THE DOMESTIC WASTEWATER MANAGEMENT IN INDONESIA

Current Situation And Future Development

Tokyo, November 21, 2017

Ir. NUSA IDAMAN SAID, M.Eng.
Senior Researcher
Center of Technology for the Environment
Agency for the Assessment and Application of Technology (BPPT)
Contents:

1. INTRODUCTION
2. CURRENT SITUATION
3. FUTURE DEVELOPMENTS
4. CONCLUSIONS
Indonesian Population

Based on data from the Minister of Home Affairs Republic of Indonesia, the number of Indonesian population is 257,912,349 people.

The growth rate of Indonesia's population is around 1.49 percent.

(Based on data of June 30, 2016)

Indonesia consists of 34 provinces. Currently, there are 416 districts in Indonesia. The number of cities in Indonesia is 98 cities. The total districts and cities in Indonesia are 514 districts and cities.
Indonesian Population

Percentage of Indonesia Population by Island
Source: BPS, 2015
Environmental Issues in Indonesia

**Water Pollution**

- 75.25% Heavy polluted
- 22.52% Moderate polluted
- 1.73% Slightly Polluted
- 0.49% Meet the Standard

**Highly Polluted River**

River Water Quality Monitoring In 2013
(411 Sampling Points)
Source: Ministry of the Environment and Forestry, 2015

- 54.69% Heavy polluted
- 19.33% Moderate polluted
- 15.54% Slightly Polluted
- 7.24% Meet the Standard
- 1.34% Other
- 1.56% Other

**Pollution Sources in 5 River basin**
(Musi, Citarum, Ciliwung, Brantas, Barito)

Source: Ministry of the Environment and Forestry, 2015
Due to the low service of wastewater treatment, especially domestic waste water, has caused severe river water pollution, especially in Java.
BOD Concentration Of Ciliwung River 2014

BOD Concentration of Ciliwung, 2014

<table>
<thead>
<tr>
<th>Location</th>
<th>Feb</th>
<th>Mei</th>
<th>Jun</th>
<th>Sep</th>
<th>Okt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kelapa Dua / Srengseng Sawah</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake PAM / Kampung Gedong</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kampung Melayu / Jemb. Kalibata</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sebelum Pintu Air Manggarai</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. Halimun</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. KH. Mas Mansyur / Karet Tengsin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. Gudang PLN / Kebon Melati</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jemb. Pantai Indah Kapuk / Muara Angke</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. Kwitang</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. Gajah Mada Tangki</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. Ancol Marina</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jl. Raya Pluit / Penjaringan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pompa Pluit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

mg/liter
BOD Concentration Of Citarum River 2014
National Policy On The Management Of Domestic Wastewater In Indonesia

Domestic Wastewater

On-site sanitation

Individual Treatment

Septage Management

Intermediate solution
Sanimas
Community Sewerage System

Permanent solution:
Communal WWTP

Expansion of existing centralized system

Centralized system/City wide

new cities

Decentralized system

Community Based

Institutional Based
### Individual, Community and Institutional-based Sanitation Approaches

<table>
<thead>
<tr>
<th>Approach</th>
<th>Community Based</th>
<th>Institutional Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Neighborhood</td>
<td>City Wide</td>
</tr>
<tr>
<td></td>
<td>Adequate Sanitation: 1. Rural 2. Slum Area</td>
<td>Wastewater infrastructure services based on demand responsive approach</td>
</tr>
<tr>
<td></td>
<td>On-site Sanitation: Small Scale Community Sewerage System (SANIMAS)</td>
<td>Wastewater infrastructures development support inter cities/region coordination to protect watershed from human waste pollution</td>
</tr>
</tbody>
</table>

- **Metropolitan & Large Cities**
  - Off-site/sewerage system

- **Medium & Small Cities**
  - Integrated system of existing on-site and new off-site sanitation
  - Improved Setage Treatment Plant (IPLT) and sludge services
  - Shallow/small bore sewer or small scale sewerage integrated to municipal sewage system to support revitalization program for old cities

- **New Town**
  - Develop a small sewage system for Low Cost Housing Area
  - Encourage sewerage development for new town

Source: Indonesia Sanitation Report, 2014
DOMESTIC WASTEWATER MANAGEMENT IN INDONESIA

Sistem Setempat (On-Site)

Storage & Processing

TRANSPORTATION

FINAL PROCESSING

Sludge Treatment Plant

Sistem Terpusat (Off-Site)

MANHOLE

SR → JARINGAN PERPIPAAN AIR LIMBAH

Centralized

Settlement

regional scale

SR  JARINGAN PERPIPAAN AIR LIMBAH
CURRENT SITUATION
Current Situation

• For urban areas with high population densities implemented with a centralized system.

• At present the centralized wastewater management system is located in only 12 cities with low service coverage (Totally below 5%).

• To reduce quantities of worse sanitation in urban area, Indonesia government introduced the community-based sanitation (SANIMAS) program to improve urban-poor sanitation since 2001. The pilot project of SANIMAS (community-based sanitation) program was initiated by AusAID through WSP-EAP World Bank (Water and Sanitation Program – East Asia Pacific) and was supported by the government of Indonesia.

• Until now, SANIMAS has been implemented in all (27) provinces, and more than 300 locations.
## Centralized Wastewater Treatment Plant Of 12 cities in Indonesia

<table>
<thead>
<tr>
<th>Wastewater Treatment Plant</th>
<th>City</th>
<th>System</th>
<th>Total Capacity (m3/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulo Brayan</td>
<td>Medan</td>
<td>UASB (Upflow Anaerobic Sludge Blanket) + Aerated Lagoon</td>
<td>10,000</td>
</tr>
<tr>
<td>Ajibata</td>
<td>Prapat</td>
<td>Aerated Lagoon</td>
<td>2,000</td>
</tr>
<tr>
<td>Setiabudi</td>
<td>DKI Jakarta</td>
<td>Aerated Lagoon</td>
<td>60,480</td>
</tr>
<tr>
<td>Bojongsoang</td>
<td>Bandung</td>
<td>Anaerobic, Facultative &amp; Maturation Pond</td>
<td>243,000</td>
</tr>
<tr>
<td>Kesenden</td>
<td>Cirebon</td>
<td>Anaerobic, Facultative &amp; Maturation Pond</td>
<td>7,033</td>
</tr>
<tr>
<td>Ade Irma</td>
<td>Cirebon</td>
<td>Anaerobic, Facultative &amp; Maturation Pond</td>
<td>5,626</td>
</tr>
<tr>
<td>Gelatik</td>
<td>Cirebon</td>
<td>Anaerobic, Facultative &amp; Maturation Pond</td>
<td>3,944</td>
</tr>
<tr>
<td>Rinjani</td>
<td>Cirebon</td>
<td>Anaerobic, Facultative &amp; Maturation Pond</td>
<td>3,944</td>
</tr>
<tr>
<td>Sewon</td>
<td>Yogyakarta</td>
<td>Aerated Lagoon</td>
<td>15,500</td>
</tr>
<tr>
<td>Pucang Sawit</td>
<td>Surakarta</td>
<td>Aerob Facultative &amp; Biofilter</td>
<td>9,504</td>
</tr>
<tr>
<td>Suwung</td>
<td>Bali</td>
<td>Aerated Lagoon</td>
<td>51,000</td>
</tr>
<tr>
<td>Margasari</td>
<td>Balikpapan</td>
<td>Extended Aerating</td>
<td>800</td>
</tr>
<tr>
<td>HKSN</td>
<td>Banjarmasin</td>
<td>RBC</td>
<td>5,000</td>
</tr>
<tr>
<td>Pekapuran Raya</td>
<td>Banjar Masin</td>
<td>RBC</td>
<td>2,500</td>
</tr>
<tr>
<td>Lambung Mangkurat</td>
<td>Banjarmasin</td>
<td>RBC</td>
<td>1,000</td>
</tr>
<tr>
<td>Basirih</td>
<td>Banjarmasin</td>
<td>RBC</td>
<td>2,000</td>
</tr>
<tr>
<td>Tata Banua</td>
<td>Banjarmasin</td>
<td>RBC</td>
<td>2,000</td>
</tr>
<tr>
<td>Sungai Andai</td>
<td>Banjarmasin</td>
<td>RBC</td>
<td>3,000</td>
</tr>
<tr>
<td>Sultan Adam</td>
<td>Banjarmasin</td>
<td>RBC</td>
<td>2,000</td>
</tr>
<tr>
<td>Margasari</td>
<td>Balikpapan</td>
<td>Extended Aeration</td>
<td>800</td>
</tr>
<tr>
<td>Sukasari</td>
<td>Tangerang</td>
<td>Oxidation Ditch</td>
<td>2,700</td>
</tr>
<tr>
<td>Batam Center</td>
<td>Batam</td>
<td>Oxidation Ditch</td>
<td>2,852</td>
</tr>
<tr>
<td>Boulevard</td>
<td>Manado</td>
<td></td>
<td>2,000</td>
</tr>
</tbody>
</table>

Pulo Brayan Wastewater Plant - Medan

The plant using a combination of UASB process and aerated lagoon. After two screens, a coarse one and a fine one, the wastewater flows through a grit chamber. The fine screen and the grit chamber are equipped with automatic cleaners.

In an Upflow Anaerobic Sludge Blanket (UASB) reactor the wastewater is treated anaerobically. The UASB has no return system and also no pH adjustment system as usually designed. After the UASB the wastewater flows into a facultative lagoon. The lagoon is equipped with two aerators. The aerators are operated for only 4-5 hours each day to reduce energy cost. The effluent is discharged into river Kera. The effluent COD is in the range of 50 to 75mg/l and the BOD between 40 and 55mg/l.
PULO BRAYAN – MEDAN WASTEWATER TREATMENT PLANT

SCREW PUMPS

UASB REACTOR

AERATED LAGOON

EFFLUENT
BOD 40 – 55 mg/L

GRIT CHAMBER
Suwung WWTP - Denpasar

SUWUNG WASTE WATER PLANT – CAPACITY 51,000 M3/DAY
BANJARMASIN WWTP USING RBC SYSTEM
WWTP Margasari – Balikpapan
(Extended Aeration With Surface Aerator)

Capacity : 2000 m³/day
Examples:
On-site Sanitation: Small Scale Community Sewerage System (SANIMAS)

A total of approximately 1700 decentralized wastewater treatment systems (DEWATS) have been constructed until 2015.

This year, Sanimas will be built in 753 locations spread across various provinces in Indonesia.
Combined System Public Toilets And Simple Piping Equipped With Biodigester
Small Scale Community Sewerage System Using Anaerobic Baffle Reactor
Small Scale Community Sewerage System Using Anaerobic Biofilter

Communal WWTP (Sanimas) Ds. Tlekung, Batu City

Communal WWTP (Sanimas) Ds. Ploso, Jombang City

Communal WWTP (Sanimas) Ds. Tunggorono, Jombang City

Communal WWTP (Sanimas) Ds. Tlekung, Batu City
Business units such as hotels, office buildings, shopping centers, hospitals, industries and their businesses which have not been served by the sewerage network have to treat their own domestic wastewater.

Wastewater treatment technology that is widely used by business activities:

1. Activated Sludge Process
3. Rotating Biological Reactor (RBC)
4. Now, have started to use Membrane Bio Reactor (MBR) technology for domestic wastewater treatment.
APPLICATION OF ACTIVATED SLUDGE TECHNOLOGY FOR DOMESTIC WASTEWATER TREATMENT IN INDONESIA

Activated sludge process is widely used because its construction is relatively simple, but its operation requires operators with relatively high skill.

The failure of the activated sludge process in Jakarta is largely due to poor operation.

Active sludge process is widely used especially in high rise buildings and in industry.
WASTEWATER TREATMENT USING OXYDATION DITCH PROCESS
LOCATION: JABABEKA CAPACITY 18,000 M3 PER DAY

- PRIMARY SEDIMENTATION TANK
- OXYDATION DITCH
- FINAL SEDIMENTATION TANK
- RECYCLE SLUDGE
- TREATED WATER
APPLICATION OF ANAEROBIC-AEROBIC BIOFILTER TECHNOLOGY FOR DOMESTIC WASTE WATER TREATMENT IN INDONESIA

ANAEROBIC-AEROBIC BIOFILTER TECHNOLOGY

Biofilter as growth media of microbes

Type: Honeycomb, cross flow
Material: PVC sheet
Specific contact areas: 200-225 m²/m³
Size: 30 cm x 25 cm x 30 cm
Hole size: 3 cm x 3 cm
Weight: 30-35 kg/m³
Porosity: 0.98
Color: transparent or black
ADVANTAGES OF ANAEROBIC-AEROBIC BIOFILTER PROCESS:

• Easy Operation and maintenance.
• Sludge produced small/slightly.
• Can be used for wastewater treatment with low concentrations or high concentrations.
• Resistant to fluctuations in the amount of waste water and fluctuations in concentrations.
• Operating costs are relatively low.
INDIVIDUAL DOMESTIC WASTEWATER TREATMENT USING ANAEROBIC-AEROBIC BIOFILTER PROCESS

Current household waste water disposal system.

Household wastewater disposal system with anaerobic-aerobic biofilter system "On Site Treatment" system developed by BPPT
INDIVIDUAL DOMESTIC WASTEWATER TREATMENT UNITS

BIOFILTER UNTUK 10 ORANG

BLOWER UDARA

Unit: Cm
BIOFILTER FOR DOMESTIC WASTEWATER CAPACITY 8-10 PEOPLE
HOSPITAL WASTEWATER TREATMENT USING ANAEROBIC-AEROBIC BIOFILTER
CAPACITY 150 M3 PER DAY
Application of biofilter for the treatment of domestic wastewater at PT. Bogasari Flour Mills. Capacity 300 m³ per day.
DOMESTIC WASTEWATER TREATMENT USING ANAEROBIC-AEROBIC BIOFILTER
CAPACITY 100 M3 PER DAY
Application Of Anaerobic-Aerobic Biofilter and MBR For Domestic Wastewater Treatment
Application Of RBC For The Treatment Of Domestic Wastewater From Office or Commercial Building

The problem is that ammonia concentrations often do not meet the effluent standards of domestic wastewater.
FUTURE DEVELOPMENTS

With the issuance of the new domestic wastewater effluent quality standard, which is more stringent than the previous one, appropriate domestic wastewater treatment technology is required in order for the treated water to meet the wastewater quality standards.

Effluent Domestic Wastewater Quality Standard
The Regulation of Environment And Forestry Of The Republic Of Indonesia
Number: P.68/Menlhk/Setjen/Kum.1/8/2016

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Maximum Concentration*</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>-</td>
<td>6 - 9</td>
</tr>
<tr>
<td>BOD</td>
<td>mg/l</td>
<td>30</td>
</tr>
<tr>
<td>COD</td>
<td>mg/l</td>
<td>100</td>
</tr>
<tr>
<td>TSS</td>
<td>mg/l</td>
<td>30</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>mg/l</td>
<td>5</td>
</tr>
<tr>
<td>Ammonia</td>
<td>mg/l</td>
<td>10</td>
</tr>
<tr>
<td>Total Coliform</td>
<td>MPN/100 ml</td>
<td>3000</td>
</tr>
</tbody>
</table>

Note:
*) Apartment, lodging, dormitories, health services, restaurants, meeting halls, settlements, domestic wastewater from industry, WWTP of settlements, WWTP of urban area, ports, airports, railway stations, terminals etc.
The following are the strategies in improving domestic wastewater management in Indonesia:

- Increase the financial capacities for wastewater infrastructure developments, both on-site and off-site, and also recover treatment cost to insure services;

- Increase the societies contribution on developing housing effluent of domestic wastewater treatment system;

- Increase the work of wastewater treatment institution and separate function between regulator and operator;

- Increase the access to domestic wastewater services, both on-site and off-site, in urban and rural areas;

- Develop a regulation and apply treatments according to the enacted guidelines.
## Key Issues and Recommendations

<table>
<thead>
<tr>
<th>Issue</th>
<th>Recommendations to Address Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 percent of urban wastewater is currently treated</td>
<td>1. Conduct citywide sanitation planning through City Sanitation Strategy, focusing on the development of centralized systems in highly urbanized areas while ensuring that low income communities and eradication of open defecation are prioritized.</td>
</tr>
<tr>
<td></td>
<td>2. Continue Decentralized Wastewater Treatment Systems (DEWATS) program in locations where centralized systems are not viable, but with consideration of comparative costs, required effluent quality and O&amp;M constraints.</td>
</tr>
<tr>
<td></td>
<td>3. Focus future DEWATS approach on provision of decentralized systems with sewerage networks.</td>
</tr>
<tr>
<td></td>
<td>4. Expand coverage of centralized sewerage more rapidly through a staged approach initially using combined sewerage and interceptors before transitioning to separate systems.</td>
</tr>
<tr>
<td></td>
<td>5. Design treatment facilities and set effluent standards to take account of influent and receiving water quality.</td>
</tr>
</tbody>
</table>
### Issue

Huge investment is needed to implement current local government sanitation investment plans and for long term.

<table>
<thead>
<tr>
<th>Recommendations to Address Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Central government to develop guidelines for local government management of wastewater services focusing on service delivery to customers.</td>
</tr>
<tr>
<td>2. One Service Provider to have overall responsibility for wastewater infrastructure including centralized sewerage, DEWATS and septage management.</td>
</tr>
<tr>
<td>3. Regulatory arrangements to be developed for wastewater services, including tariff structures whereby consumer fees cover operating costs.</td>
</tr>
<tr>
<td>4. Professionalize the sector by developing additional training and licensing programs for specific skills areas.</td>
</tr>
<tr>
<td>5. Private sector to be encouraged to take on the role of Service Provider for all or part of a wastewater system.</td>
</tr>
</tbody>
</table>
CONCLUSIONS

- The number of centralized wastewater treatment plants in Indonesia is still very small.

- Domestic wastewater is the largest source of river water pollutions.

- By increasing both off site and on site systems, the degradation of raw water quality can be reduced.

- Appropriate domestic wastewater treatment technology is required in order for the treated water to meet the new wastewater quality standards.

- Community Participation is also very important to be concerned about.
THANK YOU

OTSKUARESAMADESHITA