COMPATIBILITY OF WASTE MANAGEMENT PLACES AT TPS3R KSM BAYU SUCI, SUB-DISTRICT MARGA

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ABSTRACT

The pile of garbage is getting higher and land is starting to be limited at the Mandung TPA in Tabanan Regency to accommodate all the volume of incoming waste. The government's efforts to overcome the waste problem are by implementing independent waste management starting from the village through the TPS3R program. Currently, out of 133 villages in Tabanan Regency, only 11 villages have implemented and have TPS3R. One of the 11 TPS3R is the TPS3R KMS Bayu Suci in Batannyuh Village, Marga District. This study aims to determine the suitability of the capacity of the waste management site at TPS3R KSM Bayu Suci based on the standard of space requirements referring to the Technical Guidelines for the Implementation of Labor-Intensive Activities of the Directorate General of Human Settlements 2020. The importance of this research is to anticipate future problems that arise due to an increase in the volume of waste. but both in terms of processing equipment and land is not sufficient. The results of this study will show the extent and number of ideal equipment needed in maximizing the TPS3R program. The method used in this research is descriptive quantitative method by describing descriptively the data obtained in the field. The main data were obtained from the management of the Bayu Suci KSM and the Tabanan Regency Environmental Service. Based on the results of the study, that the minimum area of land required to maximize the service of TPS3R KSM Bayu Suci is 402 m2 with a minimum composting area of 201 m2. The composting system uses the drum method of 840 units. Based on current conditions, TPS3R KSM Bayu Suci has met the minimum land standard suitability by having a land area of 500m2, but it is still lacking in terms of hangar area for composting area which is only 75 m2 and the need to improve infrastructure to maximize waste processing services.

Keywords: capacity; household waste; TPS3R; KSM Bayu Suci; suitability.

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INTRODUCTION

Garbage is all kinds of waste generated as a result of human and animal activities, which can be in the form of solids that are considered useless or unwanted (Tcobanoglous, 1993 in Sitanggang et al., 2017). In Law Number 8 of 2008 concerning Waste Management, it is stated that everyone in the process of managing household waste and similar household waste is required to reduce and handle waste in an environmentally sound manner. In addition, the Regulation of the Minister of Public Works of the Republic of Indonesia Number/3/PRT/M/2013 concerning the Implementation of Waste Infrastructure and Facilities in the Handling of Household Waste and Types of Household Waste, emphasizes that waste management and reduction from source is the responsibility of all parties. from government and society. The active role of community leaders, Non-Governmental Organizations (KSM) or the government is very much needed in the current condition, where the process of sorting and reducing waste from the source, especially household waste is still inadequate.

Waste management with a 3R-based concept (Reduce-Reuse-Recycle) really needs to be developed to anticipate waste problems and the dangers of environmental pollution that are increasing every day and to fulfill the concept of waste management towards zero waste (Sitanggang et al., 2017). The Reduce-Reuse-Recycle Waste Management Program (TPS3R) is a government program that is carried out with a pattern of community empowerment in processing waste on a communal or regional scale, including for low-income communities and/or those living in dense and slum settlements, and not separated from government assistance. TPS3R carries the concept of waste processing by reducing the amount of waste and/or improving the characteristics of the waste, then

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the waste that cannot be processed at TPS3R will be further processed at the Final Processing Site (TPA) for waste (Directorate General of Cipta Karya, 2020).

The process of sorting waste by sorting waste into two parts, namely organic waste and non-organic waste is a standard processing process required in the TPS3R program. Organic waste is then processed biologically to produce compost (Sulistyorini, 2005). Meanwhile, non-organic waste will be recycled and managed by a waste bank so that it has economic value and increases people's income (Anasstasia & Azis, 2021; Selomo et al., 2016). Finally, the residue from TPS3R in the form of inorganic waste is transported to the landfill. In addition to the community as the main actor in the TPS3R program, the private sector plays a major role in waste management, especially providers of funds and the private sector still lacks awareness of the importance of managing waste directly from the source (Jati, 2013; Manuaba, 2014; Manurung, 2013). The operational costs of waste transportation are estimated to spend around 50-70% of the total costs incurred in waste management in an area (Hidayat, 2013).

The condition of the Mandung Final Disposal Site (TPA) belonging to Tabanan Regency, which is located in Sembung Gede Village, Kerambitan District, is increasingly worrying, given the increasing pile of garbage and limited land to accommodate all incoming waste volumes. Currently, TPA Mandung has a land area of 2.70 ha, with the amount of waste that is accommodated approximately 250,800 m3 and the height of the waste is up to 20 meters (IDNTimes, 2020). Increasing the amount of waste from year to year will cause pollution such as water, soil, air pollution and reduce the aesthetic value of the environment (Dartika & Sueb, 2021). Based on data from the Tabanan Regency Environmental Service, TPA Mandung, in 2020 it will manage 20 m3/day of organic waste, 25 m3/day of inorganic waste, and 208 m3/day of residual waste. The amount of waste generation based on the area of land function shows that the area that has the highest amount of generation is the area that has a relatively large population with urban activities (Budiana & Maryono, 2017). Limited land for final waste collection and disposal, as well as limited funds for waste transportation are one of the obstacles faced in solving the current waste problem (Pandie, 2013; Sahil et al., 2016).

The efforts made by the Tabanan Regency Government through the Tabanan Regency Regional Regulation Number 7 of 2017 concerning Prevention and Quality Improvement of Slum Housing and Slum Settlements to overcome the waste problem, one of which is by implementing independent waste management starting from the village with community empowerment through the TPS3R Program. Through a community participatory approach to the TPS3R Program, in managing waste, the community is expected to be able to position themselves in every activity to jointly solve the waste problem and are expected to be able to act on the basis of common interests (Setiadi, 2015). This activity is considered capable of improving the quality of the environment and quality of life as well as changing community attitudes regarding waste reduction and management (Puspitawati & Rahdriawan, 2012). To date, Tabanan Regency has established 14 TPS3Rs, one of which is TPS3R in Batannyuh Village, Marga District. TPS3R KSM Bayu Suci itself was built in 2016 on an area of 500 m2. The scope of service for the Bayu Suci KSM TPS3R is Banjar Umadiwang with a total population of 135 families. Based on the data obtained, the volume of waste that enters the TPS3R KSM Bayu Suci is 6 m3/day and the volume of residue that comes out is 2 m3/day. Batannyuh Village is located in a slum area with a moderate level of slums based on the Tabanan Regent's Decree on Determining the Location of Slum Housing and Slum Settlements in Tabanan Regency in 2015. One of the indicators for determining housing and slum areas is the management of household waste.

Based on previous research, many household activities cause a lot of kitchen waste or food waste so that compostable waste has a higher composition than plastic and paper waste (Achmad et al., 2015; Raharjo & Geovani, 2015; Ratya & Herumurti, 2017) . In waste management, the amount of waste generated can help predict the volume of waste generated in the future so that it can be used to plan the volume of waste to be served and calculate the need for area and infrastructure to maximize services in waste management (Budiana & Maryono, 2017; Paramita et al. al., 2018). One of the main factors affecting the performance of waste management is operational technical factors, where this factor is related to the availability of facilities and infrastructure in waste management

(Susilawati & Wahyono, 2019). To determine the concept of the waste management system and the level of need for facilities and infrastructure in waste management in an area, the data required includes data on waste generation, composition, and characteristics (Wahyudin et al., 2020).

The purpose of this study was to determine the suitability of land area and infrastructure requirements for the management of TPS3R KSM Bayu Suci in Batannyuh Village, Marga District, Tabanan Regency to evaluate and maximize waste management services.

RESEARCH METHODS

The research was conducted at TPS3R KSM Bayu Suci located in Batannyuh Village, Marga District, Tabanan Regency. The tools used to support this research consist of computers with specifications that are able to operate software including ArcMap 10.3, Microsoft Word, and Microsoft Excel. The method used in this research is descriptive quantitative method, which is a research method that describes or describes the data as it is based on data analyzes obtained in the field. The initial data related to the volume of waste per day was obtained directly from the TPS3R Bayu Suci and then the data was analyzed using a standard calculation of area and building requirements.

In this study, the data used are primary data, namely the condition of the TPS3R KSM Bayu Suci, management data and the volume of waste handling based on the results of observations and reports of Field Facilitators at the Tabanan Regency Environmental Service. As well as secondary data, namely the Technical Guidelines for the Implementation of Labor-Intensive Activities of the Directorate General of Human Settlements. TPS3R KSM Bayu Suci is located in Banjar Umadiwang, Batannyuh Village, Marga District, Tabanan Regency. This TPS3R stands on 500 m2 of land with a hangar area of 72 m2 and an office area of 16 m2. This TPS3R was built in 2016 and has been running for almost 5 years. The current number of workers is 5 people with a schedule for transporting waste 2-3 times a week. Based on data obtained from the Chairman of the Bayu Suci KSM, I Wayan Suwastika, the total population served by TPS3R is 180 families. Waste composting is carried out using the 100 litre capacity drum method. Currently, there is 1 unit composting machine which is in a badly damaged condition. The transportation system uses a 3-wheeled motorcycle tub and currently only has 1 unit.

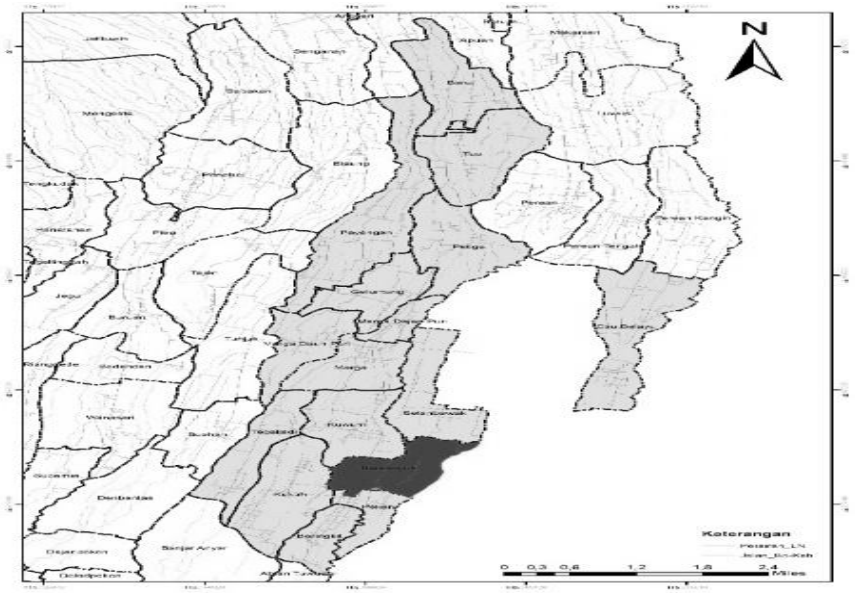

Figure 1. Research Locations in District Marga. Source: Analysis results, 2021.

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Analysis of Composting Land Needs

Analysis of the need for TPS3R land area based on the composting system using a guide document by the Directorate General of Human Settlements. The calculations used in determining the area required for TPS3R land are:

Table 1. TPS3R Land Calculation

		Calculation
Composting Volume		
Service capacity	:	Number of KK x number of people per KK
Total heap of garbage	:	Number of people x waste generation
Volume of organic waste	:	% organic waste x volume of waste per day
Total composting volume	:	Composting time x volume of waste per day
Volume of Each Drum Composer		
Drum volume	:	$\pi \times r^2 \times$ high (m^3)
Number of Drum Composers		
Number of composter drums	:	total volume of composting : volume of compost generation
Total Area of Land Requirement		
Room one unit composter drum	:	length x width total space requirement
Total land requirement	:	number of composter drum needs x space for 1 unit of composter drum

Source: Directorate General of Human Settlements (2020)

RESULTS AND DISCUSSION

In determining the level of facilities and infrastructure for TPS3R management, it is necessary to measure the generation and composition of waste.

a. Identification of Waste Generation
   Based on the data obtained, the volume of waste generated at the TPS3R KSM Bayu Suci is 6 m3/day or the equivalent of 2,202 kg/day. With 180KK services, the weight of waste generation per person is 2.45 kg/person/day.
b. Garbage Composition
   Based on data obtained from interviews, the types of waste that are processed at TPS3R Bayu Suci are organic and inorganic waste. The percentage of compost type of waste is obtained from the ratio of the total volume of waste per day as much as 6 m3/day and residue as much as 2 m3/day. Based on the comparison results, processed organic waste is 67% or 4.02 m2/day and inorganic waste is 33% or 1.98 m3/day. Based on the existing volume, the weight of organic waste that is processed is 1,475.34 kg/day and inorganic waste with a weight of 726.66 kg/day.
c. Waste Density
   Waste density is calculated using data and measurement results of waste generation, referring to SNI 19-2964-1994. Based on the calculation results, the density of waste with a volume of 6 m3 is 3,670 kg/m3 or 0.367 tons/m3.

Analysis of Composting Land Needs

The composting technique used at TPS3R Bayu Suci is composting of waste which is carried out in a closed manner using a drum to get compost and liquid fertilizer. The dimensions of the drum used are 0.5 m x 1 m x 1.3 m. The calculation of the total volume of composting can be seen in Table 2.

Table 2. Calculation of Composting Facility Needs

Description		Amount	Unit
Drum Composter Dimensions			
Drum Diameter	**:**	0,5	m

Description		Amount	Unit
Drum Length	:	1	m
Drum Total Length	:	1,3	m
Total Volume of Composting Garbage			
Number of KK services	:	180	KK
Number of services	:	900	Person
Total waste generation	:	6	m^3/day
Percentage of organic waste	:	67	%
Volume of organic waste	:	4,02	m^3/day
Garbage density	:	367	kg/m^3
Heap of organic waste	:	1,47	ton/day
Heap of organic waste	:	1.470	kg/day
Composting time	:	21	Day
Total composting volume	:	84,42	m^3/day
Compost Pile Volume = Drum Volume			
Drum Volume	:	0,10048	m^3
Number of Drum Composer Needs			
Drum Needs	:	840	unit
Scape between at the end of the drum	:	0,2	m
Length per drum unit	:	0,4	m
Width per compost unit	:	0,6	m
Room one drum unit	:	0,24	m^2
Total space requirement	:	201	m^2

Source: analysis results (2021).

Based on the results of the needs analysis, the required land area for the drum composting method is 201 m2 with a need for 840 composter units and an estimated composting time of 21 days.

TPS3R Area Calculation Analysis

The minimum calculation of TPS3R land area is based on Circular of the Directorate General of Human Settlements Number: 03/SE/DC/2020 concerning Technical Guidelines for the Implementation of Labor-Intensive Activities of the Directorate General of Human Settlements, consisting of composting land of 50%, segregation land of 10%, filtering/ 15% for packaging, 10% for warehouses, 5% for barracks for stalls, 5% for residue accumulation areas, and 5% for office buildings.

Based on the results of the calculation of the need for composting space, it takes a land area of 201 m2, so that the required TPS3R area can be seen in Table 3.

Table 3. Calculation of TPS3R Space Requirements

No	Description		Amount	Unit
1	Total Land Area	:	402	m^2
2	Composting land	:	201	m^2
3	Sorting land	:	40,2	m^2
4	Screening/packaging field	:	60,3	m^2
5	Warehouse	:	40,2	m^2
6	The barracks place	:	20,1	m^2
7	Residual accumulation area	:	20,1	m^2
8	Office	:	20,1	m^2

Source: analysis results (2021)

CONCLUSION

The area of TPS3R KSM Bayu Suci currently exceeds the minimum area to serve waste management in Batannyuh Village. However, in terms of infrastructure, it is still inadequate and

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very far below the minimum service standard to maximize waste management. It is necessary to expand the hangar to accommodate and process the volume of waste generated every day. Improving infrastructure and waste processing technology as a solution to minimize land expansion, considering that the volume of household waste will continue to increase following population growth.

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