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Slum Severity and Upgrading Strategy for the Formal Housing Area of Perumnas III RW 002, Yabansai Sub-District, Jayapura City

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ABSTRACT

Perumnas III Waena RW 002, located in Yabansai Subdistrict, Jayapura City, is a government-developed formal housing area designated as a priority slum area under Jayapura Mayor's Decree No. 115/2015. This study assessed slum severity and formulated appropriate slum-upgrading strategies. A mixed-methods approach was employed, integrating field observations, questionnaires administered to 50 residents, and an interview with the Kota Tanpa Kumuh (KOTAKU; Cities Without Slums) Program Coordinator. The technical assessment followed the seven slum assessment criteria established under Indonesia's Ministry of Public Works and Housing (PUPR) Regulation No. 14/2018. Reconstruction of the scores for 16 subvariables produced an aggregate score of 60, provisionally classifying the area as a severe slum, whereas the transformed community perception index yielded a lower score of 54.68. The reconstructed observational scores identified solid waste management, fire protection, and domestic wastewater management as the three most severely affected aspects. The discrepancy between the technical assessment and residents' perceptions underscored the importance of integrating physical infrastructure conditions with residents' lived experiences when determining upgrading priorities. Given the area's legally recognized land tenure, an in situ upgrading and renewal strategy without resident relocation was recommended. However, these findings should be interpreted cautiously because of the methodological limitations associated with reconstructing assessment scores at the subvariable level.

INTRODUCTION

Urbanization in Indonesia has increased substantially over recent decades. According to Badan Pusat Statistik (2021), approximately 56.7% of Indonesia's population lived in urban areas in 2020, and this proportion was projected to continue increasing. Rapid urbanization has contributed to the emergence and expansion of slum areas, both in informal settlements and in formal housing developments that have experienced progressive deterioration (Gilbert & Shi, 2023). Slum conditions extend beyond physical and environmental deficiencies to encompass social, economic, and

housing governance challenges (Hariyanto, 2007; Pemerintah Republik Indonesia, 2011; Ridlo, 2004). In response, the Indonesian government introduced the Kota Tanpa Kumuh (KOTAKU; Cities Without Slums) Program as a community-based initiative aimed at preventing and addressing slum conditions through integrated interventions and community empowerment (Hendrianto, 1996; Rumagit, 2020; Winny & Ana, 2009).

Jayapura City designated several slum areas under Mayoral Decree No. 115 of 2015 concerning the Designation of Slum Area Locations (Pemerintah Kota Jayapura, 2015). These designated areas encompassed 11 administrative subdistricts and accounted for approximately 7.73% of the city's total area (Rumagit, 2020). One of the designated locations was Yabansai Subdistrict, which included a 5.24-hectare slum area within Perumnas III Waena RW 002.

Unlike informal settlements commonly associated with slum conditions in Papua, Perumnas III Waena RW 002 is situated within a formal housing development originally planned and constructed by Perum Perumnas, Indonesia's state-owned housing development enterprise. Slum upgrading in formal housing developments requires a different approach from interventions in informal settlements because of differences in land tenure arrangements, existing infrastructure, building characteristics, and residential development patterns (Dwijo, 2011). Although formal housing areas are initially developed with planned infrastructure and residential layouts, inadequate maintenance, infrastructure deterioration, and changing residential needs may contribute to declining environmental quality over time.

Previous studies on slum conditions in Papua have primarily examined informal coastal settlements. For example, Indriani (2020) investigated six coastal areas in West Manokwari Subdistrict, while Musfira (2018) examined settlement conditions in Bhayangkara Village, North Jayapura District. Other studies have addressed infrastructure and housing conditions within formal residential developments, including research by Heremba et al. (2025) on the Dok IX apartment complex and Ardiansyah and Rahmawati (2021) on Perumnas housing in Gersik Village. These studies indicated that formally developed residential areas may also experience infrastructure deficiencies and declining environmental quality.

However, research specifically examining slum severity in noncoastal formal housing developments constructed by Perum Perumnas remains limited, particularly studies integrating technical assessments with residents' perceptions through a mixed-methods approach. This gap is important because slum conditions in formal housing developments may differ from those in informal settlements in terms of legal land tenure, building typology, infrastructure characteristics, and residents' adaptation to environmental deterioration. Consequently, assessments based exclusively on physical indicators may not adequately capture how residents perceive and experience declining housing and neighborhood conditions.

This study proposed that assessing slum severity in formal housing developments required an integrated approach combining technical field observations with residents' perceptions, while the formulation of upgrading strategies needed to account for legal land tenure to minimize potential adverse social consequences. Accordingly, the study aimed to (1) assess slum severity in Perumnas III RW 002, Yabansai Subdistrict, using a mixed-methods approach based on the seven assessment criteria established under the Indonesian Ministry of Public Works and Housing Regulation No. 14 of 2018; and (2) formulate context-appropriate slum-upgrading strategies based on the identified severity of settlement deficiencies and the area's legal land status.

The study was expected to contribute to the existing literature and urban settlement management practices in four areas. Empirically, it provided evidence on slum severity within a formally developed housing area in Papua, a residential context that has received relatively limited scholarly attention. Methodologically, it integrated field observations, resident perception questionnaires, and stakeholder interviews to support a more comprehensive assessment of slum conditions. Theoretically, it explored the relevance of residents' adaptation to environmental deterioration in explaining discrepancies between technical assessments and subjective perceptions of neighborhood conditions. Practically, it offered evidence-based recommendations for slum upgrading that considered legal land tenure, existing infrastructure conditions, and residents' needs, thereby supporting interventions intended to improve settlement quality while minimizing displacement risks and other adverse social consequences.

METHOD

This study employed a convergent parallel mixed-methods approach, with an emphasis on descriptive quantitative analysis supported by qualitative interviews (Creswell & Plano Clark, 2017; Simbiak & Sudiro, 2025). Slum severity was assessed using the seven criteria established under the Indonesian Ministry of Public Works and Housing Regulation No. 14 of 2018 (Menteri Pekerjaan Umum dan Perumahan Rakyat, 2018). Qualitative interviews were conducted to inform the formulation of appropriate slum-upgrading strategies. Data were collected through field observations, resident perception questionnaires, and semi-structured interviews.

Research Location and Period. The study was conducted in Perumnas III Waena RW 002, Yabansai Subdistrict, Heram District, Jayapura City, covering a designated slum area of 5.24 hectares according to the 2018 Jayapura City Slum Housing and Settlement Prevention and Quality Improvement Plan (Rencana Pencegahan dan Peningkatan Kualitas Perumahan Kumuh dan Permukiman Kumuh, RP2KPKP). The location was selected because it represented a formal housing development designated as a slum area under Jayapura Mayoral Decree No. 115 of 2015, had noncoastal topographical characteristics, and possessed legally recognized land tenure relevant to exploring upgrading strategies without resident relocation. Field data were collected in 2023.

Data Collection Techniques. Field observations were conducted to assess seven slum criteria comprising 16 subvariables, as specified in the Indonesian Ministry of Public Works and Housing Regulation No. 14 of 2018 (Menteri Pekerjaan Umum dan Perumahan Rakyat, 2018). The assessment covered building conditions, neighborhood roads, drinking water supply, neighborhood drainage, domestic wastewater management, solid waste management, and fire protection. Each subvariable was assigned a score of 0, 1, 3, or 5 based on the proportion of noncompliance with the applicable technical standards: 0 for 0–25%, 1 for 26–50%, 3 for 51–75%, and 5 for 76–100%. Because the original field observations recorded scores at the criterion level rather than separately for each subvariable, subvariable scores were reconstructed by assigning the corresponding criterion score uniformly to all subvariables within that criterion. This reconstruction assumed equal severity across subvariables within each criterion and was therefore treated as an analytical approximation rather than a direct subvariable-level measurement. The methodological implications of this assumption were addressed in the study's limitations section.

Table 1. Audit reconstruction of scores for the 16 slum sub-variables of Perumnas III RW 002

No	Aspect	Sub-Variable	Observed Condition	Assumed Non-Compliance Range	Score
1	Buildings	Building disorder	Building layout less orderly	51–75%	3
2	Buildings	Building density	Building density exceeds initial design	51–75%	3
3	Buildings	Non-compliance with technical requirements	Buildings not fully meeting technical standards	51–75%	3
4	Neighborhood Roads	Road service coverage	Segments without proper pavement	51–75%	3
5	Neighborhood Roads	Road surface quality	Road pavement is damaged	51–75%	3
6	Drinking Water Supply	Safe access availability	Clean water access uneven across households	51–75%	3
7	Drinking Water Supply	Demand fulfillment	Drinking water needs not fully fulfilled	51–75%	3
8	Neighborhood Drainage	Inability to drain runoff	Puddles in certain segments during rain	51–75%	3
9	Neighborhood Drainage	Drainage availability	Road segments without drainage channels	51–75%	3
10	Neighborhood Drainage	Construction quality	Drainage channels blocked/damaged	51–75%	3

No	Aspect	Sub-Variable	Observed Condition	Assumed Non-Compliance Range	Score
11	Wastewater Management	System not meeting standard	No communal wastewater management system available	76–100%	5
12	Wastewater Management	Infrastructure/facilities non-compliant	Wastewater management infrastructure absent	76–100%	5
13	Waste Management	Infrastructure/facilities non-compliant	No temporary disposal site or transport vehicles	76–100%	5
14	Waste Management	Management system compliance	No sustainable waste management system	76–100%	5
15	Fire Protection	Infrastructure unavailable	No hydrants or fire access	76–100%	5
16	Fire Protection	Facilities unavailable	No fire extinguishers/fire protection facilities	76–100%	5
		Total Observation Score	**16 Sub-Variables**		**60**

Source: Researcher's Observation (2023), assuming uniformity of Sub-Variables within One Aspect.

Note: The non-compliance range for each sub-variable is derived from the aspect score because detailed per-sub-variable data are not available; these values are not the result of direct measurement.

Questionnaires were administered to 50 residents of RW 002 selected through purposive sampling, with eligibility restricted to individuals who had lived in the area for at least five years. According to the Yabansai Subdistrict Monograph (Kelurahan Yabansai, 2020), the subdistrict had approximately 17,585 residents distributed across 12 Rukun Warga (RWs; community administrative units). Given the nonprobability sampling approach, the findings were intended to describe the perceptions of eligible respondents rather than provide statistically representative estimates for the entire RW 002 population. Respondents were recruited from residential clusters throughout the study area to improve geographic coverage. The questionnaire assessed residents' perceptions of seven slum criteria using a four-category scoring scale: good (0), fairly good (1), poor (3), and very poor (5). Demographic information, including gender, length of residence, and occupation, was also collected. Respondent characteristics are presented in Table 2, with additional methodological details available in Kogoya (2023). A semi-structured interview was conducted with Alfonsus Saning, S.E., the Jayapura City Coordinator of the Kota Tanpa Kumuh (KOTAKU; Cities Without Slums) Program, to examine existing and proposed government-led slum-upgrading strategies. Although the qualitative component relied on a single key informant, the interview findings were triangulated with official policy documents, field observations, and questionnaire responses. The limitations associated with purposive sampling and reliance on a single key informant were considered when interpreting the findings.

Table 2. Profile of the 50 perception questionnaire respondents

No	Respondent Characteristics	Number (n=50)	Percentage
1	Gender: Male	30	60.0%
2	Gender: Female	20	40.0%
3	Residence: 5–10 years	22	44.0%
4	Residence: 11–20 years	18	36.0%
5	Residence: > 20 years	10	20.0%
6	Occupation: Private sector worker	17	34.0%
7	Occupation: Civil servant/SOE	13	26.0%
8	Occupation: Homemaker	12	24.0%
9	Occupation: Self-employed/other	8	16.0%

Source: Researcher's Questionnaire Results (2023)

Data Analysis Method

The slum severity of each sub-variable was scored 0, 1, 3, or 5 according to the percentage of field condition non-compliance with the technical standards of Permen PUPR No. 14 of 2018, which establishes 7 slum aspects detailed into 16 sub-variables. For community perception data, Si per aspect was calculated using the formula $Si = \Sigma(xi \cdot fi) / n$, where xi is the category score (0, 1, 3, 5), fi is the frequency of respondents in that category, and n is the number of respondents (50). The Si value per aspect ranges from 0–5, with category interpretation referring to midpoints between the original discrete scales: Si 0–0.50 = Good; 0.51–2.00 = Fairly Good; 2.01–4.00 = Poor; 4.01–5.00 = Very Poor. This category translates the continuous Si averages into the discrete qualitative categories of Permen PUPR No. 14 of 2018. Because Silfanus collected data by aspect, the distribution of values across the 16 sub-variables was assumed to be uniform. Each sub-variable within an aspect receives the same score as its aspect (this limitation is explained in the Research Limitations section). The aggregation of 16 sub-variables produces a total area value with a range of 0–80, classified into four classes according to Permen PUPR No. 14 of 2018: not a slum area (0–15), light slum (16–37), moderate slum (38–59), and severe slum (60–80). The researcher analyzed interview results narratively to support the formulation of upgrading strategies. **Data Integration in Mixed Methods.** In accordance with the convergent parallel mixed methods design, the researcher's observation and the perception questionnaire were conducted in parallel and independently within the same time period, then analyzed simultaneously to identify consistencies and differences in results. The researcher's observation scores, based on the technical standards of Permen PUPR No. 14 of 2018, and the Si values from the perception questionnaire were compared aspect by aspect to map patterns of agreement and difference. The interview results with the KOTAKU Program Coordinator were not treated as a source of slum measurement, but as contextual data to understand the area's historical background and to formulate upgrading strategies aligned with government policy. The difference between observation scores and Si perception values was not treated as a bias to be eliminated, but as an important finding reflecting the difference in

perspective between assessments based on technical standards and assessments based on resident experience.

RESULTS AND DISCUSSION

Overview of the Study Area

Perumnas III Waena RW 002 is located in Yabansai Sub-District, Heram District, Jayapura City, with a slum area of 5.24 hectares. According to the Yabansai Sub-District monograph (2020), the sub-district has a population of approximately 17,585 people (9,517 males and 8,068 females) and approximately 10,154 households. The occupational distribution is dominated by private sector workers (3,918), followed by Civil Servants (PNS), State-Owned Enterprises (BUMN), and Regional-Owned Enterprises (BUMD) employees (1,654), as well as homemakers (1,647), with the remainder distributed across military (TNI), police (Polri), farmer, laborer, and craftsman sectors. Yabansai Sub-District has varied topography from lowlands to hills with an elevation of approximately 19.5 meters above sea level.

The research location is a formal housing area of permanent dwellings built through the National Housing program by Perum Perumnas, with some residents running microenterprises such as kiosks, vegetable stalls, and livestock raising to supplement family income. The land legal status of the area is based on two formal references: (1) the designation of Perumnas III RW 002 as a priority slum area for quality improvement — not an area recommended for restructuring based on land illegality — through Jayapura Mayoral Decree No. 115 of 2015 (Pemerintah Kota Jayapura, 2015); and (2) the inclusion of the area in the Jayapura City Slum Housing and Settlement Prevention and Quality Improvement Plan (RP2KPKP) document of 2018 as a slum area with legal land status (Pemerintah Kota Jayapura, 2018). These two sources consistently place the area in the legal category, so the upgrading strategy according to the Permen PUPR No. 14 of 2018 matrix does not involve resettlement.

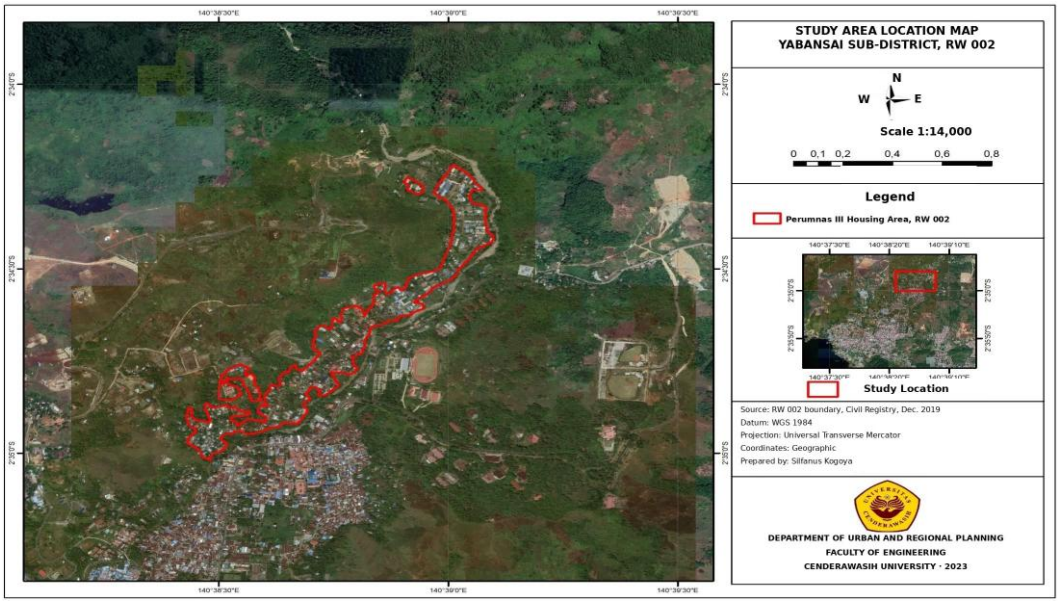


Figure 1. Study Area Location Map of Perumnas III RW 002, Yabansai Sub-District

Source: Author's Processing of RW 002 Boundary Data from Ducapil 2019, 2023

Slum Severity Based on Researcher Observation

Field observation results for the seven slum aspects in Perumnas III RW 002 show that four aspects scored 3 (poor category, 51–75% non-compliance): building conditions, neighborhood roads, drinking water supply, and neighborhood drainage. Three aspects scored 5 (very poor category, 76–100% non-compliance): wastewater management, waste management, and fire protection. Table 3 summarizes the observation scores for the seven aspects.

Table 3. Summary of seven-aspect observation scores and sub-variable contributions

No	Slum Aspect	Aspect Score	No. of Sub-Variables	Contribution Score	Category
1	Buildings	3	3	9	Poor
2	Neighborhood Roads	3	2	6	Poor
3	Drinking Water Supply	3	2	6	Poor
4	Neighborhood Drainage	3	3	9	Poor
5	Wastewater Management	5	2	10	Very Poor
6	Waste Management	5	2	10	Very Poor
7	Fire Protection	5	2	10	Very Poor
	Total Reconstruction	**—**	**16**	**60**	**Severe Slum (indicative)**

Source: Field Observation Results, 2023

The four aspects with a score of 3 (Poor category) indicate partial but inadequate infrastructure conditions. Building conditions show a less orderly layout, with density exceeding the initial design. Neighborhood roads are dominated by damaged pavement,

with several segments lacking proper pavement. Drinking water supply depends on sources whose accessibility is uneven across households. Neighborhood drainage is available, but much of it is blocked due to waste and poor maintenance.

The three aspects with the highest scores relate to environmental management systems. Based on field observations, all three show very high levels of non-compliance with technical standards, either because supporting infrastructure and facilities are unavailable or because they do not function adequately. The area has no communal wastewater management system, temporary waste disposal site, or fire-protection hydrants. These conditions suggest that the initial planning of Perumnas III did not adequately provide environmental management infrastructure, or that such infrastructure has deteriorated due to lack of maintenance. Figure 2 shows visual documentation of these six aspects, including the current conditions of buildings, roads, drainage, wastewater, waste, and water supply in the study area.



Figure 2. Documentation of the Six Slum Aspects in Perumnas III RW 002

Source: Field Observation Results, 2023

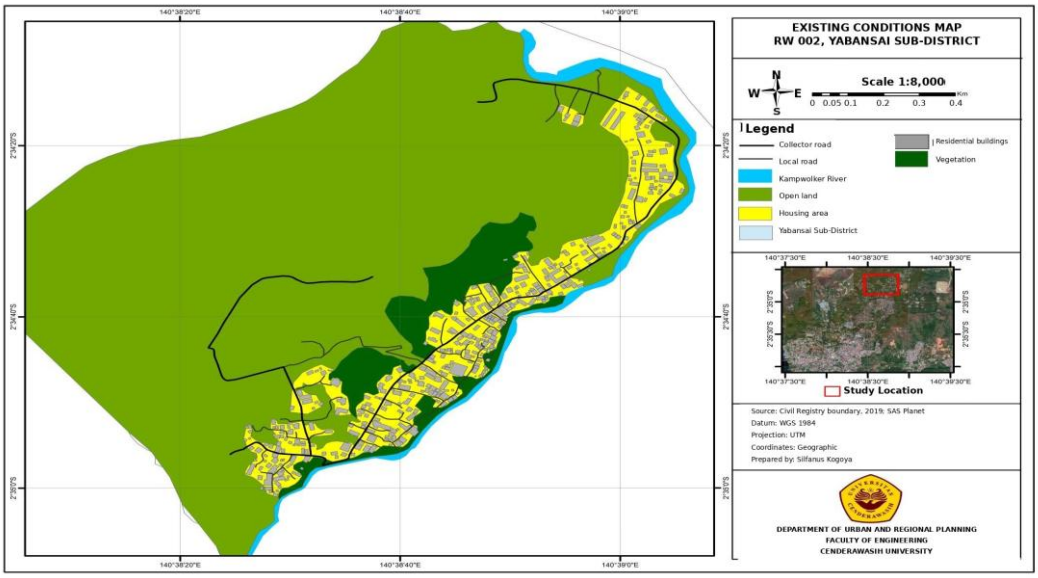


Figure 3. Existing Conditions Map of RW 002, Yabansai Sub-District

Source: Author's Processing of Village Boundary Data from Ducapil 2019 and SAS Planet, 2023

Slum Severity Based on Community Perception

The questionnaire results from 50 respondents show a perception distribution generally aligned with the researcher's observations, but with more moderate assessment intensity. Based on the Si values, six aspects fall into the Poor category, while Waste Management is in the Very Poor category (Si = 4.04). Fire Protection obtained a Si value of 3.84, approaching the Very Poor category boundary. Table 4 recapitulates the community assessment distribution and Si values per aspect.

Table 4. Distribution of community perception and Si values per slum aspect

No	Slum Aspect	Good (0)	Fairly Good (1)	Poor (3)	Very Poor (5)	Si	Category
1	Buildings	0	3	37	10	3.28	Poor
2	Neighborhood Roads	0	5	35	10	3.20	Poor
3	Drinking Water Supply	0	4	36	10	3.24	Poor
4	Neighborhood Drainage	0	2	40	8	3.24	Poor
5	Wastewater Management	0	3	38	9	3.24	Poor
6	Waste Management	0	2	20	28	4.04	Very Poor
7	Fire Protection	0	4	21	25	3.84	Poor
	Slum Perception Index					**54.68**	**Moderate Slum (analytical equivalent)**

Source: Researcher's Questionnaire Analysis, 2023

Based on community perception, waste management is in the Very Poor category (Si = 4.04), while fire protection is in the Poor category and approaches the Very Poor boundary (Si = 3.84). Five other aspects fall in the Si = 3.20–3.28 range, placing them in the Poor category. No aspect was perceived by the community as Good (score 0), indicating consensus among residents that conditions across all environmental infrastructure aspects are non-ideal. The drainage finding in this research is relevant for comparison with Ilham et al. (2025) in Abepura District, Jayapura City. Although their locations differ, both share the same city context of hilly topography and high rainfall, so drainage problems are a comparable structural issue. Ilham et al. (2025) show that drainage quality in Jayapura remains a structural problem in many areas, contributing to slum conditions and local flood vulnerability, and this finding aligns with the drainage conditions in Perumnas III RW 002.

Difference between Researcher and Community Assessment

Score reconstruction based on the technical standards of Permen PUPR No. 14 of 2018 yields an estimated area score of 60, which falls indicatively within the severe-slum range (60–80). Because field data were collected per aspect and distributed to the 16 sub-variables under the assumption of uniformity, the score of 60 is not a direct measurement of the 16 sub-variables but an analytical estimate that further research should verify through detailed measurement of each sub-variable. Meanwhile, transforming community-perception Si values to the 0–80 scale using the formula Σ(Si_aspect × number of sub-variables per aspect) yields a transformed perception index of 54.68. This index relies on the same assumption of sub-variable uniformity as the observation-score reconstruction.

This perception index is not an official slum-status designation because it was not obtained through technical measurement; when compared analytically with the Permen PUPR No. 14 of 2018 classification ranges, the index is equivalent to the moderate-slum category (38–59). The 5.32-point gap between the researcher's observation score and the community-perception index reflects the difference between assessments based on technical standards and those based on resident experience. The largest differences occur in the three aspects with the highest researcher-observation scores (score 5) — Wastewater Management, Waste Management, and Fire Protection — while from the community-perception perspective, these three aspects are rated relatively lower, although still within the Poor to Very Poor categories.

This phenomenon of difference can be interpreted through several possible theoretical explanations; one is that residents who have long occupied the area develop psychosocial bonds with their environment that make their assessment more moderate. This research did not directly measure such psychosocial bonds; the following interpretation is presented as a conceptual framework for understanding the results, not as a verified cause. The concept of *place attachment* proposed by Altman and Low (1992) emphasizes that residents who have long occupied an area develop emotional and

functional bonds with their environment. Amérigo and Aragonés (1997), through residential satisfaction theory, explain that residents' assessment of housing conditions reflects not only objective conditions but also the process of adjusting expectations to long-established living standards.

Together, these concepts provide a framework that may explain why Perumnas III RW 002 residents' perceptions appear more moderate than the researcher's assessment based on technical standards. However, because this research did not directly measure place attachment, residential satisfaction, habituation, or the perception-normalization process, this explanation is one possible theoretical interpretation. Further research that explicitly measures those psychosocial aspects is needed to verify it. Methodologically, this difference implies that slum assessment should not rely on a single data source; combining technical-standard-based assessment (observation) with resident-perception-based assessment (questionnaire) provides a more complete and balanced picture of the area's condition.

To strengthen spatial visualization of this difference, Figures 4 and 5 show the distribution of wastewater and waste management conditions in RW 002, the two aspects with the highest researcher-observation scores (score 5). The two maps show slum-area points with field-photo documentation confirming high slum severity in both aspects.

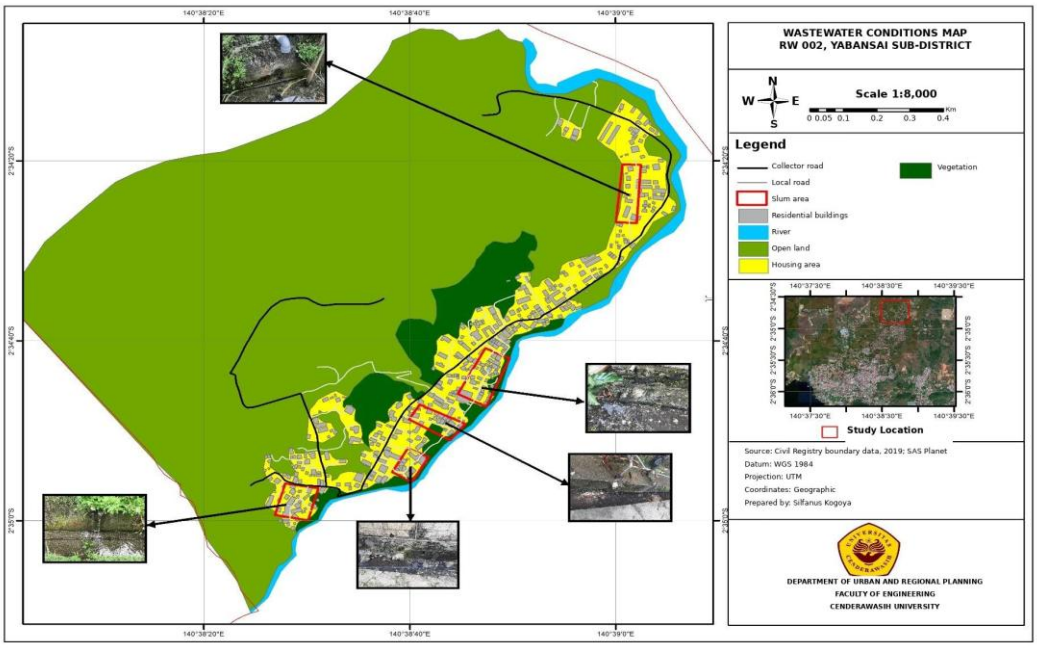


Figure 4. Wastewater Conditions Map of RW 002, Yabansai Sub-District

Source: Author's Processing of Village Boundary Data from Ducapil 2019 and SAS Planet, 2023

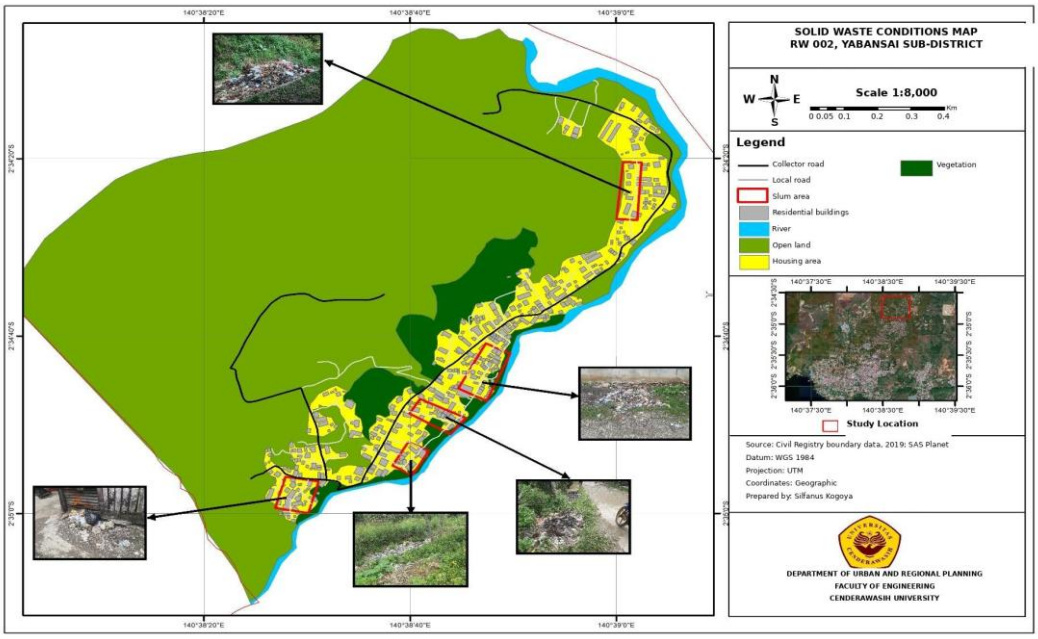


Figure 5. Solid Waste Conditions Map of RW 002, Yabansai Sub-District

Source: Author's Processing of Village Boundary Data from Ducapil 2019 and SAS Planet, 2023

Upgrading Strategy

Determining the slum-area upgrading strategy considers two key variables: slum severity and land legal status. As a formal housing area built through a national program, Perumnas III RW 002 has legal land status. With legal land status and reconstruction results that are indicatively within the severe-slum range, the upgrading direction refers to renewal while retaining residents on site — not rehabilitation (intended for light slums), and not resettlement (*resettlement*) commonly applied to slum areas with illegal land status. Formal determination of the intervention scheme still requires detailed verification of the 16 sub-variables under Permen PUPR No. 14 of 2018.

Based on an interview with Mr. Alfonsus Saning, S.E., Coordinator of the KOTAKU Program, seven upgrading directives were formulated and categorized into two priority levels based on each aspect's slum score. The highest (urgent) priority consists of three directives targeting aspects with the highest observation scores (score 5) that also show relatively high negative perception from the community (Si between 3.20 and 4.04): (a) provision of fire-protection facilities in each RT within RW 002, including hydrants and fire-truck access (observation score 5; perception Si 3.84, close to the Very Poor category); (b) provision of communal waste bins, waste-collection vehicles, and cleanliness outreach (observation score 5; perception Si 4.04, in the Very Poor category); and (c) improvement of wastewater channels with direction toward a communal disposal system (observation score 5; perception Si 3.24, in the Poor category). The next (strategic) priority consists of four directives targeting aspects with observation score 3 and perception Si in the 3.20–3.28 range (Poor category): (d) arrangement of building conditions and provision of habitable-home assistance in accordance with Jayapura

Mayoral Decree No. 115 of 2015; (e) paving and asphalting of damaged neighborhood roads; (f) restructuring of the clean-water supply system and improving household connection access; and (g) repair of blocked drainage channels and construction of new drainage at points without existing channels, accompanied by outreach banning waste dumping into drainage.

Within the score-reconstruction framework, the two-level priority categorization is based on the view that aspects with an observation score of 5 indicate very high non-compliance (76–100%) with technical standards, so intervention becomes urgent. Meanwhile, aspects with observation score 3 describe infrastructure that is already available but inadequate, so the intervention takes the form of improvement and quality enhancement. The topographic context of Yabansai Sub-District, varying from lowlands to hills, demands a tailored technical approach, especially for drainage systems and wastewater flow management that must account for the area's slope.

CONCLUSION

This study assessed slum severity in Perumnas III Waena RW 002, Yabansai Subdistrict, using a convergent mixed-methods approach. Reconstruction of assessment scores based on the technical criteria established under the Indonesian Ministry of Public Works and Housing Regulation No. 14 of 2018 (Menteri Pekerjaan Umum dan Perumahan Rakyat, 2018) produced an estimated aggregate score of 60, provisionally placing the area within the severe-slum category. Meanwhile, transformation of the perception scores (Si) obtained from 50 respondents to a 0–80 scale yielded a community perception index of 54.68, corresponding analytically to the moderate-slum category. Both the observational score of 60 and the perception index of 54.68 represented reconstructed analytical estimates rather than direct measurements of all 16 subvariables. The reconstructed observational assessment identified solid waste management, fire protection, and domestic wastewater management as the three aspects with the highest severity scores. The 5.32-point difference between the observational assessment and community perception index may reflect residents' long-term adaptation to environmental conditions, potentially associated with the concept of place attachment proposed by Altman and Low (1992) and residential satisfaction discussed by Amérigo and Aragonés (1997). However, because these psychosocial constructs were not directly measured, their explanatory relevance remained theoretical rather than empirically established.

The findings highlighted the value of integrating technical field observations and residents' perceptions to provide a more comprehensive understanding of slum conditions than either source could offer independently. They also emphasized the importance of considering legally recognized land tenure when formulating upgrading strategies to minimize potential adverse social consequences for existing residents. Given the area's formal housing status, legal land tenure, and reconstructed severity classification, in situ settlement renewal without resident relocation was recommended as the preferred upgrading strategy, rather than rehabilitation alone or resettlement. Nevertheless, formal

selection of an intervention scheme would require further field verification of all 16 subvariables specified under Permen PUPR No. 14/2018. Priority interventions included improving fire protection infrastructure, establishing communal solid waste management systems, and upgrading communal domestic wastewater management facilities. The study made four principal contributions. Empirically, it provided evidence on slum conditions within a formally developed housing area constructed by Perum Perumnas in Papua, complementing previous research primarily focused on informal coastal settlements. Methodologically, it demonstrated the integration of field observations, resident perception questionnaires, and stakeholder interviews within an assessment approach that could be adapted to other formal housing developments. Theoretically, it identified residents' adaptation to environmental deterioration as a potential explanation for discrepancies between technical assessments and subjective perceptions, although this interpretation required further empirical validation. Practically, it proposed prioritized slum-upgrading interventions that accounted for infrastructure deficiencies and legal land tenure, providing a basis for context-sensitive settlement improvement planning.

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CONFLICT OF INTEREST

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHOR CONTRIBUTIONS

All authors contributed to the conceptualization of the research, development of the methodology, data collection and analysis, manuscript preparation, and manuscript revision. All authors have read and approved the final version of the manuscript.

GENERATIVE AI STATEMENT

The author(s) declared that generative AI was used in the creation of this manuscript. The author(s) wish to acknowledge the use of Generative AI for refining the language clarity and grammatical structure of this manuscript. This application was conducted in adherence to established ethical guidelines regarding the use and disclosure of generative AI in scholarly research. Each author has provided substantial intellectual contributions to the work, which has been rigorously vetted for accuracy, and the author(s) assume full responsibility for the integrity and final contentofthemanuscript.

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