Evaluation Urban Utility Of Water System In Merauke City

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Abstract In the existing utility services in the Merauke district in the form of clean water sanitation, optimally take place notes. The Lack of Management, Service and Maintenance of Government Affected Municipal Utilities in Merauke. Not to the optimal creation of utility Merauke City is also a problem of clean water utility grid systems in the town of Merauke. On rainy season in Merauke city residents rely on rainwater as a source of clean water. If the dry season is often difficult to get clean water. This study evaluates pre-existing conditions, then analyze and make plan water networks. It aims to improve the conditions and quality of service provision of clean water for city dwellers. The results of this study (1) Networks clean water, has not been even distributed and not yet implemented the maximum care. (2) Before the clean water distribution lines, maintenance on the water network pipes and water filtration devices that are eligible for immediate drinking. (3) Before the location of water sources, water treatment plans, reservoir and pipeline supply networks (see Figure 10), which occur in the even distribution of the optimal distribution.

1. Introduction

The main living needs of living things are water. In urban conditions, water needs are managed by the local government. The need for clean water is managed in an urban water network system. Water network is a requirement that utilities should be planned for the service needs of the community to the fullest.

The utility is part of the infrastructure of a region, the facilities and utilities. According Grig in Kodoatie; 2003, the infrastructure is a physical system that is one of them is required to meet human needs both socially and economically. One important aspect of life is clean network channels

In the existing utility services in the Merauke district in the form of clean water sanitation, optimally take place notes. The Lack of Management, Service and Maintenance of Government Affected Municipal Utilities in Merauke. Not to the optimal creation of utility Merauke City is also a problem of clean water utility grid systems in the town of Merauke. Plus the town of Merauke is a muddy area, this means that most cities are not clean water sources are produced by land. On rainy musih Merauke city residents rely on rainwater as a source of clean water. If the dry season is often difficult to get clean water. Water network planning aims to improve the conditions and quality of service provision of clean water for urban dwellers.
2. Literature review

2.1. Clean water supply

Water supply system must comply with the regulation number 416 health minister / health / press / ix / 1990 dated September 3, 1990 [2]. The system takes into every building and supporting equipment that serves to deliver water from the water source to its customers [2].

The raw water is water that comes from a source of water that can be used as a water supply system for the production of clean water. The transmission system of pipe carrying water from the water source unit to deliver water from the processing unit to the main distribution unit or reservoir. Reservoir is a place to store water temporarily before being distributed to customers or consumers. The distribution system is used to distribute clean water.

From the reservoir to the customer or consumer. Home Connection (SR) is a type of customer connection of water supply drinking water directly to homes. General Faucet (KU) is a type of connection that supplies water through a valve fitted in a particular place. Public Hydrant (HU) is a common faucet that uses a temporary water tank and is used by the general public in the vicinity of public hydrants. Based on the decision of the Minister of State for Population and the Environment No. KEP-02 / MENKLH / 1/1988, on the Guidelines for Determination of Environmental Quality Standards. Good water quality is below:

| No | Class | Information |
|----|-------|-------------|
| 1  | A     | Water can be used as drinking water directly without prior processing |
| 2  | B     | Water can be used as Raw water to be processed for drinking and household use |
| 3  | C     | Water can be used for the purposes of fisheries and livestock |
| 4  | D     | Water can be used for agricultural purposes and can be used for urban businesses, industry, hydropower |

Drinking water quality requirements as follows:

- Physical Requirements: room temperature between 10-25 degrees Celsius, colorless, tasteless, odorless, can not contain S102 25 mg / l
- Terms of chemicals: 02 aggressive can cause rust and corrosion, H2S cause decay, NH4 organic substances should avoided, Cl less than 150 mg / l, when more taste awful, SO4 less than 250 mg / l, when more can damage the concrete, Fe less than 0.2 mg / l, when it is more unhealthy, the maximum lead content of 0.05 mg / l, Cu content of maximum of 3 mg / l, pH between 6.5 -9.0, Iodine approximately 60 mg / l, F1 between 1-1.5 mg / l
- The biological requirements: The water should not contain bacteria and other biota disease, can be checked by means.
- Terms radioactive: Drinking water does not contain radioactive elements.

2.2. Water Treatment

The components to neutralize the water condition physically, chemically and biologically. Treatment (processing) of this water has four stages:

- Filtration of solid materials: This phase, filtering the water flow toward subsequent mechanical treatment
- Mud settling: There are two types of suspensions and solutions. The solution can be physically separated mechanically separated, sludge is colloidal should be done coagulation (deposited). PH coagulation must be greater than 5.8.
- The addition of air: done by forced-air (aeration), for example with the windmill or system blowing air bubbles into the water, to increase water oxygen conditions.
- Siltation: This stage is the rest of the sludge (sludge) deposited by using, Aluminum sulfate (alum) and Cretaceous.
- Desinfektansi process: a process for eliminating pests / bacteria in the water by using chlorine or chlorite

2.3. Distribution Network Engineering and Planning Services Unit Water Supply System

On Procedures for Distribution Network Engineering and Planning Services Unit Water Supply System stipulated in ISO 7509: 2011 The layout and the type of distribution system: a distribution system based on the topography of the area and the location of the water treatment plant; the type of distribution system based on topography and population distribution in its service area; gravity and pump-type system, if it can not be applied topography.

Reservoir, placement is: below ground level; partially or entirely above ground level; above the ground with a buffer. Reservoir section is equipped with: piping: incoming water pipe / inlet pipe, water pipe exit / outlet pipe, pelup pipes, drain pipes, air pipes. Inspection hole to control or entrance into the reservoir; ladder to climb up to the tower reservoir and stairs to get into the reservoir; a pointing device in water level in the reservoir; water discharge gauge mounted on a pipe water out of the reservoir.

The location and height of the reservoir: Reservoir balancer is built close to the water treatment plant; service reservoir placed as close to the center of the service area, the height of the reservoir on the gravity system adapted to the conditions or requirements; zoning of the service area served by each one reservoir. Pumping systems, transmission pump discharge water into the reservoir is determined by the maximum discharge day.

Table 2. Number and discharge pump drinking water transmission system

| Debit (m³/day)       | Total Pump | Units |
|----------------------|------------|-------|
| until 2800           | 1 + 1 (backup) | 2     |
| 2,500 to 10,000      | 2 + 1 (backup) | 3     |
| More than 90,000     | 3 or +1 (backup drinking) | 4 or more |

Based on the needs of a water consumption in one day determined distribution pump discharge. The pump must be a discharge pump. The installation of booster pumps needed to raise the pressure based on technical considerations as follows: the rest of the press; topography;

Booster pump station location must be met: soil surface elevation pump station; located above to anticipate flood with a return period of 50 years; easy termed. Transmission pipeline: pipeline as short as possible; avoid the path that construction is difficult and expensive; a minimum of 5 m above the pipe; avoid the elevation difference is too large (80% of the working pressure of the pipe).

Determination of maximum discharge flow; the pipeline loss of pressure is not more than 30% of the total static head on the transmission system by pumping. For gravity systems, a maximum pressure pressure of 5 m / 1000 m or 80% of the technical specifications of the pipe. Specifications of PVC pipe must be in accordance with the SNI 03-0084-2002; the specification for PE pipe shall be in accordance with the SNI 06-4829-2005; steel pipe specifications must be in accordance with the SNI 07-2225-1991; Planning lay-out pipelines is determined by considering: situation of road network in its service area; roads that are not suitable to connect each branch system. The streets are interconnected to form a circular or closed lanes, suitable for a closed system, except when the population density is low. Low population density has a branch-shaped pipe lay-out. Topography and the natural limits of its service area; Land use its service area;

The pipe length service is limited by the maximum pressure, which is amounted to 3.5 m with details as follows: loss of pressure or feeder services D. 100 mm at 1 m; loss of pressure or feeder services D. 75 mm at 1 m; loss of service pipeline pressure of 1 m; the pressure loss fittings and plumbing tools of 0.5 m so that the total pressure loss allowed is 3.5 m. Pipe length of service (service) area bound by the ministry within one cell, the basic / elementary zone.
3. Research methodology
The research phase is composed of things as follows: Study Library, collecting and studying the theories relating to the title of the study. Data collection: Data collection phase conducted to obtain data with field work. This research was conducted in the town of Merauke. Observation of the water system in the district of Merauke using the primary survey. The primary survey is carried out by conducting a survey of Field to direct. At the time of the primary survey, carried out taking photographs depicting the factual conditions.

4. Results and Discussion
4.1. Merauke Clean Water Source
Provision of clean water systems in the area of Merauke District comes from taps and water pumps. Pipe network of water distribution system includes pipe Merauke District primary care. The pattern development pipeline is constructed to follow the pattern of the road network. Secondary pipelines with a diameter of 2.5 cm located at the side of the house and ended up in houses with a diameter of 2.5 cm.
Sources of drinking water by the graph above are mostly from rain water by 47%, then refill the water by 34% and water wells are protected by 29%, while for cooking most use of rainwater by 46%, then dug well water protected 31% and tap water from the taps of 25%.

4.1.1. Water Treatment Plant of Merauke
Source of raw water from the swamp taps take blue with a network of distribution pipes of 200 mm Giv pvc shrink to 150 mm, and a transmission pipeline 350 MM PVC pipe equipped with a reservoir building. In Merauke itself has 3 buildings reservoir housed in Muli road, highway and road Parakomando and Mandala street. Initially there WTP (Water Treatment Plant) located at Wasur and Muli Road, but now only one functionalized WTP located at Muli street.

![Figure 3. The pump house muli](image3)

![Figure 4. The tub water reservoirs](image4)

For WTP Merauke process using chemicals that alum, chlorine, and soda ash. But unfortunately until now the use of chemicals such as WTP PDAM not produce optimal water.
Figure 5. Filtration Muli

Figure 6. Transmission Pipeline Muli

Figure 7. Reservoir Muli

4.2. Scheme Merauke taps Pumping System

4.2.1. Pomp station swamp water blue:
Source of raw water from the Rawa Biru piped using PVC pipe with a length of 500 m (up in the reservoir collector in Water Pump Station Rawa Biru. The system of water flow from Lake Rawa Biru to Reservoir at Water Pump Station Swamp Blue, using a system Vessel relate where the first end of the pipe is located in the Blue Marsh Lake and the second end of the pipe is in the reservoir at the Blue
Swamp Water Pump station. (PVC). Capacity Reservoir in 4000 Liter Water Pump station No 2 unit.

Furthermore, water will be in Pumping using centrifugal pump with the following classifications:

- Pump No. 1: The capacity of 40 liters / sec (with motor power 37 kw with a flow rate of 29 to 31 liters / sec) with the inlet pipe and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Pump No. 2: Capacity 40 liters / sec (with a motor power of 45 kw at a flow rate of 30 to 33 liters / sec) with a pipe inlet and outlet Gip $\varnothing 150 \text{ mm}$. $\varnothing 150 \text{ mm}$
- Pump No. 3: Capacity 40 liters / sec (with a 55 kw motor power with a flow rate of 33 to 36 liters / sec) with a pipe inlet and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Pump No. 4: Capacity 60 liters / sec (with a 75 kw motor power with a flow rate of 36 to 40 liters / sec) with a pipe inlet and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$

Then the transmission pipeline pipe PVC pipe, the water in the water pump station to Muli. With a total distance of 56 km. (From Station Rawa Biru up to Station Wasur within 42 km using PVC pipe).

Then the transmission pipeline pipe PVC pipe, the water in the water pump station to Muli. With a total distance of 56 km. (From Station Rawa Biru up to Station Wasur within 42 km using PVC pipe). And of Water Pump Station Wasur water piped to the Water Pump Station Muli is 16 km using PVC pipe and PVC pipe. (While the Water Pump Station in Wasur not Operate). Waters of the Rawa Biru Water Pump Station Sign in collector wells in Station Water Pump Muli $\varnothing 350 \text{ mm}$. $\varnothing 350 \text{ mm}$ $\varnothing 250 \text{ mm}$. $\varnothing 250 \text{ mm}$.

4.2.2. Water Pump Station Muli (Block I):

Source of raw water (shallow wells / production wells there are 19 fruit) which of the 19 wells is interconnected by using culverts and will enter the collector wells (one fruit with the capacity of 300).

Furthermore, water will be in Pumping using centrifugal pump with the following classifications:

- Pump No. 1: Capacity: 60 liters / sec (with motor power 45 kw, Head 40 m)) with the inlet pipe and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Pump No. 2: Capacity: 40 liters / sec (with motor power 45 kw Head 50 m) with a pipe inlet and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Pump No. 3: Capacity: 60 liters / sec (with motor power 45 kw Head 40 m) with a pipe inlet and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Pump No. 4: Capacity: 60 liters / sec (with motor power 45 kw Head 50) with a pipe inlet and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Pump No. 5: Capacity: 60 liters / sec (Pump Coupling with Diesel Engines) with the inlet pipe and outlet Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$

Then the pumping system is divided into two paths: Water in Pumping from lane to Parakomando Water Pump Station (Can use the pump No. 1, No. 3, No. 4 and No. 5)

- Pump of water in wells collector to Parakomando Water Pump Station, the flow of water passing through the PVC pipe with a length of 3 km. $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- (Referred to as a pump track directly to Parakomando Station. And the flow of water can circulate into WTP / IPA by opening a valve in the pipe connecting to Gip $\varnothing 150 \text{ mm}$. $\varnothing 150 \text{ mm}$
- Tapers to a pipe to pipe the water flows into the reservoir 3 units with 50, 13, 8 L / S $\varnothing 100 \text{ mm}$. $\varnothing 75 \text{ mm}$. $\varnothing 250 \text{ mm}$. $\varnothing 250 \text{ mm}$
- Water is already at capacity in the reservoir will pump using the pump capacity of 20 liters / sec to the outlet pipe $\varnothing 100 \text{ mm}$. $\varnothing 100 \text{ mm}$. $\varnothing 100 \text{ mm}$. $\varnothing 100 \text{ mm}$
- Tapers to a pipe to filter for purification and then piped to Gip pipe and PVC pipe for
- water pump station to Parakomando with a distance of 3 km. $\varnothing 75 \text{ mm}$. $\varnothing 100 \text{ mm}$. $\varnothing 250 \text{ mm}$. $\varnothing 250 \text{ mm}$

Water in pump from lane to Mandala Water Pump Station II (You can use the pump no. 1 and no. 2)

- Pump of water in wells collector to Mandala II Water Pump Station and direct distribution to the customer, the flow of water passing through the pipeline Gip $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$. $\varnothing 200 \text{ mm}$
- Tapers to the PVC pipe. $\varnothing 150 \text{ mm}$. $\varnothing 150 \text{ mm}$. $\varnothing 150 \text{ mm}$. $\varnothing 150 \text{ mm}$
• Water in Pump of Water Pump Station in Reservoir Muli entry in Station Mandala II, furthermore the pumping system is divided into two paths:
  • Water in Pump from lane to Parakomando Water Pump Station (Can use the pump 1, No. 3, No. 4 and No. 5)
  • Pump of water in wells collector to Parakomando Water Pump Station, the flow of water passing through the PVC pipe with a length of 3 km.
  • (Referred to as a pump track directly to Parakomando Station. And the flow of water can circulate into WTP / IPA by opening a valve in the pipe connecting to Gip
  • Tapers to a pipe to pipe the water flows into the resevoar 3 units with 50, 13, 8 L / S.
  • Water is already at capacity in the resevoar will pump using the pump capacity of 20 liters / sec to the outlet pipe
  • Tapers to a pipe to filter for purification and then piped to Gip pipe and PVC pipe for water pump station to Parakomando with a distance of 3 km.
  • Water in Pump from lane to Mandala Water Pump Station II (You can use the pump No. 1 and No. 2)
  • Pump of water in wells collector to Mandala II Water Pump Station and direct distribution to the customer, the flow of water passing through the pipeline Gip tapers to the PVC pipe.
  • Water in Pump of Water Pump Station in Reservoir Muli entry in Station Mandala II, then water in Pump to customers by using pump 20 liters / sec
  • water in Pump to customers by using pump 20 liters / sec

4.2.3. Water Pump Station Parakomando:
Water Pump Station in Reservoir Muli entry in Parakomando Water Pump Station. Furthermore, the water is in the reservoir at the pump using a pump capacity of 40 liters / sec Inlet and Outlet pipe through PVC pipe. Then the pumping system is divided into two paths: the path of water pumping directly / not pass water tower and pumping lines passing through the tower. For water distribution subscription service lines serve 4 Land:
  • Old Pipe Seringgu Strip (Block III)
  • Seringgu lane Pipe (Block IV)
  • Pipe Polder Old Paths (Block VI)
  • Polder lane Pipe (Block V)
  • For a water distribution services to the Customer every two days (every day twice jetting for morning and afternoon).

4.2.4. Water Pump Station Mandala II (Block II)
Water Pump Station Muli and water in Pumping of Water Pump Station Mandala I entered in the reservoir in Station Mandala II, then water in Pumping to customers by using pump 20 liters / sec and pump coupling with Diesel engines discharge 60 Lietr / sec (used interchangeably). PVC inlet pipe, the inlet pipe tapers Gip, enlarged outlet pipe to pipe Gip.

4.2.5. Mandala Water Pump Station I
Sources of water taken from shallow wells (there are as many as four shallow wells interconnected). Then Pumping System is divided into 2 lanes but alternately Operate:
  • Pumping system by using a pump capacity of 15 liters / second using Inlet pipe Gip. Gip and outlet pipes to PVC pipes up into the reservoir in mandala Station II. (Just to add water discharge).
  • Pumping system by using a pump capacity of 15 liters / second using Inlet pipe Gip. Gip and outlet pipes to PVC pipes up into the reservoir in owned PT. PELINDO.
Figure 8. Installing a water pump (WTP / IPA) multi station to station parakomando

Figure 8. The city water supply system

Figure 9. Map of city water service coverage

4.2.6. Map of Water System Services
Eksiting conditions network map services published by the department of public works Merauke district
4.2.7. Result of Map Water Plan System

From analysis published network map of public works needs to be revised with the addition of facilities or facilities such as reservoirs, water treament plan and also because of the addition of the ever increasing population must be prepared or planned for the raw water source other than blue bog.

5. Conclusion

Utilities are a wide range of supporting infrastructures are left in the city, one of which is the water network. After identification of the utility data in the study area, it can be concluded in general that the utility Merauke District:

- Water network, has not been evenly distributed and not yet implemented the maximum care.
- Need the addition of clean water distribution lines, maintenance on the water network pipes and filtration pelunya that clean water is feasible to directly drink.
- Need additional site raw water sources, water treatment plan, reservoir and pipeline supply network (see Figure 10) to the rest of the urban settlements, that occur in the even distribution of ooptimal.

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