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## Evaluation of Wastewater Management System Implementation in Tarakan City Selumit Beach Area

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### ABSTRACT

This research refers to Permen PUPR No 4/2017, in this research it begins with collecting data. Based on the results of the analysis carried out in this study, Relocating settlements that do not meet the river bank requirements in accordance with PERMEN PU No. 63 of 1993, Development of PANDORAL as a wastewater treatment unit, Procurement of sanitation infrastructure ranging from MCK to settlement wastewater distribution system with a small bored sewer system, establishment of a water management technical agency residential waste, counseling and training on community participation in the management of residential waste water on the sea cover, monitoring the quality of WWTP effluent and seawater covering the beach, expanding the scope of services, imposing sanctions on parties who violate regulations related to waste water management, increasing cooperation with local community and private institutions in the management of residential wastewater on the sea cover, monitoring and control on the quality of WWTP effluent and sea water on the beach cover as well as implementing the previous stages of strategies in other areas.

### 1. Introduction

One of the areas that has become a priority for wastewater treatment in Indonesia is the City of Tarakan. As a city that has quite rapid development dynamics, it has implications for an increase in population where the population growth rate for Tarakan City in the last five years has been 6.15 percent. The growth of new residential areas, the rapid growth of business and industry requires that the Regional Government of Tarakan City need to provide basic service facilities and infrastructure, especially access to adequate sanitation and waste water. Based on data from the Mayor's Decree, 2021 the city of Tarakan is classified as a heavy slum, with conditions in which the buildings are not organized, the waste management infrastructure is inappropriate and the waste management is inadequate.

One of the residential zones in Tarakan City which has a fairly high population density is the Selumit Pantai slum area. One of the sub-districts in the Central Tarakan District has a



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population of 16,347 people with an area of 0.48 square kilometers. The characteristics of the Selumit Pantai area are that most of the population lives above the seaside. This creates slums and becomes a priority for handling in terms of providing access to proper sanitation for the community.

[1] The waste water management policy in Indonesia is contained in the 2020-2024 National Medium Term Development Plan (RPJMN) with the aim of achieving adequate and safe access to sanitation (domestic wastewater) for 90 percent of households. This is also stated in the Sustainable Development Goals (SDGs). Efforts to manage wastewater are in line with the development goals and priorities of Tarakan City according to the 2018-2023 RPJMD. Evaluation of domestic wastewater management from WWTP areas in Selumit Pantai is expected to be input for optimizing regional WWTP management so as to produce better effluent quality according to Minister of Environment and Forestry Regulation Number: P.68 of 2016 concerning Domestic Wastewater Quality Standards.

Based on this background, the aim of this study is evaluation of implementation of the waste water management system in the Selumit area of the city Tarakan. Forecasting is one of the statistical methods that play an important role in decision making. Forecasting serves to estimate what will happen in the future based on past data.

## 2. Research Method

This research refers to Permen PUPR No 4/2017, in this research it begins with collecting data. Two data are needed for this research, namely primary data including road surveys, drainage channels, faecal disposal facilities, and rivers and secondary data including population data, RTRW maps, Groundwater Basin (CAT) maps, Geological maps, groundwater utilization control maps, and groundwater potential maps, Environmental Health Risk Assessment (EHRA) Study Reports, Domestic wastewater distribution master plans, Regional Medium Term Development Plans (RPJMD), and City Sanitation Strategies (SSK), and domestic wastewater distribution regulations. These data will be used for the parameters in selecting the type of Domestic Wastewater Management System in the Selumit Pantai Village, Tarakan Tengah District, Tarakan City.

This research was conducted in Selumit Pantai Village, Tarakan Tengah District, Tarakan City using screening methods. Screening is a selection process that includes parameters that must be met. Screening aims to select the type of Domestic Wastewater Management System to be planned. Screening for the selection of the type of Domestic Wastewater Management System is stipulated in Appendix I of PUPR Regulation No. 4/2017 concerning the implementation of the Domestic Wastewater Management System.

Data collection techniques used in this study are:

1. Library Studies, namely data collection from literature, papers, journals or the results of previous research and initial information from the local community about the location of the clean water to be studied.
2. Observation, namely data collection through direct observation and measurement of research objects both in the field and in the laboratory which includes:
  - a. Determination of Domestic Liquid WWTP location points
  - b. Conducting soil and rock observations, taking samples for Domestic Liquid WWTP analysis.
3. Laboratory analysis

Analysis of domestic liquid waste water at the Liquid Waste Laboratory of the Industrial Research and Development Agency, Samarinda Industrial Research and Standardization Center and analysis of Domestic Liquid WWTP.

Some data processing related to research was carried out by conducting laboratory analysis of liquid waste of the Industrial Research and Development Agency, Samarinda Industrial Research and Standardization Center and analysis of Domestic Liquid WWTP.

### **3. Description And Technical**

#### **A. Research Design**

The research design is made as a basic reference in conducting research. The research conducted on the analysis of Domestic Liquid WWTP is a combined qualitative and quantitative or semi-quantitative study, namely analyzing data from the field quantitatively and qualitatively as well as conducting descriptive data analysis and data interpretation to make a conclusion.

This research is deductive and inductive in nature, meaning that it is a development of the results of previous research as basic data, so that in carrying out planning and research the general conditions of the research area are described, including methods and locations for data collection and rock, soil and water samples.

#### **1. Research Stages**

The stages of research carried out in this study were literature study, data collection in the field, sample preparation, laboratory analysis, data processing and analysis and thesis writing.

##### **a) Literature Study**

This stage is the preliminary stage before carrying out research and data collection in the field, including study of research areas to find out an overview of domestic liquid waste.

This preliminary study also includes a literature study, namely to study the physical properties of water from each data directly in the field so as to facilitate research activities.

##### **b) Field data collection**

Sampling in the field by drilling groundwater to a depth of 40 meters, soil and rock material is put into a sample bag in the form of a handful or handful, then the samples are labeled according to the order of depth in centimeters or meters. Meanwhile, water samples are taken and then put into a water storage area that cannot be contaminated for analysis of water samples in the laboratory and water samples for analysis and description of the characteristics of liquid waste.

##### **c) Sample preparation**

Liquid waste samples from the field will be analyzed at the Liquid Waste Laboratory of the Industrial Research and Development Agency, Samarinda Industrial Research and Standardization Center and analysis of Domestic Liquid Wastewater Treatment Plant.

##### **d) Laboratory Analysis**

The laboratory analysis carried out included the liquid waste laboratory, the Industrial Research and Development Agency Laboratory, the Samarinda Industrial Research and Standardization Center, as well as Domestic Liquid Wastewater Treatment Plant analysis for samples of liquid waste taken from the research location.

##### **e) Data Processing**

The overall results from the phases of the Liquid Waste Laboratory, Industrial Research and Development Agency, Samarinda Industrial Research and Standardization Center, as well as Domestic Liquid WWTP analysis are comprehensively analyzed to recommend clean water at the research location whether it meets the requirements in terms of quantity and quality aspects in the framework of Domestic Liquid WWTP analysis. . The overall results of the research are set forth in the form of a report accompanied by maps, tables, drawings and the results of laboratory analysis.

##### **f) Data Presentation**

The data presentation stage is the final stage of the whole series of research activities. At this stage the dissertation that has been prepared in the form of a report is presented in the form of a results seminar exam.

### **4. Results And Discussion**

The characteristics of slum settlements are housing conditions with high density and

relatively small housing unit sizes, roofs in slum areas are usually made of the same material as the walls. The most prominent characteristic of slum settlements is the quality of the houses that are not permanent, with a high and irregular building density, very limited road infrastructure, if any, in the form of narrow winding alleys, the absence of drainage channels and garbage collection places looks dirty. Slum settlements can be seen based on their physical, social and economic conditions and it is certain that their physical conditions are not in accordance with livable housing standards and unsupportive socio-economic conditions. From the physical conditions it can be seen how the quality of the buildings, the density of buildings, and the condition of settlement facilities and infrastructure.

The Settlement Sanitation Development Acceleration Program (PPSP) is a program initiated by several ministries with the aim of accelerating the performance of Indonesia's sanitation development. This program is intended to facilitate district/city governments in formulating strategic plans for sanitation development in their areas. Sanitation is all efforts made to ensure the realization of conditions that meet health requirements through sanitation development. The Indonesian government, in the context of achieving sanitation development, has set a target for drinking water and sanitation services to reach 100% by the end of 2019. This target, known as Universal Access, has been officially mandated through the Medium Long Term Plan (RPJMN) 2015 – 2019. In 2019 the government has issued strategic directions and policies contained in the 2020-2024 RPJMN for priority 1 programs, namely basic service infrastructure with priority 3 policies which read "Proper and Safe Drinking Water and Sanitation Provision" and for priority 3 programs namely urban infrastructure with priority 5 policies which read "Provision of Adequate and Safe Access to Drinking Water and Sanitation (Wastewater and Garbage) in Cities". The City Government of Tarakan in an effort to achieve the target of Universal Access for 100% Sanitation services has attempted to intervene through various program activities contained in the Tarakan City Sanitation Strategy (SSK) 2015-2019.

However, this does not necessarily increase the achievement significantly in accordance with the desired expectations. Results of the Triangulation Analysis of Wastewater Management in Selumit Beach Settlements City of Tarakan, Province of North Kalimantan.

### **1. Standards for Settlement Wastewater Management on Sea Coverings of Beaches**

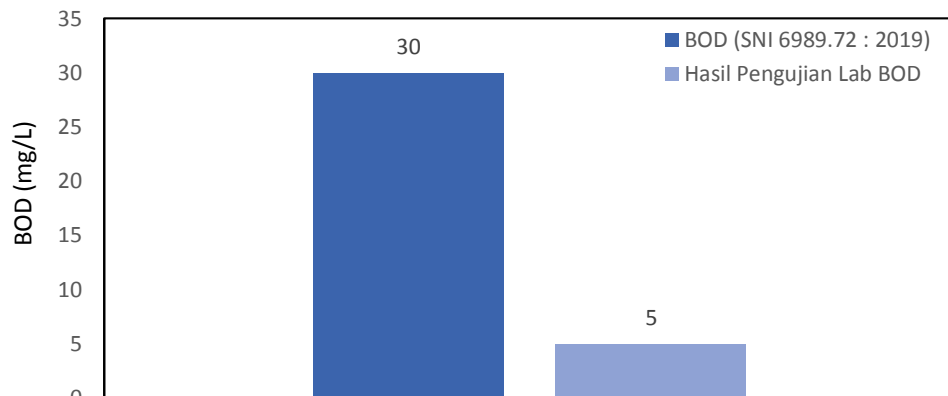
- a. Control of environmental pollution of settlements over the sea covering the coast
  - b. Fulfillment of infrastructure for waste water facilities for settlements over the sea covering the coast
- 
- a. Achievement of the MDG's target, namely the provision of sanitation facilities for at least 50% of the population in 2023
  - b. Improving the water quality of settlements over the sea covering the coast
  - c. Increasing community participation
- 
- a. Increasing the participation of the private sector and local community institutions in the management of wastewater from settlements over the sea cover of the coast
  - b. Improving the water quality of settlements over the sea covering the coast
  - c. Improving river water quality in other areas

#### Analysis of IPAL Implementation on Final Waste Results

##### 1. BOD

The results of the Biological Oxygen Demand (BOD) parameter test from the WWTP can be seen in Figure 4.3. Where the BOD value can be presented based on SNI 6989.72: 2019, showing that the standard BOD value is 30 mg/L. The BOD concentration obtained from the wastewater treatment plant in Tarakan City is 5 mg/L.

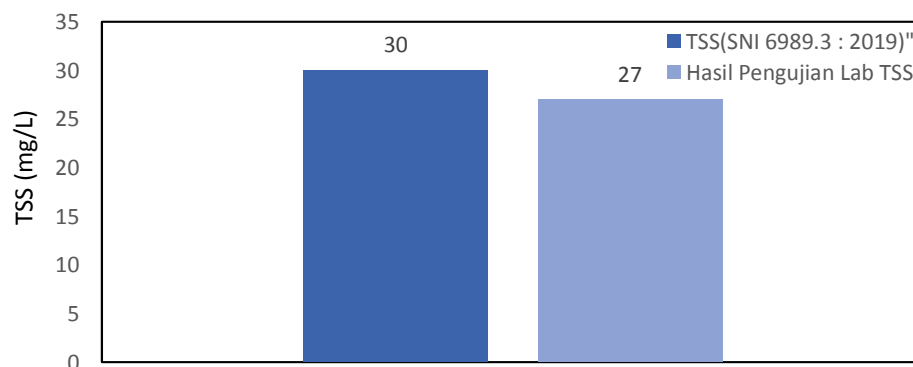
From these results it can be seen that the Tarakan city IPAL can reduce the BOD value by 83.333% of the determined SNI standard. Tarakan City IPAL BOD concentration SNI 6989.72: 2009 is still below existing standards, this proves that the efficiency of the IPAL is running well.



**Figure 1. BOD Test Results**

## 2. TSS

High levels of Total Suspended Solids (TSS) can cause turbidity in waste water. The results of the Total Suspended Solids (TSS) parameter test from WWTP can be seen in Figure 4.4. Where the TSS value can be presented based on SNI 6989.3: 2019, showing that the standard TSS value is 30 mg/L. The TSS concentration obtained from the wastewater treatment plant in Tarakan City was 27 mg/L. From these results it can be seen that the Tarakan city IPAL can reduce the TSS value by 10.00% of the determined SNI standard. The TSS concentration of the Tarakan City IPAL SNI 6989.3: 2019 is still below the existing standards, this proves that the efficiency of the IPAL in waste management is running well.

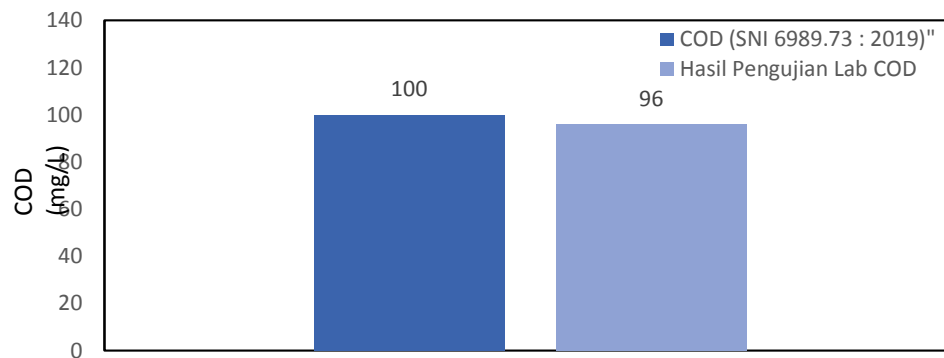


**Figure 2. TSS Test Results**

## 3. COD

The results of the Chemical Oxygen Demand (COD) parameter test from the WWTP can be seen in Figure 4.4. Where the TSS value based on SNI 6989.73: 2019 can be presented shows that the standard COD value is 100 mg/L. The COD concentration obtained from the wastewater treatment plant in Tarakan City was 96 mg/L. From these results it can be seen that the Tarakan city IPAL can reduce the COD value by 4.00% of the determined SNI standard. The COD concentration of the Tarakan City IPAL SNI 6989.73: 2019 is still below existing standards, this proves that the

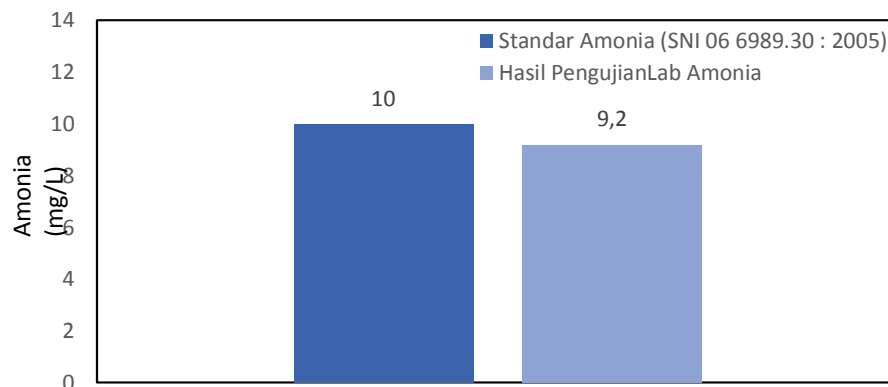
efficiency of the IPAL in waste management is running well. COD concentrations can be reduced by adding microorganisms to the AFB tank.



**Figure 3.** COD Test Results

#### 4. Ammonia

Figure 4.12 below is a comparison graph between the test results for ammonia parameters and the SNI specifications for ammonia. Where the Ammonia value can be presented based on SNI 06 6989.73: 2019 shows that the standard ammonia value is 10 mg/L. The COD concentration obtained from the wastewater treatment plant in Tarakan City was 9.2 mg/L. From these results it can be seen that the Tarakan city IPAL can reduce the ammonia value by 8.00% of the determined SNI standard. The ammonia concentration of the Tarakan City WWTP SNI 6989.73: 2019 is still below existing standards, this proves that the efficiency of the WWTP in waste management is running well.

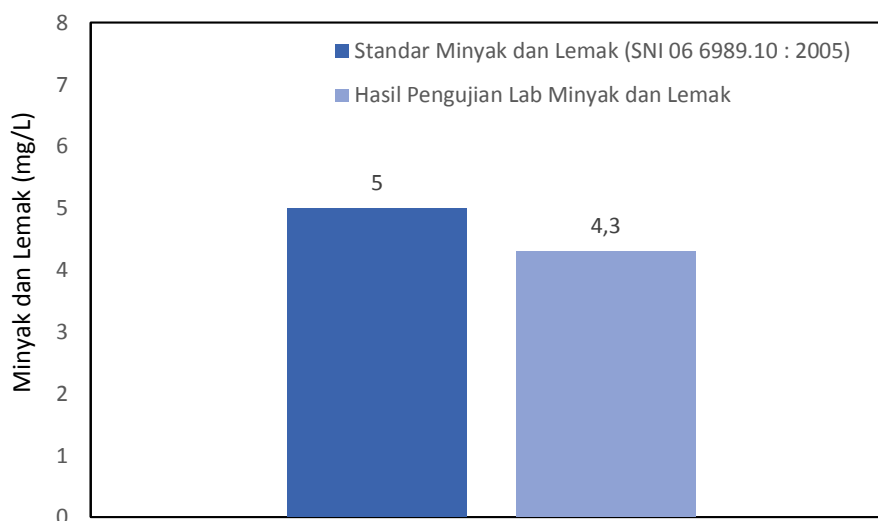


**Figure 4.** Ammonia Test Results

#### 5. Oils and Fats

Figure 4.12 below is a comparison graph between the test results for oil and fat parameters and the SNI specifications for oil and fat. Where the value of oil and fat based on SNI 06 6989.73: 2019 can be presented, it shows that the standard value of oil and fat is 5 mg/L. The concentration of oil and fat obtained from wastewater treatment plant in Tarakan City is 4.3 mg/L. From these results it can be seen that the Tarakan city IPAL can reduce the value of oil and fat by 14.00% of the specified SNI standards. The oil and fat concentration of the Tarakan City WWTP SNI 6989.73:

2019 is still below existing standards, this proves that the efficiency of the WWTP in waste management is running well.



**Figure 5. Oils and Fats Test Results**

6. pH / degree of acidity

After the waste water is in the WWTP, laboratory analysis is carried out. It can be seen that the pH value of the wastewater after going through the WWTP resulted in a pH test parameter of 7.79, where this figure meets the pH standard issued by the Indonesian National Standardization Agency. Where the pH standard issued by SNI is at pH 6 – 9. From these results, the pH parameters have met the domestic wastewater quality standards. If the pH exceeds the quality standard, it means that the pH is alkaline and preferably if the pH is low, it is acidic. Wastewater that is acidic or alkaline is difficult to process using a biological system or using microorganisms, because it can disrupt the performance of the microbes.

**2. Strategic Implementation of Settlement Upper Sea Settlement Wastewater Management**

Communities no longer dispose of their waste water directly into the sea without treatment

- a. Increased use of sanitation facilities
- b. Construction of an WWTP equipped with a small bored sewer
- c. Willingness of the community to contribute to the management of wastewater from settlements over the sea covering the coast

- a. Investment for the construction of settlement wastewater infrastructure by the private sector
- b. Increasing the use of residential waste water infrastructure over the sea covering the coast
- c. Increasing the use of residential waste water infrastructure over the sea covering the coast

**3. Residential Wastewater Treatment Regulations**

RI Law No. 23 of 1997 concerning Environmental Management.

Minister of Public Works Regulation No. 63 of 1993 concerning River Boundary Lines, River Benefit Areas, River Control Areas and Former Rivers.

- a. Policies and guidelines for the implementation of residential wastewater management that prioritizes the economically weak community.

- b. Dissemination of regulations, policies and programs related to settlement wastewater management.
- c. Develop policies related to community participation in the provision of infrastructure for settlement wastewater management facilities.

#### **4. Evaluation of Sea Settlement Wastewater Management on Selumit Beach**

- a. Relocating settlements that do not meet river bank requirements in accordance with PERMEN PU No 63 of 1993
  - b. Development of PANDORAL as a waste water treatment unit
  - c. Procurement of sanitation facilities ranging from MCK to residential wastewater distribution systems with a small bored sewer system
- 
- a. Formation of a technical agency for managing residential wastewater
  - a. Counseling and training on community participation in the management of coastal wastewater
  - b. Monitoring the quality of WWTP effluent and sea water covering the coast
  - b. Expansion of service coverage
  - c. Imposition of sanctions for parties who violate regulations related to waste water management
- 
- a. Collaboration with local community and private institutions in the management of wastewater from settlements over seas covering the coast
  - b. Monitoring and control of WWTP effluent quality and coastal seawater
  - c. Implementation of the previous stages of strategies in other areas

The regional government has developed a development strategy so that it can be used as a regional development priority for the next five years. The development strategy in the 2019-2024 Tarakan City RPJMD includes:

1. Improving the Quality of Public Health Services;
2. Improving the Quality of Education for the Community Equally;
3. Community Microeconomic Empowerment;
4. Bureaucratic Reform and Administration of Governance;
5. Increasing Green Open Spaces;
6. Fulfillment of Community Clean Water;
7. Increasing Regional Interconnection;
8. Development of Urban Transportation Systems;
9. Settlement Development and Slum Area Rehabilitation;
10. Improving the Quality of Life of the Poor;
11. Increasing the Quality of Resources and Absorption of Local Manpower;
12. Strengthening the Leading Potential of the Local Economy;
13. Maintain Price Stability and Distribution of Goods;
14. Prevention and Control of Environmental Damage;
15. Reducing Disaster Risks;
16. Strengthening the conduciveness of regional security and order;

Policy direction is a planning instrument that provides guidance to local governments so that they are more focused in determining and achieving development goals and objectives. The direction of regional medium-term development policies is a guideline for determining the stages and priorities of the five-year development in order to achieve the RPJMD targets in stages. The stages and priorities set reflect the urgency of the problems and strategic issues to be resolved but are still aligned with the timing. The priority emphasis on each stage varies



but has continuity from one period to another in order to achieve the five-year target of the stages in the RPJMD.

## **5. Conclusions And Sugesstion**

### **5.1 Conclusions**

From the results of the analysis and discussion of the research, it can be concluded that the following matters:

From the results of the analysis and discussion of the research, it can be concluded that the following matters:

1. By looking at the condition of the Tarakan City Beach Cover Area, it can be concluded that the residential condition of the Tarakan City Beach Blanket Area is classified as a mild slum condition, and the results of testing liquid waste from the WWTP settlement of the Tarakan City Beach Blanket Area which includes BOD, TSS, COD, Ammonia, Oils and Fats as well as pH, all of which are still below the standards set by the Minister of Environment and Forestry No. P.68 of 2016 concerning Domestic Wastewater Quality Standards and the reduction from standard SNI specifications ranges from 4.00% - 83.333%.
2. The WWTP operational system is functioning properly, by looking at the results of testing for BOD, TSS, COD, Ammonia, Oil and Grease and the tested pH, where the decrease ranges from 4.00% - 83.333, it is better to improve the quality of WWTP management so that all the results of WWTP waste management can achieve even higher conditions, such as adding microorganisms in the tank, so that the COD levels in the waste can drop even more. Also, further analysis is needed regarding the volume capacity of the WWTP given that the population continues to increase from year to year.
3. Recommended to the Tarakan City Government to draw up and implement Regional Policies/Regulations on household wastewater management, as well as to form a Technical Implementation Unit (UPT) under the Service which has the task and function of managing domestic wastewater so that all wastewater facilities and infrastructure are built someone is responsible for operations and maintenance.

### **5.2 Suggestion**

1. In the operation of this wastewater treatment plant, it is necessary to establish an organization at the sub-district level or an officer in charge of maintaining this system.
2. The need for further research on testing the quality of domestic wastewater at the inlet and outlet of the WWTP in the Blanket Area of?? The Coastal Area of?? Tarakan City every day for a week in order to find out what is the average value of the concentration of each parameter of the domestic wastewater test.
3. The need to increase public awareness of the importance of waste water management and clean and healthy living behavior.

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