Environmental Problems from The Establishment of Apartment in Yogyakarta Municipality and Its Surroundings

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Abstract. Yogyakarta Municipality faces the problem of limited land to build housing, thus encouraging development of apartments. Many experts believe that construction of apartments in urban areas has positive impacts on the environment, like preservation of agricultural land, green spaces, and riverbanks. This research is intended to find out whether the construction of apartments really has positive impacts on the environment? Or is there a negative impact that is not anticipated before? The results show that apartments built in densely populated areas have a negative impact in the form of drying up wells belonging to local residents, due to the utilization of deep wells to meet the water needs of apartment residents. So, the apartment can combine deep pumping wells with other technologies, namely: processing recycled wastewater into clean water, making rainwater collection systems to be absorbed into the ground, and increasing trees and green open spaces for capturing water.

Keywords: apartments, densely populated areas, negative impact, residents' wells dry, wastewater treatment

1. Introduction

The rapid population growth in urban areas has an impact on limited land for housing. The land area for housing development is increasingly limited, thus encouraging the growth of vertical housing, both apartments and flats. The Ministry of Settlement and Regional Infrastructure itself supports the development of vertical settlements because in addition to saving land, the construction of vertical housing can also avoid land conversion,

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especially land for agriculture and green space for the fresh air of the city. Thus the main functions of the land can be maintained properly. [1]

Like other cities in Indonesia, Yogyakarta Municipality also faces the problem of limited land to build housing. The area of Yogyakarta Municipality is 32.5 square km, with a population of 373,589 people. Thus, the population density reaches 11,495 per square km. With such a small area, based on land use as much as 21,026 square km is used for housing, while the others are for service activities, companies, industry, and agriculture (Badan Pusat Statistik, 2021: 77 and 389).

Yogyakarta Municipality is flanked by two regencies which also have a dense population, namely Sleman Regency and Bantul Regency. Sleman Regency has an area of 574.82 square km, with a population of 1,136,474 people. The population density reaches 1,997 people per square km (Badan Pusat Statistik, 2022b: 1 and 37). Meanwhile, Bantul Regency has an area of 506.85 square km, with a population of 998,647. The population density is 1,986 per square km (Badan Pusat Statistik, 2022a: 1 and 49). Most of the population in these two regencies live surounding of Yogyakarta Municipality. This also causes apartments not only to be built in Yogyakarta, but also in Sleman and Bantul Regencies.

The limited land for housing in Yogyakarta Municipality and its surrounding areas encourages investors to develop vertical housing, both in the form of apartments and flats. According to Muhammad Nasrullah Amir and Agam Maryono, the construction of apartments in urban area of Yogyakarta Municipality generally has good prospects because the number of apartments have not been able to meet the larger demand for residential houses (Amir and Marsoyo, 2020).

Many experts believe that the construction of apartments in urban areas has a positive impact on the environment, like maintenance of agricultural land, green spaces, riverbanks, and others. The preservation of the environment, in addition to maintaining food stability, also becomes a water catchment area, thereby reducing the risk of flood disasters. This research is intended to find out whether the construction of apartments really has a positive impact on the environment? Or is there a negative impact that is not anticipated before? This is because some apartments are built in densely populated urban areas, while others are built in open areas which are former agricultural lands and are still sparsely populated. The purpose of the study was to determine the possible negative impact of apartment construction on the surrounding environment.

2. Method

The research is qualitative. The data collection method was carried out by literature study, namely studying news that related to the impact of apartment construction on the surrounding community. In a study that uses a literature study approach, data analysis and interpretation occupies a decisive position in this research. Data analysis is the process of compiling data so that it can be interpreted. Organizing data means classifying data in patterns, themes or categories. Meanwhile, data interpretation means giving meaning to analysis, explaining patterns or categories, looking for relationships between various concepts (Nasution, 1996).

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[1] *Visi Pemerintah Bangun Permukiman Vertikal***.** 6 September 2003. https://pu.go.id/berita/visi-pemerintah-bangun-permukiman-vertikal, accessed on 18 June 2022.

Furthermore, qualitative data analysis is carried out in a process. The implementation has started since data collection is carried out intensively until after data collection is completed. This analysis process is carried out almost simultaneously with the interpretation of the data which is done as soon as possible without having to wait for a lot of data to be collected. The next analysis is done by interpreting data that was obtained inductively and comparing it with existing theories. This comparison is intended to link the findings with the theory that examines the things that are the focus of the research problem.

3. Results and Discussion

3.1 The Definition of Apartment

According to *Kamus Besar Bahasa Indonesia (KBBI)*, an apartment is a residence that consists of a sitting room, bedroom, bathroom, etc, on one floor of a building. Apartments are usually built as large and luxurious multi-storey buildings, and are equipped with various facilities such as swimming pools, fitness centers, and others (Tim Penyusun Kamus. 1990).

According to Ernst Neufert, a world architecture expert from Germany, apartment is a residential building that is separated horizontally and vertically to provide a independent residence and includes a low-rise building or a high-rise building, equipped with various facilities that comply with the specified standards. [2] Meanwhile, according to Joseph De Chiara and John Hancock, apartment is a residential unit that consisting of bedroom, bathroom, living room, kitchen, and lounge which is located on one floor of a vertical building which is divided into several residential units. [3]

In apartment buildings, not all of the land is used for housing, but is divided into three functions, namely main function, supporting function, and complementary function. The main function of an apartment is as a residence. As a place for residence, an apartment must be able to accommodate the daily activities of its residents, such as: sleeping, eating, receiving guests, doing social interactions, working, and others. The supporting function of an apartment is to meet the secondary needs of its residents, such as: entertainment venues, sports venues, meeting rooms, places of worship, and others. Finally, the complementary function is to support main functions and supporting functions of the apartment, such as: public spaces, parks, parking lots, cleaning and garbage collection facilities, security facilities, and others. [4]

The concept of an apartment as a vertical residence is actually not a new concept in Indonesia, because there are already many cities in other countries. Cities in Europe and Asia have already implemented the vertical housing policy. In the Netherlands, for example, vertical housing began to grow in the era of industrialization and modernization in the 1930s, where population growth increased significantly. In South Korea, vertical housing began to be built in 2000 after previously growing slums as a result of the population explosion in 1960 to

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[2] Yuhan Al Khairi. 2020. *Pengertian Apartemen, Karakteristik, Fungsi & Tips Terbaru***.** 3 Juli 2020. https://www.99.co/id/panduan/pengertian-apartemen, accessed on 22 June 2022.

[3] *Pengertian, Fungsi, dan Karakteristik Apartemen*. https://www.adhyaksapersada.co.id/apartemen/, accessed on 22 June 2022.

[4] Yuhan Al Khairi. 2020. *Pengertian Apartemen, Karakteristik, Fungsi & Tips Terbaru***.** 3 Juli 2020. https://www.99.co/id/panduan/pengertian-apartemen, accessed on 22 June 2022.

1970. Meanwhile in Malaysia, the construction of vertical housing has also been carried out since the 2000s, as a solution to housing needs. in urban areas.[5]

3.2 Apartments in Yogyakarta and its Surroundings

Prior to 2013 there was only one apartment in Yogyakarta Municipality, which had been established since 1998. However, after that there was a significant increase in construction of apartments in 2014-2018. Currently, there are dozens of apartments, both operating and still under construction (Amir and Marsoyo, 2020). Some of apartments are: Malioboro City Regency, The Palace Apartment and Condotel, Student Castle, Uttara the Icon, Hotel Neo+Awana, Mataram City Apartment, Malioboro Park View, Taman Melati Sinduadi, Nadiwa Student Castle Bantul, Hadiningrat Terrace, Damai Living , Dhika Universe, Happy Finland, Student Park Apartments. [6] The descriptions of apartments in Yogyakarta and its surroundings are as follows.

Table 1. Data of Apartments in Yogyakarta and Its Surroundings

No.	Name of Apartments	Address	Regency/ Municipality	Environment Conditions
1.	Malioboro City Regency	Jl. Laksda Adi Sutjipto Km. 8, Tambakbayan, Janti, Caturtunggal, Depok	Sleman Regency	Open land of former rice fields
2.	The Palace Apartment & Condotel	Jl. Kaliurang km11, Pedak, Sinduharjo, Ngaglik,	Sleman Regency	Open land of former rice fields
3.	Student Castle	Jl. Student Castle, Kledokan, Caturtunggal, Depok,	Sleman Regency	Open land of former rice fields
4.	Uttara the Icon	Jl. Kaliurang, Manggung, Caturtunggal, Depok,	Sleman Regency	Densely populated area
5.	Hotel Neo+ Awana	Jl. Mayjend Sutoyo No.52, Mantrijeron, Kec. Mantrijeron,	Yogyakarta Municipality	Open land of former rice fields

[5] *Kampung Vertikal untuk Perumahan Perkotaan.* 14 September, 2020. https://perkim.id/perkotaan/kampung-vertikal-untuk-perumahan-perkotaan/ accessed on 18 June 2022.

[6] *Daftar Apartemen di Yogyakarta*. https://www.rukamen.com/apartemen-di-yogyakarta, diunduh 21 Juni 2022

6.	Mataram City Apartment	Jl. Palagan Tentara Pelajar, Km 7, Mudal, Sariharjo, Ngaglik	Sleman Regency	Open land of former rice fields
7.	Malioboro Park View	Jl. Laksda Adisucipto No.Km 7, Janti, Caturtunggal, Depok	Sleman Regency	Open land of former rice fields
8.	Taman Melati Sinduadi	Jl. Jembatan Baru UGM, Sinduadi, Mlati	Sleman Regency	Open land of former rice fields
9.	Nadiwa Student Castle Bantul	Jl. Desa Ngebel, Geblagan, Tamantirto, Kasihan,	Bantul Regency	Open land of former rice fields
10.	Hadiningrat Terrace	Jl. Dr. Sardjito No.24, Terban, Gondokusuman,	Yogyakarta Municipality	Densely populated area
11.	Damai Living	Jl. Bimo No.1, Candirejo, Sardonoharjo, Ngaglik,	Sleman Regency	Open land of former rice fields
12.	Dhika Universe	Jl. Prof. Dr. Sardjito, Gondomanan	Yogyakarta Municipality	Densely populated area
13.	Happy Finland	Heritage Platinum, Balong, Timbulharjo, Sewon	Bantul Regency	Open land of former rice fields
14.	Student Park Apartemen	Jl. Seturan Raya No.1, Kledokan, Caturtunggal, Depok	Sleman Regency	Open land of former rice fields

From dozens of apartments, only a few are administratively located in Yogyakarta Municipality, namely: Hotel Neo+Awana, Hadiningrat Terrace, and Student Park Apartments. Meanwhile, the other apartments are located in Sleman Regency and Bantul Regency, which are the buffer areas of Yogyakarta Municipality. Some apartments are built in densely populated areas, where investors buy lands that are owned by residents and move them to other locations, while others are built by converting land from agricultural land to residential land.

One of the reasons why many apartments are built in the buffer zone of Yogyakarta Municipality is that the Government of Yogyakarta Municipality issued a regulation that apartment buildings should not be more than 32 m above ground level, or maximum of 8 floors. It has been regulated in the Municipality Regulation on Detailed Spatial Planning,

taking into account many cultural heritage buildings in Yogyakarta.[7] By constructing apartments outside of the Yogyakarta area, investors can build apartments with more than 8 floors.

3.3 The Negative Impact of the Existence of Apartments

The results show that apartments that are built in densely populated areas have a negative impact, namely drying up wells belonging to local residents. The existence of an apartment requires large amounts of water to meet the daily needs of its residents, which is obtained by sucking groundwater through pump wells. The pump wells that are used are deep pump wells that suck water in the deep soil layer, with a minimum depth of 80 meter. The existence of the 80 meter deep well absorbs water supply from the residents' wells, which are generally shallow wells with a depth of less than 40 m.[8] The dry wells of residents around the apartment make it difficult for the surrounding community to get water from their own wells. In Yogyakarta Municipality, a number of resident areas such as Miliran, Penumping, and Gowongan are locations that are affected by the water crisis, due to the large number of hotels and apartments around the location.[9]

On the other hand, the community around the apartment still relies on well water and refuses to switch to tap water from *Perusahaan Air Minum Daerah* or PDAM (the Regional Drinking Water Company) because it is considered smelly and dangerous to consume because it contains chlorine. This is certainly a problem that must be addressed immediately, considering that the dependence of people of Yogyakarta on ground water is still very high compared to several cities in Indonesia, and in general they are not willing to switch to piped water from PDAM.[10]

The Government of Yogyakarta Municipality itself seems to allow permission to drill ground wells in apartment buildings, without any consequences from the apartment manager for how to maintain ground water, so that it does not harm the surrounding residents. Efforts to build hotels and apartments should continue to comply with permits in accordance with

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[7] Yulianingsih. 2016. "Apartemen, Antara Gaya Hidup dan Kebutuhan Hunian". *Republika.co.id.* Kamis, 16 Mei 2016. https://www.republika.co.id/berita/o7sb4x291/apartemen-antara-gaya-hidup-dan-kebutuhan-hunian, accessed on 21 June 2022.

[8] Prima S.W. 2014. Bahaya Sumur Kering, Warga Karangwuni Tolak Apartemen. 25 Agustus 2014. https://medium.com/literasi/bahaya-sumur-kering-warga-karangwuni-tolak-apartemen-a8de627c0114, accessed on 4 August 2022.

[9] *Krisis Air Akibat Pembangunan Hotel dan Apartemen di Yogyakarta*, 15 Desember, 2020. https://perkim.id/permukiman/krisis-air-akibat-pembangunan-hotel-dan-apartemen-di-yogyakarta/, accessed on 22 June 2022

[10] "Yogyakarta Defisit Air, Sumur Warga Kering". *BERITA JOGJAKILAS.* 17 Agustus 2016. https://www.balairungpress.com/2016/08/yogyakarta-defisit-air-sumur-warga-kering/, accessed on 4 August 2022.

applicable laws and regulations, in order to prevent Yogyakarta from falling further into the water crisis in the future.[11]

3.4 Overcoming of Negative Impacts

The dryness of the residents' wells around apartments occurs because the presence of deep pump wells in the apartments are not combined with other water sources. To overcome the dryness of the residents' wells around the apartment, the apartment manager actually does not only rely on deep pump wells as water sources, but can combine it with several other technologies. There are three technologies that can be applied together to get optimal results, namely: reprocessing waste water into clean water, making rainwater storage system, and maximizing plants and green space to catch water surrounding the apartments.

1) **Reprocessing Waste Water into Clean Water**

For reprocessing waste water into clean water, the apartment manager can organize a sewage treatment plant facility (wastewater treatment facilities). The facility consists of several reservoirs to treat wastewater in stages, from physically, biologically, to chemically process. Through the facility, all waste from bathroom, sink, dishwasher, etc. are accommodated and processed through a screen chamber (for toilet water) and a grease trap (for kitchen waste water). The water that produced from the screen chamber and grease trap is reprocessed through the equalization chamber, aeration chamber (biological process and addition of oxygen), mixing chamber (cleaning process of pathogenic bacteria), effluent chamber, sand filter, and carbon filter (filtering of sand and carbon content). After going through the entire process of the sewage treatment plant, the water will be flowed into the jungle pond (living pond) which is placed near the apartment. The appearance of water from this pond is the final indicator of water quality after undergoing the recycling process.

It is called a living pond because in the pond there are various types of fish, such as tilapia, goldfish, catfish, etc. If the water quality is still below the environmental quality standard, the fish in the pond will die. However, if the fish live healthy, it means that the water quality is good in accordance with the environmental quality standards.[12] The water can be used for watering plants and gardens around the apartment, and finally absorbed back into the ground, becoming groundwater that is ready to be pumped back and used for the daily needs of apartment residents. In addition, some of water will be absorbed into the wells of residents around the apartment.

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[11] *Krisis Air Akibat Pembangunan Hotel dan Apartemen di Yogyakarta*. 15 Desember, 2020. https://perkim.id/permukiman/krisis-air-akibat-pembangunan-hotel-dan-apartemen-di-yogyakarta/, accessed on 22 June 2022

[12] Clara Maria Tjandra Dewi H. 2018. Apartemen Pramuka Olah Air Limbah Penghuninya, Ini Cara Kerjanya. 20 Oktober 2018. https://metro.tempo.co/read/1138242/apartemen-pramuka-olah-air-limbah-penghuninya-ini-cara-kerjanya, diunduh 7 Agustus 2022.

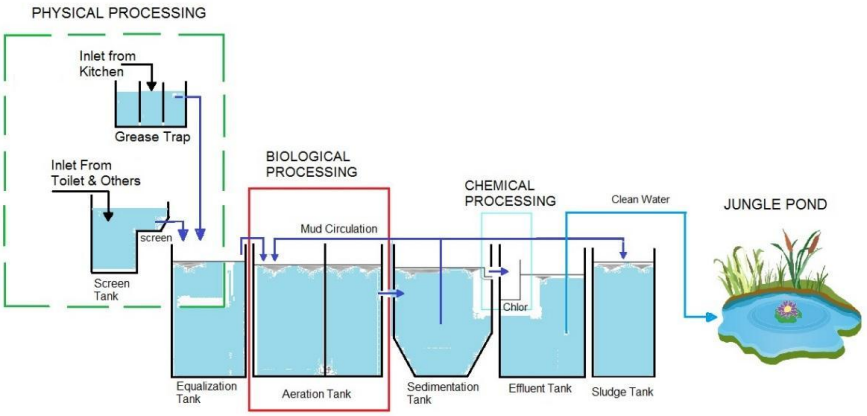

Fig. 1. Wastewater Treatment Process (*Sewage Treatment Plant*)[13]

Fig. 2. An example of a jungle pond at an apartment in Jakarta.

2) **Making Rainwater Storage System**

For construction of a rainwater storage system, the presence of rainwater can be used as a source of clean water for the daily needs of apartment residents. In this case, Yogyakarta

[13] Sayyid Aziz Rasyid. 2020. *Proses Pada Sewage Treatment Plant (STP.* 4 Januari 2020. https://id.linkedin.com/pulse/proses-pada-sewage-treatment-plant-stp-sayyid-aziz-rasyid, diunduh 8 Agustus 2022.

Municipality is one of areas that has high rainfall, which is 2,372.2 cubic mm in 2020 or an average of 197.68 cubic mm per month (Badan Pusat Statistik, 2021: 13) so it has a large enough of rainwater potential. Rainwater that falls from the roofs of apartments is channeled through pipes and accommodated into a water reservoir. This process is known as rainwater capture. The accommodation of rainwater is then put into the ground reservoir, so that it becomes groundwater that is ready to be sucked up by deep pump wells (Nadia and Mardyanto. 2016: D 241).

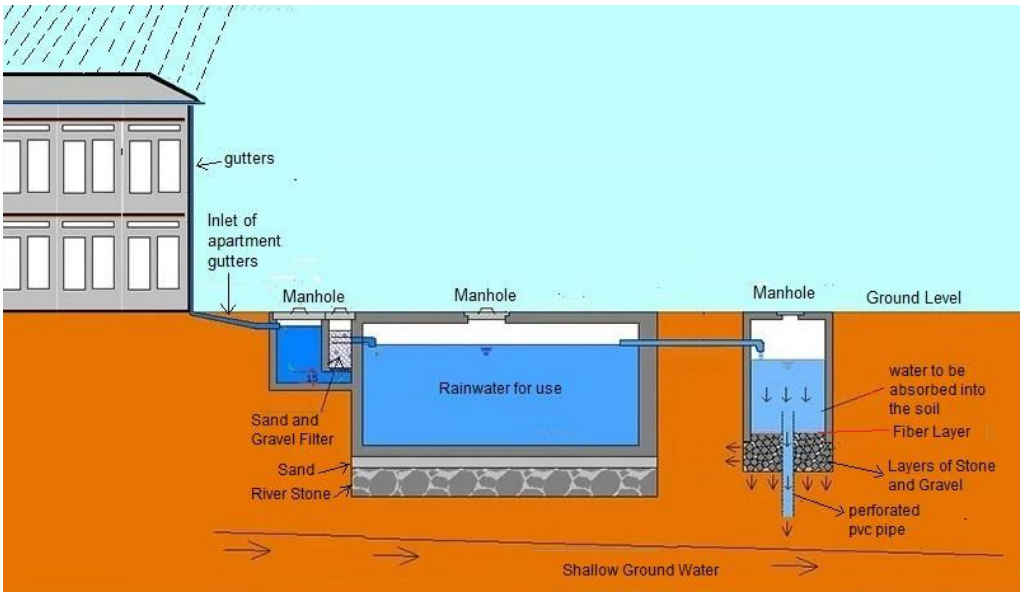

Fig. 3. Rainwater Catching Process for Reuse and Becoming Infiltration Water[14]

The workings of rainwater harvesting are as follows. First, rainwater that falls on the roof of an apartment building will flow through gutters and into a pipe that is connected to the first water reservoir. In the first reservoir there is a sand and gravel filter that will filter dust and garbage carried by water from the gutters. Furthermore, the clean rainwater then flows into the main reservoir. The water contained in the main reservoir can be pumped back into the building for daily use. If the main reservoir is no longer able to accommodate water due to continuous rain, then the water will flow through the outlet pipe into the infiltration well, which will then seep into the soil and increase the groundwater content.

3) Maximizing Plants and Green Open Spaces to Capture Water

One of the causes of the dryness of wells as the main water source for residents is that construction in apartment areas is not balanced with the provision of green space and planting of trees. Therefore, a government regulation is needed that requires apartment managers to plant as many trees as possible for greening and groundwater absorption. In addition, trees can be planted on the roof area of the apartment. The advances of technology that are developing

[14] Nita Hidayati. 2020. *Mengenal SPAH, Cara Memanfaatkan Air Hujan Yang Bisa Kamu Lakukan di Rumah*. 17 April 2020. https://www.99.co/blog/indonesia/mengenal-spah/, diunduh 24 Agustus 2022.

at this time allow the planting of trees with hydroponic techniques on the roof of the apartment.

The presence of trees and plants in the apartment environment will be able to function to absorb rainwater. This is because tree roots can absorb rainwater that enters the soil, binds groundwater, and prevents flooding.[15] Thus, trees play an important role in preventing natural disasters that can cause harm to living things.

Fig. 4. An example of empowering plants in an apartment

4. Conclusion

In the area of Yogyakarta Municipality and its surroundings, apartments have emerged as a solution to the limited land for residential construction. There are dozens of apartments, both operating and still under construction in the municipality. On the other hand, it turns out that the existence of apartments, especially those built in densely populated areas, have a negative impact in the form of drying up wells belonging to local residents due to the use of deep pump wells from apartments that suck water from the deep soil layer. For this reason, a regulation from the local government is needed so that apartment managers combine deep pumping wells with other technologies, to meet the water needs of apartment residents, without causing the wells of the surrounding residents to dry out.

There are three alternative technologies that can be used, namely: processing wastewater that is recycled into clean water, establishing a rainwater reservoir system to be absorbed into the soil, and increasing trees and green spaces to capture water and absorb it

[15] Lulu Lukyani. 2021. *4 Manfaat Menanam Pohon untuk Lingkungan*. 7 September 2021. https://www.kompas.com/sains/read/2021/09/07/214500923/4-manfaat-menanam-pohon-untuk-lingkungan?page=all, diunduh 24 Agustus 2022

into the soil. In reprocessing wastewater into clean water, it is necessary to build a sewage treatment plant system. In the rainwater collection system, water from rainfall that falls on the roofs of apartments is then channeled and collected into a water reservoir, which is called the rainwater harvesting process. In an effort to increase planting of trees and green space, it can be done with hydroponic techniques on the roof of the apartment. The three alternatives are expected to reduce the potential for the wells of residents around the apartment to dry up, as a result of using deep wells for the needs of apartment residents.

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[11]Lukyani, Lulu. *4 Manfaat Menanam Pohon untuk Lingkungan*. 7 September 2021. (2021). https://www.kompas.com/sains/read/2021/09/07/214500923/4-manfaat-menanam-pohon-untuk-lingkungan?page=all, accessed on 24 August 2022

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