

Designing of Temporary Waste Storage for Household Waste in the Implementation of the 5S Method at PT X West Java

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Abstract

Effective and standard-compliant household waste management is a challenge for the industry. PT X, a vehicle tire manufacturer, produces both industrial and household waste. Despite having a good management system, waste is still temporarily stored in open areas without separation, causing soil contamination, odors, and complaints from external parties. This study aims to calculate the waste generation and volume based on categories to design a Temporary Waste Storage Facility that complies with national regulations and supports the implementation of the 5S method. The implementation of the 5S method will improve the household waste management system at PT X, which will reduce the risk of pollution and improve operational practices in the Household Temporary Waste Storage at PT X. Data collection was conducted over eight days through direct measurements in the field in accordance with SNI 3964:2025. The analysis results showed that waste generation consisted of 622 kg/day of residual waste, 765 kg/day of recyclable waste, and 752 kg/day of organic waste. The average daily volume recorded was 2.600 m³/day of residual waste, 3.182 m³/day of recyclable waste, and 2.088 m³/day of organic waste. Based on this data, the Temporary Waste Storage design includes a zone storage division according to waste type, loading and unloading areas, operational corridors, and Temporary Waste Storage maintenance support items.

Keywords: *temporary waste storage, 5s method, household waste management, technical design, sni 3964:2025*

Abstrak

Pengelolaan sampah rumah tangga yang efektif dan sesuai standar menjadi tantangan industri. PT X, produsen ban kendaraan, menghasilkan limbah industri sekaligus limbah rumah tangga. Meski memiliki sistem pengelolaan yang baik, penyimpanan sementara sampah masih dilakukan di area terbuka tanpa pemisahan, menimbulkan pencemaran tanah, bau, dan keluhan pihak eksternal. Penelitian ini bertujuan untuk menghitung timbulan sampah dan volume berdasarkan kategori guna merancang Fasilitas Tempat Penyimpanan Sampah Sementara (TPS) yang sesuai dengan peraturan nasional dan mendukung penerapan metode 5S. Implementasi metode 5S akan meningkatkan sistem pengelolaan limbah rumah tangga di PT X, yang akan mengurangi risiko polusi dan meningkatkan praktik operasional di TPS Limbah Rumah Tangga PT X. Pengumpulan data dilakukan selama delapan hari melalui pengukuran langsung di lapangan sesuai dengan SNI 3964:2025. Hasil analisis menunjukkan bahwa berat sampah terdiri dari 622 kg/hari limbah sisa, 765 kg/hari limbah daur ulang, dan 752 kg/hari limbah organik, Volume rata-rata harian yang tercatat adalah 2,600 m³/hari untuk limbah sisa, 3,182 m³/hari untuk limbah daur ulang, dan 2,088 m³/hari untuk limbah organik. Berdasarkan data ini, desain TPS mencakup pembagian zona penyimpanan berdasarkan jenis limbah, area muat dan bongkar, koridor operasional, serta item dukungan pemeliharaan TPS.

Kata Kunci: *tempat penyimpanan sampah sementara, metode 5s, pengelolaan sampah rumah tangga, desain teknis, sni 3964:2025*

1. Introduction

Human activity cannot be separated from the generation of waste, whether in households, public areas, or workplaces [1]. According to the WHO (World Health Organization), waste is an object that is no longer used or has lost its value, is disliked, and is then thrown away by humans[2]. Data from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry (KLHK) indicate that in 2021, Indonesia produced 78.332 tons of waste per day. This number continues to increase every year, so that by 2024, the amount of waste generated was recorded at 93.73 tons per day. Waste

originates from various sectors, one of which is the industrial sector, not only through production processes but also through the daily activities of workers[3].

As a company engaged in manufacturing tires for vehicles, PT X is inseparable from producing waste. The company's operational activities not only produce industrial waste but also household waste [4] Interestingly, some of this waste has commercial value and can be sold to third parties and become an additional income for PT X. Before being transported by a third party, the waste will be collected from its sources by PT X cleaning staff, and then transported to a temporary storage area. However, at the temporary storage area, the waste is not placed according to the facilities recommended by the Indonesian government, but is only placed on open land. In addition, no separation system between waste that has commercial value and that does not have commercial value. As a result, several types of waste have been mixed and some have seeped into the soil [5], so they are considered to have no use value anymore. In fact, trash bins already have standards in place for sorting waste by type in the company's waste management system.

Another problem caused by the lack of household waste sorting facilities is the emergence of various environmental problems, such as soil pollution and unpleasant odors from mixed wet waste. Bad smell comes from water splatters, food waste, and food residues left behind during the transportation process by a third party [6], [7]. So, to handle this, PT X needs to plan the provision of Temporary Waste Storage. Based on the Government Regulation of the Republic of Indonesia No. 81 of 2012 concerning the Management of Household Waste and Waste-like Household, as an industrial area that collects waste, PT X has an obligation to provide Temporary Waste Storage facilities equipped with a waste sorting system and to prevent environmental pollution.

To maintain consistency, the design is intended to be in line with the implementation of the 5S method in the layout and access. This method was originally developed for workplace maintenance and organizational needs in Japan[8], but has now been widely adopted by various fields. In its application to household waste management, the 5S method is used to enforce compliance and establish habits in accordance with household waste management standards at PT X's. This implementation includes waste sorting by type, facility maintenance, and maintaining the cleanliness of the Temporary Waste Storage to prevent environmental and health issues around the Temporary Waste Storage area.

2. Research Method

This study aims to design a Household Temporary Waste Storage Facility building at PT X, a manufacturing company that produces vehicle tires. At the planning stage, several reference standards were used in the planning and data collection process, namely:

A. Data Collection

The design of the Temporary Waste Storage requires data on waste generation and volume to determine the required area for waste storage. Measurements are carried out using a sampling method that refers to SNI 3964:2025 concerning Methods for Collecting and Measuring Samples of Household Waste and Similar Household Waste. For 8 days, the volume and weight of waste were measured using meters and weighbridges based on the amount of waste collected by transport vehicles throughout the PT X area twice a day [9].

B. Legal Regulations and National Technical Standards Compliance

The design of the Temporary Waste Storage refers to: Regulation of the Minister of Public Works of the Republic of Indonesia (MPW) Number 03/PRT/M/2013, Government Regulation Number 81/2012, and SNI 8632-2018. These three references are interrelated, providing a comprehensive explanation of the technical design criteria requirements for the management of household waste and similar waste at Temporary Waste Storage [10], [11], [12]. The following Table 1 summarizes the results of the integration of these three regulations, which contain important criteria as the basis for Temporary Waste Storage design.

Table 1. The List consolidates National Regulation and SNI for the Temporary Waste Storage of Household Waste and waste-like household

No	Source	Desain Criteria	About
1.	MPW No 03/2013, SNI 8632/2018	Maximum Area	Maximum 200 m ²
2.	MPW No 03/2013, Gov. Regulation 81/2012, SNI 8632/2018	Waste Segregation.	Minimum 5 waste categories or sorting area

No	Source	Desain Criteria	About
3.	MPW No 03/2013, SNI 8632/2018	Building Type	Non-permanent waste container
4.	MPW No 03/2013, Gov. Regulation 81/2012,	Area & Capacity	Adjusted to the volume of generated waste
5.	MPW No 03/2013, Gov. Regulation 81/2012	Accessibility	Easily accessible for waste collection vehicles
6.	MPW No 03/2013, Gov. Regulation 81/2012	Environmental Protection	Does not pollute the environment.
7.	MPW No 03/2013, SNI 8632/2018	Placement/Location	Placement does not disrupt aesthetics or traffic.
8.	SNI 8632/2018	Roof cover	Roof to protect from rain

C. Support in Implementing the 5S Method

In addition to complying with the design criteria specified in the regulations, the Temporary Waste Storage design will also be developed to support orderliness and cleanliness in the work area, in line with the principles of the 5S Method as summarized in **Table 2** [13].

Table 2. 5S Method Indicators Desain

No	5S Metode	Description	Indicators Desain
1.	Seiri	Sorting waste according to type.	Availability of waste storage areas according to classification (organic, residual, and recyclable).
2.	Seiton	Every activity and storage of waste/items has its own place.	The placement is not mixed with the building's partitions and labels. The allocation of areas for placing items and the layout support ease of operational activities.
3.	Seiso	Routine cleaning and maintenance of cleanliness	The area is equipped with water sources, drainage channels, and floors that drain water into the drainage system so that there is no standing water and water does not seep into the ground.
4.	Seiketsu	Disciplined maintenance of the previous 3S with the implementation of SOPs.	The design supports the implementation of existing SOPs at PT X regarding waste sorting, storage, and collection/transportation schedules to ensure they are carried out on time.
5.	Shitsuke	Internalizing 5S as a habit through regular audits.	The area design, arranged according to needs, facilitates routine control mechanisms for maintaining the visual cleanliness of the building and ensuring the proper placement of trash by staff.

D. Data Calculation

a) Storage Area Calculation

The storage area is designated to hold sorted waste after collection and before third-party transport. The area is calculated using the basic volume formula, adding the size of the circulation space, and multiplying the estimated number of days the waste is stored before transportation[5]. The calculation of the area follows:

$$\text{Storage Area} = \frac{\text{Waste Volume (m3)}}{\text{High waste generation planning (m)}} \times (1 + \text{Circulation}) \times \text{Storage duration} \quad (1)$$

b) Storage Width Calculation

The width of the planning area is determined after calculating the holding area. The calculation is performed as follows:

$$\text{Width Storage} = \frac{\text{Waste holding area (m2)}}{\text{Storage length planning (m)}} \quad (2)$$

3. Results and Discussion

3.1 Existing Waste Management System Conditions at PT X

Based on direct field observations, the existing condition of household waste management at PT X is as follows:

A. Waste Bin Container

Household waste is generally collected in plastic containers. The sources of waste come from office activities, cafeterias, plantation areas, and smoking areas. Waste containers are categorized into three types: organic, recyclable, and residual. Organic waste refers to easily decomposable waste, particularly food. Recyclable waste refers to waste that can be recycled and has resale value to third parties. Residual waste refers to waste that cannot be recycled or has no resale value.

B. Collection System

Cleaning staff collect trash from every container in the building twice a day. Trash is packed in plastic bags according to category, but no re-sorting, so unsorted trash remains mixed. Packaged trash is then transported to a temporary storage area by a collection team using trucks for recyclable and residual waste, and special three-wheeled motorcycles for organic waste, covering the entire PT X area.

C. Storage Area

The collection process does not meet standards; waste is mixed, placed on the ground, and is not protected from rain, show in **Figure 1**.



Figure 1. Existing Storage Area

D. Third Party Transportation

A third party collects the trash every afternoon, but the mixed nature of the trash often causes some waste to be left behind.

3.2 Type of Household Waste Category at PT X

Observation results show that PT X's household waste comprises general waste (recyclable and residual) and organic waste. This classification is based on field surveys, company management standards, and interviews with waste-management staff and third-party handlers.

Table 3. Waste Category at PT X

Category	Waste Name	Description	
General Waste	Cardboard & Paper	Used cartons, newspapers, and office paper	
	Recycle	Plastic Bottles	PET Bottles
		Plastic Food Containers	Plastic meal boxes, cups, and bowls
	Residue	Broken Stationery	Damaged pens, markers, and other office stationery
		Fabric	Fabric majun that does not contain hazardous materials
		Used Tissue	Contaminated tissue paper
		Styrofoam	Food containers, cups, and packaging made of styrofoam
		Can	Drink cans or air freshener cans
		Dirty Plastic Sachet / Packaging	Oil- or food-contaminated plastic wrappers
	Organic Waste	Garden Waste	Leaves, grass clippings, and small branches mix with sand
Sanitary Pads		Used sanitary pads and similar hygiene products	
Other Non-Recyclable Waste		All waste that does not fall into the recyclable or food waste categories, like cigarette butts	
Fruit Waste		Fruit and skin residue	
Food leftovers		Leftover rice, noodles, meat, and other ready-to-eat food	
	Kitchen Preparation Waste	Vegetable scraps, fish/meat trimmings, and other raw cooking waste	

Source: Analysis Result, 2025

3.3 Waste Generation

Waste generation can be defined as the amount of waste produced per person or per unit in units of volume (m³) or weight (kg) per day[9], [14]. In this study, calculations were made based on the sorting category plan at the waste collection site and the waste categories specified in PT X's waste bins, namely Residual, Recyclable, and Organic waste. After taking samples and conducting measurements for 8 days, the following tables present the detailed calculation results:

Table 4. Waste Generation Calculation

Day	Residual		Recyclable		Organic	
	Volume (m ³)	Weight (kg)	Volume (m ³)	Weight (kg)	Volume (m ³)	Weight (kg)
1	2.600	710	3.313	874	2.394	944
2	2.934	614	3.42	768	2.075	741
3	3.253	736	3.268	785	2.075	813
4	2.858	730	3.268	841	2.261	741
5	2.888	618	3.694	962	2.128	923
6	1.231	195	1.596	188	1.332	182
7	2.721	772	3.496	869	2.394	938
8	2.326	600	3.404	831	2.048	732
Average	2.600	622	3.182	765	2.088	752

Source: Analysis Result, 2025

Table 4 shows the average results of waste measurements taken twice a day for eight days. The residual category has an average volume of 2.600 m³ per day with a weight of approximately 622 kg per day. The recyclable category shows an average volume of 3.182 m³ per day with a weight of approximately 765 kg per day. Meanwhile, the organic category has an average volume of 2.088 m³ per day with a weight of approximately 752 kg per day.

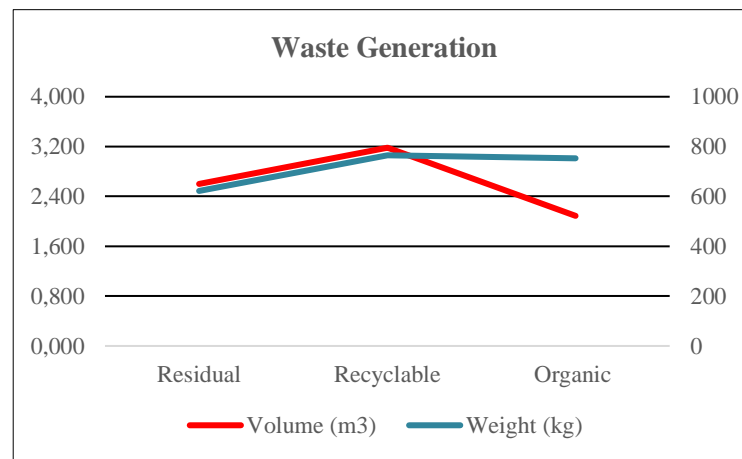


Figure 2. Comparison chart of volume and weight of waste for each category

Source: Analysis Result, 2025

The graph shows that recyclable waste has the highest average volume and weight (3.182 m³ and 765 kg/day). Residual waste is in the middle (2.600 m³ and 622 kg/day), while organic waste has the lowest volume (2.088 m³) but a weight almost equivalent to recyclable waste (752 kg/day).

3.4 Planning Household Temporary Waste Storage

A. Storage Area and Width Calculation Results

Storage space will be created according to the needs and types of waste produced. Recyclable and residual waste will be stored in one room and only separated by a partition approximately 1 m high. Meanwhile, organic waste will be stored in a tank 1 m high to facilitate the cleaning process and leachate drainage because organic waste has a high moisture content and rots quickly[15]. From the

storage area calculation equation, the area of each area for storing waste based on sorting according to category is as follows:

Table 5. Storage Area and Width Area

No	Parameter	Residual	Recyclable	Organic	Unit	Reference
1.	Average Waste Volume	2.600	3.182	2.088	m ³ /day	Calculation
2.	Storage Height	1	1	1	m	Assumed
3.	Shelter Length	3.5	3.5	3.5	m	Assumed
4.	Circulation	15	15	15	%	De Chiara & Callender (1983)[16]
5.	Storage Duration	3	3	3	Day	Assumed from transport frequency
6.	Storage Area	9	11	7.3	m ²	Calculation Eq 1
7.	Shelter Width	2.5	3.1	2.1	m	Calculation Eq 2

Source: Analysis Result, 2025

B. Operational Corridor

This corridor area helps staff unload waste and sort it if there is waste that has not been separated. The size of the corridor is determined after calculating the total width of the waste storage area and is assumed to be as needed. The recyclable and residual area measures 5.6 m x 1.5 m, while the organic waste area measures 4 m x 0.98 m.

C. Loading/Unloading Area

Area where vehicles stop to unload or load waste. The length of the area is determined based on the length of the PT X trucks.

Table 6. Loading/Unloading Area Calculation Result

No	Parameter	Residual & Recyclable	Organic	Unit	Reference
1.	Width	5.6	4.0	m	Total Width Area
2.	Length	5.0	5.0	m	Assumed Length Truck
3.	Area	28	20	m ²	W x L

Source: Analysis Result, 2025

D. Total Planned Land Area

The Temporary Waste Storage facility for PT X's household waste is planned to have a total area of 96 m², with the following details.

Table 7. Total Planned Land Area Temporary Waste Storage

No	Area	Land area (m ²)
1.	Residual waste storage area	9
2.	Recycle waste storage area	11
3.	Organic waste storage area	7.3
4.	Recycle and Residual operational corridor	8.4
5.	Organic operational corridor	3.9
6.	Recycle and Residual loading/unloading	28
7.	Organic loading/unloading	20
8.	Organic-waste leachate gutter area	2
9.	Organic-waste access cleaning areas (left & right)	6.6
Total Land		96

Source: Analysis Result, 2025

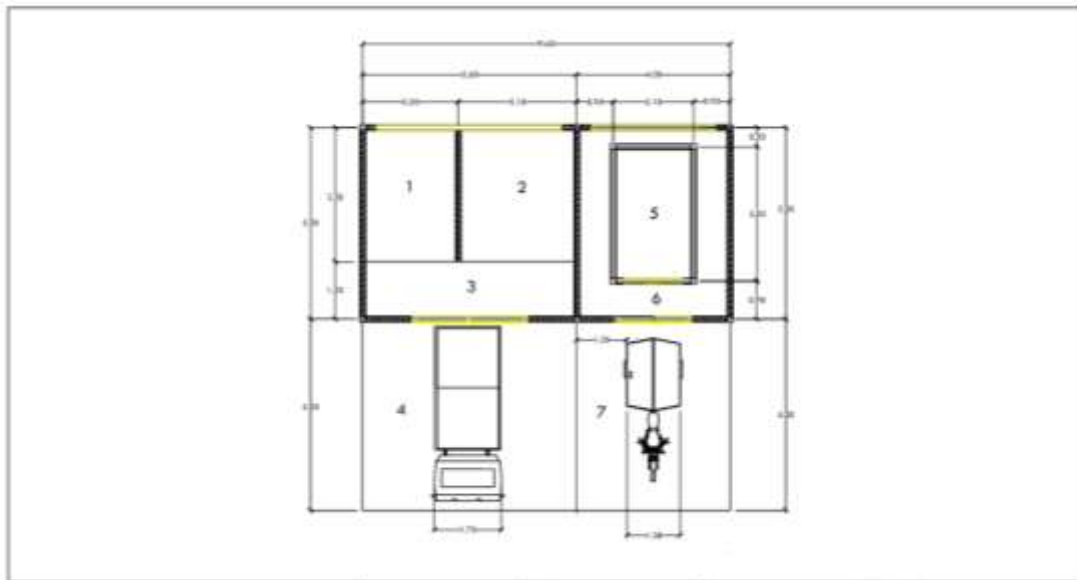


Figure 3. Layout Planning Household Temporary Waste Storage PT X

The image above shows the layout plan of the waste transfer station, which is divided into several zones with different functions.

- (1) Residual Waste Storage Area: area for storing residual waste.
- (2) Recyclable Waste Storage Area: area for storing recyclable waste.
- (3) Residual & Recyclable Waste Operational Corridor: operational corridor for the transfer and sorting of residual and recyclable waste.
- (4) Residual & Recyclable Waste Truck Loading/Unloading Area: truck loading/unloading area for residual and recyclable waste.
- (5) Organic Waste Storage Area: special storage area for organic waste.
- (6) Organic Waste Operational Corridor: organic waste operational corridor.
- (7) Organic Waste Loading/Unloading Area: truck loading/unloading area for organic waste.

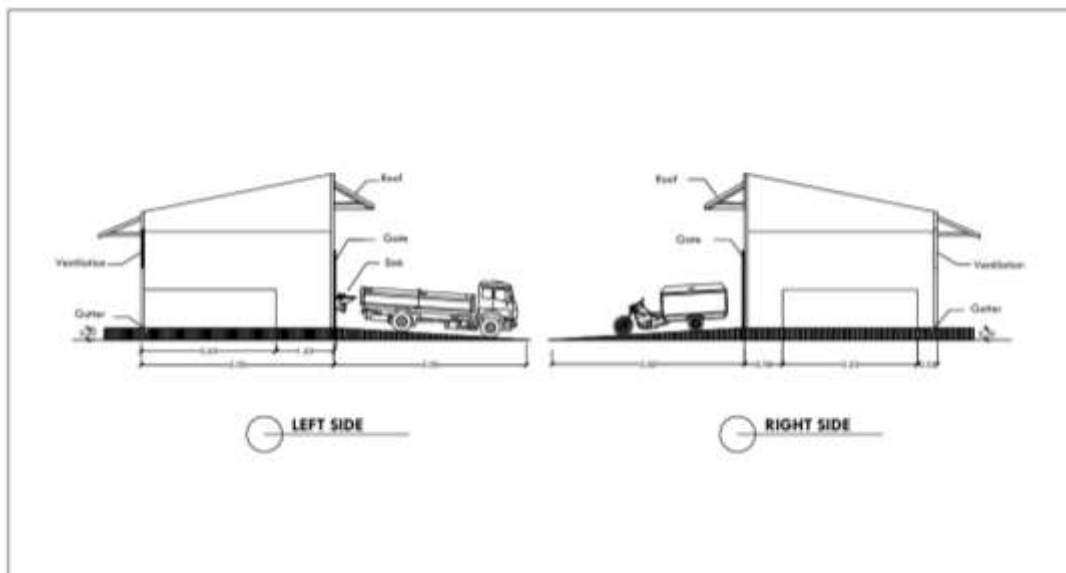


Figure 4. Left and Right View

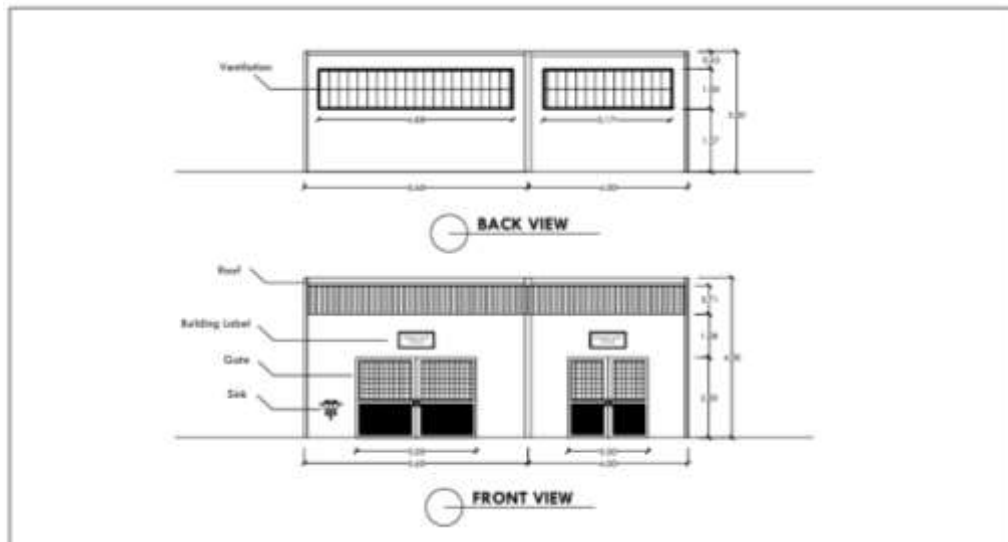


Figure 5. Back and Front View

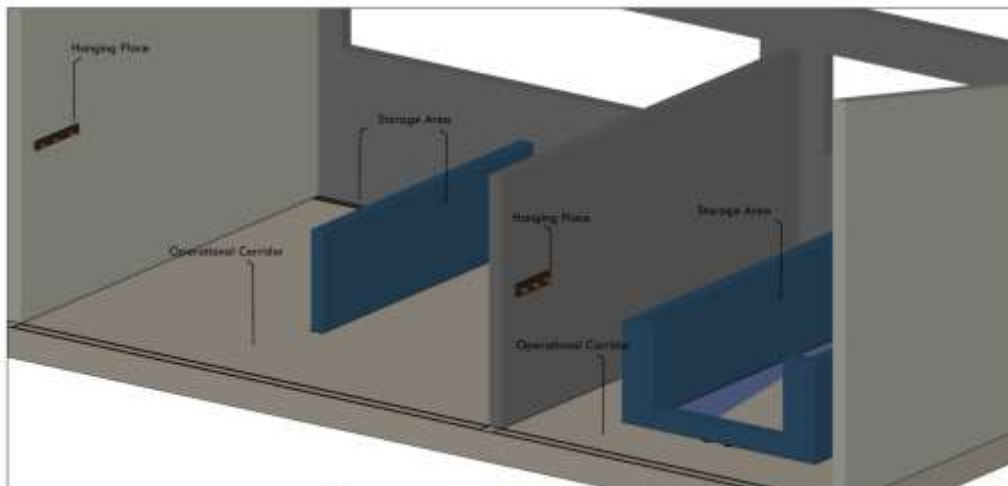


Figure 6. Front Inside View Planning

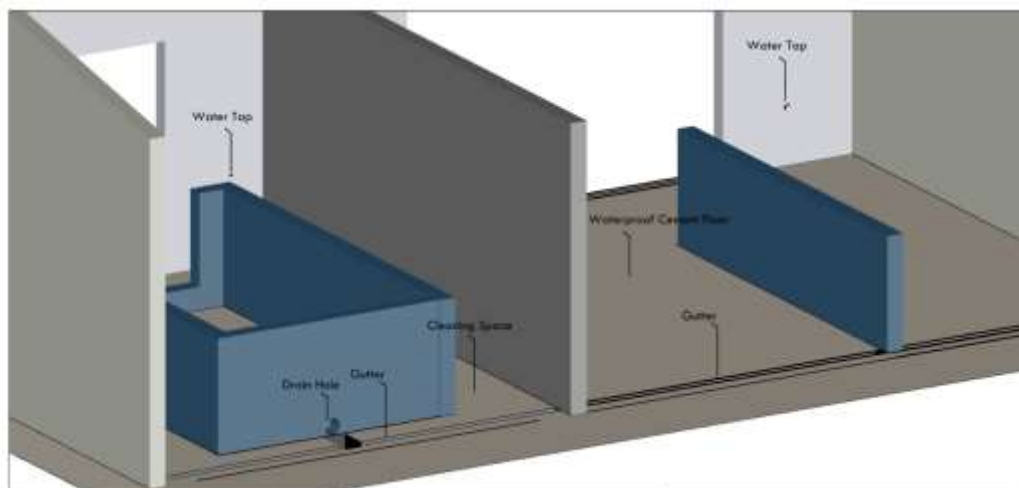


Figure 7. Back Inside View Planning

3.5 Planning Location

The location of the household Temporary Waste Storage facility PT X is determined based on the company's needs and taking into account areas that do not interfere with main operational activities. The storage location is still within the area owned by PT X, with a distance of ± 0.3 km between the planned location and the factory area. The planned location is shown in **Figure 8**.

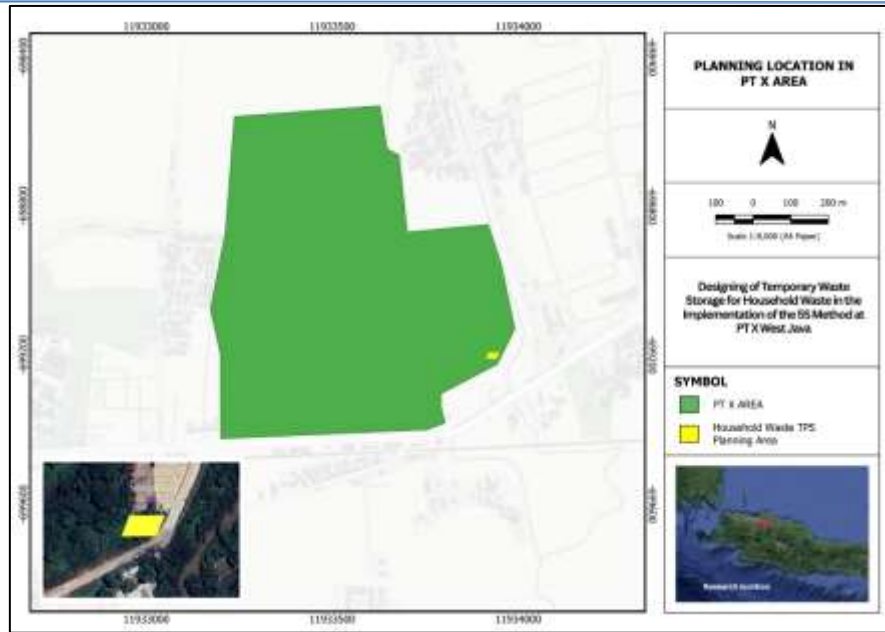


Figure 8. Planning Location Temporary Household Waste Storage Facility at PT X

3.6 Desain Evaluation

A. Evaluation Desain in Accordance with Indonesian Regulation and Standard Requirements

Table 8 presents the planned design results for the Household Temporary Waste Storage facility, comparing and ensuring compliance with Regulation of the Minister Regulation of Public Works of the Republic of Indonesia (MPW) Regulation No. 03/PRT/M/2013, Government Regulation No. 81/2012, and SNI 8632-2018.

Table 8. Evaluation Desain

No	Criteria	Regulation	In Design	Validation In Design
1	Maximum Area 200 m ²	MPW Regulation No. 03/2013; SNI 8632:2018	√	Planning Area 96 m ²
2	Waste Segregation	MPW Regulation No. 03/2013; Gov. Regulation No. 81/2012; SNI 8632:2018	√	According to the Waste Category (Figure 2,5)
3	Building Type Non-permanent waste container	MPW Regulation No. 03/2013; SNI 8632:2018	X	The area is made permanent
4	Adjusted to the volume of generated waste	MPW Regulation No. 03/2013; Gov. Regulation No. 81/2012	√	Calculation (Tables 5)
5	Easily accessible for waste collection vehicles	MPW Regulation No. 03/2013; Gov. Regulation No. 81/2012	√	Area division: storage, sorting corridor, and vehicle loading/unloading (Figure 2,3,5)
6	Does not pollute the environment	MPW Regulation No. 03/2013; Gov. Regulation No. 81/2012	√	Waterproof floors and enclosed buildings (Figures 3,4,6)
7	Placement does not disrupt aesthetics or traffic	MPW Regulation No. 03/2013; SNI 8632:2018	√	Empty land area and ±3 km from the factory area (Figure 7)
8	Equipped with a roof cover	SNI 8632:2018	√	(Figure 3,4)
Total Achieved			7	
Percentage			87.5%	

Source: Analysis Result, 2025

Based on the evaluation results, the proposed design plan meets 7 of the 8 criteria. One criterion that is not met is due to the design being in the form of a permanent building, in accordance with the company's needs and to support operational convenience, which is considered less than optimal if only containers are used.

B. Evaluation Desain in the 5S Method Support

The design is expected to improve the waste management system, particularly in the Household Temporary Waste Storage, by emphasizing ease of sorting and maintaining cleanliness. In addition, this design is expected to complement and meet the criteria set out in Indonesian regulations and standards. The following table shows the design's achievements in supporting the implementation of the 5S Method.

Table 9. 5S Method Evaluation Desain

No	Method	Indicators	Achievements In Design	Validation
1	Seiri	Availability of waste storage areas according to classification (organic, residual, and recyclable)	√	(Figure 2,5)
2	Seiton	The placement is not mixed with the building's partitions and labels. The allocation of areas for placing items and the layout support ease of operational activities.	√	(Figure 4,5,6)
3	Seiso	The area is equipped with water sources, drainage channels, and floors that drain water into the drainage system so that there is no standing water and water does not seep into the ground.	√	(Figure 5.6)
4	Seiketsu	The design supports the implementation of existing SOPs at PT X regarding waste sorting, storage, and collection/transportation schedules to ensure they are carried out on time.	√	(Figure 2,5)
5	Shitsuke	The area design, arranged according to needs, facilitates routine control mechanisms for maintaining the visual cleanliness of the building and ensuring the proper placement of trash by staff.	√	(Figure 2,5,6)

Based on **Table 9**, the area design planning successfully supported the implementation of the five principles of 5S (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke). The creation of a design based on the 5S method is expected to be a means of fostering compliance and discipline among officers in the sorting and cleanliness maintenance process, from the collection and transportation stages to storage inside the building. Therefore, the existing management SOPs at PT X can be implemented consistently.

4. Conclusion

PT X's household waste management system has a basic mechanism for sorting, collection, and cooperation with third parties, but its effectiveness in terms of collection facilities is still limited due to inadequate facilities, inconsistent sorting, and storage in open areas that cause soil contamination and odors. Therefore, facilities need to be built and require measurement data in accordance with SNI 3964:2025. The study's results indicate an average waste generation of 622 kg/day of residue, 765 kg/day of recyclables, and 752 kg/day of organic waste, corresponding to volumes of 2,600 m³, 3,182 m³, and 2,088 m³, respectively. Based on this data, an area of 96 m² is required, divided into zones for residue (9 m³), recyclables (11 m³), and organic waste (7.2 m³). This facility is equipped with an operational corridor, loading and unloading area, waterproof floor, drainage, ventilation, water source, and protective roof. This design meets 7 of the 8 national regulatory criteria and supports the implementation of the 5S method, thereby increasing effectiveness, facilitating the implementation of SOPs, and improving the cleanliness of household waste management at the PT X Temporary Waste Storage Facility.

5. Acknowledgment

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6. Abbreviations

TPS	Tempat Penampungan Sementara
5S	Seiri, Seiton, Seiso, Seiketsu, and Shitsuke
SOP	Standard Operating Procedure
MPW	Minister Regulation of Public Works of the Republic of Indonesia
SNI	Standar Nasional Indonesia

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