

Technical Study of Sediment Pond Maintenance Scheduling (Sediment pond) For Guard Quality Sand Wash PT. Gunung Source Fortune (GStudy Of scheduling Technical Of Sediments Pond Maintenance To Maintan washing sand Quality In Gunung Sumber Fortune LTD)

Fitra Alif Sairozi*, Lakon Utamakno, Yudho Dwi Galih Cahyono

Majors Technique Mining, Institute Adhi Tama Technology, Surabaya

Email: *fitraalif12@gmail.com

Received: 2022-12-15 Received in revised from 2022-12-28 Accepted: 2022-12-29

Abstract

PT. Gunung Sumber Rejeki is a subsidiary of PT. Agung Satrya Abadi which is located at Wonosunyo Village, Kec. Gempol, Kab. Pasuruan, Province. East Java. Gravel sand mining The sale value of natural products (sirtu) can be increased by processing and refining. The feed material is brought to the stone crusher and sand washing plant with the production of stone split 1 cm – 1 cm, 1 cm – 2 cm, 5 cm – 10 cm and sand wash with a silt content of less than 5%. In 1 cycle of pond maintenance, the feed material that can be processed is 1587.15 tons with a maintenance schedule every 6 days in all pond segments. Sludge impurities from the process washing sand flowed into pond one and experienced as much sedimentation 298.5 m³ / 6 days, pool two as much 313.98 m³ / 6 day, pool three as much 365.7 m³ / 6 day, and pool four as much 385.5 m³ / 6 day. Maintenance settling pond very need done because water in a settling pond reused for washing sand so that very influential on quality sand which in earn

Keywords: Pool deposition, sand quality, Law Stokes

1. Introduction

The development of the construction sector until the current era of globalization is still used as a benchmark from progress something country or area in scope small. Sector construction have a very complex role including supporting the growth and development of various especially in the economic, social and cultural fields. Enabling infrastructure development increasing community and commercial mobility, sanitation infrastructure, health and education as well other social functions for the better and support the growth and development of various sector other like industry, trading, tourist and other sectors.

Development infrastructure in Java East specifically experience enhancement which very significantly from year to year in line with short-term and long-term development strategies from the central and local governments. The need for infrastructure development no regardless from material ingredient building.

On the basis of the high market demand for building materials, building materials are a business opportunity for PT. Gunung Sumber Rejeki which is engaged in the processing and refining of mining materials. By increasing the value of the raw material in the form of natural sand gravel (sirtu) which has gravel composition = 33.63%, sand = 51.17%, and silt + clay = 15.20%, processed into 3 types results production that is sand wash with rate mud in lower 5%, stone splits with size 1 cm – 1 cm, 1 cm – 2 cm, 5 cm – 10 cms, and mud wash.

Maintaining material quality has become the company's vision from PT. Gunung Sumber Rejeki for the sake of respond to growing business competition. This is related to quality control in every production of sand washing every day. High silt content in the washed sand can result in reduced quality of concrete that will be created and refers to SNI 03-4142- 1996 with a fine aggregate threshold as a concrete mixture of not more than 5%. So therefore scheduling maintenance of settling ponds is very important to produce sand with sludge levels under 5%.

2. Method

Location Study

Kindly astronomical location study located on coordinate : Line Longitude 112 39' 24.58" BT – 112 38' 44.78" BT and East Latitude 7 37' 45.72" LS – 7 37' 40" LS. Administratively it is located in the Village Wonosunyo, Subdistrict gempol, Regency Pasuruan, Java East (see Figure 1).

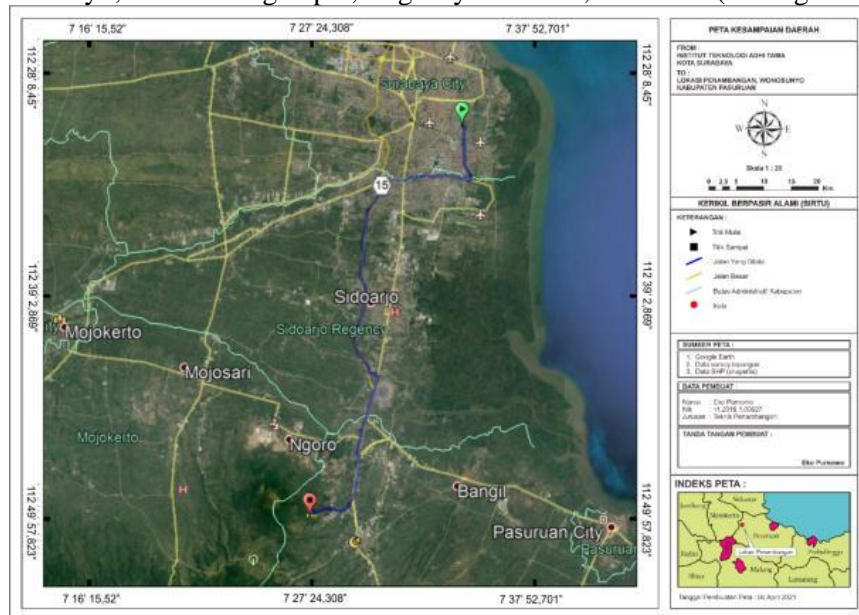


Figure 1. Location Study

Potency Water which

Enter Several parameters are taken into account in assessing the amount of potential water that will enter the pond in pool deposition among them discharge water rain which direct enter to in pool sedimentation, the discharge of the pump used to wash the sand then the water enters the pond deposition, and discharge tailings.

Debit Rainfall Rain

Analysis bulk rain conducted with use method Gumbel. Equality Gumbel as following:

$$X_r = X + s_d / s_n (Y_r - Y_n) \text{ or } X_t = X + k \cdot s_d \quad (1)$$

Information :

X_r = rainfall rain plan maximum (mm/day)

X = Precipitation rain average (mm/day)

S_d = standards deviation

S_n = Reduced standards deviation

Y_r = Reduced Variate

Y_n = Reduced mean

Intensity rainfall Rain

Calculation of rainfall using the monobe formula as follows:

$$I_t = R_{24/22} \times (24/t) \quad (2)$$

Information:

I_t = rainfall in t hours (mm/hour)

R_{24} = bulk rain which predicted (mm)

M = constant, with score $m = 2/3$

Large catch rain

Large catch rain measure large pool deposition because lips pool more tall from surface soil in around pool deposition

Debit Water which Direct Enter

Water rain which direct enter to pool deposition could in count use equality following:

$$Q = 0.278 \times I \times A \quad (3)$$

Information :

Q = Potential runoff water which direct enter pool (m^3/sec)

I = The amount bulk rain in t o'clock (mm/h)

A = Large aperture pool (km^2)

Debit Pump

Debit water from pump which used for washing sand on process sand washing plant which enter into the pool deposition (sedimentary pond)

$$Q = \frac{\text{kapasitas pompa } (\frac{\text{liter}}{\text{detik}})}{\text{massa jenis air } (\frac{1000kg}{m^3})} \quad (4)$$

Information :

K_p = pump capacity (liters/second)

ρ_a = Mass type water ($1000kg/m^3$)

Debit Tailings

Debit amount tailings form silt and clay which late together water going to pool deposition on moment process washing sand.

$$C_f = (\text{Sand yield wash ton/day}) / (\text{Sirtu feed ton/day}) \times 100\%$$

System Precipitation Sediments Pond

A number of parameter which need calculated in study system deposition which there is on pool deposition Among other.

Speed Precipitation

Speed deposition counted use equality Stokes as follows

$$V_t = \frac{g \times D^2 \times (\rho_s - \rho_a)}{18\mu} \quad (5)$$

Information :

V_t = Slurry settling rate vertically downwards (m/sec)

g = Gravity (m/s^2)

ρ_p = Density of solids (kg/m^3)

ρ_a = Water density ($1000kg/m^3$)

μ = Dynamic viscosity of water ($kg/m.second$)

D = Diameter particle (meters)

Time Precipitation Particle

Time which needed particle for precipitate in base pool deposition vertically

$$t_v = \frac{H}{V_t \text{ (detik)}} \quad (6)$$

Information :

t_v = vertical slurry settling time (minutes)

H = Depth pool (meters)

V_t = Rate slurry deposition vertically down (m/sec)

Speed Horizontal Particle

Speed slurries for go out from pool deposition 1(one) to pool deposition 2(two) and so on in a manner horizontally use equality following

$$V_h = \frac{Q_{total}}{A} \quad (7)$$

Information :

V_h = horizontal slurry settling time (minutes)

Q_{total} = Amount slurries which enter pool (m^3/sec)

A = Large aperture pool deposition (m^2)

Time Particle Go out

Time required slurries out by horizontally counted with the following equation this:

$$t_h = \frac{P}{V_h} \quad (8)$$

Information :

t_h = length of time it takes for slurry to leave each pond segment (seconds)

P = long pool deposition (meters)

V_h = Speed horizontal slurries horizontally (meters/second)

Percentage Precipitation Particle

The magnitude percentage deposition counted with equations following this

$$\frac{\text{waktu yang dibutuhkan air keluar}}{\text{waktu yang dibutuhkan air keluar} + \text{waktu pengendapan}} \times 100\% \quad (9)$$

Volume Solids

Volume solids is the volume slurries enter into the pool deposition counted with equality following:

$$V = V \text{ solids and water} \times \% \text{ solids} \quad (10)$$

Volume Precipitation

Volume deposition counted with equality following this:

$$V = V \text{ solids} \times \% \text{ Precipitation}$$

Time Maintenance Pool

$$\text{Maintenance Pool} = \frac{\text{volume kolam pengendapan (m3)}}{\text{Vol total padatan per hari (}\frac{m3}{\text{hari}}\text{)}} \quad (11)$$

Percentage Rate Mud

$$\text{Sludge levels} = \frac{\text{Tinggi Lumpur}}{\text{Tinggi Pasir}} \times 100\% \times K \quad (12)$$

Method Study

The method used in this research is qualitative method. Collected data studied to get the desired goal by studying related references with study as base study.

- a. **Studies References** The author will review various sources of literature and references related to research this like data BMKG, and journal related pool deposition (sedimentary ponds).
- b. **Observation field** this stage covers observation for look at the situation and conditions processing workflow and purification gravel natural sand (sirtu).
- c. **Observation data** Data collection was carried out to answer the formulation of the problem in this study. data that in collect covers data primary and data secondary.
- d. **Processing and analysis data** Data processing based on literature studies and some related software with problem. Plot processing and analysis data as following:
 1. Calculation percentage solids
 2. Calculation speed deposition
 3. Calculation time which needed particle for precipitate
 4. Speed calculation water in pool
 5. Calculation percentage deposition
 6. Calculation volume solids
 7. Calculation volume deposition
 8. Calculation time maintenance pool deposition
- e. **Interpretation results analysis data** aim for interesting conclusion based on from results processing data that is limit precipitate in pool deposition so that quality sand wash could Fulfill SNI 03-4142-1996

3. Results and Discussion

Analysis debit which Enter

Calculation of discharge pump used to wash sand

$$Q = (\text{pump capacity (liters/second)}) / (\text{density of water (1000 kg/m}^3 \text{)})$$

$$Q = 1.86 \text{ l/s} : 1000 \text{ kg/m}^3$$

$$Q = 0.00186 \text{ m}^3/\text{sec}$$

The pump discharge used is 0.00186 m³/second

Calculation discharge tailings

Amount material bait average which enter 258,37 tonnes/day with score CF Gravel sandy experience (sirtu) as big 15.2% got from results testing lab material bait.

$$\text{Number of gross stones} = (258.37 \text{ tons/day}) / 0.152$$

$$= 39,27 \text{ tons}$$

$$Q \text{ tailings} = (39,27 \text{ tonnes/day}) / (28,800 \text{ seconds/day})$$

$$= 0.00136 \text{ m}^3/\text{sec}$$

So the amount of tailings discharge that will enter the settling pond is 0.00136 m³/second

Calculation discharge water which direct enter

Based on the processing of rainfall data (appendix E), the average rainfall value is 45,15 mm/hr with intensity rain the most occur on month December sd month April as much as 70.96 mm/hour. Based on the average rainfall with a return period of rain for 5 years, it is obtained that R is equal to 24 mm/day, thus the magnitude intensity rain highest obtained month April as much 66,44 mm/hr.

With the size of the pool area the whole is 0.0002625 km² so got for magnitude discharge water which direct enter to pool deposition is as big

$$Q = 0.278 \times 66,44 \text{ mm/hr} \times 0.0002625 \text{ km}^2$$

$$Q = 0.004848459 \text{ m}^3/\text{sec}$$

So big discharge water which direct entered into pool deposition as big 0.004848459 m³/sec

Calculation Percent Solids

Tests were carried out on samples of sediment material from the research location brought to the mechanics lab soil with method measure volume Cup measuring, fill in Cup measuring until full

with The material is then in the oven at 100 oC for 2 days then measured the volume of depreciation rate water so that got volume solids as big on Table 1.

Table 1. Percent Solids Pool Volume Deposition

No	Deep	Percent Solids Pool
1	8 cm ³ 6,18 cm ³	77.2%
2	8 cm ³ 6,5 cm ³	81.2%
3	8 cm ³ 7.57 cm ³	94.6%
4	8 cm ³ 7.98 cm ³	99.7%

Calculation speed deposition

Results laboratory density tailings as big 2,265 tons/m³, diameter particle 0.15 mm and score viscosity (viscosity dynamic water) 0.00000142 kg/ms

$$V_t = (g \times D^2 \times (\rho_p - \rho_a)) / 18\mu$$

$$V_t = (9.807 \text{ m/s squared} \times 0.15^2 \times (2265 - 1000)) / 18.0.00000142 V_t$$

$$= 2,2 \text{ m/sec}$$

So settling speed pool is of 2.2 m/sec.

Calculation time deposition particle

The magnitude time deposition particle in pool is comparison Among depth pool with magnitude speed pool deposition. Table 2 shows time precipitation particle.

Table 2. Time Precipitation Particle

No	Pool Depth Settling Pool Settling Rate (m)	Time Precipitation(seconds)	Time Precipitation (minute)
1	3,3 m	2,2 m/s 1.5 s	0.025 m
2	3,6 m	2,2 m/s 1,6 s	0.026 m
3	4,1 m	2,2 m/s 1,9 s	0.031 m
4	4,5 m	2,2 m/s 2 s	0.033 m

Calculation speed horizontal particle

The magnitude time deposition particle is a comparison Among discharge total water which enter with area each segment pool deposition we can see in Table 3.

Table 3. Speed Horizontal Particle Pool

No	Pool Extensive Deposition Q	total Particle Velocity
1	65,625 m ²	0.000473 m/s
2	65,625 m ²	0.000473 m/s
3	65,625 m ²	0.000473 m/s
4	65,625 m ²	0.000473 m/s

Calculation time particles come out

The magnitude score time for particle go out from pool deposition is comparison between long pool with speed particle for go out pool deposition. (See Table 4).

Table 4. Time Particle Go out Pool Pond Long Sediment Speed

No	Particle Exit(th) (second)	Particle Timeout Time Particle Go out (minute)
1	5,25 m 0.000473 m/s 11,099 second	184.9 minutes
2	5,25 m 0.000473 m/s 11,099 second	184.9 minutes
3	5,25 m 0.000473 m/s 11,099 second	184.9 minutes
4	5,25 m 0.000473 m/s 11,099 second	184.9 minutes

Percentage deposition particle

For count equality percentage deposition parameter which used is time which needed water for out (th) , and time deposition particle (tv). We can see the value of them in Table 5.

Table 5. Percentage Precipitation

No	Pool Sedimentation Sedimentation Time(tv) (minutes)	Time Particle Go out (years) (minutes)	Solid Percentage(%)
1	0.025 m	184.9 minutes	99.97%
2	0.026 m	184.9 minutes	99.97%
3	0.031 m	184.9 minutes	99.98%
4	0.033 m	184.9 minutes	99.99%

Volume Precipitation

For count volume solid, parameter which in calculate especially formerly is the solids percentage of each settling pond segment and the total volume of water and solids. From the calculation of the tailings discharge that enters the pond it is 0.00136 m³/second with 8 working hours every day and discharge water which direct enter as big 0.00484 m³/sec with 1.45 o'clock rain/day found volume total water and solids as much:

$$V = (0.00136 \text{ m}^3/\text{second} \times 3,600 \text{ seconds/hour} \times 8 \text{ working hours}) + (0.00484 \text{ m}^3/\text{second} \times 3600 \text{ seconds} \times 1.45 \text{ hours rain})$$

$$V = 64,476 \text{ m}^3/\text{day}$$

Volume solids is multiplication Among percent solids each segment pool with the total volume of water and solids entering the settling pond. As for volumes deposition is multiplication Among percent deposition on each segment pool with volume solids which enter to settling pond. Tall deposition on pool got from volume deposition shared with large pool each segment in Table 6.

Table 6. Sedimentary Material Per Day

No	Pool Volume Deposition	Sedimentary Volume Solids	Tall Precipitation OnPool
1	64,45 m ³ /day	49.75 m ³ /day	46 cm
2	64,45 m ³ /day	52.33 m ³ /day	48 cm
3	64,46 m ³ /day	60.95 m ³ /day	56 cm
4	64,47 m ³ /day	64.25 m ³ /day	59 cm

Based on empirical data obtained from research in the field shows that every 6 days work PT. Gunung Source Fortune To do maintenance pool deposition for guard The quality of washing sand has a silt content below 5%. So the total volume of solids, volume settling and the height of the sediment in the pond multiplied by 6 days to get the volume threshold valuedeposition and tall precipitate on pool.

4. Conclusion

1. Amount material bait as reference maintenance pool deposition is as big 1587,15 tons.
2. The right time as a reference for maintaining settling ponds is 6 working days 8 o'clock work every day.
3. The settling volume threshold for each settling pond segment is the segment pond 1 (one) of 298.5 m³/6 days, pond 2 (two) segment of 313.98 m³/6 days, segment pool 3 (three) 365.7 m³/6 day and segment pool 4 (four) 385.5 m³/6 day.

Referensi

- [1] ASTM C117 — 95. Standard Test Method for Materials Finer than 75-µm (No.200) Sieve in Mineral Aggregates by Washing.
- [2] Herlambang, Y. Kajian Teknis Penjadwalan Pemeliharaan Kolam Pengendapan (Tailing Pond) PT. Persada Pratama Cemerlang (PT. PPC) Site Meliau. Jurnal Mahasiswa Teknik Sipil Universitas Tanjungpura, 7(1).
- [3] Keputusan Menteri Energi dan Sumber Daya Mineral Republik Indonesia No. 1827 K/30/MEM/2018. Pedoman Pelaksanaan Kaidah Teknik Pertambangan Yang Baik.
- [4] Kobelco. Manual Handbook Kobelco SK-200 Series.
- [5] Peraturan Pemerintah No. 23 Tahun 2010. Pelaksanaan Kegiatan Usaha Pertambangan Mineral dan Batubara PT.Agung Satrya Abadi.

- [6] Ridho, M., & Rosadi, P. E. 2019. Penanganan Kolam Sedimentasi Hasil Pencucian Bauksit Di PT. ANTAM Tbk. Tayan. *Jurnal Mineral, Energi, dan Lingkungan*, 2(2), 87-96.
- [7] Santosa, S. 1992. Peta Geologi Bersistem Indonesia Lrmbar 1607-6 & 1607-3. Pusat Penelitian dan Pengembangan Geologi. Bandung.
- [8] NI 03-4142-1996. Metode Pengujian Jumlah Bahan Dalam Agregat Yang Lolos Saringan No. 200.
- [9] Tim Engineering. 2016. Dokumen Upaya Kelola Lingkungan dan Upaya Pemantauan Lingkungan Sukandar, Rumidi. 2016. Bahan Galian Industri. Gajah Mada University Press. Yogyakarta.
- [10] Sukandarrumidi. 2021. Pengolahan Bahan Galian Industri, Batubara dan Minyak Bumi. UGM Press.
- [11] Sulistyana, Waterman. 2015, Perencanaan Tambang Edisi Keenam. Infonet Media.
- [12] Tim Engineering. 2017. Dokumen Studi Kelayakan PT.Agung Satria Abadi.
- [13] Tim Engineering. 2019. Dokumen Studi Kelayakan PT.Gunung Sumber Rejeki.