

## Increase The Percentage of Coal Conservation Deposited in ROM Drainage Areas

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### ABSTRACT

**Keywords:** Coal conservation; fine coal management; environmental pollution; ROM drainage area; root cause analysis; Fishbone diagram.

The research aims to increase the conservation percentage of trapped coal in the ROM A1 drainage area from February to June 2024 by improving fine coal management and adding value to the conservation of PJP. This study also seeks to reduce penalties from fine coal blending into sellable products and minimize environmental pollution in the ROM A1 area. The study employs a descriptive method, focusing on implementing coal conservation in drainage areas by determining the scope of each conservation object. Root cause analysis using a Fishbone diagram was used to identify key improvement strategies for increasing coal conservation percentages. Initial observations in the ROM A1 drainage area revealed 6,829 tons of unpreserved fine coal, primarily due to rainwater runoff. The results showed that with proper implementation of conservation techniques, including the installation of fine coal traps and the centralization of fine coal in collection points, the conservation rate improved from 0% to 62% by April 2024. In tangible terms, 83 tons of fine coal, worth IDR 26,434,928, were saved, contributing to both environmental conservation efforts and economic benefits for the company. This study highlights the importance of continuous coal conservation efforts, especially in mining operations where environmental and financial impacts can be significant.



### Introduction

Mineral and coal conservation is an effort to optimize the management, utilization, and data collection of mineral and coal resources in a measurable, efficient, responsible, and sustainable manner. Mineral and coal conservation is one of the aspects that must be carried out in accordance with the Mineral and Mineral Law Attachment VII of the Ministry of Energy and Mineral Resources No. 1827 K/30/MEM/2018 to realize the principles of good mining techniques (Good Mining Practice). Planning for the optimal implementation of mineral and mineral conservation is carried out by first determining the scope of mineral and mineral conservation in detail as well as evaluating and monitoring the implementation and the obstacles that occur in its implementation. The

scope of coal conservation includes mining recovery, processing recovery, low-quality coal, residual processing products, marginal reserves, and unmined reserves.

PT Antareja Mahada Makmur is a subsidiary of PPA, which is also a coal contractor company. The types of activities carried out include stripping the rock/cover soil subfield excavation, loading and removing the layer (stripping) of rock/cover soil with or without being preceded by blasting, and Transportation Services. With operational activities that are closely related to coal, the implementation of good mining engineering principles, especially the conservation aspect of the implementation of coal conservation through determining the scope of conservation objects and solving problems that occur after the evaluation process so that it can be followed up, is something that must be understood and considered in the implementation of mining activities.

The objectives of this study are:

1. Increasing the percentage of coal conservation deposited in the new ROM A1 drainage area in February – June 2024 through good fine coal management, and adding value to the PJP conservation aspect
2. Saving penalty costs from fine coal that is debblended into products sold by the owner
3. Reduces the level of environmental pollution in the new ROM A1 area.

## **Research Methods**

The research method used is descriptive. This study will explain the implementation of the drainage area's conservation level by determining the scope of each conservation object. This study also compared what can be done to increase the percentage of coal conservation deposited in the new ROM A1 drainage area with Root cause analyst Fishbone.

Data collection in this study was conducted through direct field observations in the ROM A1 drainage area, interviews with workers related to coal conservation, and documentation related to coal management activities at PT Antareja Mahada Makmur. Quantitative data were gathered from records pertaining to coal production and management, including the volume of discarded fine coal, precipitation levels, and the efficacy of the fine coal capture system. In addition, qualitative data were gathered through in-depth interviews with the objective of gaining insight into the challenges and opportunities associated with the implementation of coal conservation measures.

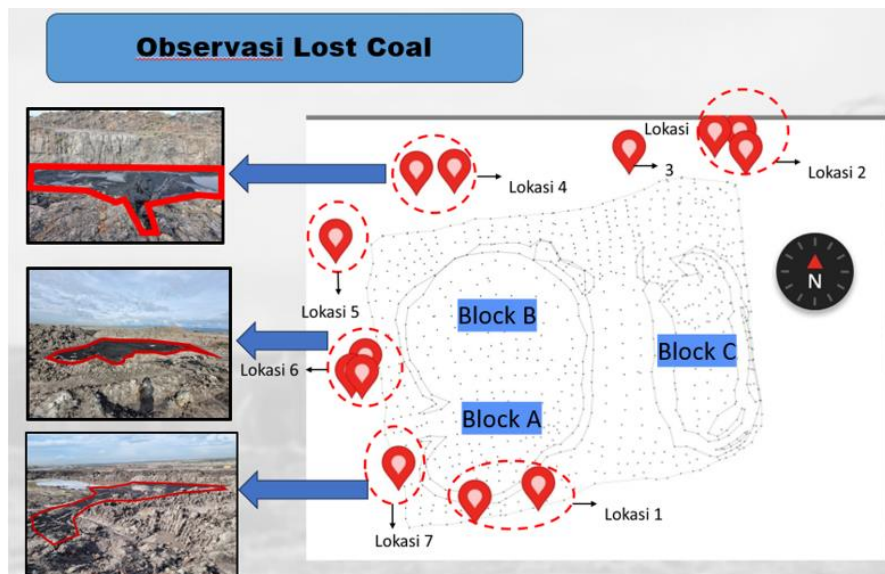
The data were analyzed using a descriptive approach. The quantitative data were processed using simple statistical methods to calculate the percentage change in coal conservation, the decrease in the amount of wasted fine coal, and the estimated economic value saved. The qualitative data were analyzed using a thematic approach to identify root cause factors that affect the level of conservation. Fishbone diagrams were used as a visual aid to map the relationships between the various causal factors and plan corrective measures.

## Results and Discussion

### The Root of the Problem

In the Ministry of Energy and Mineral Resources No. 1827 of (2018) concerning Guidelines for the Implementation of Good Mining Engineering Principles, especially in Appendix VII concerning Guidelines for the Implementation of Mineral and Coal Conservation, it is stated straightforwardly regarding the scope and objects of mineral and coal conservation. There are 8 (eight) mineral and coal conservation objects, including mining recovery, processing recovery, low-quality coal, low-grade minerals, accompanying minerals, marginal reserves, residual processing and refining products, and unmined reserves (Dzakir et al., 2023; Singo, 2020; Young et al., 2022).

PT Antareja Mahada Makmur Site Borneo Indobara is engaged in Mining contractor services with the process business of coal transportation and loading services (ROM Management). This is, of course, very related to the implementation of the conservation of the new ROM A1 condition. When the Lost Coal observation was carried out, coal splatters in drainage were found, which were suspected to be caused by dissolved rainwater. Improvements focus on the new A1 ROM due to its longer lifespan.



**Figure 1. Observation Area Lost Coal**

Based on observations, the ROM A1 N drainage area has 68.29 tons of fine coal that has not been conserved (Wills & Finch, 2015). From November to January 2023, there was rain with an average of 85.94 hours and a discharge of 204.32 m<sup>3</sup>/hour.

ROM A1 BARU															
LOKASI 1		LOKASI 3			LOKASI 4			LOKASI 5							
panjang (m)	tebal (m)	lebar(m)	volume (m3)	panjang (m)	tebal (m)	lebar(m)	volume (m3)	panjang (m)	tebal (m)	lebar(m)	volume (m3)	panjang (m)	tebal (m)	lebar(m)	volume (m3)
70	0,1	2	14	11,75	0,12	0,7	0,99	5	0,1	1,4	0,7	10	0,07	30	7
volume (ton)				12,6				0,855				6,5			
LOKASI 2		LOKASI 6			LOKASI 7			LOKASI 8							
panjang (m)	tebal (m)	lebar(m)	volume (m3)	panjang (m)	tebal (m)	lebar(m)	volume (m3)	panjang (m)	tebal (m)	lebar(m)	volume (m3)	panjang (m)	tebal (m)	lebar(m)	volume (m3)
20	0,3	2	4	11,75	0,12	0,9	1,27	5	0,13	1,45	0,9425	18	0,08	30	14,4
volume (ton)				3,6				1,0325				12,96			
8,15 Ha = 0,0815 Km <sup>2</sup>				VOLUME TOTAL				68,29				14,4			
total volume (m3)				11,84				8,6325				14,4			
volume (ton)				10,66				7,77				14,4			
No	Waktu	Koefisien Limpasan (C)	Intensitas Hujan (I) (mm/jam)	Luas Area ROM A1N (A) (Km <sup>2</sup> )	Jam Hujan	Debit (Q) (m <sup>3</sup> /s)	Debit/Jam (m <sup>3</sup> /jam)								
1	November	0,9	6,9	0,0815	47,31	0,141	506,52								
2	Desember	0,9	5,8	0,0815	68,96	0,118	425,77								
3	Januari	0,9	4	0,0815	141,53	0,082	293,63								
AVERAGE		0,9	5,57	0,0815	85,94	0,114	408,64								
No	Waktu	Koefisien Limpasan (C)	Intensitas Hujan (I) (mm/jam)	Luas Area Catchment (1/2 A) (Km <sup>2</sup> )	Jam Hujan	Debit (Q) (m <sup>3</sup> /s)	Debit/Jam (m <sup>3</sup> /jam)								
1	November	0,9	6,9	0,04075	47,31	0,070	253,26								
2	Desember	0,9	5,8	0,04075	68,96	0,059	212,89								
3	Januari	0,9	4	0,04075	141,53	0,041	146,82								
AVERAGE		0,9	5,57	0,04075	85,94	0,057	204,32								

Figure 2. Volume ton Fine Coal When it rains

Rain conditions with the above discharge certainly affect lost coal in the area of catchment drainage, so this project is carried out to save coal that is wasted in the drainage area due to rainwater flow and should be able to be used again as a product (Habel et al., 2023; Juwono & Subagiyo, 2018).

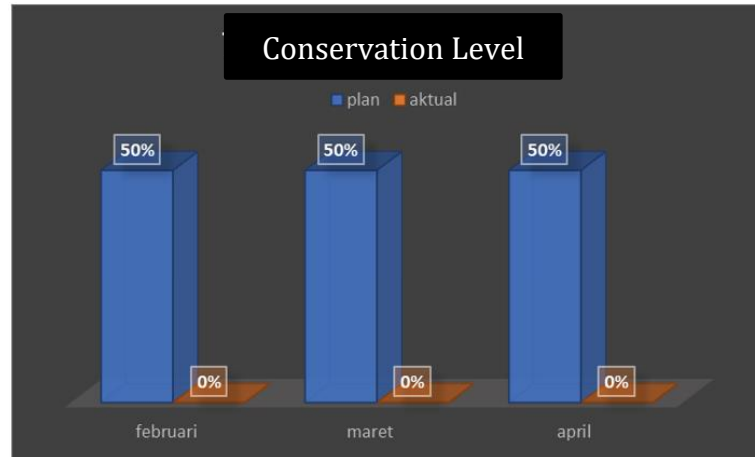


Figure 3. Conservation Level

Based on the data graph above, the conservation rate of fine coal in the ROM A1 N drainage catchment area in November – January is still 0% or has not been implemented. Therefore, it is necessary to carry out coal conservation in the catchment area of ROM A1 drainage (Eterigho-Ikelegbe et al., 2021; Harrar et al., 2022; Vidya & Ilianta, 2020).

## Increase The Percentage of Coal Conservation Deposited in ROM Drainage Areas

<b>Quality</b>	Meningkatkan presentase konservasi coal terendap pada area drainase ROM A1 baru pada bulan Februari – April 2024 melalui pengelolaan fine coal yang baik, dan penambahan nilai pada aspek konservasi PJP
<b>Cost</b>	tonase x Rp 19.000 (1\$ coal getting & Rp 4.000 manajemen rom), tonase x SR x 2\$ (pembayaran OB sesuai SR), dan penyelamatan biaya pinalti sebesar tonase x SR x 2\$. Fine coal yang deblending menjadi produk terjual oleh owner sebesar tonase x HBA (36,32 \$)
<b>Delivery</b>	Pengelolaan fine coal pada area drainase ROM A1 baru tersampaikan dengan baik kepada GL ROM pada saat sosialisasi sehingga dapat berjalan
<b>Safety</b>	Mengurangi tingkat pencemaran lingkungan pada area ROM A1 baru
<b>Moral</b>	Meningkatkan kesadaran pentingnya pengelolaan fine coal pada area drainase

Figure 4. Estimated QCC

NO	FAKTOR	KONDISI SEHARUSNYA	KONDISI AKTUAL
1	METHODE	Terdapat sistem konservasi batubara yang terbawa air	belum terdapat sistem endapan fine coal yang terbawa air
2	MATERIAL	Material fine coal di drainase diblending dan dijadikan produk	fine coal pada area drainase belum diblending dan dijadikan produk
3	ENVIRONMET	Terdapat area konservasi fine coal di drainase	belum terdapat area untuk endapan fine coal pada drainase
4	MAN	Pekerja ROM melakukan konservasi batubara di drainase	Pekerja ROM tidak mengkonservasi batubara di drainase

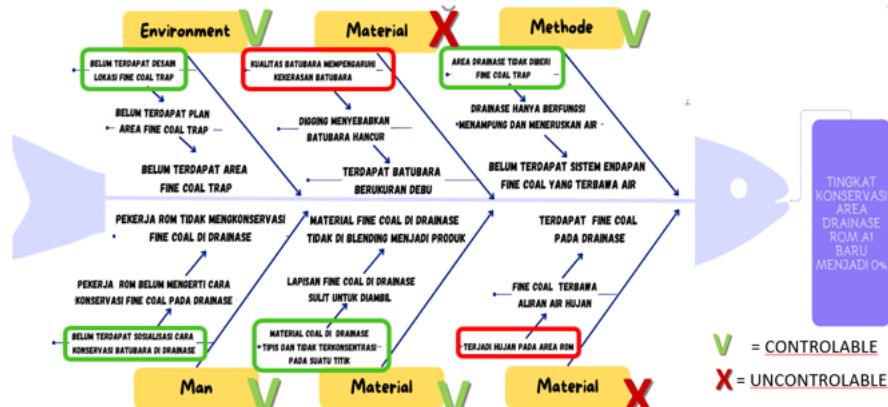


Figure 5. Root cause Analyst -Fishbone

## Planning

The estimated QCC benefits above are the baseline VS Target in the coal conservation level in the new ROM A1 drainage area based on the Rootcause Analyst fishbone (Bazalgette et al., 2022). A plan for improvement ideas from conservation problems related to fine coal emerges as follows:

**Table 1. QCC Plan**

<b>N O</b>	<b><u>CATEGO RY</u></b>	<b><u>WHAT</u> The Root of the Problem</b>	<b><u>HOW</u> Corrective action plan</b>	<b><u>WHY</u> Reasons for the Repair Plan</b>	<b><u>MoE</u> Process KPIs</b>	<b><u>WH O</u> PIC</b>	<b><u>WHE N</u> Due Date</b>	<b><u>WHER E</u> Locati on</b>	<b><u>HOW MUCH</u> Cost</b>
1	Method	The drainage area is not given a fine coal trap	Making fine coal traps in drainage	Fine coal is centralized at the collection point and easy to pick up	Production	Ryan, GL ROM	Week 4 January 2024	ROM A1	6 jam x 225.000 RP <b>1.350.000</b>
2	Material	Coal material in drainage is thin and not concentrated at a point	Picking up fine coal that has been concentrated in the control box	Fine coal materials in the drainage area can still be deblended into products	Production	Ryan, GL ROM	Week 4 April 2024	ROM A1	2,8 jam x 225.000 Rp <b>630.000</b>
3	Environment	There is no design for the location of the fine coal trap	Create a fine coal trap location design	Some areas can be used as a fine coal deposition system	Production	Ryan, GL ROM	Week 3 January 2024	ROM A1	-
4	Man	There has been no socialization of how to conserve coal in drainage	Conducting socialization/study of coal conservation in drainage	So that workers in ROM know how to conserve coal in drainage	Production	Ryan, GL ROM	Week 3 January 2024	ROM A1	-

**Implementation of the Fix Idea**

NO.	What	Before Condition	After Conditions
1	METHODE	The drainage area is not given a fine coal trap	In the drainage area, there is a fine coal trap

**Figure 6. Methode**

NO.	What	Before Condition	After Conditions
2	MATERIAL	Coal material in drainage is thin and not concentrated at a point	Fine coal extraction that has been concentrated in the controlbox

**Figure 7. Material**

NO.	What	Before Condition	After Conditions
3	ENVIRONMENT	There is no design for the location of fine coal deposits	There is a design for the placement of the fine coal sedimentation system



Figure 8. Environmen

NO.	What	Before Condition	After Conditions
4	MAN	There has been no socialization of how to conserve coal in drainage	There is socialization of how to conserve coal in drainage



**Evaluate Results**

Based on the results of the evaluation, there was a significant increase in coal deposits in the ROM A1 New drainage area from 0% to 62% for the period of February – April 2024.



Increase The Percentage of Coal Conservation Deposited in ROM Drainage Areas

periode endapan	tanggal pengambilan	kode box	jumlah bucket coal produk (m3)			
februari	15-Feb-24	D	10			
februari	15-Feb-24	C	9			
februari	20-Feb-24	A	12			
februari	20-Feb-24	B	10			
maret	25-Mar-24	E	8			
maret	02-Apr-24	F	8			
april	16-Apr-24	C	6			
april	19-Apr-24	A	10			
april	01-May-24	E	5,5			
april	01-May-24	A	14			
Jumlah Pengambilan	Volume Endapan Tiap Box	Volume Endapan	Endapan Terkonservasi	Persentase Terkonservasi		
10	150	150	92,5	62%		
periode	Koefisien Limpasan (C)	Intensitas Hujan (I) (mm/jam)	Luas Area Catchment (1/2 A) (Km2)	Jam Hujan	Debit (Q) (m3/s)	Debit/Jam (m3/jam)
februari	0,9	3,9	0,04075	123,07	0,040	143,15
maret	0,9	3,3	0,04075	85,74	0,034	121,12
april	0,9	7,37	0,04075	64,3	0,075	270,51
AVERAGE	0,9	4,86	0,04075	91,04	0,050	178,26

Figure 9. Calculation of Wasted Coal Slag in Drainage

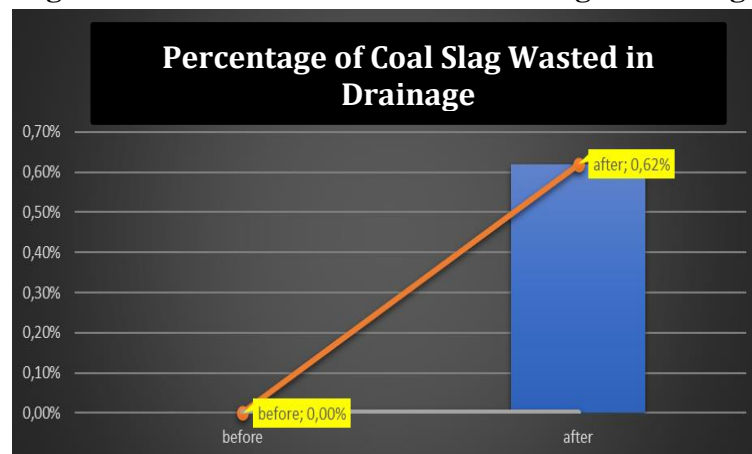


Figure 10. Percentage of Coal Slag Wasted in Drainage

The tangible benefits obtained are 83 tons of fine coal saved from the drainage area worth Rp. 26,434,928 in terms of mining services, which can continue in the following month based on coal in the control box and coal sales of 83 tons worth Rp. 49,067,390. Meanwhile, the intangible benefits are an additional conservation effort in the 2024 PJP assessment.

Comparison of the previous QCC estimate Baseline increased as follows:

- a) Quality  
Saving wasted coal in drainage areas by 0.2% of runoff water volume
- b) Cost  
83 tons of coal saved by mining services worth Rp. 26,434,928, coal sales of Rp. 49,067,390
- c) Delivery

The management of fine coal in the ROM A1 drainage area was well conveyed to the new ROM A1 workers at the time of socialization

d) Safety

Reducing the level of environmental pollution in the ROM A1 new area

e) Moral

Increased awareness of ROM workers on the importance of fine coal management in drainage areas

### Next QCC Ideas

After an improvement to the Baseline of planning and implementation of QCC Implementation of the Coal Slag System, the optimization of sediment in the drainage area on all sides of the initial ROM formation.

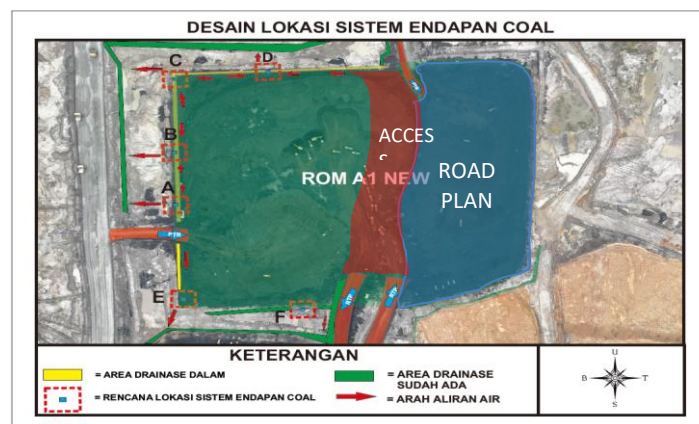


Figure 11. Coal System Slate Site Design

### Conclusion

The implementation of mineral and mineral conservation starts from the planning stage to the implementation of the plan for mining activities and the evaluation of the implementation of these activities. The implementation of conservation aspect activities in the form of a control box (Fine coal management in the ROM A1 New drainage area) to reduce the level of pollution in the mining environment that the next QCC idea needs to be further improved related to the conservation aspect.

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