – TD1)

- Acid Base Accounting

Thirty-one (31) samples from the HC1 stratigraphic unit were included in the environmental database, with 18 derived from within the pit shell and 13 derived from outside the pit shell. Of the 18 samples from within the pit shell, 2 are classified as waste, 16 are classified as low-grade ore. Only in-pit samples will be discussed in this section.

The total sulphur distribution of the tested samples ranged from 0.01 to 3.3 %, with an average value of 0.28 %. The sulphur range of the HC1 samples is consistent with the sulphur distribution estimated by the block model which ranges from <0.1% to approximately 3%. However, as described in section 3.1.1 the vast majority of HC1 (i.e. 98% of the total mine waste) is expected to have total sulphur <0.2 %.

The samples tested have ANC contents that range from 0.5 to 2.8 kg H_2SO_4/t, with an average value of 0.91 kg H_2SO_4/t. The ANC range of the samples tested is slightly lower than that the ANC range observed in the block model (i.e. <1 to 10 kg H_2SO_4/t)

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 632 µS/cm. Paste pH values of 13 of the samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for 1 of the samples tested is slightly acidic with values of pH 4.4.

- Mineralogy and Sulphur Speciation

For the HC1 stratigraphic unit the key minerals identified by XRD in the 8 samples tested are hematite, an amorphous phase, kaolinite, goethite, and alunite. Mineralogical and sulphur speciation testwork conducted on the samples, combined with weakly acidic paste pH but near neutral NAG pH values suggest that the majority of sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 18 samples of the HC1 stratigraphy tested from within the pit shell, 4 were classified as NAF. These are characterised by low total S concentrations (<0.04 wt%), slightly elevated ANC values averaging 1.55 kg H_2SO_4 /t, near neutral to slightly acidic paste pH values between 4.8 and 6.5 (averaging 5.63), and NAG pH values >4.5.

Of the 18 samples of the HC1 stratigraphy tested from within the pit shell, 13 were classified as UC(NAF). These are characterised by total sulphur concentrations ranging from <0.1 to 3.35 %, positive NAPP values, low ANC values averaging 0.75 kg H_2SO_4 /t, but NAG pH values >4.5. The mineralogy of these (UC)NAF samples is dominated by hematite, an amorphous phase, kaolinite goethite, and alunite. Sulphur speciation suggest that sulphur is associated with sulphate rather than sulphides, thus supporting a UC(NAF) classification. As some of samples contain alunite, there is minor potential some acidity release upon leaching.

Of the 18 samples of the HC1 stratigraphy tested from within the pit shell, 1 was classified as PAF. This sample is characterised by moderate total S concentrations (0.26 wt%), low ANC values of <1 kg H_2SO_4 /t, an acidic paste pH of 4.0, and a NAG pH value of 4.4, with sulphur speciation indicating that sulphur is associated with sulphate forms. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, is likely responsible for the NAG pH <4.5. This sample may represent naturally acidic materials.

The BHP WAIO classification predicts 8 samples to be AMD3 (including the sample classed as PAF) with the remaining samples classified as AMD0. In contrast, the AMIRA testwork suggests that only 1 of the studied samples is classified as PAF, with the reminder 17% classified as NAF and UC(NAF).

This suggests that the BHP classification is conservative and results in the management of more waste as AMD3 than that predicted from actual ABA testwork.

- Position Relative to the Water Table

Of the 18 samples from within the pit shell all are from above the water table.

- Geochemical Abundance Index (GAI)

Nine (9) samples of the HC1 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Ag for 3 samples (GAI = 4, 5, and 6), As for 4 samples (GAI = 3), Fe for 1 sample (GAI = 3), and Hg for 2 samples (GAI = 3 and 4).

- Leaching Tests

Leach tests were conducted on 1 sample of HC1, which was classified as UC(NAF).

The (UC)NAF sample has low ANC values (<1 kg H_2SO_4 /t) and a moderate total S concentration (0.21 %) likely associated with sulphate sulphur. The leachate from this samples was highly-saline (EC of 1292 µS/cm) and contained low dissolved concentration of metals such as Al (1.48 mg/L), Mn (2.66 mg/L), Ni (0.03 mg/L) and Zn (0.01 mg/L). The dissolved sulphate within the leached PAF sample was 242 mg/L.

- Implication for HC1 Waste Mined at MAC/SF

The HC1 stratigraphic unit constitutes 2.68% of the material to be mined at MAC/SF. Of the samples tested (within the pit shell) all but one is classified as NAF (AMD0).

All 18 samples of the HC1 stratigraphy are derived from the South Flank deposit.

The environmental geochemical data available suggest that sulphur is generally associated with sulphates, with alunite being present in the mineral assemblage of many of the samples submitted for XRD analysis. Samples with alunite and low ANC can generate acidic pH when leached (although generally with low acidity values). HC1 is expected to generate or release low levels of AMD upon leaching. However, there may be sufficient ANC in the remaining waste to neutralise the relatively low acidity load.

Furthermore, based on BHP waste management procedure, all AMD3 waste is encapsulated and stored at least 10 m from the final surface, limiting the potential for leaching.

3.1.2.4.9 Clay – CY1 (Tertiary Detritals – TD1)

- Acid Base Accounting

Eleven (11) samples from the CY1 stratigraphic unit were included in the environmental database, with all 11 derived from within the pit shell. Of the 11 samples all are classified as waste. The total sulphur distribution of the tested samples ranged from below detection limits to 0.25 wt%, with an average value of 0.04 wt%. The sulphur content of the CY1 samples is overall consistent with that of the CY1 material based on MAC/SF block model data with approximately 90% of the mine waste having total sulphur < 0.2 wt%. However, the sulphur range predicted in the block model is greater than that captured in the environmental database. CY1 is only mined from SF, Grand Central deposit.

The samples tested have ANC contents that range from 0.1 to 1.0 kg H_2SO_4 /t, with an average value of 0.50 kg H_2SO_4 /t. The ANC range for the samples tested in consistent with that predicted by the block model.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is variable saline, with values ranging from 14 µS/cm to 853 µS/cm. Paste pH values of approximately 36% of the samples tested are slightly acidic with pH values less than 5.5. All the NAG pH values are >4.5.

- Mineralogy and Sulphur Speciation

For the CY1 stratigraphic unit the key minerals identified by XRD in the 10 samples tested are hematite, kaolinite, an amorphous phase, and goethite. Minor alunite was detected in one sample. Mineralogical and sulphur speciation testwork conducted on these samples, combined with weakly acidic to near neutral paste pH, and near neutral NAG pH values suggests that the majority of the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 11 samples of the CY1 stratigraphy tested from within the pit shell, 4 were classified as NAF. These are characterised by low total S concentrations (≤0.02 wt%), ANC values averaging 0.85 kg H_2SO_4 /t, near neutral paste pH values generally ≥6.0, and NAG pH values ≥5.7. The mineralogy of these NAF samples is dominated by hematite, kaolinite, and an amorphous phase.

Of the 11 samples of the CY1 stratigraphy tested from within the pit shell, 7 were classified as UC(NAF). These are characterised by moderate total S concentrations (≤0.25 wt%, averaging 0.06 wt%), low ANC values averaging 0.3 kg H_2SO_4 /t, positive NAPP values, and slightly acidic paste pH values between 4.8 and 6.5, but NAG pH values between >4.5. The mineralogy of these (UC)NAF samples is dominated by hematite, kaolinite, an amorphous phase, and goethite, while sulphur speciation suggest that all sulphur is associated with sulphates, thus supporting a UC(NAF) classification. Minor alunite was the only sulphur-bearing phase detected (in one sample). As some of samples contain alunite, contents there is minor potential some acidity release upon leaching.

The BHP WAIO classification predicts 2 of the samples to be AMD3 with the remaining samples classified as AMD0. In contrast, the AMIRA testwork suggests that all samples studied classified as NAF/UC(NAF).

This suggests that the BHP classification is conservative and results in the management of more waste as AMD3 than that predicted from actual ABA testwork.

- Position Relative to the Water Table

Of the 11 CY1 samples from within the pit shell, all are derived from above the water table.

- Geochemical Abundance Index (GAI)

Ten (10) samples of the CY1 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Ag for 2 samples (GAI = 3), and As in 8 samples (GAI = 3).

- Leaching Tests

No leach tests were conducted on samples of CY1.

- Implication for CY1 Waste Mined at MAC/SF

The environmental geochemical data available suggest that sulphur is generally associated with sulphates, with alunite being the only sulphur bearing phase identified in some of samples submitted for XRD analysis. Samples with alunite and low ANC can generate acidic pH when leached (although generally with low acidity values). CY1 is expected to generate or release low levels of acidity upon leaching. However, there may be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads.

All CY1 samples were derived from the South Flank deposit. The CY1 stratigraphic unit represents an inconsequential proportion of the LoA mine waste (i.e. 0.21%) at SF. Of this 25% (or 0.05% of the total waste) is expected to be classed as AMD3 and as such will be encapsulated and stored at least 10 m from the final surface, limiting the potential for leaching.

3.1.2.4.10 Surface Scree – SZ (Tertiary Detritals)

- Acid Base Accounting

Four (4) samples from the SZ stratigraphic unit were included in the environmental database, with 1 derived from within the pit shell and 3 derived from outside the pit shell. Of these 4 samples, all 4 are classified as waste. All samples will be described.

The total sulphur distribution of the tested samples did not vary from 0.02 wt%, which is in agreement with the low sulphur content of SZ material based on MAC/SF block model data (i.e. 99th percentile < 0.1 wt%).

The samples tested have ANC contents that range from 1.9 to 8.4 kg H_2SO_4 /t, with an average value of 5.5 kg H_2SO_4 /t. While sample tested cover a lower range in ANC compared to that observed in the block model (i.e. 1->100 kg H_2SO_4/t), 95th percentile ANC values across are generally low below 10-20 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 338 µS/cm. Paste pH values of 100% of the samples tested are near neutral with pH values greater than 5.5 (average pH 7.13). The NAG pH values for approximately 100% (n=1) of the samples tested are near neutral with values greater than pH 4.5 (NAG pH 7.2).

- Mineralogy and Sulphur Speciation

For the SZ stratigraphic unit, the key minerals identified by XRD in the sample tested are hematite, goethite, quartz, and an amorphous phase. Mineralogical testwork conducted on these samples, combined with near neutral paste pH and NAG values shows that sulphur is likely to be associated with trace amounts sulphates.

- AMD Classification

Of the 4 samples of the SZ stratigraphy tested from within the pitshell (and adjacent to the pit shell), all 4 were classified as NAF. These are characterised by very low total S concentrations (0.02 wt%), low ANC values averaging 5.5 kg H_2SO_4 /t, near neutral paste pH values >6.7, and NAG pH values of 7.2. The mineralogy of these NAF samples is dominated by hematite, goethite and quartz.

BHP WAIO classification predicts 100% of the samples to be AMD0. This agrees with the AMIRA testwork that suggests that 100% of the studied samples are classified as NAF.

- Position Relative to the Water Table

Of the 4 samples from within the pit shell (and adjacent to the pitshell), all 4 are from above the water table.

- Geochemical Abundance Index (GAI)

One (1) sample of the SZ stratigraphic unit was analysed for major and trace element bulk chemistry. The GAI values for this sample show a significant enrichment in Ag (GAI = 5) and Fe (GAI = 3).

- Leaching Tests

Leach tests were conducted on 1 sample, which was classed as NAF.

The NAF sample had a low ANC value (< 3.9 kg H_2SO_4/t) and a low total S concentration (0.02 %) likely associated with sulphate sulphur. The leachate from this sample had low salinity (EC of 280 µS/cm) and contained very low dissolved concentrations of metals such as Ca (31mg/L), K (11mg/L), Na (6.7 mg/L) and Mg (2.97 mg/L). The dissolved sulphate within the leached NAF samples was 50 mg/L.

- Implication for SZ Waste Mined at MAC/SF

The SZ stratigraphic unit constitutes 3.61% of the LoA waste material at MAC/SF. A total of 100% of the material from this stratigraphic unit is classified as NAF (AMD0).

The environmental geochemical data available suggest that sulphur is likely to be associated with sulphates, although no mineralogy data is available. SZ is not expected to generate or release AMD upon leaching. This stratigraphy is expected to be inert.

3.1.2.4.11 Tertiary Detritals 3 – TD3 (Tertiary Detritals)

- Acid Base Accounting

Three (3) samples from the TD3 stratigraphic unit were included in the environmental database, with all 3 derived from within the pit shell. Of the 3 samples from within the pit shell, all 3 are classified as waste. The total sulphur distribution of the tested samples ranged from 0.15 to 2.89 wt%, with an average value of 1.23 wt%.

The sulphur range of the TD3 samples is consistent with the sulphur distribution estimated by the block model which ranges from <0.1% to approximately 1.5%. However, as described in section 3.1.1 the vast majority of TD3 (i.e. 99.7% of the total mine waste) is expected to have total sulphur <0.1 %.

The samples tested have ANC contents that range from <1 to 6.6 kg H_2SO_4/t, with an average value of 2.7 kg H_2SO_4/t. While sample tested cover a lower range in ANC compared to that observed in the block model (i.e. 1->100 kg H_2SO_4/t), 95th percentile ANC values across are generally low near or below 10 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is highly saline, with average values of approximately 805 µS/cm. Paste pH values of all the samples tested are near neutral with pH values greater than 5.5. The NAG pH values for all the samples tested are slightly acidic to near neutral with values greater than pH 4.5.

- Mineralogy and Sulphur Speciation

No mineralogy is available for TD3, however, sulphur speciation indicates that all sulphur is associated with sulphates. Weakly acidic suggests and elevated salinity suggest that sulphates may be represented by alunite and gypsum.

- AMD Classification

Of the 3 samples of the TD3 stratigraphy tested from within the pit shell, 1 was classified as NAF. This sample is characterised by a total S concentration of 0.15 %, low ANC (6.6 kg H_2SO_4/t), near neutral paste pH value (pH 7), and a NAG pH value of 7.1.

Of the 3 samples of the TD3 stratigraphy tested from within the pit shell, 2 were classified as UC(NAF). These are characterised by total S concentrations of 0.66 and 2.89 %, negligible ANC, paste pH > 5.5 pH units, NAG pH values >5.5, but positive NAPP. All sulphur in these samples, however, is associated with sulphates, thus supporting a UC(NAF) classification.

BHP WAIO classification predicts 2 of the 3 samples to be AMD3 with the remaining samples classified as AMD0. In contrast, the AMIRA testwork suggests that 100%% of the studied samples are classified as NAF/UC(NAF.

- Position Relative to the Water Table

Of the 3 samples from within the pit shell all 3 are from above the water table, sourced from shallow depths of < 10m bgl.

- Geochemical Abundance Index (GAI)

No samples of the TD3 stratigraphic unit were analysed for major and trace element bulk chemistry.

- Leaching Tests

No leach tests were conducted on samples of the TD3 stratigraphy.

- Implication for TD3 Waste Mined at Packsaddle

Note, the tertiary detritals (TD3) is a generic stratigraphic description comprising WP3, ST3, and GS3. TD3 may or may not be not differentiated in its individual units.

The TD3 stratigraphic unit constitutes 7.19% of the LoA waste material at MAC/SF.

The environmental geochemical data available suggest that sulphur is likely to be associated with sulphates, with occasional occurrences of alunite in higher sulphur samples. As mentioned in section 3.1.1, 99.7% of TD3 mine waste has total sulphur < 0.1% while 99.3% is classed as AMD0. An irrelevant volume equal to approximately 98,000m^3 is classed as AMD3.

TD3 is not expected to generate or release AMD upon leaching. This stratigraphy is expected to be overwhelmingly benign. However, where AMD3 waste is mined, it will be encapsulated and stored at least 10 m from the final surface as per BHP waste management requirements.

3.1.2.4.12 Yandicoogina Shale Member – Y (Brockman Iron Formation)

The Y stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Four (4) samples from the Y stratigraphic unit were included in the environmental database, with 3 derived from within the pit shell and one outside the pit shell. Of the 4 samples from within the pit shell and adjacent areas, 3 are classified as waste, 1 is classified as low-grade ore. All samples will be described.

The total sulphur distribution of the tested samples ranged from below detection limits to 0.06 wt%, with an average value of 0.04 wt%. The average sulphur content of the samples sourced from Y stratigraphy agree with the sulphur distribution of the block model data, where by virtually all mine waste (99.7%) has total S < 0.1%.

The samples tested have ANC contents that range from 1 to 2 kg H_2SO_4 /t, with an average value of 1.5 kg H_2SO_4 /t. While sample tested cover a lower range in ANC compared to that observed in the block model (i.e. 1 to 30 kg H_2SO_4/t), 95th percentile ANC values across are generally low near or below 5 kg H_2SO_4/t.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is slightly saline, with average values of approximately 193 µS/cm. Paste pH values of all the samples tested are near neutral with pH values greater than 5.5. The NAG pH values for all the samples tested are near neutral with values greater than pH 4.5. NAG testwork indicates negligible capacity to release acidity in these samples with NAG7 acidity generally less than 1 kg H_2SO_4/t.

- Mineralogy and Sulphur Speciation

For the Y stratigraphic unit, the key minerals identified by XRD in the 1 sample tested are goethite, an amorphous phase, kaolinite, hematite and quartz. Sulphur speciation conducted on two samples suggest that all sulphur is present as sulphate.

- AMD Classification

Of the 4 samples of the Y stratigraphy tested from within, or adjacent to the pit shell, all 4 were classified as NAF. These are characterised by very low total S concentrations (≤ 0.06 wt%), very low ANC values averaging 1.5 kg H_2SO_4 /t, near neutral paste pH values generally ≥6.2, and NAG pH values ≥6.2. The mineralogy of these NAF samples is dominated by goethite, an amorphous phase, kaolinite, hematite, and quartz.

BHP WAIO classification predicts 100% of the samples to be AMD0. This agrees with the AMIRA testwork which classifies 100% of the samples as NAF.

- Position Relative to the Water Table

Of the 4 samples of the Y stratigraphy tested from within, or adjacent to the pit shell, all 4 are from above the water table.

- Geochemical Abundance Index (GAI)

Two (2) samples of the Y stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show no significant enrichment any of the elements analysed.

- Leaching Tests

Leach tests were conducted on 1 sample of the Y stratigraphy, which was classed as NAF.

The NAF sample had low ANC value of 2 kg H_2SO_4/t and a low total S concentration of 0.06 wt%. The leachate from this samples was moderately-saline (EC of 580 µS/cm) and contained very low dissolved concentration of metals such as Ca (16.6 mg/L), Co (0.007 mg/L), Cu (0.002 mg/L), K (24.8 mg/L), Mg (38.15 mg/L), Mn (0.135 mg/L), Na (28.2 mg/L), and Se (0.021 mg/L). The dissolved sulphate within the leached NAF sample is 229 mg/L.

- Implication for Y Waste Mined at Packsaddle

The Y stratigraphic unit constitutes 1.08% of the LoA waste material at Packsaddle deposits. A total of 100% of the material from this stratigraphic unit is classified as NAF (AMD0).

Y is not expected to generate or release AMD upon leaching and is considered benign.

3.1.2.4.13 Joffre Member – J6 (Brockman Iron Formation)

The J6 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Twenty-one (21) samples from the J6 stratigraphic unit were included in the environmental database, with 8 derived from within the pit shell and 13 from outside the pit shell. Only the in-pit samples will be discussed.

Of the 8 samples from within the pit shell, 1 is classified as waste, 4 are classified as low-grade ore, and 3 are classified as high-grade ore. The total sulphur distribution of the tested samples ranged from 0.03 to 0.12 wt%, with an average value of 0.06 wt%. The sulphur range in the block model is somewhat larger than that of the dataset with maximum concentration of 0.3%. However, the average sulphur content samples tested is consistent with the overall sulphur distribution of J6 material based on the Packsaddle deposits block model data where 98% of the predicted mine waste has total S grade <0.1%.

The samples tested have ANC contents that range from 0.5 to 2.9 kg H_2SO_4 /t, with an average value of 1.6 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the J6 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is slightly-saline, with average values of approximately 156 µS/cm. Paste pH values of approximately 5 samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for 3 of the samples tested are slightly acidic with values less than pH 4.5. NAG testwork indicates a minimal-moderate capacity to release acidity from these samples with NAG7 acidity generally less than 1.25 kg H_2SO_4 /t.

- Mineralogy and Sulphur Speciation

For the J6 stratigraphic unit no mineralogy data was available. Sulphur speciation data suggest that all sulphur in the samples tests (7 out of 8) is associated with sulphates.

- AMD Classification

Of the 8 samples of the J6 stratigraphy tested from within the pit shell, 4 (50%) were classified as NAF. These are characterised by low total S concentrations (≤0.07 wt%), moderate ANC values averaging 2.48 kg H_2SO_4 /t, slightly acid to near neutral paste pH values generally 5.4-6.7, and a NAG pH value of 6.1. No mineralogy data were available for these NAF samples.

Of the 8 samples of the J6 stratigraphy tested from within the pit shell, 3 (38%) were classified as UC(NAF). These are characterised by low-moderate total S concentrations (0.04-0.12 wt%, averaging 0.08 wt%), low ANC values of <1 kg H_2SO_4 /t, slightly acidic paste pH values between 4.8 and 5.1, positive NAPP, but NAG pH >4.5. Sulphur speciation suggest that all sulphur is associated with sulphate form, thus supporting a UC(NAF) classification.

Of the 8 samples of the J6 stratigraphy tested from within the pit shell, one was classified as PAF. This sample is characterised by a low total S concentration of (0.06 wt%), a moderate ANC values of 1.4 kg H_2SO_4 /t, a slightly acidic paste pH value of 5.2, and an acidic NAG pH value of 4.3, with all sulphur associated with sulphate forms. Residual acidity from peroxide used in the NAG tests may be responsible for the NAG pH <4.5. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. This sample may represent naturally acidic materials.

The BHP WAIO classification predicts 12.5% of the samples to be AMD2 with the remaining samples classified as AMD0. Whereas the AMIRA testwork suggests that 12.5% of the studied samples are classified as PAF, 50% classified as NAF, and 37.5% classified as UC(NAF).

- Position Relative to the Water Table

Of the 8 samples from within the pit shell all are derived from above the water table.

- Geochemical Abundance Index (GAI)

Two (2) samples of the J6 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 2 samples (GAI = 3).

- Leaching Tests

Leach tests were conducted on 2 samples of J6, of which all were classified as UC(NAF).

The UC(NAF) samples had low ANC values of <1 kg H_2SO_4/t, and low-moderate total S concentrations (0.10-0.12 wt%). The leachate from this samples was slightly-saline (EC of 139 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.05 mg/L), Fe (ave. 0.03 mg/L), Mn (ave. 0.04 mg/L), Zn (ave. 0.09 mg/L). The average dissolved sulphate within the leached UC(NAF) samples was 11.6 mg/L.

- Implication for J6 Waste Mined at Packsaddle

The J6 stratigraphic unit constitutes 3.09% of the LoA waste material at the Packsaddle deposits.

The vast majority of J6 is not expected to generate or release AMD due to the low total sulphur and available ANC (albeit low).

BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

3.1.2.4.14 Joffre Member – J5 (Brockman Iron Formation)

The J5 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Nine (9) samples from the J5 stratigraphic unit were included in the environmental database, with all 3 derived from within the pit shell and 6 from outside the pitshell. Of the 9 samples from within, or adjacent to, the pit shell, 6 are classified as waste, and 3 are classified as low-grade ore. All samples will be discussed.

The total sulphur distribution of the tested samples ranged from below 0.01 to 0.14 wt%, with an average value of 0.06 wt%. The sulphur range in the block model is somewhat larger than that of the environmental dataset with maximum concentration of 0.3%. However, the average sulphur content samples tested is consistent with the overall sulphur distribution of J5 material based on the Packsaddle deposits block model data with 99.5% of the predicted mine waste having sulphur grade <0.1%.

The samples tested have ANC contents that range from below detection limits to 2.2 kg H_2SO_4/t, with an average value of 0.77 kg H_2SO_4/t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the J5 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is slightly saline, with average values of approximately 115 µS/cm. Paste pH values 2 of the samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for 1 of the samples tested was acidic with values less than pH 4.5.

- Mineralogy and Sulphur Speciation

No mineralogy is available for J5. Sulphur speciation data available for few samples suggest that sulphur is associated with sulphate forms.

- AMD Classification

Of the 9 samples of the J5 stratigraphy tested (excluding sample Y380294, as per above) 5 were classified as NAF. These are characterised by low total S concentrations (≤ 0.06 wt%, averaging 0.03 wt%), low ANC values averaging 0.8 kg H_2SO_4/t and near neutral paste pH values generally ≥ 5.8.

Three samples were classified as UC(NAF) and were characterised by low-moderate total S concentrations (≤0.14 wt%, averaging 0.1 wt%), low ANC values averaging less than 1 kg H_2SO_4/t, slightly acidic paste pH values between 5.1 and 5.7, positive NAPP values but NAG pH values >4.5, with sulphur speciation tests suggesting that most or all sulphur associated with sulphate forms, thus supporting a UC(NAF) classification.

One sample was classified as PAF. This are characterised by low total S concentrations (0.09 wt%), ANC values less than 1 kg H_2SO_4/t, slightly acidic paste pH values ≤5.7, all sulphur associated with sulphate forms, and NAG pH values ≤4.4. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. This sample may represent naturally acidic materials.

BHP WAIO classification predicts two samples to be AMD2 with the remaining samples classified as AMD0 in agreement with the results from the ABA tests.

- Position Relative to the Water Table

All the 9 samples from the J5 stratigraphy within, or adjacent to the pit shell are from above the water table.

- Geochemical Abundance Index (GAI)

Four (4) samples of the J5 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 1 sample (GAI = 3) and Se for 1 sample (GAI = 3).

- Leaching Tests

Leach tests were conducted on 3 samples of the J5 stratigraphy, of which 1 was classed as NAF, and 2 as UC(NAF).

The NAF sample had a very low ANC value (< 1 kg H_2SO_4/t) and a very low total S concentrations (0.01 %). The leachate from this sample was slightly-saline (EC of 103 µS/cm) and contained very low dissolved concentration of metals such as Ca (4.16 mg/L), Co (0.002 mg/L), K (3.1 mg/L), Mg (4.68 mg/L), Mn (0.52 mg/L), Na (4.3 mg/L), Ni (0.01 mg/L). The dissolved sulphate within the leached NAF sample was 13.2 mg/L.

The UC(NAF) samples had very low ANC values (< 1 kg H_2SO_4/t) and low total S concentrations (≤0.1 wt%). The leachate from this samples was slightly-saline (ave. EC of 152 µS/cm) and contained low dissolved concentration of metals such as Ca (ave. 3 mg/L), K (ave. 2 mg/L), Mg (ave. 34 mg/L), Mn (ave. 0.02 mg/L), Na (ave. 22 mg/L), and Ni (ave. 0.002 mg/L). The average dissolved sulphate within the leached UC(NAF) samples was 24 mg/L.

- Implication for J5 Waste Mined at Packsaddle

The J5 stratigraphic unit constitutes 0.45% of the LoA waste material at the Packsaddle deposits.

The vast majority of J5 is not expected to be similar to the low sulphur samples tested and as such is unlikely to generate or release AMD. Small acidity potentially released from naturally acidic mine waste is likely to be readily buffered by available ANC (albeit low).

Only a miniscule amount of AMD2 is expected to be mined from J5. BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

3.1.2.4.15 Joffre Member – J4 (Brockman Iron Formation)

The J4 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Twelve (12) samples from the J4 stratigraphic unit were included in the environmental database, with 2 derived from within the pit shell and 10 derived from outside the pit shell. Of 11 samples tested 10 are classified as waste and 1 is classified as low-grade ore. The total sulphur distribution of the tested samples ranged from below detection limits to 0.07 wt%, with an average value of 0.02 wt%. All samples are discussed.

The sulphur range in the block model is somewhat larger than that of the environmental dataset with maximum concentration of approximately 0.3%. However, the average sulphur content samples tested is consistent with the overall sulphur distribution of J4 material based on the Packsaddle deposits block model data with 99.4% of the predicted mine waste having sulphur grade <0.1%.

The samples tested have ANC contents that range from below detection limits to 1.3 kg H_2SO_4 /t, with an average value of 0.65 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the J4 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is weakly saline, with average values of approximately 101 µS/cm. Paste pH values of approximately 36% of the samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for 100% of the samples tested are > pH 4.5.

- Mineralogy and Sulphur Speciation

No mineralogy is available for J4. Sulphur speciation (sulphide / sulphate) testwork available for two samples suggest that all sulphur is associated with sulphate forms.

- AMD Classification

Of the 11 samples of the J4 stratigraphy tested from within, or adjacent to the pit shell, 9 were classified as NAF. These are characterised by low total S concentrations (≤0.03 wt%, averaging 0.01 wt%), very low ANC values averaging 0.6 kg H_2SO_4 /t, near neutral paste pH values >5.0, and a single NAG pH value of 5.4.

Of the 11 samples of the J4 stratigraphy tested from within the pit shell, 2 were classified as UC(NAF). These are characterised by low total S concentrations (≤0.07 wt%, averaging 0.05 wt%), very low ANC values averaging 0.9 kg H_2SO_4 /t, slightly acidic paste pH values between 4.6 and 5.4, marginally positive NAPP values, but NAG pH > 4.5. Sulphur speciation data for these samples suggest that all sulphur is associated with sulphate forms, thus supporting a UC(NAF) classification.

BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA testwork.

- Position Relative to the Water Table

Of the 11 samples of the J4 stratigraphy from within, or adjacent to the pit shell, 7 are from above the water table and 1 from below, the position of the water table for 3 of the samples was unknown.

Samples from above the water table were characterised by total S concentrations up to 0.07 wt% S (averaging 0.03 wt%), ANC values up to 1.3 kg H_2SO_4 /t (averaging 0.67 kg H_2SO_4 /t), slightly acidic to near neutral paste pH values (4.6 – 6.8, 70% greater than pH 5.5), weakly saline paste EC with average values of approximately 127 µS/cm, and slightly acidic to near neutral NAG pH values (4.8 – 5.7). These samples can be classified as a mixture of NAF (71%) and UC(NAF) (29%) or BHP WAIO classification of AMD0 (100%).

The sample from below the water table is characterised by a very low total S concentration of 0.003 wt% S, an ANC value <<1 kg H_2SO_4 /t, a slightly acidic to near neutral paste pH value of 5.4, a very low salinity paste EC of 30 µS/cm. This sample can all be classified as NAF or BHP WAIO classification of AMD0.

- Geochemical Abundance Index (GAI)

Three (3) samples of the J4 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in As for 1 sample (GAI = 3) and Se for 1 sample (GAI = 7).

- Leaching Tests

Leach tests were conducted on 2 samples of the J4 stratigraphic unit, of which 50% were classed as NAF, and 50% as UC(NAF).

The NAF sample had very low ANC values (< 1 kg H_2SO_4/t) and a very low total S concentrations (0.03 %). The leachate from this samples is slightly-saline (EC of 101 µS/cm) and contained very low dissolved concentration of metals such as Ca (2.23 mg/L), K (2.1 mg/L), Mg (3.12 mg/L), Mn (0.03 mg/L) and Na (7.8 mg/L). The dissolved sulphate within the leached NAF sample was 14 mg/L.

The UC(NAF) sample had very low ANC values (< 1 kg H_2SO_4/t) and very low total S concentrations (0.02 %). The leachate from this samples is slightly-saline (EC of 142 µS/cm) and contained very low dissolved concentration of metals such as Ca (2 mg/L), K (5 mg/L), Mg (3 mg/L), Mn (0.045 mg/L) and Na (21 mg/L). The dissolved sulphate within the leached UC(NAF) samples is 26 mg/L.

- Implication for J4 Waste Mined at Packsaddle deposits

The J4 stratigraphic unit constitutes 0.35% of the LoA waste material at Packsaddle deposits. Due to low sulphur grade of this stratigraphy and the testwork results, the bulk of J4 is not expected to generate or release AMD upon leaching.

3.1.2.4.16 Joffre Member – J3 (Brockman Iron Formation)

The J3 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Twenty (20) samples from the J3 stratigraphic unit were included in the environmental database, with 7 samples derived from within the pit shell and 13 derived from outside of pit shell. Of these 7 in-pit samples, 4 are classified as waste, 1 are classified as low-grade ore, and 2 are classified as high-grade ore. Only the in-pit samples will be discussed in the sections below.

The total sulphur distribution of the tested 7 samples ranged from 0.01 to 0.04 %, with an average value of 0.02 %. The sulphur range in the block model is somewhat larger than that of the environmental dataset with maximum concentration of approximately 0.2%. However, the average sulphur content samples tested is consistent with the overall sulphur distribution of J3 material based on the Packsaddle deposits block model data with 98.7% of the predicted mine waste having sulphur grade <0.1%.

The samples tested have ANC contents that range from <1 to approximately 3 kg H_2SO_4 /t, with an average value of 1.3 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the J3 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 106 µS/cm. Paste pH values of 1 of the samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for tested samples were all above pH 4.5. Similar geochemical characteristics, i.e. very low sulphur and ANC, near neutral to alkaline natural pH, and NAG pH>4.5 is also observed in the ex-pit samples.

- Mineralogy and Sulphur Speciation

No mineralogy data was available for the J3 stratigraphic unit. However, limited sulphur speciation data (all samples) suggest that all sulphur in the samples tested (3) was associated with sulphate forms.

The weakly acidic to near neutral paste pH but near neutral NAG pH values suggest that the majority of the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the seven (7) samples of the J3 stratigraphy tested from within the pit shell, 6 (85%) were classified as NAF. These are characterised by low total S concentrations (≤0.04 wt%), low ANC values averaging 1.45 kg H_2SO_4 /t, slightly acidic to near neutral paste pH values of 5.0-7.2, and NAG pH >4.5.

Of the seven samples of the J3 stratigraphy tested from within the pit shell, 1 was classified as UC(NAF). This sample is characterised by a low total S concentration of 0.03 wt%, a low ANC value of <1 kg H2SO4 /t, a slightly acidic paste pH value of 5.5, a slightly positive NAPP but a NAG pH >4.5. Sulphur speciation data for this samples suggests that all sulphur is associated with sulphate forms, thus supporting a UC(NAF) classification.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA classification.

- Position Relative to the Water Table

Of the 7 samples from within the pit shell four are from above the water table, and the position of the water table for 3 of the samples was unknown.

- Geochemical Abundance Index (GAI)

No major and trace element bulk chemistry data were available for in-pit J3 samples.

- Leaching Tests

No leach tests data were available for in-pit J3 samples.

- Implication for J3 Waste Mined at Packsaddle

The J3 stratigraphic unit constitutes 0.60% of the LoA waste material at the Packsaddle deposits. Due to low sulphur grade of this stratigraphy and the testwork results, the bulk of J3 is not expected to generate or release AMD upon leaching.

3.1.2.4.17 Joffre Member – J3J5 (Brockman Iron Formation)

The J3J5 stratigraphy is only sourced from the Packsaddle deposits.

The J3J5 stratigraphy overlaps the J3 to J5 units, and it is not differentiated in the logging; thus, the geochemistry of the J3J5 unit is consistent with that of the individual J5, J4 and J3 units.

The J3J5 stratigraphic unit constitutes 0.71% of the LoA waste material at the Packsaddle deposits. Virtually all of this material (i.e. 99.67%) has sulphur grades <0.1%. Based on the geochemistry of the individual J3, J4 and J5 units it is not expected that J3J5 materials will generate or release AMD upon leaching.

3.1.2.4.18 Joffre Member – J2 (Brockman Iron Formation)

The J2 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Forty-one (41) samples from the J2 stratigraphic unit were included in the environmental database, with 11 derived from within the pit shell and 30 derived from outside the pit shell. Of the 11 samples from within the pit shell, 5 are classified as waste, and 5 are classified as low-grade ore, and one is classified as high-grade ore. Only the in-pit samples described in the sections below.

The total sulphur distribution of the in-pit samples ranged from 0.01 to 0.09 %, with an average value of 0.04 %. The sulphur range in the block model is somewhat larger than that of the environmental dataset with maximum concentration of approximately 0.2%. However, the average sulphur content samples tested is consistent with the overall sulphur distribution of J2 material based on the Packsaddle deposits block model data with 97.9% of the predicted mine waste having sulphur grade <0.1%.

The samples tested have ANC contents that range from below detection limits to 5.2 kg H_2SO_4 /t, with an average value of 1.38 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the J2 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the in-pit samples the paste EC has low salinity, with average values of approximately 100 µS/cm. Paste pH values of 4 samples are slightly acidic with pH values less than 5.5. The NAG pH values for all samples are > 4.5. NAG testwork indicates minimal capacity to release acidity from these samples with NAG7 acidity generally less than 0.6 kg H_2SO_4 /t.

- Mineralogy and Sulphur Speciation

For the J2 stratigraphic unit the key minerals identified by XRD in the 2 samples tested are goethite, quartz, hematite, and an amorphous phase(s). Sulphur speciation testwork conducted on 8 samples suggest that all the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 11 samples of the J2 stratigraphy tested from within the pit shell, 6 (55%) were classified as NAF. These are characterised by low total S concentrations (≤0.09 wt%; averaging 0.03 wt%), moderate ANC values averaging 2.15 kg H_2SO_4 /t, slightly acidic to near neutral paste pH values 4.7-6.4 (averaging pH 5.78), and NAG pH values >4.5. No mineralogy data was available for these NAF samples, while sulphur speciation data available for 3 samples indicated that sulphur is associated with sulphates.

The reminder 5 samples were classified as UC(NAF). These are characterised by low total S concentrations (≤0.08 wt%; averaging 0.05 wt%) low ANC values averaging 0.46 kg H_2SO_4 /t, slightly acidic paste pH values between 4.7 and 6.1, slightly positive NAPP values, but NAG pH >4.5. The mineralogy of these (UC)NAF samples is dominated goethite, quartz, hematite, and an amorphous phase. Sulphur speciation data for these samples suggest that all sulphur is associated with sulphate forms, thus supporting a UC(NAF) classification.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA predictions.

- Position Relative to the Water Table

Of the 11 samples from within the pit shell, 8 are from above the water table and the position of the water table for 3 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Eight (8) samples of the J2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 3 samples (GAI = 3).

- Leaching Tests

Leach tests were conducted on 7 samples of J2, of which 3 samples were classed as NAF, and 4 samples as (UC)NAF.

The NAF samples had low ANC values (≤ 2 kg H_2SO_4 /t) and low total S concentrations (≤0.05 %) likely associated with sulphate sulphur. The leachate from these samples had low salinity (EC of 59-168 µS/cm) and contained very low dissolved concentration of metals such as Fe (ave. 0.03 mg/L). The average dissolved sulphate within the leached NAF sample was 15.3 mg/L.

The (UC)NAF samples had low ANC values (≤ 1.3 kg H_2SO_4 /t) and low-moderate total S concentrations (≤0.08 %) likely associated with sulphate sulphur. The leachate from this samples had low salinity (EC of 29-160 µS/cm) and contained low dissolved concentration of metals such as Al (ave. 0.06 mg/L), Fe (ave. 0.49 mg/L), Mn (ave. 0.15 mg/L). The average dissolved sulphate within the leached PAF samples was 18.3 mg/L.

- Implication for J2 Waste Mined at Packsaddle deposits

The J2 stratigraphic unit constitutes 3.38% of the LoA waste material at Packsaddle. Of the samples tested (within the pit shell) all are classed NAF/UC(NAF)

The low total sulphur concentrations, NAF classification, and near neutral NAG leachate suggests that the J2 stratigraphy is unlikely to generate or release significant AMD/NMD upon leaching.

3.1.2.4.19 Joffre Member – J1 (Brockman Iron Formation)

The J1 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Twenty-three (23) samples from the J2 stratigraphic unit were included in the environmental database, with 4 derived from within the pit shell and 19 derived from outside the pit shell. All samples will be described in these sections.

Of the 23 samples, 16 are classified as waste and 7 are classified as low-grade ore. The total sulphur distribution of the tested samples ranged from below detection limits to 0.16 %, with an average value of 0.02 %. The sulphur range in the block model is somewhat larger than that of the environmental dataset with maximum concentration of approximately 0.8%. However, the average sulphur content samples tested is consistent with the overall sulphur distribution of J1 material based on the Packsaddle deposits block model data with 98.9% of the predicted mine waste having sulphur grade <0.2%.

The samples tested have very low ANC contents that range from below detection limits to 3.3 kg H_2SO_4 /t, with an average value of 1.31 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the J2 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is weakly saline, with average values of approximately 73 µS/cm. Paste pH values of approximately 65% of the samples tested are slightly acidic with values less than 5.5. The NAG pH values all samples tested are ≥ pH 4.5.

- Mineralogy and Sulphur Speciation

No mineralogy was available for the J1 stratigraphic unit.

- AMD Classification

Of the 23 samples of the J1 stratigraphy tested, 22 were classified as NAF. These are characterised by very low total S concentrations (<0.05 wt%), low ANC values averaging 1.3 kg H_2SO_4 /t, weakly acidic to near neutral paste pH values between 4.5 and 7.3, and NAG pH values >5.0.

Of the 23 samples of the J1 stratigraphy, only 1 was classified as PAF. This is characterised by low total S concentrations 0.16 wt%, ANC value of 1 kg H_2SO_4 /t, weakly acidic paste pH value of 4.5, and a NAG pH values of 4.5. This sample is correctly classed as AMD2 by the BHP WAIO classification system.

- Position Relative to the Water Table

Of the 23 samples, 8 are from above the water table and 4 from below, the position of the water table for 11 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Four (4) samples of the J1 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe in only 1 sample (GAI = 3).

- Leaching Tests

Leach tests were conducted on 4 samples of J1, of which 22 were classed as NAF, and 1 as PAF.

The NAF samples had low ANC values (≤1.8 kg H_2SO_4/t) and low total S concentrations (≤0.02 wt%). The leachate from these samples displayed low salinity (EC of 50 µS/cm), had an average pH of 5.69 and contained very low dissolved concentration of metals. The average dissolved sulphate within the leached NAF samples was very low at 5.2 mg/L.

The PAF sample had a very low ANC value (1 kg H_2SO_4/t) and a low total S concentration (0.16 wt%). The leachate from this sample was weakly-saline (EC of 276 µS/cm), displayed a leach pH of 4.5 and contained low dissolved concentration of metals such as Fe (4.1 mg/L) and Mn (0.27 mg/L) and mobilised trace concentrations metals including Co (0.002 mg/L), Se (0.001 mg/L). The dissolved sulphate within the leached PAF sample was 57 mg/L.

- Implication for J1 Waste Mined at Packsaddle

The J1 stratigraphic unit constitutes 2.07% of the LoA waste material at Packsaddle.

The environmental geochemical data available suggest that sulphur is present in J1 at low levels. Static geochemistry including leach tests suggests J1 is not expected to generate or release significant AMD, NMD or SD upon leaching, with the vast majority of the waste likely to be relatively inert.

3.1.2.4.20 Whaleback Shale, Undifferentiated – W (Brockman Iron Formation)

The W stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Forty-eight (48) samples from the W stratigraphic unit were included in the environmental database, with 20 derived from within the pit shell and 28 derived from outside the pit shell. Of the 20 samples from within the pit shell, all are classified as waste. Only the in-pit samples described in the sections below.

The total sulphur distribution of the tested samples from within the pit shell ranged from below detection limits to 0.9 %, with an average value of 0.09 %. The sulphur range in the block model is somewhat narrower compared to that of the environmental dataset with maximum sulphur concentration in the block model of approximately 0.5%. Overall the sulphur distribution of W material based on the Packsaddle deposits block model predicts that 97.6% of the mine waste has sulphur grade <0.1%.

The samples tested have ANC contents that range from 0.5 to 6.6 kg H_2SO_4 /t, with an average value of 2.31 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the W stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 341 µS/cm. Paste pH values of 12 samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for 5 samples tested are slightly acidic with values less than pH 4.5. NAG testwork indicates minimal-moderate capacity to release acidity from these samples with NAG7 acidity generally less than 1.15 kg H_2SO_4 /t.

- Mineralogy and Sulphur Speciation

No mineralogy data was available for samples of the W stratigraphic unit from within the pit shell. Sulphur speciation data (sulphide / sulphate) available for 6 sample indicate that all sulphur is in sulphate form.

- AMD Classification

Of the 20 samples of the W stratigraphy tested from within the pit shell, 13 were classified as NAF. These are characterised by low total S concentrations (<0.07 wt%), ANC values averaging 2.80 kg H_2SO_4 /t, paste pH values generally 5.1 – 7.2 (averaging pH 6.0), and NAG pH values >4.5.

Four samples (4) were classified as UC(NAF). These are characterised by very low to low total S concentrations ranging from 0.05 to 0.12%, very low ANC values averaging 1.0 kg H_2SO_4 /t, slightly acidic paste pH values between 4.8 and 5.3, marginally positive NAPP, but NAG pH values >4.5. Sulphur speciation data for these samples suggest that all sulphur is associated with sulphate forms, thus supporting a UC(NAF) classification

Three (3) samples were classified as PAF. These are characterised by very low to low total S concentrations ranging from 0.09 to 0.9 %, low ANC values of <1.2 kg H_2SO_4 /t, acidic paste pH values <5.5, and NAG pH values <4.5. Sulphur speciation testwork available for all three samples suggest that all sulphur is bound to sulphate forms and not sulphides. Thus, while the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests rather than sulphide oxidation is likely responsible for the NAG pH <4.5. These samples may represent naturally acidic materials.

The BHP WAIO classification predicts 4 samples to be AMD2 and 1 to be AMD1, with the remaining samples classified as AMD0. In contrast, the AMIRA testwork only classifies 3 samples as PAF, and the reminder as NAF/UC(NAF). The 3 samples classed as PAF based on the AMIRA method, are also classed as AMD2 by the BHP classification. On the other hand, one sample sourced from below the water table was classed as AMD1, but laboratory testwork identified this sample as NAF, albeit with natural acidity. Thus the BHP AMD classification is conservative.

- Position Relative to the Water Table

Of the 20 W samples from within the pit shell, 16 (80%) are derived from above the water table, and the position relative to the water table of the remaining four samples is unknown.

- Geochemical Abundance Index (GAI)

One sample of the W stratigraphic unit was analysed for major and trace element bulk chemistry. The GAI values for this sample show no significant enrichment.

- Leaching Tests

Leach tests were conducted on sample P6/2-PAF was classed PAF (AMD2). The sulphur content of this sample is higher than that of expected in the Packsaddle deposits based on the block models, and thus does not represent typical material to be mined from MAC.
This PAF sample had nil ANC value (<1 kg H_2SO_4/t) but elevated total S concentrations (0.9%). The leachate from this sample was moderately-saline (EC of 638 µS/cm) and contained low dissolved concentration of metals such as Al (0.63 mg/L), Co (0.003 mg/L), Se (0.002 mg/L) and moderate concentrations of Ca (0.47 mg/L), Mg (19.05 mg/L), Na (110.4 mg/L) and Cl (193 mg/L), and low sulphate of 44 mg/L. Overall, materials similar to the sample tested are not expected to mobilise meaningful metals and/or salinity loads.

- Implication for W Waste Mined at Packsaddle

The W stratigraphic unit constitutes 4.49% of the LoA waste material at Packsaddle.

The environmental geochemical data available suggest that sulphur is generally associated with sulphates, and that due to the low total sulphur content of the majority of the mine waste, the potential for AMD generation and release from this stratigraphy is nil to low. W is expected to generate or release low levels of acidity only in those samples that are naturally acidic and with elevated sulphur. However, there may be sufficient ANC in the remaining waste to neutralise in-situ such relatively low acidity loads.

NMD may be released in higher sulphur samples with elevated ANC. However, the proportion of such materials in the overall waste is negligible, thus limiting the risk for NMD.

Note that BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

3.1.2.4.21 Dales Gorge Member – D4 (Brockman Iron Formation)

The D4 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Seventeen (17) samples from the D4 stratigraphic unit were included in the environmental database, with 3 sourced from within the pit-shell and 14 outside the pit shell. Of the 17 samples from within, or adjacent to the pit shell, 12 are classified as waste, 4 are classified as low-grade ore, and 1 is classified as high-grade ore. All samples will be described in these sections.

The total sulphur distribution of the tested samples ranged from below detection limits to 0.36%, with an average value of 0.03%; all samples but one had total sulphur concentration <0.05%, and for most sulphur was below detection limit of 0.01S% . The sulphur range in the block model is somewhat larger compared to that of the environmental dataset with maximum concentration in the block model of approximately 0.6%. Overall the sulphur distribution of D4 material based on the Packsaddle deposits block model predicts that 99.2% of the mine waste has sulphur grade <0.1%, and as such is in line with the statistical distribution of the sample set.

The samples tested have ANC contents that range from below detection limits to 2.6 kg H_2SO_4/t, with an average value of 1.29 kg H_2SO_4/t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the D4 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is very slightly saline, with average values of approximately 60 µS/cm. Paste pH values of 2 samples tested are slightly acidic with pH values less than 5.5. The NAG pH values for 2 samples, P4/23-PAF and P4/24-PAF, are acidic with values less than pH 4.5 (samples). However these samples have negligible sulphur with values below detection limit.

- Mineralogy and Sulphur Speciation

No mineralogy is available for D4. Sulphur speciation (sulphide / sulphate) testwork conducted on 4 samples, including the only one with moderate sulphur (0.34 %S, K603513) suggest that all sulphur is associated with sulphate forms.

- AMD Classification

Of the 17 samples of the D4 stratigraphy tested 14 were classified as NAF. These are characterised by very low total S concentrations (below detection to 0.05 wt%), low ANC values averaging 1.5 kg H_2SO_4 /t, slightly acidic to near neutral paste pH values generally ≥5.3, and NAG pH values ≥4.5.

One (1) sample is classified as UC(NAF). This is characterised by low total S concentrations (0.36 wt%), a low ANC value <1 kg H_2SO_4 /t, slightly acidic paste pH of <4.5, positive NAPP value, but NAG pH value >4.5. Sulphur speciation testwork showed that all sulphur is associated with sulphate and thus suggest that the NAPP value is overestimated as no pyrite is detected in this sample. This justifies the classification of this sample as UC(NAF).

An additional two (2) samples (P4/23-PAF and P4/24-PAF) are classified as UC(PAF). These are characterised by total S concentrations below detection, nil ANC values <1 kg H_2SO_4 /t, slightly acidic paste pH values between 5.5 and 5.7, negative NAPP values, but NAG pH values between 3.5 and 3.7. While the acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. This sample may represent naturally acidic, barren materials. These samples should be considered as UC(NAF)

BHP WAIO classification predicts 1 the samples to be AMD2; this sample was classed as NAF based on the results of the geochemical testwork. Samples P4/23-PAF and P4/24-PAF are classed as UC(PAF) by the AMIRA testwork on the account of the NAG pH testwork results, however, as explained above it is belived that the classification for these samples should be more correctly UC(NAF). The BHP WAIO classification predicts these two samples to be AMD0 on the account of the nil sulphur concentration. The classification of all other samples is consistent between the WAIO and the AMIRA systems.

- Position Relative to the Water Table

Of the 17 samples of the D4 stratigraphy from within, or adjacent to the pit shell, 5 are from above the water table and 9 from below, the position of the water table for 3 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Three (3) samples of the D4 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show no significant enrichment in the elements analysed.

- Leaching Tests

Leach tests were conducted on 3 samples of the D4 stratigraphy, of which 2 were classed as NAF, and 1 as UC(PAF).

The NAF samples had low to very low ANC values (< 2 kg H_2SO_4/t) and total S concentrations below detection. The leachate from this samples was slightly-saline (ave. EC of 29 µS/cm) and contained very low dissolved concentration of metals such as Ca (ave. 3.3 mg/L), Fe (ave. 0.25 mg/L), K (ave. 1.6 mg/L), Mg (ave. 2.1 mg/L), Mn (ave. 0.1 mg/L), Na (ave. 2.9 mg/L) and Zn (ave. 0.03 mg/L). The average dissolved sulphate within the leached NAF samples was 3.6 mg/L. Materials similar to those tested are likely to be barren and not mobilise meaningful metals and/or salinity loads.

The UC(PAF) sample had a very low ANC value (< 1 kg H_2SO_4/t) and a total S concentration below detection. The leachate from this samples was very slightly-saline (EC of 14 µS/cm) and contained low dissolved concentration of metals such as Ca (1.9 mg/L), Co (0.015 mg/L), Fe (3.3 mg/L), K (0.6 mg/L), Mg (1.6 mg/L), Mn (0.7 mg/L), Na (0.9 mg/L), Ni (0.01 mg/L) and Zn (0.01 mg/L). The dissolved sulphate was 1.5 mg/L. Materials similar to those tested are likely to be barren and not mobilise meaningful metals and/or salinity loads.

- Implication for D4 Waste Mined at Packsaddle

The D4 stratigraphic unit constitutes 3.79% of the LoA waste material at Packsaddle.

Testwork result show that materials similar to the samples tested have limited to nil to low potential for metal mobilisation, and should be considered barren. Occasionally some samples, which are naturally acidic (due to alunite/gibbsite) may release limited acidity loads if in contact with water. However, it is expected that bulk of the waste will have sufficient ANC to manage is situ such small quantity of acidity.

NMD may be released in higher sulphur samples with elevated ANC. However, the proportion of such materials in the overall waste is negligible, thus limiting the risk for NMD.

3.1.2.4.22 Dales Gorge Member (Middle Shale) – D3 (Brockman Iron Formation)

The D3 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Thirty-two (32) samples from the D3 stratigraphic unit were included in the environmental database, with 17 derived from within the pit shell and 15 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 17 samples from within the pit shell, 6 are classified as waste, 6 are classified as low-grade ore, and 5 are classified as high-grade ore. The total sulphur distribution of the in-pit samples ranged from below detection limits to 0.07 wt%, with an average value of 0.02 wt%. The sulphur range in the block model is somewhat larger compared to that of the environmental dataset with maximum concentration in the block model of approximately 0.3%. Overall the sulphur distribution of D3 material based on the Packsaddle deposits block model predicts that 99.5% of the mine waste has sulphur grade <0.1%, and as such is in line with the statistical distribution of the sample set.

The samples tested have ANC contents that range from 1.0 to 8.2 kg H_2SO_4 /t, with an average value of 2.91 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the D3 stratigraphy being characterised by very low to low ANC.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is low salinity, with average values of approximately 129 µS/cm. Paste pH values of 5 samples are slightly acidic with pH values less than 5.5. None of the samples returned NAG pH values less than pH 4.5 (averaging 5.92). NAG testwork indicates minimal capacity to release acidity from these samples with NAG7 acidity generally less than <1 kg H_2SO_4 /t.

- Mineralogy and Sulphur Speciation

For the D3 stratigraphic unit no mineralogical or sulphur speciation data is available. Based on mineralogy and sulphur speciation from other D* stratigraphic units it is expected that weakly acidic paste pH observed in some samples is due to gibbsite and/or alunite present in naturally acidic waste.

- AMD Classification

Of the 17 samples of the D3 stratigraphy tested from within the pit shell, 16 were classified as NAF. These are characterised by low total S concentrations (<0.07 wt%), low ANC values averaging 3.07 kg H_2SO_4 /t, near neutral to slightly acidic paste pH values averaging 6.10, and NAG pH values >4.5.

Of the 17 samples of the D3 stratigraphy tested from within the pit shell, 1 was classified as UC(NAF). This sample is characterised by low total S concentrations (0.07 wt%), low-moderate ANC values of 1.0 kg H_2SO_4 /t, slightly positive NAPP value, a near neutral paste pH of 6.9, but a NAG pH value >4.5. All other samples are classed as NAF.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in accordance with the AMIRA classification identifying the samples as NAF/UC(NAF).

- Position Relative to the Water Table

Of the 17 samples from within the pit shell 4 are from above the water table and 8 from below, the position of the water table for 5 of the samples was unknown.

- Geochemical Abundance Index (GAI)

No samples of the D3 stratigraphic unit were analysed for major and trace element bulk chemistry.

- Leaching Tests

No leach tests were conducted on samples of the D3 stratigraphic unit.

- Implication for D3 Waste Mined at MAC/SF

The D3 stratigraphic unit constitutes 3.94% of the LoA waste material at Packsaddle.

Testwork result show that materials similar to the samples tested are all classed as NAF/AMD0; the D3 unit is overwhelmingly very low/low sulphur and as such is not expected to generate or release AMD or NMD upon leaching.

3.1.2.4.23 Dales Gorge Member – D2 (Brockman Iron Formation)

The D2 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Twenty-three (23) samples from the D2 stratigraphic unit were included in the environmental database, with 10 derived from within the pit shell and 13 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 10 samples from within the pit shell, 2 are classified as waste, 5 are classified as low-grade ore, and 2 are classified as high-grade ore. The total sulphur distribution of the tested samples ranged from below detection limits to 0.15 wt%, with an average value of 0.03 wt%. The sulphur range of the sample set is consistent with the sulphur distribution of D2 material based on the Packsaddle deposits block model with virtually all mine waste having total sulphur <0.2%.

The samples tested have ANC contents that range from 0.4 to 32.6 kg H_2SO_4 /t, with an average value of 5.6 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the D2 stratigraphy being generally characterised by low ANC, and occasionally by moderate to high ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC has salinity, with average values of approximately 173 µS/cm. Paste pH values of 1 sample was slightly acidic with pH values less than 5.5. The NAG pH values of all samples are near neutral and greater than 4.5 (averaging 6.88).

Mineralogy and Sulphur Speciation

For the D2 stratigraphic unit no mineralogy data was available. Sulphur speciation data available for two samples suggest that all sulphur is associated with sulphate forms.

- AMD Classification

Of the 10 samples of the D2 stratigraphy tested from within the pit shell, 9 were classified as NAF. These are characterised by low total S concentrations (up to 0.15 wt%, averaging 0.03 wt%), moderate ANC values averaging 6.18 kg H_2SO_4 /t, near neutral paste pH values >5.5 (averaging pH 6.73), and NAG pH values >4.5.

One (1) sample was classified as UC(NAF). This sample is characterised by a low total S concentration (0.05 wt%), a low ANC value of 1 kg H_2SO_4 /t, slightly positive NAPP value (0.7 kg H_2SO_4/t) slightly acidic paste pH values of 4.4, but NAG pH values of 5.9. Sulphur speciation data for these samples suggest that all sulphur is associated with sulphate forms, thus supporting a UC(NAF) classification.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA classification predicting all samples to be NAF/UC(NAF).

- Position Relative to the Water Table

Of the 10 samples from within the pit shell 7 are from above the water table and 1 from below, the position of the water table for 2 of the samples was unknown.

- Geochemical Abundance Index (GAI)

One (1) sample of the D2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for this sample show significant enrichment in Fe (GAI = 3).

- Leaching Tests

Leach tests were conducted on 1 sample of D2, which was classed as NAF.

This NAF sample had a high ANC value (32.6 kg H_2SO_4 /t) and moderate total S concentrations of 0.15 wt%. The leachate from this samples was moderately-saline (EC of 400 µS/cm) and contained very low dissolved concentration of trace metals, with most below detection limit but for Mo (0.01 mg/L) and Se (0.002 mg/L). The dissolved sulphate within the leached NAF sample was 171 mg/L.

- Implication for D2 Waste Mined at Packsaddle

The D2 stratigraphic unit constitutes 3.95% of the LoA waste material at Packsaddle.

Testwork result show that materials similar to the samples tested are all classed as NAF/AMD0; the D2 unit is overwhelmingly very low/low sulphur and as such is not expected to generate or release AMD or NMD upon leaching.

3.1.2.4.24 Colonial Chert Member – D1 (Brockman Iron Formation)

The D1 stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Fifty-seven (57) samples from the D1 stratigraphic unit were included in the environmental database, with 11 derived from within the pit shell and 46 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 11 samples from within the pit shell, 2 are classified as waste, 7 are classified as low-grade ore, and 2 are classified as high-grade ore. The total sulphur distribution of the tested samples from within the pit shell ranged from 0.01 to 0.19 wt%, with an average value of 0.06 wt%. The average sulphur content of the D1 sample set is consistent with the overall sulphur distribution of D1 material based on the Packsaddle deposits block model with virtually all mine waste having total sulphur <0.1%.

The samples tested have ANC contents that range from 0.2 to 4.4 kg H_2SO_4 /t, with an average value of 1.38 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the D1 stratigraphy being generally characterised by low ANC, and occasionally by moderate to high ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC has low salinity, with average values of approximately 140 µS/cm. Paste pH values of 3 samples are slightly acidic with pH values less than 5.5, with these samples being characterised by total S > 0.13%. The NAG pH values for all samples tested are >4.5. NAG testwork indicates minimal capacity to release acidity from these samples with NAG7 acidity generally less than 0.55 kg H_2SO_4 /t.

- Mineralogy and Sulphur Speciation

No mineralogy data was available for the samples of the D1 stratigraphy. Based on mineralogy and sulphur speciation from other D* stratigraphic units it is expected that weakly acidic paste pH observed in some samples is due to gibbsite and/or alunite present in naturally acidic waste, and thus associated with sulphates and not sulphides.

- AMD Classification

Of the 11 samples of the D1 stratigraphy tested from within the pit shell, 8 were classified as NAF. These are characterised by low total S concentrations (≤0.07 wt%), ANC values averaging 1.75 kg H_2SO_4 /t, near neutral paste pH values ≥5.5, and NAG pH values ≥4.5. No mineralogy data was available for these NAF samples.

Three (3) samples were classified as UC(PAF). These are characterised by moderate total S concentrations (0.13-0.19 wt%), low ANC values averaging 0.40 kg H_2SO_4 /t, slightly acidic paste pH values between 4.8 and 5.1. No mineralogy or NAG data was available for these UC(PAF) samples. All samples had a positive NAPP value and an ANC/MPA ratio <1. Due to the lack of sulphur speciation data they were conservatively classes as UC(PAF).

The BHP WAIO classification correctly classifies two of the UC(PAF) samples to be AMD1/AMD2 (lack of reference to the water table prevents the differentiation between AMD1/AMD2 waste), with the remaining samples classified as AMD0. This discrepancy is due to the slight difference in total sulphur measured from the primary assay compared to the total sulphur measure via LECO.

All other samples are correctly identified as AMD0 (NAF).

- Position Relative to the Water Table

Of the 11 samples from within the pit shell 5 are from above the water table and 1 from below, the position of the water table for 5 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Three (3) samples of the D1 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in As for all samples (GAI = 3) and Fe for 1 sample (GAI = 3).

- Leaching Tests

Leach tests were conducted on 3 samples of D1, of which all samples were classed as NAF (AMD0).

The NAF samples had moderate ANC values (averaging 1.57 kg H_2SO_4 /t) and very low total S concentrations (0.01 wt%). The leachate from these samples had low-moderate salinity (EC between 128 and 449 µS/cm; averaging 239 µS/cm) and contained low dissolved concentration of metals such as Mn (ave. 0.07 mg/L), Fe (ave. 0.24 mg/L), and Zn (ave. 0.03 mg/L). The average dissolved sulphate within the leached PAF sample was 33 mg/L.

Implication for D1 Waste Mined at Packsaddle

The D1 stratigraphic unit constitutes 1.66% of the LoA waste material at Packsaddle.

All D1 samples are derived from the Packsaddle deposit.

Testwork result show that materials similar to the samples tested have limited potential for metal mobilisation, and should be considered largely inert. Occasionally some samples, which are naturally acidic (due to alunite/gibbsite) may release limited acidity loads if in contact with water. However, it is expected that bulk of the waste will have sufficient ANC to manage is situ such small quantity of acidity.

NMD is not expected to be released due to the low sulphur concentration of D1 materials.

3.1.2.4.25 Mt McRae Shale (Upper) – RU

The RU stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Fifty-nine (59) samples from the RU stratigraphic unit were included in the environmental database, with 7 being derived from within the pit shell. The sulphur distribution of the RU stratigraphy across all samples ranges from 0.001% to 1.2%, with all samples but two having total sulphur < 0.3%S. Only the in-pit samples will be discussed in the sections below.

The 7 in-pit samples all are classified as waste. The total sulphur distribution of the tested samples ranged from 0.01 to 0.08 wt%, with an average value of 0.02 wt%. The average sulphur content of the RU sample set is consistent with the overall sulphur distribution of RU material based on the Packsaddle deposits block model with virtually all mine waste having total sulphur <0.1%.

The samples tested have ANC contents that range from 1.3 to 5.0 kg H_2SO_4 /t, with an average value of 3.30 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the RU stratigraphy being generally characterised by low ANC, and occasionally by moderate to high ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is slightly-saline, with average values of approximately 171 µS/cm. Paste pH values of all in-pit samples are near neutral to slightly alkaline (6.2-8.0, averaging 6.86). The NAG pH values for all samples are near neutral, with all samples having NAG pH values greater than 4.5. NAG testwork indicates a minimal capacity to release acidity from these samples with NAG7 acidity generally less than 1.0 kg H_2SO_4 /t.

- Mineralogy and Sulphur Speciation

No mineralogy data was available for the RU samples. The low sulphur concentrations combined with weakly acidic to near neutral paste pH and NAG pH values suggest that acid generating minerals are absent or occur in low concentrations and/or there is sufficient ANC to buffer any acidity released, if any.

- AMD Classification

Of the 7 samples of the RU stratigraphy tested from within the pit shell, 6 were classified as NAF. These are characterised by low total S concentrations (0.01 wt%), moderate ANC values averaging 3.63 kg H_2SO_4 /t, near neutral to slightly alkaline paste pH values ≥6.2, and NAG pH values >6.2.

Of the 7 samples of the RU stratigraphy tested from within the pit shell, 1 was classified as UC(NAF). This sample was characterised by a low total S concentration of 0.08 wt%, a moderate ANC value of 1.3 kg H_2SO_4 /t, a near neutral paste pH value of 6.3, a NAPP value marginally positive, but a NAG pH value of 6.3, justifying a UC(NAF) classification.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA system.

- Position Relative to the Water Table

Of the seven samples from within the pit shell 5 are from above the water table and the position of the water table for 2 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Six (6) samples of the RU stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in As for 3 samples (GAI = 3 and 4) and Sb for 1 sample (GAI = 3).

- Leaching Tests

Leach tests were conducted on six samples of RU, of which 5 were classed as NAF and 1 as UC(NAF).

The NAF samples had moderate ANC values (averaging 3.9 kg H_2SO_4/t) and low total S concentrations (0.01 wt%). The leachate from these samples was slightly-saline (average EC of 267 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.1 mg/L), Mn (ave. 0.9 mg/L), Zn (ave. 0.08 mg/L). The average dissolved sulphate within the leached NAF samples was 28.8 mg/L. The samples also released alkalinity with an average value of 27 mg $CaCO_3$/L suggesting that small amounts of ANC can liberate alkalinity in contact water. Lastly, no arsenic or selenium (although enriched in the samples) were above detection limit in the leachate.

The UC(NAF) sample was characterised by a moderate ANC value of 1.3 kg H_2SO_4/t and a low total S concentration of 0.08 wt%. The leachate from this sample was slightly-saline (average EC of 60 µS/cm) and contained very low dissolved concentration of metals, such Mn (0.01 mg/L) and Ni (0.01 mg/L). The dissolved sulphate within the leached NAF samples was 4 mg/L.

- Implication for RU Waste Mined at Packsaddle

The RU stratigraphic unit constitutes 0.17% of the LoA waste material at Packsaddle with 99.99% expected to have very low sulphur concentrations. Material similar to the samples tested is not expected to generate or release AMD or NMD upon leaching. This stratigraphy is likely to be inert.

3.1.2.4.26 Mt McRae Shale (Nodule Zone) – RN

The RN stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Twenty-eight (28) samples from the RN stratigraphic unit were included in the environmental database, with 20 derived from adjacent to the pit shells and suitable for describing the RN stratigraphy. Only the samples near the pit shell will be discussed in the sections below.

All of these 20 samples are classified as waste. The total sulphur distribution of the tested samples ranged from 0.01 to 0.14%, with an average value of 0.03%. The average sulphur content of the RN sample set is consistent with that of the Packsaddle block model data as 100% of the RN blocks have total sulphur <0.1 wt%.

The samples tested have ANC contents that range from 0.5 to 198 kg H_2SO_4/t, with an average value of 16.4 kg H_2SO_4/t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the RU stratigraphy being generally characterised by low ANC, and occasionally by moderate to high ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 206 µS/cm. Paste pH values of 2 samples are slightly acidic with pH values less than 5.5. The NAG pH values for all samples are non-acidic, with values greater than pH 4.5.

Mineralogy and Sulphur Speciation

No mineralogy is available for the RN samples. Sulphur speciation data was available for six samples shows that the sulphur budget of all samples is dominated by sulphate minerals

AMD Classification

Of the 20 samples of the RN stratigraphy tested from adjacent to the pit shells, 17 were classified as NAF. These are characterised by generally low total S concentrations (averaging 0.03%), variable ANC values 0.5 to 198 kg H_2SO_4/t, near neutral paste pH values generally >5.5 (single value at pH 4.9), and NAG pH values >5.2.

Three (3) samples were classified as UC(NAF). These are characterised by low total S concentrations (averaging 0.04%), low ANC values averaging 0.67 kg H_2SO_4/t, paste pH values >5.5, slightly positive NAPP values, but NAG pH values >4.5. Sulphur speciation data for these samples confirm that all sulphur is associated with sulphide, thus justifying, in addition to a NAG pH > 4.5, a UC(NAF) classification for these samples.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA classification.

Position Relative to the Water Table

Of the 20 samples from adjacent to the pit shells, 2 are from above the water table and 6 from below, the position of the water table for 12 of the samples was unknown.

Geochemical Abundance Index (GAI)

Six (6) samples of the RN stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in As (GAI = 3) for 2 samples; (GAI = 4) for 3 samples; and (GAI = 6) for 1 sample, Cd for 1 sample (GAI = 3), Co for 1 sample (GAI = 3), Mn for 1 sample (GAI = 3); and (GAI = 5) for 1 sample; Mo for 2 samples (GAI = 3), and Sb for 2 samples (GAI = 3).

- Leaching Tests

Leach tests were conducted on 3 samples of RN, of which 2 were classed as NAF, and 1 as UC(NAF) based on the AMRIA method.

The samples had moderate ANC values (averaging approximately 3 kg H_2SO_4/t) and low total S concentrations of 0.02 wt%. The leachate from these samples was slightly-saline (EC of 198 µS/cm) and contained very low dissolved concentration of metals, such as As (ave. 0.002 mg/L), Se (ave. 0.02 mg/L), Co (ave. 0.03 mg/L), Mn (ave. 2.9 mg/L), Ni (ave. 0.02 mg/L), and Zn (ave. 0.07 mg/L). The average dissolved sulphate within the leached NAF samples was 19.7 mg/L. The samples also released alkalinity with an average value of 42 mg $CaCO_3$/L suggesting that small amounts of ANC can liberate alkalinity in contact water. .

- Implication for RN Waste Mined at Packsaddle

The RN stratigraphic unit constitutes 0.03% of the LoA waste material at Packsaddle. RN is expected to mobilise negligible to low metals or salinity loads. Due to very low total sulphur observed in this stratigraphic unit, occasional volumes of RN waste with elevated ANC are not expected to generate or release NMD.

3.1.2.4.27 Mt McRae Shale (Chert) – RC

The RC stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Sixteen (16) samples from the RC stratigraphic unit were included in the environmental database, with 7 derived from adjacent to the pit shells and suitable for describing the RC stratigraphy. Only the samples near the pit shell will be discussed in the sections below.

All of these 7 samples are classified as waste. The total sulphur distribution of the tested samples ranged from below detection limits to 0.19%, with an average value of 0.08%. The average sulphur content of the RC sample set is consistent with that of the Packsaddle block model data as 100% of the RC blocks have total sulphur <0.1 wt%.

The samples tested have ANC contents that range from 1.4 to 265 kg H_2SO_4/t, with an average value of 40.77 kg H_2SO_4/t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the RU stratigraphy being generally characterised by low ANC, and occasionally by moderate to high ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 210 µS/cm. Paste pH values of all samples are near neutral with pH values greater than 5.5 (averaging 7.34). The NAG pH values for all of the samples are non-acidic, with values greater than pH 4.5. NAG testwork indicates a moderate capacity to release acidity from these samples with NAG7 acidity generally averaging 4.5 kg H_2SO_4/t.

- Mineralogy and Sulphur Speciation

Sulphur speciation data available for two samples of the RC stratigraphy that sulphur mostly associated with sulphide minerals. No mineralogy is available for RC to assist determine which S bearing species are present in these samples.

- AMD Classification

Of the 7 samples of the RC stratigraphy tested from adjacent to the pit shells, 5 were classified as NAF. These are characterised by generally low total S concentrations (≤0.14%, averaging 0.04%), moderate ANC values averaging 56.24 kg $H_2SO_{4/t}$, near neutral paste pH values >6.9, and NAG pH values ≥8.4.

Two (2) samples were classified as UC(NAF). These are characterised by moderate total S concentrations (averaging 0.19%), low ANC values averaging 2.1 kg $H_2SO_{4/t}$, paste pH >5.5, and NAG pH > 4.5, but slightly positive NAPP values. The UC(NAF) classification of these samples likely reflects overestimation of the NAPP value due to the presence of sulphate sulphur.

The BHP WAIO classification predicts all samples to be classified as AMD0 consistently with the AMIRA system.

- Position Relative to the Water Table

Of the 7 samples from adjacent to the pit shells 3 are from below the water table and the position of the water table for 4 of the samples was unknown.

- Geochemical Abundance Index (GAI)

One (1) sample of the RC stratigraphic unit was analysed for major and trace element bulk chemistry. The GAI values for this samples show significant enrichment (i.e. GAI enrichment factors >3) in As (GAI = 4), Cd (GAI = 3), Hg (GAI = 3), and Mn (GAI = 3).

- Leaching Tests

Leach tests were conducted on 1 sample of RC, which was classified as NAF (AMD0).

This NAF sample had a moderate ANC value (8.4 kg $H_2SO_{4/t}$) and a moderate total S concentration (0.14%). The leachate from this samples was slightly-saline (EC of 192 µS/cm) and contained very low dissolved concentration of metals. The dissolved sulphate within the leached NAF sample was 26.4 mg/L.

- Implication for RC Waste Mined at Packsaddle

The RC stratigraphic unit constitutes <0.01% of the LoA waste material at Packsaddle. RN is expected to mobilise negligible to low metals or salinity loads. Due to very low total sulphur observed in this stratigraphic unit, occasional volumes of RC waste with elevated ANC are not expected to generate or release NMD.

3.1.2.4.28 Mt McRae Shale (Lower) – RL

The RL stratigraphy is only sourced from the Packsaddle deposits.

- Acid Base Accounting

Thirteen (13) samples from the RL stratigraphic unit were included in the environmental database, with 7 derived from adjacent to the pit shells and but suitable for describing the RL stratigraphy.

The following descriptions only concern the 7 samples from adjacent to the pit shells. All of these 7 samples are classified as waste. The total sulphur distribution of the tested samples ranged from 0.02 to 0.28%, with an average value of 0.10%. The average sulphur content of the RL sample set is broadly consistent with that of the Packsaddle block model data as 100% of the RL blocks have total sulphur <0.1 wt%.

The samples tested have low ANC contents that range from 1.4 to 9.0 kg $H_2SO_{4/t}$, with an average value of 2.71 kg H_2SO_4/t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the RU stratigraphy being generally characterised by low ANC, and occasionally by moderate ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is slightly saline, with average values of approximately 168 µS/cm. Paste pH values of all samples were near neutral with pH values greater than 5.5 (averaging 7.0). The NAG pH values for all samples were non-acidic with values greater than pH 4.5.

- Mineralogy and Sulphur Speciation

No mineralogy is available for the RL samples.

Sulphur speciation data available for two samples indicate that one sample is dominated by sulphide sulphur (~77% of the total sulphur, sample Y299927), whilst the other contains only sulphate sulphur. Nevertheless, both samples have near neutral paste pH and NAG pH values.

- AMD Classification

Of the 7 samples of the RL stratigraphy from adjacent to the pit shells, 6 were classified as NAF. These NAF samples are characterised by low-moderate total S concentrations (0.02 to 0.23%), low-moderate ANC values averaging 4.13 kg H_2SO_4/t, near neutral paste pH values ≥6.6, and NAG pH values of 6.0.

One (1) sample was classified as UC(NAF). This sample is characterised by a moderate total S concentration of 0.28%, a moderate ANC values of 3.2 kg H_2SO_4/t, a near neutral paste pH of 7.8, a slightly positive NAPP value, but a NAG pH value of 6.1. The UC(NAF) classification of this samples likely reflects overestimation of the NAPP, Sulphur speciation, NAG pH test and paste pH support the classficiaton of this sample and UC(NAF).

The BHP WAIO classification predicts 2 of the samples to be AMD1 (sample Y299927 and sample Y314952) with the remaining samples classified as AMD0. The AMIRA classification identifies all samples are NAF/UC(NAF), suggesting that the BHP classification is conservative.

- Position Relative to the Water Table

Of the 7 of the RL stratigraphy from adjacent to the pit shells, 3 are from below the water table and the position of the water table for 4 of the samples was unknown.

- Geochemical Abundance Index (GAI)

None of the samples of the RL stratigraphic unit were analysed for major and trace element bulk chemistry.

- Leaching Tests

None of the samples of the RL stratigraphic unit were subject to leach test work.

- Implication for RL Waste Mined at Packsaddle

The RL stratigraphic unit constitutes <0.01% of the LoA waste material at Packsaddle. The very low sulphur concentration suggest that these samples are unlikely to mobilise meaningful metals and or salinity upon leaching. . Due to very low total sulphur observed in this stratigraphic unit, occasional volumes of RL waste with elevated ANC are not expected to generate or release NMD.

3.1.2.4.29 Paraburdoo Member Undifferentiated – OB (Wittenoom Formation)

The OB stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Thirty-seven (37) samples from the OB stratigraphic unit were included in the environmental database, with six derived from within the pit shell and 31 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the six samples from within the pit shell, all are classified as waste. The total sulphur distribution of the tested samples ranged from below detection limits to 0.01S%. The average sulphur content of the OB sample set is consistent with the overall sulphur distribution of OB material based on North Flank and R deposit block model data being characterised by 100% of its materials having sulphur <0.1%.

The samples tested have ANC contents that range from 1.2 to 2.7 kg H_2SO_4 /t, with an average value of 2.07 kg H_2SO_4 /t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the OB stratigraphy being generally characterised by low ANC, and occasionally higher ANC values.

- Paste pH/EC and NAG suite

Paste EC is slightly-saline, with average values of approximately 78 µS/cm. Paste pH values of all in-pit samples tested have pH values > 5.5. No NAG data was available for in-pit OB samples (note NAG pH data available for samples outside the pitshell show that for comparable sulphur and ANC concentration, all samples have NAG pH >4.5).

- Mineralogy and Sulphur Speciation

Mineralogy and sulphur speciation data are available for the in-pit OB samples (note, sulphur speciation data available for samples outside the pitshell show that for comparable sulphur and ANC concentration, sulphur is associated with sulphate forms).

- AMD Classification

Of the six samples of the OB stratigraphy tested from within the pit shell all are classified as NAF (AMD0).

- Position Relative to the Water Table

Of the six samples from within the pit shell 3 are from above the water table and 3 from below.

Geochemical Abundance Index (GAI)

No samples of the OB stratigraphic unit were analysed for major and trace element bulk chemistry.

- Leaching Tests

No samples of the OB stratigraphic unit were subject to leach test work.

- Implication for OB Waste Mined at MAC/SF

The OB stratigraphic unit constitutes 0.01% of the LoA waste material at MAC/SF.

The very low sulphur concentration suggest that these samples are unlikely to mobilise meaningful metals and or salinity upon leaching. Based on the limited data available the OB stratigraphy is not expected to generate or release AMD / NMD upon leaching.

3.1.2.4.30 West Angela Member – WA2 (Wittenoom Formation)

The WA2 stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Ninety-two (92) samples from the WA2 stratigraphic unit were included in the environmental database, with 51 derived from within the pit shell and 41 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 51 samples from within the pit shell, 46 are classified as waste, 3 are classified as low-grade ore, and 2 are classified as high-grade ore. The total sulphur distribution of the tested samples ranged from below detection limits to 3.89 wt%, with an average value of 0.34 wt%. The sulphur range of the WA2 sample set is consistent to that of the WA2 material based on MAC/SF block model data.

The samples tested have ANC contents that range from below detection limits to 21.8 kg H_2SO_4 /t, with an average value of 2.71 kg H_2SO_4 /t. The ANC range for the in-pit samples is lower than that predicted by the block model, however it represents the bulk of the WA2 materials. In particular, the statistical distribution for ANC predicted by the block models suggest that the majority of the WA2 tends to have low-moderate ANC (e.g. <20 kg H_2SO_4/t), with lesser volumes showing high ANC values (i.e. > 50 kg H_2SO_4/t).

- Paste pH/EC and NAG suite

Paste EC is moderately saline, with average values of approximately 360 µS/cm. Paste pH values of approximately 50% of the samples tested are slightly acidic with pH values < 5.5, all of these samples have NAG pH data < 4.5. All the samples with slightly acidic pH and acid NAG pH are characterised by ANC below detection limit and sulphur fully associated with sulphate (see below). The reminder of the samples have paste pH > 5.5 and NAG pH > 4.5, very low to moderate ANC, and all sulphur is also associated with sulphate forms (see below).

- Mineralogy and Sulphur Speciation

For the WA2 stratigraphic unit the key minerals identified by XRD in the 31 samples tested are goethite, kaolinite, quartz, hematite, and an amorphous phase. Minor alunite was detected in some samples. Sulphur speciation data, available for 38 samples, show that virtually all sulphur is associated with sulphate forms, but for sample Y347104_PAF. For sample Y347104_PAF, only 75% of the total sulphur appears to be associated with sulphate forms, however, mineralogical testwork identified only alunite as the main sulphur bearing mineral (note laboratory testwork does not fully dissolve all sulphates, as some minerals such as alunite, barite are sparingly soluble).

Mineralogical testwork on these samples, combined with weakly acidic to near neutral paste pH and NAG values confirms that all the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 51 samples of the WA2 stratigraphy tested from within the pit shell, 25 were classified as NAF. These are characterised by low total S concentrations (<0.03 %), low ANC values averaging 5 kg H_2SO_4 /t, near neutral paste pH values generally >5.7 (single value at pH 4.9), and NAG pH >4.5. The mineralogy of these NAF samples is dominated by goethite, hematite, kaolinite, and quartz. Rare alunite was identified as the only sulphur-bearing phase.

Six (6) samples were classified as UC(NAF). These are characterised by low-moderate total S concentrations (<1.66 wt%, averaging 0.38 %), negligible ANC with values below or near detection limit, slightly acidic paste pH at values <5.5, and NAG pH values between 4.6 and 5.8, and positive NAPP. The mineralogy of these UC(NAF) samples is dominated by goethite, kaolinite, hematite and quartz. Alunite was identified as the only sulphur-bearing phase; where tested all sulphur is associated with sulphate resulting in an overestimate of the NAPP value; this justifies a UC(NAF) classification. As these samples contain slightly elevated sulphur, combined with NAG pH's above 4.5, and low ANC, there is low potential for NMD generation.

Twenty (20) samples were classified as PAF. These are characterised by moderate total S concentrations (> 0.12 wt%, averaging 0.75 wt%), ANC values below detection limit of < 1 kg H_2SO_4/t, acidic paste pH values <5.5, and NAG pH values ≤4.5, ranging from 4.0 to 4.5. The mineralogy of these samples is dominated by goethite, kaolinite, hematite, and quartz. Alunite was identified as the only sulphur-bearing mineral phase, and sulphur speciation testwork assigned all sulphur to sulphate species. The acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. These "PAF" sample may represent naturally acidic materials.

The BHP WAIO classification predicts 23 of the samples tested to be AMD2 (PAF) and 1 to be AMD1/AMD2 (unknown location of the water table), correctly identifying all the samples classed "PAF" using the AMIRA classification system. However, the BHP WAIO classification overestimate the proportion of AMD2 samples by approximately 15% compared to the prediction using the AMIRA system.

All the remaining samples are classed AMD0/NAF in accordance with the AMIRA system.

- Position Relative to the Water Table

Of the 51 samples from within the pit shell 33 are from above the water table and 13 from below, the position of the water table for 5 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Thirty-seven (37) samples of the WA2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Ag for 3 samples (GAI = 3), As for 2 samples (GAI = 3), Hg for 3 samples (GAI = 3), Mn for 1 sample (GAI = 3), and Se for 1 sample (GAI = 6).

- Leaching Tests

Leach tests were conducted on 4 samples of WA2, of which 50% were classed as NAF, and 50% as PAF.

The NAF samples had low ANC values (< 7 kg H_2SO_4/t) and low total S concentrations (<0.01%) associated with sulphate sulphur. The leachate from these samples was slightly-saline (EC of 133 µS/cm) and contained very low dissolved concentration of metals. The average dissolved sulphate within the leached NAF samples was 8.95 mg/L. Arsenic, Co, Cr, Cu, Hg, Se were below detection limit, while Cu was near or below detection limit (i.e. <0.001 mg/L to 0.001 mg/L) and Mn was only marginally mobilised in the leachate (i.e. 0.004 – 0.06 mg/L).

The PAF samples had very low ANC values (< 1 kg H_2SO_4/t) and low-moderate total S concentrations (<0.91%) associated with sulphate sulphur. The leachate from these samples was moderately saline (EC of ave. 770 µS/cm) and contained low dissolved concentration of metals such as As (ave. 0001 mg/L), Se (0.006 mg/L), Mn (ave. 3.48 mg/L) and Al (ave. 1.6 mg/L). The average dissolved sulphate within the leached PAF samples was 164 mg/L.

- Implication for WA2 Waste Mined at MAC/SF

The WA2 stratigraphic unit constitutes 7.00% of the LoA waste material at MAC/SF.

The environmental geochemical data available suggest that sulphur is generally associated with sulphates, with alunite being present in the mineral assemblage of most of the samples submitted for XRD analysis. Samples with alunite and low ANC can generate acidic pH when leached (although generally with low acidity values). WA2 is expected to generate or release low levels of AMD upon leaching of naturally acidic samples when characterised by total S > 0.3% and low ANC (< 1 kg H_2SO_4/t).

However, due to the slow dissolution rate of alunite and the associated low release of acidity (<10 mg/L CaCO3/t, BHP on-going project), it is expected that there should be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads released by alunite bearing waste similar to that tested.

NMD may be released in higher sulphur samples with elevated ANC. However, the proportion of such materials in the overall waste is negligible, thus limiting the risk for NMD.

Note that BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

3.1.2.4.31 West Angela Member – WA1 (Wittenoom Formation)

The WA1 stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Forty-five (45) samples from the WA1 stratigraphic unit were included in the environmental database, with 11 derived from within the pit shell and 34 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 11 samples from within the pit shell, 3 are classified as waste, 5 are classified as low-grade ore, and 3 are classified as high-grade ore. The total sulphur distribution of the tested samples ranged from 0.01 to 0.64 %, with an average value of 0.18%. The sulphur range for the in-pit sample set is lower than that predicted by the block model, however it represents the bulk of the WA1 materials. In particular, the statistical distribution for sulphur predicted by the block models suggest that the majority (94%) of the WA1 mine waste tends to have very low sulphur (<0.1%), with only 0.1% of the WA1 mine waste expected to have total sulphur concentration greater than 0.5%. Thus, the statistical distribution of the samples tested is consistent with the bulk properties of the WA1 mine waste.

The samples tested have ANC contents that range from below detection limits to 4.20 kg H_2SO_4/t, with an average value of 0.96 kg H_2SO_4/t. This is generally consistent with the statistical distribution for ANC predicted by the block models, with the N3 stratigraphy being generally characterised by low ANC, and occasionally high ANC values.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 366 µS/cm (one value of 1,121 µS/cm). Paste pH values of all the samples tested are acidic with pH values less than <5.5. The NAG pH values for approximately 55% of the samples tested are slightly acidic with values < pH 4.5. All the samples with slightly acidic pH and acid NAG pH are characterised by ANC below or near detection limit and sulphur mostly associated with sulphate forms (see below).

- Mineralogy and Sulphur Speciation

For the WA1 stratigraphic unit the key minerals identified by XRD in the 8 samples tested are goethite, an amorphous phase, hematite, and kaolinite. Minor alunite was detected in 4 of the 8 samples, and gibbsite in 2 of the 8 samples. Mineralogical testwork conducted on these samples, combined with acidic paste pH suggests that sulphates are the key acid generating minerals (note laboratory testwork does not fully dissolve all sulphates, as some minerals such as alunite, barite are sparingly soluble).

Mineralogical testwork conducted on these samples, combined with weakly acidic to near neutral paste pH and NAG values confirms that all the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 11 samples of the WA1 stratigraphy tested from within the pit shell, 2 were classified as NAF. These are characterised by low total S concentrations (≤0.02%), moderate ANC values averaging 3.25 kg $H2_sO_4$ /t, slightly acidic paste pH values of 5.4, and NAG pH >4.5 No mineralogy data is available for these NAF samples.

Three (3) samples were classified as UC(NAF). These are characterised by low-moderate total S concentrations (up to 0.21 wt%, averaging 0.13 wt%), low ANC values averaging 0.53 kg H_2SO_4/t, slightly acidic paste pH values between 4.2 and 4.6, slightly positive NAPP values, but NAG pH >4.5. Alunite was identified as the only sulphur-bearing phase; where tested all sulphur is associated with sulphate resulting in an overestimate of the NAPP value; this justifies a UC(NAF) classification. As these samples contain slightly elevated sulphur, combined with NAG pH's above 4.5, and low ANC, there is low potential for NMD generation.

Six (6) samples were classified as PAF. These are characterised by moderate total S concentrations (>0.11%, averaging 0.27%), ANC values ≤<1 kg H_2SO_4/t, acidic paste pH values <5.5, and NAG pH values <4.5, ranging from 4.1 to 4.4 pH. The mineralogy of these PAF samples is dominated by goethite, an amorphous phase, and hematite. Alunite was identified as the only sulphur-bearing mineral phase, while sulphur speciation testwork assigned all sulphur to sulphate species. The acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. These "PAF" sample may represent naturally acidic materials.

The BHP WAIO classification predicts 8 of the samples tested to be AMD2 (PAF), correctly identifying all the samples classed "PAF" using the AMIRA classification system. However, the BHP WAIO classification overestimate the proportion of AMD2 samples by approximately 30% compared to the prediction using the AMIRA system.

All the remaining samples are classed AMD0/NAF in accordance with the AMIRA system.

Note that BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

- Position Relative to the Water Table

Of the 11 samples from within the pit shell 8 are from above the water table and 2 from below, the position of the water table for 1 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Eight (8) samples of the WA1 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 1 sample (GAI = 3).

- Leaching Tests

No leach data was available for the WA1 in-pit samples.

- Implication for WA1 Waste Mined at MAC/SF

The WA1 stratigraphic unit constitutes 5.27% of the LoA waste material at MAC/SF.

The environmental geochemical data available suggest that sulphur in WA1 samples may be associated with a mixture of sulphates, and potentially sulphides, with alunite being present in the mineral assemblage of many of the samples submitted for XRD analysis. Samples with alunite and low ANC can generate acidic pH when leached (although generally with low acidity values).

However, due to the slow dissolution rate of alunite and the associated low release of acidity (<10 mg/L $CaCO_3$, BHP on-going project), it is expected that there should be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads released by alunite bearing waste similar to that tested.

NMD may be released in higher sulphur samples with elevated ANC. However, the proportion of such materials in the overall waste is negligible, thus limiting the risk for NMD.

Note that BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

3.1.2.4.32 Mt Newman Member – N3 (Marra Mamba Iron Formation)

The N3 stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Thirty (30) samples from the N3 stratigraphic unit were included in the environmental database, with 6 samples derived from within the pit shell and 24 derived from outside of the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the six in-pit samples, 3 are classified as waste, 2 are classified as low-grade ore, and 1 is classified as high-grade ore. The total sulphur distribution of the tested samples ranged from below detection limits to 0.01%, with an average value of 0.03 %. The sulphur range for the in-pit sample set is lower than that predicted by the block model, however it represents the bulk of the N3 materials. In particular, the statistical distribution for sulphur predicted by the block models suggest that the majority (96%) of the N3 mine waste tends to have very low sulphur (<0.1%), with only 4% of the N3 mine waste expected to have total sulphur concentration greater than 0.1%. Thus, the statistical distribution of the samples tested is consistent with the bulk properties of the N3 mine waste.

The samples tested have ANC contents that range from 0.5 to 10.4 kg H_2SO_4/t, with an average value of 1.87 kg H_2SO_4/t. The ANC range for the in-pit samples is lower than that predicted by the block model, however it represents the bulk of the N3 materials. In particular, the statistical distribution for ANC predicted by the block models suggest that the majority of the N3 tends to have low ANC (e.g. <10 kg H_2SO_4/t), with lesser volumes showing high ANC values (i.e. > 50 kg H_2SO_4/t).

- Paste pH/EC and NAG suite

For the samples tested the paste EC is slightly-saline, with average values of approximately 105 µS/cm. Paste pH values of most samples are near neutral, with pH values generally greater than 5.5 (one sample has a paste pH of 5.4). The NAG pH values for all samples are >4.5.

- Mineralogy and Sulphur Speciation

No mineralogy data was available for the N3 samples. No sulphur speciation testwork was conducted due to the very low sulphur values in the samples tested.

- AMD Classification

All of the six samples of the N3 stratigraphy tested from within the pit shell are classified as NAF, consistent with the BHP WAIO classification results that predict 100% of the samples to be AMD0.

- Position Relative to the Water Table

All of the seven samples of the N3 stratigraphy tested from within the pit shell are derived from below the water table.

- Geochemical Abundance Index (GAI)

Two (2) samples of the N3 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show no significant enrichment in any of the analysed elements.

- Leaching Tests

Leach tests were conducted on two (2) samples of N3, of which 100% were classed as NAF.

The NAF samples had low ANC values (0.5 and 3.4 kg H_2SO_4 /t) and low total S concentration (<0.01 %). The leachate from the two samples had low salinity (EC of 26 and 96 µS/cm) and contained very low dissolved concentration of metals. The dissolved sulphate concentrations within the leached NAF samples were 0.5 and 5.9 mg/L.

- Implication for N3 Waste Mined at MAC/SF

The N3 stratigraphic unit constitutes 4.00% of the LoA waste material at MAC/SF.

Based on the data available, N3 is not expected to generate or release AMD / NMD upon leaching.

3.1.2.4.33 Mount Newman Member (Shaley) – N2 (Marra Mamba Iron Formation)

The N2 stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Thirty-seven (37) samples from the N2 stratigraphic unit were included in the environmental database, with 13 derived from within the pit shell and 24 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 13 samples from within the pit shell, 7 are classified as waste, 2 are classified as low-grade ore, and 3 are classified as high-grade ore. The total sulphur distribution of the tested samples from within the pit shell ranged from below detection limits to 0.2 wt%, with an average value of 0.05 wt%. The sulphur range for the in-pit sample set is lower than that predicted by the block model, however it represents the bulk of the N2 materials. In particular, the statistical distribution for sulphur predicted by the block models suggest that the majority (97%) of the N2 mine waste tends to have very low sulphur (<0.1%), with only 0.15% of the N2 mine waste expected to have total sulphur concentration greater than 0.2%. Thus, the statistical distribution of the samples tested is consistent with the bulk properties of the N2 mine waste.

The samples tested have ANC contents that range from 0.5 to 4.0 kg H_2SO_4 /t, with an average value of 1.52 kg H_2SO_4 /t. The ANC range for the in-pit samples is lower than that predicted by the block model, however it represents the bulk of the N2 materials. In particular, the statistical distribution for ANC predicted by the block models suggest that the majority of the N2 mine waste tends to have low ANC (e.g. <10 kg H_2SO_4/t), with lesser volumes showing high ANC values (i.e. > 50 kg H_2SO_4/t).

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately saline, with average values of approximately 283 µS/cm. Paste pH values of 6 the samples are slightly acidic with pH values < 5.5.

The NAG pH values for all samples but one (sample Y347130_PAF) is > 4.5 pH. The sample with NAG pH <4.5 is characterised by elevated sulphur-sulphate and ANC below detection limit (see below).

- Mineralogy and Sulphur Speciation

For the N2 stratigraphic unit the key minerals identified by XRD in the single sample tested are goethite, an amorphous phase, kaolinite, as well as minor quartz and rutile. The weakly acidic to near neutral paste pH and NAG values suggests that the majority of the sulphur is likely to be associated with sulphates, not sulphides.

- AMD Classification

Of the 13 samples of the N2 stratigraphy tested from within the pit shell, 10 were classified as NAF. These samples are characterised by low total S concentrations (<0.07 %), ANC values averaging 1.77 kg H_2SO_4 /t, slightly acidic to near neutral paste pH values >5.5 and NAG pH values >4.5. No mineralogy data was available for these NAF samples.

Two (2) samples were classified as UC(NAF). These samples are characterised by moderate total S concentrations (0.13-0.20 %), low-moderate ANC values of 0.60 and 1.0 kg H_2SO_4 /t, slightly acidic paste pH values <5.5, slightly positive NAPP values but NAG pH values >4.5. No mineralogy data was available for these (UC)NAF samples, however, sulphur speciation data indicates the lack of sulphides and suggests that all sulphur is associated with sulphate forms. As these samples contain slightly elevated sulphur, but low ANC there is low potential for NMD generation.

One (1) sample was classified as PAF. This sample is characterised by moderate total S concentrations (0.18 %), a low ANC values below detection limit of 1 kg H_2SO_4 /t, acidic paste pH value <5.5, a NAG pH value < 4.5. The mineralogy of this PAF sample is dominated by goethite, an amorphous phase, kaolinite, with minor quartz and rutile, while sulphur speciation suggests that all sulphur is associated with sulphate minerals. The acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. These “PAF” sample may represent naturally acidic materials.

The BHP WAIO classification identifies 3 samples as AMD2 type waste, while only one sample is classed as “PAF” by the AMIRA classification, suggesting that the BHP classification is conservative. All other samples are classed AMD0/NAF/

- Position Relative to the Water Table

Of the 20 N2 samples from within the pit shell, nine are derived from above the water table and the position of the remaining four relative to the water table is unknown.

- Geochemical Abundance Index (GAI)

Five (5) samples of the N2 stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 3 samples (GAI = 3) and Se for one sample (GAI = 6).

- Leaching Tests

Leach tests were conducted on 4 samples of N2, of which three samples were classed as NAF, and the other one sample as (UC)NAF.

The NAF samples had slightly elevated ANC values (averaging 3.1 kg H_2SO_4 /t) and low total S concentrations (≤0.04 %). The leachate from these samples was moderately-saline (ave. EC of 307 µS/cm) and contained very low dissolved concentration of metals, including Se averaging at 0.001 mg/L. The dissolved sulphate within the leached NAF samples averaged 19.5 mg/L.

The UC(NAF) sample had low ANC values (0.6 kg H_2SO_4 /t) and moderate total S concentrations (0.13 %). The leachate from this samples was moderately-saline (EC of 504 µS/cm) and contained low dissolved concentration of metals such as Al (0.13 mg/L), Se (0.005 mg/L), and Mn (0.14 mg/L). The average dissolved sulphate within the leached UC(NAF) sample was 53 mg/L.

- Implication for N2 Waste Mined at MAC/SF

The N2 stratigraphic unit constitutes 6.68% of the LoA waste material at MAC/SF.

It is expected that N2 may generate only low levels of AMD potentially associated with alunite bearing waste. However, due to the slow dissolution rate of alunite and the associated low release of acidity (<10 mg/L $CaCO_3$, BHP on-going project), it is expected that there should be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads released by alunite bearing waste similar to that tested.

NMD may be released in higher sulphur samples with elevated ANC. However, the proportion of such materials in the overall waste is negligible, thus limiting the risk for NMD.

Note that BHP is encapsulating AMD2 waste such that it is not placed near the final landform surface or on natural ground.

3.1.2.4.34 Mount Newman Member – N1 (Marra Mamba Iron Formation)

The N1 stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Forty-nine (49) samples from the N1 stratigraphic unit were included in the environmental database, with 11 derived from within the pit shell and 38 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 11 samples from within the pit shell, 7 are classified as waste, 1 is classified as low-grade ore, and 3 are classified as high-grade ore. The total sulphur distribution of the tested samples ranged from below detection limits to 0.03 wt%, with an average value of 0.01 wt%. The sulphur range of the N1 sample set is consistent with the overall sulphur distribution of N1 mine waste based on MAC/SF block model data with 98% of the waste characterised by total S <0.1%.

The samples tested have ANC contents that range from 0.40 to 5.6 kg H_2SO_4/t, with an average value of 1.1 kg H_2SO_4/t. The ANC range for the in-pit samples is lower than that predicted by the block model, however it represents the bulk of the N1 materials. In particular, the statistical distribution for ANC predicted by the block models suggest that the majority of the N1 mine waste tends to have low ANC (e.g. <10 kg H_2SO_4/t), with lesser volumes showing high ANC values (i.e. > 50 kg H_2SO_4/t).

- Paste pH/EC and NAG suite

For the samples tested the paste EC has low salinity, with average values of approximately 102 µS/cm. Paste pH values of 3 samples tested are slightly acidic with pH values < 5.5. The NAG pH values for all tested samples are near neutral with values greater than pH 4.5.

- Mineralogy and Sulphur Speciation

No mineralogy data was available for N1 samples, however sulphur speciation testwork suggest that all sulphur is associated with sulphate forms.

- AMD Classification

Of the 11 samples of the N1 stratigraphy tested from within the pit shell, 9 were classified as NAF. These are characterised by very low total S concentrations (≤0.01 %), low-moderate ANC values averaging 1.2 kg H_2SO_4/t, near neutral paste pH values >5.5 and NAG pH values >4.5.

Two (2) samples were classified as UC(NAF). These are characterised by low total S concentrations (≤0.03 %), low ANC values averaging 0.60 kg H_2SO_4/t, slightly acidic paste pH <5.5, marginally positive NAPP values (i.e. 0.1-0.2 Kg H_2SO_4/t), but NAG pH values >4.5. Sulphur speciation indicates lack of sulphides and thus suggest that NAPP values are overestimated.

The BHP WAIO classification predicts 100% of the samples to be AMD0 in agreement with the AMIRA classification.

- Position Relative to the Water Table

Of the 11 N1 samples from within the pit shell 6 are from above the water table and 3 from below, the position of the water table for 2 of the samples was unknown.

- Geochemical Abundance Index (GAI)

Three (3) samples of the N1 stratigraphic unit were analysed for major and trace element bulk chemistry. None of these samples show significant enrichment in any elements.

- Leaching Tests

Leach tests were conducted on a single sample of N1, which was classified as NAF.

The NAF sample had a low ANC value (1 kg H_2SO_4 /t) and a low total S concentration (0.01%). The leachate from this samples had low salinity (EC of 60 µS/cm) and contained very low dissolved concentration of metals. The dissolved sulphate within the leached NAF samples was 1.1 mg/L.

- Implication for N1 Waste Mined at MAC/SF

The N1 stratigraphic unit constitutes 7.42% of the LoA waste material at MAC/SF.

Based on low total sulphur concentrations and near neutral NAG pH, N1 mine waste is not expected to generate or release significant levels of AMD/NMD upon leaching.

3.1.2.4.35 MacLeod Member – MM (Marra Mamba Iron Formation)

The MM stratigraphy is only sourced from the North Flank and South Flank deposits.

- Acid Base Accounting

Seventy-six (76) samples from the MM stratigraphic unit were included in the environmental database, with 5 derived from within the pit shell and 71 derived from outside the pit shell. Only the in-pit samples will be discussed in the sections below.

Of the 5 samples from within the pit shell, 1 is classified as waste, 3 are classified as low-grade ore, and 1 is classified as high-grade ore. The total sulphur distribution of the tested samples ranged from 0.04 to 0.22 wt%, with an average value of 0.12 wt%. The sulphur range of the MM sample set is broadly consistent with the overall sulphur distribution of MM mine waste as predicted by block model data with virtually all material (i.e. 99.88%) characterised by total S <0.3%.

The samples tested have ANC contents that range from 0.5 to 0.8 kg H_2SO_4 /t, with an average value of 0.56 kg H_2SO_4 /t. The ANC distribution of the sample set is broadly consistent with that of the overall MM material based on MAC/SF block model data.

- Paste pH/EC and NAG suite

For the samples tested the paste EC is moderately-highly saline, with average values of approximately 553 µS/cm (maximum values of 1,667 µS/cm). Paste pH values of 4 samples are slightly acidic with pH values < 5.5. The NAG pH values 2 samples are slightly acidic with NAG pH ≤ 4.5. These sample have acidic paste pH, ANC below detection limit, with all sulphur associated with sulphate forms (where data are available).

- Mineralogy and Sulphur Speciation

No mineralogy data was available for the MM samples, however sulphur speciation testwork suggests all sulphur is associated with sulphate forms.

- AMD Classification

Of the 5 samples of the MM stratigraphy tested from within the pit shell, 3 were classified as UC(NAF). These are characterised by low-moderate total S concentrations (0.04 – 0.15 %), low ANC values below detection limit <1 kg H_2SO_4 /t, acidic paste pH values (≤5.5), and near neutral NAG pH values >4.5.

Two (2) samples were classified as PAF. These are characterised by moderate total S concentrations (0.13 - 0.22 wt%, averaging 0.18 wt%), low ANC values less than 1 kg H_2SO_4 /t, acidic paste pH values <4.0, and NAG pH values <4.5. However, sulphur speciation testwork suggest that all sulphur is associated with sulphate minerals and not sulphides (e.g. pyrite). The acidic paste pH may be associated with the presence of sparingly soluble alunite and/or trace gibbsite; residual acidity from peroxide used in the NAG tests, however, rather than sulphide oxidation is likely responsible for the NAG pH <4.5. These “PAF” sample may represent naturally acidic materials.

The BHP WAIO classification predicts 2 of the samples to be AMD2 with the remaining samples classified as AMD0 in agreement with the AMIRA classification.

- Position Relative to the Water Table

All five MM samples are derived from above the water table.

- Geochemical Abundance Index (GAI)

Three (3) samples of the MM stratigraphic unit were analysed for major and trace element bulk chemistry. The GAI values for these samples show significant enrichment in Fe for 2 samples (GAI = 3).

- Leaching Tests

Leach tests were conducted on 3 samples of MM, of which 2 were classed as UC(NAF), and 1 as PAF.

The UC(NAF) samples had low ANC values below detection limit of <1 kg H_2SO_4 /t and low total S concentrations of 0.04 wt%. The leachate from these samples was slightly-saline (average EC of 118 µS/cm) and contained very low dissolved concentration of metals, such as Al (ave. 0.68 mg/L), Fe (ave. 5.22 mg/L), Mn (0.61 mg/L), and Ni (0.03 mg/L). The average dissolved sulphate within the leached NAF samples was 20.1 mg/L.

The PAF sample had low ANC values of <1 kg H_2SO_4 /t and moderate total S concentrations of 0.13 wt%. The leachate from this samples was slightly-saline (EC of 261 µS/cm) and contained low dissolved concentration of metals such as Al (3.99 mg/L), Fe (23.88 mg/L), Co (0.02 mg/L), Mn (1.69 mg/L), Ni (0.07 mg/L), Zn (0.03 mg/L) and Se (<0.001 mg/L). The dissolved sulphate within the leached PAF samples was 75.2 mg/L.

- Implication for MM Waste Mined at MAC/SF

The MM stratigraphic unit represents 4.42% of the LoA waste material at MAC/SF.

It is expected that MM may generate only low levels of AMD potentially associated with alunite bearing waste. However, due to the slow dissolution rate of alunite and the associated low release of acidity (<10 mg/L $CaCO_3$, BHP on-going project), it is expected that there should be sufficient ANC in the remaining waste to neutralise the relatively low acidity loads released by alunite bearing waste similar to that tested.

NMD may be released in higher sulphur samples with elevated ANC. However, the proportion of such materials in the overall waste is negligible, thus limiting the risk for NMD.

3.1.3 Pit Wall assessment

The intersection between the mining block models for MAC and SF deposits, and the proposed pit shells (Figure 3-123, MAC and Figure 3-124, SF) was interrogated in order to estimate the surface area of exposed material from each AMD Class on the walls of the final pit shells. Table 3-97 presents the estimated surface areas of AMD Class 1, 2, and 3 material for each pit.

The pit wall assessment is based on a conservative approach that assumes full exposure of every single pit without any backfilling, so the status of pit development (i.e. backfilling) is not considered in this section.

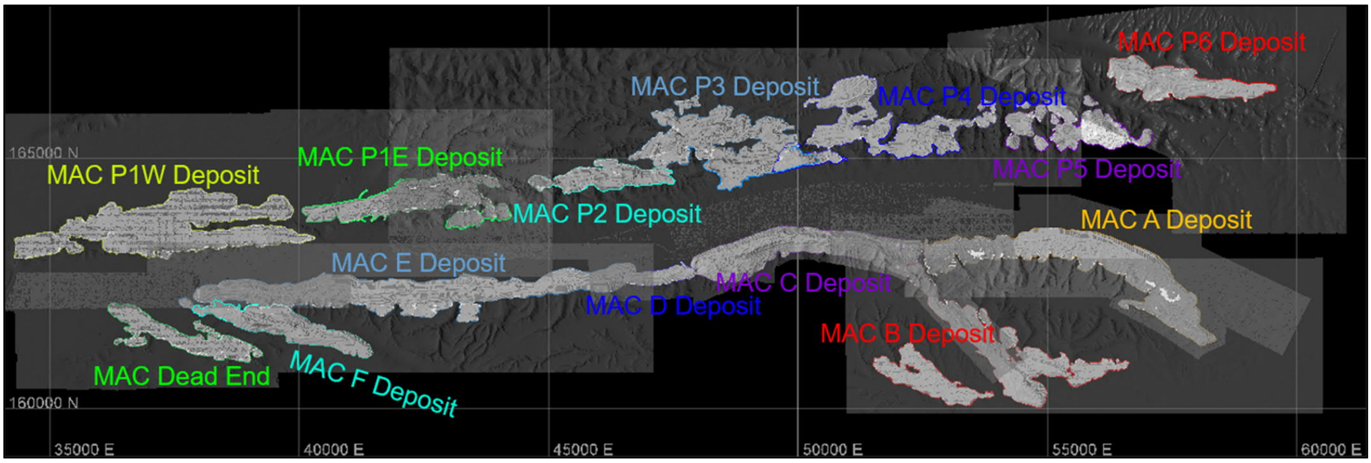


Figure 3-123 Location and extent of MAC pit shells included in the pit wall assessment, and pre-mining surface topography

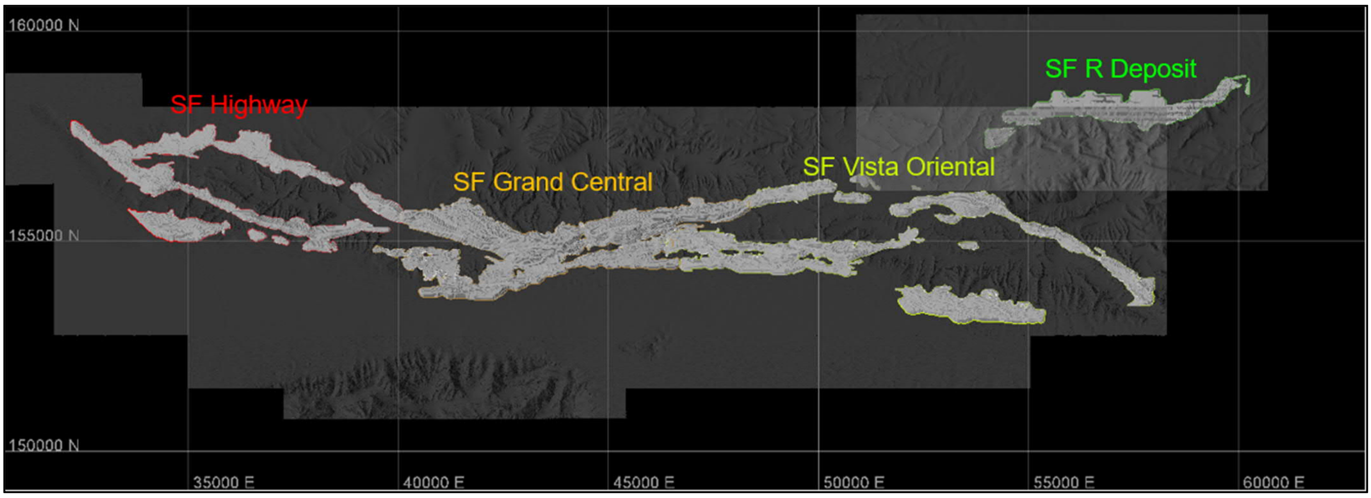


Figure 3-124 Location and extent of SF pit shells included in the pit wall assessment, and pre-mining surface topography

Table 3-97 Surface area* of exposed pit wall per AMD Class for MAC pits

Mining Area	Deposit	2D Pit Footprint Ψ	Total 3D Pit Surface Area	AMD Class 1	AMD Class 2	AMD Class 3	Total AMD Class 1-3	AMD Class 1-3,
		(ha)	(m^2)	(m^2)	(m^2)	(m^2)	(m^2)	% of Total
North Flank (MAC) - Marra Mamba	A	390	4,958,000	0	0	0	0	0.00%
	B	366	4,516,900	0	17,200	6,500	23,700	0.50%
	C	276	3,468,800	0	5,400	0	5,400	0.20%
	D	38	496,500	0	0	0	0	0.00%
	E	473	6,739,300	800	31,800	0	32,600	0.50%
	F	146	1,765,500	0	4,700	0	4,700	0.30%
	Dead End	124	1,737,600	0	6,300	0	6,300	0.40%
Total	**7 Deposits**	**1,812**	**23,682,600**	**800**	**65,400**	**6,500**	**72,700**	**0.31%**
Packsaddle (MAC) - Brockman Bedrock	P1E	218	2,959,700	0	17,600	0	17,600	0.60%
	P1W	441	6,541,800	0	27,900	1,000	28,900	0.40%
	P2	106	1,345,000	0	4,200	0	4,200	0.30%
	P3	328	4,431,100	0	7,000	0	7,000	0.20%
	P4	286	3,813,500	0	2,600	0	2,600	<0.1%
	P5	141	2,082,100	0	400	0	400	<0.01%
	P6	158	1,916,900	0	6,600	0	6,600	0.30%
Total	**7 Deposits**	**1,679**	**23,090,100**	**0**	**66,300**	**1,000**	**67,300**	**0.29%**

Note: **Areas are rounded to the nearest 100 m^2.*

ΨFootprint includes satellite pits but excludes internal undisturbed areas.

Table 3-98 Surface area* of exposed pit wall per AMD Class for SF pits

South Flank - Marra Mamba - PAF wall exposure as a function of deposit and AMD class								
Mining Area	**Deposit**	**2D Pit Footprint Ψ**	**Total 3D Pit Surface Area**	**AMD Class 1**	**AMD Class 2**	**AMD Class 3**	**Total AMD Class 1-3**	**AMD Class 1-3,**
		(ha)	(m^2)	(m^2)	(m^2)	(m^2)	(m^2)	% of Total
South Flank - Marra Mamba	Grand Central	948	11,905,600	0	113,000	10,100	123,100	1.00%
	Highway	659	8,157,600	0	66,400	1,000	67,400	0.80%
	Visa Oriental	916	11,355,600	0	77,200	5,500	82,700	0.70%
	R Deposit	305	4,484,600	0	0	1,100	1,100	<0.1
Total	**4 Deposits**	**2,828**	**35,903,400**	**0**	**256,600**	**17,700**	**274,300**	**0.76%**

*Note: *Areas are rounded to the nearest 100 m^2.*
ΨFootprint includes satellite pits but excludes internal undisturbed areas.

3.1.3.1 MAC North Flank

Deposit A

The MAC Deposit A pit did not contain any potential exposures of AMD Class 1, 2 or 3 material (Figure 3-125). The Deposit A pit wall predominantly comprised N1-3 strats with smaller areas of WA1, WA2 and Tertiary Detrital strats near the crest of the north wall (Figure 3-125).

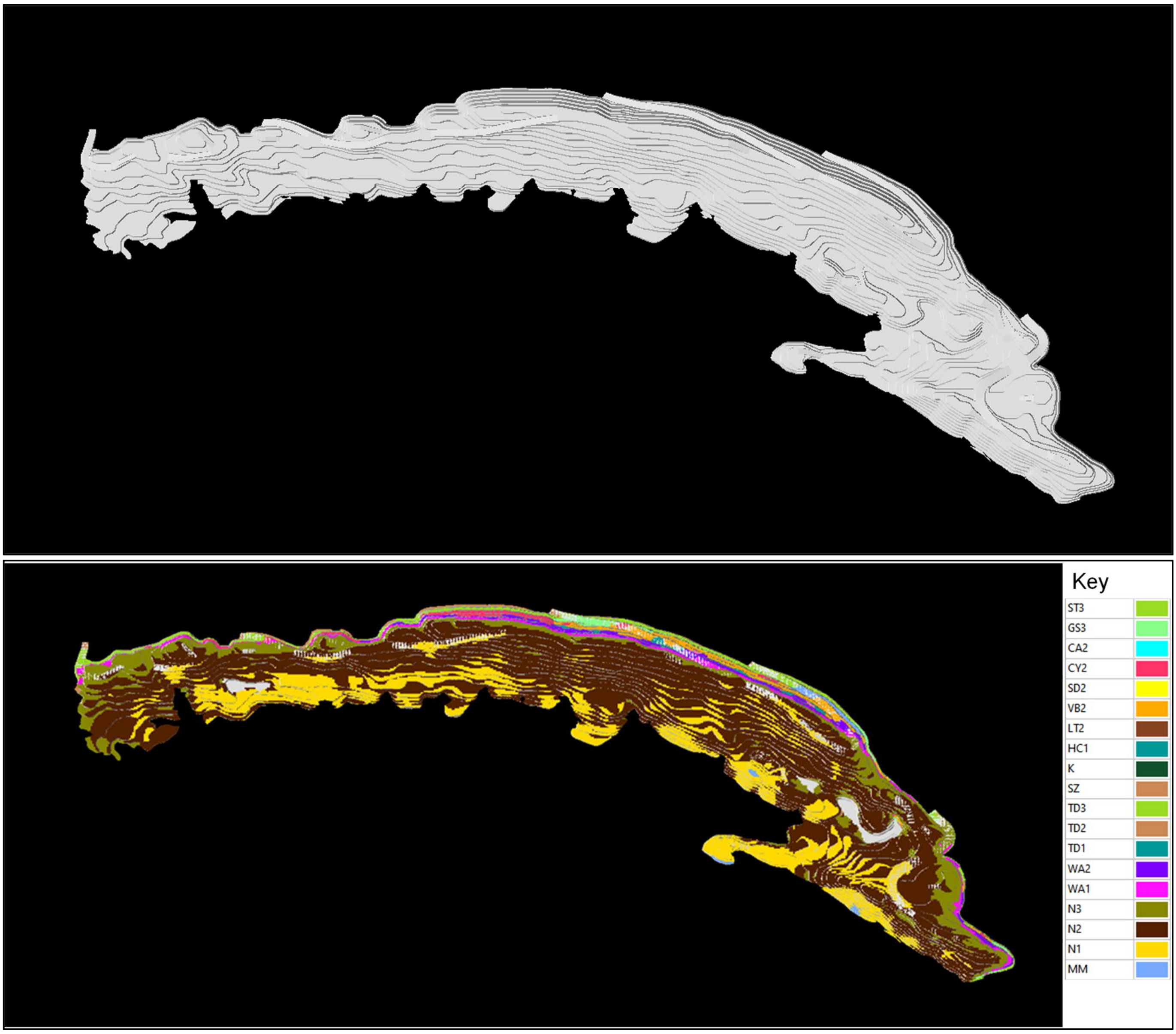


Figure 3-125 Location of potential exposures of AMD1-3 material (upper image, no potential exposures) and the stratigraphy of the MAC Deposit A pit wall (lower image).

Deposit B

The MAC Deposit B pits contained ~17,200 m^2 of potential exposures of AMD2 and 6,500 m^3 of AMD3 material (Figure 3-126) representing ~0.5% of the total surface area of the pit shells for Deposit B. Most of these exposures are near the crest of the pit or/and on the upper section of the pit.

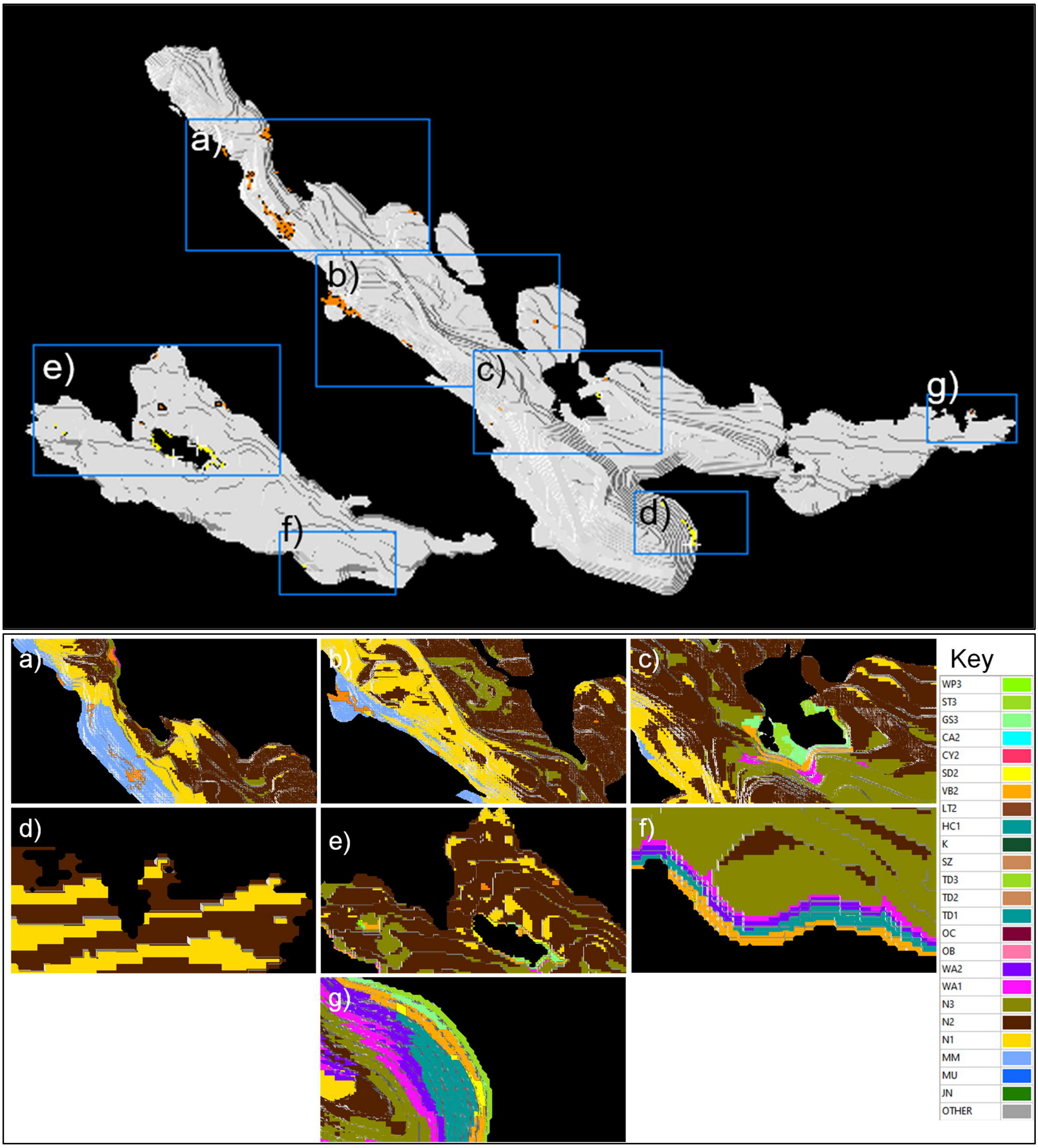


Figure 3-126 Location of potential exposures of AMD2 material (orange areas), AMD Class 3 material (yellow areas) (upper image), and the stratigraphy of the MAC B pit wall around the exposure areas (lower image).

Potential exposures of AMD Class 2 material included wall rock from the WA1/N3 (10%), N3, (3%), N2 (16%), N1 (2%), N1/MM (1%) and MM (68%) stratigraphic units. These exposures were located at depths between 653 and 722 m RL. The majority of exposure areas were at the crest of the pit or within the upper half of the pit wall. The large exposure area at the south end of Figure 3-126 and extended down to the floor of the pit.

Potential exposures of AMD3 material included wall rock from the VB2 (99%) and HC1 (1%) stratigraphic units. These exposures were located between 625 and 689 m RL, which was at the pit crest or within the upper half of the pit wall.

Deposit C

The MAC Deposit C pit contained an inconsequential exposure of AMD2 material of approximately ~5,400 m^2 (Figure 3-127) representing ~0.2% of the total surface area of the Deposit C pit shell.

All of these exposures were on the south wall of the pit, at depths between 648 and 715 m RL, which was within the upper half of the pit wall, and within the MM stratigraphic unit.

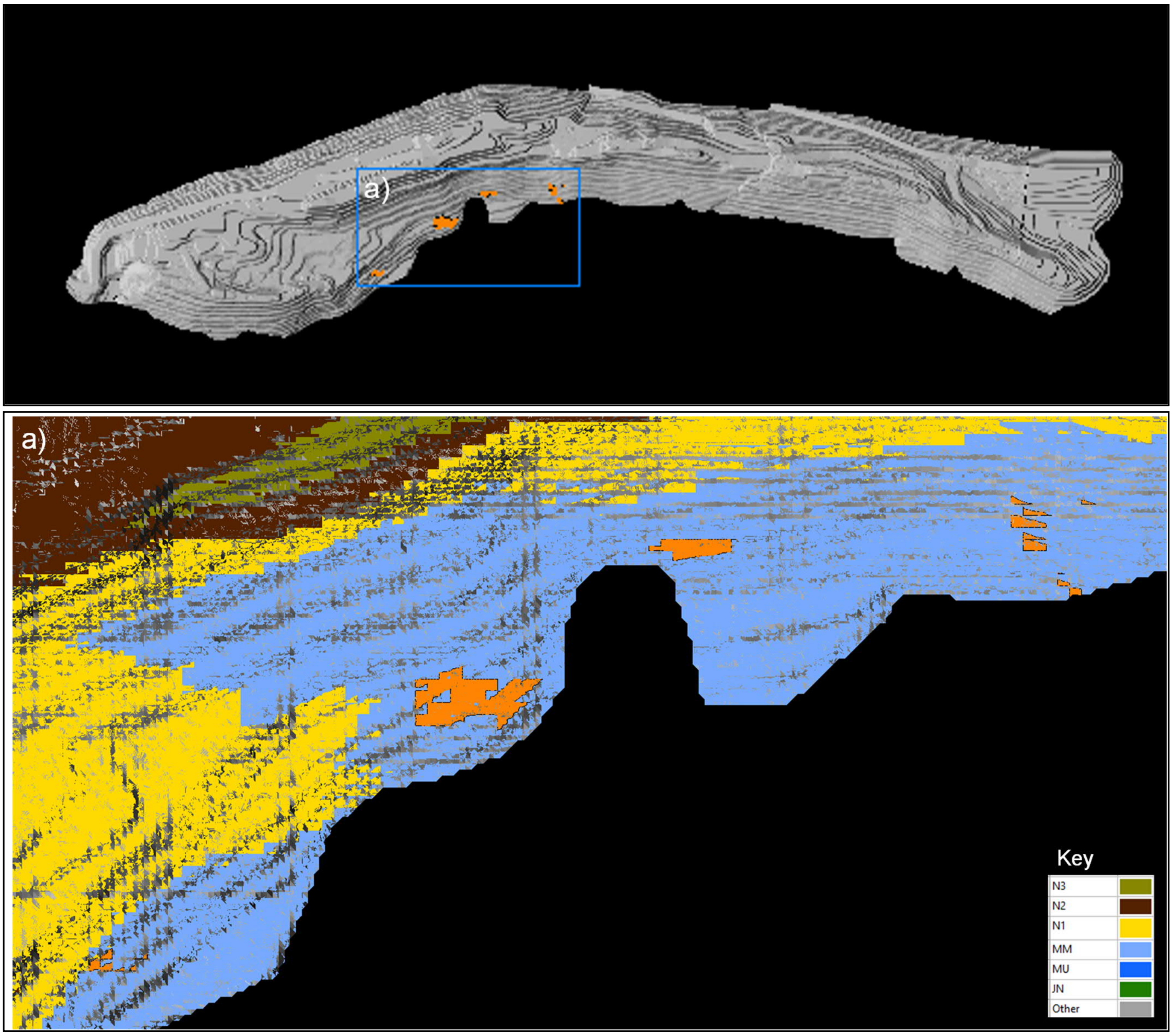


Figure 3-127 Location of potential exposures of AMD2 material (orange areas, upper image) and stratigraphy of the MAC C pit wall around the exposure areas (lower image).

Deposit D

The MAC Deposit D pit did not contain any potential exposures of AMD Class 1, 2 or 3 material (Figure 3-128).

The Deposit D pit wall was predominantly comprised of TD3, WA1, WA2, N1 and MM material with smaller areas of N2 and N3 material through the center of the pit (Figure 3-128).

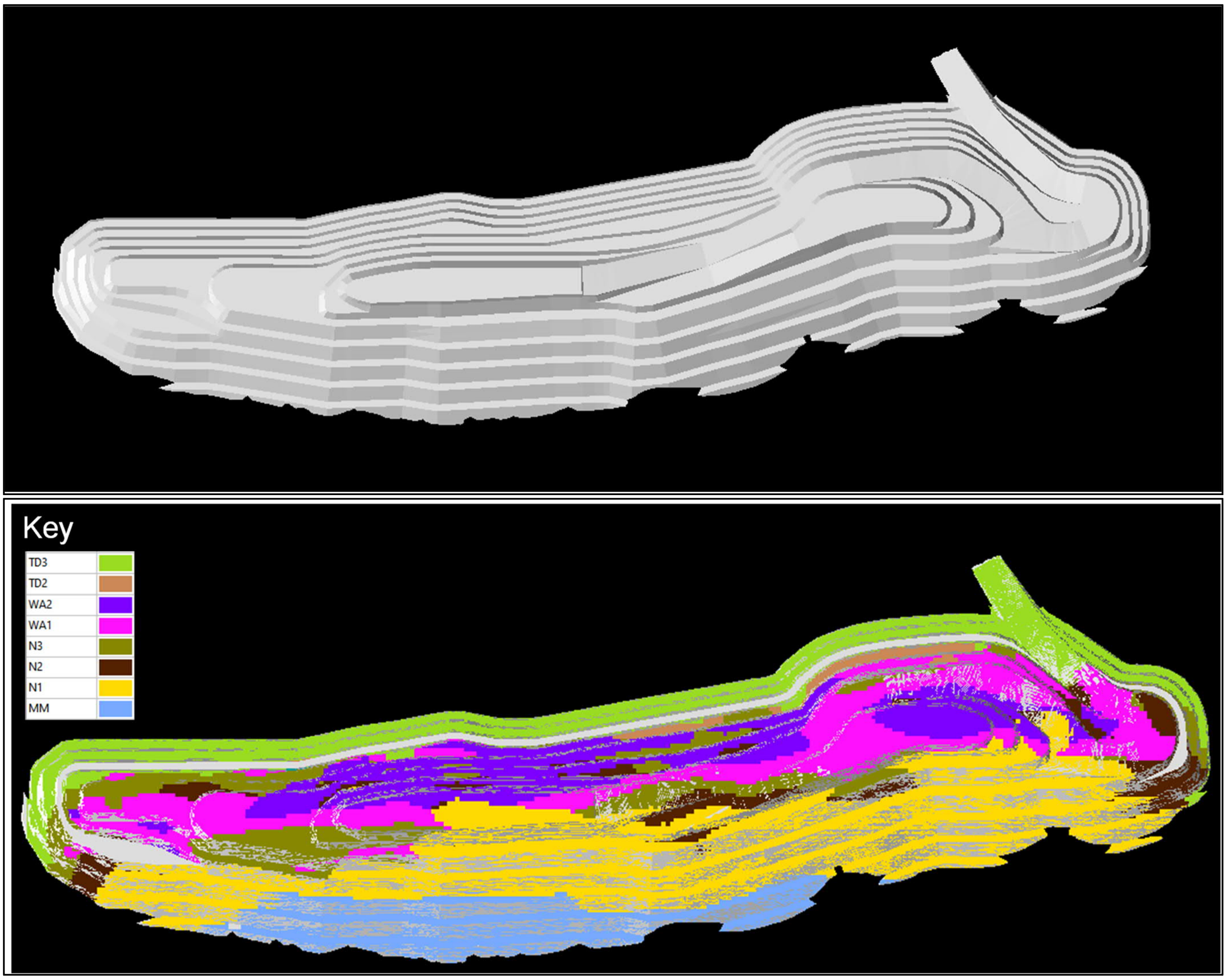


Figure 3-128 Location of potential exposures of AMD1-3 material (upper image, no potential exposures) and the stratigraphy of the MAC D pit wall (lower image).

Deposit E

The MAC Deposit E pit contained ~31,800 m^2 of potential exposures of AMD2 material and the inconsequential amount of AMD1 exposure of 800 m^2 (Figure 3-129). The AMD2 exposure represents ~0.5% of the total surface area of the Deposit E pit. Most of these exposures are near the crest of the pit and/or on the floor of shallow benches.

Potential exposures of AMD2 material were located along the south wall of the pit at depths between 696 and 796 m RL. This was near the pit crest and across the floor of several shallow benches along the south wall of the pit. These exposure areas were within the N2 (1%), N1 (1%), N1/MM (44%) and MM (53%) stratigraphic units.

The potential exposure of AMD1 material was located at the far east end of the pit, on the pit floor (depth between 584 and 588 m RL). This exposure was within the WA2 (West Angela member shale) stratigraphic unit.

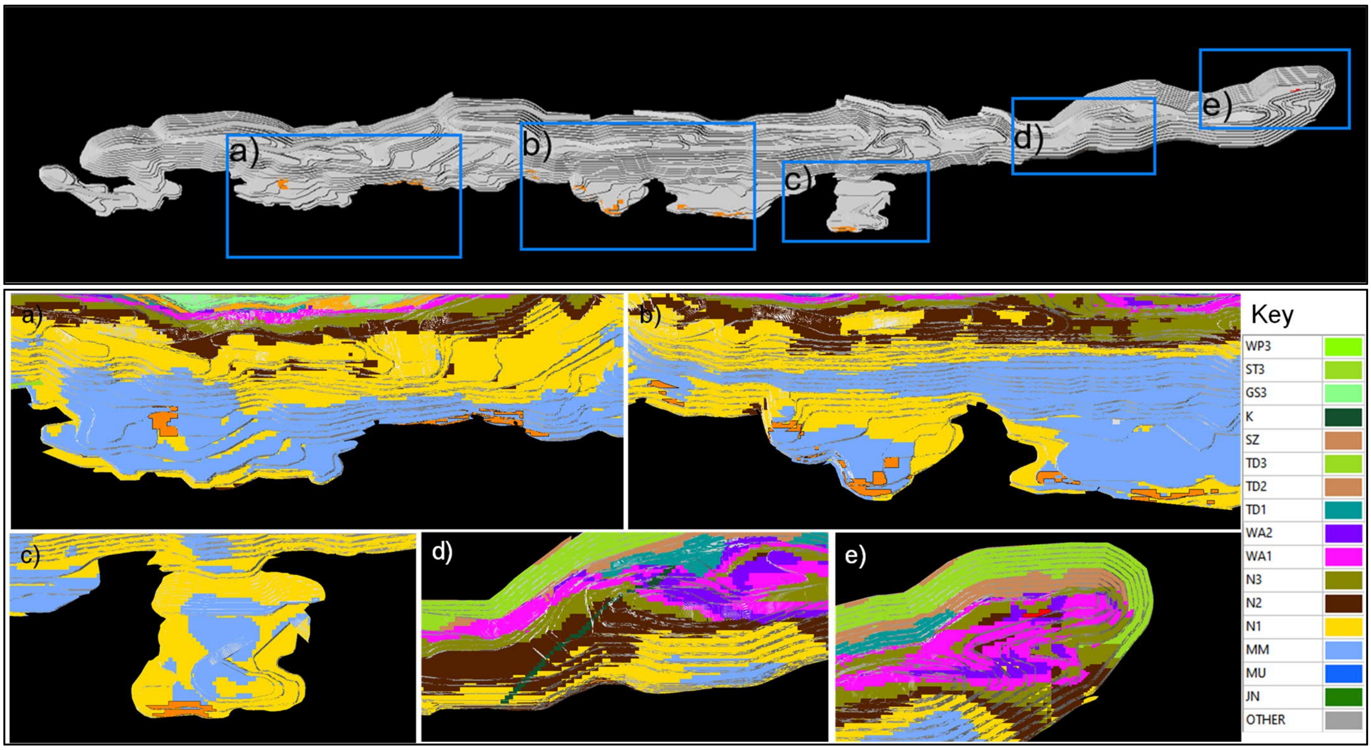


Figure 3-129 Location of potential exposures of AMD1 material (red areas), AMD2 material (orange areas) (upper image), and the stratigraphy of the MAC E pit wall around the exposure areas (lower image).

Deposit F

The MAC Deposit F pit contained a ~4,700 m^2 of potential exposures of AMD2 material (Figure 3-130) representing ~0.3% of the total surface area of the Deposit F pit. Most of these exposures are near the crest of the pit and/or on the floor of shallow benches.

The potential exposure areas were located around the north, east and south walls of the pit at depths between 740 and 817 m RL. The exposure area in Figure 3-130a is located on the floor of a shallow bench. The exposure area in Figure 3-130b is within the upper half of the pit wall. The exposure areas in Figure 3-130c are on the pit wall at a maximum depth of ~40 mbgl, becoming shallower and closer to the pit crest towards the eastern end of the pit. The exposure areas in Figure 3-130d were at various depths between the pit crest and floor, up to 40 mbgl.

These exposures were within the N2 (2%), N1 (10%), N1/MM (19%) and MM (70%) stratigraphic units (Figure 3-130).

The total surface area of potential exposures of AMD Class 1-3 material for the Deposit F pit was less than 20% of the total area of exposures estimated in the previous risk assessment (Table 3-97; KCB, 2014).

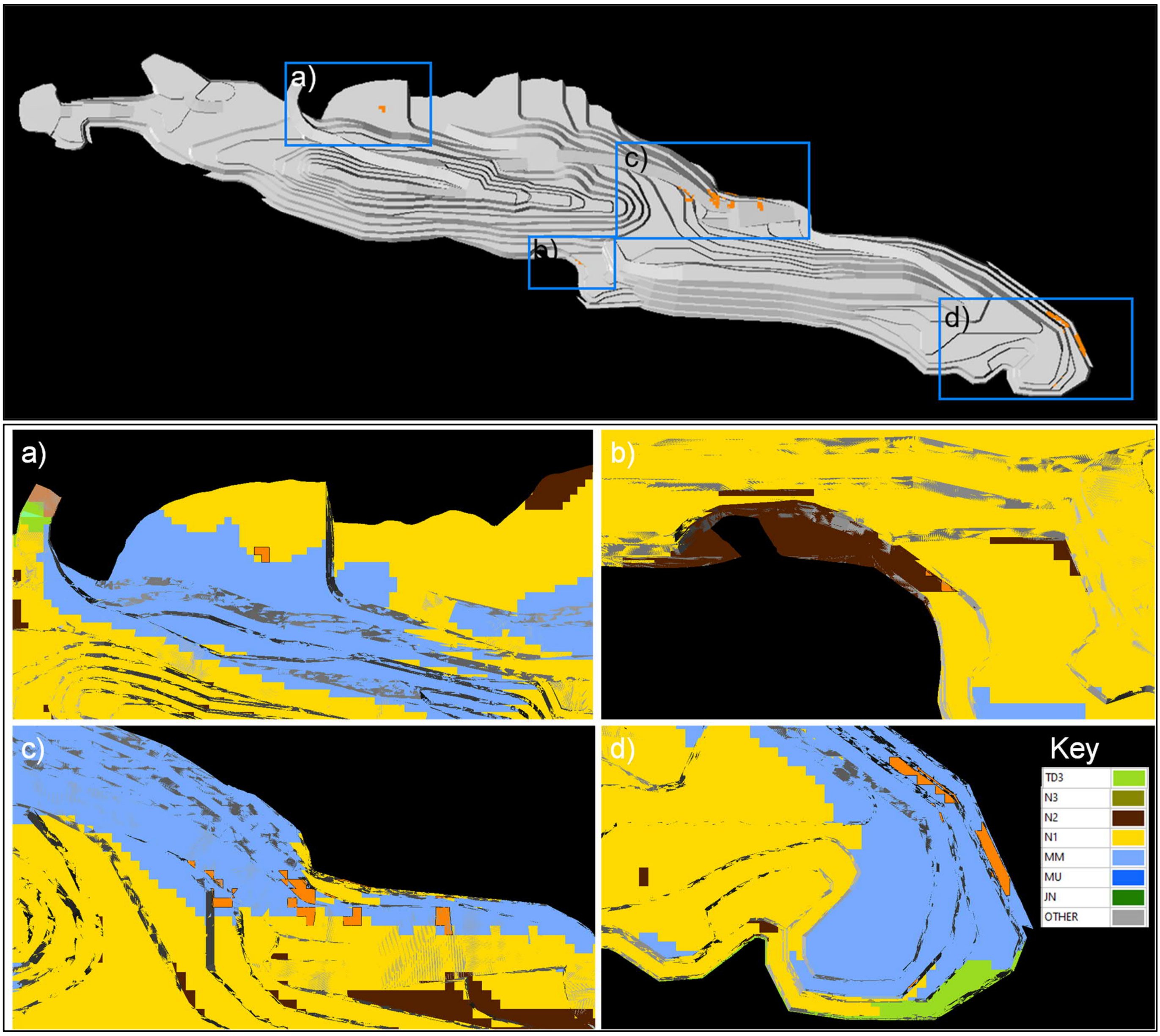


Figure 3-130 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC F pit wall around the exposure areas (lower image).

__Dead End__

The Dead End pit contained ~6,300 m^2 of potential exposures of AMD2 material (Figure 3-131) representing ~0.4% of the total Dead End pit shell surface area. Most of these exposures are on the southwest section of the pit, generally across the top 40m of the pit shell.

These exposure areas were at depths between 695 and 772 m RL. The westernmost exposure area in Figure 3-131a and the easternmost exposure in Figure 3-131b were within 50m of the surface. All other exposure areas in Figure 3-131a, and Figure 3-131b were within 20 m of the pit crest, although some of these exposure areas were on the floor of shallow benches. The larger exposure areas in Figure 3-131c were around internal crests near the pit floor, while the smaller exposure areas were on the pit walls at depths of~40 mbgl.

These exposure areas were within the N3/N2 (30%), N2 (59%), N1 (9%), N1/MM (1%) and MM (<1%) stratigraphic units (Figure 3-131).

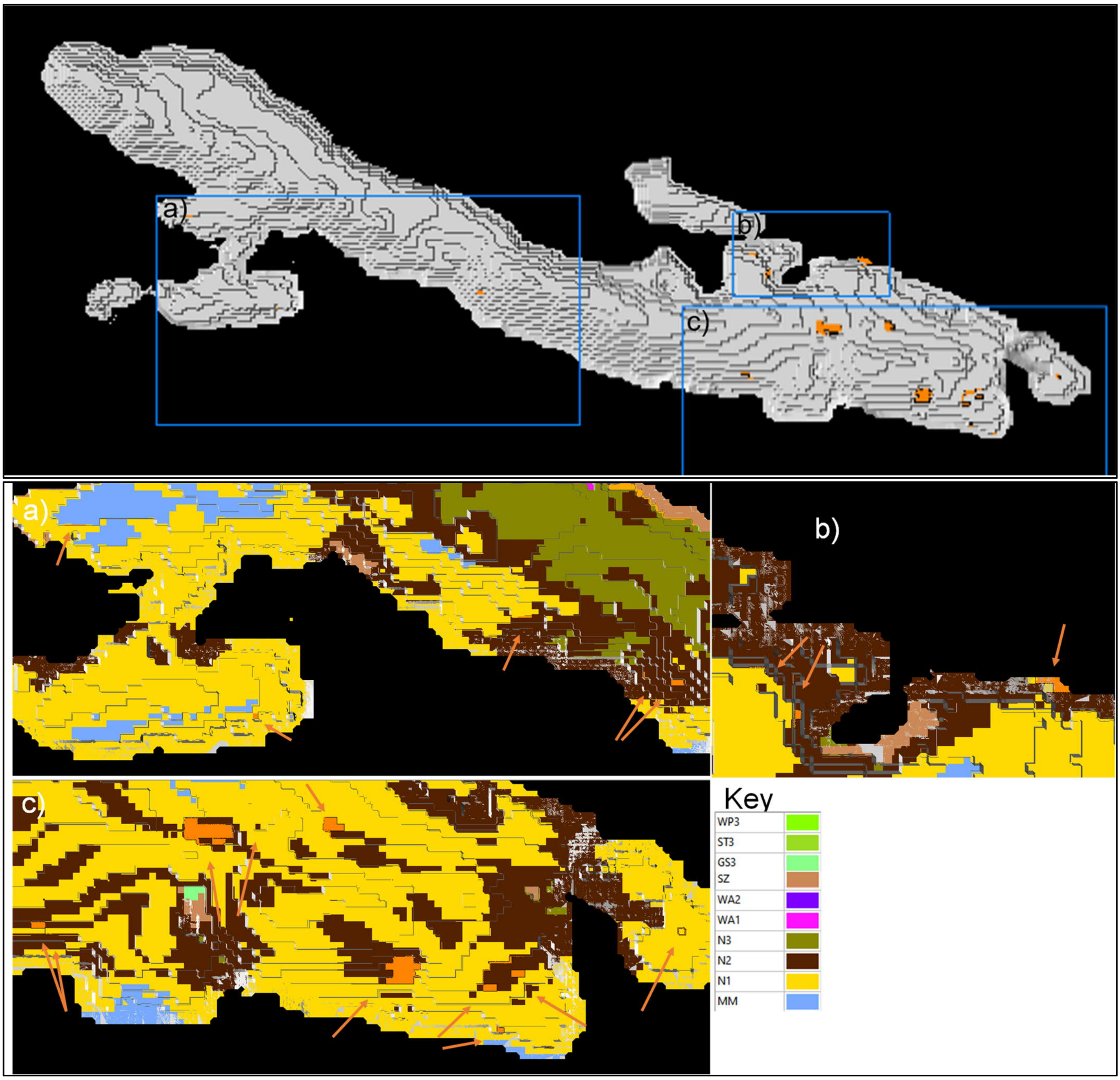


Figure 3-131 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the Dead End pit wall around the exposure areas (lower image).

3.1.3.2 MAC Packsaddle

Deposit P1E

The MAC Deposit P1E pit contained ~17,600 m^2 of potential exposures of AMD2 material (Figure 3-132) representing ~0.6% of the total surface area of the P1E pit. Most of these exposures are near the crest of the pit, and/or on the floor of shallow benches.

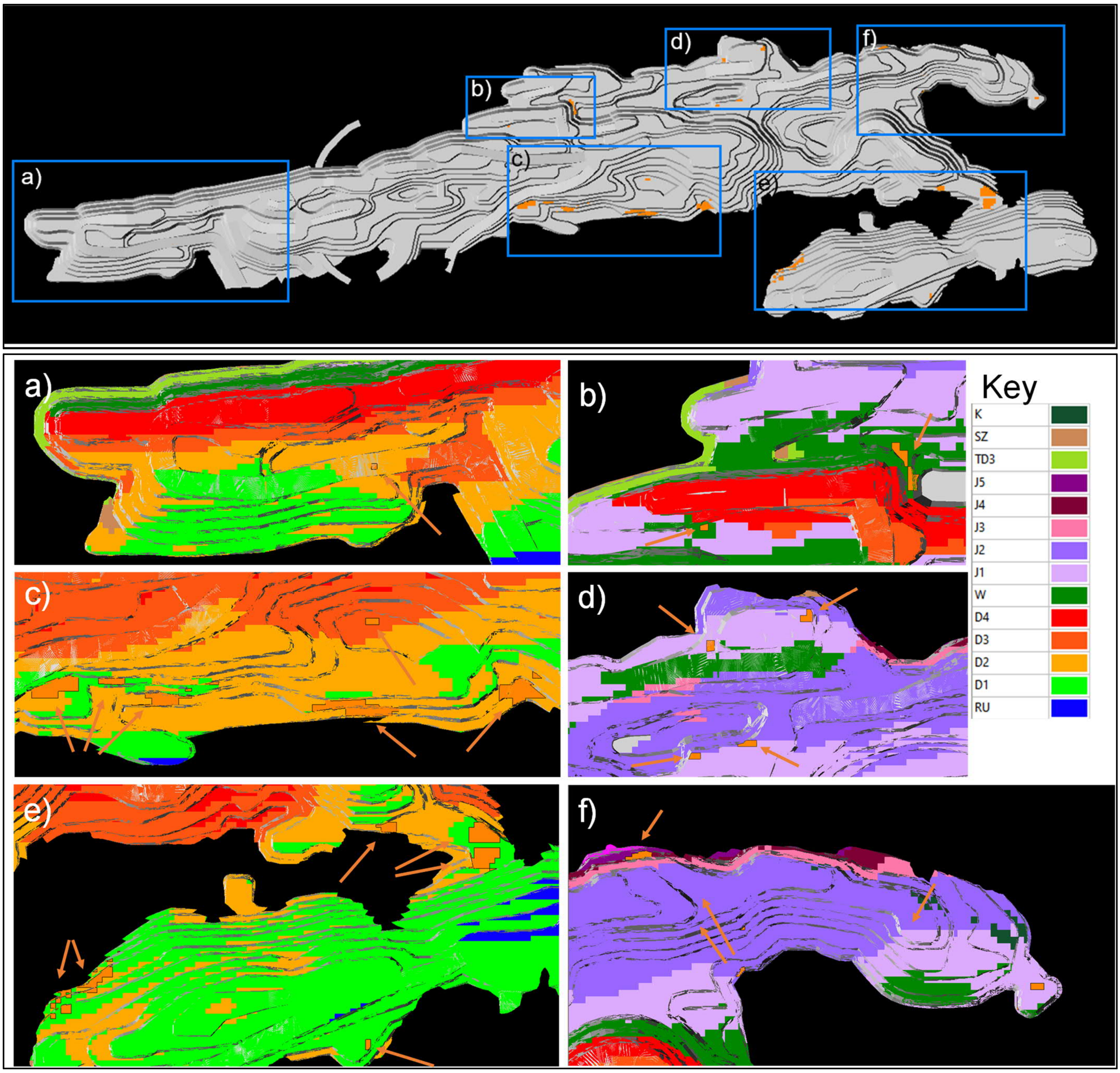


Figure 3-132 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC P1E pit wall around the exposure areas (lower image).

These exposures were at various depths but tended to be towards the eastern side of the pit. The exposure area in Figure 3-132a was in the centre of a mine access road. The exposure areas in Figure 3-132b were around an internal pit crest. The exposure areas in Figure 3-132c were within the upper half of the pit wall. The northernmost exposure area was at the top of an internal pit crest. The exposure areas in the north-west corner in Figure 3-132d were at the pit crest and along the floor of a shallow bench. The exposure areas in the south each corner were at the pit crest, within the upper half of the pit wall or across the floor of the shallow outer bench. The northern exposure areas in Figure 3-132e were at the bottom of a shallow outer bench. The southern exposure areas were within the upper half of the pit wall, above or along the floor of an upper bench. The exposure area in Figure 3-132f were mostly at the crest or within the upper half of the pit wall. The one small exposure area at the centre of Figure 3-10f was at the approximate midpoint of the pit wall.

These exposure areas were within the D1 (33%), D1/D2 (17%), D2 (35%), D3 (1%), J1-J5 (10%) and W (4%) stratigraphic units.

Deposit P1W

The MAC Deposit P1W pit contained ~27,900 m^2 of potential exposures of AMD2 material and an inconsequential amount of AMD3 material of ~1000 m^2 (Figure 3-133). AMD2-3 total exposure represent ~0.4% of the total surface area of the P1W pit. The exposures of AMD2 waste are mostly distributed near the pit crest or on the upper section of the pit wall.

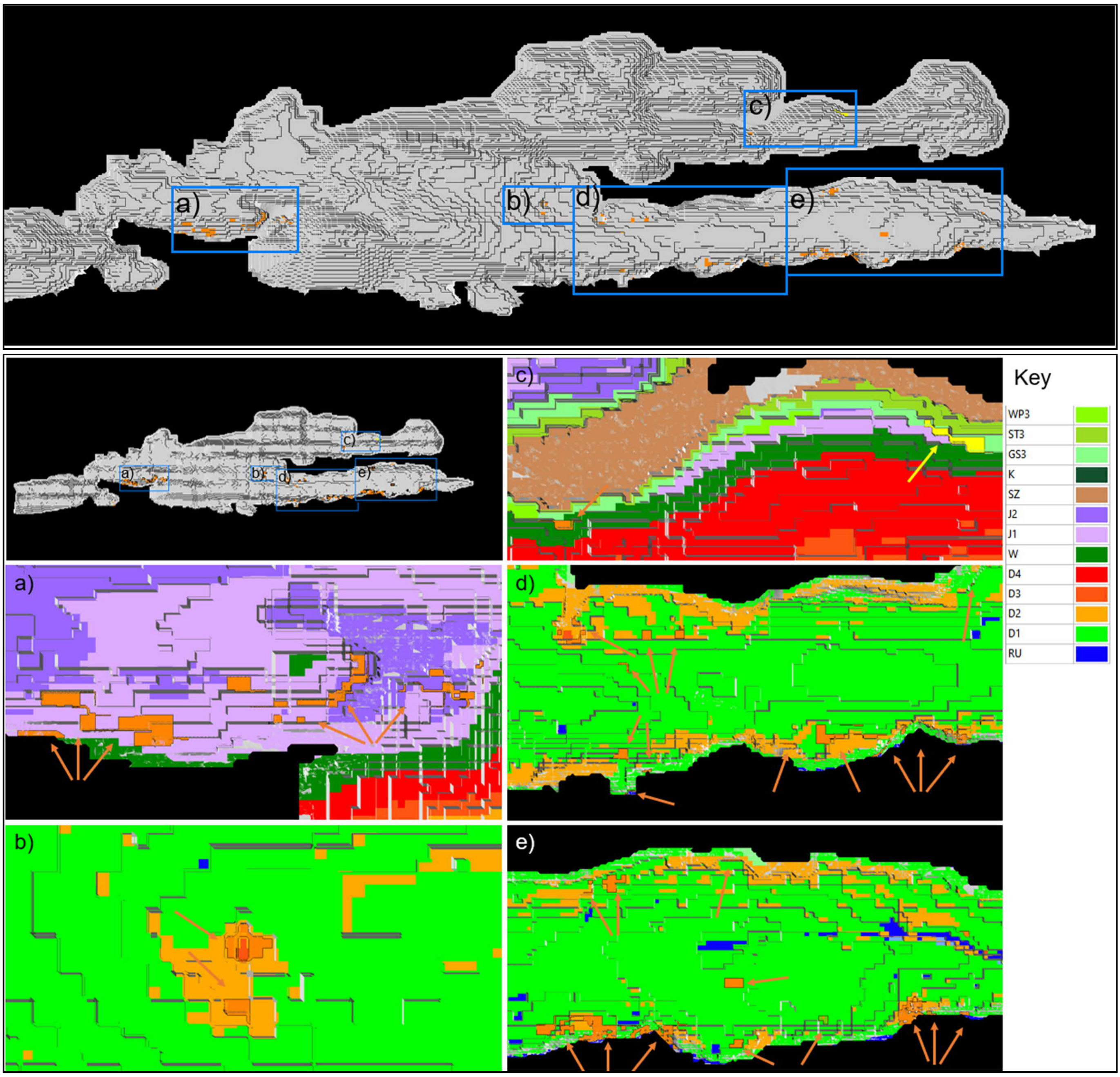


Figure 3-133 Location of potential exposures of AMD2 material (orange areas), AMD Class 3 material (yellow area) (upper image), and the stratigraphy of the MAC P1W pit wall around the exposure areas (lower image).

Potential exposures of AMD2 material were mainly along the south-west wall and the southern arm of the pit. The exposure areas in Figure 3-133a were along the crest and upper half of the south west wall. The eastern exposure areas in Figure 3-133b were around an internal pit crest. The western exposure areas were within the upper half of the pit wall. The AMD2 exposure areas in Figure 3-133c was at the approximate midpoint of the pit wall. The exposure areas in Figure 3-133d were at the crest or within the upper half of the south east wall. The exposure area in the centre of Figure 3-133e was on the pit floor. All other exposure areas in Figure 3-133e were at the crest or within the upper half of the pit wall.

These exposure areas were within the J2 (<1%), J2/J1 (27%), J1 (5%), W (1%), D2 (9%), D2/D1 (37%) and D1 (20%) stratigraphic units.

The potential exposure area of AMD3 material was within the upper half of the north wall, along the northern arm of the pit. This exposure area was within the upper half of the pit wall at a depth between 720 and 728 m RL, and within the GS3 and WP3 stratigraphic units (Figure 3-133c).

Deposit P2

The MAC Deposit P2 pit contained ~ 4,200 m^2 of potential exposures of AMD2 material (Figure 3-134) representing ~0.3% of the total surface area of the Deposit P2 pit shell. The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest.

Potential exposures of AMD2 material were located around the north wall of the pit at depths between 828 and 916 m RL. The exposure area in Figure 3-134a was within the lower half of the pit wall, within the W stratigraphic unit. The exposure areas in Figure 3-134b were within the upper half of the pit wall, within the J2 - J4 stratigraphic units. The eastern exposure areas in Figure 3-134c were at or just below the pit crest while the western exposure areas were on the floor of a shallow side bench or around an internal crest. These exposure areas were within the J2 - J6 stratigraphic units. The exposure area in Figure 3-134d was within the upper half of the northern pit wall.

Overall the exposure area of W material comprised 2% of the total AMD2 exposures and J2 – J6 material comprised the remaining area (98%) of AMD Class 2 exposures.

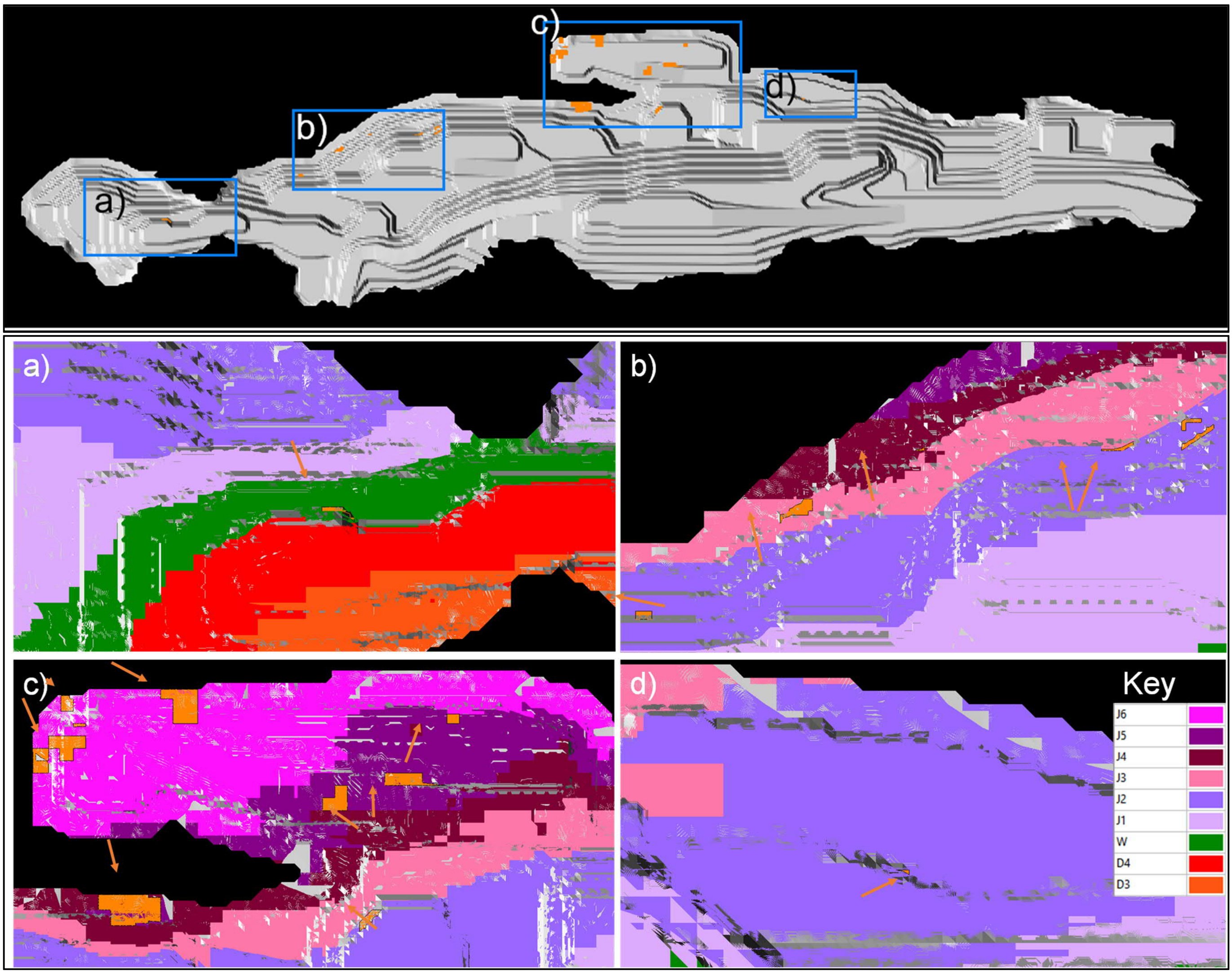


Figure 3-134 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC P2 pit wall around the exposure areas (lower image).

Deposit P3

The MAC Deposit P3 pits contained ~7,000 m^2 of potential exposures of AMD2 material (Figure 3-135) representing ~0.2% of the total surface area of the Deposit P3 pit shells. The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest.

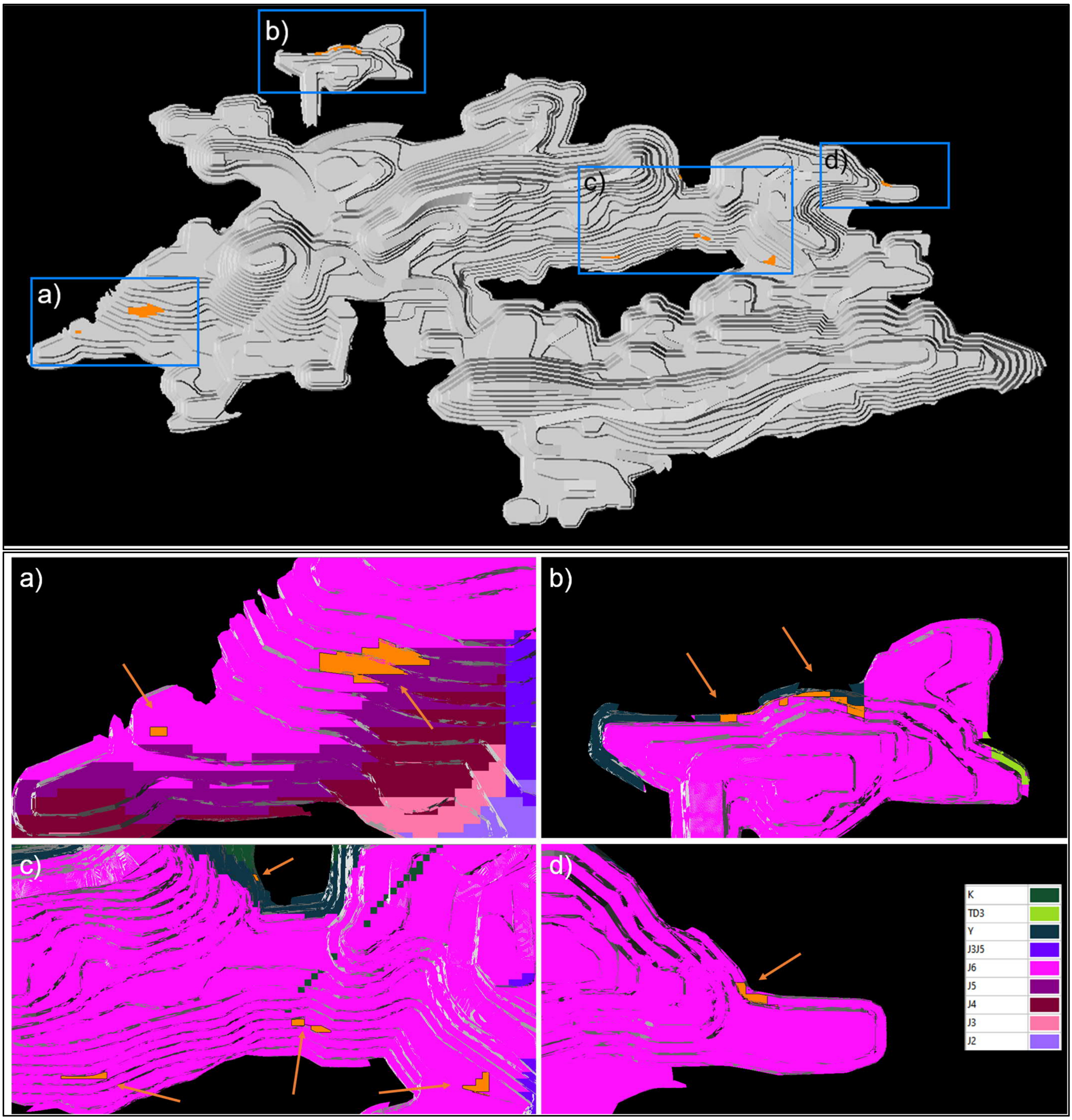


Figure 3-135 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC P3 pit wall around the exposure areas (lower image).

The exposure areas were located at depths between 764 and 872 m RL. The eastern exposure area in Figure 3-135a was on the floor of a shallow outer bench while the western exposure area was within the upper half of the pit wall. The exposure areas in Figure 3-135b were at the crest of a satellite pit to the north of the main pit. The northern exposure area in Figure 3-135c was at the pit crest while the southern exposure areas were within the upper half of the pit wall around an internal pit crest. The exposure area in Figure 3-135d was at the pit crest.

These exposure areas were within the Y (1%), J6/Y (16%) and J6 (83%) stratigraphic units.

Deposit P4

The MAC Deposit P4 pits contained an inconsequential amount of ~2,600 m^2 of potential exposures of AMD2 material representing <0.1% of the total pit shell surface area for the P4 deposit pits (Figure 3-136). The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest.

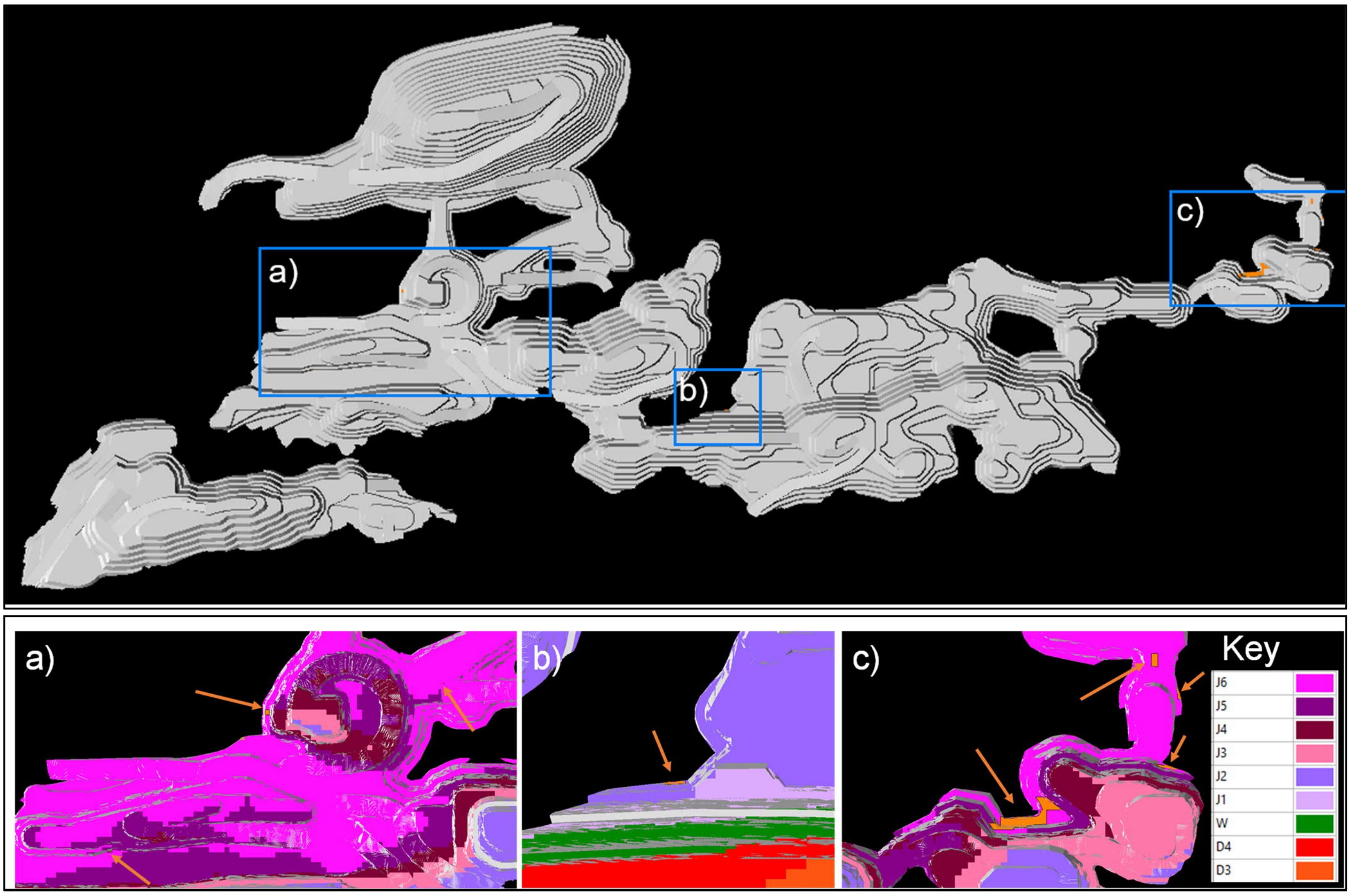


Figure 3-136 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC P4 pit wall around the exposure areas (lower image).

These exposure areas were at depths between 744 and 916 m RL. The westernmost exposure area in Figure 3-136a was at the top of an internal crest, the central exposure was near the pit outer crest and the easternmost exposure area was at the bottom of a pit access ramp. The exposure area in Figure 3-136b was at the pit crest. The exposure areas in Figure 3-136c were around an internal pit crest, at the pit outer crest and across a shallow pit at the northeastern tip of the pit.

All of these exposure areas were within the J6 stratigraphic unit, except for the exposure area in Figure 3-136b which was in the J2 stratigraphic unit (5% of AMD2 surface area for the Deposit P4 pits).

Deposit P5

The MAC Deposit P5 pit shells contained a negligible surface exposure of ~400 m^2 of potential AMD2 material representing <0.01% of the total pit shell surface area for the Deposit P5 pit shells (Figure 3-137).

These exposures were at depths between 806 and 917 m RL. The northern exposure area in Figure 3-137a was at the bottom of the pit wall on a shallow satellite pit and the southern exposure area was in the upper half of the pit wall on a deeper satellite pit. The exposure areas in Figure 3-137b were at the pit crest.

These exposure areas were within the J1 (9%), J2 (66%), J3J5 (16%) and J6 (10%) stratigraphic units.

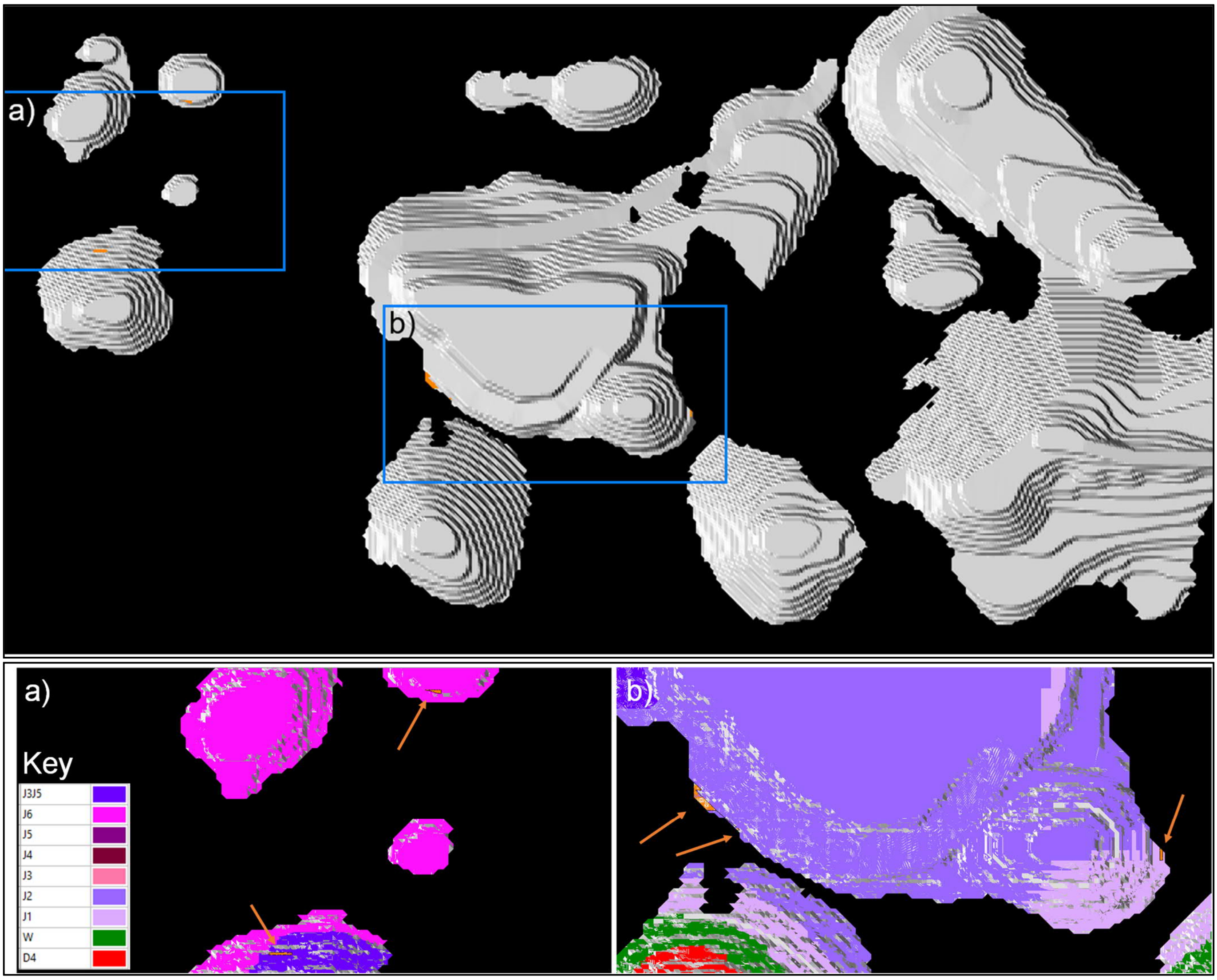


Figure 3-137 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC P5 pit wall around the exposure areas (lower image).

__Deposit P6__

The MAC Deposit P6 pit contained ~6,600 m^2 of potential exposures of AMD2 material representing ~0.3% of the total surface area of the Deposit P6 pit shell (Figure 3-138). The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest.

These exposure areas were at depths between 680 and 796 m RL. The exposure area in Figure 3-138a was at the pit crest. The exposure areas in Figure 3-138b, Figure 3-138d and the western exposure area in Figure 3-138c were at or just below the outer pit crest. The eastern exposure area in Figure 3-138c was at the top of an internal pit crest.

The exposure areas were within the J2 - J1 (2%), J1/W (34%), and D4 - D1 (66%) stratigraphic units (Figure 3-138).

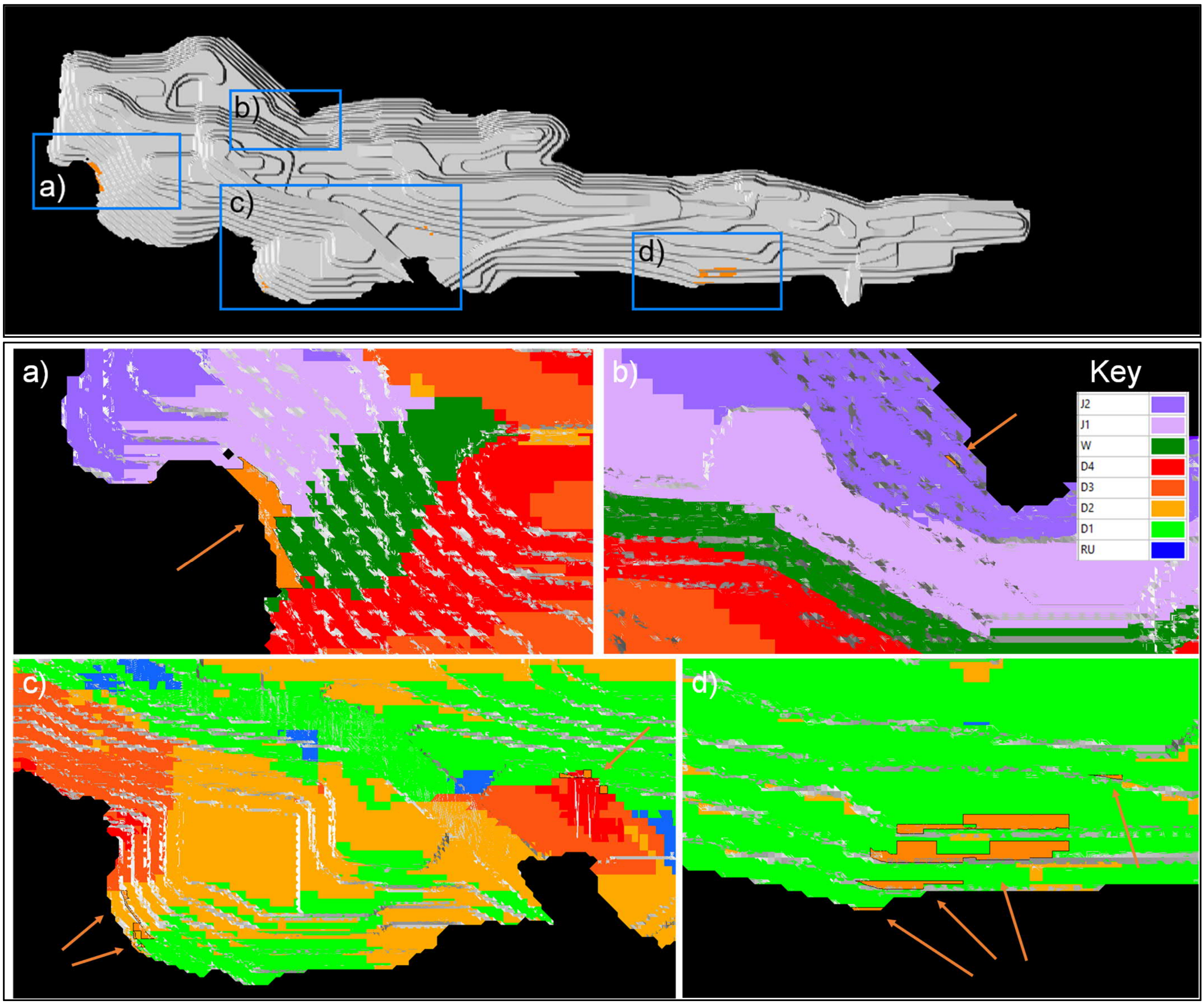


Figure 3-138 Location of potential exposures of AMD2 material (orange areas, upper image), and the stratigraphy of the MAC P6 pit wall around the exposure areas (lower image).

3.1.3.3 South Flank

Grand Central

The SF Grand Central deposit pits contained ~113,100 m^2 of potential exposures of AMD2 and 10,100 m^2 of potential AMD3 material (Figure 3-139) representing in total ~1.0% of the total surface area of the Grand Central pits. The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest.

The potential exposure areas in Figure 3-139a were within the upper half of the pit wall. The section of the pit shown in Figure 3-139b was a shallow outer bench, so several of the exposure areas in the centre of the figure were on the floor of this bench. The potential exposure areas in Figure 3-139c crest or upper half of pit wall. Exposure area on the north arm at the approximate mid-point of the pit wall. The potential exposure areas in Figure 3-139d and Figure 3-139e were across the floor of shallow outer benches. The potential exposure areas in Figure 3-139f were at the crest of upper half of pit wall.

AMD2 exposure areas were within the WA1-WA2 (8%), N1-N3 (68%), MU (<1%),MM/N1 (3%), and MM (21%) stratigraphic units. AMD3 exposure areas were within the GS3/WP3 (46%) and VB2 (54%) stratigraphic units.

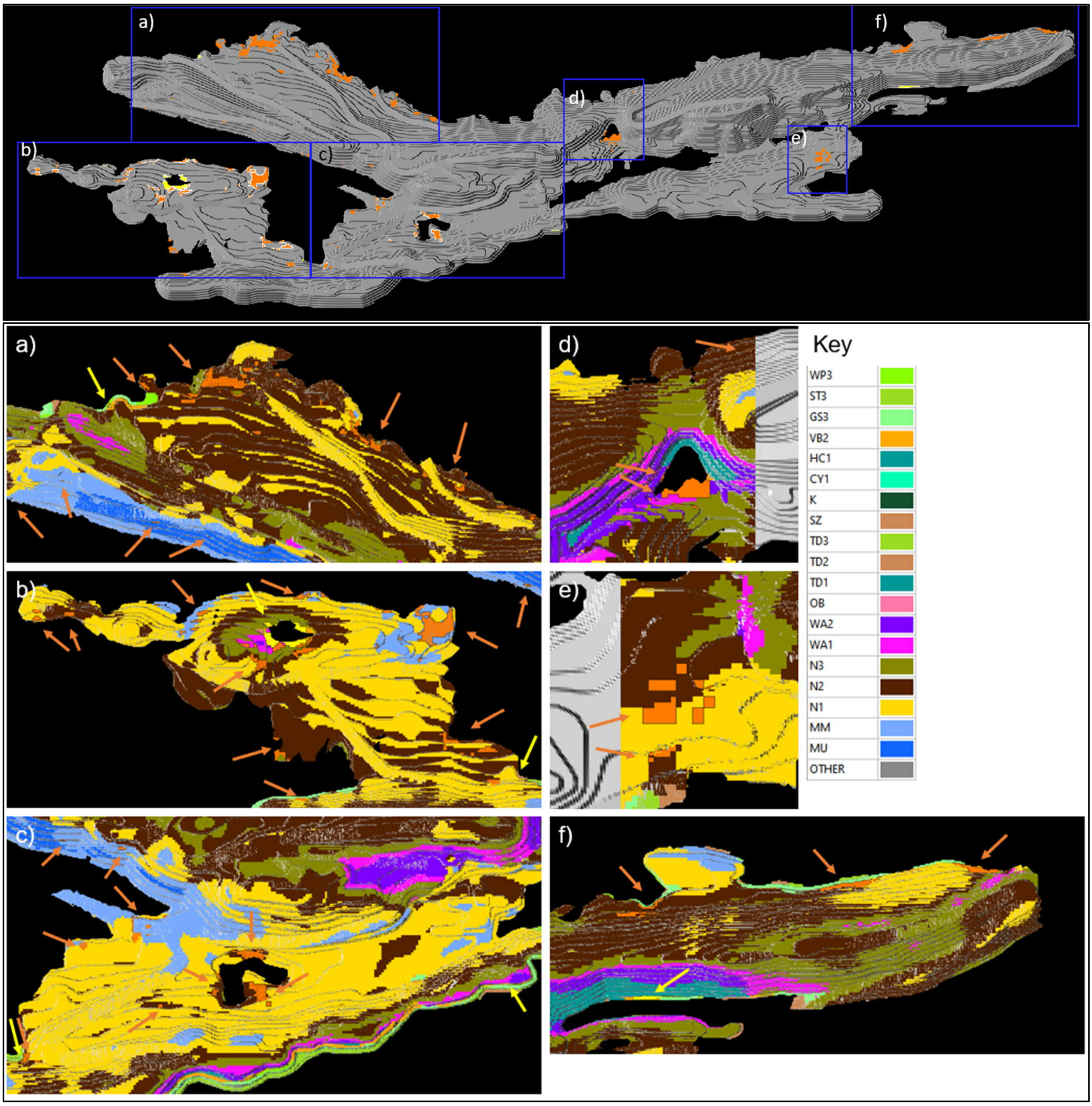


Figure 3-139 Location of potential exposures of AMD2 material (orange areas), AMD3 material (yellow areas) (upper image), and the stratigraphy of the Grand Central pit wall around the exposure areas (lower image).

<u>**Highway**</u>

The SF Highway deposit pits contained ~66,400 m^2 of potential exposure areas of AMD2 and ~1000 m^2 of potential AMD3 material (Figure 3-140) representing in total ~0.8% of the total surface area of the Highway Deposit pit shells. The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest and/or on the floor of shallow benches.

In general, the potential exposure areas along the north wall in Figure 3-140a were at the crest or the upper half of the pit wall and exposure areas along the south wall were within the lower half of the pit wall and occasionally along the pit floor. This section of the pit was very shallow so exposures on the pit wall were not at depth.

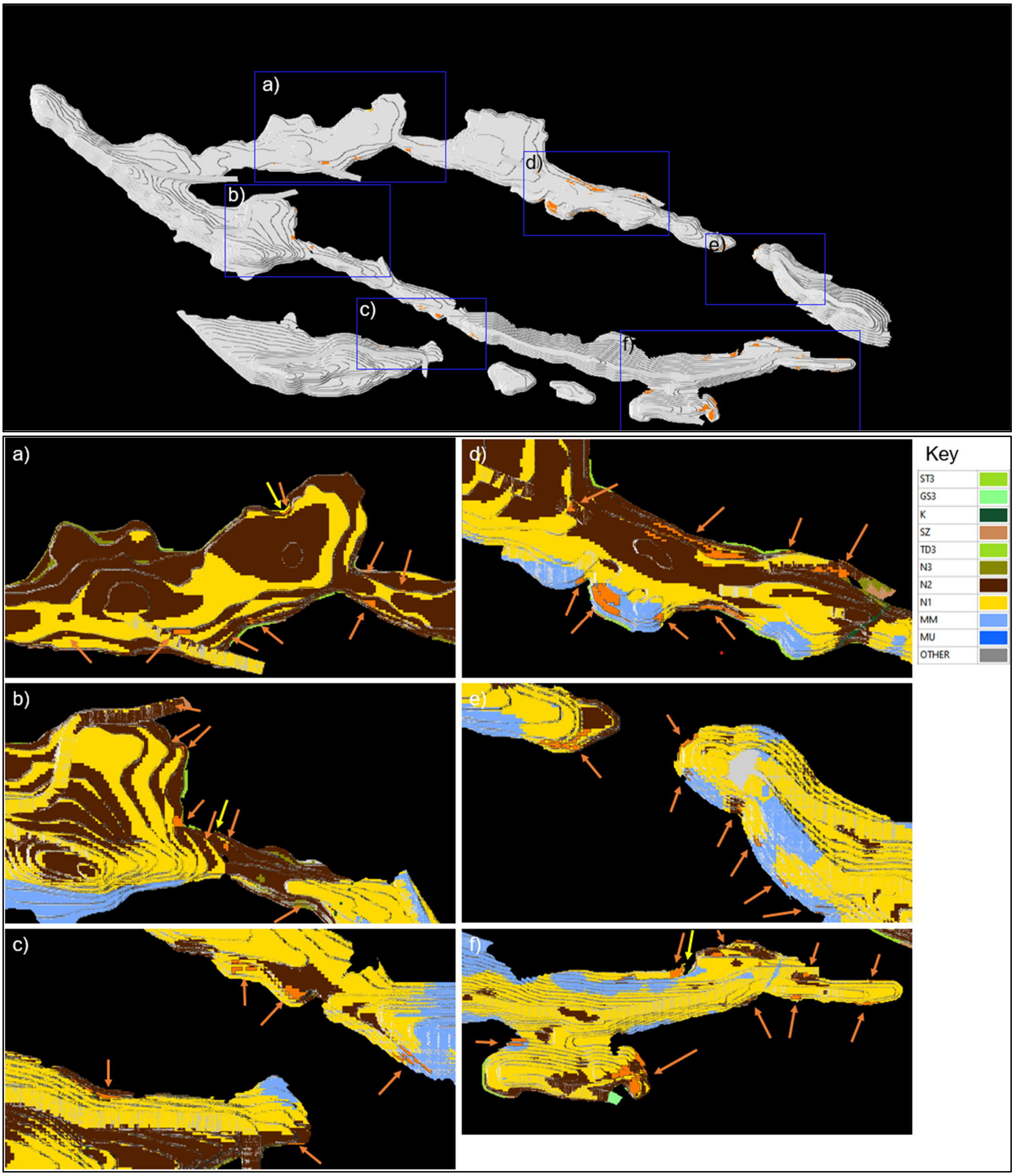


Figure 3-140 Location of potential exposures of AMD2 material (orange areas), AMD Class 3 material (yellow areas with arrow) (upper image), and the stratigraphy of the Highway pit wall around the exposure areas (lower image).

The potential exposure areas were at the pit crest or within the upper half of the pit wall. The AMD2 exposure areas at the centre of the figure, where the pit becomes shallow and narrow, were within the lower half of the pit wall, but this was not at depth. The potential exposure areas in northern section of the main pit in Figure 3-140c were at the approximate midpoint of the pit wall, whereas the exposure areas in the southern section of the main pit in this figure and in the satellite pit were at the pit crest or upper half of the pit wall. Within the satellite pit, the pre-mining water table height was modelled to be at depth of 665 m RL.

The exposure area along the north wall extended to a minimum depth of 692 m RL. The majority of potential exposure areas in Figure 3-140d were within the lower half of the pit wall or along the pit floor. The easternmost exposures along the north and south walls were at the pit crest and upper half of the pit wall. The potential exposure areas in Figure 3-140e were at the pit crest and within the upper half of the pit wall. The potential exposure areas in Figure 3-140f were mostly within the upper half of the pit wall, although in the sections where there were shallow outer benches, some exposure areas were across the floor of these shallow benches.

AMD2 exposure areas were within the N3 (1%), N2 (52%), N2/N1 (6%), N1 (19%) and MM (22%) stratigraphic units.

AMD3 exposure areas were within the TD3 (75%) and SZ (25%) stratigraphic units.

Deposit R

The SF Deposit R pits contained an inconsequential amount equal to ~ 1,100 m^2 of potential exposures of AMD3 material representing <0.02% of the total pit shell surface area for the Deposit R pits (Figure 3-141).

These exposure areas were at depths between 518 and 538 m RL. The exposure area in Figure 3-141a was at the bottom of the northwest wall and the exposure area in Figure 3-141b was in the lower half of the north wall, below an intermediary bench. Both of these exposures were below the pre-mining water table.

The exposure area in Figure 3-141a comprised a section of exposed LT2 (lignite clay). The exposure area in Figure 3-141b was within the VB2 (vuggy breccia) stratigraphic unit.

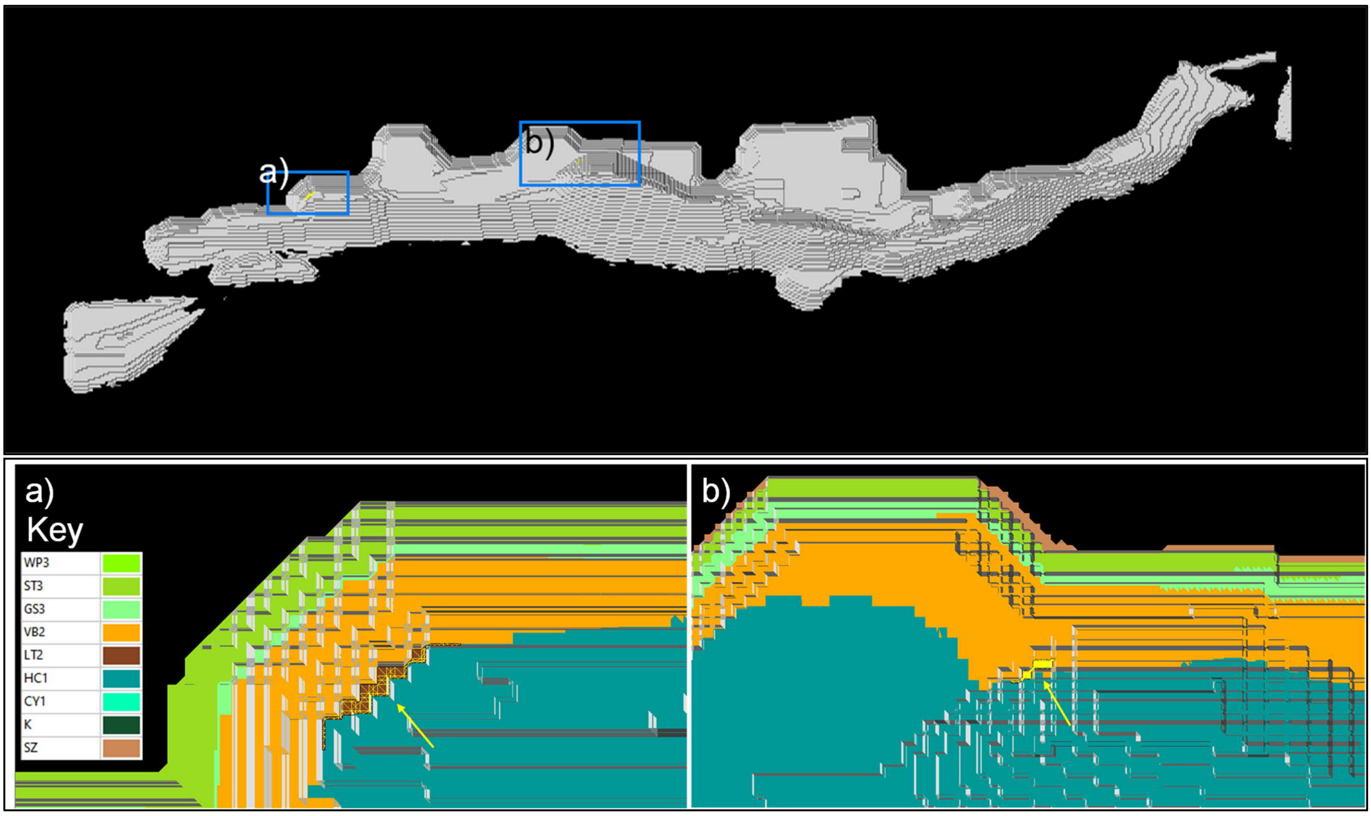


Figure 3-141 Location of potential exposures of AMD3 material (yellow areas, upper image), and the stratigraphy of the Deposit R pit wall around the exposure areas (lower image).

Vista Oriental

The SF Vista Oriental pits contained ~82,700 m^2 of potential exposures of AMD2 and Class 3 material (Figure 3-142) representing ~0.7% of the total surface area of the Vista Oriental pits. The vast majority of these exposures are located within the upper sections of the pit, and/or near the pit crest and/or on the floor of shallow benches.

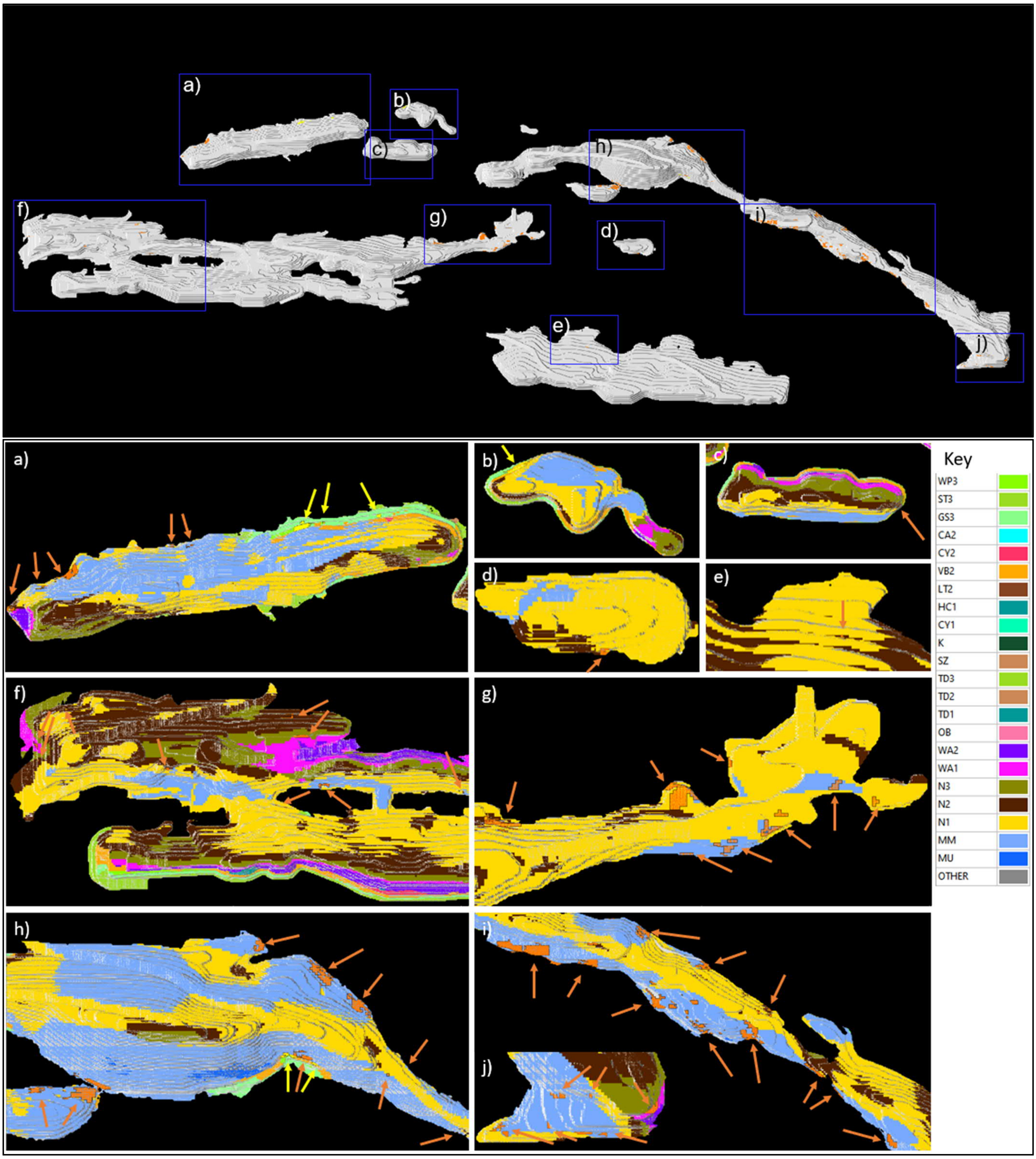


Figure 3-142 Location of potential exposures of AMD2 material (orange areas), AMD3 material (yellow areas) (upper image), and the stratigraphy of the Vista Oriental pit wall around the exposure areas (lower image).

Potential exposures areas in Figure 3-142a-e were at the pit crest or within the upper half of the pit wall. The majority of potential exposures areas in Figure 3-142f were also at the pit crest (including around internal pit crests) or within the upper half of the pit wall. The exposure area in the centre of Figure 3-142f was within the lower half of the pit wall. Additionally, the exposure area in the north east corner, within the WA1 stratigraphic unit, was on the floor of a shallow outer bench. The section of the pit shown in Figure 3-142g is a shallow outer bench so exposure areas in this figure were located at the pit crest, several sections of the pit wall and across the floor of this shallow bench. The majority of exposures areas in Figure 3-142h were at the pit crest or within the upper half of the pit wall. One exposure area in the south east corner of the figure was on the floor of a shallow section of the pit which joins larger, deeper sections of the pit. The section of the pit Figure 3-142i contains many exposure areas covering the pit wall from the crest to the pit floor and several exposure areas on the pit floor. The potential exposures areas along the south wall and southwest tip of the pit in Figure 3-142j were at the pit crest or within the upper half of the pit wall. The walls descended steeply and the floor of the pit was modelled to be below the water table. The height of the modelled pre-mining water table is between 620 m RL to 610 m RL at the base of the pit. The row of exposure areas in the middle of the figure were in the lower half of the pit wall at a minimum depth of 624 m RL.

Potential exposure areas of AMD2 material were within the WA1-WA2 (3%), N1-N3 (10%), N1/MM (12%) and MM (76%) stratigraphic units. Potential exposure areas of AMD3 material were within the GS3 & WP3 (45%) and VB (55%) stratigraphic units.

3.1.3.4 Summary

A breakdown of each AMD Class per stratigraphic unit is given in Figure 3-143 for MAC deposits and in Figure 3-144 for SF deposits.

Key findings from the surface exposure assessment are:

- A single potential exposure of AMD Class 1 material was found within the MAC E Deposit pit. This exposure was on the floor of the pit within the WA2 stratigraphic unit. This exposure covered an area of ~800 m^2.
- Potential exposures of AMD Class 2 material were within all pits, with the exception of MAC A, MAC D and SF R Deposits. Within the MAC North Flank and SF deposits, these exposures were predominantly within the MM and N1-N3 stratigraphic units. Within the MAC P1E, P1W and P6 these exposures were predominantly within the Dales Gorge Member (D1-D4). Within the MAC P2-P5, these exposures were within the Joffree Member (J1-J6).
- Potential exposures of AMD Class 3 material were within the pits for MAC B (6,500 m^2), MAC P1W (1,000 m^2) and all four South Flank deposits (Grand Central: 10,100 m^2, Highway: 1,000 m^2, R Deposit: 1,100 m^2, and Vista Oriental: 5,500 m^2). These exposure areas were within the TD3 (ST3, WP3, GS3), TD2 (VB2, LT2), TD1 (HC1) and SZ stratigraphic units. Some blocks within the mining model, and therefore exposure areas within these blocks were classified as AMD Class 2 but were also modeled to be within the WA1 and N3 (Grand Central), N2 (Highway) and MM (Vista Oriental) stratigraphic units.

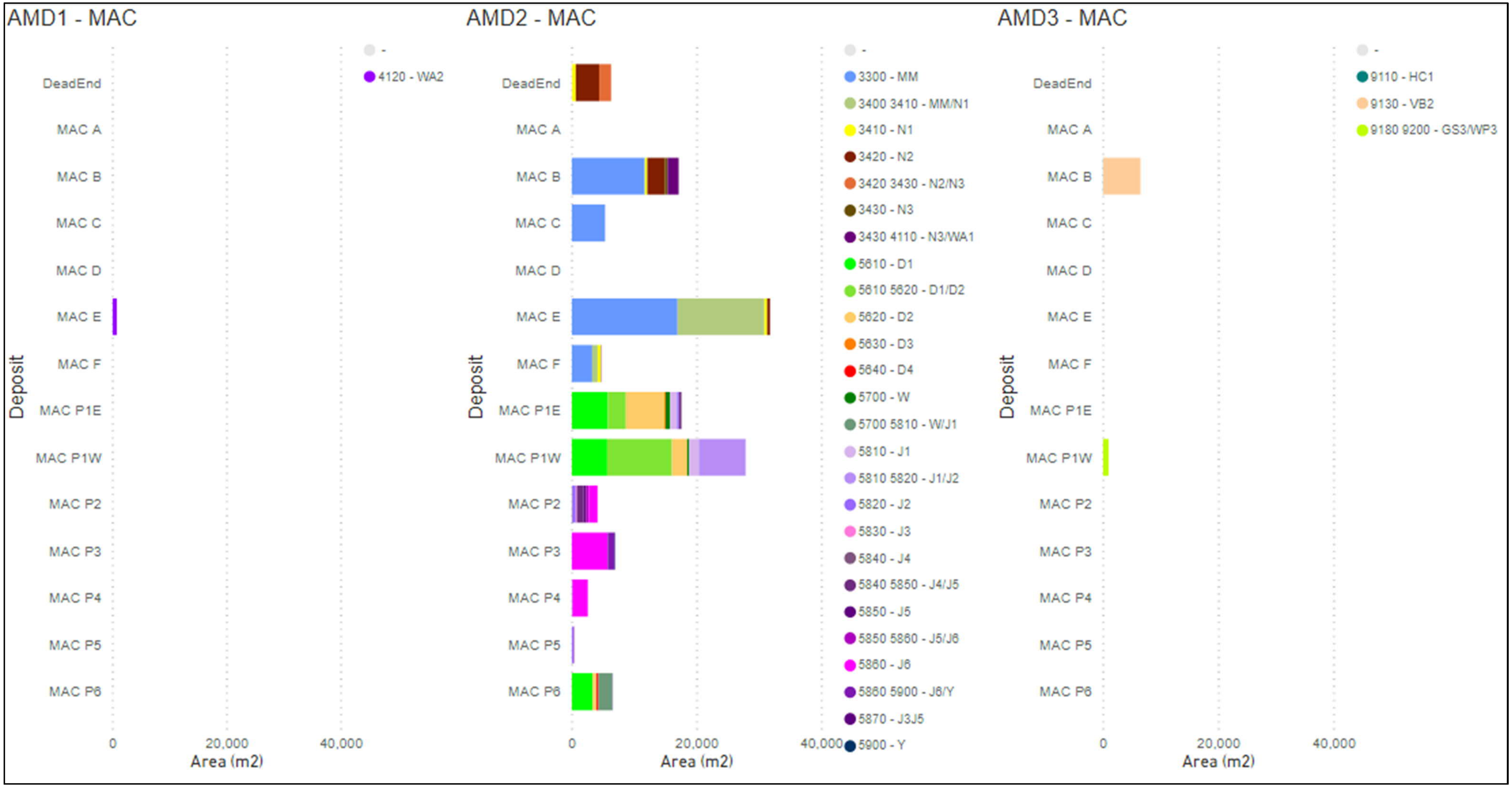


Figure 3-143 Stratigraphy of AMD Class 1-3 exposure areas for MAC deposits

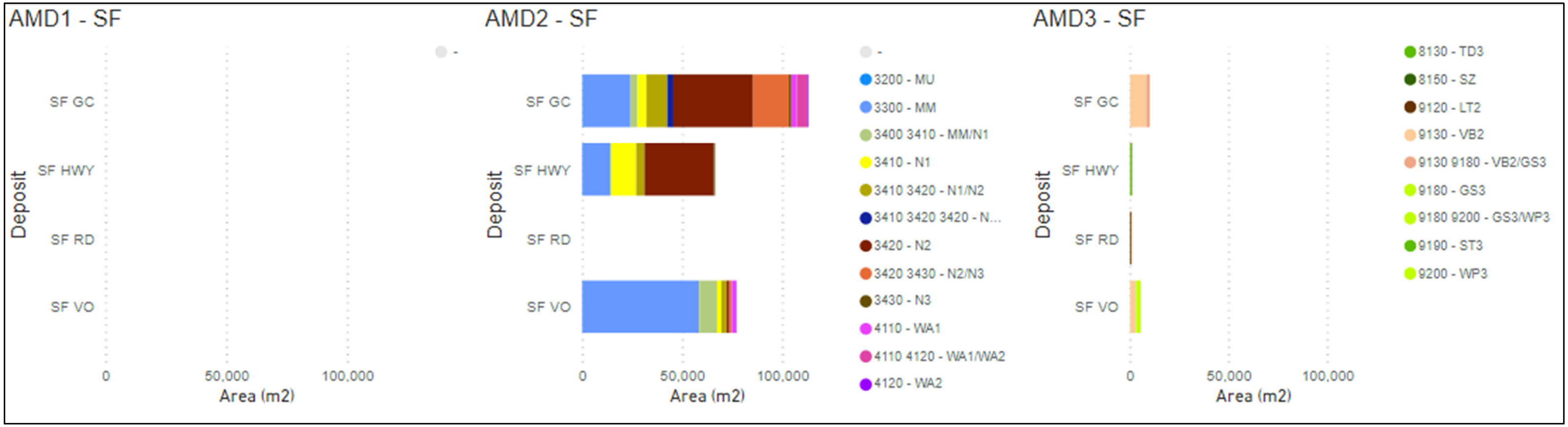


Figure 3-144 Stratigraphy of AMD Class 1-3 exposure areas for SF deposits

3.2 Metalliferous and Saline Drainage Potential

All the MAC and SF deposits contain very low or low sulphur as indicated by the mining block model data (section 3.1.1), thus NMD/SD is not expected to be a hazard for the vast majority of the waste rock and low-grade ore. The waste rock and low-grade ore with total sulphur ≥ 0.5% and appreciable ANC would represent a potential NMD or SD risk should oxidation occur, and generated acidity was neutralised.

The volume of AMD0 waste with total sulphur ≥ 0.5% are presented in Table 3-99 for MAC (Packsaddle and North Flank) deposits and in Table 3-100 for South Flank deposits, respectively.

Table 3-99 Volume of AMD0 (NAF) waste blocks from MAC deposits where total sulphur ≥ 0.5%

Formation	Deposit	As-mined (m^3)		To-be-mined (m^3)		Sum (m^3)	% of total AMD0 volume
		Waste rock	LGO	Waste rock	LGO		
Packsaddle – Brockman	All	0	0	0	0	0	0%
North Flank - Marra Mamba	All #	128,400 *	0	0	0	128,400	0.12%
Sum		128,400	0	0	0	128,400	

*Note: # only from C deposit, * all MU stratigraphy.*

Table 3-100 Volume of AMD0 (NAF) waste blocks from SF deposits where total sulphur ≥ 0.5%

Formation	Deposit	As-mined (m^3)		To-be-mined (m^3)		Sum (m^3)	% of total AMD0 volume
		Waste rock	LGO	Waste rock	LGO		
South Flank - Marra Mamba	Highway	0	0	2,400	1,200	3,600	0.003%
	Grand Central	6,400	400	18,800	0	25,600	0.015%
	Vista Oriental	0	0	2,000	0	2,000	0.001%
	R deposit	0	0	116,400	800	117,200	0.092%
Sum		6,400	400	139,600	2,000	148,400	

Key findings are summarised as follows:

- The block models of MAC Packsaddle deposits (Brockman Iron Formation) don't predict any as-mined or to-be-mined AMD0 (NAF) blocks with sulphur ≥ 0.5%.
- Of all the block models of MAC North Flank deposits (Marra Mamba Iron Formation), only an insignificant volume equal to 128,400 m^3 from C deposit (as-mined MU waste rock) show total S ≥ 0.5%. These MU waste rocks, stored in the ex-pit OSA (CD_IS03), only comprise 0.12% of total LoA AMD0 waste and represent low risk of NMD/SD hazard for C deposit.
- The block models for South Flank deposits predict a total volume of 6,800 m^3 as-mined AMD0 waste and a total volume of 141,600 m^3 to-be-mined AMD0 waste where weighted average sulphur is ≥ 0.5%. The proportion of AMD0 waste blocks with sulphur ≥ 0.5% to the total LoA AMD0 waste volume is typically negligible for each deposit (<0.1%, Table 3-100). Overall, the low abundance of these S-rich NAF waste suggests low NMD/SD risk for South Flank deposits. The volume of AMD0 waste blocks are presented in Table 3-101 as a function of stratigraphy.
  - For Highway deposit, the 3,600 m^3 to-be-mined AMD0 waste with sulphur ≥ 0.5% only represents 0.003% of the LoA AMD0 waste volume, and contains 55.6% SZ, 11.1% N3 and 33.3% N1.
  - For Grand Central deposit, a total volume of 25,600 m^3 AMD0 waste (6,800 m^3 as-mined and 18,800 m^3 to-be-mined) has total sulphur ≥ 0.5%, representing 0.015% of total LoA AMD0 waste volume, with the majority from WA2/WA1 (64.1%) and smaller portions from Tertiary Detritals (34.4% VB2, HC1 and CY1) and Marra Mamba Iron Formation (1.6% N3).
  - For Vista Oriental deposit, an insignificant volume of 2,000 m^3 to-be-mined AMD0 waste is identified to have total sulphur above 0.5%, which represents 0.001% of total LoA AMD0 waste volume, and consists of VB2 (40%), HC1 (20%), and WA1-2 (40%) stratigraphies.

– For R deposit, a total volume of 117,200 m^3 AMD0 waste (predominately to-be-mined waste rock) shows total sulphur ≥ 0.5%, representing 0.092% of total LoA AMD0 waste volume and dominated by VB2 stratigraphy.

Table 3-101 Volume of AMD0 (NAF) waste blocks from SF where total sulphur ≥ 0.5% as a function of stratigraphy

Deposit	Strat	As-mined (m^3)		To-be-mined (m^3)		Sum (m^3)	% of total AMD0 volume
		Waste rock	LGO	Waste rock	LGO		
Highway	8150 - SZ	0	0	2,000	0	2,000	55.6%
	3430 - N3	0	0	400	0	400	11.1%
	3410 - N1	0	0	0	1,200	1,200	33.3%
	Sum	0	0	2,400	1,200	3,600	
Grand Central	9130 - VB2	0	0	5,600	0	5,600	21.9%
	9110 - HC1	2,800	0	0	0	2,800	10.9%
	9100 - CY1	400	0	0	0	400	1.6%
	4120 - WA2	2,000	0	12,800	0	14,800	57.8%
	4110 - WA1	1,200	0	400	0	1,600	6.3%
	3430 - N3	0	400	0	0	400	1.6%
	Sum	6,400	400	18,800	0	25,600	
Vista Oriental	9130 - VB2	0	0	800	0	800	40.0%
	9110 - HC1	0	0	400	0	400	20.0%
	4120 - WA2	0	0	400	0	400	20.0%
	4110 - WA1	0	0	400	0	400	20.0%
	Sum	0	0	2,000	0	2,000	
R deposit	9130 - VB2	0	0	116,000	800	116,800	99.7%
	9110 - HC1	0	0	400	0	400	0.3%
	Sum	0	0	116,400	800	117,200	

The environmental geochemistry data associated with the stratigraphies listed in Table 3-101 suggest that the majority of the ABA samples demonstrate a "barren" characteristics – very low sulphur (<0.1%) and low ANC (<10 kg H_2SO4/t), and none of the NAF and UC(NAF) samples have both total sulphur ≥ 0.5 wt% and high ANC, as presented in Figure 3-145. Only one WA2 waste rock sample (from B deposit ex-pit drill hole) show total sulphur of 0.41 wt% and ANC of 104 kg H_2SO_4/t, however, no leach test was conducted on this sample.

With the entire MAC/SF environmental geochemistry samples taken into account, the short-term leach test results of AMD0 (NAF) indicate that:

- Release of salinity from AMD0 (NAF) materials is likely to be limited, and
- Leachate generally does not contain elevated concentrations of elements that are of environmental concern.

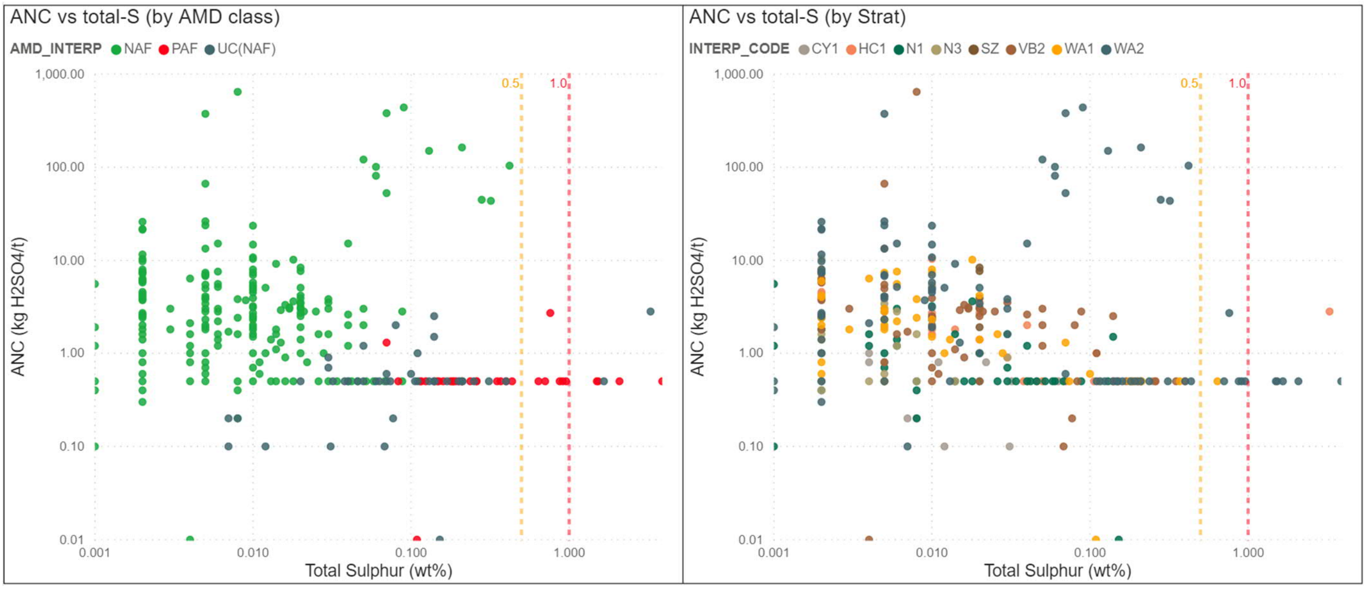


Figure 3-145 ANC vs Total Sulphur (ABA samples)

3.3 Potential Hazard Source Ranking

3.3.1 MAC North Flank

A deposit

It is noted that AMD source hazard of the waste rock / low-grade ore and pit surface is considered negligible for A deposit due to the following:

- LoA waste are completely AMD0.
- None of any AMD1-3 exposure is identified on the pit wall of A deposit.

B deposit

For MAC B deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low-moderate
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.12% (or 44,800 m^3) and 1.56% (or 730,800 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - AMD3 waste comprises 0% (or 0 m^3) and 1.53% (or 716,400 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 1,492,000 m^3, representing 1.78% of the total LoA waste materials for B deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of B deposit.
  - A total exposure area of 23,700 m^2 AMD material (17,200 m^2 AMD2 and 6,500 m^2 AMD3) representing ~0.50% of the total pit surface area (4,516,900 m^2) for B deposit.

C deposit

For MAC C deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.

- AMD2 waste comprises appx. 0.56% (or 337,200 m^3) and 1.02% (or 480,400 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
- No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
- The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 817,600 m^3, representing 0.76% of the total LoA waste materials for C deposit.

- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of C deposit.
  - An inconsequential exposure of 5,400 m^2 AMD2 material representing ~0.2% of the total pit surface area (3,468,800 m^2) for C deposit.
  - No AMD3 exposure on the pit wall of C deposit.

D deposit

It is noted that AMD source hazard of the waste rock / low-grade ore and pit surface is considered negligible for D deposit due to the following:

- LoA waste are completely AMD0.
- None of any AMD1-3 exposure are identified on the pit wall of D deposit.

E deposit

For MAC E deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.07% (or 98,800 m^3) and 0.60% (or 307,600 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - AMD3 waste comprises 0% (or 0 m^3) and 0.01% (or 6,400 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 412,800 m^3, representing 0.21% of the total LoA waste materials for E deposit.
- Pit surface - source hazard risk low-moderate
  - A negligible exposure of 800 m^2 AMD1 material on the pit wall of E deposit.
  - 31,800 m^2 of AMD2 exposure representing ~0.48% of the total pit surface area (6,739,300 m^2) for E deposit.
  - No AMD3 exposure on the pit wall of E deposit.

F deposit

For MAC F deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.50% (or 62,000 m^3) and 8.02% (or 722,000 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 784,000 m^3, representing 3.66% of the total LoA waste materials for F deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of F deposit.
  - An inconsequential exposure of 4,700 m^2 AMD2 material representing ~0.30% of the total pit surface area (1,765,500 m^2) for F deposit.

- No AMD3 exposure on the pit wall of F deposit.

Deadend deposit

For MAC Deadend deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.02% (or 2,400 m^3) and 0.84% (or 75,600 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 78,000 m^3, representing 0.42% of the total LoA waste materials for Deadend deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of Deadend deposit.
  - An inconsequential exposure of 6,300 m^2 AMD2 material representing ~0.40% of the total pit surface area (1,737,600 m^2) for Deadend deposit.
  - No AMD3 exposure on the pit wall of Deadend deposit.

3.3.2 MAC Packsaddle

P1W deposit

For MAC P1W deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low-moderate
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.67% (or 531,600 m^3) and 0.53% (or 930,800 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - AMD3 waste comprises 0% (or 0 m^3) and 0.01% (or 18,000 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 1,480,400 m^3, representing 0.58% of the total LoA waste materials for P1W deposit.
- Pit surface - source hazard risk low-moderate
  - No AMD1 exposure on the pit wall of P1W deposit.
  - A total exposure area of 28,900 m^2 AMD material (27,900 m^2 AMD2 and 1,000 m^2 AMD3) representing ~0.40% of the total pit surface area (6,541,800 m^2) for P1W deposit.

P1E deposit

For MAC P1E deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.47% (or 118,400 m^3) and 1.94% (or 405,200 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 524,000 m^3, representing 1.14% of the total LoA waste materials for P1E deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of P1E deposit.

- 17,600 m^2 of AMD2 exposure representing ~0.60% of the total pit surface area (2,959,700 m^2) for P1E deposit.
- No AMD3 exposure on the pit wall of P1E deposit.

P2 deposit

For MAC P2 deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.58% (or 75,200 m^3) and 0.77% (or 121,600 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 196,800 m^3, representing 0.68% of the total LoA waste materials for P2 deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of P2 deposit.
  - An inconsequential exposure of 4,200 m^2 AMD2 material representing ~0.30% of the total pit surface area (1,345,000 m^2) for P2 deposit.
  - No AMD3 exposure on the pit wall of P2 deposit.

P3 deposit

For MAC P3 deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.03% (or 17,200 m^3) and 0.42% (or 176,000 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 193,200 m^3, representing 0.20% of the total LoA waste materials for P3 deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of P3 deposit.
  - An inconsequential exposure of 7,000 m^2 AMD2 material representing ~0.20% of the total pit surface area (4,431,100 m^2) for P3 deposit.
  - No AMD3 exposure on the pit wall of P3 deposit.

P4 deposit

For MAC P4 deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.02% (or 6,800 m^3) and 0.31% (or 142,000 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 148,800 m^3, representing 0.17% of the total LoA waste materials for P4 deposit.
- Pit surface - source hazard risk low
  - No AMD1 exposure on the pit wall of P4 deposit.

– An inconsequential exposure of 2,600 m^2 AMD2 material representing <0.1% of the total pit surface area (3,813,500 m^2) for P4 deposit.

– No AMD3 exposure on the pit wall of P4 deposit.

<u>P5 deposit</u>

For MAC P5 deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  – No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  – AMD2 waste comprises appx. 0% (or 0 m^3) and 1.42% (or 424,800 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  – No AMD3 waste is identified from LoA waste rock / low-grade ore volume.
  – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 424,800 m^3, representing 0.88% of the total LoA waste materials for P5 deposit.
- Pit surface - source hazard risk low
  – No AMD1 exposure on the pit wall of P5 deposit.
  – A negligible exposure of 400 m^2 AMD2 material representing <0.1% of the total pit surface area (2,082,100 m^2) for P5 deposit.
  – No AMD3 exposure on the pit wall of P5 deposit.

<u>P6 deposit</u>

For MAC P6 deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  – No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  – AMD2 waste comprises appx. 2.59% (or 417,600 m^3) and 1.74% (or 501,200 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  – AMD3 waste comprises 0% (or 0 m^3) and 0.02% (or 6,800 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  – The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 925,600 m^3, representing 2.06% of the total LoA waste materials for P6 deposit.
- Pit surface - source hazard risk low
  – No AMD1 exposure on the pit wall of P6 deposit.
  – An inconsequential exposure of 6,600 m^2 AMD2 material representing ~0.30% of the total pit surface area (1,916,900 m^2) for P6 deposit.
  – No AMD3 exposure on the pit wall of P6 deposit.

3.3.3 South Flank

<u>Highway deposit</u>

For Highway deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low-moderate
  – No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  – AMD2 waste comprises appx. 0.28% (or 232,000 m^3) and 3.98% (or 2,269,200 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  – AMD3 waste comprises 0.14% (or 119,200 m^3) and 0.15% (or 84,800 m^3) of the total waste rock and low-grade ore for the LoA, respectively.

- The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 2,705,200 m^3, representing 1.92% of the total LoA waste materials for Highway deposit.

- Pit surface - source hazard risk low-moderate
  - No AMD1 exposure on the pit wall of Highway deposit.
  - A total exposure area of 67,400 m^2 AMD material (66,400 m^2 AMD2 and 1,000 m^2 AMD3) representing ~0.80% of the total pit surface area (8,157,600 m^2) for Highway deposit.

Grand Central deposit

For Grand Central deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk moderate-high
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 3.19% (or 3,657,200 m^3) and 6.24% (or 4,572,400 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - AMD3 waste comprises 1.97% (or 2,261,600 m^3) and 2.70% (or 1,973,600 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 12,464,800 m^3, representing 6.63% of the total LoA waste materials for Grand Central deposit. Note that the AMD2-3 waste volume and percentage make the source hazard ranking as moderate-high (Table 2-3), however, this ranking is conservative because the volume of AMD2-3 material is over-estimated by the block model assuming all sulphur present is pyrite, and (some of) the low-grade ore could be blended and shipped out of site.
- Pit surface - source hazard risk low-moderate
  - No AMD1 exposure on the pit wall of Grand Central deposit.
  - A total exposure area of 123,100 m^2 AMD material (113,000 m^2 AMD2 and 10,100 m^2 AMD3) representing ~1.00% of the total pit surface area (11,905,600 m^2) for Grand Central deposit.

Vista Oriental deposit

For Vista Oriental deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low-moderate
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0.97% (or 1,279,600 m^3) and 2.96% (or 2,770,400 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - AMD3 waste comprises 0.25% (or 326,400 m^3) and 0.87% (or 819,200 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 5,195,600 m^3, representing 2.31% of the total LoA waste materials for Vista Oriental deposit.
- Pit surface - source hazard risk low-moderate
  - No AMD1 exposure on the pit wall of Vista Oriental deposit.
  - A total exposure area of 82,700 m^2 AMD material (77,200 m^2 AMD2 and 5,500 m^2 AMD3) representing ~0.70% of the total pit surface area (11,355,600 m^2) for Vista Oriental deposit.

R deposit

For SF R deposit, the following key potential source hazards are identified:

- Waste (ex-pit / in-pit OSAs) - source hazard risk low
  - No AMD1 waste is identified from LoA waste rock / low-grade ore volume.
  - AMD2 waste comprises appx. 0% (or 0 m^3) and <0.01% (or 2,000 m^3) of the total waste rock and low-grade ore for the LoA, respectively.

  - AMD3 waste comprises 0.10% (or 67,600 m^3) and <0.01% (or 400 m^3) of the total waste rock and low-grade ore for the LoA, respectively.
  - The total LoA volume of AMD2-3 waste (waste rock and low-grade ore combined) is 70,000 m^3, representing 0.05% of the total LoA waste materials for R deposit.
- Pit surface - source hazard risk low
  - No AMD1 or AMD2 exposure on the pit wall of R deposit.
  - A negligible exposure of 1,100 m^2 AMD2 material representing <0.1% of the total pit surface area (4,484,600 m^2) for R deposit.

4 Source-Pathway-Receptor Risk Analysis

BHP's Risk Framework (BHP, 2018a) was used to identify AMD risks at MAC and SF. Severity and likelihood (current risk) tables from BHP's Risk Management OR (Figure 4-1; BHP, 2019c) were used to determine the maximum foreseeable loss and enable the calculation of the residual risk rating.

Severity Level	Descriptor	Severity Factor
5	6 or more fatalities or 6 or more chronic life threatening illnesses; or Severe impact to the environment and where recovery of ecosystem function takes 10 years or more; or Severe impact on community lasting more than 12 months or a substantiated human rights violation impacting 6 or more people; or Severe impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a global level; or US$2 billion or more[2].	1000
4	1-5 fatalities or 1-5 chronic life threatening illnesses; or Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years; or Serious impact on community lasting 6-12 months or a substantiated human rights violation impacting 1-5 persons; or Serious impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a national level; or Between US$250 million and up to US$2 billion[2].	300
3	Life altering or long term/permanent disabling injury or illness to one or more persons; or Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years; or Substantial impact on community lasting 2-6 months; or Substantial impact on company reputation, legal rights or compliance, social value proposition, or ability to access opportunities at a sub national level (state, territory, province); or Between US$50 million and up to US$250 million[2].	100
2	Non-life altering or short-term disabling injury or illness to one or more persons; or Measureable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year; or Measureable but limited community impact lasting less than one month; or Measureable but limited impact on company reputation, legal rights or compliance, or social value proposition at a local level (region, city, town); or Between US$2 million and up to US$50 million[2].	30
1	Low level impact resulting in first aid only; or Minor, temporary impact to the environment, where the ecosystem recovers with little intervention; or Minor, temporary community impact that recovers with little intervention; or Minor, temporary impact on company reputation, legal rights or compliance, or social value proposition; or Less than US$2 million[2].	10

Uncertainty	Frequency	Likelihood factor
Highly Likely	Likely to occur within a 1 year period.	3
Likely	Likely to occur within a 1 - 5 year period.	1
Probable	Likely to occur within a 5 - 20 year period.	0.3
Unlikely	Likely to occur within a 20 - 50 year period.	0.1
Highly Unlikely	Not likely to occur within a 50 year period.	0.03

Likelihood	Severity Level				
	1	2	3	4	5
Highly Likely	30	90	300	900	3000
Likely	10	30	100	300	1000
Probable	3	9	30	90	300
Unlikely	1	3	10	30	100
Highly Unlikely	0.3	0.9	3	9	30

Figure 4-1 BHP Risk Management tables used to assign severity (upper plate), likelihood (middle plate), and risk (lower plate)

For the source-pathway-receptor (SPR) assessment, the following risk events are assessed:

- Uncontrolled release of AMD from ex-pit WRD due to stored AMD Class 1, AMD Class 2, and/or AMD Class 3 material;
- Uncontrolled release of AMD from in-pit WRD due to stored AMD Class 1, AMD Class 2, and/or AMD Class 3 material;

- AMD Class 1, AMD Class 2, and/or AMD Class 3 material exposed on pit surfaces during operations; and
- AMD Class 1, AMD Class 2, and/or AMD Class 3 material exposed on pit surfaces post closure.

A preliminary SPR assessment has been developed with pathway and receptor inputs taken from early phase studies (Section 1.2). The suitability of the identified pathways and receptors may be subject to further update once more studies are completed in the future.

The source hazard component of the SPR risk assessment is summarised in Table 4-1. Pathways and receptors considered in the SPR assessment at MAC and SF are described in detail in section 1.2.

Potential receptors include:

- Weeli Wolli Spring: The Spring is located at a point where Weeli Wolli Creek flows through a gorge within the Wildflower Range. The Spring area is recognised as having multiple ecological values and has been listed as a Priority 1 PEC. The community is described as fringing forest or woodland of *Melaleuca argentea* and *Eucalyptus camaldulensis* over trees of Coolibah and a dense shrub layer dominated by *Acacia citronoviridis*. A relatively high diversity of stygofauna is associated with the calcrete and alluvial aquifer at the Springs. The creek valley at Weeli Wolli Spring further supports a diverse bird assemble of over 60 species and a microbat assemble including the Ghost bat (*Macroderma gigas*) – a State listed species.
- Ben's Oasis: Ben's Oasis is a perennial pool along the channel of Weeli Wolli Creek where groundwater has mounded upstream of a dolerite dyke. These pools support riparian woodland and forest associations and has been designated as a Priority 1 PEC along with Weeli Wolli Spring. Limited documented information is available on the ecology of Ben's Oasis.
- Coondewanna Flats including Lake Robinson: The wetland features are located in an internally draining alluvial plain which is the terminus for surface water flow within catchment. While the Coondewanna Flats wetlands present surface water receptors, they are not considered to present groundwater receptors given significant (> 20 m below ground surface) depth to groundwater. The Flats include several vegetation communities with ecological value and is listed as a PEC. A series of sub-types have been identified including:
  - Tussock grassland *of Eriachne benthamii*, *Eulalia aurea* and *Themeda triandra* with open woodland of *Eucalyptus victrix* over shrubland of *Duma florulenta*. The vegetation type is limited to the Lake Robinson depression and corresponds with the Priority 1 PEC.
  - Open forest of *Acacia aptaneura* and *Eucalyptus victrix* over open tussock grassland of *Eulalia aurea* and *Eriachne benthamii* with open shrubland of *Duma florulenta*. The vegetation type is widespread across the Coondewanna Flats and corresponds with the Priority 3 PEC.
  - Closed forest of *Eucalyptus victrix* and *Acacia aptaneura* and over open tussock grassland of *Eriachne benthamii* and *Eulalia aurea* with open shrubland of *Duma florulenta.* The vegetation type occurs as a mosaic of discrete patches and corresponds with the Priority 3 PEC (BHP, 2017b).

Potential pathways connecting potential sources to potential receptors include:

- Seepage from OSAs and low-grade ore stockpiles to surface water or groundwater, with subsequent potential AMD transport in surface water or groundwater.
- Runoff from pit wall rock to the base of pits. Backfilling of pits could potentially result in a groundwater through flow system, with subsequent potential AMD transport by groundwater migrating away from the pits.
- Ex-pit surface water flows that have been in contact with OSAs and low-grade ore stockpiles could present pathways towards and then along Whaleback Creek and the Fortescue River.
- Surface water: Whaleback Creek, Southern Creek, and Fortescue River.
- Groundwater: Hydraulically connected to OSA seepages and/or AMD impacted pit water.

Results of the SPR assessment are summarised in Table 4-2 for ex-pit and in-pit OSAs, and in Table 4-3 for pit walls, respectively.

All identified hazards present a low risk, even prior to controls (as per the WAIO AMD Management Standard). Although not discussed within this risk assessment, BHP follow an internal AMD Management Standard that sees all AMD Class 1, AMD Class 2, and AMD Class 3 material handled in a specific way to mitigate the generation and release of AMD.

Table 4-1 Likelihood for AMD generation from mine waste and pit wall rock at MAC/SF

<table>
<tr><th>SOURCE</th><th>LIKELIHOOD</th><th colspan="2">COMMENT</th></tr>
<tr><td rowspan="2">As-mined and to-be-mined waste rock and low-grade ore</td><td rowspan="2">AD, NMD, SD

Unlikely
All North Flank and Packsaddle deposits,
All South Flank deposits except for Grand Central

Probable
Grand Central deposit *</td><td>MINING MODEL: Key findings were:
• AMD0 waste (waste rock and low-grade ore combined): Overwhelming majority of LoA waste rock and low-grade ore, across Packsaddle (99.36%), North Flank (99.35%) and South Flank (97.00%) are classified as AMD0 (NAF).
• AMD1 waste (waste rock and low-grade ore combined): Zero volume of LoA AMD1 waste is modelled across MAC/SF deposits.</td><td>• AMD2 waste (waste rock and low-grade ore combined): AMD2 waste comprise appx. 0.64% (3,868,400 m^3), 0.52% (2,861,600 m^3) and 2.17% (14,782,800 m^3) of LoA waste volume for Packsaddle, North Flank and South Flank, respectively.
• AMD3 waste (waste rock and low-grade ore combined): AMD3 waste appx. 0.004% (25,200 m^3), 0.13% (722,800 m^3) and 0.83% (5,652,800 m^3) of LoA waste volume for Packsaddle, North Flank and South Flank, respectively.</td></tr>
<tr><td>ENVIRONMENTAL GEOCHEMICAL DATASET: Key findings were:
• Overall, AMD classification correlate well with WAIO classifications, with the WAIO classification more conservative.
• The majority of waste materials from Tertiary Detritals, Brockman Iron Formation, Wittenoom Formation and Marra Mamba Iron Formation are NAF or UC(NAF) with low AMD risk potential.
– The stratigraphic units that are considered unlikely to generate or release significant AMD or NMD upon leaching include 1) Tertiary Detritals (ST3, SZ), 2) Brockman Iron Formation (Y, J4, J3, J2, J1, D3, D2), 3) Wittenoom Formation (OB), and 4) Marra Mamba Iron Formation (N3, N1).
– The stratigraphic units that are considered likely to generate or release some AMD or NMD upon leaching include higher sulphur 1) Tertiary Detritals (WP3, GS3, CY2, VB2, HC1, CY1, TD3), 2) Brockman Iron Formation (J6, J5, W, D4, D1), 3) Wittenoom Formation (WA2, WA1), and 4) Marra Mamba Iron Formation (N2, MM).</td><td>– However, for the latter stratigraphic group with some AMD/NMD potential, there is likely to be sufficient ANC in the remaining waste material to neutralise the relatively low acidity loads from some of the stratigraphic units, which are typically associated with sulphate (e.g. alunite) based on available XRD mineralogy data. In addition, AMD2-3 waste will be encapsulated such that it is not placed near the final landform surface or on natural ground to reduce AMD source hazard.
• The leachability of elements that are enriched in solid waste is generally low in response to rapid leach event regardless of the sample stratigraphical origin. .</td></tr>
</table>

SOURCE	LIKELIHOOD	COMMENT	
		NMD and SD: Key findings were: • The block models of MAC Packsaddle deposits (Brockman Iron Formation) don't predict any as-mined or to-be-mined AMD0 (NAF) blocks with weighted average sulphur ≥ 0.5%. • Of all the block models of MAC North Flank deposits (Marra Mamba Iron Formation), only an insignificant volume equal to 128,400 m^3 from C deposit (fully as-mined MU waste rock) show total S ≥ 0.5%. These MU waste rocks only comprise 0.12% of total LoA AMD0 waste and represent low risk of NMD/SD hazard for C deposit.	• The block models for South Flank deposits predict a total volume of 148,400 m^3 LoA AMD0 waste (waste rock and low-grade ore combined) with sulphur ≥ 0.5%, representing only 0.02% of the total LoA AMD0 waste volume. • Overall, the low abundance of the S-rich NAF waste suggests low NMD/SD risk across MAC and SF deposits.
Pit wall	AD, NMD, SD **Unlikely** All deposits across MAC/SF deposits	Key findings were: • AMD1: a negligible exposure of ~800 m^2 of AMD1 material on the pit wall of E deposit, representing 0.01% of total pit shell surface of E deposit. No AMD1 exposure is identified elsewhere. • AMD2: exposure area of 65,400 m^2, 66,300 m^2 and 256,600 m^2 of AMD2 material are identified on the pit wall surfaces of North Flank, Packsaddle and South Flank deposits, representing 0.28%, 0.29% and 0.71% of the total pit wall surface for each mining area, respectively.	• AMD3: exposure area of 6,500 m^2, 1,000 m^2 and 17,700 m^2 of AMD3 material are identified on the pit wall surfaces of North Flank, Packsaddle and South Flank deposits, representing 0.03%, <0.01% and 0.05% of the total pit wall surface for each mining area, respectively. • Combined AMD2-3 exposure area comprises 0.31% (72,700 m^2), 0.29% (67,300 m^2) and 0.76% (274,300 m^2) of the total pit wall surface for each mining area, respectively, suggesting low risk of AMD from pit wall material.

** Conservative estimation of the likelihood because the volume of AMD2 material is over-estimated by assuming all sulphur present is pyrite, and (some of) the low-grade ore could be blended and shipped out of site.*

Table 4-2 Risk assessment results of the likelihood of AMD generation from identified source hazards – Ex-Pit and In-Pit OSAs

Formation	Deposit	Event	Source Material	Severity Level	No Controls		Controls		AMD Class as % of total Material
					Likelihood	URR	Likelihood	RRR	
North Flank (MAC) - Marra Mamba	A deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 100%
	B deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 98.22% AMD2: 0.93% AMD3: 0.85%
	C deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.24% AMD2: 0.76%
	D deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 100%
	E deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.79% AMD2: 0.20% AMD3: <0.01%
	F deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 96.34% AMD2: 3.66%
	Deadend deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.58% AMD2: 0.42%

Formation	Deposit	Event	Source Material	Severity Level	No Controls		Controls		AMD Class as % of total Material
					Likelihood	URR	Likelihood	RRR	
Packsaddle (MAC) - Brockman Bedrock	P1W deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 99.42% AMD2: 0.58% AMD3: <0.01%
	P1E deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 98.86% AMD2: 1.14%
	P2 deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.32% AMD2: 0.68%
	P3 deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.80% AMD2: 0.20%
	P4 deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.83% AMD2: 0.17%
	P5 deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.12% AMD2: 0.88%
	P6 deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 97.94% AMD2: 2.05% AMD3: <0.02%

Formation	Deposit	Event	Source Material	Severity Level	No Controls		Controls		AMD Class as % of total Material
					Likelihood	URR	Likelihood	RRR	
South Flank - Marra Mamba	Highway	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 98.08% AMD2: 1.78% AMD3: 0.14%
	Grand Central	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	2	Probable *	9	Highly Unlikely	0.9	AMD0: 93.37% AMD2: 4.38% AMD3: 2.25%
	Vista Oriental	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 97.69% AMD2: 1.80% AMD3: 0.51%
	R deposit	Uncontrolled release of AMD from ex-pit and/or in-pit OSAs due to stored AMD2 and/or AMD3 material.	AMD0 AMD3	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.95% AMD3: 0.05%

RRR = Residual Risk Ranking; URR = Uncontrolled Risk Rating

** Conservative estimation of the likelihood because the volume of AMD2 material is over-estimated by assuming all sulphur present is pyrite, and (some of) the low-grade ore could be blended and shipped out of site.*

Table 4-3 Risk assessment results of the likelihood of AMD generation from identified source hazards – Pit Walls

Formation	Deposit	Event	Source Material	Severity Level	No Controls		Controls		AMD Class as % of pit surface area
					Likelihood	URR	Likelihood	RRR	
North Flank (MAC) - Marra Mamba	A deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 100%
	B deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2 AMD3	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.48% AMD2: 0.38% AMD3: 0.14%
	C deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.84% AMD2: 0.16%
	D deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 100%
	E deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD1 AMD2	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 99.52% AMD1: 0.01% (or 800 m2) AMD2: 0.47%
	F deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.73% AMD2: 0.27%
	Deadend deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.64% AMD2: 0.36%

Formation	Deposit	Event	Source Material	Severity Level	No Controls		Controls		AMD Class as % of pit surface area
					Likelihood	URR	Likelihood	RRR	
Packsaddle (MAC) - Brockman Bedrock	P1W deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 99.56% AMD2: 0.43% AMD3: <0.02%
	P1E deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.41% AMD2: 0.59%
	P2 deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.69% AMD2: 0.31%
	P3 deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.84% AMD2: 0.16%
	P4 deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.93% AMD2: 0.07%
	P5 deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.98% AMD2: 0.02%
	P6 deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.66% AMD2: 0.34%

Formation	Deposit	Event	Source Material	Severity Level	No Controls		Controls		AMD Class as % of pit surface area
					Likelihood	URR	Likelihood	RRR	
South Flank - Marra Mamba	Highway	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 99.17% AMD2: 0.81% AMD3: 0.01%
	Grand Central	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 98.97% AMD2: 0.95% AMD3: 0.08%
	Vista Oriental	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD2 AMD3	2	Unlikely	3	Highly Unlikely	0.9	AMD0: 99.27% AMD2: 0.68% AMD3: 0.05%
	R deposit	AMD release from pit walls due to AMD1, AMD2, and/or AMD3 material exposed on pit surface post closure	AMD0 AMD3	1	Unlikely	1	Highly Unlikely	0.3	AMD0: 99.98% AMD3: 0.02%

RRR = Residual Risk Ranking; URR = Uncontrolled Risk Rating

5 Improvement Activities

Available data demonstrates that MAC and SF deposits generally present very low risk of AMD generation (Section 3.1). BHP continually collects data and improves the assessments of AMD risk as normal practice. BHP's greater regional environmental geochemistry dataset is also available to assist in the understanding and managing of AMD risk for MAC and SF.

Implementation of BHP's AMD Management Standard (BHP, 2018a) is continued to improve the knowledge of the deposits and to update the AMD risk assessment where applicable.

The following improvement activities are listed for consideration:

- The ongoing sampling and analysis program, which forms part of BHP's AMD Management Framework (BHP, 2018a), utilises multi-disciplinary drilling programs all across the WAIO operations to continually strengthen the regional environmental geochemical database. This allows capitalisation on pre-planned drilling programs to target deposits of specific importance as well as deposits and stratigraphic units to improve the current database. It also includes targeted analysis for specific parameters, which may be limited in the existing dataset.
- If mine plans change and may potentially result in exposure of previously untested stratigraphies or mining areas, characterisation test work should be undertaken to identify short and long-term potential for AMD generation.
- If new data becomes available and suggests current assumptions with respect to AMD potential may require revising, the AMD risk assessment should be updated.
- Where adaptive management is required due to unacceptable analysis results or monitoring results, AMD management procedures must be revised to address any changes in AMD risk.

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Appendix A

ABBREVIATION	DEFINITION
ABA	Acid base accounting
AMD	Acid and metalliferous drainage, which can also include low metal saline drainage
ARD	Acid Rock Drainage
ANC	Acid neutralisation capacity
CSM	Conceptual site model
GAI	Geochemical Abundance Index
Mt	Million tonnes
MPA	Maximum potential acidity
MWM	Mine Waste Management Pty Ltd
NAF	Non-acid forming
NAPP	Net acid production potential
NMD	Neutral and Metalliferous Drainage
NP	Net percolation
OSA	Overburden Storage Area
PAF	Potentially acid forming
ROM	Run of mine
SD	Saline Drainage
WRD	Waste Rock Dump

Appendix B

TERM	DEFINITION
Acid Base Accounting	Conducted to predict acid generation and neutralisation characteristics of a waste rock material.
Acid Neutralisation Capacity	This is a measure of the insitu neutralising potential of a sample. Expressed as kg H_2SO_4 equivalent per tonne.
Acid and Metalliferous Drainage	Includes both acidic drainage typically caused from the oxidation of exposed sulphides, and neutral metalliferous drainage resulting from elevated levels of trace metals/metalloids and salinity. Saline drainage can also occur. In all instances sulphate is high.
Acidic Drainage	A form of AMD, characterised by low pH, elevated toxic metal concentrations, high sulphate concentrations and high salinity.
As-mined	Mined out waste and ore before the time of this study (mind-January 2021)
Maximum Potential Acidity	Is a measure of the in situ acid production of a sample. Expressed as kg H_2SO_4 equivalent per tonne.
Metalliferous Drainage	A form of AMD characterised by near-neutral pH, elevated metal/metalloid concentrations, and high sulphate salinity.
Net Acid Production Potential	Is a measure of the samples overall acid generating capacity and is calculated by subtracting the ANC from MPA. A negative NAPP indicates a net neutralising capacity and a positive NAPP indicates a net acid generating capacity. NAPP, MPA, and ANC are expressed in kg H_2SO_4 per tonne equivalent.
Non-Acid Forming	Although site specific definitions apply, generally refers to material unlikely to generate acidic conditions.
Potentially Acid Forming	Although site specific definitions apply, generally refers to material with the potential to generate acidic conditions.
Saline Drainage	Is a product of AMD, characterised by high sulphate salinity but near-neutral pH and low concentrations of metals/metalloids.
To-be-mined	Mined out waste and ore after the time of this study (mind-January 2021)

Appendix C

INTRODUCTION TO ACID AND METALLIFEROUS DRAINAGE

Rocks containing sulphide minerals such as pyrite exposed to oxygen and water as a result of mining undergo weathering processes (reaction with oxygen and water) and oxidise releasing acid and metals. Pyrite is the main form of sulphide mineral present at the Project. The oxidation of pyrite is explained by Equation 1 to Equation 3 where ferric (Fe^{3+}) iron precipitates in a goethite or ferrihydrite type form (iron-oxyhydroxide).

Equation 1: $$FeS_{2(s)} + \frac{7}{2}O_{2(g)} + H_2O_{(l)} \rightarrow Fe^{2+}{}_{(aq)} + 2SO_4{}^{2-}{}_{(aq)} + 2H^+{}_{(aq)} + energy$$

Equation 2: $$Fe^{2+}{}_{(aq)} + \frac{1}{4}O_{2(g)} + H^+{}_{(aq)} \rightarrow Fe^{3+}{}_{(aq)} + \frac{1}{2}H_2O_{(l)} + energy$$

Equation 3: $$Fe^{3+}{}_{(aq)} + 3H_2O_{(l)} \rightarrow Fe(OH)_{3(s)} + 3H^+{}_{(aq)}$$

Often there is incomplete oxidation of ferrous (Fe^{2+}) to ferric iron and ferrous salts such as melanterite, $FeSO_4$ (Equation 4) can form. These salts, when hydrolysed, release stored ferrous acidity (Equation 5). These acid sulphate salts are highly soluble.

Equation 4: $$FeS_{2(s)} + \frac{7}{2}O_{2(g)} + H_2O_{(l)} \rightarrow FeSO_{4(s)} + 2SO_4{}^{2-}{}_{(aq)} + 2H^+{}_{(aq)} + energy$$

Equation 5: $$FeSO_{4(s)} + \frac{1}{4}O_{2(g)} + \frac{5}{2}H_2O_{(l)} \rightarrow Fe(OH)_{3(s)} + SO_4{}^{2-}{}_{(aq)} + 2H^+{}_{(aq)}$$

However, if oxidation to ferric iron is complete yet the hydrolysis is incomplete, jarosite type secondary minerals can form. Jarosite type minerals form at pH values below 3.5 and release only 2 moles of acidity per mole of ferric iron incorporated into the jarosite mineral lattice, not the associated 3 moles of acidity associated with complete iron hydrolysis. Thus, jarosite type minerals store acidity that can be released once pH increases or if the environmental conditions change such that the mineral is no longer stable (Equation 6). Jarosite is stable at pH values < 4 in oxic conditions. Above pH 4.7 jarosite is soluble, dissolving slowly (Li et al., 2007), which has long term implications for the rebound of pH to circum-neutral conditions after sulphide exhaustion and/or for the treatment of AMD impacted waters.

Equation 6: $$KFe^3(SO_4)_2(OH)_{6(s)} + 3H_2O_{(l)} \rightarrow 3Fe(OH)_{3(s)} + 2SO_4{}^{2-}{}_{(aq)} + 3H^+{}_{(aq)} + K^+{}_{(aq)}$$

The acidity load associated with the dissolution of ferrous salts such as melanterite will occur immediately upon wetting. This acidity can be measured by simple leach tests followed by back titration to determine the acidity load in kg of H_2SO_4 per tonne of waste rock. The jarosite type minerals have much slower dissolution kinetics and are not determined by simple wetting tests, rather 4M HCl digestion.

The acidity released by pyrite oxidation and secondary acidic salts can be neutralised by carbonate minerals and silicate minerals present within the waste rock. Neutralisation by calcium carbonate (limestone) typically results in 2 moles of hydrogen ions being neutralised per mole of limestone (Equation 7) provided CO_2 can form and be released.

Equation 7: $$CaCO_{3(g)} + 2H^+{}_{(aq)} \rightarrow Ca^{2+}{}_{(aq)} + CO_{2(g)} + H_2O_{(l)}$$

Silicate mineralogy will often be the key to understanding the long-term weathering potential of waste rock. Silicate weathering consumes hydrogen ions as the mineral either completely dissolves (congruent weathering) or is transformed into another phase (incongruent weathering) (Lottermoser, 2010). For example, the congruent weathering of potassium feldspar can be represented by Equation 8. However, the rate at which this reaction occurs is far slower than the dissolution of carbonates (Lottermoser, 2010).

Equation 8: $$KAlSi_3O_{8(s)} + H^+{}_{(aq)} + 7H_2O_{(l)} \rightarrow K^+{}_{(aq)} + Al^{3+}{}_{(aq)} + 3H_4SiO_{4(aq)} + 3OH^-{}_{(aq)}$$

ACID BASE ACCOUNTING

Acid base accounting (ABA) is conducted to predict the acid generation characteristics of a waste rock material through determination of the acid neutralising capacity (ANC) and the maximum potential acidity (MPA). Although analysis of pH using distilled water is not a standard ABA test, it is often completed to aid in the interpretation of the ABA data as ancillary information.

The net acid production potential (NAPP) is a measure of the samples overall acid generating capacity and is calculated by subtracting the ANC of the sample from the MPA. A negative NAPP indicates that the sample has a net neutralising capacity and a positive NAPP indicates that the sample has a net acid generating capacity. NAPP, MPA, and ANC are expressed in kg H_2SO_4/t equivalent.

ANC is determined by acid digestion (using HCl) of the sample followed by back-titration (using NaOH) to determine the quantity of acid consumed by neutralising minerals within the rock sample. MPA is based on total sulphur in wt%S (or sulphide sulphur if available) multiplied by the stoichiometric conversion factor 30.6. This conversion factor is determined from the stoichiometry of pyrite oxidation. NAPP is calculated via Equation 9 (all units are in kg H_2SO_4/t):

Equation 9: $NAPP = MPA - ANC$

Thus, potentially acid forming (PAF) material have a positive NAPP and non-acid forming (NAF) material have a negative NAPP.

ABA analysis for this project included the following:

Paste pH/EC: Pulverised sample (25 g) is equilibrated with deionised water at a 1:2 ratio and left for 12 hours (or overnight) before pH and EC measurements of the slurry are recorded (AMIRA, 2002).

Total Sulphur (TS): Measured by heating a pulverised sample (< 2 g) in a LECO furnace to ~1,650°C and measuring the sulphur dioxide production. Assay sulphur values measured by XRF analysis on pelletised samples can be used as a substitute for total sulphur measured by LECO.

Total Carbon (TC): Measured by heating a pulverised sample (< 2 g) in a LECO furnace to ~1,650°C and measuring the carbon dioxide production.

Acid Soluble Sulphur (S-SO_4 or S_{HCl}): Method uses 3M hydrochloric acid (HCl) to extract soluble and slightly soluble sulphate from a pulverised sample (< 2 g) over a 1 hour period. Sulphides should not react and would normally be expelled; extracted sulphur is determined by ICP analysis of the digestion liquor.

Chromium Reducible Sulphur (S-CRS): Method is based on the conversion of reduced inorganic sulphur to H_2S by a hot acidic $CrCl_2$ solution. The evolved H_2S is trapped in a zinc acetate solution as ZnS which is then quantified by iodometric titration (Ahern et al., 2004).

Sulphide Sulphur: Can be calculated indirectly, if sulphide sulphur has not been measured directly, via Equation 10.

Equation 10: *Sulphide Sulphur = TS – S-SO4*

Maximum Potential Acidity (MPA): A measure of the maximum potential of a sample to generate acidity. MPA can be calculated using TS or sulphide sulphur (all units are in kg H_2SO_4/t):

Equation 11: $MPA = TS \times 30.6$

Acid Neutralising Capacity (ANC): Measures the amount of HCl a pulped sample (2 g) can neutralise with gentle heating and the addition of hydrogen peroxide (2 drops of 30%) to dissolve any ferrous iron present (AMIRA, 2002).

Net Acid Production Potential (NAPP): The NAPP value is calculated as the difference between MPA and ANC as per Equation 9. A negative NAPP value indicates that a sample may have sufficient ANC to prevent acid generation and conversely, if MPA exceeds ANC, the material may be acid generating.

Single Addition Net Acid Generation (NAG) Test: A pulverised sample (2.5 g) is digested with 250 mL of 15% hydrogen peroxide and allowed to react to completion before measuring the pH of the NAG liquor. The NAG liquor is then titrated with NaOH to pH 4.5 and pH 7. Acidity measured by the titration to pH 4.5 is due to free hydrogen ion as well as acidity from aluminium and iron (AMIRA, 2002). Additional acidity measured by the titration to pH 7 can be attributed to metal hydrolysis reactions such as copper and zinc (AMIRA, 2002).

Sequential NAG Test: Involves conducting a series of single addition NAG tests to obtain the maximum NAG acidity value. This may be required for high sulphide bearing samples where complete oxidation may not occur. Incomplete oxidation can also be due to the catalytic decomposition of the hydrogen peroxide from high organic carbon contents (AMIRA, 2002).

TOTAL ELEMENTAL ANALYSIS

The results from solid phase total or near-total analysis such as total elemental (TE) analysis or x-ray fluorescence (XRF) analysis can be used to make an inference regarding elements of potential environmental concern. Results can be assessed using tools such as the geochemical abundance index (GAI) to identify elements that may be enriched in respect to average values. However, an enrichment in a specific element does not imply mobility or bioavailability.

It is important to understand the strengths and weaknesses of each method, particularly the various digestions so that drainage predictions are not adversely affected (Price 2009).

Solid samples are digested to enable analysis with inductively coupled plasma mass spectrometry (ICP-MS) or ICP atomic emission spectrometry (ICP-AES). Various digestions can be utilised depending on the mineralogy of the sample or if specific elements are targeted, such as:

Lithium Borate Fusion: Lithium borate flux is mixed with a pulped sample to lower the melting point and is then fused to produce a glass disc. The glass disc is either analysed directly by XRF or if a lower detection limit is required, the disc can be dissolved and analysed by ICP (Price, 2009).

Sodium Peroxide Fusion: Sodium peroxide and sodium hydroxide is added to a pulped sample before being heated to 550°C. Diluted nitric acid is then used to dissolve the digested residue before analysis with ICP. This flux is typically used to digest samples with sulphide contents greater than 5% or other refractory or resistant minerals (Price, 2009).

Four Acid Digest: Hydrofluoric acid, perchloric acid and nitric acid are added to a pulped sample and taken to near dryness before leaching the nearly dry cake with hydrochloric acid (Price, 2009). The majority of the samples within the environmental geochemical dataset would have been digested using this method.

Aqua Regia Digest: Samples digested in a heated water bath with a 3:1 mixture of hydrochloric acid and nitric acids (less complete digestion than the four-acid digest).

Appendix D

BHP developed procedures for classifying material that can be a contributing source of AMD based on its Net Acid Production Potential (NAPP), which accounts for acid generating and neutralising potentials.

The NAPP classification evaluates the balance between acid generating and acid neutralising potential for a sample or waste block. Where unweathered (un-oxidised) material is assessed as having a NAPP > 3 kg H_2SO_4/t it is classified as AMD Class 1 material (potentially acid forming; PAF) and encapsulated in PAF management cells. Weathered and detrital material having a NAPP > 3 kg H_2SO_4/t is managed as a lower AMD risk material and is classified as AMD Class 2 or 3 (Figure D1).

Classification	Geochemical / Physical Stability Stratigraphy	Description
AMD1	**Geochemically problematic:** All stratigraphies below water table, NAPP ≥3 kgH_2SO_4/tonne.	**Adverse AMD waste rock** for containment within OSAs following specific dumping guidance due to the adverse geochemical properties leading to Acid and Metalliferous Drainage (AMD). **Management recommended** AMD1: Paddocked dumped and encapsulated AMD2 /AMD3: Encapsulated by at least 10m of geochemically stable waste.
AMD2	**Geochemically problematic:** All stratigraphies above water table, NAPP ≥3 kgH_2SO_4/tonne.	
AMD3	**Geochemically problematic:** All Non-bedrock stratigraphies, ie. Detritals. NAPP ≥3 kgH_2SO_4/tonne, includes alluvial, Scree, Tertiary Detritals (TD1, TD2, and TD3)	

Figure D1 WAIO AMD classification system. All other material is classified as AMD Class 0 and is considered as inert waste.

For the ANC component of the NAPP calculation, BHP utilises a method for calculating proxy ANC by combining assay results for CaO, MgO and loss on ignition (LOI).

Having calculated a proxy ANC, the values are then combined with estimates of maximum potential acidity (MPA = 30.6 x %sulphur), to allow assessment of the acid-base account via the calculation of the NAPP value.

Appendix E

Table E Summary of lithological categories addressed in the assessment.

STRATNUM	Strat Code	Strat Description
9200	WP3	Welded Pisolites
9190	ST3	Siltstone
9180	GS3	Gravelly Siltstone
9160	CA2	Calcrete
9150	CY2	Clay
9140	SD2	Sand
9130	VB2	Vuggy Breccia
9120	LT2	Lignite Clay
9110	HC1	Hematite Conglomerate
9100	CY1	Ferruginous Clay
8200	K	Dykes/Sills (K Formerly used for Clay)
8150	SZ	Surface scree
8130	TD3	Tertiary Detritals 3 (includes former AZ, BZ, CZ, FZ, GZ, HMZ, LLZ, LZ)
8120	TD2	Tertiary Detritals 2 (CID Equivalent)
8110	TD1	Tertiary Detritals 1 (includes former ROD)
6120	HE	Weeli Wolli Dolerite
6110	HJ	Weeli Wolli Iron Formation (PHj)
5910	YE	Brockman Iron Formation, Yandicoogina Shale Member (Dolerite Sills)
5900	Y	Brockman Iron Formation, Yandicoogina Shale Member (Phby)
5870	J3J5	Brockman Iron formation, Joffre Member (PHbj) J3 - 5 zone undifferentiated (Formerly JC)
5860	J6	Brockman Iron formation, Joffre Member (PHbj) - J6
5850	J5	Brockman Iron formation, Joffre Member (PHbj) - J5 - shaly
5840	J4	Brockman Iron formation, Joffre Member (PHbj) - J4
5830	J3	Brockman Iron formation, Joffre Member (PHbj) - J3 - shaly
5820	J2	Brockman Iron formation, Joffre Member (PHbj) - J2
5810	J1	Brockman Iron Formation, Joffre Member - J1 - shaly
5700	W	Brockman Iron Formation, Whaleback Shale (PHbw) - Undifferentiated
5640	D4	Brockman Iron Formation, Dales Gorge Member (PHbd) - D4
5630	D3	Brockman Iron Formation, Dales Gorge Member (PHbd) - D3 - middle shaly
5620	D2	Brockman Iron Formation, Dales Gorge Member (PHbd) - D2
5610	D1	Colonial Chert Member (Ahrc), informally the lowest unit of the Dales Gorge Member in the Newman area.
5440	RU	Mt McRae Shale - Upper
5430	RN	Mt McRae Shale - Nodule Zone
5420	RC	Mt McRae Shale - Chert
5410	RL	Mt McRae Shale - Lower
5400	R	Mt McRae Shale (AHr) - Undifferentiated
4300	OC	Wittenoom Formation, Shaley Bee Gorge Member OC - Undifferentiated
4200	OB	Wittenoom Formation, Paraburdoo Member (Ahdp) OB - Undifferentiated (Formerly WP)
4120	WA2	Wittenoom Formation, West Angela Member - A2 (Shale Waste) (Formerly A2)
4110	WA1	Wittenoom Formation, West Angela Member - A1 (Formerly A1)
3430	N3	Marra Mamba Iron Formation, Mount Newman Member - N3
3420	N2	Marra Mamba Iron Formation, Mount Newman Member - N2 (Shaley)
3410	N1	Marra Mamba Iron Formation, Mount Newman Member - N1
3300	MM	Marra Mamba Iron Formation, MacLeod Member (Ahmm)
3200	MU	Marra Mamba Iron Formation, Nammuldi Member (Ahmu)
2100	JN	Jeerinah Formation (AFjr) - Undifferentiated

Appendix F

Appendix G