

Analysis of Green Open Space Needs Based on Population Projections in Medan Baru Subdistrict

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ABSTRACT

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The availability of adequate green open space (RTH) is one of the efforts to maintain optimal environmental quality. The need for green open space is affected by population and area. Based on the Law No. 26 Year 2007 on Spatial Planning, it is explicitly determined that the proportion of public green open space is 20%. Sub-district Medan Baru is a sub-district located in the city center, part of which is a commercial and service area. Sub-district Medan Baru is also one of the sub-districts planned to be the city service center, which has the function of trade / business activity center, service activity center and provincial and city government activities, so the population density in the area is dense and affects the need for green space. The data used in this research are land use map, administrative map of Medan Baru sub-district and green open space coordinate data of Medan Baru sub-district. From the results of the study, it was obtained that the area of public green space in Medan Baru Sub-district is 18.78 hectares and it can be interpreted that the availability of public green space in Medan Baru Sub-district is 3.48% of the total area.

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I. Introduction

The development of the city undergoes changes that tend to progress every year. The development of the city is influenced by population growth, which causes the growth of settlements, industry and trade, which has an impact on changes in the physical environment. In addition, the high volume of traffic in the city has an impact on the physical changes in the environment [1]. Changes in the physical environment, if not balanced with the increase in the amount of public green open space, can lead to decreased water and air quality, reduced water catchment areas, and increased environmental pollution [2]. According to Purnomohadi [3] the availability of adequate green open space (RTH) is one of the efforts to maintain optimal environmental quality. The existence of green spaces is very important for the development of cities in an effort to meet human needs, because all plants in green spaces can absorb carbon dioxide (CO₂), produce oxygen, reduce temperature and provide a cool atmosphere and become a water catchment area. Reduced quantity and decreased quality of green spaces can cause various environmental problems such as flooding, high air pollution and decreased community productivity due to limited space for social interaction [4].

Based on Law No.26 Year 2007 [5] on Spatial Planning explicitly determines that the proportion of urban green space is at least 30% of the area with details of 20% public open space and 10% private open space. The division of RTH is a minimum standard in maintaining the ecology of the city, including aspects of climate, hydrology, and other ecological systems to increase air capacity in accordance with the needs of human life. In addition, RTH also functions as the beauty of an urban area and adds to the aesthetic value of a city.

Medan City is the third largest city in Indonesia with high population growth. based on data from the Central Bureau of Statistics in 2023 [6], the total population of Medan city from 21 sub-districts is 2,474,166 people. The population density in Medan city causes land conversion into settlements,



high-rise buildings, shopping centers, and industries both large and small. This urban development is not balanced with the allocation of green spaces such as the development of parks, urban forests, buffer zones and other developments that are oriented towards environmental balance. The adequacy of public green open space (RTH) in Medan City has not met the rules set by Law No. 26/2007, which is 20% of the total area. Likewise, the distribution of public green spaces in Medan City in 21 sub-districts is not evenly distributed. Therefore, the development of RTH has been regulated in the RTRW of Medan City Year 2022-2042.

In the urban area of Medan City, such as in Medan Baru Sub-district, it is one of the sub-districts located in the city center where most of the area is a trade and service area [7]. In addition, Medan Baru sub-district is also one of the sub-districts planned to be the city service center which has the function of trade/business activity center, service activity center and provincial and city government activities. Medan Baru sub-district has several green areas including Beringin Park, Gajah Mada Park and USU complex. Beringin Park is planned as an urban forest while Gajah Mada Park functions as an urban park. The need for green spaces in Medan Baru sub-district has not met the composition of green spaces that have been determined. Basic research that has been done before in Medan Baru sub-district is the availability of green open space with an oxygen demand approach where the results of RTH analysis show the ability to absorb CO₂ of 7,569.17 tons / year. While the demand for O₂ is 86,458 kg / day or an area of 0.1708 Ha. The available amount is 65,777.06 kg O₂ / day or an area of 129.93 Ha [8]. The researcher discussed the need for public green space for the next three years, related to the population growth of the area.

II. Research Method

A. Research Location

The research subject is located in Medan Baru Sub-district, Medan City, North Sumatra Province. Medan Baru sub-district is bordered by Medan Sunggal and Medan Selayang to the west, Medan Polonia to the east, and Medan Petisah to the north. The research location map can be seen in Figure 1 below.

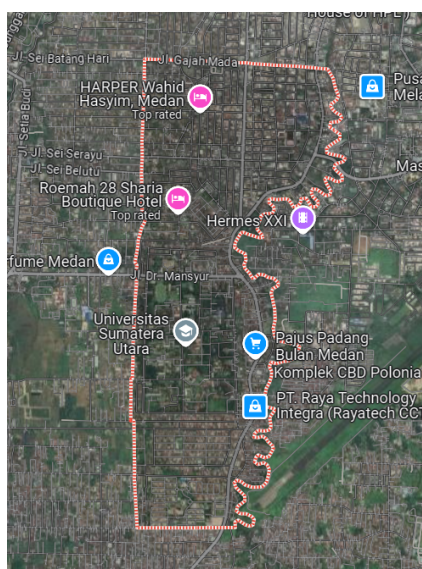


Figure 1. Research Location

B. Stages in Research

- In the initial stage, data collection was carried out in the form of land use map, administrative map of Medan Baru sub-district, and green open space coordinate data of Medan Baru sub-district.
- From the land use map, the area of public green open space in Medan Baru sub-district was calculated.

- The need for public green open space is 20%, so from the results of calculation of public green open space in Medan Baru Sub-district then calculated the lack of green open space that is not yet available..
- To determine the need for public green open space based on population, calculations are made based on the Minister of Public Works Regulation No. 5/PRT/M/2008 [9] using the following formula.

- The need for green open space based on area can be calculated using the following equation (1).

$$K = L \times (30/100) \quad (1)$$

Where

K = Green Space Availability

L = Area

- The green space requirement based on the number of residents is calculated using a standard of 20m² per resident. The green space requirement is calculated using Equation 2 below.

$$RTH \text{ pi} = P_i \times k \quad (2)$$

Where :

RTH pi = Green Open Space Needs Based on Population

Pi = Total Population In Region i

k = Value Of Green Open Space Provision Per Population

- The need for green open space in the projection of population growth in the next few years based on the population growth rate of a city is calculated using the following equations 3 and 4.

Population Growth Rate Formula.

$$R = \left(\frac{P_t}{P_o} \right)^{1/t} - 1 \quad (3)$$

Where,

PT = Total Population in Year t

Po = Total Population in Starting Year

T = Period of Time (Difference)

R = Population Growth Rate

$$P_n = P_o (1+r)^n \quad (4)$$

Where,

Pn = Total Population in a Given Year

Po = Total Population in Starting Year

R = Population Growth Rate

N = Number Of Year Intervals

III. Results and Discussion

Medan Baru sub-district has six villages including Babura, Petisah hulu, Merdeka, Darat, Padang Bulan, and Titi Rante. Medan Baru sub-district has a land area of 538.90 Ha. Based on SNI 7645: 2010 [10] Land Cover Calcification, the land use map in Medan Baru Sub-district can be seen in the following figure 2.

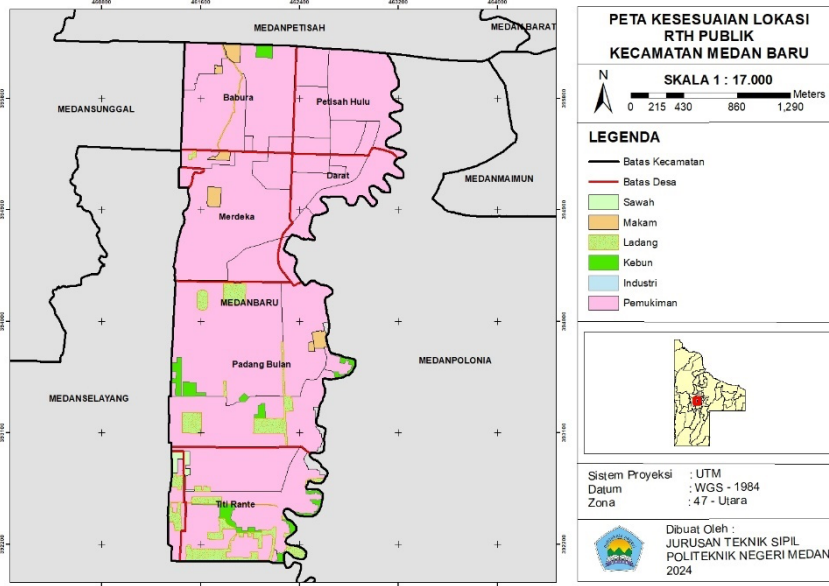


Figure 2. Land Use Map Of Medan Baru Sub-District

Public RTH in Medan Baru sub-district is in the form of cemeteries, city parks and urban forests. Many city parks can be found in Padang Bulan sub-district, more precisely in the area of the University of North Sumatra Complex. An overview of the location of public green spaces in Medan Baru regency can be seen in Table 1 below.

Table 1. Location of public green spaces in Medan Baru sub-district

No	Building Name	Address	Coordinates	Green space location photo
1	TPU Islam Babura	Jl. Sei Tuntung Baru, Babura, Kec. Medan Baru, Kota Medan, Sumatera Utara	3.582608°N, 98.655606°E	
2	TPU Islam Merdeka	Jl. Sei Batu Gingging Ps. X No.1, Merdeka, Kec. Medan Baru, Kota Medan, Sumatera Utara 20119	3.574410°N, 98.655273°E	
3	TPU Islam Padang Bulan	Jl. Jamin Ginting I No.256psr, Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20155	3.562801°N, 98.662452°E	

4	TPU Kristen KwalaBatuan	Jl. K.H. Wahid Hasyim No.95, Babura, Kec. Medan Baru, Kota Medan, Sumatera Utara 20114	3.583932°N, 98.657105°E	
5	TPU Kristen Merdeka	Jl. Abdullah Lubis No.52/71, Merdeka, Kec. Medan Baru, Kota Medan, Sumatera Utara 20153	3.577051°N, 98.656220°E	
6	TPU Kristen Padang Bulan	Jl. Jamin Ginting No.300, Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20155	3.562942°N, 98.662482°E	
7	Taman Gajah Mada	Jl. Mayjen D.I Panjaitan No.124, Babura, Kec. Medan Baru, Kota Medan, Sumatera Utara 20111	3.584389°N, 98.659408°E	
8	Stadion Mini USU	Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20153	3.566074°N, 98.653598°E	
9	Lapangan USU	Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20157	3.556535°N, 98.658462°E	
10	Foto Penghijauan di Median Jalan	Jl. Dr. A. Sofian No.28, Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20157	3°33'23"N,9 8°39'30"E	

11	Taman USU	Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20222	3.566324°N, 98.656756°E	
12	Foto Penghijauan di Jalan USU	Padang Bulan, Kec. Medan Baru, Kota Medan, Sumatera Utara 20222	3.564016°N, 98.660186°E	

The amount or area of public green space in Medan Baru sub-district can be seen in Table 2 below.

Table 2 Availability of Public Green Open Space in Medan Baru Sub-district

No	Village Name	Area (Ha)	Cemetery/TPU (Ha)	City Park (Ha)	Urban Forest (Ha)
1	Babura	78.30	2.04	0.00	1.32
2	Darat	39.93	0.00	0.00	0.00
3	Merdeka	89.08	2.58	0.00	0.00
4	Padang Bulan	170.15	1.76	5.30	0.00
5	Petisah Hulu	68.39	0.00	0.00	0.00
6	Titi Rante	93.05	0.00	5.78	0.00
	Total	538.90	6.38	11.07	1.32

From the table above, it is obtained that the existing Public Green Space area in Medan Baru Sub-district is 18.78 Ha and it can be interpreted that the current availability of Public Green Space in Medan Baru Sub-district is 3.48% of the total area. Based on the Medan City RTRW 2022-2042, Medan City Regional Regulation No. 1 of 2022, urban green open space is 20% for public green open space and 10% for private green open space of the total area, so the availability of public green open space in Medan Baru Sub-district has not met the standard public green open space needs.

Population growth also affects the need for green open space in an area. Public green space needs in Medan Baru Sub-district based on the number of residents can be done with the calculations below.

- a. Green Open Space Needs based on area using the regulation of the Minister of Public Works No.5/PRT/M/2008 regarding the availability of green open space in an area with the following formula (Pers 1):

$$K = L \times (30/100) = 538.90 \times (0,3) = 161.67 \text{ Ha}$$

Based on the above calculation, Medan Baru Subdistrict's green space demand is 161.67ha, but available public green space is 18.78 Ha.

- b. Green open space requirement based on population. In accordance with the regulation of the Ministry of Public Works No. 05/PRT/M/2008, the need for green open space is calculated based on the number of residents with a standard of 20m² per resident. The calculation of Public Green Space needs in Medan Baru Sub-district using Pers 2 can be seen in Table 3 below.

Table 3 Green Open Space Needs by Population of Medan Baru Sub-district

No	Village Name	Area (Ha)	Total Population	Public green space needed (Ha)	Existing public green space (Ha)	Lack of Public Green Space
1	Babura	78.30	7624	15.25	3.36	11.89
2	Darat	39.93	2004	4.01	0.00	4.01
3	Merdeka	89.08	6963	13.93	2.58	11.35
4	Padang Bulan	170.15	6207	12.41	7.06	5.35
5	Petisah Hulu	68.39	6136	12.27	0.00	12.27
6	Titi Rante	93.05	7486	14.97	5.78	9.20
Total		538.90	36420	72.84	18.78	54.06

Based on table 5.2 above, the required public green space based on population size is 72.84 Ha while the existing public green space available based on population size is 18.78 Ha. So it can be said that the lack of public green space if based on the population in Medan Baru Sub-district is 54.06 Ha.

- c. Green Open Space Needs Projected Population Growth over the Next Several Years The first steps in calculating a city's population growth rate using Pers 3 are shown in Table 4 below.

Table 4 Population Growth Rate In Medan Baru Subdistrict

No	Year	Total Population
	2020	36552
	2021	37174
	2022	36598
	2023	36420
Population Growth Rate		-0,0012052165

Based on table 4, the population growth rate in Medan Baru sub-district is - 0.0012052165. This happens because the number of residents is decreasing every year. Population growth projections for the next 3 years, namely in 2026, can be calculated using Pers.4, the projected population of Medan Baru Sub-district is 36289 people in the next 3 years, it can be seen that the need for green open space based on population is 72.58 Ha.

IV. Conclusion

Based on the process and results obtained from this study, it can be concluded that:

- The area of public green space in Medan Baru Sub-district is 18.78 Ha and it can be interpreted that the availability of public green space in Medan Baru Sub-district is 3.48% of the total area.
- The projected population of Medan Baru Sub-district is 36289 people in the next 3 years, so it can be known that the need for green open space based on population is 72.58 Ha

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