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# Republic of Indonesia

## Septage Management Pilots and Capacity Building in Indonesia

Technical Assistance

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## Technical Assistance



## Synthesis Report

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### Abbreviations and Terms

AusAID	Australian Agency for International Development
<i>Bappenas</i>	National Development Planning Agency
BLUD	<i>Badan Layanan Umum Daerah</i> (Regional general services agency)
CS	Customer satisfaction
DFAT	Department of Foreign Affairs and Trade (Government of Australia)
<i>Dinas</i>	Department
DKP	<i>Dinas Kebersihan dan Pertamanan</i> (Cleaning Department)
IPLT	<i>Instalasi Pengolahan Lumpur Tinja</i> (Septage Treatment Facility)
IUWASH	Indonesia Urban Water Supply, Sanitation and Hygiene Program (USAID)
ICT	Information Communication Technology
IT	Information Technology
O&M	Operation and maintenance
OSS	On site sanitation
MPW	Ministry of Public Works
PDAM	<i>Perusahaan Daerah Air Minum</i> (Autonomous local water enterprise)
PDPAL	Autonomous local wastewater enterprise
<i>Perda</i>	Local government regulation or by-law
PU	<i>Pekerjaan Umum</i> (Public Works Department)
SKPD	<i>Satuan Kerja Pemerintah Daerah</i> (Local Government working unit)
TA	Technical assistance
TSU	Technical Service Unit
UPT(D)	<i>Unit Pelaksana Teknis Daerah</i> (Local Technical Service Unit - TSU)
WSP	World Bank - Water and Sanitation Program
WTP	Willingness to pay

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## Overview of Technical Assistance (P146114)

This report is a synthesis of the technical assistance (TA) and recommendations, carried out by the World Bank Water and Sanitation Program (WSP) since September 2014.

The recommendations have been developed through on-going consultations and meetings with the Directorate of Environmental Sanitation, Ministry of Public Works, Government of Indonesia. The TA has been carried out in close collaboration and partnership with USAID's Indonesia Urban Water, Sanitation and Hygiene project (IUWASH), who have been implementing similar work in different cities.

A number of other materials have been made available to the client and include:

- Guidelines for Design of Sludge Treatment Plants to support a ministerial decree, in English and translated into Indonesian.
- City reports for Balikpapan, Tabanan and Tegal on the social and on-site sanitation formative research for improving septage management and sludge treatment plant in English.
- Guidelines for conducting a sanitation census and standard operating procedures for on-demand emptying provided to the Ministry of Public Works. The Ministry has subsequently shared these guidelines with other cities.
- Individual City Reports on Regular Desludging - Institutional and Financial Aspects for Balikpapan and Tabanan.
- Report on the Role of The Private Sector in On-Demand and Regular Desludging.
- Tools for improving FSM developed and shared with government and other development partners including:
  - on-demand tracking procedures,
  - standard operating procedures for Tabanan sludge treatment plant,
  - assessment of mechanized sludge treatment systems, and
  - Information and Communications Technology applications for supporting an e-census of households and for monitoring emptying and discharge.
- Training materials for courses developed for national and local government officials and decision-makers.

## Structure of the Synthesis report

Chapter 1 is the Executive summary

Chapter 2 gives the background to sanitation in Indonesia and to fecal sludge management in particular

Chapter 3 provides an overview of the technical assistance approach

Chapter 4 gives details of the implementation of the technical assistance

Chapter 5 summarizes the lessons learned

Chapter 6 outlines the recommendations and next steps.

# 1 Executive Summary

## Context

The Government of Indonesia’s mid-term development plan for 2015-2019 sets a target of 100% access to improved sanitation by 2019. This includes increasing centralized and decentralized sewerage from the current 2% to 5%, and thereby recognizing that on-site sanitation and fecal sludge management (FSM) will remain the main approach to improving urban sanitation in the medium term. Previous technical assistance, together with other development partners, has helped change the governments’ paradigm for fecal sludge management from building sludge treatment plants to management of the wider fecal sludge service chain.<sup>1</sup> Additionally, the World Bank’s Urban Sanitation Review and the increasing use of Fecal Waste Flow Diagrams (SFDs) in Indonesian cities has highlighted that around 5% of fecal wastes are delivered to treatment, with the remaining 95% lost to the environment during containment, emptying and transport. The design and operation of sludge treatment plants is recognized as needing improvement, with the Ministry of Public Works finding that over 90% of 150 existing facilities are not operational.

To achieve the target of 100% improved sanitation, there is a national drive to improve fecal sludge management. This technical assistance recognizes that to achieve the goals it is necessary to support the development of national FSM policies, regulations and guidelines, while also improving capacity at the local level by supporting the implementation of improved FSM models in target cities.

## Technical assistance objective

The objective of the technical assistance (TA) was to provide government with tested advice on how to scale up improved septage management nationwide through <sup>2</sup>

- (i) improvement of septage management in three cities through the application of new management models (local level); and
- (ii) assistance to national government in training and capacity building and the formulation of policies and regulations to improve septage management at scale (national level).

The TA provided implementation support in three pilot cities (Balikpapan, Tabanan and Tegal) and two “support” cities (Bandung and Jakarta). With limited information on household and private sector activities and attitudes to FSM, an understanding of existing conditions through formative research was an important component. The research provided evidence of demand for and need to improve FSM, while informing the choices of national and local governments and development partners on appropriate approaches to improve FSM. Table 1 below outlines the TA outputs against the project concept note intermediate outcomes and indicators.

**Table 1 – Intermediate Outcome Indicators and Outputs**

Intermediate Outcome	Indicators	Outputs/Achievements
Local government’s fecal sludge management improved in pilot cities	1.1 Pilots in 3 cities demonstrate effective application of new FSM models and are locally sustained by mid-2015.	Ongoing FSM pilots in Balikpapan and Tabanan. The third city (Tegal) did not meet the criteria for progressing. The pilots have progressed slowly due to challenges described in this report. Partially achieved.
	1.2 Following the establishment of baseline indicators, pilot cities improve rate of collection and treatment by xx% by 2016.	In Balikpapan, private operators are now discharging at the treatment plant (100%) rather than onto land or indiscriminately (0%). In Tabanan the assessment of the treatment plant assured

<sup>1</sup> Development of Urban Septage Management Business Models in Indonesia, P130771

<sup>2</sup> Septage and fecal sludge are used interchangeably throughout the report.

Intermediate Outcome	Indicators	Outputs/Achievements
		the TSU that there was capacity to accept all private trucks. While monitoring emptying and discharge to treatment has commenced, political economy factors are affecting their accuracy, making it hard know by how much the rate of disposal has increased.
	1.3 Private sector involvement improved in one or more cities, and at least one demonstration of the reuse of treated septage by mid-2015	Private operators are in discussion with the public agencies in both cities and preparation of memorandum of understanding is underway. The private operators and the implementing agencies are motivated to improve formalization of private sector in regular emptying programs. Partially achieved.
Policy, strategy informed	2.1 National Government changes its funding allocations from sludge treatment plants to supporting improved fecal sludge management at city level by 2015.	The Ministry of Public Works (MPW) has new readiness criteria for cities to receive support for fecal sludge management, requiring cities to have a responsible institution. The new OBA program includes construction of improved on-site sanitation and sludge emptying trucks. Tabanan has received two new vacuum trucks and Balikpapan one. Achieved.
	2.2 National and local government formulate and issue new or improved fecal sludge regulations by mid-2015	WSP has provided tested advice, guidelines and draft regulations for sludge treatment plants; sanitation censuses; and standard operating procedures for on-demand emptying, which have been adopted at national and local level as revised regulations. Partially achieved.
	2.3 Tested models replicated and adapted if necessary and applied in at least three other cities by 2016.	Momentum for regular emptying pilots has increased, and national government is supporting pilots and planning to implement the models in a further 11 cities in 2016. National government and IUWASH recognize that the WSP model of improved on-demand emptying services is a necessary interim step to regular emptying, and they are now prioritizing developing this in partner cities. Not yet achieved.
	2.4 Development partners demonstrate a more holistic approach to urban sanitation by including projects in septage management by 2015.	In January 2016, the Asian Development Bank (ADB) presented a proposed strategy for development of sanitation. It referred extensively to WSP and IUWASH FSM TA and pilots, and included FSM in the proposed investment packages. Partially achieved.
	2.5 The World Bank position and references on fecal sludge management are informed by the TA	An urban sanitation investment program is in the pipeline for FY18 and will include sewerage, on-site sanitation and fecal sludge management. The experience and lessons learned from the TA pilots and the Global FSM ESW study will inform its development and preparation. Achieved.
Government capacity increased	3.1 Learning from previous TA and pilot cities shared with a nationwide audience at three or more major government-led events in 2013, 2014 and 2015	Presented at and supported MPW organized workshops: “Promoting innovation in urban sanitation” (February, 2015) “Introducing LLTT to cities” (August, 2015), “Sludge Treatment Plants” (November, 2015), and two workshops organized by ADB (February 2015 and January 2016), and a workshop for the National Water and Sanitation Working Group (March, 2015). Achieved.
	3.2 Government staff and/or	The National Development Planning Agency (Bappenas) and

Intermediate Outcome	Indicators	Outputs/Achievements
	government hired consultants are leading or presenting training materials and providing guidance by 2015.	the MPW have agreed that FSM is an inseparable part of sanitation management, and FSM is a vital component to achieve universal sanitation access by 2019. MPW has also moved the focus from investment in septage treatment plant to integrated fecal waste management to ensure the whole sanitation service chain is linked. MPW employed consultants trained in April 2016. Partially achieved.
	3.3 Updated and improved national training materials and training programs for septage management are embedded in MPW training curricula.	Contributed to a 2014 national training event in Bekasi and will support further training for facilitators and consultants on regular desludging and on sludge treatment plant design guidelines in April-May 2016. Partially achieved.

## Key Lessons Learned

### 1. The national drive to improve FSM is strong but there is a mismatch with local readiness.

- **The national government’s drive to improve FSM is strong, but official policies requiring cities to improve FSM are not yet in place**, which limits the ability of local agencies to convince mayors and city planning agencies to prioritize and invest. The transfer of national drive to a local level is made more difficult by the absence of direct line of communication and by multiple local agencies having responsibility for FSM.
- **New national initiatives are implemented quickly but with insufficient promotion and information, causing local stakeholders to be cautious.** The lack of clear policies, and the complexity of finance and FSM approaches, means local agencies are not participating due to uncertainty about criteria, finance and implementation. The **development of new guidelines and programs may be too rapid to include learning from field research and piloting.** Development partners need to work closely with government and provide ‘just-in-time’ updates to help shape these documents
- **Clarification of the institutional responsibilities for FSM takes time, and the lack of national guidance or precedent makes development slower and more uncertain.** Many cities need to clarify or change the agency responsible for FSM and this take time e.g. in Balikpapan it took 18 months to clarify the legal responsibilities. So this needs to be started well in advance of implementing a FSM program, but the availability of national guidance would mean cities were less cautious about making mistakes. National and provincial levels need to be up-to-date with changes at the city level so that the provision or transfer of assets is to the correct agency> for example to avoid situations such as when the national government provided trucks to the Balikpapan technical service unit (TSU) despite the responsibility for FSM having been transferred to the local water enterprise (PDAM).

### 2. Improving FSM requires increased capacity of local agencies

- **The approach taken for the improvement of FSM can be adapted to suit the local agency**, but the capacity or type of agency may need to change to move up the ladder of FSM improvements.<sup>3</sup> The ability to introduce and manage a regular emptying program is dependent on the agency’s human resources capacity, information technology and financial systems.

<sup>3</sup> See Figure 25

- **A designated local operator is needed to manage septage.** A well-functioning "healthy" PDAM with a large customer base can incorporate septage tariffs into water billing, finance pilot and promotion programs, manage mechanical sludge treatment plants and handle customer relations, which will all support regular emptying. For many TSUs, operating regular emptying and mechanized sludge treatment systems is more challenging, because they are dependent on local government budgets, and do not have a billing system. A TSU could partner with other agencies but will still require the human resources and skills for a large numbers of customers, mechanized treatment systems, and budgets for piloting and promotion of regular desludging.
  - **The capacity of local agencies needs to be increased to implement regular desludging programs or manage mechanized treatment plants.** More staff with higher level skills, experience and adequate training will be required.
- 3. Advocacy and buy-in of the highest level of local government is vital.**
- **Include the head of the Public Works Department and the city planning agency, and the mayor** in advocacy for improved FSM. Their involvement supports the timely approval of changes in responsibility, regulation(s) and budget.
  - **An active sanitation working group can be influential in obtaining support for improved FSM,** especially when the heads of agencies are involved, and it is led by local development planning agency. **Champions** can facilitate greater engagement with the mayor and the various agencies.
  - **Signed agreements support continuity through staff changes.** Obtaining written agreements on the approach, institutional responsibilities, and budget for improved FSM programs reduced delays when management staff changed. Involving the working group and advocacy immediately upon new staff appointment assisted in maintaining progress.
- 4. Formative research benefits advocacy, early action and the introduction of new approaches.**
- **The research findings that 72% of respondents were willing to join the regular emptying program and 46% were willing to pay** was influential in the local government's willingness to pilot regular emptying programs. The findings also encouraged to the Ministry of Public Works and development partners to continue developing the regular emptying approach.
  - **The research also provided evidence of the need to improve on-site sanitation,** which contributed to the new output-based aid sanitation program. For example, 55% of on-site sanitation systems in Balikpapan overflow into a river or drain and well over 50% have unsealed tank bases, and in all cities 30%-40% are single pits or tanks. Some technical solutions remain unsolved with options for high groundwater areas and options for improved manholes and tank access (over 40% of tanks are located under houses in Balikpapan and Tegal) still required.
  - **The assessment of regulations and institutional capacity identified gaps early on** and enabled an immediate start to the process of developing new regulations and clarifying responsibilities.
- 5. Improving on-demand emptying is an important first step.**
- **A parallel approach of improving on-demand emptying while developing regular emptying pilots** is an important interim step. With the slow development of regular emptying programs, there are clear benefits to improving on-demand operations, regulations, customer databases, record-keeping and capacity as preparation for regular emptying.
  - **The local political economy influences willingness to improve monitoring.** There is some hesitation towards fully transparent monitoring of emptying and discharge to sludge treatment plants. Understanding actual as well as official operations of current FSM, such as informal payments or use of government trucks for private operations, may increase understanding and help find win-win solutions.

## 6. Developing a regular emptying program is a step-by-step process that takes time

- **The development of regular emptying pilots requires each issue to be addressed as it arises.** Some lessons can be learned from other cities, but responsibilities, regulations, and the interpretation of regulations vary between cities. Approaches being piloted with different institutional arrangements are expected to prevent the need for ‘reinventing the wheel’.
- **A house-by-house sanitation census is vital to developing a regular emptying program,** but adequate information must be collected and recorded accurately in a customer database. Inaccurate data and inadequate promotion leads to delays and households refusing the emptying service. As private operators are only paid for emptying, when many houses could not be emptied in the pilot their motivation to participate decreased.
- **The use of information and communication technology (ICT) provides a way to encourage discharge at sludge treatment plants, monitor emptying and reduce private operators’ bills, particularly** when the sludge treatment plant is not manned full time or deliveries are high. However, some agencies, particularly local TSU and departments, may not have the necessary computer skills or equipment, and treatment plant sites may not have the necessary data network coverage.

## 7. Improving sludge treatment requires feedback between design, operation and monitoring.

- **Design needs to better consider operational requirements** including: access for safe operation and maintenance, modular design with parallel streams to better suit demand or allow for maintenance, and use of hydraulic pressure rather than pumps where possible.
- **Design and operation need improved monitoring** of sludge loading and characteristics to improve operation and performance. Because few treatment plants have a laboratory and on-site monitoring is almost non-existent, there is little feedback to optimize treatment.
- **Mechanized sludge treatment systems** have a need for improved operator skills, steady finance for operation, a supply chain for spare parts, and on-time monitoring. With few international examples of septage treatment plants for similar conditions, pilots with monitoring are needed to assess the suitability of different systems for Indonesian conditions.
- **Reuse of treated sludge is almost non-existent in policy, guidance and practice.** This may be due to the low volume collected and the inadequate treatment of sludge. As volumes of treated sludge increase and management of FSM moves to more profit driven utilities, there is more potential for developing guidelines and markets.

## 8. Financing regular emptying can be adapted to suit different institutions.

- **While regular emptying can be profitable, upfront funds are required** for pilots and to start implementation. The TSU in Tabanan and Makassar requested but did not receive a local budget for the pilots, which are on hold until the mid-year budget reallocation. By contrast, the utilities in Balikpapan and Solo were able to mobilize funds from the enterprise or partners.
- **The assumptions and estimates in the tariff model will need to be verified,** as only estimates of expenses and program assumptions have been used to calculate the monthly cost recovery tariff. The actual cost of program operations and finance for FSM need to be separated to better monitor expenses. The cities are investigating whether the tariff can be set in a lower level regulation to make updating easier.
- **Confidence in the agency providing the regular emptying service was a customer concern** from the household surveys. Enforced regulations are required and should be explained to households to reassure them that they will receive the service as well to provide a mechanism for reporting issues. Private operators rely on the TSU to pay invoices regularly for services performed, which should also be regulated.

## Key Recommendations

### Institutional Development

#### National government needs to provide policy and guidance to support cities developing FSM systems.

- An explicit policy requiring cities to improve FSM will provide wastewater agencies a tool to advocate institutional changes and support requests for budget from the mayor and local parliament.
- Provide guidance for drafting of FSM regulations, with examples, unambiguous wording, financing options and tariff collection mechanisms. Also include recommended types of local institution, human resources, financial systems for regular emptying, and prerequisites for advanced treatment systems.

#### Program promotion, clarity and quality of options, and city readiness need to be improved.

- Promotion needs to target the city planning heads, technical departments, sanitation working groups and mayors to advocate the implementation of FSM programs and willingness to provide funding.
- Inclusion of lessons from pilots and field assessments to improve the quality FSM programs is essential. When not yet available, updating of key components or revisions needs to be allowed.

#### Each city needs to clarify responsibilities for emptying, treatment, asset ownership, and update wastewater and septage regulations.

- Assess whether the existing institutions can meet the required capacity, or if other institutions are more suitable e.g. the local water utility or a new institution. Clarify the current regulations, responsibilities and asset ownership for FSM services.
- Introducing regular emptying needs to be city-driven due to the regulatory, financial and management changes, which need the support of the mayor, head of planning and technical departments. Evidence of household demand for improvements, private sector interest and financial feasibility are needed.
- National government needs to recognize that time is required to clarify or set up suitable agencies, and ensure they have the correct agency when providing or transferring assets.

#### Local Government agencies need increased capacity for regular emptying and advanced sludge treatment.

- Review the capacity of local wastewater agencies to manage FSM and more advanced sludge treatment. Consider alternatives including provincial or private sector treatment operators and monitoring specialists.
- Wastewater agencies need to review staff numbers and staff capacity and skills to manage improved FSM programs. Specific training and hands-on capacity building is needed for operations staff. The provision of standard operating procedures and management training alone is inadequate.

### Emptying - city level institutions

#### On-demand emptying services should be improved, while introducing and piloting regular emptying.

- Improving on-demand emptying is an important interim step to increase capacity, improve record-keeping and systems, develop relationships with the private sector, improve operation of treatment plant with increased loading, and implement procedures for monitoring and feedback.
- Ensure that new agencies responsible for regular emptying also have responsibility for the management of on-demand emptying, even where a private company is the service provider.

#### Improvements in on-demand emptying need to consider the existing management and political economy.

- Local regulations and reporting from the TSU require clarification. Improved monitoring by TSU also requires that departments use the monthly reports and data for annual planning, budgets, etc.
- Involving the head of department (or other agency) is vital to increasing the capacity (staff, IT, budget) of the wastewater agency to manage improved FSM services because the head of the wastewater agency does not usually have sufficient authority.
- Political economy influences, such as unclear regulations about private sector operations and use of government trucks, may affect motivation for improved monitoring. Clarify regulations and establish memorandums of understanding to encourage and formalize private sector involvement.

#### Special considerations are needed for serving low income areas, and check tariff assumptions.

- Government trucks need to increase their capacity and hose lengths to low-income households are often

<p>the most difficult to access and rely on lower cost public services.</p> <ul style="list-style-type: none"> <li>Assumptions used in the tariff calculations should be verified in practice. In particular, the number of tanks emptied, whether customers accept partial emptying, and the trips possible per day.</li> </ul>
<p><b>Treatment and Reuse</b></p>
<p><b>Design of Treatment systems need to better consider operational requirements.</b></p> <ul style="list-style-type: none"> <li>New national design guidelines should include recommendations from recent assessments of sludge treatment plant operations.</li> <li>Designs need to be for realistic future loads, while also working on current lower loading. Modular designs to match increasing demand over time are recommended. Treatment units need to be designed so that the waste flows can be redirected or bypassed to allow for operational maintenance or repair.</li> </ul>
<p><b>Develop a better understanding of suitable treatment systems for Indonesia.</b></p> <ul style="list-style-type: none"> <li>Consider sludge separation chambers as a first step, as Imhoff tanks are not recommended.</li> <li>Evidence suggests that sludge quality will vary and sludge treatment systems are needed that will cope with varied qualities of sludge. Further monitoring of sludge parameters and pilot testing different systems to understand the design and operation parameters is required.</li> </ul>
<p><b>Operators need increased skills and capacity.</b></p> <ul style="list-style-type: none"> <li>Standard operating procedures alone are inadequate to train staff, who also need on-the-job training.</li> <li>More technical skilled staff are needed to operate more complicated systems, so they can assess sludge quality and inflow and adapt treatment processes to suit, particularly in the rainy season.</li> </ul>
<p><b>Mechanized treatment is an opportunity in some cities with adequate skills and capacity</b></p> <ul style="list-style-type: none"> <li>Establish step-by-step processes and criteria for mechanized treatment systems and include these in design guidelines, e.g. reliable electricity supply, staff skills, laboratory analysis and a steady revenue income.</li> <li>The supply chain for spare parts and the lack of asset maintenance are constraints requiring improved options for asset management and purchasing spare parts.</li> <li>The current low capacity of operations staff is a barrier to improving and attracting skilled staff to the role, which will be a challenge in many cities.</li> </ul>
<p><b>Reuse opportunities have not fully been considered, and there are no national guidelines on reuse</b></p> <ul style="list-style-type: none"> <li>Reuse is likely to vary between cities due to cultural beliefs and practices, but there is evidence that a ready market may be present in some places. However reuse has not been included in government priorities/discussions. Guidelines for safe reuse should be included and promoted.</li> </ul>

## 2 Background

### 2.1 Context and Rationale

Rapid urbanization since the 1970s has resulted in almost half of Indonesia's 254 million people living in urban areas, and this trend is expected to continue.<sup>4</sup> While the last decade has seen consistently high economic growth, infrastructure and service delivery has lagged behind that of comparable neighboring countries. Indonesia has one of the lowest rates of urban sewerage coverage in Asia. Less than two percent of the urban population has a connection to a networked sewerage system, despite an estimated 82% urban population accessing improved sanitation.<sup>5</sup> The majority of urban residents use on-site sanitation systems with pour-flush pan toilets provided by the household. Despite being referred to as septic tanks (*tangki septik*), previous World Bank – WSP studies have shown that these are typically soak-pits or unsealed tanks.<sup>6</sup> Of around 150 sludge treatment facilities built in the 1990s, fewer than 10% were still operational by 2009.<sup>7</sup> The World Bank's Urban Sanitation Review in 2013 estimated that less than 4 percent of septage in Indonesia is treated at a treatment plant.<sup>8,9</sup>

The government's medium-term development plan for 2015-2019 includes the target of 100% access to improved sanitation by 2019.<sup>10</sup> This includes an increase in off-site sanitation (centralized and decentralized sewerage systems) to 5% with the remaining 95% of households relying on on-site sanitation and fecal sludge treatment.

The Ministry of Public Works estimates that the infrastructure requirements to achieve this target include building over 16 million septic tanks and 780 sludge treatment plants, as well as communal and centralized sewerage. The budget for this was estimated in 2015 to be IDR 202 trillion (USD 16 billion), with current a budget allocation for the mid-term development plan 2015-2019 of around one tenth at IDR 20.7 trillion (USD 1.5 billion). While alternative sources such as private sector and development partners are required to help fund the considerable gap, the 2015-2019 allocation is five times that of the previous 5-year period of investment.

In 2011 the Ministry of Public Works (MPW) requested technical assistance from World Bank -WSP to support the development of improved septage management models. The TA (Urban Septage Management Business Models) was completed in November 2013.<sup>11</sup> The key recommendations were:

- *Develop 'readiness criteria'* for national investment in fecal sludge treatment facilities at city level. Including requiring an appropriately staffed institution, and local regulations and operational budgets for managing fecal sludge services, not limited to the septage treatment facility (IPLT).
- *Treatment plant design guidance* should be revised to take account of field experience. Actual demand for on-site sanitation emptying services is low and this should be taken into account when planning for services and designing facilities, particularly IPLTs.
- *Management of septage and the associated environmental health risks should be required in city sanitation strategies.* National government should ensure that city sanitation strategy guidelines include the assessment of existing on-site systems (existence of overflow pipes, typical size of local pits/tanks, and demand for emptying), the groundwater profile, and options for improving low quality systems.

<sup>4</sup> World Fact Book estimates a rate of urbanization of 2.69% for 2010-2015 with 53.7% of the total population in urban areas (2015). <https://www.cia.gov/library/publications/the-world-factbook/geos/id.html> Accessed February 2016

<sup>5</sup> WHO/UNICEF Progress on sanitation and drinking water - 2015 update and MDG, 2015

<sup>6</sup> WSP 2015, Improving On-site Sanitation and Connections to Sewers in Southeast Asia – Insights from Indonesia and Vietnam (P146352). And WSP 2013, Assessment of Sludge Accumulation and Pit Filling Rates in Indonesia (P130771).

<sup>7</sup> Evaluation of Indonesian Septage Treatment Plants, Ministry of Public Works, 2012

<sup>8</sup> East Asia Pacific Region Urban Sanitation Review – Indonesia Country Study, World Bank 2013

<sup>9</sup> The report the terms septage and fecal sludge are used interchangeably.

<sup>10</sup> PPSP is the government's first five-year sanitation strategy from 2015 to 2019.

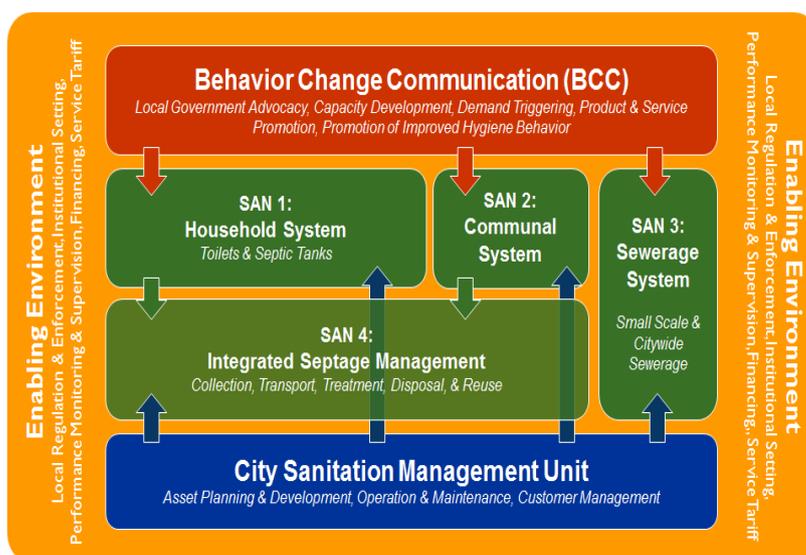
<sup>11</sup> Development of Urban Septage Management Business Models in Indonesia, 2013

- A study of treated sludge reuse options should be commissioned by national government, including assessment of potential health risks, agricultural benefits, and commercial viability.

Ongoing support to MPW and other national agencies through this TA and the parallel publication of the findings of the *East Asia Pacific Region Urban Sanitation Review* (P120020) and the study on “*Improving On-site Sanitation and Connecting Sewers*” (P146352) have contributed to a clear shift in the national government’s paradigm and policy on fecal sludge management (FSM). Moving from a focus on sewerage and the construction of sludge treatment plants, there is now an increased recognition of the need to improve FSM and on-site sanitation to achieve the 100% sanitation target, in line with the new Sustainable Development Goals. This TA addressed the next steps in improving FSM through tested advice based on implementing the models and recommendations from the first TA in pilot cities while providing tested advice to shape nationwide FSM improvements.

**Figure 1 - IUWASH Domestic Wastewater Services Framework**

While this TA focuses on fecal sludge management for household systems, the IUWASH diagram (Figure 1) shows how an integrated approach is necessary. Recent WSP studies found adequate fecal sludge management is also lacking communal sanitation systems. Clarification of institutional roles and regulations and increasing capacity of city wastewater and sanitation agencies should improve this situation and also current and future centralized sewerage management.<sup>12</sup>



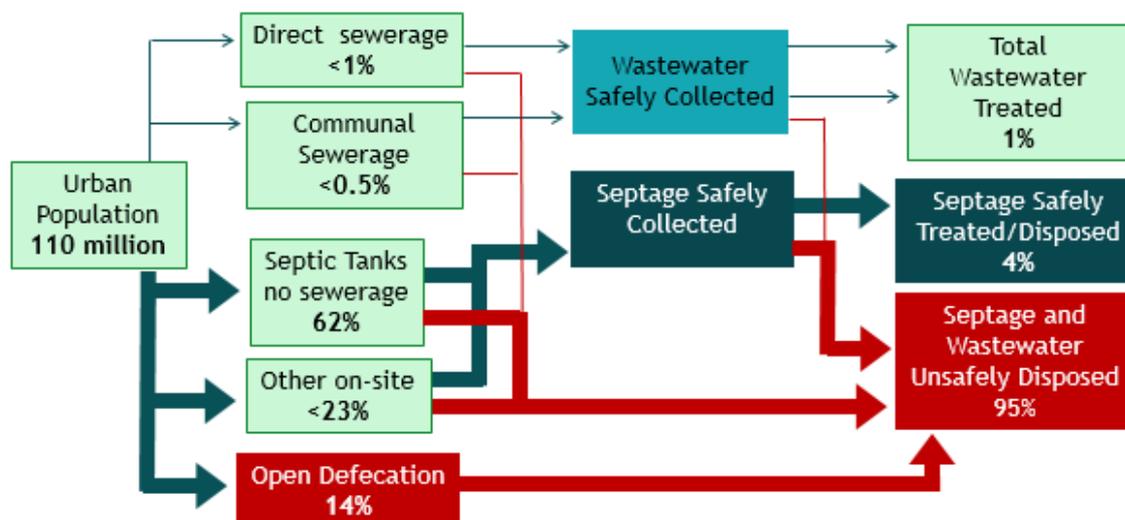
## 2.2 Overview of Sanitation and Septage Management in Indonesia

Below is a summary of the key components of FSM in Indonesia, as a context to the discussion that follows and to enable comparison with other countries. Figure 2 shows the fecal waste flows in Indonesia as calculated in the 2013 Urban Sanitation Review and highlights the significant proportion of fecal waste that is not safely treated and disposed, including only 4% of septage safely treated.<sup>13</sup>

<sup>12</sup> Review of Community Managed Decentralized Wastewater Treatment Systems in Indonesia, WSP Indonesia 2013.

<sup>13</sup> East Asia Pacific Region Urban Sanitation Review – Indonesia Country Study, World Bank 2013

**Figure 2 – Wastewater and Septage Flows in Urban Indonesia**



*Adapted from World Bank Urban Sanitation Review*

While the above mentioned medium-term development plan includes provision for improving on-site sanitation and sludge treatment, these are only two components of fecal sludge management. To protect public health and the environment, septage must be regularly emptied from the on-site systems, then transported to a suitable treatment facility and treated before either reuse or discharge to the environment. The stages in this full sanitation ‘chain’ are shown in Figure 3. This TA aimed to address the entire sanitation service chain for fecal sludge management and the report is structured around each of these elements.

**Figure 3 - The Sanitation Services Chain**



The following summarizes the typical approach to FSM in Indonesia.

**Containment:** 91% of urban households have access to a private toilet, which are typically squat pour-flush goose neck toilets.<sup>14</sup> Anal cleansing with water is commonly practiced. Despite the existence of a national septic tank standard, the majority of on-site systems are unsealed single chamber pits that predominately discharge to the ground, and 13% overflow into drains and waterways.<sup>15</sup> The majority of greywater is discharged to the drain and sometimes a separate soak pit. On-site sanitation systems usually only receive blackwater (from the toilet) and minimal, if any, solid waste.

**Emptying and Transport:** Emptying on-site systems in urban areas is not common practice, with a recent WSP household survey finding that 68% of households had never emptied their on-site system, despite using them for an average of 15 years. A previous study found the sludge accumulation rate was on the lower end of international values (<25L/p/yr) but within the expected range for a wet system only receiving blackwater and minimal solid waste. Since the contents are typically wet, emptying with a vacuum pump (or occasionally a modified water pump) attached to a tanker truck is the most common

<sup>14</sup> WHO/UNICEF JMP Indonesia data ([www.wssinfo.org/documents/?tx\\_displaycontroller\[type\]=country\\_files](http://www.wssinfo.org/documents/?tx_displaycontroller[type]=country_files), Jan 2016)

<sup>15</sup> East Asia Pacific Region Urban Sanitation Review – Indonesia Country Study, World Bank 2013. The study surveyed 1,200 households in six cities. Type of system; (47% single pit, 24% twin pits, 20% septic tanks, 1% prefabricated tanks, 9% don’t know. Discharge: 57% leach from walls/base, 30% discharge to second soak pit, 13% overflow to drain/river).

approach. A previous household survey, focused on low income urban areas, found very few instances of manual emptying. Emptying is carried out by government or private sector on an on-demand basis.

**Treatment, Reuse and Disposal:** Based on the previous FSM TA, emptied sludge is discharged to government treatment sites, a sewerage system (Bandung only), drains and rivers, or on to land, either informally or at the request of farmers. With few cities having wastewater treatment systems, septage is typically treated at a stand-alone septage treatment facility (not combined with wastewater). In some cities when fecal sludge is managed by the solid waste department, septage treatment is occasionally combined with the treatment of solid waste leachate. Most septage treatment systems are non-mechanized with varying designs including solid-liquid separation, sludge drying beds and waste stabilization ponds. A national government assessment in 2012 found that around 90% of the sludge treatment plants built since 1990s are not operational.<sup>16</sup> The previous FSM TA found few examples of formal reuse of treated sludge, but some evidence that there could be a market and demand for it. The lack of examples may be due to low volumes of sludge collected and treated, and the lack of a commercial focus around government-operated treatment plants.

### 3 Overview of the Technical Assistance

#### 3.1 Technical Assistance Objective

The objective of the TA was to provide government with tested advice on how to scale up improved septage management nationwide. It had two main components:

- (i) improvement of septage management in three cities through the application of management models (local level); and
- (ii) assistance to the national government in training and capacity building and the formulation of policies and regulations to improve septage management at scale (national level).

**Table 2 – Project Concept Note Indicators and Outputs**

Intermediate Outcome	Indicators	Outputs/Achievements
Local government's fecal sludge management improved in pilot cities	1.1 Pilots in 3 cities demonstrate effective application of new FSM models and are locally sustained by mid-2015.	Ongoing development of pilots in Balikpapan and Tabanan. The pilots have progressed slowly due to challenges described in this report and will start implementation in mid-2016. The third city (Tegal) did not meet the criteria for progressing. Partially achieved.
	1.2 Following the establishment of baseline indicators, pilot cities improve rate of collection and treatment by xx% by 2016.	In Balikpapan, private operators are now (100%) discharging at the treatment plant rather than onto land or indiscriminately (0%). Due to a change in responsibility, public emptying services have not yet commenced.  In Tabanan assessment of the treatment plant informed the TSU that there is sufficient capacity to accept all private trucks. While monitoring emptying and discharge to treatment has commenced, but capacity and political economy factors are affecting the accuracy of the reports, making it difficult to report whether the collection and disposal has increased.  In Bandung, 250 households were emptied a regularly. After delays with local staff changes and budget, the next phase of 3,000 households has commenced.  Partially achieved.

<sup>16</sup> Evaluation of Indonesian Septage Treatment Plants, Ministry of Public Works, 2012

Intermediate Outcome	Indicators	Outputs/Achievements
	1.3 Private sector involvement improved in one or more cities, and at least one demonstration of the reuse of treated septage by mid-2015	Private operators are in discussions with the public agencies in both cities and the preparation of memorandum of understanding is underway. The private operators and the implementing agencies are motivated to improve formalization of private sector involvement in regular emptying programs. Partially achieved.
Policy or strategy informed	2.1 National government changes its funding allocations from sludge treatment plants to supporting improved fecal sludge management at city level by 2015.	The Ministry of Public Works (MPW) has new readiness criteria for cities to receive support for fecal sludge management activities, which require cities to establish an institution responsible for sanitation. The OBA program includes support for the construction of improved on-site sanitation and sludge emptying trucks. In Tabanan, the cleaning department received two new vacuum trucks from the Ministry of Public Works to support the proposed regular emptying program. Achieved.
	2.2 National and local government formulate and issue new improved fecal sludge regulations by mid-2015	WSP has input tested advice to the development of national guidelines and regulations on regular emptying, sludge treatment plants, conducting sanitation censuses, standard operating procedures for on-demand emptying. Achieved.
	2.3 Tested models replicated and adapted if necessary and applied in at least three other cities by 2016.	Momentum for regular emptying pilots has increased with the national government supporting pilots and development planning to implement in a further 11 cities in 2016. There has been recognition from national government and IUWASH that the WSP model of on-demand emptying services is a necessary interim step towards regular emptying, and they are now prioritizing developing this step in partner cities. Achieved.
	2.4 Development partners demonstrate an holistic approach to urban sanitation by including septage management in new projects by 2015.	In January 2016, the Asian Development Bank (ADB) presented a proposed strategy for development of sanitation. It referred extensively to WSP and IUWASH FSM TA and pilots, and included FSM in the proposed investment packages. Achieved.
	2.5 World Bank position and references on fecal sludge management Informed by TA	An urban sanitation investment program is being developed, and it is planned to include a mix of sewerage, on-site sanitation and fecal sludge management. The experience and lessons learned from these pilots alongside the Global FSM ESW study will inform its development and preparation. Achieved.
Government capacity increased	3.1 Learning from previous TA and pilot cities shared with nationwide audience at three or more major Government led events in 2013, 2014 and 2015	Presented at and supported MPW organized workshops: "Promoting innovation in urban sanitation" (February, 2015) "Introducing LLTT to cities" (August, 2015), "Sludge Treatment Plants" (November, 2015), and two workshops organized by ADB (February 2015 and January 2016), and a workshop for the National Water and Sanitation Working Group (March, 2015). Achieved.
	3.2 Government staff and/or	The National Development Planning Agency (Bappenas)

Intermediate Outcome	Indicators	Outputs/Achievements
	government hired consultants are leading or presenting training materials and providing guidance by 2015.	and MPW have agreed that FSM is part of sanitation management and FSM is seen as a vital component to achieve universal access by 2019. MPW has also moved their focus from investment to septage treatment plants to integrated fecal waste management to ensure the whole sanitation service chain linked. MPW employed consultants trained in April 2016. Partially achieved.
	3.3 Updated and improved national training materials and programs for septage management become embedded in MPW training curricula.	Contributed to national training in Bekasi in 2014 and will support further training for facilitators and consultants on regular desludging and on sludge treatment plant design guidelines in 2016. Partially achieved.

Many of the outputs are ‘partially achieved’ due to the pilot development taking longer than anticipated at design. The main reason for the delays were due to changes in the key local govern decision makes in all of the cities and the need to re-advocate and spend time explaining developments, prior decisions and ensuring continuity. Processes around changing institutional arrangements and regulations took time, as did securing local budgets for developing the census and piloting regular desludging.

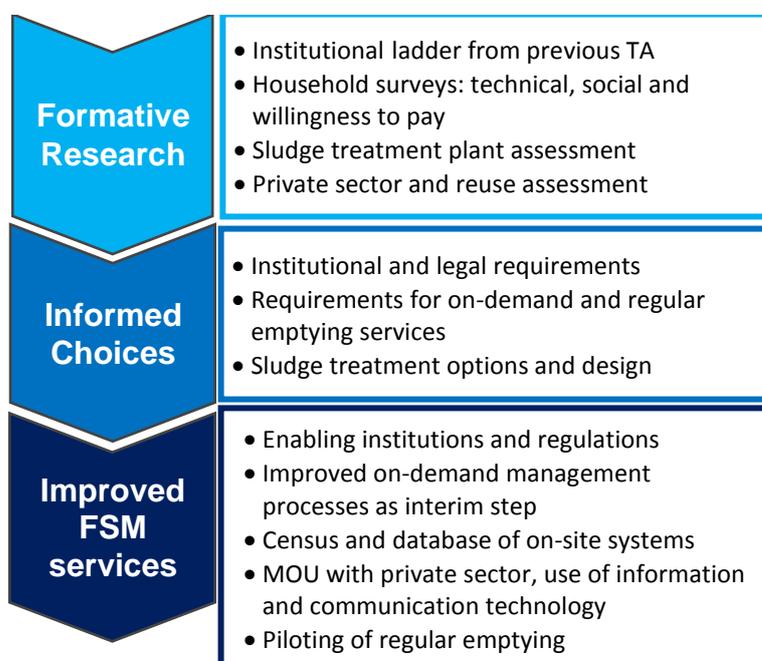
### 3.2 Approach

This report summarizes the findings and recommendations of the studies and capacity building activities carried out by the WSP team between September 2013 and March 2016. The TA is follow-on work to the models and recommendations developed under the previous TA and their application in three main pilot cities (Balikpapan, Tabanan and Tegal) and two secondary supported cities (Bandung and Jakarta). The focus of this report is on the pilot cities, although it also refers to relevant findings from IUWASH (see ‘Partnership’ below) and other investigations where these are appropriate.

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outlines the TA approach. The current situation was assessed through household and technical site surveys, interviews with key informants from local government and the private sector, and through a technical assessment of septage treatment plants. The formative research was critical to understanding the existing FSM situation and challenges and for designing a response. The research provided evidence and enabled consensus building among stakeholders for the development of relevant and realistic local FSM options while also identifying the barriers and gaps at the national level. The research provided evidence to local and national government of the need to improve FSM services and drive informed decisions on the most suitable

**Figure 4 - Technical Assistance Approach**



approach.

The informed choices were not only relevant to the cities that received support from WSP but were also used to assist the national government in developing policies and guidelines as well as contributing to other cities developing FSM approaches with other donor support (see Figure 5).

**Partnerships**

The partnership approach by WSP and USAID’s IUWASH program involved working together to assist the Ministry of Public Works improve and develop fecal sludge governance (programs, policy and guidance) through a coordinated technical assistance.

WSP helped coordinate regular meetings with various government departments (mainly the National Development Planning Agency (Bappenas) and the Ministry of Public Works) and development partners (IUWASH, SNV, USDP).<sup>17</sup> Sharing of findings, new ideas and lessons learned at these meetings has enabled rapid progress to be achieved in developing improved FSM models and regulations, and their implementation. While at times the agencies had different opinions about the approach taken or recommendations, these were discussed and resolved internally, and a united voice and consistent advice was provided to the Ministry.

While the partnership approach was strongest with IUWASH, both agencies prioritized involving other development partners and local agencies. For example, JICA approached WSP to discuss the on-site sanitation component of their Jakarta sewerage loan and there were periodic discussion with the Asian Development Bank throughout the TA period.

Benefits of the partnership approach included:

- Sharing data, templates for regulations and agreements, and emerging or final tools developed
- Avoiding ‘reinventing the wheel’ and learning from each other about challenges and causes of delay
- Increased ability to build government capacity through joint workshops, pooled funding and a wider range of city pilots to learn from
- Greater involvement of government in decision making, understanding local issues and immediate adoption of findings into national programs
- Each agency focused on different aspects of FSM, applying different models and progressing at different rates has led to more rapid overall progress.

**Figure 5 - Partnership Approach: Vertical and Horizontal Interaction**



<sup>17</sup> USAID funded Indonesia Urban Water Supply, Sanitation and Hygiene Program (IUWASH)  
 SNV – a not-for-profit international development organization founded in the Netherlands  
 USDP – Netherlands Embassy Urban Sanitation Development Program

A key component of the coordinated and shared approach were the many meetings among the partners and workshops and training events co-facilitated by the Ministry, WSP, IUWASH and other development partners. See Appendix 1 for details.

### 3.3 Overview of the Cities

The TA provided two levels of assistance to cities: intense support with detailed surveys and regular field visits to Tegal, Tabanan and Balikpapan, and secondary support to Bandung and Jakarta to assist with the development of certain aspects of FSM and include in capacity building and workshops.

Figure 6 – Map of Partner Cities



Source: Google Maps

**Balikpapan** is located on the southern coast of East Kalimantan and with a population of 664,595 (2013) is the second largest city in the province after the provincial capital Samarinda. It is an administrative center for oil and mining companies and consequently has a higher cost of living than Tabanan and Tegal. The PDAM supplies piped water to approximately 73% of the city's population and also manages the existing wastewater treatment plant (Margasari) and sewerage system, which serves approximately 7,000 people. The original sludge treatment plant (Manggar) was built in the 1990s and is located at the solid waste landfill site, with a combined treatment system for fecal sludge and leachate waste. During the TA the treatment system was being upgraded, funded and commissioned by the Provincial Department of Public Works located in Samarinda. Balikpapan is also part of WSP's Global FSM Diagnostic Tools Study and additional survey activities included the development of a fecal waste flow diagram (SFD), physical analysis of fecal sludge samples, a political economy assessment based on institutional interviews, and a city-level service delivery assessment.<sup>18</sup>

**Tabanan** is a district of Bali with a population of 420,913 (2010) with an area of 840km<sup>2</sup>, located 40km from Denpasar. Bali is a predominately Hindu province (the other cities are predominately Muslim) and has a slightly different administrative structure. Seventy-seven percent of households have a private toilet, 13% use a shared facility and 10% practice open defecation; and 51% have a piped water supply to their property.<sup>19</sup> There is no centralized sewerage system but many communal wastewater systems (SANIMAS). The sludge treatment plant was built in 2012. A TSU (technical service unit) was recently established under the city cleaning department (DKP) to manage FSM.

<sup>18</sup> Fecal Sludge Management: Diagnostics and Guidelines for Service Delivery in Poor Urban Areas (P146128)

<sup>19</sup> Household census, Badan Pusat Statistik 2010 <http://sp2010.bps.go.id/>

**Tegal** is a smaller city with a population of 240,000 located in Central Java, approximately 150 km west of Semarang on the main Jakarta to Surabaya road. Ninety-six percent of households have a private toilet. Piped water supply coverage is low, with less than 30% of households connected to PDAM piped water supply and no sewerage system or wastewater treatment. Fecal sludge is managed by the sludge treatment technical service unit of the housing and settlements department, which includes responsibility for operating the sludge treatment plant refurbished in 2013 and one sludge emptying truck.

**Bandung** is the capital of West Java with a population of 2.5 million (2013) and is an inland hilly city with high rainfall. Piped water is supplied to 69% of households managed by PDAM, which are also responsible for the management of sewerage and wastewater treatment. They are also required to provide sanitation services to those households not connected to the sewerage system, which requires regular desludging provided every 2 years. All water customers pay an additional 30% of their water bill toward wastewater management.

**DKI Jakarta**, the Special Capital Region of Jakarta (hereafter, Jakarta) is the capital of Indonesia and also the largest and most dense province, with a population of 9.6 million. Approximately 50% of residents use bottled water for drinking, 20% use piped water and 76% of households have a private toilet. PDPAL-Jaya manages a centralized sewerage and treatment which services 2-4% of the population. A large combined sewerage project for central Jakarta has been proposed by JICA and is currently under development. The responsibility for FSM has recently been moved from the cleaning department to PDPAL (autonomous local wastewater enterprise). The handover took two years and was completed in December 2015. PDPAL are to receive approximately IDR 70 billion (USD 53 million) per year for the next five years for on-site sanitation, sludge treatment and regular emptying activities to establish and manage improved FSM. They have also to establish a new team to manage the regular emptying.

**Table 3 – Activities undertaken in each City**

	Tabanan	Balikpapan	Bandung	Tegal	Jakarta
Willingness to Pay Survey	✓	✓		✓	
Sludge Treatment Plant Assessment	✓ and SOP	✓		✓	✓
Private Sector Assessment	✓	✓		✓	
Input to Sanitation Regulations	✓	✓			
Improved On-demand Emptying	✓	✓	✓		
Promote Regular Emptying	✓	✓			✓
Census for Regular Emptying	✓	✓ Proposed			
Regular Emptying Pilot	✓ Starting	✓ Starting	✓ 250 households emptied in first pilot, second pilot delayed, starting 2016.		✓ IUWASH
Information and communication technology (ICT)	Used for census but not yet for operations	✓	Proposed		

### **Levels of Support**

**Balikpapan and Tabanan** received primary level TA support based on a signed agreement early in the TA following the household social and on-site surveys. WSP's TA approach focused on government driving the FSM improvements and development of regular emptying pilots, and as such required a commitment from the local government agencies.

**Tegal** was the only city which showed interest in the first TA and was initially included as a primary level support city. However, after the social and on-site survey and treatment plant assessment, there was minimal commitment from the local government to progress FSM improvements. After several meetings in Tegal, it was agreed that without the substantial commitment of local government the TA support would cease. Apparent reasons for the low commitment included the managing department (city housing and spatial planning department) focusing on other priorities, which was evident from their sending only the head of the IPLT TSU to national FSM training activities rather than higher level department staff; weak communication between the IPLT TSU and the department; a weak sanitation working group with low level staff who lacked the authority to make decisions; and infrequent opportunities to meet the head of the regional development planning agency (Bappeda) or the working group.

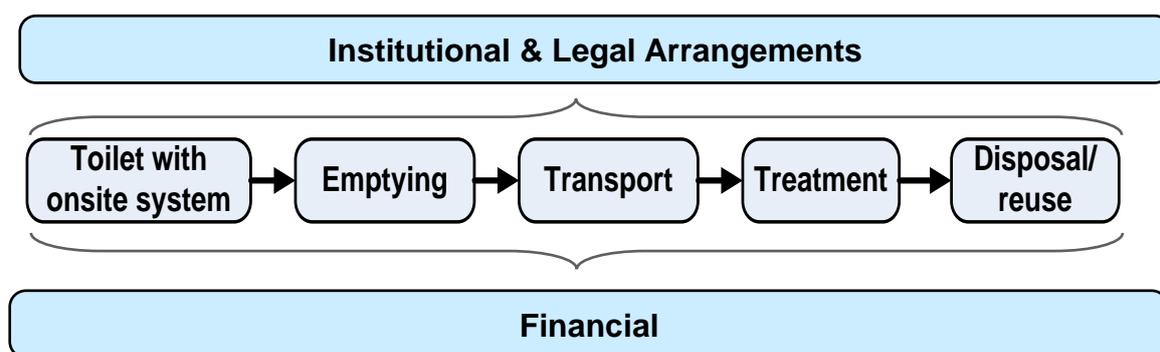
**PDAM Bandung** requested the support of WSP to improve its FSM program, with regular emptying already a regulated responsibility of the PDAM for all water customers not connected to the sewer. As Bandung already had clear regulations of responsibility, existing agreements with the private sector and significant human resource capacity, the main support was to assist in the implementation of a regular emptying pilot. Due to delays in the appointment of the new PDAM managing director, support was put on hold for approximately the months, however with his recent appointment the next phase of regular emptying has recently started.

**Jakarta** was primarily supported by IUWASH, but this TA provided secondary support through consultant inputs to develop the regular desludging program, based on its linkages with the recommendations of the study on *Upgrading On-site Sanitation and Connecting to Sewers* (WSP, 2015) and *The Economic Impact of Sanitation in Jakarta* (WSP, 2016).

## 4 Technical Assistance Implementation

The section outlines the results of the formative research, and how existing conditions that influence the different aspects of the sanitation chain and their institutional and financial arrangements can be developed to improve FSM.

Figure 7 – Implementation along the Sanitation Service Chain



### 4.1 Institutional and Legal Arrangements

#### 4.1.1 Sanitation Management and Types of Sanitation Institution

The previous FSM TA included a summary of the institutional arrangements in Indonesia, including the responsibilities of the national, provincial, local levels of government and the various ministries involved in sanitation management. This and the *Upgrading On-site Sanitation and Connecting to Sewers* Indonesia Report discussed the unclear responsibility for sanitation at the local level, with various departments involved and frequent gaps in responsibility for all components of the sanitation service chain.

While the city sanitation strategies and sanitation working groups should clarify these roles, this process has typically not included FSM.<sup>20</sup> As well as the different government departments involved in sanitation, there are also different types of management institutions that can be responsible for sanitation management. While these were introduced in the first TA, the responsibility for regular emptying has been clarified and since the first TA, PDAM/PDPAL have become the more common highest management level than the previously proposed semi-autonomous local government body or BLUD (see below), of which there are currently no examples. Local management options for wastewater include:

- **City government department** – FSM can be managed by the department for solid waste, cleaning or housing, or by a regional infrastructure agency. However, a government department cannot collect tariffs or independently plan or manage human resources, and all operations are funded by the local government's annual budget. They can however receive local and national grants.
- **Technical service unit (TSU)** – A TSU can be established under a relevant local department or provincial agency. TSU are easy to establish and have a small degree of autonomy. For example, they can collect tariffs but must hand these over to local government within 24 hours. They cannot keep any revenue and rely on local government budget for their operations. Examples of these are the TSU in Tabanan, Makassar and Tegal that are responsible for FSM.
- **A semi-autonomous local government body** (*Badan Layanan Umum Daerah* or BLUD) – A BLUD is described as model of financial management that enables a TSU to operate with more flexibility and autonomy in finance, planning and human resources, but still receive an operating budget from local government. This type of body has not yet been set up for sanitation in any city.
- **Autonomous local water** (*Perusahaan Daerah Air Minum* or PDAM) **or wastewater enterprise** (*Perusahaan Daerah Penanganan Air Limbah* or PDPAL). These are owned by the local government but independent in financing, planning and management of services. These enterprises are expected to be profitable and generate revenue to cover their service delivery and operational expenses. They are not meant to receive local government budgets for operational expenses, however many are not profitable and rely on ad-hoc local government support. FSM is managed by the PDAM in Solo and Bandung, and was recently designated to the PDPAL in Jakarta. Through this TA the responsibility for FSM was moved to the PDAM in Balikpapan (see below) and has been proposed that this responsibility be moved to the PDAM in Bogor.

The following are important considerations when starting to develop the sanitation institutions to provide septage services.

- **Clarify roles and responsibilities:** With the numerous departments involved in sanitation and the multiple regulations which refer to it, a preliminary assessment of responsibilities and gaps for each component of FSM is required, with the working group providing guidance on how roles and responsibilities should be applied in practice. This guidance should be provided in the city sanitation strategies, but is frequently omitted. The support of development partners in clarifying and creating guidance on establishing a TSU is evident in the increased clarity of responsibility and inclusion of FSM in the scope of the recently established TSU in Tabanan and Makassar. The TSU in Tegal was set up in 2008 with responsibility for sludge treatment. However, such regulations are not always clearly worded and as shown in Box 1 below, the new regulation in Balikpapan did not provide an adequate definition of the wastewater it referred to.
- **Review current capacity:** For cities considering the introduction of regular emptying, it is necessary to review the capacity of the current agency to manage an increased workload and financial responsibility. In cities where the PDAM operates well, the working group often recommends them,

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<sup>20</sup> City sanitation strategies, are a national government requirement and the basis for investing national annual budgets in sanitation infrastructure at the local level. The strategies, are developed by the city working group based on a situation assessment (known as White Book)

rather than the cleaning department, as the most suitable agency to manage FSM. In both Balikpapan and Bogor this was recently proposed, but the PDAM were initially not motivated to accept the increased responsibilities. Both PDAM are managing underperforming sewerage systems and were doubtful about taking on the additional task of FSM. The TA conducted various advocacy sessions with the Balikpapan PDAM highlighting the potential financial revenue of regular emptying, and with strong support from the working group and a letter of clarification from the mayor, the PDAM in Balikpapan has accepted the responsibility.

- **Improve communications between stakeholders:** The challenge of there being no direct line of management from national to local level and the multiple stakeholders involved was evident in the design and construction of Balikpapan's new sludge treatment plant. While design recommendations from the TA were shared with national and local level staff, the provincial public works agency in Samarinda, using local consultants, designed independently funded and built a new treatment plant in Balikpapan, unaware of the recommendations. This highlighted the need for capacity building, improved communication and sharing of guidelines and recommendations with all levels of government, private consultants and development partners.
- **Sanitation working groups can provide valuable support:** When there is a need to clarify and adjust responsibilities and regulations for improved FSM (discussed further in section 5.1), the multi-departmental sanitation working groups are well placed to advise. However, their strength and influence varies between cities and they provided the most valuable support when higher level management representatives from each department were included rather than lower level staff.

#### Box 1 – Clarifying Institutional Responsibility in Balikpapan

##### Steps taken to clarify Balikpapan's institutional responsibility for septage management

Previously the PDAM was responsible for the management of centralized sewerage and wastewater treatment while the city cleaning department was responsible for sludge emptying and sludge treatment. A new local government regulation in December 2014 gave the PDAM responsibility for "*air limbah masyarakat*" (community wastewater) which the PDAM interpreted as the existing "communal" sewerage systems and not all forms of sanitation, which are typically called "*air limbah domestik*" (domestic wastewater).

Due to the poor operation of the sludge treatment plant and lack of sludge emptying services by the cleaning department, the working group agreed that the PDAM would be a more suitable agency to manage FSM, particularly as the working group was motivated to trial regular emptying. Although the regulation already existed, the PDAM would not accept responsibility until a clarifying "letter of appointment" was provided. Working closely with the regional development planning agency (Bappeda), the working group and the PDAM, the TA assisted with the following steps to clarify institutional responsibility:

- Regular meetings with Bappeda, the working group, and the PDAM, and presentations to the mayor, to clarify the regulation and agree on an official letter of appointment. It was approximately nine months from realizing the regulation was unclear to receiving the official letter.
- Using the household survey results for regular emptying and potential income revenue, encourage the PDAM to support FSM. Due to a change in the PDAM management, repeated advocacy was required. Since written confirmation of agreements had been made with the previous head of the PDAM, the change in staff did not cause significant delays or alteration of plans.
- Support the PDAM to develop a "task force" to manage regular emptying, including human resource requirements. Assist in the update of accounting and finance systems to include wastewater components, by learning lessons from other cities and a learning visit to PDAM Solo.
- Assist Bappeda and the PDAM to clarify and agree on the asset transfer process. The TA assisted with the clarification from the Ministry of Home Affairs regarding the lending of assets to non-government departments (PDAM is considered a non-government department and therefore must pay to use the sludge treatment plant). The plan is to hand over the sludge treatment plant to PDAM, however this will take at least two years due to lengthy audit and transfer processes.
- Support Bappeda and the working group to develop regulations for regular emptying.

#### 4.1.2 Capacity of Institutions to Manage FSM

The capacity of the agencies responsible for FSM varied significantly and is partly influenced by the type of organization (TSU, PDAM, etc.) and by the size and scope of the agency. The number of staff allocated to FSM activities varied from five staff at the TSU in Tabanan and Tegal to over 20 staff at PDAM Solo and 14 at the PDAM in Balikpapan. Information technology resources also varied, from Tabanan's one computer and reliance on manual operations to PDAM Balikpapan's online customer database and android information communication technology (ICT) to read meters. The number of trucks and treatment plant capacity and technology also varied between the cities but was not necessarily related to the size and demand for services.

The capacity of the agency is important when considering the possible options to improve FSM and either tailor the improvement to the existing capacity and/or work at building the capacity to manage an improved approach in the future. The TA was able to provide a range of options to the partner cities to suit their current capacity i.e. manual data records introduced at Tabanan and an android based census implemented in Balikpapan. Since the PDAM in Balikpapan was not yet operating an emptying service, the capacity building focused on the regulatory and institutional set up described in Box 1. Specific capacity building activities in Tabanan included:

- Door-to-door census:** Assisting with the implementation of a pilot door-to-door sanitation census (900 households, 31 commercial buildings and 67 social buildings), data entry, data analysis and setting up of a customer database. While this required very close/step-by-step support, the result was an accurate census that could be used by the TSU for the regular emptying pilot, and which was also valuable to the health, environment and public works departments involved in the sanitation working group. The census will now be independently carried out in an additional 3,000 households.
- Monitoring:** Training staff to monitor on-demand emptying customers and track discharge to sludge treatment plants. However, the monitoring appeared inaccurate and it is unclear whether this is due to capacity or low motivation to monitor. Low motivation could be due to the political economy conflicts of greater transparency (discussed in section 4.1). Also there was a lack of demand for the data collected as there was no requirement to report to the cleaning department. Following advocacy by the TA team, the cleaning department is now aware of its regulatory role and interested in receiving monthly reports to guide its planning and budget. Further assistance is being provided to improve this system.
- Treatment plant operations:** Developing standard operating procedures (SOP) following the initial assessment. Although the sludge drying beds were divided as recommended, there were few other improvements in operations. With only the SOP and no on-site training, the TA team realized that documents are too complicated and are insufficient alone for the operator to understand the daily changes in operations. On-site training is required and will be especially necessary with increased loading during regular emptying.

**Figure 8 Technical Assistance Approach**



#### 4.1.3 Legal Arrangements and Regulations

There are numerous levels of sanitation and FSM regulations, and uncertainty and gaps in their application. The levels of regulations include:

- National laws** such as the environmental discharge standards, which provides quality standards for the discharge of wastewater from treatment facilities, and requirements for wastewater discharge from major buildings, industry and commercial facilities.

- **Regional regulations**, which are the highest level of local regulation, issued by the local parliament with the approval of the mayor. They regulate all matters related to regional autonomy and national government support tasks. They typically require a long process of approval, often more than a year.
- **Regulations/decrees of mayors/district heads** are derivatives of regional regulations, and are used to regulate items in a regional regulation in more detail. Approval is required only from the mayor, not from local parliament. The regular emptying tariff in Solo is regulated by a decree of the mayor, which took just six months from submission to approval.
- **Letters**, which are used to update or amend an item that is already regulated. Examples include a letter from the PDAM in Balikpapan requesting clarification of the regional regulation on responsibility for wastewater; a letter of a decision by the board of directors of the PDAM to be used to regulate the regular emptying tariff in Balikpapan; a letter of permission from the local parliament in Solo for inclusion of a special tariff for low-income households in addition to the regular empty tariff already established by a regulation of the mayor.
- **A memorandum of understanding (MoU)** can be a formal legally binding agreement if signed and endorsed by a public notary. It has been proposed that agreements between private companies and wastewater agencies take the form of an MoU.

A number of different regulations can relate to sanitation and FSM and since there is no standard approach or streamlining, they are used in various forms in the different cities. Table 4 summarizes the types of regulations relating to FSM, what they typically include and important considerations when assessing their influence on FSM programs.

**Table 4 – Regulations relating to FSM**

Inclusion	Important Considerations
<b>Responsibility for management</b>	
Define agency	Occasionally the definition/set-up of the agency and its scope differ between regulations. It is important to consider whether their scope is limited terms of their ability to collect money or receive funding, and to interact with private companies.
Define scope of work	The scope of work might include only part of the sanitation chain. As seen in Balikpapan, the definition of sanitation is important (does it refer to communal or centralized sewerage, fecal sludge, all sanitation, domestic or industrial). It is also necessary to consider other regulations that may specify the agency responsible for, for example, tariff collection. In Balikpapan, the tariff regulations specifically state that the cleaning department is responsible for tariff collection, so this must be amended to reflect the change in responsibility.
<b>Finance</b>	
Tariffs	Tariffs for emptying and discharge to sludge treatment plant. Also whether the tariffs are for a household only or can be used to set a fee for private sector engagement. Tariff wording is important: the current Balikpapan sewerage tariff is to as a “retribution”, which means it must go to local government.
Requirement to pay	This can be separate to the actual tariff and it is recommended that new regulations contain separate provisions on the requirement to pay in a regional regulation, and provisions on the tariff amount and agency responsible in the more flexible regulation of the mayor.
<b>Environmental</b>	
Wastewater discharge regulations	National wastewater discharge standards exist and apply locally. However, their interpretation varies. While Bandung was able to use the umbrella environmental regulation to force private companies to pay for discharging sludge, in Tabanan the regulation was interpreted to apply to industrial and commercial wastewater only and could not be applied to wastewater discharges. Although the discharge of sludge to the environment is referred to as “illegal”, it is unclear whether it is part of national environmental regulation, which is quite specific as to what sources of wastewater are controlled (from apartment buildings, industry, commercial buildings,

	treatment plants).
<b>Household sanitation requirements</b>	
Use on-site sanitation	While a building permit typically requires a household to have on-site sanitation built to government design codes, the processes to ensure that this actually happens are not in place, and the rules are typically only applied to plans for new buildings.
Join regular emptying programs	It has been proposed that regulations are introduced requiring households to join a regular emptying program where one exists in their area to increase participation, revenue and impact, and thereby make better use of programs set up by government.

## 4.2 Containment: On-site Sanitation Systems



The first FSM TA advocated the benefit of assessing existing conditions to inform improved FSM programs and operations. Two recommendations relevant to the containment stage include:

- The development of city sanitation strategies should include the assessment of existing on-site systems by considering discharge, size, demand for emptying, and relation to groundwater level;
- For improved FSM, managers should base their decisions on good records and information. This requires creation and application of simple information systems and targeted use of data to inform decisions. These data will include customer details (current and future), details of every emptying trip, vehicle operations and trips, and treatment plant performance.

Two household surveys were conducted under the TA. The first was a study of the willingness to pay and customer satisfaction of emptying services, including a technical assessment of on-site sanitation. This was used to understand household drivers for regular emptying and current demand for emptying, and to inform the approach and key messages required for the promotion campaign. The second household survey was a sanitation census, used to develop a customer database and obtain details regarding size and access to on-site sanitation to plan and implement pilot regular emptying programs.

### 4.2.1 On-site Sanitation Survey – Poor Quality Systems and Difficult Access

A technical survey of on-site sanitation was conducted in Balikpapan, Tegal and Tabanan in early 2014 as part of the willingness-to-pay and customer satisfaction surveys. 73-88 household surveys were carried out in each city to understand the type and condition of existing on-site sanitation systems, which inputs to demand and access for emptying. Key survey findings were

	Balikpapan	Tegal	Tabanan
<b>Type of on-site sanitation</b>			
Single circular pit	14%	32%	14%
Twin circular pit	7%	24%	5%
Single tank	16%	10%	25%
2-3 chamber tank	63%	34%	56%
<b>Other features</b>			
Overflow pipe to drain or river	55%	9%	16%
Approximate size (m <sup>3</sup> )	3.4	1.9	5.0

	Balikpapan	Tegal	Tabanan
<b>Base of on-site sanitation pit or tank</b>			
Plastered base	26%	18%	40%
Unsealed base	53%	66%	51%
Unknown base	21%	16%	9%
<b>Access for emptying</b>			
Located under house	39%	43%	9%
Manhole/access to empty	17%	13%	53%

As found in previous studies of urban sanitation in Indonesia, a variety of on-site sanitation types exist in the three cities. Although most on-site sanitation systems in Balikpapan and Tabanan have multiple chamber tanks as per the national design standard, many systems have unsealed bases. As well as the type and containment of systems influencing demand for emptying, many systems in Balikpapan also

have an overflow pipe to a drain or river. This enables them to continue operating when full, further reducing the demand for emptying. It also makes regular emptying important to reduce untreated wastewater overflowing into drains and rivers. The demand for emptying and design of emptying programs is also influenced by the size of the tanks. This varies significantly between cities and needs to be considered when sizing the emptying trucks, designing the treatment plant, in tariff calculations (if based on volume) and for the truck logistics. Access to on-site systems is a clear challenge, particularly in Balikpapan and Tegal where most systems do not have a manhole for pit emptying and many systems are located under the house, which requires someone to be at home to permit access to empty, and often requires breaking floor tiles to access the pit (if possible).

**Figure 9 – Difficult access to pit under a house**



#### 4.2.2 Sanitation Census – Required for a Regular Emptying Database

A database of all customers with details of their on-site sanitation systems is required to develop a regular emptying program (including a pilot program). Existing databases such as those held for water supply customers or national census data are either not available, limited to water supply customers or of insufficient detail and content for a regular emptying program. For example, information is needed on the distance from the septic tank/pit to a main road where the tanker will wait; any need for special equipment; and the location and type of the opening (hatch or manhole) to the septic tank. The required details and methods of data collection have been developed and revised following lessons from implementation in each city:

- **IUWASH coordinated a census** in their regular emptying pilot areas of Bogor, Solo, and Makassar in 2014. Data from this census had inadequate detail about the type and access to the on-site sanitation systems and errors in the location of the tanks. Therefore, it could not be used for the regular emptying pilots as planned. IUWASH have since developed an android application (detailed in Box 2) and will repeat the census in their partner cities.
- **Balikpapan health department** was conducting its own health census when the TA initially engaged with the working group, and additional questions relating to sanitation were added to the census. While the data was expansive, there was inadequate detail about access to sanitation systems for the regular emptying pilot. A subsequent census has been developed based on the PDAM customer database (which was not the responsible agency at the start of the TA) and will be conducted using the android phone application developed by IUWASH.

##### Key considerations for conducting a regular emptying sanitation census:

- Ensure that the detailed information on physical access to the on-site sanitation is collected.
- Ensure that the data will fit into an existing Management Information System or database of the agency,
- If the agency is not currently using computers, training and support in data collection and developing and using a customer database will be needed.
- The census should be designed to collect broad data which is useful to other agencies but must also provide the data needed for regular emptying.

- **Tabanan health department** conducted a pilot census with WSP support and local government funding. While the sanitarians involved had experience conducting censuses, due to the technical sanitation components and involvement of various agencies, the TA provided training and oversight to ensure quality and detail. However, due to limited computer skills and the lack of an existing customer database, the data processing was slow and required ongoing TA support. Following intense capacity building, the health department and TSU will now be able to replicate the census in 3,000 additional households. The detail of the data from this census was sufficient to identify areas and develop the database for the regular emptying pilot. Since the working group was intensively involved in the implementation of the census, the data generated is also being used by the health department to address open defecation, and by the public works department to target sites for communal wastewater systems.

The final census guidelines developed by the TA were provided to the Ministry of Public Works, which is now distributing them to other agencies/cities.

**Figure 10 – Sanitation census: training, interviewing households and tank measuring**



#### **Box 2 – Sanitation Census Mobile Phone Application**

IUWASH have developed an android application to collect survey data and create a database for regular emptying. The survey questions and approach were developed from the shared findings of the manual (paper) census conducted by WSP and IUWASH. This app is expected to make collection and data analysis more efficient, with the information collected also available to pit emptying staff to quickly identify the house, tank location and volume of the system.

The app is currently being tested in Bekasi, near Jakarta and it has been proposed that it be used in Balikpapan for the census in the pilot area. The PDAM staff are already familiar with app and have a management information system which uses the app to monitor water meters. In Tabanan, it will be proposed for use by the health department for their next phase of census. However, they have less experience in mobile data collection and the current app is limited to regular emptying pilot questions and not the broader health questions of their current census, and would therefore need some adaptation.

#### **4.2.3 Improving On site Sanitation**

With increasing evidence from this and other studies of the poor quality of on-site sanitation in many cities, the government is establishing a new program to provide output based aid (OBA) funding to local governments who invest in upgrading the quality of on-site sanitation facilities and increase sludge transported to the treatment plant. All households that are part of the OBA program will automatically be registered as a regular desludging customer. The OBA funding will be focused on ensuring the containment tank is well-built and does not present a public health hazard by over flowing, leaking or discharging to the environment.

### 4.3 Emptying and Transport



#### 4.3.1 Demand for Emptying

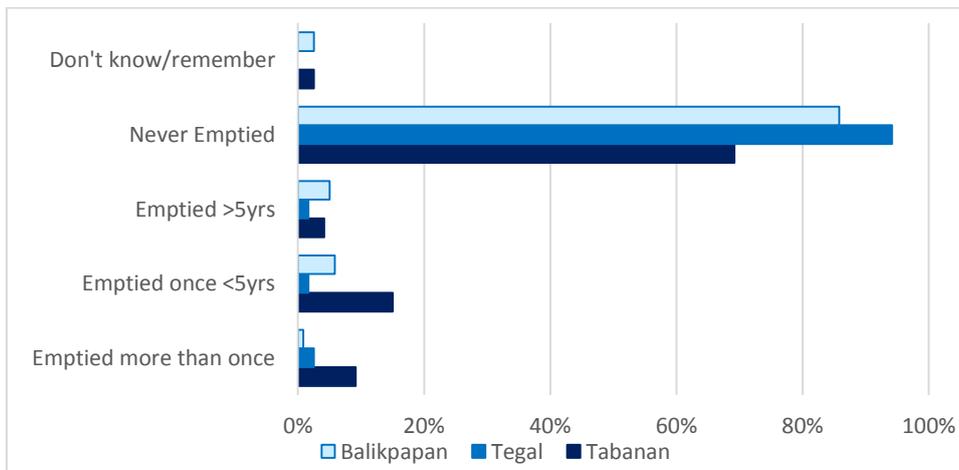
With little hard data and knowledge of consumer attitudes and demand for improved fecal sludge management, social research on septage management at a household level was conducted by WSP to understand willingness-to-pay (WTP) for regular sludge emptying services and customer satisfaction with existing emptying services. The survey interviewed 120 households each in Balikpapan, Tegal and Tabanan to assess their WTP, and a further 70-120 households in each city about customer satisfaction (CS) with sludge emptying within the last three years. Additionally, six focus group discussions were held in each city with groups of residents to discuss their understanding and attitudes in more detail. The technical surveys ran in parallel, and included some of the households confirming the technical configuration and operation of on-site systems, with a focus on low-income households. The WTP and CS surveys included both low and middle income households as a reflection of the city-wide situation.

#### Current emptying rates

Similar to previous studies by WSP in Indonesia, which indicated that over 60% of respondents in low-income areas had never emptied their on-site systems, these surveys also found low rates of emptying. Eighty-three percent of respondents to the WTP survey had never emptied their on-site sanitation system. Comparison between the three cities is shown in Figure 11. The respondents from the customer satisfaction (CS) survey were selected because they had their systems emptied in the last three years so were not included in this analysis.

The focus group discussions confirmed that emptying was uncommon and many participants thought it was not necessary to empty tanks regularly because their tanks were over ten years old. Emptying was only required, or was only requested, when there were problems such as overflows, blocked toilets or bad smells. Some respondents mentioned that it would be a wasted expense to empty the tank if it was not full. Respondents, particularly in Balikpapan, also worried that emptying would be difficult due to the system being located under the house and there would be a need to break the floor tiles, while others were worried that it would be impossible to empty their tank due to the road being too narrow for a truck.

Figure 11 – Emptying Frequency



### Customer satisfaction with emptying

Households that have had their systems emptied in the last three years were interviewed. They were also asked about their willingness to join and pay for a regular emptying service as discussed below. The participants were drawn from the records of existing customers of private and public emptying services. However, this data was limited or non-existent in some areas and therefore community leaders were relied on to find households that met the criteria.

Key findings include:

- Private companies are the main provider of emptying services in all three cities (Balikpapan 59%, Tegal 72%, Tabanan 51%)
- Self-emptying (by the household) is low, with 7% of respondents reporting this in Balikpapan and under 2% in Tegal and Tabanan.
- Key benefits of using private services included practicality and an immediate and speedy service.
- Some households did not know whether a public service existed. Those who chose a public service said it was cheaper than the private option or they knew the staff in the office. However, in Tabanan low-income households said that the government trucks were not able to access their houses due to the narrow streets, but private companies could (due to longer hoses and more powerful pumps). Additionally, in Tabanan there was dissatisfaction with the government provider taking 2-3 days between booking and emptying.
- While most respondents did not report any difficulties or complaints about the quality of the emptying service, the challenges they noted included lack of access to an on-site system in Tegal; breaking of concrete to access the systems in Balikpapan and Tegal; and the distance from the truck to the house in Tabanan due to the narrow streets.

### Willingness to join a regular emptying Program

The WTP survey proposed that households would have their tank emptied every four years. This would be managed by the local government. The sludge would be taken to a facility to treat it properly so that it would not harm the environment. Rather than a lump sum fee at the time of emptying, households would instead pay a monthly fee, with the first emptying service provided for free.

**Figure 12 – Willingness to Join and Pay for Regular Emptying (by survey type and city)**

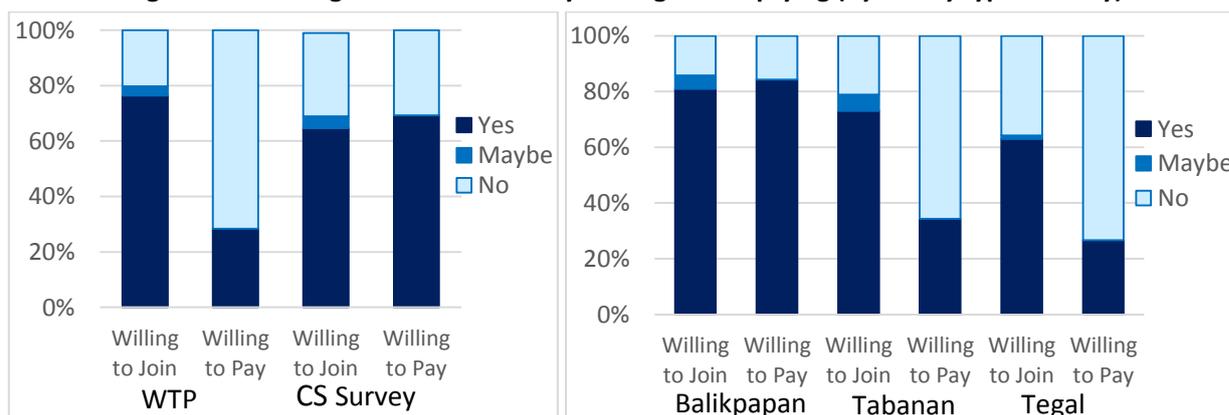


Figure 12 shows overall substantial interest in joining a regular emptying program, with the focus group discussions and data analysis finding that customers who had previously emptied their systems more interested. The respondents from the customer satisfaction survey (who had all emptied their systems in the last three years) were more likely to be willing to pay than the respondents from the WTP survey (83% of whom had never emptied their systems). Overall, there was a lower interest in such a program in Tegal (63%) than in Balikpapan (81%) and Tabanan (73%).

**Table 5 – Household Interest in a Regular Emptying Program**

<b>Reasons respondents were interested</b>	<ul style="list-style-type: none"> <li>• Monthly payments were low and more affordable than the cost of an on-demand service.</li> <li>• To avoid embarrassment when the tank is full and emits foul smells, causing problems in the neighborhood.</li> <li>• Maintaining the condition of the tank (Tegal)</li> <li>• Health reasons, though no specifics were described.</li> <li>• The monthly tariff is more affordable than building a new tank</li> </ul>
<b>Reasons respondents were not interested and their concerns</b>	<ul style="list-style-type: none"> <li>• Some respondents said that emptying their tanks every four years was unnecessary, as they had tanks that were 10 years old and they had not had any problems.</li> <li>• Middle-income respondents in Tegal thought that monthly payments were unnecessary and that current up-front payments were reasonable and more practical.</li> <li>• Some were not interested or questioned the sustainability of monthly payments based on their poor experience with other services (garbage and communal water in Tegal, security in Balikpapan), which not all households paid for.</li> <li>• They questioned whether the septage removal service would actually happen after they had paid the tariff or thought that they would have to pay even when the service was not provided. Tegal respondents said that they has been promised daily garbage removal but it was only collected twice a week and they were unable to contact management to report the problems. They suggested that regulations be implemented to manage payments, and that contact information and details of the person in charge be provided.</li> <li>• They questioned the government’s ability to implement the program, particularly as their current equipment is inadequate (size and number of vehicles, access to low-income areas).</li> </ul>

It will be critical to provide sufficient detail about the payment and emptying mechanisms and other arrangements, and reassurance about the service to address these concerns. Particularly with a four-year interval between emptying, the households will need to be convinced that the government will continue to provide services to sustain their willingness to pay for the services. This could be done by using media coverage of the services as they are rolled out around the city as evidence that the service is really operational and on-going.

Lessons from the experiences of residents paying and not paying other monthly tariffs for garbage removal or water should be taken into consideration when developing the billing and payment methods and sanctions for non-payment.

**4.3.2 On-demand emptying**

On-demand or on-request emptying is when a household contacts a public or private operator to empty its tank when needed, and this is the current approach to pit emptying in Indonesia. Bandung is the only exception to this, where the PDAM is obliged to empty the on-site systems of all customers who are not connected to the sewerage system. However, despite paying an extra 30% on top of their water bills for wastewater services, most households do not receive this service.

The aim of on-demand service improvements is to increase and ensure the discharge of collected sludge to a treatment facility in order to reduce indiscriminate dumping, improve service monitoring systems through more efficient processes, and improve septage treatment plant operations. Secondary aims are to build a customer database and improve services as a transition to regular emptying.

**Steps required to improve these services include:**

1. Identifying the current situation from existing city data, household surveys and assessment of operations;
2. Developing and implementing data tracking and recording, improving financial management, and offering incentives to private companies to discharge to treatment plants.
3. Improving the operation of sludge treatment plants, particularly to be able to manage increased loading.
4. Promoting regular emptying to households and communities.

5. Collecting customer on-site sanitation details (as per census) to develop a database for regular emptying.

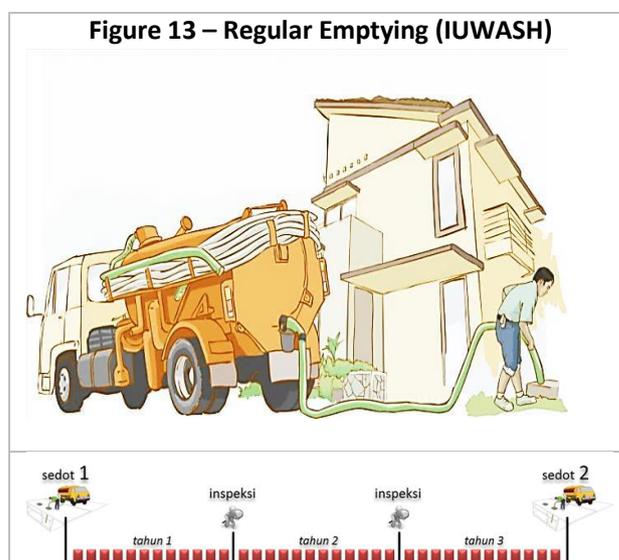
Development of a call center model with a central hub managed by local government that customers can contact to request emptying services was considered. However it was seen as inappropriate because of the lack of customer confidence in the government's ability to handle orders in a timely manner, the possibility of disorganized management and private companies not wishing to share their existing customer databases.

### 4.3.3 Regular Emptying

Regular emptying is also referred to as scheduled emptying or in Indonesian *layanan lumpur tinja terjadwal* (LLTT or L2T2). A regular emptying program would involve households paying a monthly tariff to receive scheduled pit emptying every 3-4 years. The program would be managed by the agency responsible for FSM and systems emptied by government or private sector trucks.

The main aims of a regular emptying program include:

- Preventing emptying prior to systems filling up so that households can continue to use their toilets.
- Maintaining the retention time of well-built septic tanks to ensure they function as designed.
- Reducing the number of systems discharging directly to drainage or waterways.
- Improving emptying efficiency: maximize use of trucks (full operation every day); improve ease of locating houses and tanks through door-to-door censuses; reduce truck movement through systematic, planned trips and emptying multiple tanks per trip, if possible.
- Increasing the number of systems emptied
- Spreading the cost of emptying over 3-4 years rather than upfront as a lump sum.
- Increasing the discharge of sludge to treatment plants, rather than dumping in rivers/land.
- Potentially generating income/revenue for wastewater agency from operations and reuse of treated sludge.

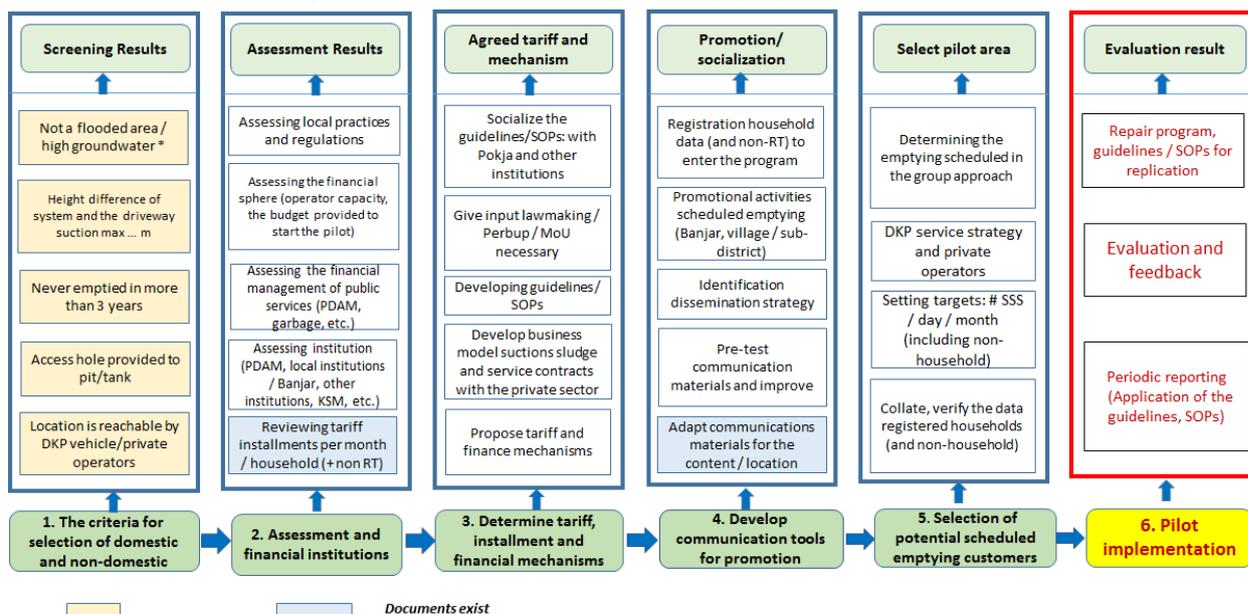


A summary of the possible steps toward a regular emptying program is presented below. This is continuously being refined as the pilot programs are developed and different approaches trialed in each city. Further details of the pilots are included in appendix 3.

1. **Screen census results** – Develop customer databases and assess suitable locations for pilots.
2. **Assess legal and institutional requirements** – Clarify responsibility for FSM and asset ownership, tariffs for sludge emptying and discharge to treatment plants, develop regular emptying participation/payment regulations as required.
3. **Regulations** – Commence regulations for regular emptying service provision, requirement to participate and emptying payment requirements (exact tariff to be input as the program develops).
4. **Agree on business model** – Agree on business model, including scope of pilot/program, frequency of emptying, agency responsibilities, and private sector involvement. Develop human resource capacity and IT systems. Develop MOU with private companies, including payment and monitoring mechanisms (i.e. ICT).
5. **Assess finance mechanisms and tariffs** – Assess and agree on billing and tariff collection methods and schedules for the TSU to develop agreements with external parties. Set up accounting system.

- Agree on tariff and incorporate into regulations. Obtain initial/standby funding for implementing pilots.
- 6. **Sludge treatment plant** – review capacity and operation requirements to handle increased loading, and train operators and implement quality monitoring if required.
- 7. **Promotion** – Develop tools for promotion and promote regular emptying to the pilot area (and private sector and other agencies involved)
- 8. **Select pilot area** – Select area for pilot, obtain household agreement to participate (if required), agree on emptying arrangements and period, pre-test ICT if used

Figure 14 - Workplan for Regular Emptying Pilot in Tabanan



#### 4.3.4 Private Sector Emptying Services

Emptying is provided by both public agencies and the private sector in most Indonesian cities but the majority of respondents of the household survey reported that they used private operators. Despite the relatively low proportion of households regularly emptying their on-site systems, interviews with private sector operators in many towns and cities indicate that sludge emptying is a viable business. Many of the private operators have existed for more than 10 years, and in some cities with multiple operators, even with relatively low demand the market is still large.

The first FSM TA recommended increased relationships between government and the private sector, highlighting the following advantages of sub-contracting private sector operators to provide services on behalf of the city:

- Facilitates regulation of private sector practices
- Reduces the need for government investment in septage tankers
- Ensures that the loads carried by the contractors are included in government records
- Allows rational planning of services, thus avoiding duplication and waste and ensuring that there are no service gaps.

This TA included an assessment of the private operators in each city, followed by activities to establish cooperative agreement between them and the wastewater agency. This assessment included discussing their willingness to sign a memorandum of understanding with the local wastewater agency to discharge sludge to the treatment plant, and their interest and ability to participate in a regular emptying program.

In the TA partner cities, private operators have a larger fleet of emptying trucks and are estimated to be the main provider of sludge emptying services (from the household survey and records of treatment plant discharge where they exist). A summary of the findings from the household survey and private sector assessment is shown in

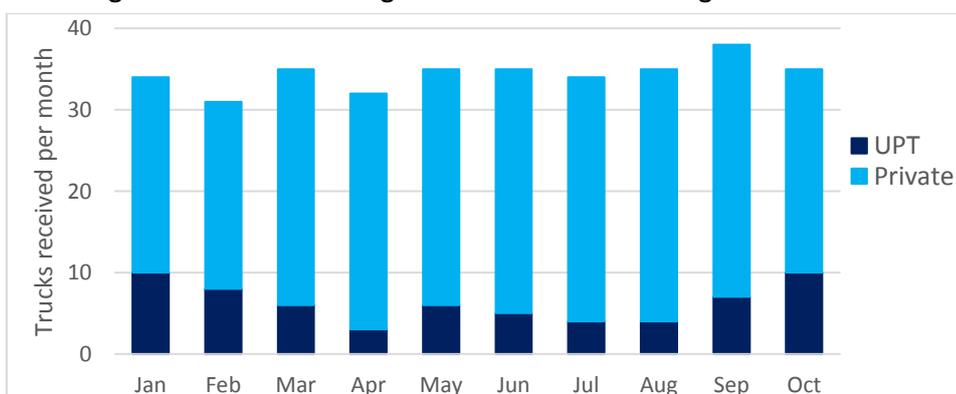
**Table 6 – Household Survey Findings Private vs Public Emptying**

Service Provider Assessment	Balikpapan		Tabanan		Tegal	
	Private	Public	Private	Public	Private	Public
Number of operators	3	DKP	6	TSU	7	TSU
Number of trucks (total)	8	0-1 <sup>a</sup>	11	3 <sup>b</sup>	7	1
Estimated number of pits emptied per day	16 <sup>c</sup>	Not operating	2/truck		<1/operator <sup>d</sup>	Not operating
Household Survey Findings	Private	Government	Private	Government	Private	Government
Who emptied pit	63%	37%	48%	52%	74%	26%
Average cost emptying- IDR	425,600	322,000	280,200	206,100	282,4500	244,500
- USD	32	24	21	15.5	21	18.5

- a) 1 truck has not functioned since 2013, new truck provided to cleaning department but as they are no longer responsible for FSM, it is unused.
- b) 2 new trucks were provided in December 2015 by the Ministry for the proposed regular emptying program.
- c) No data records of trips, estimate from private operators.
- d) The busiest operator estimated 25 trips/month, with 55% outside Tegal city.

Prior to the TA there was infrequent recording of discharge to the treatment plants, with the last records in 2013 showing annual number of trips of 159 in Balikpapan, 14 in Tegal (July-November) and 490 in Tabanan (344 government trucks, 146 private). In Tabanan, the TA introduced a monitoring procedure to record the number of requests for emptying made to the TSU and subsequent discharge to the treatment plant. This has been slowly adopted and the data for 2015 is shown in Figure 15. However, there are questions about the accuracy of data collected and the political economy factors influencing full transparency of operations (discussed in 5.3.2). It appears that the data was recorded for the first 10 days of the month, then the requests for emptying were possibly modified to match the discharge rate. It is unclear whether this was a misunderstanding, capacity issue or due to other reasons, however it was raised with the agency head and will be discussed internally.

**Figure 15 – Tabanan Sludge Treatment Plant Discharge Records 2015**



The cities differ as to whether private operators are permitted or compelled to discharge to government treatment facilities. All the sludge treatment facilities are operating below capacity, and although most do not have a formalized discharge fee, some operators collect fees (recorded and not). Despite being permitted to discharge to government facilities, when these are located far from the city or far from the customer, it is common for private operators to discharge sludge to drains, rivers or onto open land. In Balikpapan, the main private operator used to discharge sludge on to his property next to the treatment

plant, but following encouragement from a high level official that he should support the city's recent "Clean City" award and discharge into the rehabilitated treatment facility, he has done so and convinced other operators to do the same.

Private operators are the main providers of sludge emptying services in most cities, so their inclusion in the improvement of fecal sludge management is beneficial and necessary. Many government agencies do not have operating trucks or not enough trucks to serve significantly more customers. Some PDAM are not motivated to run a fleet of trucks, and the private sector can fill this gap. From the household surveys it was clear that the government trucks were unable to empty households in dense areas or away from the main road. It was common for government trucks to have shorter hoses of only 30 meters in length compared with typically 100 meters for private sector trucks. This should be addressed in the standards for trucks provided by government, particularly as it is often low-income households in the harder-to-reach areas that require the lower cost public services. Due to pit sizes between 1.5-3m<sup>3</sup>, a normal truck with long hose is more suitable to access these areas than the small motorbike tankers that have been purchased but are typically unused in the cities.

At present, private operators are not regulated nor have official arrangements with government agencies. However, in some cities an MOU with government permits their operation and their use of the sludge treatment facility. Existing MOUs are known in Jakarta (which also charges for discharge to treatment) and Bandung (monthly license to discharge into the sewer manhole). From the city assessments and discussion with private operators, there is a considerable interest in establishing a formal arrangement with government to permit their operation and allow discharge at the treatment plant. With the major service providers in each city, the opportunity to be involved in the regular emptying program was discussed as a second step of the MOU. All operators were interested in participating since they are currently operating below capacity.

In Tabanan and Balikpapan, both the private sector and government agency agree with an MOU to clarify roles and formalize the operation of the private sector. In Tabanan, the MOU is being revised to suit on-demand arrangements and discussions are underway with two private sector operators. In Balikpapan, it was recommended that the larger private operators be involved in the regular emptying pilot and there be an agreement with all private sector operators to force them to discharge at the treatment plant. The details of the MOU will depend on the proposed arrangement of the pilot regular emptying program (whether PDAM purchase trucks or rely on private sector only) and any revision to the tariff (currently no tipping fee). Box 3 shows a draft MOU with a private sector operator, based on an on-demand, upfront payment model (as in Bandung).

### Box 3 – Proposed Memorandum of Understanding with Private Sector Operators

The aim of the MOU is to regulate the operations of private sector operators to increase the discharge of sludge to the treatment plant. The TA recommends inclusion of the following requirements:

- Pay upfront monthly fee for discharging at the treatment plant based on the estimated number of trips (ie. 2 trips per day, 26 days per month).
- Discharge sludge at the treatment plant, with a minimum number of trips required to secure an MOU the subsequent month;
- Record customer details (as per census data to provide input to regular emptying customer database)
- Adhere to standards of quality of equipment, health and safety practices

As in Bandung, it is proposed that trucks get a sticker indicating they have signed an MOU for that month and the involvement of traffic police and other sectors will be sought to assist with enforcement.



### 4.3.5 Information and Communication Technology (ICT)

A key challenge of improving the FSM service chain is the delivery of emptied sludge to the treatment plant. The use of ICT is being explored as a method to track that trucks discharge at the treatment plant. This will also have wider benefits of providing customer data to pit emptiers and automating the recording of trips, useful for private operators billing trips in the regular emptying programs.

The scope of the proposed android system for the management of regular emptying by private operators includes:

- Dispatching to the private operator the batch of customers to be emptied for the month. This information can be viewed on a mobile phone and includes the data collected from the census (household contact details, GPS location and picture of the house, location and accessibility of the on-site system).
- Once emptying is complete, a barcode at the house (placed during the census) will be scanned by the pit emptier’s mobile phone (the equivalent of a customer signature on a manual form).
- The truck’s barcode will be scanned at the treatment plant to record discharge. This is the equivalent of the treatment operator’s signature but does not require the treatment plant to be manned.
- The last scan indicates completion of the order and the data from the phone is sent to the authority’s database. This is used to update the customer database with the completed/incomplete orders, confirm that all orders were discharged at the treatment plant, and to make payments to the private operator.

Figure 16 – Mobile phones used by private operators



Left to right Tabanan (2), Tegal (2) and Balikpapan

The same barcode system can also be used for regular emptying by public operators, but will be focused on tracking households that are emptied and ensuring that the sludge is discharged only at the treatment plant.

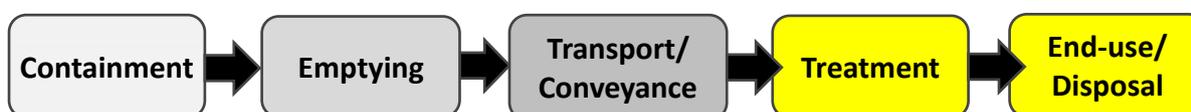
Figure 17 – Example of ICT process and Household Barcode (IUWASH)



This system requires both the agency and private operator to have adequate mobile phone and computer systems. Private operators in Balikpapan have adequate mobile phones and most also have computers, and the PDAM in Balikpapan has computer databases and uses mobile phones to read water meters, whereas the TSU in Tabanan does not have adequate technology or computer skills. Additional challenges of this system were identified by IUWASH in its first trial in Solo:

- Errors during the uploading of customer data from the census meant the private operator given the first batch of customers to empty did not have the correct details of the pit location and access. Care needs to be taken to ensure the alignment of the customer database and information collected by the census. Merging the new census app and the barcode app used by pit emptiers is expected to better align data.
- The sludge treatment plant did not have mobile data coverage. Since the app only functioned online, it could not be used at the treatment plant. The backup procedure of the operator signing the manual form also failed because the operator was not always there. A signal booster has been requested for the area and the app is being adapted to work off-line and send data when it later receives a signal.

#### 4.4 Sludge Treatment and Reuse



##### 4.4.1 Assessment of treatment operation in supported cities

More than 150 sludge treatment plants have been built in Indonesia since the 1990s. However, a survey by the MPW found that less than 10% of these are still operational and many of the 10% are not operating well. The first TA also identified poor performance of treatment plants in the previous study towns and recommended improving treatment plant planning and design procedures to take account of existing realities. The sludge treatment plants in Balikpapan, Tegal and Tabanan were assessed in April 2014 to understand design and operation challenges and recommend improvements to be incorporated in the Ministry of Public Works' National Septage Treatment Plant Guidelines.<sup>21</sup>

Key findings of the city sludge treatment plant assessments included:<sup>22</sup>

- Most treatment plants were receiving much lower loads than the design loading;
- Treatment units are not always operated as intended because the design operation is either not possible or not understood. However, often the design did not consider operational requirements (see Figure 18);
- Current management systems were geared to simple low-level activities and had limited capacity to manage improved or more complex technologies.
- Use of pumps to empty sludge settling tanks was often unnecessary and the systems could have been designed to operate under hydraulic pressure. Pumping did not occur as regularly as required.

The assessment proposed revisions to the standard operating procedures (SOP) in Tabanan and Tegal, while the Balikpapan treatment built in 1990s did not have SOP and was being rebuilt shortly after the assessment. The TA reviewed the new treatment design at Balikpapan, which highlighted that the consultants who did the design for the regional government followed the current national guidelines. However, the selection and design of systems was not optimized and did not adequately consider operation requirements. For example, there are five solid separation chamber units and only three

<sup>21</sup> Draft Ministry of Public Works Regulation for Wastewater Management Annex: Technical Guidelines on Septage Treatment

<sup>22</sup> See TA outputs: Report on IPLT Balikpapan, Report on IPLT Tabanan and Report on IPLT Tegal, May 2014 in English and translated to Indonesian.

drying beds and the initial sludge separation chamber cannot be emptied manually.<sup>23</sup> In Tabanan the recommendation to divide the large sludge drying bed has been implemented. However, subsequent visits highlighted that a document alone is inadequate to change processes and hands on-training would be more suitable. The difficult coordination of the various government levels and private consultants involved in sludge treatment plant design and construction highlighted the need to include a broad audience in the promotion and training of the new guidelines.

**Figure 18 – Operational challenges with current treatment plants**

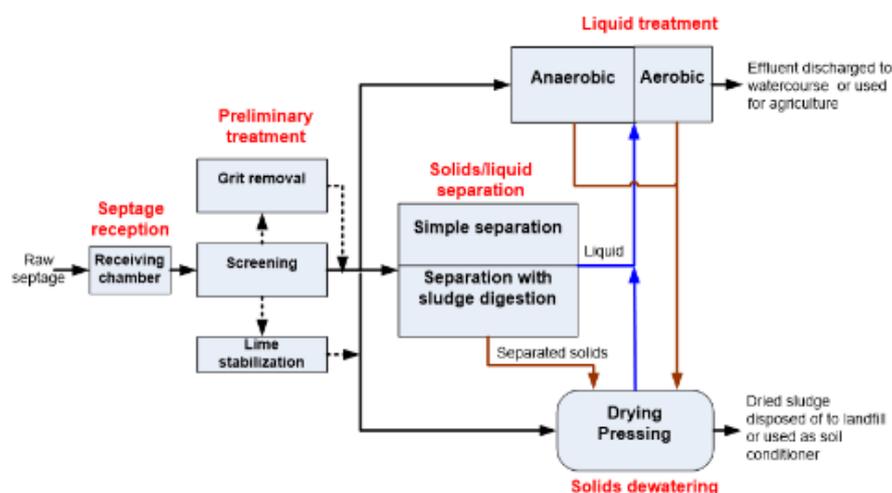


Based on the city assessments, the schematic in Figure 19 was developed to assist in the selection of suitable treatment options. The following recommendations were proposed for inclusion in the draft national design guidelines:

- The following should be included in the treatment objectives:
  - i. Remove water content of septage;
  - ii. Reduce the biological oxygen demand and suspended solid concentrations of liquid fraction of septage;
  - iii. Reduce pathogens to acceptable level.
- National guidelines need to refer to specifically to sludge or septage characteristics not only wastewater characteristics.
- Sludge treatment facilities should be designed with loading options which include:
  - Provision of two treatment streams so one can be taken out of service for desludging and maintenance.
  - Ensure that the loading system can operate effectively under the current (lower) loading conditions as well as under realistic estimates of ultimate design load.
- The following are recommended in relation to the treatment processes:
  - Screening should be provided, but grit removal may not be necessary for small plants.
  - Include solids-liquid separation to reduce the organic load of the liquid fraction and reduce the water content of solids.
  - Imhoff tanks are unsuitable (agreed by MPW in December 2015). Hopper bottomed sedimentation tanks as solids-liquid separation chambers (SSC) are recommended although further investigation of SSC is required.
  - Tanks should be designed to desludge through hydrostatic pressure rather than pumps.
  - All systems should be designed to allow safe operational access for cleaning and emptying.
- Improve truck access for discharge by reducing the slope on the access ramp to the discharge point and providing an adequate turn around area.

<sup>23</sup> Notes on Balikpapan IPLT design, WSP 2014.

Figure 19 - Overview of proposed treatment process options



#### 4.4.2 Assessment of Mechanized Treatment

With many new sludge treatment plants and optimization of existing treatment in planning, recent designs by development partners have included mechanized treatment options. Based on the current poor operation of many basic treatment plants, the TA investigated the existing mechanized treatment systems in Jakarta and Surabaya to understand their operation and the requirements for mechanized systems in Indonesia. Two systems exist in Jakarta (with mechanized Huber screen/grit removal and Huber Rota-mat sludge screw press) and Surabaya (oxidation ditch). The key findings of this investigation were as follows:

- Overall the systems were operating well and indicate that in larger cities mechanized treatment options are suitable.
- The Huber sludge press systems achieve good results (dried sludge suitable for reuse) when they work properly. They are suitable for the liquid sludge common in South-East Asia and compared with other mechanized dewatering options have relatively low power demands.
- Replacing parts is problematic due to few local suppliers, unpredictable budgets for spare parts, and the high frequency at which parts require replacement. For example, motors for oxidation ditches in Surabaya burn out quickly and Huber recommends replacing some parts every 3-5 years. Some parts are only available from Germany and most operators lack adequate asset management systems to order and store spare parts. Locally available or easy-to-repair parts would improve the operation and lifespan of the systems.
- There are few worldwide examples of septage treatment plants for similar conditions. New technology requires field testing to assess which options are best suited and to understand the design consideration for local conditions.
- Monitoring of sludge characteristics is inadequate. The lack of sampling and monitoring during operation (especially the oxidations ponds) results in sub-optimal operation. There is limited existing data on fecal sludge characteristics to design treatment processes. Data that is available varies greatly, which is also found in international studies, and indicates that systems may need to operate across a range of influent conditions. This is another reason why increased monitoring and field testing is required.

**Figure 20 - Jakarta Huber screw press and Duri kosambi dried sludge from the screw press**



### 4.4.3 Reuse Assessment

The assessment of reuse practices was limited by the poor operation of existing treatment plants, which were not regularly producing treated and dried sludge for reuse. The existing systems in Tegal and Balikpapan were not receiving high loads or operating sufficiently to produce dried sludge. However, operations staff in Balikpapan indicated they had previously emptied sludge but disposed of it into landfill. While there was discussion about the reuse of sludge in Balikpapan for land rehabilitation required due to the mining activities in the province, this is a long way off and unlikely. Tabanan has occasionally remove dried sludge and dumped it next to the drying beds; however, due to the Balinese culture that sees waste as dirty and untouchable, this was not reused.

While the supply side is low, there is also low drive from the treatment plant operators to sell the sludge, possibly because the treatment plants operated by local government departments or TSU are not commercially driven. At national level there has not been a strong focus on the regulations for reuse or the promotion of sludge as a source of income generation for treatment plants.

**Figure 21 - Dried sludge after periodic cleaning maintenance (Tabanan)**



## 4.5 Financing FSM

### 4.5.1 Current financing arrangements

A summary of the main sources and mechanisms of funding for the FSM service chain is shown in Table 7 below.

**Table 7 – Funding the FSM Service Chain**

Level	Requirement
<b>On-site sanitation</b>	
Household	Toilets and on-site systems are typically fully self-funded.
Local Government	The new OBA for on-site sanitation program requires up-front local government funding, to be reimbursed after construction by national government. Some local governments are concerned that the proposed IDR 3 million (US\$300) per system will be insufficient to cover costs and are uncertain who will be responsible for covering the gap.
National	The Ministry of Public Works has allocated IDR 200 billion to the on-site sanitation OBA program

Level	Requirement																				
Government	in 2016. The aim was to implement in 100 cities, however currently less than 20 cities will take part due to various budget and administration issues (discussed in Appendix 2).																				
<b>Emptying and Conveyance</b>																					
Household	<p>Currently pay directly to truck driver upon emptying. Bandung is an exception, where piped water supply customers pay 30% on top of their water bill for sanitation (either for the sewer tariff or to receive regular emptying).</p> <p>Based on local regulations and household survey responses, the current emptying tariffs are:</p> <table border="1"> <thead> <tr> <th>IDR/pit emptied</th> <th>Balikpapan</th> <th>Tabanan</th> <th>Tegal</th> </tr> </thead> <tbody> <tr> <td>Regulated fee</td> <td>350,000</td> <td>200,000 – 300,000 depending on distance</td> <td>50,000 (1m<sup>3</sup>) to 150,000 (for &gt;2m<sup>3</sup>)</td> </tr> <tr> <td>Range of emptying costs reported in survey</td> <td>150,000-1million</td> <td>100,000-600,000</td> <td>60,000-700,000</td> </tr> <tr> <td>Average &amp; range of fees charged by government*</td> <td>322,000</td> <td>206,100</td> <td>244,400</td> </tr> <tr> <td>Average &amp; range of fees charged by private operators</td> <td>422,600</td> <td>280,200</td> <td>282,500</td> </tr> </tbody> </table> <p>* Government tariffs may vary from regulated tariffs where additional fees for longer hose length or opening tanks are charged. Private operators set their own tariffs.</p>	IDR/pit emptied	Balikpapan	Tabanan	Tegal	Regulated fee	350,000	200,000 – 300,000 depending on distance	50,000 (1m <sup>3</sup> ) to 150,000 (for >2m <sup>3</sup> )	Range of emptying costs reported in survey	150,000-1million	100,000-600,000	60,000-700,000	Average & range of fees charged by government*	322,000	206,100	244,400	Average & range of fees charged by private operators	422,600	280,200	282,500
IDR/pit emptied	Balikpapan	Tabanan	Tegal																		
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Average & range of fees charged by government*	322,000	206,100	244,400																		
Average & range of fees charged by private operators	422,600	280,200	282,500																		
Local Government	<p>Operation cost and management varies with institution:</p> <p>TSU Tabanan:</p> <ul style="list-style-type: none"> <li>As a government department unit, it cannot receive money or make a profit, and must transfer the income from emptying and tipping to the treasury within 24 hours. For regular emptying programs, a third party would have to be involved to collect the money and transfer it back to the TSU.</li> <li>Operation costs are covered annually by local government budget.</li> <li>Additional expenditure, such as upfront funding for the regular emptying pilot, must also come from local budget. In both Tabanan and Makassar, the TSU did not receive the requested budget for the pilot program and are awaiting the mid-year reallocation.</li> </ul> <p>PDAM Balikpapan:</p> <ul style="list-style-type: none"> <li>Although it does not currently provide emptying services, it does operate a sewerage system. While a PDAM typically generates income and must use this to cover its operation costs, there is a different arrangement in Balikpapan because the city owns the wastewater treatment plant. Here, “retribution” from households goes to local government and it provides an annual operation budget for managing the program and operating the treatment plant.<sup>24</sup></li> <li>PDAM have flexible finance options. For example, the sister “cooperative” organization of the PDAM in Balikpapan provided the upfront financing for the pilot, while in Solo the PDAM covered the cost itself.</li> </ul>																				
National/ Provincial Government	Trucks are typically paid for by national government budget or grants, and in the past budget allocation appeared to be ad-hoc. Trucks are also included in the new OBA, depending on the number of new systems installed.																				
Private	Private operators are typically informal businesses (or side businesses) with no proper bookkeeping. Estimated operation costs (staff, petrol, truck maintenance, tipping fees) are all required as inputs to calculate regular emptying tariffs.																				
	In Bandung, private operators pay an upfront monthly fee to discharge into the sewerage. This is based on an estimated number of trips per day and the cost of emptying.																				
<b>Treatment &amp; Reuse</b>																					
Local	Currently all sludge treatment plants are government agency (cleaning department or TSU)																				

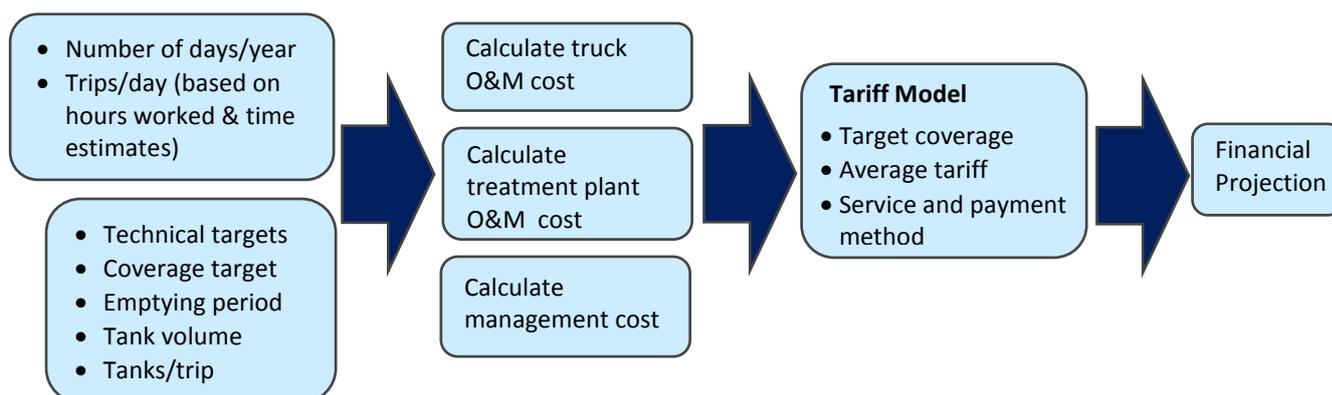
<sup>24</sup> Using “retribusi” (retribution) means it cannot be paid in advance of the service and requires that the money goes to local government rather than “tariff” which can be paid upfront and collected by the PDAM or a similar agency.

Level	Requirement
Government	owned and operated. Therefore, operation costs are estimated from the local annual budget. In Balikpapan, it was agreed that the PDAM would operate the new plant even though provincial government would own the asset during the estimated two-year handover period. Based on a newly enforced Ministry of Home Affairs regulation, the PDAM have agreed to pay IDR 7million (USD/year to use the plant.
National/ Provincial	Treatment plant design and construction are financed by national and provincial government and grants. These are intended to include major repairs.
Private	Sludge discharge to the treatment plant is either not regulated/free (Balikpapan), informally charged or included as a formal fee (Tabanan IDR 50,000/trip and Tegal IDR 15,000/m <sup>3</sup> ). In many cities, recording and collection of this fee is not monitored, possibly due to the low numbers of trucks discharging. It has been proposed that upfront payment of fees based on an MOU between the government agency and private operator will be used for improved on-demand emptying, and depending on the financial arrangements, some cities have proposed that private operators be charged no fee for discharge as part of the regular emptying program.

### 4.5.2 Tariff Setting

A model for calculating the tariff for regular emptying was developed in partnership with IUWASH to suit current government and private sector operational costs and the proposed conditions of regular emptying programs. The inputs are based on data provided by the various agencies. However, accuracy varies since the expenses for sanitation are typically not separated from the overall agency costs.

**Figure 22 – Calculating Tariff and Financial Projections for the Regular Emptying Tariff Model**



Steps for calculating a city regular emptying tariff:

1. **Collect data** including current operation and maintenance costs of emptying, treatment and management; details of pit/tank size, time required for emptying and disposal, truck size; analysis of institutional capacity for payment and private sector involvement.
2. **Agree on regular emptying model** including government and private sector, coverage, frequency, costs and subsidies.
3. **Agree on tariff** including variations for non-residential areas, communal treatment and low-income households. Level of agreement required varies per city but recommend broader stakeholders included in discussions (lesson from Solo).
4. **Update regulations** to include requirement to pay tariff and participate in regular emptying program, and tariff amount.
5. **Update financial systems** of agency to include separate line items for monitoring expenses and income. If TSU, set up an agreement with another institution to bill and collect payments.
6. **Promote and implement** the new tariff.

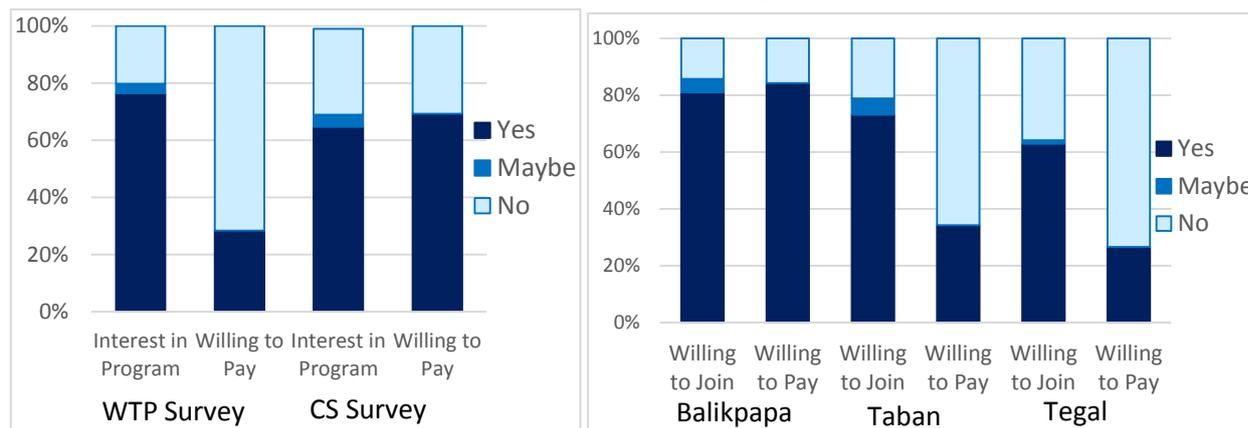
The details of the inputs and assumptions to the tariff calculation model are included in Appendix 4. Based on the current regular emptying model approach and an estimation of expenses based on data

and discussions in Balikpapan and Tabanan, an average tariff of IDR 9,500/month and IDR 8,500/month respectively have been proposed and agreed although not yet incorporated into regulations. As has occurred in Solo, this is to be an average tariff with potentially a lower charge for low-income households and higher charge for commercial or office buildings.

### 4.5.3 Willingness to Pay

From the willingness-to-pay survey, overall 72% of respondents were willing to join a regular emptying program and 46% willing to pay towards regular emptying. Willingness to pay was higher for respondents who had previously emptied their systems (69% in the customer satisfaction survey [all previously emptied], vs 28% in general WTP survey) and by residents in Balikpapan (see figures below).

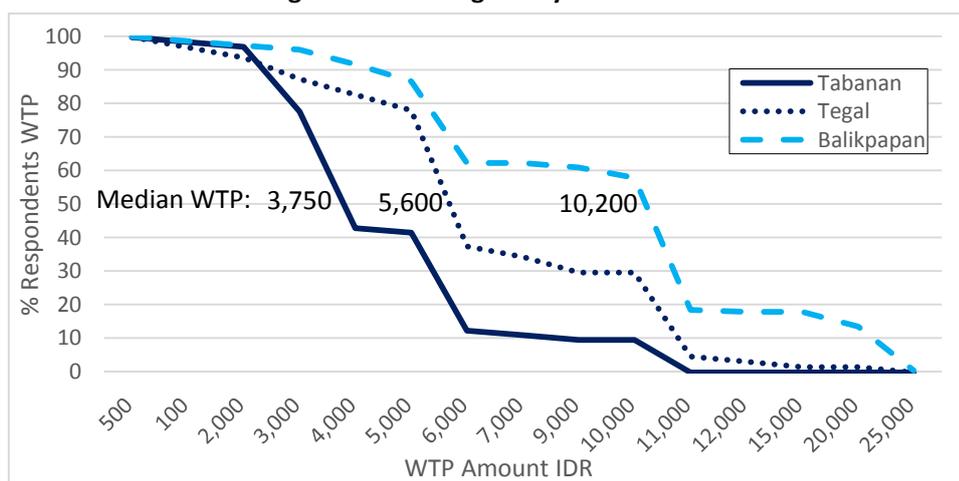
**Figure 23 – Willingness to Join and Pay for Regular Emptying Program**



Other key findings:

- **Amount willing to pay:** Tabanan respondents reported the lowest amount with a median IDR 3,750 compared with IDR 5,600 in Tegal and IDR 10,200 in Balikpapan. With a higher living cost in Balikpapan, over 50% of respondents were willing to pay more than IDR 10,000 per month.

**Figure 24 – Willing to Pay Amount**



- **Preferred method of payment:** This differed between the cities. In Tabanan respondents preferred to pay the local government office (53%) and with the solid waste fee (25%); in Tegal, payment to the government office was also preferred (54%) followed by to the neighborhood head (20%); while in Balikpapan, where a greater proportion of households have access to piped water, the preference was to combine payment with their water bill (36%) or pay to the neighborhood head (36%). While paying to the local government or water agency is perceived as a trusted and credible, paying to the neighborhood head is practical since close to home. Interviews with some neighborhood heads

indicated it was often difficult to collect contributions from their communities, with some households not routinely paying security or other fees

## 5 Lessons Learned

### 5.1 Institutional and Legal

#### 5.1.1 Fast vs. slowly emerging – a disconnect between national and local change

There has been a significant increase in the understanding of the need to improve on-site sanitation and FSM at the national level and significant amounts of finance are being made available. However, this has not **yet led to specific FSM policies and there is a disconnect between the national drive and local government ability** to implement such programs.

Through various FSM capacity building activities, technical assistance and piloting (see Appendix 2), discussions, planning and subsequent prioritization of FSM has increased considerably. While national government prioritizes on-site sanitation and sludge treatment, there are no clear policies and regulations to provide cities with a sufficient basis to request local budgets and political support. However, MPW is addressing this, with national FSM regulations and a wastewater policy being developed, and FSM support provided to selected cities.

The strong national drive and ambitious targets have led to the development of programs and budgets, including improvements to on-site sanitation through OBA mechanisms; funding sludge emptying trucks and new or rehabilitation of sludge treatment plants. For the OBA program, although the budget was available and programs approved to start, the cities were not ready to receive and implement the program due to difficulty in meeting the readiness criteria and getting local budget approval in time; or they were unwilling to participate. A lesson learned from this is the need to develop, clarify or modify the local agency responsible for FSM and that **change and development of institutions takes time**. The mismatch in timing of national/provincial funding and the process required for the city to clarify responsibility for FSM also complicates asset handover. For example national government funded trucks were given to the TSU in Balikpapan despite responsibility having moved to the PDAM.

The speed at which national government is developing programs and guidelines is commendable, however local governments are reacting with some caution and in some cases are unable to participate. Thus **there is a need for more capacity building and promotion**, as concepts such as regular emptying and OBA for on-site sanitation are new and appear complicated. It is commonly accepted that **the guidelines for some technical components need improvement**, such as for the types of on-site sanitation system or sludge treatment components, and should include best practices and findings of field assessments. While government requests input and advice from the findings of field work and analysis, there is often insufficient time to incorporate these findings into reports so they are added as appendices that may contradict the main report.

#### 5.1.2 Importance of advocacy and champions

**A strong inter-agency sanitation working group is important.**

As FSM and particularly regular emptying are new concepts, the necessary advocacy and support to get the mayor to agree to regulations and funding for FSM activities was greatly assisted by an active and strong sanitation working group.

Strong working groups typically included the heads of each department, rather than lower level staff, and had close links with Bappeda. They were particularly strong where the head of Bappeda led the working group.

Involving all working group members assists with the continuation of programs and ideas despite staff rotations (as described below). While the PDAM have typically not participated in the working groups, with their increasing involvement in sanitation it is recommended they are included. The PDAM in

Bandung, for example, is not involved in the working group and there is a clear disconnect in urban sanitation programs and also no motivation for the PDAM to fulfill its responsibility to provide regular emptying to paying customers.

Having **a local champion** who is motivated to promote FSM, willing to lead and well connected with the mayor and/or Bappeda can be particularly useful. In Balikpapan, for example, one well-connected champion was able to continue to support FSM improvement even after transferring to a new role in local government and another helped inform a newly appointed mayor about the program.

With the various regulatory changes, clarifications of responsibility and financial support needed for an improved FSM program, **it is vital to include the head of the city planning office (Bappeda) and head of the wastewater agency** from the start of advocacy and discussions. Their ability to involve other departments, make decisions and changes, and push regulations and budget through local government are particularly necessary due to the lack of clear national regulations and alternative requirements of regular emptying.

**Staff rotations between different government departments and agencies** occurred at high- and mid-levels in all cities during the TA. In all cases, this caused delays, highlighting **the benefit of strong advocacy material and official organizational mandates and signed agreements being in place as soon as possible**. A signed agreement to participate in FSM improvement was a preliminary step of the WSP team's support in each city and ongoing decisions were also agreed in writing, making the transition to a new management simpler. As discussed in section 3.3, in Tabanan, due to reasons of staff authority, other priorities and a less strong working group, there was no formal commitment to participate or progress FSM with TA support.

### 5.1.3 Clarifying roles and mandates and capacity building for FSM institutions

The need and challenge of clarifying institutional responsibility for sanitation at a local government level was identified in the first TA. The set up and conditions of institutions in each city are different, and the PDAM in cities that do not yet provide water services to a majority of residents may be unable to take on extra responsibilities. However, in cities such Balikpapan (where the PDAM serves over 70% of the residents with piped water and also manages a small sewerage system) there are clear benefits of the PDAM being responsible for FSM. In the study cities, the benefits of the PDAM managing FSM included:

- **Human resource capacity** – the PDAM typically had more staff with more skills and a more flexible capacity to increase staff numbers than the TSU;
- **Information technology resources** – the PDAM (notably in Balikpapan) had computers with GIS and online customer databases, and experience in using ICT, whereas the TSU in Tabanan had only one computer and poor IT skills;
- **Budget flexibility** for pre-financing regular emptying. While the PDAM in Balikpapan was able to provide up-front funding for the pilot through its cooperative and the PDAM in Solo funded the pilot from its budget, the TSU in Tabanan and Makassar had to request local government budget for the pilot and were refused.
- **Business drive** while dependent on the management attitude, the business mindset and drive for profit of the PDAM was evident. However, it is vital that the PDAM provide financial details of the regular emptying program.
- **Tariff collection** is more straightforward with a PDAM as they can include payments for emptying in customers' water bills and they often already have customer databases, billing systems and payments points for water supply.

Additionally,

- **Promotion** requires clarification of who is responsible for it. The approach and source of funding for promotion of the regular emptying program and any new regulations. Additionally, the

commencement of promotion is a clear indicator of the city’s commitment to the program and willingness to convince public and government of its benefits and need.

**Staff capacity is a major concern in improving FSM.** Many agencies have insufficient capacity to manage existing on-demand emptying well, let alone the more complex requirements of a regular emptying program or mechanized treatment. It is not only a question of increasing staff numbers, but also of building staff skills to ensure they have the technical, financial and planning capacity to manage, and computer skills to use, automated management systems.

Similar to the findings of the first TA, whatever the level of political commitment, resources and capacity, **it is possible to improve FSM at any level.** Within this TA, WSP was able to adapt the nature and type of FSM improvements to suit the institution, while also developing an improved understanding of the requirements to progressively move towards improved on-demand and regular emptying. The changes in the ladder since the first TA reflect the progress that has occurred in the sector with the upper steps leading towards improved on-demand and regular emptying, and the inclusion of PDAM and PDAPL in FSM.

**Figure 25 – Updated Ladder for Institutional Change**

	EXISTING SITUATION	RECOMMENDED ACTIONS	
5	PDAM/PDPAL with clear regulation, customer/financial database, billing system and ability to increase human resources and plan strategically.	Starting with a pilot project, move towards regular emptying in all built-up areas and improve on-demand emptying. Income matches operational expenditure and efficient tariff collection. Budget for long term and planning for system expansion, engaging with private sector to meet demand if needed. Improve treatment plant performance to manage increasing load, including regular monitoring and improved quality dried sludge to develop reuse opportunities.	Jakarta
4	PDAM/PDPAL/TSUD exists with clarified responsibility, management/finance systems and staff to adequately manage on-demand emptying Have adequate vacuum trucks or willing to work with private sector. Treatment plant operational.	Improve on-demand emptying and reduce gap between expenditure and income. Planning/preparing for regular emptying pilot project based on census data. Develop regulations, management and financial systems to incorporate regular emptying and MOU with private sector if required. Improve treatment plant performance and operation to manage increased loading.	Solo Bandung Balikpapan Makassar
3	TSUD exists but incorporated into other department (ie. Solid waste or cleaning). Operating on-demand emptying service and have basic monitoring and reporting processes.	Consider suitable management options for FSM in future, (ie. for regular emptying) and begin Legislature process to change or clarify responsibilities if required. Ensure that job descriptions include specific reference to septage management. Review on-demand management and potential need for regular emptying based on monitoring of demand and discharge.	Tabanan Bogor
2	TSUD for septage management exists but poor records and financial performance. Treatment exists but not operating well.	Implement record system and then produce and implement basic strategy to improve performance/to improve government on-demand emptying and delivery to treatment plant. Ensure tariffs are adequate and regulated and develop MOU with private sector to discharge at treatment plant. Review treatment plant operation/status and capacity.	Tegal Metro
1	Municipality has sludge tanker and IPLT, managed by DINAS. Maybe some private tanker operators.	Legislate for creation of separate technical service unit with responsibility for all aspects of sanitation and septage management. Form business unit..	
0	No formal septage management and no septage treatment. Maybe private sector.	Produce and implement septage management plan based on realistic assessment of demand.	

**5.1.4 Regulations are missing, unclear and inconsistent**

In addition to there being no overall national policy guiding cities to develop FSM, there is **no umbrella regulation** for FSM, which has slowed development and approval of regulations due to uncertainty about terminology and processes. A common challenge is the number of different regulations relating to FSM services, and the time needed to update regulations as necessary.

A **national guideline for streamlining sanitation regulations** would help cities understand which level of regulation is required, and providing a glossary of terminology would help avoid confusion. Due to the different management arrangements and existing regulations in each city, this guideline would need to be flexible to suit each city. Additionally, **the application of regulations is inconsistent between cities.** For example the national environmental discharge regulation is used to charge private operators in Bandung but not in the other pilot cities. Although regulations must be specific to the current situation, where possible it is beneficial if **regulations are inclusive to future regular emptying programs and**

**operators.** There is a particular need for clarification on what items can be included in each level of regulation, from regional regulation to MOU, to assist decision making on type of regulation used.

The initial TA and studies by WSP and others found that the **asset handover process is complicated and slow.** The change of management responsibility is often further complicated due to the handover of assets, which requires clarification of current ownership (many were never fully handed over from national government at decentralization), an audit of what exists, and agreement to receive the asset (which is often a challenge for poorly functioning sludge treatment plants). For example, the handover of the sludge treatment plant in Balikpapan is expected to take two years, during which time the PDAM will pay rent for use of the facility, a process which has taken time to clarify with MoHA and agree on an acceptable rate. It is still unclear whether the trucks will also be handed over and when the operation of the treatment plant will change to the PDAM. These are similar issues to those being faced in the handover of assets to PDPAL in Jakarta.

## 5.2 Containment: Improving On-site Sanitation

### 5.2.1 Why an on-site sanitation census is needed

Learning from the outcomes of a previous census by IUWASH and data collected by the Health Department in Balikpapan, it was clear that census data could easily be invalid or simply not very useful if it was not accurately collected or contained insufficient detail – in both cases re-surveying is now required. The process in Tabanan was time consuming, with significant support required at each stage, however this resulted in accurate data, has built the capacity of various agencies in implementing the survey and they are now able to independently replicate it in other areas. The TSU now has a customer database developed from data from the census in three areas, and has learned to input customer data using a simple emptying database in Excel spreadsheets. It will replicate the census in six additional areas in 2016 and feed the results into the city sanitation strategy.

The development and implementation of the census in Tabanan was a multi-agency process, and although the data was preliminary for the benefit of the TSU, the other agencies identified its value as follows:

- The health department identified locations practicing open defecation to target sanitation campaigns;
- The public works department was able to prioritize locations for the building of communal toilet facilities;
- The general benefit of a database of households that is shared between agencies.
- The TSU having a database with sufficient details on location and access to on-site systems is the first step towards regular emptying program.

### 5.2.2 Improving on-site sanitation quality is vital to achieve the benefits of improved FSM

With the poor quality of on-site sanitation systems found in this and other studies by WSP, an improved fecal sludge management program alone will not reduce the pollution caused by unsealed or poorly built systems. However, both on-site systems and FSM must be improved in parallel since improving one will increase demand on the other, with better sealed septic tanks found to require more regular emptying.<sup>25</sup> As recommended by WSP ESW and following the success of the DFAT funded output-based grant program for sewerage, national government recently launched an output-based grant program for improving on-site sanitation and aims to meet the parallel goals of improving on-site sanitation and the requirement to improve FSM practices. Details of the proposed OBA are in the appendix, and while it is an important approach to achieve improved on-site sanitation at scale, some initial challenges include:

- Insufficient promotion and subsequent uncertainty of local government about the program requirements, resulting in less than 20 cities participating compared with a target of 100 cities.

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<sup>25</sup> WSP Sludge Accumulation rates, 2013

- The request for local government budget required for up-front payment is time critical and some cities were unable to obtain approval for the annual budget. However, MPW does not allow cities to commence mid-year even if they are able to obtain budget in the mid-year review.
- Verification criteria is uncertain – cities are worried that they might build systems only for them not to be verified and reimbursed if national government does not agree that they meet the strict criteria (low income, join regular desludging).
- Concern that construction of on-site systems will cost more than the IDR 3 million allocated and uncertainty about who will cover the gap in funding.

While access to the tank for emptying is a key issue identified in this and previous studies, the difficulty finding and opening on-site systems is yet to be addressed. In Solo, confusion about the census led to many of systems in the first pilot being inaccessible or difficult to find and open, while in Dumaguete, Philippines, the regular emptying program has been stopped due to difficulties finding the systems and being unable to access them inside or at the backs of houses during the day. (However, households agreed to continue paying in installments for an on-demand service.) The census is a preliminary step to address this challenge, as it will identify the location and accessibility of the system. How this information is then incorporated into the regular emptying program is unclear with these systems being avoided for the pilot, but possibilities include charging the households a penalty fee or compensation provided to the private emptying operators due to the significant extra time needed to empty these systems.

## 5.3 Emptying

### 5.3.1 Moving from on-demand services to regular emptying

With evidence of the need to improve FSM services outlined in the previous TA and applied research by WSP and others, there has been an increased recognition and prioritization by national government to improve FSM services. While WSP's preliminary work had focused on improving the on-demand approach, the IUWASH program primarily focused on developing regular emptying. With new and effective promotion material such as the Jakarta animation video, the income potential, and it being a "new/innovative" idea, regularly emptying has become a significant focus of the national government's sanitation strategy.

The potential benefits of regular emptying that appeal to the national government include:

- Significantly increasing the use of existing investment in under-utilized sludge treatment plants;
- A systematic and sustainable approach to improving the on-site sanitation component of urban sanitation (which will continue to be >80% of urban sanitation in most cities).
- With the time required to develop sewerage projects, the development a regular emptying program will demonstrate the government's commitment to addressing urban sanitation challenges at scale.
- Reducing the indiscriminate disposal of fecal sludge (and consequent public health risks and environmental pollution) by informal emptying services, by providing incentives for safe disposal at a sludge treatment facility.
- Providing a means to leverage benefits from an existing private sector that is motivated to increase its operations, with the government recognizing the benefits of working together.

Although WSP initially prioritized developing models to improve management of on-demand approaches, national government decided to move ahead with trialing the use of regular emptying. This decision was based on the formative research findings indicating a strong interest from households. This motivate local government agencies to start regular emptying and IUWASH started to pilot regular emptying in Jakarta and Solo where the government agencies were not offering on-demand services.

However, as the requirements for regular emptying programs and the time needed for implementation became clearer, IUWASH and national government realized that the approach being taken by WSP to build up and improve on-demand capacity and systems, while also developing the regular emptying pilots, was a necessary interim step. Many of the processes for on-demand emptying can be adapted to

regular emptying management and provide a straightforward approach to test and develop these systems. At the same time, the rapid implementation by IUWASH of regular emptying programs provided substantial information, processes and tools that could be used by other cities. Additionally, IUWASH could reshape their models based on findings from WSP research and census.

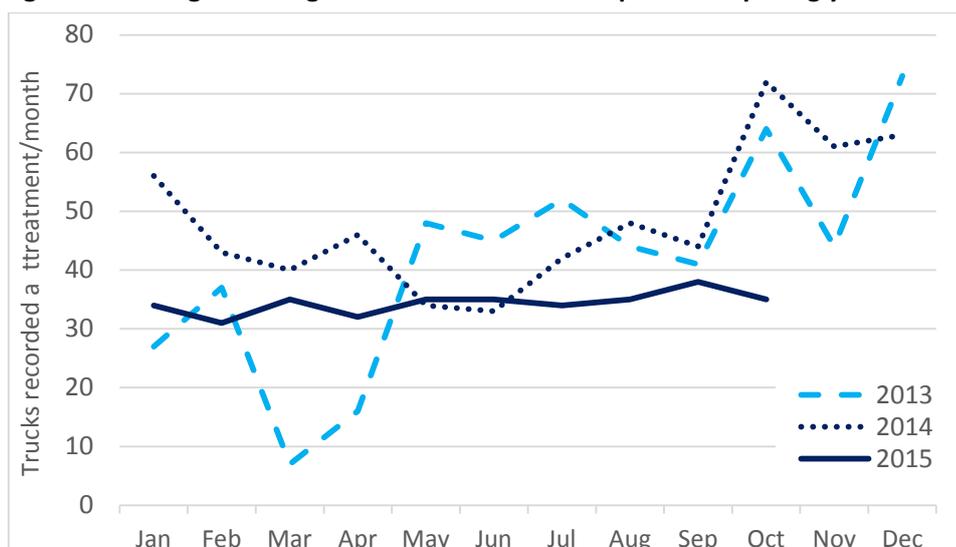
### 5.3.2 Improving on-demand emptying service models

With the aim of the TA was to implement improved emptying models in the partner cities, the process of clarifying and changing institutional responsibility took considerable time and it was necessary to take **one step at a time to improve emptying services**. In Balikpapan, it was quickly realized that the PDAM was the most appropriate organization to manage FSM and therefore the capacity building focused on the regulations required to change responsibility and assisting the PDAM develop a FSM task team to manage FSM, in particular regular emptying.

A finding linked to the Institutional ladder (Figure 26) is that **the scope for improving existing on-demand operations is dependent on the staff capacity and information technology resources**. In Tabanan, there was significant step-by-step support by the TA including during the data entry by the health agency and with the TSU to analyze the data and extract information on emptying and pit type to develop a customer database for regular emptying. Although the process was slow, the resulting database quality was better than in other cities and adequate for developing the regular emptying pilot. Through the TA support the capacity of the TSU has been built for managing a customer database and the TSU and health department are now able to implement the next stage of the census independently. While manual recording of orders and discharge to the treatment plant was adopted, there was no strong motivation to improve it. This changed when the cleaning department understood the benefits of TSU reporting and saw its value to planning, budgeting and promoting regular emptying. The records became a mechanism for communication between the two agencies that had been lacking. It is insufficient and unsustainable to improve data collection without having a use or demand for the data.

The **political economy influences willingness and speed to improve FSM services**. There has also been little motivation for sludge treatment plant operators to adopt the proposed standard operating procedures (SOP) or track discharging trucks. As was seen in Figure 15, the data collection in Tabanan is incomplete and the emptying demand data, used to check if all deliveries reach the treatment plant, also appears to be inaccurate. This could be due to lack of skill and understanding of the process and purpose, but it could also be that the operator (and TSU/department staff) are not motivated to accurately record operations, and in Tabanan there appears to be a disincentive to operate a fully transparent system. Government and private roles and responsibilities were not clearly defined and some blurring occurs, particularly around government trucks being used by private operators or by government employees running private emptying businesses. Without clearly defined regulations, private sector operation is sometimes perceived as “illegal”, and clarification of roles and private sector MOU could make the sector more transparent and allow for better monitoring.

**Figure 26 – Sludge discharged at Tabanan treatment plant – surprisingly flat in 2015**



2015 data monitored using a TA supported tool. Previous data provided by the TSU.

### 5.3.3 Developing regular emptying pilot programs

The process of implementing pilot regular emptying programs has also been slow due to the need to develop new regulations and finance mechanisms, conduct on-going advocacy to change management and staff perceptions, and fine tune the new concept of regular emptying in Indonesia. The details of the current and proposed pilot programs by WSP and others are detailed in the Appendix, and there has been a clear benefit of parallel development in multiple cities, with lessons learned and shared as the sector works closely together to develop this new emptying model to fit the Indonesian context.

At the time of writing, the pilot areas were being defined and tariff set in Balikpapan with budget available to start in April. In Tabanan, a proposal is under development but likely to be finalized more slowly due to staff capacity limitations and the need to wait for a local government budget. While WSP supported Bandung to implement an initial round of regular emptying for 250 households, there were long delays in implementing subsequent programs due to lack of budget and change in PDAM management, (See section 5.5).

Although IUWASH started the pilot programs earlier, the development and government advocacy was such that they experienced a wavering of interest and difficulty obtaining approval for some aspects at the local level. Although at times slower, the WSP approach was city driven with all options being decided by the city, and their drive and commitment was needed prior to progressing. Although there are clear benefits of regular emptying, it is more complicated to set up in cities where sludge management is almost non-existent. Rushing this process is unlikely to lead to successful or sustainable services.

Based on the steps to shift to regular emptying, the following challenges and considerations have been learnt through developing the pilot programs.

**Table 8 – Lessons Learned and Considerations for Regular Emptying Pilots**

Activity	Lessons Learned and Considerations
Census	Care must be taken to ensure the census collects accurate and sufficient information and that data is recorded and uploaded into a database/GIS correctly. Many cities currently do not have the necessary computer and GIS skills and will require support. Using the same app for census collection as to provide truck drivers with customer information might overcome the problem of mismatched data.
Regulations	While lessons can be shared between cities, regulations are set up and implemented differently. Regulations should be a first priority in developing regular emptying due to their long processing

Activity	Lessons Learned and Considerations
	time.
Management mechanisms/ business model	The regular emptying model will vary depending on the capacity of the managing agency, private sector involvement and financial arrangements. With different approaches currently being trialed in each city (TSU, PDAM, PDPAL, involving and not involving the private sector), the considerations for each of these models will be useful for future pilot program development.
Finance	The financial mechanism and regulation for payment should also be a preliminary activity in developing a pilot. The tariff model is being trialed in various cities and the assumptions required assist government to fully understand and decide on the scope of their pilot program.
Private sector	It is fortunate that the private sector was motivated to participate in the pilots, particularly as they have many teething issues that complicated their participation. However, in most cities there is motivation from both sides to involve the private sector in regular emptying, and providing sufficient incentive for them to participate during the uncertain start-up period is needed.
Sludge treatment plant	While the treatment plants in most pilot cities have the capacity to receive greater loads, there needs to be more hand-on training of operators to improve operating procedures.
Promotion	The approach to forced or participatory inclusion in the regular emptying pilot varied between cities. However, it was clear from the Solo pilot that if it is forced, greater promotion is required to reduce the time the truck operator has to get approval to empty.
Define pilot area	At this stage, the pilot areas are typically middle-income areas selected for their ability to pay water bills regularly (and therefore more likely to pay the regular emptying tariff). Testing in more difficult areas will be needed prior to scaling up.

Sharing lessons between different agencies is important, with proposed knowledge sharing between Balikpapan, Tabanan and Solo, Malang and Bandung. Lessons learnt from the first pilot in Solo and a brief update of the Dumaguete regular emptying program highlight that there is still much to learn and trial to develop a successful regular emptying program.

#### Box 4 – Summary of Lessons from Regular Emptying Programs

##### Solo, Indonesia Pilot Program

A regular emptying pilot was developed for 50 households to be emptied by two private operators. Promotion/information sessions were held in the pilot locations but households were not required to sign up, all households in the area were included. A recent evaluation found only 25% of households had been emptied due to the following issues:

- **Errors in the processing and upload of the census data** to the PDAM customer database resulting in a misalignment of data. The customer/address did not match the census data (tank details, ability/access to empty) making finding the household and accessing the on-site system slow. The census data will be reloaded and assessed for accuracy and trialled for another 50-200 households.
- **Insufficient promotion** – attendance at information sessions held in the pilot areas was only 20%, resulting in many households not understanding or refusing to join the program when the private operator came to empty.
- **Time taken to empty**, particularly due to the above two issues. The private operator complained about the time required to find the house, the 30 minutes needed to explain the regular emptying program, and time needed to find the septic tank and then open it. Adequate promotion and accurate census data could help overcome these issues (at least for the pilot phase, difficult tank access will remain).
- **Program delays due to tariff dispute** – Despite there being a regulation for the regular emptying tariff approved by the mayor, during the first pilot period, the local parliament forced the project to be put on hold as they felt uninformed about the program and had not approved the tariff. After three months of meetings, it was agreed that the tariff for low-income households would be lowered to IDR 6,000/month with medium-income households paying IDR 8,500/month.
- **Private sector almost losing motivation** due to the length of time taken to empty and the waste of fuel going to households that refused to be emptied (for which the private operator was therefore not paid). However, they were convinced to try again and the PDAM has encouraged them to submit invoices to receive payment for the first trial.
- **No data signal at the treatment plant** for the operation of the ICT scanner and phone app. The back-up approach of the treatment plant operator signing the form also did not work because the treatment plant was often unmanned. Additionally, the treatment plant was reluctant to accept the increased responsibility and higher number of trucks. The PDAM/IUWASH have requested a signal booster for the treatment plant and are looking to modify the app to function offline and send data when a signal becomes available.

##### Dumaguete, Philippines Update

Dumaguete was the first city in the Philippines to introduce a regular emptying program and its a state of the art treatment plant is often used as a training facility. The regular emptying program had been operating for 2 years but has recently shifted back to on-demand operation due to the difficulty accessing systems (could not be found or required access inside the house and no-one home) or refusal to empty. While the regular emptying has stopped, the regular payments will continue with households preferring to pay small monthly amounts and receive emptying when it suits them. Another factor affecting the program was that the initial strong communication strategy was stopped with a change in government, resulting in a clear increase in households refusing emptying. (Source SNV 2015).

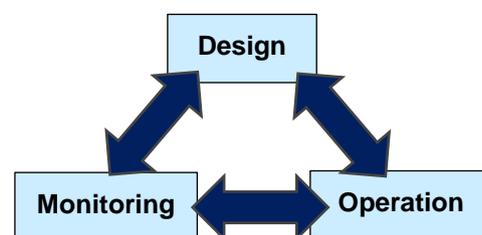
## 5.4 Sludge Treatment and Reuse

### 5.4.1 Need to consider operation in design and challenge of updating guidelines

Aside from the specific design recommendations coming from the assessment of treatment plants, there are overarching challenges that need to be addressed to improve both the design and operation of sludge treatment plants. In summary:

- Design and construction of systems needs to consider the requirements for operation and the skills of the operator. Aside from incorporating the proposed recommendations, another suggestion is to involve the operators in the design process, particularly for rehabilitation projects.
- Modular/step-wise approach to design, either step-wise construction or designing for modular operation. Systems need to operate under current low loading and realistic assessment of demand in the future.
- Operators need hands-on training, particularly in the processes of emptying sludge separation chambers, loading sludge drying beds and modifying operation based on inflow/quality. As seen in Tabanan, providing a SOP alone is inadequate and current government training is typically targeted at management not operational staff.
- Design systems to use hydrostatic pressure where possible rather than pumping sludge.
- Where possible incorporate solids/liquid separation with the objective of removing as much of the organic load with the settled solids to be treated in the sludge drying bed and reduce loading on the pond system.
- Analyze sludge at a local level since the parameters vary and basing design and operation on local sludge quality can optimize treatment.

While the recommendations were accepted by the Ministry of Public Works, due to the rapid development of the sludge treatment guidelines and difficulty contradicting options proposed by government consultants, the recommendations will only be included as appendices. This is a particular challenge as they contradict the main guidelines, with WSP advising against the use of Imhoff tanks, which MPW agrees with; however, they are still recommended in the guidelines. Another challenge is the promotion of design recommendations to the private consultants involved in the design of treatment systems and the national and provincial agencies responsible for review. WSP have proposed that these consultants be involved in promotion and training of the new guidelines when released, and be included in the government's regular training program in Bekasi.



### 5.4.2 Moving to Mechanized Treatment

Mechanized treatment provides the opportunity to improve the quality of sludge treatment and automate processes. While this can be seen as an ultimate target, there are various human resource, technical and management requirements to enable sustainable operations of these systems. As for various aspects of FSM, the conditions in Indonesian cities vary, and while for some cities mechanized treatment is a viable option, other cities are far off achieving the necessary requirements and a well operated non-mechanized option is a more realistic target. Key considerations for mechanized sludge treatment in Indonesian cities include:

- **Staff capacity:** The staff numbers and skills at existing treatment plants are inadequate for operating a more complex system. Staff typically do not have any technical background and are not provided training therefore do not understand the operation requirements/SOP, and their activities are often limited to meeting trucks, raking screens and reacting to issues such as overflow during rainy season. Designs for improved treatment systems need to consider current staff capacity or the agency needs to assign high capacity staff (which is difficult due to the poor conditions/remote

location of many sludge treatment plants). Alternative options to be considered include having treatment plant experts who are located centrally and can assist smaller cities with the management and operation, or the inclusion of the private sector in treatment plant operation, providing there are adequate performance accountability measures.

- **Monitoring/quality analysis:** Aside from the Jakarta sludge treatment plant where daily basic quality analysis is performed, most treatment plants do not have any quality monitoring. Even in Jakarta the analysis is basic and not used to inform the treatment process. Many mechanized treatment systems rely on quality analysis to manage and adapt the processes to ensure adequate loading. Equipped laboratories are necessary either at sludge treatment plant sites or nearby environmental/health laboratories that have staff capable of monitoring sludge and subsequently SOP and operators that can use this data to manage treatment processes.
- **Reliable electricity supply:** A basic requirement for mechanized treatment, but needs to be considered since many plants are remote and without power. Also for ICT or remote management, the telecommunication coverage needs to be considered.
- **Supply chain and procurement of spare parts:** This needs to be considered, including the local availability of parts and equipment and the institutional and financial processes required for procurement and asset management. The high cost and need for regular replacement of some parts should be considered in the design and while upfront construction is typically provided, private enterprises (i.e. PDAM) will need to cover the operating and maintenance cost.

Despite these issues, the relatively good operation and maintenance of the Jakarta and Surabaya mechanized treatment plants reinforced that mechanized options are suitable in some cities, and these options should be included in the National Sludge Treatment Plant Design Guidelines. However, there are conditions that should be met to assess whether a city is suitable for mechanized treatment and also steps to be taken to enable a city to effectively operate a mechanized treatment plant. As shown below:

**Table 9 – Improving Sludge Treatment - criteria for change in type of treatment used**

	Large Cities	Small Cities	
Conditions for change	Regular income and budget (e.g. LLTT) for operation and maintenance Staff capacity (number/skill) Confirm: central vs decentralized system Confirm: Limited or large land area available	Power supply Annual maintenance NPV Operating costs Basic back-up capacity e.g. generator for electricity	
	Mechanized (as in Jakarta)	Hybrid/Intermediate	Simple/natural system
Future Treatment Options	<ul style="list-style-type: none"> <li>• Mechanical screening (Huber Rotamat – effective when working but operational problems)</li> <li>• Mechanical aeration in aerated lagoons</li> <li>• Sludge dewatering using Huber inclined screw press – good results (high water content) but problems with spare parts</li> <li>• Provision for further dewatering on drying beds but not needed and not used</li> <li>• Some dried sludge used as soil conditioner but demand needs to be created</li> </ul>	<ul style="list-style-type: none"> <li>• Hand-raked or simple mechanical screen</li> <li>• Possible lime stabilization to aid digestion, reduce pathogen levels</li> <li>• Solids-liquid separation – need for further study</li> <li>• Liquid treatment – could be RBCs, rapid gravity filters, baffled reactors, various types of mechanical aeration, perhaps followed by ponds</li> <li>• Solids dewatering on drying beds</li> <li>• Disposal options as for simple system</li> </ul>	<ul style="list-style-type: none"> <li>• Hand raked screen or screens</li> <li>• Solids – liquid separation in hopper-bottomed sedimentation tank or solids-liquid separation chamber</li> <li>• Waste stabilization pond treatment for liquid fraction</li> <li>• Solids fraction treated in drying beds followed by storage and land-filling or composting and use as soil conditioner/fertilizer</li> <li>• Grit collected in ponds – no separate provision</li> </ul>

Outstanding issues that need to be resolved before considering mechanized options and improved sludge treatment in Indonesia include:

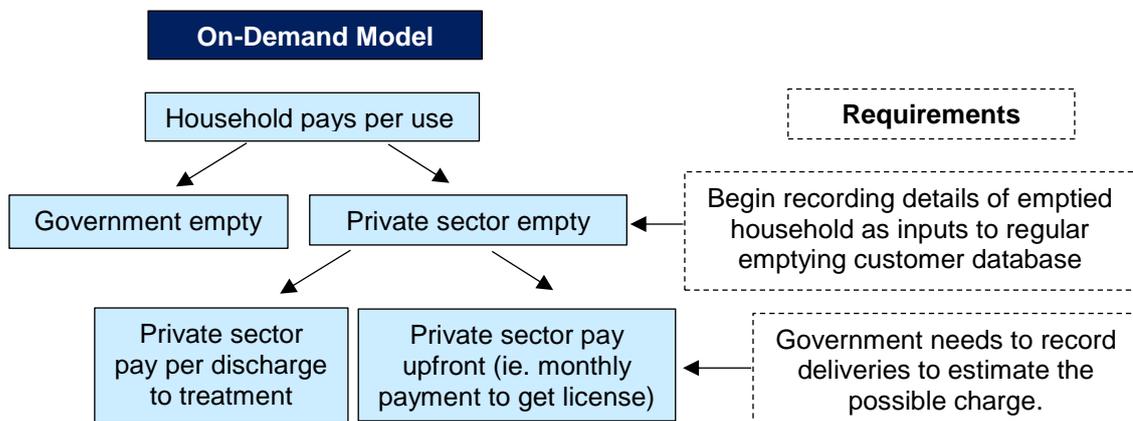
- **Data on sludge** both for the design and operation phases. Previous studies in Indonesia and internationally have gathered some data but the results are particularly varied, therefore more data is needed and site specific analysis is also required. Local laboratories also need guidance on analysis options (and equipment and training to perform the analyses) and to understand which parameters that are most influential in the treatment processes, and therefore need to be prioritized.
- **Pilot testing**/trialed design options – There is currently a lack of best practice/ tested examples of sludge treatment plants operating in similar conditions to understand the design and operation requirements and suitability. There needs to be a systematic assessment of the performance of different sludge treatment options. And for new designs, it is recommended that small pilot projects be implemented, possibly in affiliation with universities, to test different designs and understand operating criteria. This is not just for mechanized options but even for simple sludge/liquid separation chambers to understand their performance with varied settle-ability of sludge.

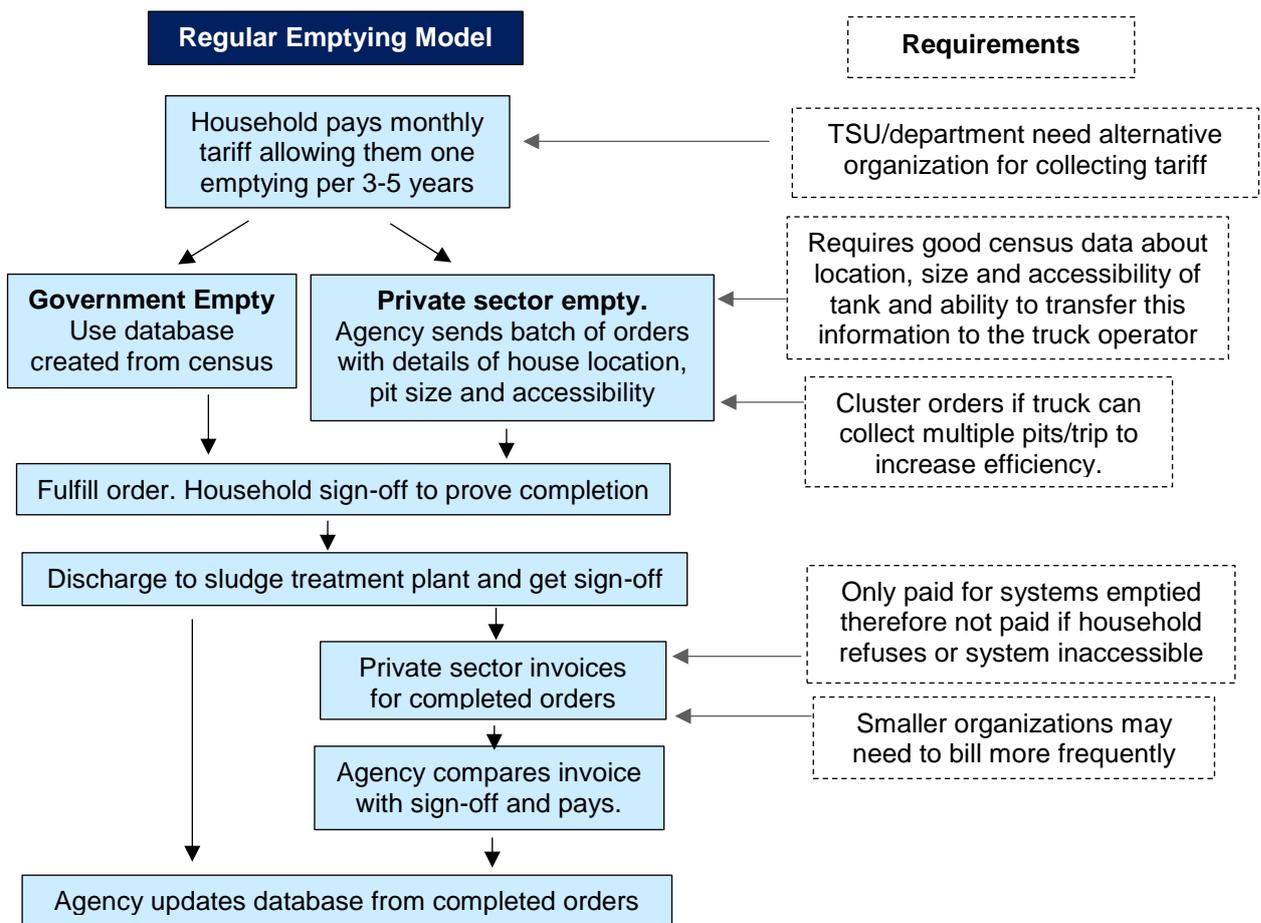
### 5.5 Finance

Moving to regular emptying requires a significant change in financial management, which is currently ad-hoc, manually recorded, and due to low numbers, not monitored. While improved financing mechanisms are necessary for regular emptying, they can also be implemented for on-demand emptying, especially to provide incentives for private operators to discharge at the treatment plant.

Example of on-demand and regular emptying finance arrangements are shown below and are still being developed in more detail to suit the conditions in each city.

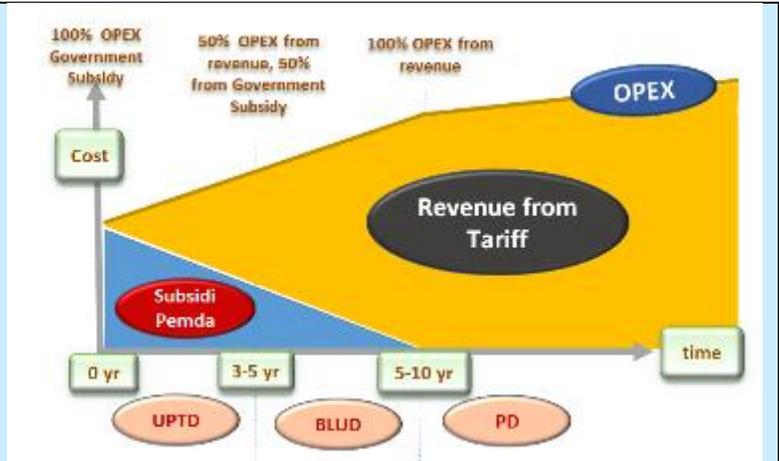
**Figure 27– Examples of On-demand and Regular Emptying Finance models**





**Box 5 – IUWASH Model of Institutional Development Wastewater Business in 3 Phases**

- Initial Phase (0-5 years):**
- TSUD is established: all operating expense is covered by local government.
  - TSUD is operating: revenues gradually increase to cover 50% of the operating cost
- Second Phase (5-10 years):**
- BLUD is established: service is expanded to cover > 80% of city
  - BLUD is operating: revenues gradually increase to cover 100% of the operating cost
- Third Phase: (>10 years)**
- PDPAL is established: revenues cover 100% of operating cost



**Note:** This model is based on a TSU currently operating septage collection. If a PDPAL or PDAM implement collection and management from the start, the operating expense should be recovered from tariffs immediately.

Challenges and requirements as cities move towards regular emptying include:

- **Government agencies (TSU or department) cannot charge and collect household payments.** They must therefore use an alternative mechanism to collect regular emptying payments. This was quickly resolved in Tabanan where the LPD (Lembaga Perkreditan Desa – locally owned customary banking system) will be used to collect tariffs.

- **Tariff assumptions will need to be refined** as the pilots are implemented to test whether the estimated costs of operation, service area and pits emptied per truck match reality.
- **The challenge of accounting for households paying for a service in advance.** Following the approach adopted by the PDAM in Solo, the first emptying considered is free of charge and the household pays off that debt through monthly tariff payments off over 3-4 years.
- **To pre-finance the initial empty, who pays the private sector or implement pilots** (where the tariff regulation has not yet been approved and households are not yet paying), cities require a standby/upfront fund. In government agencies this is requested as part of annual budget but in both Tabanan and Makassar was not approved, and therefore they must wait for the mid-year refinancing. The PDAM have more flexibility in finance, and the PDAM in Solo funded the pilot from its main budget, while Balikpapan funded the pilot through its cooperative/subsidiary organization.
- **Even when tariff mechanisms are in place, it is important that the funds collected can be directly allocated to the operation of the emptying program.** In Bandung, despite 30% of water bills being charged to wastewater, this income does not go to the wastewater department and they must request budget for operations. While the emptying pilot was successfully implemented, they did not receive funding for subsequent pilots or the ongoing provision of regular emptying (despite being a regulated requirement). It is recommended that the revenue from regular emptying be recorded as a separate tariff line so it can more easily be tracked and distributed.
- **Accountability of the wastewater agency to implement the project and pay private operators is a concern for both parties.** A strong concern raised during the household survey was the uncertainty whether the government would actually deliver the services paid for, especially after waste programs have not fulfilled proposed waste removal services. Additionally, private operators need the assurance of the timely payment of invoices since they provide the service in advance and working cooperatively is a changed mindset.

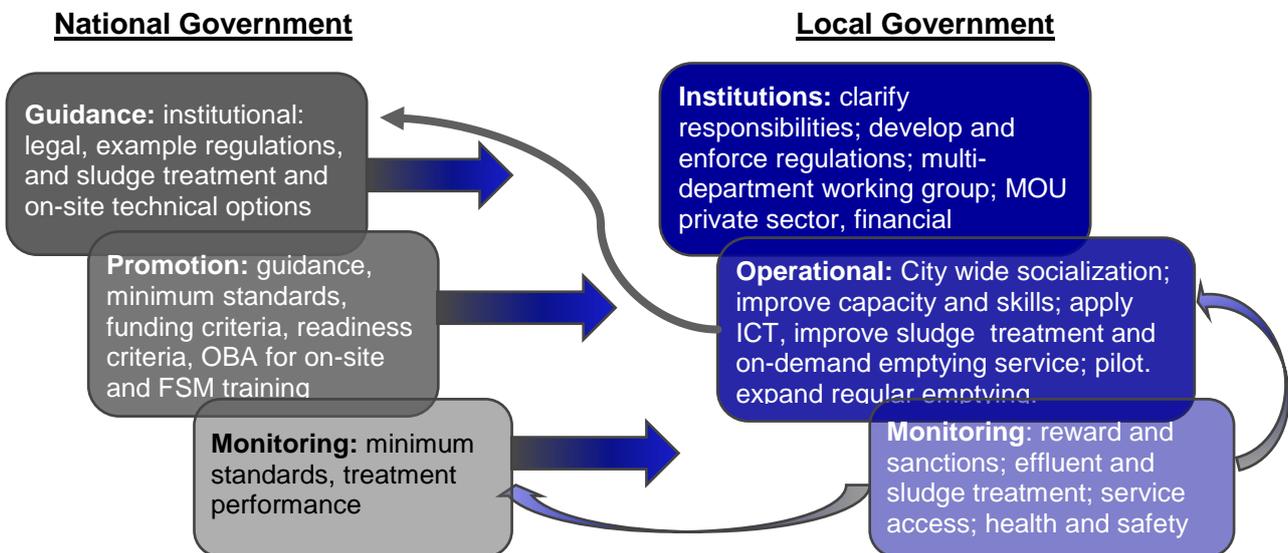
## 6 Recommendations and Next Steps

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Table 10 summarize the TA recommendations and generic next steps in developing the national and local FSM program. While regular desludging pilots are underway in the two cities of Tabanan and Balikpapan – they have more steps to follow. The diagram also show the generic steps which will needed at the local level in other cities too.

These are primarily targeted to the level of government and agencies underlined below.

**Figure 28 Overview of Recommendations for National and Local level**



**Table 10: Summary of Recommendations**

Recommendations
<b>Institutional Development</b>
<p><b>Detailed <u>national guidance</u></b> is needed to support cities:</p> <ul style="list-style-type: none"> <li>• <b>Explicit policy requiring cities to improve FSM</b> or a minimum service standard for FSM as a tool for wastewater agencies to propose required institutional changes and request budget.</li> <li>• <b>Guidance on drafting FSM regulations</b> with specific examples of suitable levels, unambiguous wording and financing options and mechanisms.</li> <li>• <b>Development of criteria for improving FSM</b> including the institution types, required human resources; financial systems for regular emptying and pre-requisites for advanced treatment systems.</li> </ul> <p><b><u>National program promotion, clarity and quality of options and city readiness need to be improved.</u></b> The new national FSM program has been developed at commendable speed, and attention now needs</p>

## Recommendations

to be given to the uptake of the program and quality outcomes through:

- Promotion needs to include the heads of planning, heads of department, the working group and if possible the mayor to assist the smooth acceptance, budget and implementation of improved FSM programs.
- Allow for inclusion of best practice and lessons from pilots and field assessment to improve the quality and clarity of programs. When not yet available, allow opportunities to update or revise key components.

**Each city needs to clarify responsibilities for emptying, treatment, asset ownership** and undertake a gap assessment of regulations.

- The working group needs to review the existing institution's capacity to manage current and future FSM needs in the city, assess whether the existing institution can meet the required capacity, and decide whether a different institution would be more suitable (e.g. PDAM) or a new institution would be necessary (e.g. BLUD or PDPAL).
- The working group needs to clarify the current regulations, responsibility and asset ownership for FSM services (if not already included in the city sanitation strategy).
- National government needs to recognize the time required for clarification and change of institutions, provide clarity on suitable agencies, and ensure they are dealing with the correct agency particularly when providing or transferring assets.
- Before proposing regular emptying or an advanced sludge treatment plant, ensure the city has an institution that has the required capacity (most likely a PDAM/PDPAL), as well as the necessary financial monitoring and staff capacity.

**Introducing regular emptying requires a city-driven approach** due to the specific regulatory, finance and management changes that will need the full support of mayors, and heads of Bappeda and departments.

- Support through evidence of household demand for improvement, private sector willingness to involve and financial assessment of feasibility.
- Regular emptying programs requires mechanisms for a regulator to monitor whether operators are fulfilling their service provision, and ensure that private operators comply with MOU, and that sludge treatment and discharge is of adequate quality.

**An increase in the capacity of local wastewater agencies is needed.** This is particularly required for managing regular emptying and more advanced sludge treatment systems.

- National and provincial public works departments need to review the capacity of local wastewater agencies to manage an improvement in FSM and more advanced sludge treatment processes.
- Consider alternative options where and when skills are not available. This could include provincial or private sector sludge treatment plant operation and contracting monitoring specialists.
- City wastewater agencies need to review current staff numbers and capacity to manage increased workload and specific skills required for improved FSM programs.
- Specific training or hands-on capacity building is needed for operational staff. The provision of standard operating procedures and training for management staff is inadequate and ineffective for developing skills.

## Emptying

**Local level improvements in on-demand emptying should be made while also introducing and piloting regular emptying.**

- Improving on-demand emptying is an important interim step to: increase capacity; develop

## Recommendations

relationships with private sector; improve operation of treatment with increased loading; and implement procedures for monitoring.

- Ensure that new agencies responsible for regular emptying also have responsibility for the management of on-demand emptying, even if private sector is the service provider.

### **Local level improvements in on-demand emptying and the introduction of regular emptying need to consider the existing management arrangements and political economy factors**

- The role of regulations and reporting by the TSU to department head requires clarification. Improved monitoring by the TSU needs to be accompanied by advocacy to the department to use the information (e.g. for monthly reports, annual planning, etc.)
- Involving the department (or other agency) head is vital to increasing the capacity (staff, IT, budget) of the wastewater agency to manage improved FSM services. The head of the wastewater agency typically does not have sufficient authority.
- Political economy influences need to be considered as the current lack of regulation of private sector/emptying has led to uncertainty about legality, which may limit willingness to improve processes and monitoring of FSM
- Clarifying regulations for private sector participation and establishing memorandums of understanding to formalize private sector involvement.
- Introduce improved monitoring, preferably with computer customer and finance databases to better understand and monitor operations.
- Where possible use ICT for customer details, including their participation in promotion or education activities. This will increase efficiency and successful emptying, especially when private sector is providing the service.

### **National and local level Technical considerations:**

- Government trucks should increase their pump capacity and hose lengths to maximize the households they can serve. This is particularly important as low-income households are often the most difficult to access and rely on lower cost government services. The customer satisfaction survey and private sector assessment found that the private sector was able to serve more customers due to their 70-90m length hoses compared with the 30m hoses used by government trucks.
- Assumptions used in the tariff calculation model must be verified in practice, especially the number of systems emptied per collection, and whether customers accept partial emptying and the trips possible per day.
- On-site sanitation improvements should be prioritized for the benefits of regular emptying to be realized. This includes both the containment of sludge to reduce leakage from unsealed systems, as local environmental and public health benefits are not achieved when on-site systems are leaking.
- Improved manholes or hatches for access to systems is integral to a successful regular emptying program.

## Treatment and Reuse

**National, provincial and local levels need to better design treatment systems to consider operational requirements.** Where possible designs should allow for modular construction and operation to match increasing demand over time.

- **New national design guidelines should include recommendations from recent assessments of current treatment plant operations,** in particular, the design and position of inlet screens; avoiding Imhoff tanks and improved design of access and discharge points for tankers.

## Recommendations

- **Designs should be realistic future loads**, while also consider operation with current lower loading. Evidence based sludge accumulation and pit emptying rates for Indonesia should be applied for designs.
- Treatment units need to be designed so that the waste flows can be redirected or bypassed to allow for operational maintenance or repair requirements.
- Wherever possible use hydraulic pressure rather than relying on pumps

### **National government needs to develop a better understanding of suitable treatment systems for Indonesia.**

- Sludge separation appears to be a suitable first step, but Imhoff tanks are not recommended. Sludge separation chambers (SSC) are not yet fully proven and more information is needed on sludge quality inflow and SSC operation. Pilot projects need to test designs and collect data and analysis on sludge quality.
- Evidence suggests that sludge quality will vary and sludge treatment systems that will cope with varied qualities of sludge are needed. Further monitoring of sludge parameters and pilot testing different systems to understand the design and operation parameters is required.

### **Local operators need increased skills and capacity**

- Standard operating procedures are inadequate to train staff, who need on the job training. Operators need to be included in and attend national training, but this rarely happens for low level/contract staff.
- There is a possible need for more technical skilled staff to operate more complicated systems that can assess sludge quality and inflow and adapt treatment processes to suit, particularly in the rainy season.
- There is a possible need for decentralized treatment experts that can assist.

### **Mechanized treatment is a definite opportunity in *some* cities**

- This option should be included in guidelines, however there is a challenge due to limited knowledge and experience of what systems are appropriate
- Different systems need to be tested, to identify which systems to recommend. There is a lack of international knowledge on appropriate systems for specific contexts.
- Establish step-by-step processes to enable cities to manage mechanized treatment, and include in design guidelines. These steps are required prior to implementing. It is likely that mechanized treatment will be suitable only in some cities where reliable electricity, staff skills, laboratory analysis and a steady revenue income are available.
- At present, the supply chain for spare parts and asset maintenance are constraints. The ability/options of service providers and wastewater agencies for asset management/getting spare parts need to be assessed.
- The current low capacity of operations staff, which is a barrier to improving and attracting skilled staff, will be a challenge.
- Mechanized treatment will require greatly improved and ongoing monitoring and analysis of sludge (e.g. MLSS for anaerobic pond operation). Analysis methods that suit the laboratory equipment and skills are required as well as the staff capacity to carry out the analyses.

**Local reuse opportunities have not yet been fully considered** and there is a lack national guidelines on reuse.

- This has not been looked at in detail but is likely to vary between cities due to cultural beliefs.

## Recommendations

- Not currently included in government priorities/discussion. Guidelines of safe reuse should be included and promoted.

## Appendix 1 – Contributions to Partnership Approach

**Table 11 – FSM Capacity Building Activities in 2015**

Date	Activity	Topic of contribution
Jan-15	FSM3, Hanoi	
Jan-15	SPG Meeting	Financial flows from national to local government and Village law and its implication to sanitation
Feb-15	ADB's Event	Septage animation promotion
Feb-15	WSP-IUWASH Meeting	OBA: options for financing and readiness criteria of LG
Feb-15	Workshop	Promoting innovation in urban sanitation
Mar-15	PU asking for inputs	PU LLTT Guideline
Mar-15	PU Meeting	PU LLTT Guideline
Mar-15	Pokja AMPL Workshop	Universal access and Champion Booklet
Apr-15	WSP-IUWASH Meeting	Combining emerging FSM tools and identifying gaps
Jun-15	USAID study tour to Philippines	Financial toolkit for FSM
Aug-15	PU Workshop	Introducing LLTT to cities
Aug-15	IUWASH Meeting	Developing android-based census for FSM
Sep-15	Input to PU	IPLT Guideline
Oct-15	WSP-IUWASH Meeting	Updates from cities and discussion with PU Consultant for LLTT?
Oct-15	WSP-IUWASH Meeting	ICT and On-demand system
Nov-15	PU Workshop	IPLT Workshop
Nov-15	National Water and Sanitation conference	Creating future for water and sanitation
Nov-15	Input to PU	Guidelines for On-site system Census
Dec-15	Meeting with PU	Move from current support to next program, further TA/ESW prior to FSM TA
Nov-15	PU-WSP-IUWASH Meeting	IPLT Design Guideline
Jan-16	Bappenas-PU-WSP-IUWASH Meeting	Updates from cities and potential city champions for universal access
Jan-16	ADB Workshop	Sanitation roadmap and city wide sanitation investment program

**Table 12 - Joint contribution to National Septage Guidelines**

Guideline Chapters	WSP Inputs	IUWASH Inputs
<b>1. AREA IDENTIFICATION SERVICES</b>		
<ul style="list-style-type: none"> <li>Census questionnaires for household on-site sanitation</li> </ul>	<ul style="list-style-type: none"> <li>Training <i>shit-flow</i> diagram</li> <li>Guidelines and tools census of on-site sanitation units</li> </ul>	<ul style="list-style-type: none"> <li>Readiness questionnaire citizens</li> <li>Septic tank census questionnaire</li> </ul>
<b>2. EMPTYING AND TRANSPORT</b>		
<ul style="list-style-type: none"> <li>Standard Operational Procedure</li> <li>Carrier fleet technical specifications for sewerage</li> <li>Example of calculation of trips</li> <li>Calculation of total requirements</li> </ul>	<ul style="list-style-type: none"> <li>Estimate the accumulated sludge suction tank needs</li> <li>Guide to the recording system suction on-demand services and scheduled</li> </ul>	<ul style="list-style-type: none"> <li>Information system service settings sludge scheduled</li> </ul>

Guideline Chapters	WSP Inputs	IUWASH Inputs
truck	<ul style="list-style-type: none"> <li>Operating information technology systems suction and transport of sludge</li> </ul>	
3. PROCESSING, USE and DISPOSAL		
Operation & Maintenance sludge treatment plant	<ul style="list-style-type: none"> <li>Sludge treatment plant design guidelines</li> </ul>	<ul style="list-style-type: none"> <li>Typical design for sludge treatment plant</li> </ul>
4. INSTITUTIONAL & REGULATORY FRAMEWORK		
<ul style="list-style-type: none"> <li>Role division and the Regional Centre</li> <li>Format agreement of the national Government and Local Government</li> <li>Institutions business forms for regular emptying</li> <li>Inter-regional cooperation</li> </ul>	<ul style="list-style-type: none"> <li>Stairs institutional framework</li> </ul>	<ul style="list-style-type: none"> <li>Templates local regulation of wastewater (with aspects of the management of sludge)</li> <li>Examples of regional heads regulations on sludge management system</li> <li>Template related regulations TSUD</li> </ul>
5. ADVOCACY & PROMOTION		
	<ul style="list-style-type: none"> <li>Leaflet &amp; film "4 Sehat, 5 Sempurna"</li> </ul>	<ul style="list-style-type: none"> <li>Generic FSM animation film</li> <li>Promotion of sanitation services guide</li> <li>Promotional materials (leaflets)</li> </ul>
6. FINANCIAL		
<ul style="list-style-type: none"> <li>Details of funding management components for sewerage</li> <li>Funding regular emptying through state / regional management</li> </ul>		<ul style="list-style-type: none"> <li>Toolkit planning and financial management systems sludge (USAID)</li> <li>Tariff setting mechanism</li> </ul>
7. PRIVATE SECTOR PARTNERSHIP		
	<ul style="list-style-type: none"> <li>Template private sector partnerships</li> </ul>	<ul style="list-style-type: none"> <li>Examples of private sector partnerships</li> </ul>

**Regular Emptying Video**

The authority of fecal sludge management in DKI Jakarta was transferred from the cleaning department waste agency (DKP) to the wastewater enterprise (PDPAL) with the aim of improving the cities wastewater management in 2013. IUWASH (with the support of WSP) devised a work-plan to assist PDPAL improve their sludge emptying services, including the dissemination of information to the public and government, particularly regarding regular emptying.



With social media seen to be a popular medium in Indonesia, a Speed Drawing Animation was used to explain the impact of poor sanitation on Jakarta, the plans of PDPAL and Jakarta local government to improve sanitation and the cleaner environment and community achieved. The 5-6 minute video (available in both English and Indonesian) was considered a very successful means of communications with the city government subsequently increasing the budget from US\$32 million to US\$258 million over 5 years to commence regular desludging. <https://www.youtube.com/watch?v=ooxdDYfJ1K4>

Following the success of this video, a generic video was developed funded by IUWASH and WSP for use by other cities to promote regular emptying to government and public, with interchangeable segments to tailor to the individual city.

## Appendix 2 – Output Based Aid approaches for improving on site sanitation

The National Government’s Wastewater Management Local Grants program is an effort to accelerate the improvement of on-site sanitation construction and provision of sludge emptying trucks through an output-based approach. Particularly in cities with existing sludge treatment facilities and synergizing with regular emptying program, Local Governments will invest in advance to build septic tanks and supply sludge removal trucks with grants from the national government to be disbursed after construction and performance verification. The current national government plan is to allocate IDR 200 billion (USD15 million) towards a target of 65,000 units across thirty cities, with reimbursement of IDR 3million/unit (USD 225/unit) and for every 3000 units built also IDR 3.5million/unit towards a sludge truck.

MPW has allocated 200 billion Rupiah to the program in 2016, currently less than 20 cities will take part due to various budget and approval/ administration issues. To participate in 2016 cities had to get budget for the upfront cost of the on-site systems, from which they will get reimbursed \$300/system, which some cities complain is inadequate to cover the cost. Some cities are interested to apply but did not receive Local budget allocation this year. While they could be allocated budget during the mid-year amendment, the program is implemented on an annual basis and the mid-year commencement is possibly insufficient time for the required OBA steps: promotion, construction, verification and reimbursement. Administration agreement between national and city governments may also take a long time. Other complaints were that the schedule was too fast and insufficient promotion for cities to fully understand the concept, promote to higher bodies, and get approval for funding.

**Table 13 – Criteria for on-site sanitation output based aid**

Criteria for Cities to receive funding	Criteria for households to receive on-site systems
<ul style="list-style-type: none"> <li>• City sanitation strategy and development plan</li> <li>• Existing sludge treatment plant</li> <li>• Established operator for sanitation/wastewater</li> <li>• Have or are developing wastewater regulations</li> <li>• Will implement regular emptying</li> <li>• Can provide local budget allocation</li> </ul>	<ul style="list-style-type: none"> <li>• Without an on-site system or have an undersized system</li> <li>• Customer of regular emptying</li> <li>• Contribution by household</li> <li>• Provide access for emptying</li> <li>• Provide land for on-site system</li> </ul>

**Challenges of OBA:** Tabanan refused OBA because they believe its too complicated, were unclear how they are reimbursed and think the criteria for verification could be too strict. Balikpapan preferred to focus on the sewer OBA (Hibah) but intend to join the next year. Other issues include the delays in getting local budget funding at the start of the year and uncertainties regarding the new and relatively complex mechanisms, despite interest in the overall program. The proposed sanitation solutions are somewhat limited or not best practice and need further development. **Communication between national government and city needs to be improved to clearly explain the program requirements and approach.**

### Appendix 3 – Summary of FSM pilot programs

Table 14 – Final Status of key element of pilot programs

Supporting partner and city	Proposed pilot program	Summary of Current Status and particular challenges April 2016
WSP – Balikpapan	<ul style="list-style-type: none"> <li>• PDAM to pilot in 1000 households which are existing PDAM’s water customers using private sector and ICT systems</li> <li>• Improve systems for on-request desludging</li> </ul>	<ul style="list-style-type: none"> <li>• Formative research was undertaken, presented and discussed with local government alongside a Fecal waste Flow Diagram</li> <li>• Newly established responsibility for FSM in PDAM.</li> <li>• PDAM has established a regular desludging team of 8 people including Operation, Finance, IT, Customer relation, etc. The team works well and reports regularly to director.</li> <li>• Awaiting final regulations and clarification of handover of treatment facility. In meanwhile, PDAM will ‘rent’ the use of sludge treatment plant from local government.</li> <li>• PDAM plans work with the private sector emptiers which are experienced and willing to participate.</li> <li>• PDAM have pilot budget approved, already have customer database and experience in ICT for water meter readings.</li> <li>• On-request service has been improved with all companies using treatment for disposal; improved manual record keeping.</li> <li>• Promotion local team for scheduled and on-request septage emptying is awaiting formal decree from local government</li> <li>• The team visited Solo on WSP event and established a comprehensive plan of LLTT.</li> <li>• Support to continue under programmatic TA for urban sanitation.</li> </ul>
WSP – Tabanan	<ul style="list-style-type: none"> <li>• TSU to pilot in 1000h households and communal wastewater systems (SANIMAS) and institutions in 3 Banjars. Proposed to use TSU trucks for the initial pilot and manual recording.</li> <li>• Improve systems for on-request desludging</li> </ul>	<ul style="list-style-type: none"> <li>• Low capacity and 5 staff.</li> <li>• Formative research was undertaken presented and discussed with the TSU.</li> <li>• House to house census carried out for 900+ households</li> <li>• Didn’t get annual budget for piloting regular desludging in 2016 and plans to include request in the 2016 mid-year budget reallocation.</li> <li>• Treatment plant has been sub-divided to provide two drying beds as advised.</li> <li>• TSU is limited in its desludging services as their trucks can only reach small distances from the road.</li> <li>• The Tabanan team visited Surakarta for the Knowledge Exchange, and established a short term plan for LLTT, and hope for more support from the Mayor.</li> <li>• Support to continue under programmatic TA for urban sanitation.</li> </ul>
WSP - Tegal	<ul style="list-style-type: none"> <li>• Planned to improve on-request emptying</li> </ul>	<ul style="list-style-type: none"> <li>• Low capacity of TSU</li> <li>• Formative research was undertaken presented and discussed with the TSU.</li> <li>• TSU lacked local government support for developing the improved FSM pilot and WSP was unable to continue with the technical assistance.</li> </ul>
WSP – Bandung	<ul style="list-style-type: none"> <li>• PDAM required to provide regular emptying as part of current charges.</li> <li>• Implemented one pilot of 250hh using PDAM trucks</li> </ul>	<ul style="list-style-type: none"> <li>• WSP assisted PDAM conduct a sanitation census in a select pilot area and set up a pilot regular emptying program for 250 households.</li> <li>• The budget to continue not approved due to management changes.</li> </ul>

	<p>and proposed another for 3000 households.</p>	<ul style="list-style-type: none"> <li>• Without a business plan for regular emptying, no separation of wastewater revenue from water income and no sanction/enforcement to fulfill its regular emptying obligation for paying customers and due to not signing an agreement for the TA activities the support was postponed.</li> <li>• There was a plan to re-activate regular desludging by the Head of Wastewater Customer Relations, but he was moved to Local Government so the plan was not implemented.</li> <li>• A new Director of Wastewater has now agreed to continue by taking over such plan and to have regular desludging started.</li> <li>• Since February 2016, after PDAM Malang visit event, the regular desludging of PDAM Kota Bandung has restarted and will continue to desludge of one Kecamatan of Arcamanik (3000 HH).</li> <li>• Currently emptying three further areas: Sukamiskin, Cisaraten kulon, Cisaranten indah and more.</li> </ul>
<p>IUWASH with WSP support – Jakarta</p>	<ul style="list-style-type: none"> <li>• PD-PAL to pilot regular desludging in Kelurahan Rawamangun.</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a sanitation census of 4,289 households (out of 8,000 potential households) through the involvement of Dasa Wisma Cadre (PKK Cadre from Kelurahan Rawamangun).</li> </ul> <p>Activities of preparing and executing process of regular desludging:</p> <ul style="list-style-type: none"> <li>• Business Plan workshop</li> <li>• Action plan sessions (from business Plan, due to 3 changes in Director of PD-PAL)</li> <li>• MoU of LLTT activities in 4 areas: Rawamangun, Kemanggisan, Pademangan and Lenteng Agung signed by Lurah, IUWASH and PD PAL Jaya</li> <li>• These MoUs are the regulations for PKK do the socialization, data collection etc.</li> <li>• Operation and Operator Training for new employees (transferred from DKP)</li> <li>• Starting regular desludging, non mandatory, non regulation, in 4 Kelurahan, total approx. 400 HHs and continues.</li> </ul>

## Appendix 4 – Tariff Calculations

**Table 15 – Assumptions included in regular emptying Tariff in Balikpapan**

Variable	Range	Balikpapan Example	Notes
<b>Program variables</b>			
Coverage (% of the city that will be part of the regular emptying program)	20-40%	40% of the 76,772 households that have septic tanks (20% in first 2 years, 30% in next 2)	This is the most influential and difficult v to estimate variables.
Systems emptied per trip to treatment	1-2 tanks/pits	2	Depends on tank and truck volume and whether pits are not fully emptied.
Trips to treatment plant per day	2-3	2	Depends on proximity and time to emptying (pump strength/speed)
Household system size	1.5-3m <sup>3</sup>	1.5	Based on census/survey. Occasionally assumed that full tank volume will not be emptied.
Frequency of emptying (3-4 years)	3-4 years	4	
Truck ownership and maintenance	Government or private owned trucks		
<b>Based on current expenses</b>		IDR	
Treatment plant costs (per m3)		61,640	Includes staff, electricity, laboratory, maintenance, generator,
Management Costs (per month per customer)		1,523	Staff, promotion/socialization, office overheads, asset depreciation
Truck costs (per trip)		240,000	Includes petrol, staff, maintenance, capital cost (every 12 years)
Billing efficiency		90%	
Proposed Tariff (Average IDR/month), before tax		8,449	Assume only households involved in program pay, not blanket/all
Proposed Tariff (Average IDR/month), after tax		9,300	

The above assumptions have been discussed with the PDAM and local government in Balikpapan. A similar process is underway in Tabanan, but is not yet complete.