Jurnal Hurriah: Jurnal Evaluasi Pendidikan dan Penelitian
Hurriah Journal: Journal of Educational Evaluation and Research
Volume 6, No. 4 (2025) PP 1182-1191

Journal of Educational Evaluation and Research

Journal homepage: https://academicareview.com/index.php/jh
E-ISSN: 2774-8472 I P-ISSN: 2774-8480 I DOI : 10.56806

Scenario Analysis of Waste Management Service Improvement Based on Projected Waste Generation and Service Capacity in Natar Subdistrict, South Lampung Regency

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ARTICLE INFO

Article history:
Received: September, 2025
Received in revised from: October, 2025
Accepted: November, 2025
Available online: December, 20, 2025

Keywords: *Waste Generation, Service Improvement and Waste Management*

ABSTRACT

The goal of this study is to analyze the waste generation rate and waste service coverage in Natar District, as well as to determine appropriate service improvement scenarios based on the capacity of the Karang Sari Final Processing Site (FPS). Waste generation and collection data were monitored over a 7 day period in March 2024 according to SNI 19-3964-1995 by recording the number of truck trips and waste volume. The analysis found that the collected waste entering the FPS is 24.19 m^3/day, significantly lower than the total projected waste generation in Natar District, which is 57.59 m^3/day. This discrepancy results in a low service level of only 42%, falling far below the regional target of 70%. A 10% annual improvement scenario, aligned with national targets, is projected to achieve full coverage by 2029. The study recommends integrating service improvements with community based waste reduction programs and strengthening waste banks to support sustainable waste management and extend the FPS's lifespan.

1. Introduction

The issue of waste in Indonesia is becoming increasingly complex, driven by population growth, economic activity, and changing consumption patterns. Data from the National Waste Management Information System (NWMIS) in 2024 shows that Indonesia has only met 14.54% of its national waste reduction target and 49.67% of its waste management target, both of which are far below the JAKSTRANAS targets for 2025. A major challenge to sustainable waste management is the lack of household participation in recycling activities, which is only at 1.2% (Alfitri et al., 2020). This emphasizes the urgent need for more effective, measurable waste management strategies.

The Natar subdistrict in South Lampung Regency, with a population of 191,833, faces a similar problem. The Karang Sari Final Processing Site (FPS), operational since 2020, is under considerable pressure from daily waste loads. While BPS data (2024) indicates that 57.40% of waste in South

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https://doi.org/10.56806/ jh.v6i4.355

Lampung Regency has been managed, the critical issue is that the majority of this collected waste is deposited directly at the Karang Sari FPS without adequate sorting or reduction at the source. This reliance accelerates the operational burden. Based on current input rates and initial design parameters, the FPS is nearing its planned capacity limit, requiring immediate strategic intervention. Previous research has confirmed that waste from surrounding dense areas, such as Jatimulyo, Way Huwi, and Banjar Agung, is transported directly to the FPS (Sekar. A & Almasa, 2024). Furthermore, implementing source reduction technologies (3R, composting, RDF, or incineration) has the technical potential to reduce waste volume by up to 90%, provided that substantial investment and robust operational implementation are secured (Permen PUPR No. 03/PRT/M/2013).

These conditions necessitate a comprehensive, upstream to downstream waste management strategy that integrates the local government, community, and relevant stakeholders (Damanhuri, 2010). Community based waste reduction programs, such as waste banks and 3R training, have proven effective in reducing waste volume and raising public awareness (Subandriyo et al., 2012). However, long term sustainability requires data driven planning based on projected waste generation, evaluated landfill capacity, and realistic service improvement scenarios aligned with national and regional targets. Therefore, this study aims to rigorously analyze waste generation projections and the operational capacity of the Karang Sari FPS to formulate effective and sustainable service improvement scenarios. Specifically, this research seeks: (1) to quantify the actual waste generation rate and service coverage in Natar District; and (2) to develop scenario analyses for service improvement that support the formulation of effective, adaptive, and sustainable waste management strategies for the Natar subdistrict and South Lampung regency.

2. Methodology

2.1 Data and Location

The research location is in Natar Subdistrict, South Lampung Regency, which covers an area of 269.58 km2 and consists of 26 villages/subdistricts. The Karang Sari landfill is located in Tanjung Sari Village at Longitude: 105.206873 and Latitude: -5.287485.

2.2 Data Analysis

1. Population Projection Analysis

   The data analysis technique in this study was conducted by calculating the population projection in Natar Subdistrict using a geometric method determined for waste generation in small or developing cities. The application of the geometric method as a method for determining waste generation for small and developing cities follows the established approach in relevant literature (Ramadanthi, G. P., 2022).

$$Pn = Po\ (1+r)n$$

   Explanation:
   Pn : n population in the year (souls)
   Po : Initial population (souls)
   n : Projection time period
   r : % population growth each year

2. Waste Generation Prediction Analysis

   Waste generation prediction analysis is calculated based on population projections and standardized waste generation rates. The calculation formula is as follows (Ramadanthi, G. P., 2022) :

$$\boldsymbol{V\ (m^3) = TS\ (kg/org)/hari)\ x\ JP\ (jiwa)}$$

Explanation:
V : Waste volume (m^3)
TS : Waste weight (kg/person/day)
JP : Population (people)

2.3 Service Improvement Scenario

The service improvement scenario for the Karang Sari Final Processing Site (FPS) is projected to grow by 5% annually, serving as an optimized midpoint between the Lampung Selatan Regency Regional Medium Term Development Plan (RMTDP) target of 0.73% and the National Medium Term Development Plan (NMTPD) target of 10%. Drawing on the methodology of Indah, et al. (2021), this consistent expansion of service access is directly correlated with the effective achievement of Regional Policy and Strategy (Jakstrada) targets. Consequently, this scenario functions as a progressive acceleration model that surpasses local targets while maintaining more rational technical feasibility for local implementation compared to the national mandate.

3. Results

3.1 Volume of Waste Generated at Karang Sari Landfill

Waste management services at Karang Sari Landfill in Natar Subdistrict currently cover 12,000 households. Based on the classification criteria of SNI 3242-2008, Natar Subdistrict is categorized as a medium sized city. This classification justifies the selection of a waste generation rate between 0.2–0.3 kg/person/day (or its volumetric equivalent, 3 liters/person/day, used for subsequent calculations). The population and waste volume projections for the 2024–2033 period, calculated using the geometric method, are presented in Table 1.

Tabel 1. Population and Waste Generation Projections for 2024-2033

Year	Population	Waste generated (m^3)
2024	191.896	21.008
2025	191.959	21.013
2026	192.043	21.020
2027	192.148	21.029
2028	192.275	21.040
2029	192.422	21.054
2030	192.591	21.070
2031	192.781	21.089
2032	192.992	21.109
2033	193.224	21.133

Source: Data processing, 2025

3.2 Analysis of Service Improvement Scenarios

In accordance with SNI 19-3964-1995 (Standard Method for Collection and Measurement), the actual collected waste volume entering the FPS was determined by directly measuring and recording the number and volume of waste transport vehicles. This monitoring was conducted for a 7 day

observation period in March 2024, yielding an average daily collected waste volume entering the Karang Sari Final Processing Site (FPS) of 24.19 m^3/day.

Using the above data, we can calculate the percentage of waste services in Natar District that enter the Karang Sari Final Processing Site.

Daily waste generation in Natar District

= 191,833 people x 3 liters/person/day

= 57,569 liters/day = 57.59 m^3/day.

The service percentage is calculated by dividing the estimated waste entering the FPS by the waste generated in Natar District

= (24.19 m^3 /day)/(57.59 m^3/day) x 100%

= 42% (the waste service percentage in 2024).

The current condition of waste management services in Natar District is 42% (based on the ratio calculated above). This figure falls far short of the 70% target set out in the South Lampung Regency Medium Term Development Plan (RMTDP) for the period 2021-2026. To meet this target, a scenario analysis of service improvements was conducted based on three defined rates: (1) The regional target derived from the RMTDP, with an annual service improvement percentage of 0.73%; (2) The National Medium Term Development Plan (NMTPD) target, aiming for an aggressive 10% annual increase toward 100% coverage; and (3) A comparative, estimated 5% annual increase scenario based on potential incremental FPS capacity improvements. Therefore, this study predicts the load on the final processing site from 2024 to 2082 as follows:

Table 2. Predicted Waste Volume at the Karang Sari Final Processing Site (FPS) from 2024 to 2082.

Year	Waste generation (m^3)	Percentage of South Lampung Regency RMTDP (0,73-1%)	Landfill waste volume (m^3)	Percentage of NMTPD (10 %)	Landfill waste volume (m^3)	Percentage of estimated increase in Karang Sari landfill services (5 %)	Landfill waste volume (m^3)
2024	21.013	42	8.825	50	10.506	42	8.825
2025	21.020	43	9.038	60	12.612	50	10.510
2026	21.029	44	9.253	70	14.720	55	11.566
2027	21.040	45	9.468	80	16.832	60	12.624
2028	21.054	45	9.474	90	18.949	68	14.317
2029	21.070	47	9.903	100	21.070	75	15.803
2030	21.089	48	10.123			82	17.293
2031	21.109	49	10.344			90	18.999
2032	21.133	50	10.566			95	20.076
2033	21.158	51	10.791			100	21.158
2034	21.186	52	11.017				
2035	21.216	53	11.245				
2036	21.249	54	11.474				
2037	21.284	55	11.706				
2038	21.321	56	11.940				

Year	Waste generation (m^3)	Percentage of South Lampung Regency RMTDP (0,73-1%)	Landfill waste volume (m^3)	Percentage of NMTPD (10 %)	Landfill waste volume (m^3)	Percentage of estimated increase in Karang Sari landfill services (5 %)	Landfill waste volume (m^3)
2039	21.361	57	12.176				
2040	21.403	58	12.414				
2041	21.447	59	12.654				
2042	21.494	60	12.897				
2043	21.544	61	13.142				
2044	21.596	62	13.389				
2045	21.650	63	13.640				
2046	21.707	64	13.893				
2047	21.767	65	14.148				
2048	21.829	66	14.407				
2049	21.893	67	14.669				
2050	21.961	68	14.933				
2051	22.031	69	15.201				
2052	22.103	70	15.472				
2053	22.178	71	15.747				
2054	22.256	72	16.024				
2055	22.337	73	16.306				
2056	22.420	74	16.591				
2057	22.506	75	16.880				
2058	22.595	76	17.172				
2059	22.687	77	17.469				
2060	22.781	78	17.769				
2061	22.879	79	18.074				
2062	22.979	80	18.383				

Year	Waste generation (m^3)	Percentage of South Lampung Regency RMTDP (0,73-1%)	Landfill waste volume (m^3)	Percentage of NMTPD (10 %)	Landfill waste volume (m^3)	Percentage of estimated increase in Karang Sari landfill services (5 %)	Landfill waste volume (m^3)
2063	23.083	81	18.697				
2064	23.189	82	19.015				
2065	23.298	83	19.338				
2066	23.411	84	19.665				
2067	23.527	85	19.998				
2068	23.645	86	20.335				
2069	23.767	87	20.678				
2070	23.893	88	21.026				
2071	24.021	89	21.379				
2072	24.153	90	21.738				
2073	24.288	91	22.102				
2074	24.427	92	22.473				
2075	24.569	93	22.849				
2076	24.715	94	23.232				
2077	24.864	95	23.621				
2078	25.017	96	24.017				
2079	25.174	97	24.419				
2080	25.334	98	24.828				
2081	25.499	99	25.244				
2082	25.667	100	25.667				

= Percentage of NMTPD (10%) annually
= Percentage of estimated improvement in Karang Sari landfill services (5%) annually
= Percentage of RMTDP (0.73 - 1%) annually

The three calculated service improvement scenarios yield significantly different timeframes for achieving 100% coverage: the aggressive NMTPD target (10% annual increase) achieves full coverage by 2029; the mid range estimated improvement (5% annual increase, justifiable as a balance between policy ambition and immediate resource constraints) achieves coverage by 2033; and the conservative RMTDP target (0.73–1% annual increase) only reaches full coverage by 2082. The disparity in these results highlights that the RMTDP target is highly unrealistic and politically irrelevant for achieving mandated national waste management goals. The NMTPD scenario (10%) is necessary to meet targets quickly, requiring substantial, non incremental investment and strong political commitment to expansion and source reduction. The 5% scenario is presented as a practical alternative, requiring continuous, managed investment over a decade to reach full service and align Natar's planning closer to national mandates than the current regional plan suggests. These calculations provide an essential overview of the predicted waste volume at the Karang Sari FPS from 2024 to 2082, guiding medium term planning for South Lampung Regency.

3.3 Perceptions of Waste Reduction Practices as Support for Service Improvement Scenarios

Improving waste management services in Natar Regency relies heavily on effective community engagement in reducing waste production at source. Experience in Hajimena Village demonstrates that a knowledge based intervention, which increased community understanding of plastic waste management by 60.4% (Ambarwati et al., 2022), was successfully implemented through practical actions, such as processing plastic waste into paving blocks. This effort to increase knowledge and behavior supports service improvements by diverting materials from the main collection stream, thereby reducing the burden on landfills. Similar findings were seen in Pemanggilan Village, where community based activities using the 3R principle enabled the processing of household waste (single use cups and plastic bottles) into valuable crafts (Sutopo et al., 2021). This case study highlights the potential of community based waste reduction programs to directly reduce the volume of waste entering landfills, underscoring the need for local governments to expand outreach and capacity building efforts across the Natar region.

A literature review supports the importance of a holistic approach to waste management. Ruslinda et al. (2012) emphasize that understanding waste generation, composition, and characteristics is fundamental to designing an effective waste management system. Integrating this characterization data is essential for determining the most effective reduction strategy, such as prioritizing organic waste processing. For instance, the conversion of organic waste into fertilizer (Alex, 2015). A vital strategy that not only reduces production volume but also offers economic benefits in organic waste processing (Sukandarumidi, 2009). Furthermore, long term sustainability demands that population growth projections (Tampuyak et al., 2016) be directly integrated into long term waste facility planning, as increasing populations drive proportional increases in the required management infrastructure.

From a technological perspective, solutions like plastic pyrolysis are relevant. A study by Setiani et al. (2020) shows that plastic pyrolysis, which converts polypropylene and LDPE into pyrolytic oil, has economic potential. Within the integrated Natar waste management system, this technology offers a specific, high impact solution for reducing the non organic waste fraction that currently accelerates FPS capacity decline, complementing the source reduction efforts targeting organic and easily recyclable materials. All technical and social strategies must align with the national regulatory framework (Law Number 18 of 2008) and the technical guidance provided by the Ministry of Public Works (2003).

The strategy for service improvement in Natar District focuses on the mid range scenario, where service coverage increases by 5% each year until reaching 100% in 2033. This 5% annual

increase is empirically justified as the highest achievable incremental growth rate given the current resource constraints and is presented as a realistic policy benchmark that significantly exceeds the conservative RMTDP target (0.73-1%). This scenario emphasizes that improving service effectiveness requires a dual approach: expanding collection and transportation coverage, as well as intensive source reduction via educational campaigns, the provision of recycling facilities, community incentives, and strengthening the 3R program through collaboration with the private sector, investment institutions, and CSR support. Integrating this comprehensive strategy is expected to significantly improve waste service performance while ensuring the long term sustainability of waste management in Natar District, in line with regional development goals.

4. Conclusions

The study rigorously analyzed trash generation and service coverage in Natar District, South Lampung Regency, and evaluated scenarios for enhancing waste management based on the capacity of the Karang Sari Final Processing Site (FPS). The analysis confirmed that the FPS receives an actual collected waste volume of 24.19 m^3/day, which results in a low service level of 42% when compared to the total projected daily waste generation of 57.59 m^3. This figure is substantially below the regional target of 70%. Scenario analysis demonstrates that an aggressive estimated annual service improvement of 10% (aligned with national goals) could allow for full service coverage by 2029, while a more conservative 5% annual increase (representing a more feasible operational goal) would achieve this goal by 2033. The findings critically indicate that the current regional policy target is insufficient. As a direct implication of this analysis, the study strongly recommends incorporating community based waste reduction programs and improving waste management techniques through cooperative efforts among local stakeholders, as these measures are essential to meet the regional service target and ensure the long term viability of the FPS.

References

Alex, S. (2015). *Sukses mengolah sampah organik menjadi pupuk organik*. Yogyakarta: Pustaka Baru Press. https://inlislite.ipdn.ac.id/opac/detail-opac?id=4667

Alfitri, A., Helmi, H., Raharjo, S., & Afrizal, A. 2020. Sampah Plastik sebagai Konsekuensi Modernitas dan Upaya Penanggulangannya. Jurnal Sosiologi Andalas, 6(2), 122–130. https://doi.org/10.25077/jsa.6.2.122-130.2020

Ambarwati, A., Qunifah, V., Bahri, S., Marina, L., Hadi, S., Laila, A., Hendri, J., (2022). Pemanfaatan Sampah Plastik Manjadi Paving Blok Di Desa Hajimena Natar, Lampung Selatan. Jurnal Abdi Insani Vol 9. https://doi.org/10.29303/abdiinsani.v9i3.581

Badan Pusat Statistik, 2024, Kabupaten Lampung Selatan Dalam Angka Tahun 2024, Kabupaten Lampung Selatan. https://lampungselatankab.bps.go.id/id/publication/2024/02/28/8488cafc7fde7f7311e3a022/kabupaten-lampung-selatan-dalam-angka-2024.html

Departemen Pekerjaan Umum. (2003). *Petunjuk survey dan analisa data untuk perencanaan teknis dan manajemen persampahan*. Direktorat Jenderal Cipta Karya, Departemen PU.

Damanhuri ,E dan Padmi, T. 2010. Diktat Pengelolaan Sampah. Teknik Lingkungan Institut Teknologi Bandung (ITB). Bandung. https://newberkeley.wordpress.com/wp-content/uploads/2015/12/diktatsampah-2010-bag-1-3-pengelolaan-sampah.pdf

Indah, N. H., Rahardyan, B., & Keumala, N. (2021). Analisis Keberlanjutan Pengelolaan Sampah Perkotaan di Indonesia. *Jurnal Teknik Lingkungan*, 27(1), 1–15. https://doi.org/10.5614/j.tl.2021.27.1.1

Peraturan Menteri Pekerjaan Umum Republik Indonesia Nomor 3 tahun 2013 tentang Penyelenggaraan Prasarana dan Sarana Persampahan dalam Penanganan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga. https://peraturan.bpk.go.id/Details/144707/permen-pupr-no-03prtm2013-tahun-2013

Ramadanthi, G. P. (2022). *Perencanaan Umum dan Pemilihan Lokasi TPA* [Materi Presentasi]. Direktorat Sanitasi, Direktorat Jenderal Cipta Karya, Kementerian Pekerjaan Umum dan Perumahan Rakyat.

Rimantho, D., & Tamba, M. (2021). Usulan strategi pengelolaan sampah padat di TPA Burangkeng Bekasi dengan pendekatan SWOT dan AHP. *Jurnal Ilmu Lingkungan*, 19(2), 383–391. https://doi.org/10.14710/jil.19.2.383-391

Rencana Pembangunan Jangka Menengah Nasional 2020-2024. https://perpustakaan.bappenas.go.id/e-library/file_upload/koleksi/migrasi-data-publikasi/file/RP_RKP/Narasi%20RPJMN%20IV%202020-2024_Revisi%2014%20Agustus%202019.pdf

Rencana Pembangunan Jangka Menengah Daerah Kabupaten Lampung Selatan Tahun 2021-2026. https://share.google/v9EPJo4fuAVESFMTE

Ruslinda, Y., Indah, S., & Laylani, W. (2012). Studi timbulan, komposisi, dan karakteristik sampah domestik Kota Bukittinggi. *Jurnal Teknik Lingkungan UNAND*, 1(9), 1–12.

Sekar. A & Almasa, 2024. Identifikasi Perkembangan Infrastruktur Di Kecamatan Jati Agung (Studi Kasus: Desa Jatimulyo, Desa Way Huwi Dan Desa Banjar Agung). Perencanaan Wilayah dan Kota, Fakultas Teknologi Infrastruktur dan Kewilayahan Institut Teknologi Sumatera. 10.24252/jpm.v13i1.45081

Setiani, V., Setiawan, A., Mazdhatina, O. S., & Puspitasari, D. (2020). *Analisis kelayakan ekonomi dari minyak hasil produk cair pirolisis sampah plastik polipropilen (PP) dan LDPE (Low-Density Polyethylene).* Teknik Pengolahan Limbah & Teknik Permesinan Kapal, Politeknik Perkapalan Negeri Surabaya (PPNS). https://media.neliti.com/media/publications/493847-analisis-kelayakan-ekonomi-dari-minyak-h-caceca03.pdf

SNI 3242-2008 Pengelolaan Sampah di Permukiman. https://upstdlh.id/files/SNI_3242-2008.pdf

SNI 19-3983-1995 Tentang Spesifikasi Timbulan Sampah Untuk Kota Kecil dan Sedang di Indonesia.https://perpustakaan.ciptakarya.pu.go.id/opac/index.php?p=show_detail&id=10539

Subandriyo. Anggoro.D., and Hadiyanto. 2012. Optimasi Pengomposan Sampah Organik Rumah Tangga Menggunakan Kombinasi Aktivator Em4 Dan Mol Terhadap Rasio CN. Jurnal Ilmu Lingkungan UNDIP, Volume 10 issue 2:70-75. https://doi.org/10.14710/jil.10.2.70-75

Sukandarumidi. (2009). *Rekayasa gambut, briket batubara dan sampah organik*. Yogyakarta: Universitas Gadjah Mada.

Sutopo, S., Murwanto, B., Gultom, T, B. (2021). Pemberdayaan Masyarakat Melalui Pengolahan Sampah Plastik Di Desa Pemanggilan Kecamatan Tanjungkarang Natar Kabupaten Lampung Selatan. Jurnal Sinar Sang Surya Vol.6. http://dx.doi.org/10.24127/sss.v6i1.1880

Tampuyak, S., Sulastri, & dkk. (2016). Analisis proyeksi pertumbuhan penduduk dan kebutuhan fasilitas persampahan di Kota Palu 2015–2025. *e-Journal Katalogis*, 4(4), 94–104. https://www.neliti.com/id/publications/150700/analisis-proyeksi-pertumbuhan-penduduk-dan-kebutuhan-fasilitas-persampahan-di-ko

Undang-Undang Republik Indonesia No. 18 Tahun 2008 tentang Pengelolaan Sampah. https://peraturan.bpk.go.id/Details/39067/uu-no-18-tahun-2008