



The identification of retention ponds for flood management in Palembang City

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Abstract. Retention ponds have the function of temporarily storing water from the drainage system before it flows into the river so that it can reduce flood peaks. In the Palembang area there are 49 retention ponds based on data from the Palembang City PUPR Service, but after investigating it turns out there are 43 retention ponds, this is because there are two retention ponds that have the same name, There are retention ponds that are overgrown with swamp plants so it is difficult to differentiate between retention ponds and swamps, and there is no secondary data that can be used as a reference in looking for retention ponds according to existing data. There are two types of retention pond pavement in the Palembang area, namely concrete pavement and soil with good to damaged structural conditions, while the retention pond doors are functioning well until there are no doors, some retention pond conditions when flooded are not full and will full when the water flow is maximum. From the results of the investigation, the factors causing flooding are the elevation of retention ponds which is lower than residential areas and the buildup of sedimentation in retention ponds, resulting in a reduction in the capacity to hold water flow in retention ponds, so that the maximum discharge in an area that enters the retention pond is not accommodated optimally which causes flooding with the largest flood point having a frequency of more than 15 times a year with a height of more than 50 cm and a receding duration of 3 to 4 hours, and the lowest flood point with a frequency of less than five times a year with a height of 5 to 20 cm and a receding time of 2 to 3 hours.

Keywords: Retention Ponds, Water Discharge, Sedimentation, Flood.

1 Introduction

High rainfall, combined with the incapacity of drainage channels in a region to accommodate the precipitation, can result in frequent occurrences of floods. Floods are also caused by a lack of public awareness in protecting the environment by throwing rubbish carelessly, cutting down trees carelessly, and changing the function of land.

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Flooding is a natural phenomenon that occurs and cannot be avoided. Floods can occur on a large scale if the water overflows but remains stagnant, causing environmental damage, and on a light scale, namely if the rain falls but recedes again. (Harmani & Soemantoro, 2017). Palembang City is a lowland area which has 16 districts and 107 sub-districts. Palembang City is one of the cities in Indonesia that often experiences flooding. To overcome flooding, it is necessary to plan the construction of retention ponds. The function of the retention pond is to store rainwater for a certain period of time so that it can reduce the highest flood discharge that occurs in the area. The concept of a retention pond is to accommodate water that flows through a drainage channel into a retention pond, then the water flows back slowly into the drainage channel.

This retention pond has an important role in controlling floods in the city of Palembang. Palembang city has 49 retention ponds, but flooding problems in several areas of Palembang city still occur during high rainfall. From this background, it is necessary to identify the condition and location of the retention pond so that the existence of the retention pond can be analyzed in relation to the location of the flood. This research is a continuation of previous research regarding the distribution of retention ponds in Palembang City (Indrayani, Herius, Mirza, & Hasan, 2021).

2 Literature Review

2.1 Theoretical Studies

Flooding is a natural event where the channel cannot accommodate the water capacity due to the water discharge increasing so that it exceeds its storage capacity (Adi, 2013). Floods have several types as follows:

- a. River flooding is the overflow of river water through river embankments.
- b. Coastal flooding is a rise in sea levels due to high tide.
- c. Sudden floods are floods that occur suddenly due to heavy rain with high intensity.
- d. Local/urban flooding is flooding that occurs in residential or urban areas due to inadequate drainage or growth in land use.
- e. Lake/reservoir flooding is an increase in the water level of a lake/reservoir until it passes the lake/reservoir embankment.

To overcome flood disasters, flood control efforts are carried out, namely by creating retention ponds. Retention ponds function to replace water catchment areas whose land has been covered by infrastructure development such as housing/offices (Florince, Arifaini, & Adha, 2015). This retention pond collects rainwater which flows through the drainage channel into the retention pond which then seeps into the ground and flows slowly into the drainage channel, Therefore, to plan a retention pond, the height of the retention pond must be lower than ground level so that water can be directly collected in the retention pond without puddles.

3 Research Objectives and Benefits

Several researchers conducted research related to retention ponds as flood control structures, (Andayani, Djohan, & Arlingga, 2019) with the title Flood Management with Retarding Basin in Gandus Subdistrict. In other research, retention ponds can control peak discharge by suppressing or cutting flood peaks that would otherwise occur (Harmani & Soemantoro, 2017).

From this research, research can be carried out to determine the physical condition of retention ponds as an effort to control floods in Palembang City, so that the number of retention ponds and the physical condition of retention ponds in the city of Palembang are sufficient and in optimal condition to be used as flood control which is currently very much needed by the Palembang city government in anticipating floods that often occur in the city of Palembang. Apart from that, this is in line with the National Research Priority (PRN) roadmap in disaster mitigation.

The aim of this research is to identify retention ponds in Palembang City to avoid flooding. The benefits of this research are expected to serve as recommendations for the provision and maintenance of retention ponds as a solution for flood management in the city of Palembang.

4 Research Methodology

4.1 Study Region

The research was conducted in the Palembang City area which consists of 18 districts and 107 sub-districts located between 2°52'3°5' South Latitude and 104°37'104°52' East longitude. The research area can be seen in Figure 1

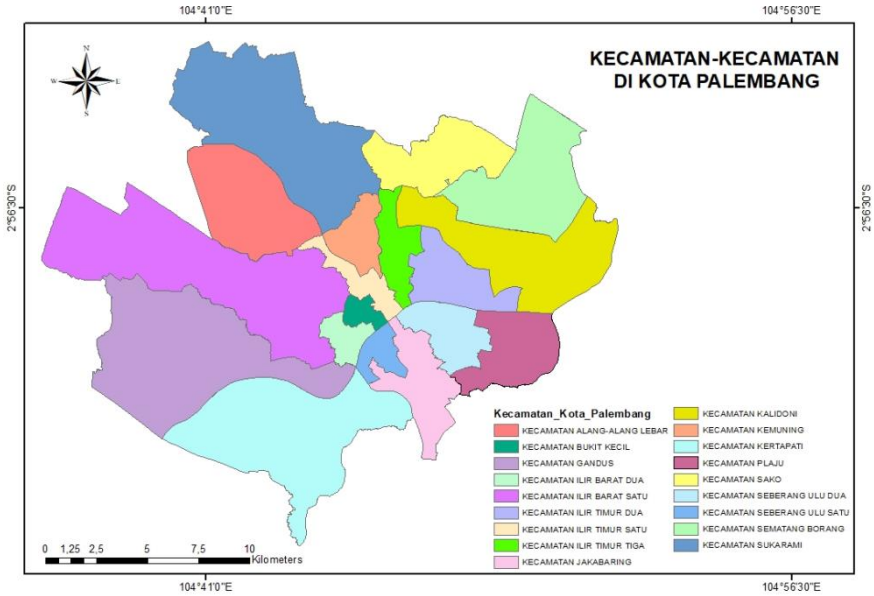


Fig. 1. Inundation or Flooding Study Area in Palembang

4.2 Method of Collecting Data

The required data to support this research consists of primary data in Table 1 and secondary data in Table 2.

Table 1. Type And Location of Primary Data Collection.

Data Primary	Locations of Data Collection
Documentation of retention pond conditions	All retention ponds in Palembang City
Data on area, depth, coordinates, sub-district, sub-district, and name of retention pond	All retention ponds in Palembang City Interpretation from Google Earth Data processing with GIS

Table 2. Types And Institution Related to Secondary Data Collection.

Data Seconds	Institution
Inventory of the number of retention ponds in the city of Palembang	PUPR Department of Palembang

4.3 Research Stages

The research begins by identifying the problems that occur in the field. Secondary data collection takes the form of an inventory of retention collection data throughout Palembang City, and primary data was obtained directly in the field by filling out

questionnaires and interviews with the community and community leaders, as well as district and sub-district officials in the Palembang City area. The distribution of the questionnaire was carried out in two stages, the first stage was distributing the questionnaire via social media (WhatsApp, Face Book, Instagram) to people who live in Palembang City, the second stage is distributing questionnaires and interviews directly to the field (districts and sub-districts in Palembang City), to find out the existing conditions of retention ponds in sub-districts areas in Palembang City and to cross check the results of distributing the first stage of the questionnaire to the field to obtain coordinates and descriptions of the retention ponds. Next, a field survey was carried out to determine the condition of the existing retention ponds, then from the results of the field survey an analysis of the retention ponds was carried out regarding flood control efforts in Palembang City.

5 Research Results and Discussion

5.1 Retention Group Distribution

Based on data from the PUPR Department of Palembang City PUPR Service, there are 49 retention ponds in the Palembang City area. A map of the distribution of Palembang city retention ponds can be seen in Figure 2.

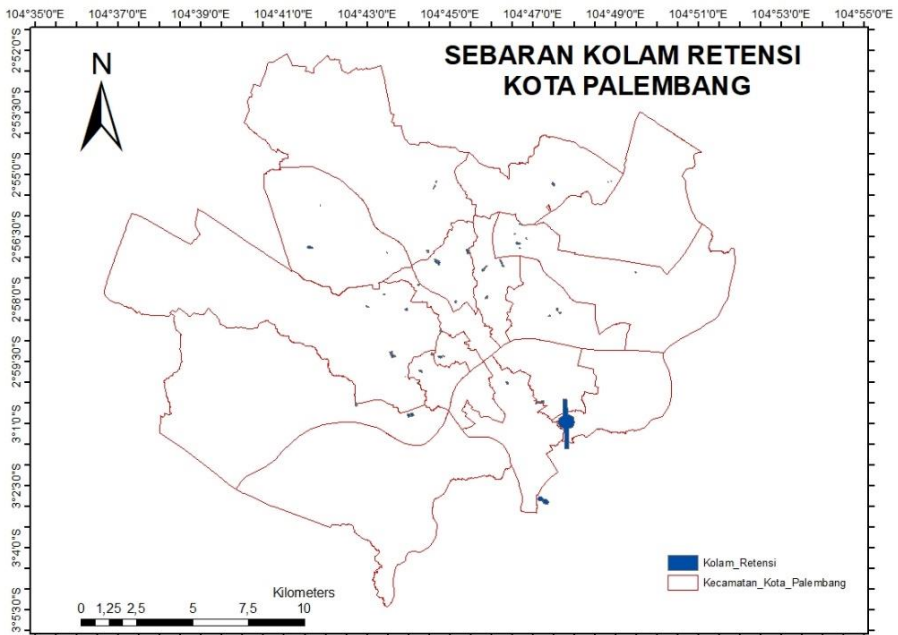


Fig. 2. Map of Retention Ponds Distribution in Palembang City

From the results of identifying 49 retention ponds, 43 retention ponds were found, because there were two retention ponds that had the same name, Retention ponds are overgrown with swamp plants so it is difficult to distinguish retention ponds from swamps, and there is no secondary data so it is difficult to differentiate them in the field. Retention ponds that have not been identified include the Macan Kumbang retention pond, the Sumur Tinggi retention pond, the Bari Hospital retention pond, the Sungai Bendung retention pond, the Rafflesia retention pond, and the RC Reservoir retention pond. The retention ponds in the Palembang City area are spread across 14 districts with a total of 43 retention ponds, which can be seen in table 3.

Table 3. Distribution of Retention Pondss in Palembang City

No	Districts	Retention Ponds Name	No	Districts	Retention Ponds Name
1	Kalidoni	Citra Damai 2 Retention Pond Kedamaian Retention Pond PLN Retention Pond Tanjung Sari 2 Retention Pond Vila kedamaian Retention Pond			Kancil Putih Retention Pond Brimob Retention Pond SDN 3 Palembang Retention Pond Tanjung Burung Retention Pond Sport Hall Retention Pond
2	Iilir Timur II	Simpang Patal (Kolam Kiwal) Retention Pond Pertamina Golf Retention Pond IBA Retention Pond Telkom Retention Pond Arafuru Retention Pond Arafuru SMA 5 Retention Pond	7	Gandus	Poligon Retention Pond Sungai Lambidaro Retention Pond
			8	Iilir Barat Dua	Kemang Manis Retention Pond KI kecil Retention Pond
			9	Sako	Bumi Nusa Cendana (Kanan) Retention Pond Bumi Nusa Cendana (Kiri) Retention Pond
3	Kemuning	RSMH Retention Pond Seduduk Putih Retention Pond Talang Aman I Retention Pond	10	Alang-Alang Lebar	Sangkurian Retention Pond Punti Kayu Retention Pond Talang Kelapa Retention Pond

		Talang Aman II Retention Pond			Taman Purbakala Retention Pond
4	Sukarami	Ario Kemuning Retention Pond	11	Bukit kecil	KI besar Retention Pond
		Sukawinatan Retention Pond	12	Seberang Ulu Satu	Belakang Poltabes Retention Pond
		Griya Buana Indah Retention Pond			Silabranti Retention Pond
5	Iilir Timur I	Simpang Polda Retention Pond			GOR Jakabaring Retention Pond
6	Iilir Barat Satu	Siti Khodijah Retention Pond	13	Jakabaring	OPI Retention Pond
		MAN 3 Retention Pond	14	Kalidoni	SMP 37 Retention Pond
		SMPN 22 Pakjo Retention Pond			

5.2 Results of Inspection of the Physical Condition of the Retention Ponds

The physical conditions of retention ponds in Palembang City that were reviewed included pavement, structural conditions, sluice, water flow conditions, depth and height of retention ponds, condition of ponds during flooding. The results of observations of the retention pond can be seen in Figure 3.



Fig. 3. Citra Damai retention pond 2

Citra Damai 2 Retention Ponds is one of the retention ponds in Palembang City, namely in Bukit Sangkal Village, Kalidoni District. The condition of the retention pond structure is good with pavement, the depth of the retention pond is 92 cm above the water surface and the height of the retention pond is 235 cm, there is a sluice gate and it is still functioning, the condition of the water flow and the condition of the ponds when it is flooded is not full. All observation results are summarized in table 4.

Table 4. Distribution of Retention Pondss in Palembang City

No	Category	Condition	amount
1	pavement	concrete pair	20
		land	23
2	Structure	Good	10
		Lightly damaged	14
		moderate damage	17
		heavily damaged	1
3	Sluice	functioning properly	18
		not functioning well	5
		Does not have	20
4	Water Flow Condi- tions	Flow	21
		not functioning well	1
		lots of piles of rubbish	4
		Lots of water hyacinths	10
		Dry and lots of sediment	7
5	Depth of retention pond	40 – 120 cm	32
		121 – 200 cm	10
		201 – 280 cm	-
		>281 cm	1
6	Height of retention pond	110 – 200 cm	16
		201 – 300 cm	26
		301 – 400 cm	-
		>400 cm	1
7	Pond Conditions During Floods	Full	24
		Not Full	16
		unidentified	3

6 Conclusion

Of the 49 retention ponds, there are 43 retention ponds spread across 14 sub-districts in the Palembang area, this is because there are two retention ponds that have the same name, Retention ponds are overgrown with swamp plants, making it difficult to distinguish retention ponds from swamps, and there is no secondary data, making it difficult to search for retention ponds. There are 20 retention ponds with concrete pavement and 23 earthen ponds. The condition of the ponds structures is in good condition with 10 retention ponds, 14 ponds with light damage, 17 ponds with moderate damage, one retention ponds with heavy damage. Retention ponds have functioning sluice gates with

a total of 18 retention ponds, 5 retention ponds do not have functioning sluice gates, there are 20 retention ponds that do not have sluice gates. The condition of the water flow in the retention ponds is 21 retention ponds, one retention pond's water flow is not functioning, there are four flowing water ponds in the retention pond which contain lots of rubbish. The water flow in the retention ponds where there are lots of water hyacinths, there are 10 retention ponds, and dry retention ponds and a lot of sedimentation as many as 7 retention ponds. The retention pond has a depth from the water surface in the range of 40 – 120 cm with a total of 32 retention ponds, the depth of the retention pond is in the range of 121 – 200 cm with a total of 10 retention ponds, one retention pond with a retention pond depth above the water surface > 281 cm. There are 16 retention ponds with a height of 110 – 200 cm, 26 retention ponds with a height of 201 – 300 cm, and one retention pond with a height of > 400 cm. The condition of the retention ponds when the flood was full, 24 retention ponds were full, 16 retention ponds were not full, and 3 retention ponds were unknown .

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