



TAILING POND MAINTENANCE SYSTEM PT. DINAMIKA SEJAHTERA MANDIRI AT THE TERAJU SITE, TOBA DISTRICT, SANGGAU REGENCY

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Abstract

PT. Dinamika Sejahtera Mandiri has 6 settling ponds. One of the factors that must be considered in mining activities is the residue from the washing process that will enter the settling pond. Pool conditions at PT. The Mandiri Sejahtera Dynamics is almost complete, which requires a study on the maintenance of the settling pond to be carried out. This research aims to plan and schedule the dredging of the settling pond and the addition of tools for optimal pond maintenance.

The research was conducted by collecting primary and secondary data, primary data consisting of tailings samples, circulation time, and total discharge time. While secondary data consists of rainfall, equipment specifications, pond depth, and pond area. Then it will be processed from the calculation of planned precipitation, rainwater discharge, percent solid, particle velocity, settling material, pond dredging time, and the number of additional tools.

In the design, dredging is done after the pool is half full. Obtained for Pool 1, the treatment time is every 575 days (4.8 months), Pool 2 every 567 days (18 months), Pool 3 every 895 days (29.8 months), Pool 4 every 1,356 days (45 months), Pool 5 every 1,298 days (43 months), and pool 6 every 1,338 days (44.6 months). Meanwhile, for tailings dredging activities, it is necessary to add 2 long arms Excavator Hitachi PC 210 LC with a dredging time of pond 1 for 31 days, pond 2 for 43 days, pond 3 for 183 days, pond 4 for 67 days, pond 5 for 24 days, pool 6 for 20 days.

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1. Introduction

PT. Dinamika Sejahtera Mandiri is one of the companies engaged in mining bauxite commodities in Teraju Village, Toba District, Sanggau Regency, West Kalimantan Province. PT. Dinamika Sejahtera Mandiri obtained a Mining Business Permit (IUP) for Production Operations No: 456/2009/SGU with an area of 11,310 Ha. Bauxite mining activities carried out by PT. Dinamika Sejahtera Mandiri uses an open pit mining system with an available cast method in backfilling.

PT. Dinamika Sejahtera Mandiri, as the holder of a Mining Business Permit (IUP) of bauxite ore in Toba District, conducted one of the mining in Bukit 08 (Mungguk Damar) and washed bauxite ore located on Bukit 23 (Cabing). The bauxite washing process impacts

the deterioration of water quality if not appropriately addressed.

So far, to anticipate the occurrence of excessive deposition of residual material in the settling pond, PT. Dinamika Sejahtera Mandiri, every day, only dredges materials in open channels using two units of Long Arm Excavator heavy equipment and in the inlet and outlet pipes of each pool using one unit of Long Arm Excavator heavy equipment. PT. PT. Dinamika Sejahtera Mandiri applies a closed circulation method where the treated water will be reused for the washing process.

Therefore, this research was conducted to make scheduling and maintenance of settling

ponds and can be used as a reference for PT. Dinamika Sejahtera Mandiri.

2. Materials and Methods

Research conducted at PT. Dinamika Sejahtera Mandiri was carried out within ±1 month. The stages of this research consist of 5 general stages: literature study, field observations, data collection, data processing and analysis, and conclusions. The stages of the investigation will be described as described below:

i. Literature Study

It is carried out by looking for supporting library materials from related agencies, libraries, journals, and internet sites. information obtained from the study of literature related to reclamation and mine closure.

ii. Field observations

Make direct observations of the problems discussed, namely the maintenance system and dredging of settling ponds in PT. The dynamics of Independent Prosperity, such as how to overcome residues from the tailings pond used and circulation from the tailings pond itself whether using closed circulation or not.

iii. Data collection

a) Primary Data

- Solid Percent Tailings Sample
Solid *percent tailings* sampling data was carried out by sampling method, by taking samples using sample tubes in the form of 600 ml mineral bottles in each deposition pond. Sample points were taken as many as 7 points starting from the inlet on the open channel to pool 6.
- Time of Distribution
Retrieval time data using a stopwatch starting from the dredging tool until it turns back to an empty state. 30 times data retrieval represents 30 days.
- Full Time Sample Discharge
Data retrieval of this time using a stopwatch by waiting for a full 30-liter bucket.

b) Secondary Data

Secondary data consists of precipitation data, digging and loading equipment specification data, pool depth, settling pond area data, and enterprise uptime.

- Data processing and analysis

a. Calculation of rainfall plans

Rainfall plans can be calculated using the equation:

$$R = \bar{X} + k \cdot SD$$

R = Planned rainfall (m/s)

\bar{X} = Average daily rainfall (mm/day)

k = Reduced Variate

SD = Standart Deviation

b. Calculation of rainwater discharge

Rainwater discharge can be calculated using the equation:

$$Q = R \times A$$

Information:

Q = Rainwater discharge (m³/sec)

R = Planned rainfall (m/s)

A = Area of the deposition pond (m²)

c. Calculation of solid percent

Solid percent can be calculated using the equation :

$$\%Solid = \frac{Berat\ padatan\ (Mp)}{Berat\ total\ (Mt)} \times 100\%$$

d. Particle velocity calculation

The particle velocity can be calculated using the equation :

$$V_t = \frac{g \times D^2 \times (\rho_s - \rho_a)}{18 \times \mu}$$

Information:

g = Gravitational force (m/s²).

D = Diameter of solids particles (2×10⁻⁶ m) (astm clay size).

μ = Viscosity of water (1.31 × 10⁻⁶ kg/s) (Table 2.5)

ρ_s = Specific gravity of bauxite (1,300 kg/m³)

ρ_a = Specific gravity of water (kg/m³)

e. Calculation of precipitating material

Precipitating material can be calculated using the equation :

$$Mm = \%solid \times Q_{total}$$

Information:

Mm = Precipitating material (m³/day)

Q_{total} = Total discharge (m³/day)

f. Calculation of pool maintenance and addition of tools

Pool treatment can be calculated using the equation :

$$Wp = \frac{Volume\ Kolam}{Volume\ terendapkan}$$

Information:

Wp = Dredging time (days)

Location	Surface Area (m ²)	Precipitation Plan (m/s)	Rainwater Discharge (m ³ /sec)	Rainwater Discharge (m ³ /day)
Open Channel	755	2 x 10 ⁻⁶	0,015	130,46
Pool I	36.700	2 x 10 ⁻⁶	0,0734	6341,76
Pool II	37.900	2 x 10 ⁻⁶	0,075	6.480
Pool III	167.100	2 x 10 ⁻⁶	0,3342	28.874,88
Pool IV	58.700	2 x 10 ⁻⁶	0,1174	10.143,36
Pool V	35.000	2 x 10 ⁻⁶	0,07	6.048
Pool VI	26.500	2 x 10 ⁻⁶	0,053	4579,2

Pool volume (m³)

3. Result and Discussion

- **Precipitation plans**

The rainfall data used in the study is the maximum daily rainfall data for the last 10 years, namely from 2011 – 2020, and after calculations obtained daily planned rainfall of 2 x 10⁻⁶ m / second.

- **Area of Settling Pond**

The area of rain catch can be determined and known the extent of the surrounding pond embankment. Based on observations in the field, seven rain catchment areas with different areas were obtained and were influenced by elevation points where the water flowed into the settling pond.

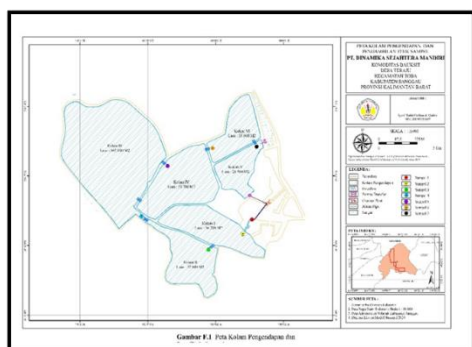


Figure 1. Settling Pond Map

- **Rainwater Discharge**

The water that enters the settling pool comes from rainwater that enters the settling pool. Rainwater discharge is calculated using rational methods, the

parameters for calculating rainwater discharge are planned rainfall, and the area of the settling pond area. The magnitude of the rainwater discharge can be seen in Table 1

Table 1. Rainwater Discharge

- **Percent Solid**

In determining the percentage of solids in the deposition, it is carried out by the comparison method, by taking sludge samples in each settling pond. The number of samples taken was 7 points.

Table 2. Percent Solid Per Pool

Sample	Solids Weight (gr)	Sludge Weight (gr)	Percent Solids (%)
1	112	1.276	8,1
2	94	1.421	6,2
3	86	1.317	6,1
4	43	907	4,1
5	7	254	2,7
6	4	178	2,2
7	2	118	1,7
Total			31,1
Average			4,4

- **Particle Speed**

Based on the test results of the percent solids sample, the results of 7 percent solids samples were obtained by 4.4%, of which the percent solids were less than 40%. Then the speed of deposition of particles contained in the slurry is as follows:

$$V_t = \frac{9,8 \text{ m/s}^2 \times (2 \times 10^{-6})^2 \text{ m} \times (1.300 \text{ kg/m}^3 - 1000 \text{ kg/m}^3)}{18 \times 1,31 \times 10^{-6} \text{ kg/s}}$$

$$= 0,0005 \text{ m/s}$$

• **Percent Deposition**

Table 3. Percent Solids

Pool	Percent Deposition
1	98,01
2	99,54
3	99,59
4	99,53
5	99,59
6	99,52

Amount of Material Precipitating

The discharge of the precipitated material is calculated from the addition of tailings discharge and rainwater discharge and then multiplied by the solid percent in each pool. Then it is obtained la the amount of material settles each pool is as follows:

Table 4. Amount of Material Settles

Location	Total Discharge (m ³ /day)	Percent solid (%)	Result (m ³ /day)
Open channel	2.316,56	8,1	187,64
Pool I	8.074,18	6,2	490,64
Pool II	7.251,55	6,1	440,31
Pool III	29.903,62	4,1	1.221,02
Pool IV	11.429,28	2,7	307,26
Pool V	7.141,03	2,2	156,46
Pool VI	5.222,16	1,7	88,35

• **Settling Pond Treatment**

Based on the results of measurements and observations in the field, it is necessary to have regular dredging and cleaning of the settling pond. The dredging time of the settling pond is obtained through a comparison between the volume of each segment and the number of solids per day of each piece, as seen in Table 5.

Table 5. Maintenance Time and Dredging

Location	Full Time Pool (Day)	Dredging Time (Day)
Open Channel	20	0,6
Pool I	575	47
Pool II	587	43
Pool III	906	183
Pool IV	1.306	67
Pool V	1.362	35
Kolam VI	1.387	20

PT. Dinamika Sejahtera Mandiri only uses 2 Long Arm Excavator machines to dredge on open channels. So the overall total for full time and a half pool is 5,727.9 days, while the dredging time when using an additional 2 Long Arm Excavators with a productivity of 3,017.6 m³ / day is 395.6 days.

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