Sustainability (STPP) Theory, Practice and Policy
Vol. 4 No. 1
e-ISSN: 2808-4829
DOI: https://doi.org/10.30631/sdgs.v4i1.2614
https://e-journal.lp2m.uinjambi.ac.id/ojp/index.php/SDGs

The Livability Level of Settlements in Kelurahan Dalam Bugis: An Analysis of Waste Management Aspects and Fire Protection Systems

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ARTICLE INFO

Keywords: *Settlement; Garbage; Fire*

Received: April 20, 2024
Accepted: Mei 28, 2024
Published: June 1, 2024

ABSTRACT

The dynamic development of an area significantly impacts people's living patterns, particularly regarding settlement issues. One major issue in settlement development is the livability of the settlement. This research aims to identify the distribution of settlement livability levels based on waste management conditions and fire protection systems. The study was conducted in Kelurahan Dalam Bugis, East Pontianak District, Pontianak City. A mixed methods approach was used in this research. Spatial quantitative data were analyzed and presented using Geographic Information Systems, while qualitative data were presented through data reduction, documentation, observation, and field interviews. The results showed that 16.4% of settlements are categorized as light slums (livable), 0.7% as moderate slums (quite livable), and 82.9% as severe slums (not livable). Livable settlements cover an area of 32.54 hectares (1,706 housing units). Moderately livable settlements cover an area of 1.33 hectares (97 housing units). Uninhabitable settlements cover an area of 159.13 hectares (2,290 housing units). Mitigation of critical health and safety aspects, such as fire hazards, requires increasing public awareness of waste management and providing adequate waste processing and fire-fighting facilities to prevent unwanted events.

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Introduction

One of the most fundamental and crucial needs for humans is habitable housing. The flow of urbanization, driven by various complex interests, poses significant challenges to meeting this need. Rapid urbanization presents major challenges in achieving affordable and sustainable housing (Moghayedi et al., 2023). This trend leads to imbalanced dynamics between metropolitan urban agglomeration and its complementarity with the socio-economic and socio-cultural welfare of society (Paul, 2024).

Several aspects are considered to assess the suitability of an area as a residential zone to ensure sustainable urban development. Zhang et al. (2023) explain that urban livability

assessments have garnered widespread attention due to their importance for sustainable urban development. The livability of habitable urban settlements has become a major focus among academics both domestically and internationally (Zhao et al., 2022). In China, for instance, urban livability is a profound concern, particularly in urban areas (Yurui et al., 2020).

Livability concerning habitable living spaces frequently emerges as an indicator in various health studies to establish public policies (Gonzalez Bohorquez et al., 2024). The livability of a city encompasses social, economic, environmental, and other factors, playing a crucial role in determining the quality of life (Cao et al., 2021). In the context of Indonesia, rapid urbanization poses distinct challenges to creating habitable settlements. The habitability of settlements is assessed based on the Settlement Location Assessment Formula stipulated in the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 14/PRT/M/2018 on the Prevention and Quality Improvement of Slum Housing and Settlements. The levels of habitability of settlements are categorized into three: habitable (light slums), moderately habitable (moderate slums), and uninhabitable (severe slums).

One of the criteria for assessing the habitability of settlements is waste management conditions and fire protection systems. Kelurahan Dalam Bugis is one of the urban areas in Indonesia facing various issues related to settlement habitability, particularly in terms of waste management and fire protection systems. Waste management is a vital component in creating a healthy and comfortable residential environment. In Kelurahan Dalam Bugis, waste management remains a significant challenge, particularly regarding public awareness and supporting infrastructure. An effective and efficient approach to waste management is essential to ensure the cleanliness and health of the residential environment. According to Susilawati (2018), one of the main indicators in creating a healthy and clean environment is good waste management. Ineffective waste management can lead to serious health and environmental issues. Studies show that active community participation in waste management, such as sorting waste at the source and participating in recycling programs, can improve system performance (Wahyuni, 2017).

Besides waste management, an adequate fire protection system is also a determining factor for settlement habitability. According to Putra (2019), to reduce the risk of fires in residential areas, it is important to provide fire protection infrastructure such as hydrants and portable fire extinguishers, as well as to offer fire management training and instructions. Another study by Hartono (2020) indicates that strengthening fire protection systems through local government and community collaboration can enhance residents' safety and comfort. In the context of Kelurahan Dalam Bugis, the main challenges in the fire protection system include limited funding and inadequate infrastructure.

Fire protection systems are crucial for settlement quality. Fires can occur at any time and often result in significant material and non-material losses. The risk of fire in Dalam Bugis is very high, especially in densely populated residential areas. Therefore, to protect residents and property from fires, adequate fire protection systems, including available fire extinguishers and effective evacuation systems, are essential.

This study aims to describe the spatial distribution and analyze the habitability levels of settlements in Kelurahan Dalam Bugis, focusing on two main aspects: waste management and fire protection systems. It is expected that this analysis will provide a comprehensive overview of the current conditions and offer recommendations for future improvements. This study will assist local governments and related parties in developing better policies and strategies to improve the habitability of settlements in Kelurahan Dalam Bugis. Therefore, a healthier, safer,

and more comfortable residential environment can be created, enhancing the quality of life for residents.

Methodology

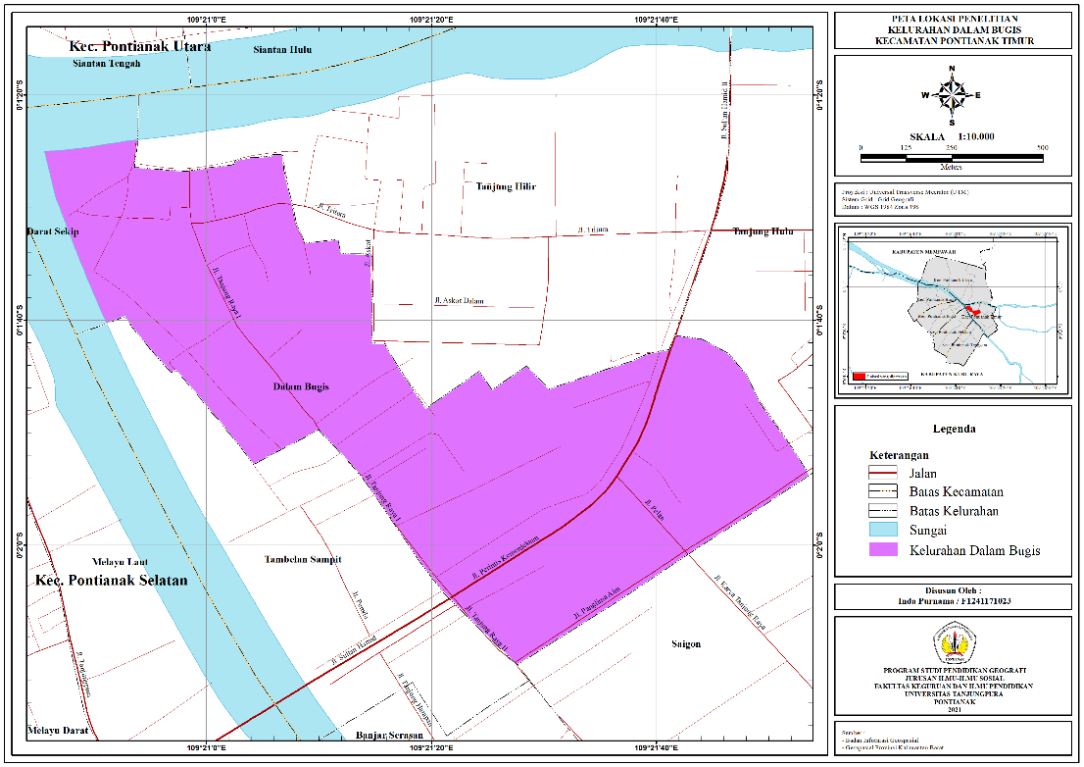
Study Area

This research was conducted in Kelurahan Dalam Bugis, East Pontianak District, Pontianak City. Kelurahan Dalam Bugis is located at coordinates 109°20'53" - 109°21'27" E and 0°01'19" - 0°02'10" N (Profil Kelurahan Dalam Bugis, 2020). The approach used in this research was mixed methods. Quantitative spatial data analysis and presentation were conducted using Geographic Information Systems (GIS), while qualitative data presentation was carried out through data reduction, documentation, observations, and field interviews.

Data Sources

The data sources used in this research are primary and secondary data. Primary data were obtained through interviews with residents of Kelurahan Dalam Bugis and the Cipta Karya Department of the Ministry of Public Works and Public Housing (PUPR). Secondary data were obtained from the Kelurahan Dalam Bugis profile, 2021 settlement photos, the Mayor of Pontianak's Decree No. 1063.1/D-PRKP/2020 on Housing Location Determination, and the Indonesian Ministry of Public Works and Public Housing Regulation No. 02/2018 on Slum Housing Prevention and Quality Improvement.

Figure 2. Administrative map of Kelurahan Dalam Bugis



Data Analysis

Data analysis was conducted through three simultaneous activities: data reduction, data display, and verification or conclusion drawing. The data presentation involved tables of scoring results, documents, and data identifying settlement livability based on the Settlement Location Assessment Formula stipulated in Regulation No. 14/PRT/M/2018 by the Indonesian Ministry of Public Works and Public Housing.

The Livability Level of Settlements in Kelurahan Dalam Bugis: An Analysis of Waste Management Aspects and Fire Protection Systems

The habitability level of a settlement based on waste management conditions was assessed using a weighting system for each criterion. The scoring criteria for waste management infrastructure not meeting technical standards are:

1. Score 1 (good) for areas where 25% - 50% of the infrastructure does not meet standards.
2. Score 3 (poor) for areas where 51% - 75% of the infrastructure does not meet standards.
3. Score 5 (very poor) for areas where 76% - 100% of the infrastructure does not meet standards.

Similarly, the scoring criteria for waste management systems not meeting technical standards are:

1. Score 1 (good) for areas where 25% - 50% of the system does not meet standards.
2. Score 3 (poor) for areas where 51% - 75% of the system does not meet standards.
3. Score 5 (very poor) for areas where 76% - 100% of the system does not meet standards.

Weighting was also applied to the fire protection condition aspect. The scoring criteria for the absence of fire protection infrastructure are:

1. Score 1 (good) for areas where 25% - 50% of the infrastructure is unavailable.
2. Score 3 (poor) for areas where 51% - 75% of the infrastructure is unavailable.
3. Score 5 (very poor) for areas where 76% - 100% of the infrastructure is unavailable.

The scoring criteria for the absence of fire protection systems are:

1. Score 1 (good) for areas where 25% - 50% of the system is unavailable.
2. Score 3 (poor) for areas where 51% - 75% of the system is unavailable.
3. Score 5 (very poor) for areas where 76% - 100% of the system is unavailable.

The scores for each condition aspect were then summed to determine the initial habitability level of the settlements. The score range for building conditions and environmental drainage is 0-10, categorized as light slums (habitable), moderate slums (moderately habitable), and severe slums (uninhabitable). Habitable settlements (light slums) score 0-3, moderately habitable settlements (moderate slums) score 4-7, and uninhabitable settlements (severe slums) score 8-10 (Ramadhan, Purnomo, & Summiyatinah, 2020).

After determining the habitability levels, the researchers presented maps showing the spatial distribution of settlement habitability in Kelurahan Dalam Bugis, East Pontianak District, Pontianak City, using overlay, buffer, and clip techniques based on waste management conditions and fire protection condition aspects.

Data validation was conducted to test data credibility using supporting references. These references included supporting evidence that corroborated the reported research findings, such as interview results, observational assessments of slum levels, and photographic documentation.

Result

Distribution of Settlement Livability Levels Based on Waste Management Conditions and Fire Protection Systems in Kelurahan Dalam Bugis, East Pontianak District

Based on the assessment formula, the distribution of settlement livability levels in Kelurahan Dalam Bugis, East Pontianak District, Pontianak City, was evaluated using observations, interviews, and documentation as follows:

1. Habitable Settlements (Light Slums)

   The livability level of settlements in Kelurahan Dalam Bugis based on waste management and fire protection conditions is illustrated in the map below. The map

indicates that there are two settlement areas classified as habitable (light slums). Light slum 1 is located between 109°20'53.96"E - 109°20'48.61"E and 0°1'19.94"N - 0°1'35.02"N. Light slum 2 is located between 109°21'6.30"E - 109°20'59.10"E and 0°1'25.38"N - 0°1'46.56"N, covering a total area of 32.54 hectares, which is 16.4% of Kelurahan Dalam Bugis, with 1,706 housing units.

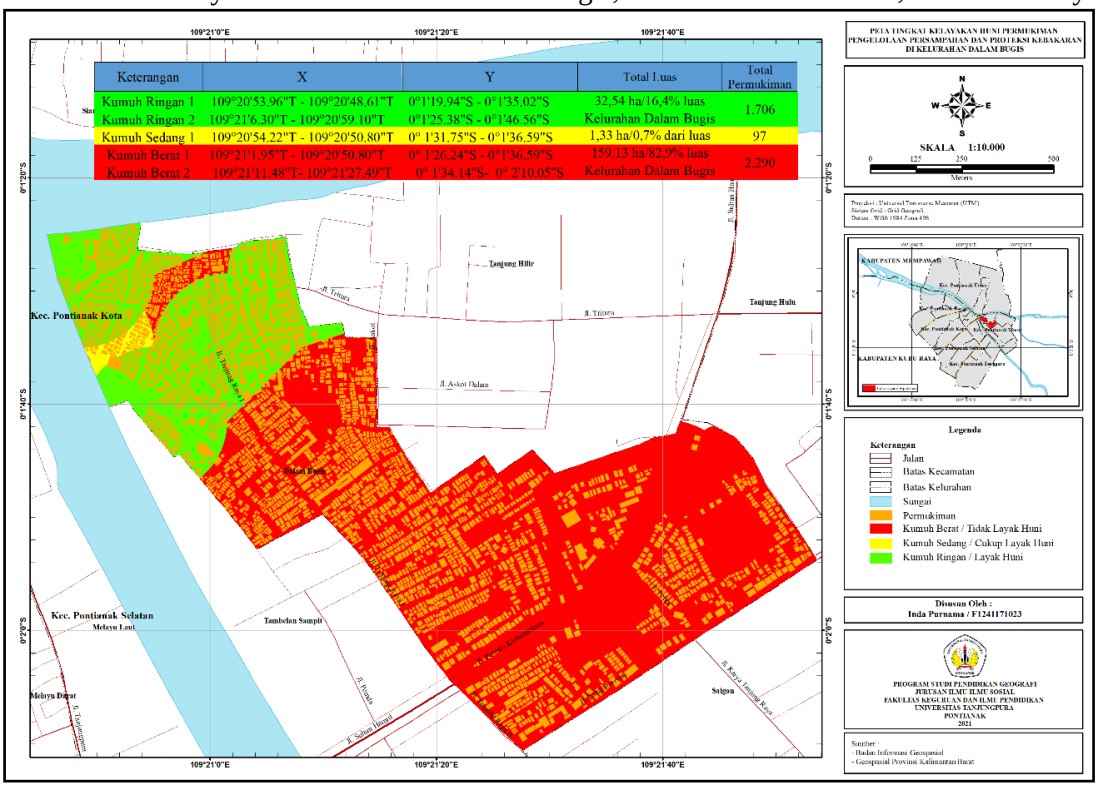
2. Moderately Habitable Settlements (Moderate Slums)

The livability level of settlements in Kelurahan Dalam Bugis categorized as moderate slums (moderately habitable) based on waste management and fire protection conditions is shown in the map below. The map indicates that there is one settlement area classified as a moderate slum (moderately habitable). The moderate slum is located between 109°20'54.22"E - 109°20'50.80"E and 0°1'31.75"N - 0°1'36.59"N, covering a total area of 1.33 hectares, which is 0.7% of Kelurahan Dalam Bugis, with 97 housing units.

3. Uninhabitable Settlements (Severe Slums))

The livability level of settlements in Kelurahan Dalam Bugis categorized as severe slums (uninhabitable) based on waste management and fire protection conditions is shown in the map below. The map indicates that there are two settlement areas classified as severe slums (uninhabitable). Severe slum 1 is located between 109°21'1.95"E - 109°20'50.80"E and 0°1'26.24"N - 0°1'36.59"N. Severe slum 2 is located between 109°21'11.48"E - 109°21'27.49"E and 0°1'34.14"N - 0°2'10.05"N, covering a total area of 159.13 hectares, which is 82.9% of Kelurahan Dalam Bugis, with 2,290 housing units. The detailed distribution of settlement livability levels based on waste management and fire protection conditions can be seen in the map below:

Figure 3. Map of Settlement Livability Levels Based on Waste Management Conditions and Fire Protection Systems in Kelurahan Dalam Bugis, East Pontianak District, Pontianak City



Discussion

Distribution of Settlement Livability Levels Based on Waste Management Conditions and Fire Protection Systems in Kelurahan Dalam Bugis, East Pontianak District

Waste Management

Waste management encompasses the disposal and processing of household, commercial, office, and public building waste, integrated with a broader regional waste disposal system. The condition of waste management was assessed based on whether the infrastructure and systems met technical requirements.

According to Indonesian Government Regulation No. 81/2012, Article 1 Paragraph 7, Temporary Disposal Sites (TPS) are locations where waste is stored before being transported to recycling, management, or integrated processing facilities. Article 8 defines TPS 3R (Reduce, Reuse, Recycle) as places for waste collection, sorting, reuse, and recycling at the area level.

The criteria for waste management infrastructure include the presence of TPS or TPS 3R at the neighborhood level. Interviews and observations revealed that there are only two TPS in Kelurahan Dalam Bugis, located at Pasar Kadariyah Pontianak and Jalan Tanjung Raya 1. According to 2020 data from the Pontianak Environmental Agency, there are no TPS 3R or TPST (Integrated Waste Processing Sites) in Kelurahan Dalam Bugis.

Table 1. Data TPS 3R in Pontianak City

No	*Name*	*Address*
1.	*Rumah kompos*	*Jalan Kebangkitan Nasional*
2.	*TpS 3R Kurnia*	*Jalan M. Yamin*
3.	*TPS 3R Sungai Beliung*	*Jalan Komyos Sudarso*
4.	*Bank Sampah Ananda*	*Jalan Purnama 2*
5.	*PDU*	*Jalan Karet Nipah Kuning Dalam*

Source: Pontianak City Environment Agency 2021

Waste bins for separating organic and inorganic waste are only found in three locations in Kelurahan Dalam Bugis: the Lurah Office, Masjid Jami Sulthan Syarif Abdurahman, and Gang Berkat. Waste in Jalan Tanjung Pulau is transported using carts coordinated by the local neighborhood association (RW). In Kampung Tua, waste carts were initially used but later discontinued by the community.

Interviews and observations revealed that the Kotaku Program (2017/2018) provided bins for domestic waste sorting and storage, placed in front of homes around Masjid Jami Sulthan Syarif Abdurahman. The bins can be seen in the following image:

Figure 4. Waste Bins in Front of Homes

According to the Ministry of Public Works Regulation No. 03/PRT/M/2013, waste processing involves altering the characteristics, composition, and/or processing location of waste. This criterion was assessed based on whether a settlement is connected to a septic tank, either individually, communally, or centrally. Interviews revealed that homes built over rivers have toilets that discharge directly into the river and are not connected to a septic tank. In other areas of Kelurahan Dalam Bugis, homes not built over rivers have toilets connected to septic tanks.

Thus, waste processing is carried out at integrated waste processing facilities. Waste collection and transportation in Kelurahan Dalam Bugis are only conducted around Masjid Jami Sulthan Syarif Abdurahman, specifically in Jalan Tanjung Pulau. The collection and transportation activities are carried out by Bank Sampah Beting Permai personnel. According to Asteria & Heruman, "bank sampah" is a concept of waste collection that involves sorting waste. The locations of 'bank sampah' in East Pontianak District are listed in Table 2.

Table 2. Data Bank Sampah in East Pontianak District

No	*Name*	*Address*	*Neighborhood*
1.	*Bank Sampah Beting Permai*	*Jalan Tanjung Pulau*	*Kelurahan Dalam Bugis*
2.	*Bank Sampah Laily Raya*	*Jalan Pemda Saigon*	*Kelurahan Saigon*
3.	*Bank Sampah Melati*	*Jalan Parit Mayor*	*Kelurahan Parit Mayor*
4.	*Bank Sampah Ananda*	*Jalan Amanah*	*Kelurahan Parit Mayor*
5.	*Bank Sampah Bina Sejahtera*	*Jalan Ya'am Sabran*	*Kelurahan Tanjung Hulu*

Source: Pontianak City Environment Agency 2021

Research findings categorize settlements in Kelurahan Dalam Bugis as uninhabitable (severe slums), moderately habitable (moderate slums), and habitable (light slums).

Fire Protection

According to the Ministry of Public Works Regulation No. 26/PRT/M/2008, fire protection systems include equipment, facilities, and infrastructure, both installed and in use, for active and passive protection and management to safeguard buildings and their surroundings from fire hazards. Fire protection conditions are assessed based on the availability of fire protection infrastructure and systems. Fire protection infrastructure criteria include the availability of water supply, access roads, and communication facilities. Fire protection system criteria include the availability of portable fire extinguishers (APAR), fire trucks, and ladder trucks as needed.

According to Regulation No. 26/PRT/M/2008, water sources such as hydrants, fire wells, or reservoirs must be planned to facilitate their use by fire departments during fires. Observations in Kelurahan Dalam Bugis show that water supply comes from the Kapuas and Landak Rivers, as well as ditches passing through residential areas. Interviews revealed that residential areas directly adjacent to the Kapuas and Landak Rivers source their water from these rivers. In areas not directly adjacent to the rivers and only crossed by ditches, the water supply comes from these ditches.

According to Zulfiar and Gunawan (2018), "access roads within building complexes must be paved to allow fire trucks to pass." The 2020 Kelurahan Dalam Bugis Profile states that access roads in Kelurahan Dalam Bugis total 650 km. However, in areas like Kampug

Beting, with road widths of only 1.5 to 3 meters, interviews revealed that these roads are insufficient for fire trucks and can only be accessed by fire motorcycles.

Interviews revealed that communication with the nearest fire department is only possible via telephone. According to Lestari (2019), communication facilities include public telephones and other devices for notifying the fire department of a fire. Fire protection system criteria include the availability of portable fire extinguishers (APAR). In Kelurahan Dalam Bugis, APARs are distributed in Kampung Beting, where access is difficult due to narrow roads (1.5-3 meters wide). Interviews revealed that the installation of APARs was part of the 2017 Kotaku Program. The following image shows the APARs distributed in Kelurahan Dalam Bugis.

Figure 5. (a) APAR in Gang Stabil, Kelurahan Dalam Bugis; (b) APAR in Pasar Tradisional Istana Kadariah

In Kampung Beting, APARs are located in five locations: Masjid Jami Sulthan Syarif Abdurahman, two in Gang Stabil, Keraton Kadriah, and Pasar Tradisional Istana Kadriah. Interviews revealed that there are no firefighting groups in Kelurahan Dalam Bugis, and therefore, no fire trucks or ladder trucks are available.

Based on observations, interviews, and documentation, settlements in Kelurahan Dalam Bugis are categorized as habitable (light slums), moderately habitable (moderate slums), and uninhabitable (severe slums). Habitable settlements (light slums) include two areas: 1) 109°20'53.96"E - 109°20'48.61"E and 0°1'19.94"N - 0°1'35.02"N, and 2) 109°21'6.30"E - 109°20'59.10"E and 0°1'25.38"N - 0°1'46.56"N, covering a total area of 32.54 hectares (16.4% of Kelurahan Dalam Bugis) with 1,706 housing units.

There is one moderately habitable settlement (moderate slum) in Kelurahan Dalam Bugis, located at 109°20'54.22"E - 109°20'50.80"E and 0°1'31.75"N - 0°1'36.59"N, covering a total area of 1.33 hectares (0.7% of Kelurahan Dalam Bugis) with 97 housing units.

There are two uninhabitable settlements (severe slums) in Kelurahan Dalam Bugis: 1) 109°21'1.95"E - 109°20'50.80"E and 0°1'26.24"N - 0°1'36.59"N, and 2) 109°21'11.48"E - 109°21'27.49"E and 0°1'34.14"N - 0°2'10.05"N, covering a total area of 159.13 hectares (82.9% of Kelurahan Dalam Bugis) with 2,290 housing units.

Conclusion

Based on the research conducted in Kelurahan Dalam Bugis, it can be concluded that the waste management and fire protection conditions indicate that 16.4% of the settlements are categorized as light slums (habitable), 0.7% as moderate slums (moderately habitable), and 82.9% as severe slums (uninhabitable). The habitable settlements cover an area of 32.54

hectares with a total of 1,706 housing units. The moderately habitable settlements cover an area of 1.33 hectares with a total of 97 housing units. The uninhabitable settlements cover an area of 159.13 hectares with a total of 2,290 housing units. Given the importance of health aspects for the community, the government should establish integrated waste processing sites (TPST) and TPS 3R in Kelurahan Dalam Bugis. Furthermore, mitigating fire hazards should be a government priority by constructing adequate fire protection facilities to prevent unwanted incidents.

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