INSTITUTIONAL AND TECHNOLOGICAL REFORMS IN URBAN WASTEWATER MANAGEMENT: STORY OF MALAYSIA

RESEARCH REPORT

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INTRODUCTION

Since independence, the sewerage management in Malaysia has evolved from basic sanitation facilities to advanced treatment facilities in a phased manner addressing the public health and river pollution issues. Since then basic sanitation facilities as overhang latrines, pit and bucket systems and pour flush systems were slowly replaced by more modern systems like aerated lagoons, activated sludge system, package systems and variety of mechanical plant. However, sewage still remains as one of the major pollutants of inland waterways in Malaysia. In the 1900s, the emergent of new treatment technologies were mainly driven by the basic need to treat the sewage so as to control waterborne diseases. Today, the environmental regulations including effluent discharge standards are becoming more stringent with increasing awareness toward sustainable environmental management. Public are also more educated and more alert on the need to preserve the water source and the environment.

Malaysia has a population of approximately 3 million people as of 2015 with a population growth rate of 1.3% (Department of Statistics, Malayasia, 2017). The sewerage system in Malaysia comprises a mix of off-site systems (sewer network connected to public and private sewage treatment plants) and on-site systems (individual septic tanks, communal septic tanks, and Pits). The proportions of population equivalent served by the various sewerage facilities are shown in Table 1.

Table 1: Profile of the Malaysian Sewerage System, 2015

S. No	Sewerage Facilities	2015	
		Quantity	Population Equivalent (PE)
1	Public Sewage Treatment Plant	6,571	23,517,185
	a) Multi-point Plant	6,481	16,296,052
	b) Regional Plant	90	7,221,133
2	Private Sewage Treatment Plant	3,158	2,795,877
3	Communal Septic Tank	4,386	532,051
4	Individual Septic Tank	1,321,856	6,747,774
5	Traditional System	894,859	4,274,293
6	Network Pumping Station	1,078	NA
7	Length of Sewer Network (km)	18,689	NA

Source: SPAN, 2016a.

Note: (a) Multi-point Plant: STPs to cater for sporadic and scattered development by different developers;

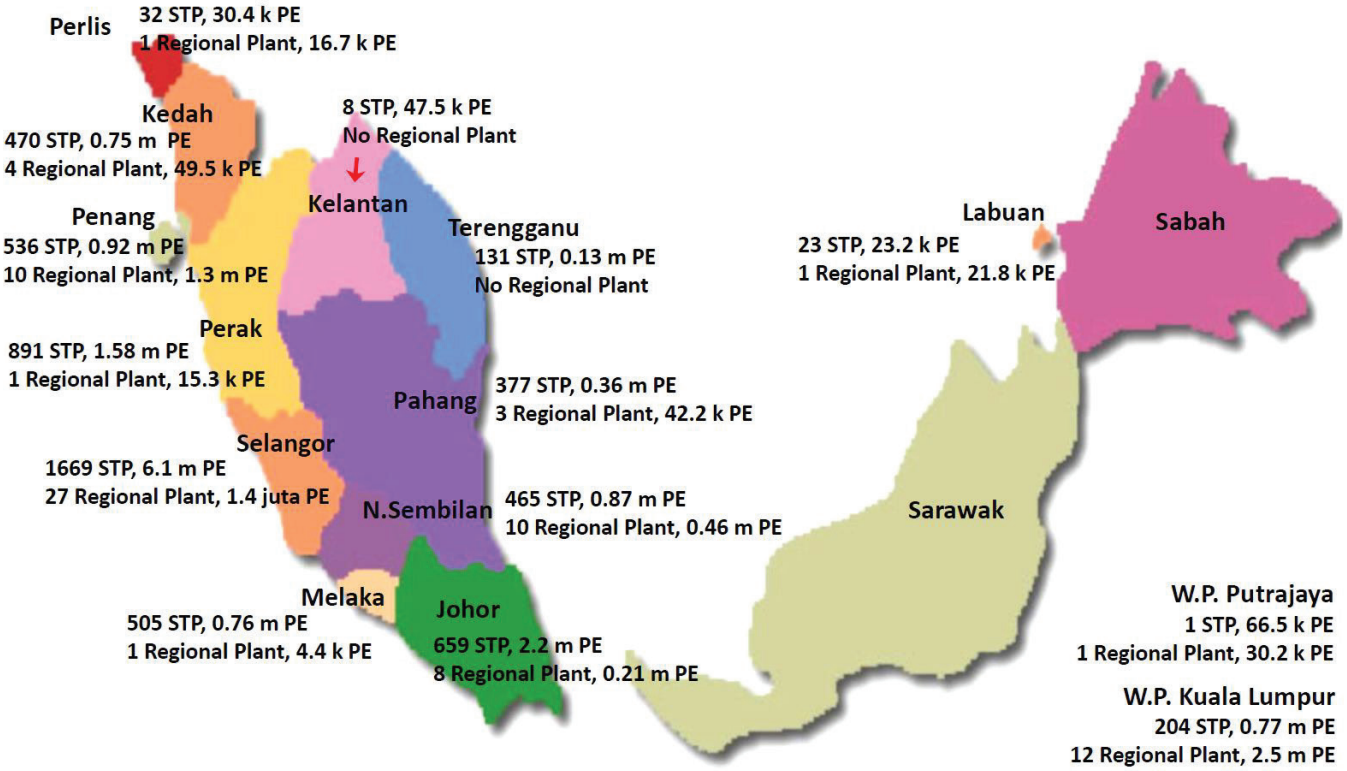
(b) Regional Plant: STPs identified in the sewerage catchment study to cater for a sewerage catchment area.

(c) The Population Equivalent is an estimate of the usage made of sewage facilities. It is not a measure of population

The proportions of population equivalent (PE) served by the sewerage treatment plants during 2015 in different states of Malaysia are shown in Fig. 1.

This report provides concise exposition of the Malaysian sewerage management under the country's existing primary federal environmental legislation. The report gathers essential information from different authorities that can be of use by policy-makers in the efforts of improving the existing situation of sewerage management problem in the country.

Figure 1: STPs in different parts of Malaysia



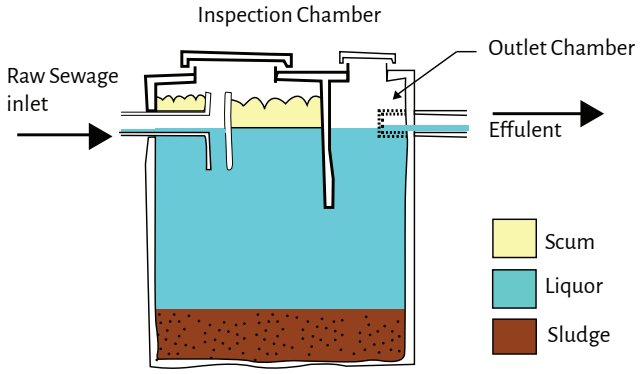
Source: National Water Service Commission, 2016.

EVOLUTION OF THE SEWERAGE SYSTEM IN MALAYSIA

During Malaysia's pre-independence period, the development of sanitation facilities was very limited as the need for sanitation was not critical. Most people used pit latrines, hanging latrines and bucket latrines (Baki, 2005).

In the 1950s, Malaysian towns started to develop and population densities began to grow. Improvement of the sanitation sector became vital in order to address the sewage pollution. Technological advancement at that time saw the primary systems using sedimentation processes. Individual Septic Tanks (ISTs) used this concept (Baki, 2005). This primary system could only provide basic primary treatment via sedimentation and digestion. In the towns, ISTs began to replace the primitive systems (Bucket Latrines), thus reducing the direct pollution impacts on the environment. The pollution level reduction can be indicated in terms of Biochemical Oxygen Demand (BOD), which is a measurement of the amount of dissolved oxygen (DO) used by aerobic microorganisms when decomposing organic matter in water (Sustainable Sanitation and Water Management, 2017). Sometimes, it is also indicated in terms of Suspended Solids (SS) which is the amount of tiny solid particles that remain suspended in water and act as a colloid. In ISTs, the BOD was typically reduced from 200-400 mg/l to 150-200 mg/l and the SS was reduced from 200-350 mg/l to 50-100 mg/l as shown in Fig. 2 (Baki, 2005).

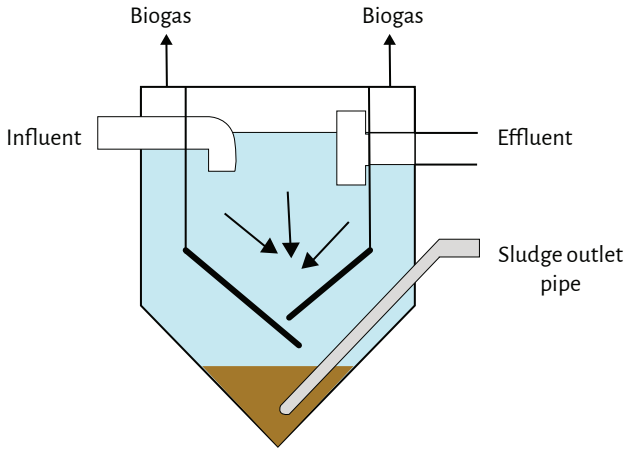
Figure 2: Typical Performance of Individual Septic Tank



After Malaysia's independence in 1957, the need for improved sanitation led to community-based sanitation as more towns were established. Community Septic tanks (CSTs) were introduced to improve the community management of sewerage. In terms of performance, they were similar to ISTs but the CSTs served a bigger population via a series of pipes connecting a row of houses to communal tanks (Baki, 2005).

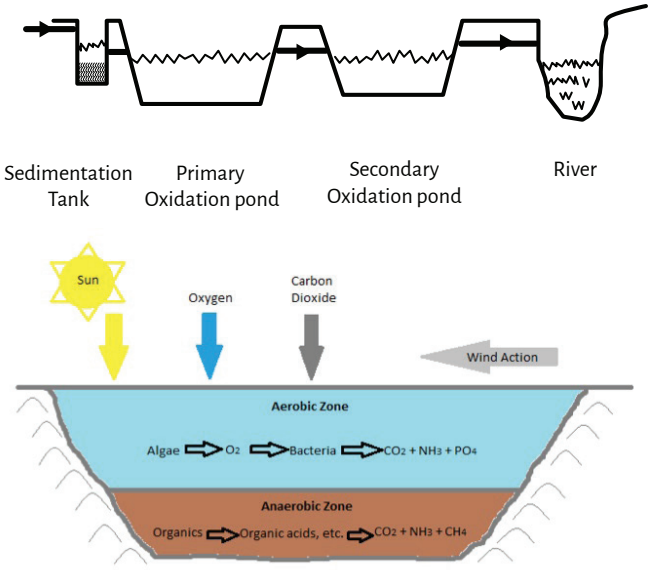
Imhoff tanks, another improved version of the primary treatment system, were later introduced for the community sewerage systems. Here, BOD was typically reduced from 200-400 mg/l to 50-175 mg/l as shown in Fig. 3 (National Water Service Commission, 2016).

Figure 3: Typical Performance of an Imhoff Tank



In the 1970s, as Malaysia continued to develop and its towns grew into cities, improvement of environmental conditions became imperative and led to the enactment of the Environmental Quality Act in 1974. Partial secondary treatment systems such as oxidation ponds were introduced (Baki, 2005). The oxidation pond (Fig. 4) is a biological system used for the treatment of

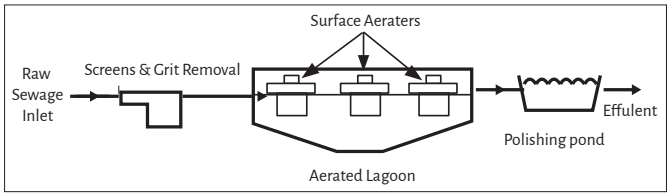
Figure 4: Typical performance of Oxidation Ponds



waste water. It is regarded as a secondary treatment method by which natural purification and stabilization of waste waters like domestic sewage, trade waste and industrial effluents are accelerated. The biological treatment process in oxidation ponds mainly involves an interaction between bacteria, algae and other organisms. It efficiently removes bacteria, biodegradable organics, phosphorous and nitrogen present in the waste water to be discharged to the receiving streams (NC Tharavathy, 2013). The introduction of oxidation ponds in Malaysia improved the treatment performance, reducing BOD from 200-400 mg/l to 20-100 mg/l (Baki, 2005).

In the late 1970s, aerated lagoons (Fig. 5) were introduced to serve a larger population within a limited land area reserved for oxidation ponds. This was done by introducing aerators to the systems (Baki, 2005). An aerated lagoon is a suspended-growth process in a waste water treatment unit. The treatment system consists of a large earthen lagoon or basin that is equipped with mechanical aerators to maintain an aerobic environment and to prevent settling of the suspended biomass (The Water Treatments, 2014a). With the introduction of this system, BOD was reduced from 200-400 mg/l to 20-100 mg/l (Baki, 2005).

Figure 5: Typical Performance of Aerated lagoon

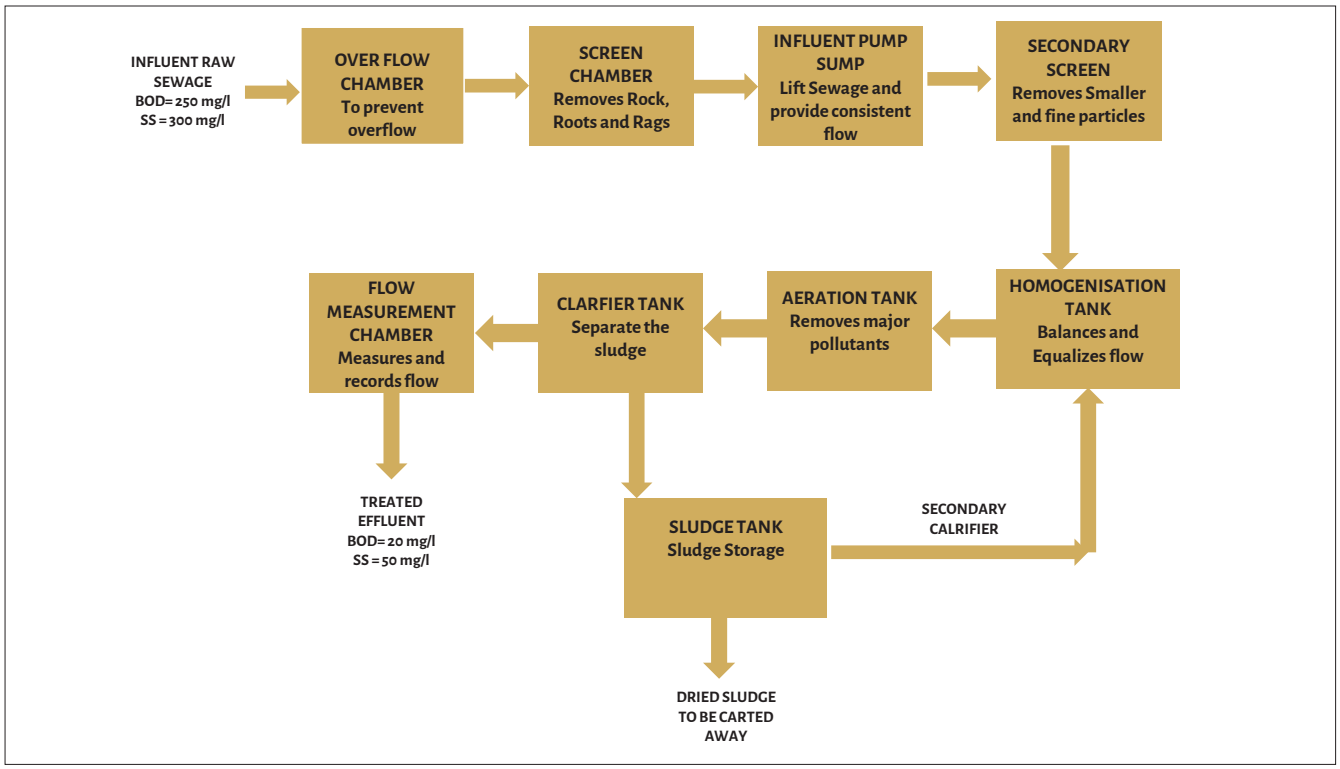


Source: The Water Treatments, 2014a.

The need for improvement in the sewerage systems became stronger in the 1980s after the Environmental Quality Regulations were enacted in 1979. Technological advancements included the introduction of full secondary treatment via mechanized STPs. There are various types of mechanized STPs ranging from the conventional activated sludge to extended aeration, rotating biological contactors and trickling filters. Fig. 6 depicts an extended aeration activated sludge system. Mechanized STPs capable of providing full secondary treatment are far superior to the other systems discussed earlier. These mechanized plants greatly improved treatment performance, reducing BOD from 200-400 mg/l to 10-30 mg/l (Baki, 2005).

In the 1990s, improvement in pumps technology allowed for the introduction of more efficient pumps into the sewerage industry. Improvements were made in the impeller design, the materials used and the compactness of the whole pump. Various types of aerators, such as aspirators and submersible aerators, as well as improvements in their design were also introduced over the years to allow for more efficient oxygen transfers. The technological developments included improvement of existing systems such as the use of programmable logic control (PLC) and

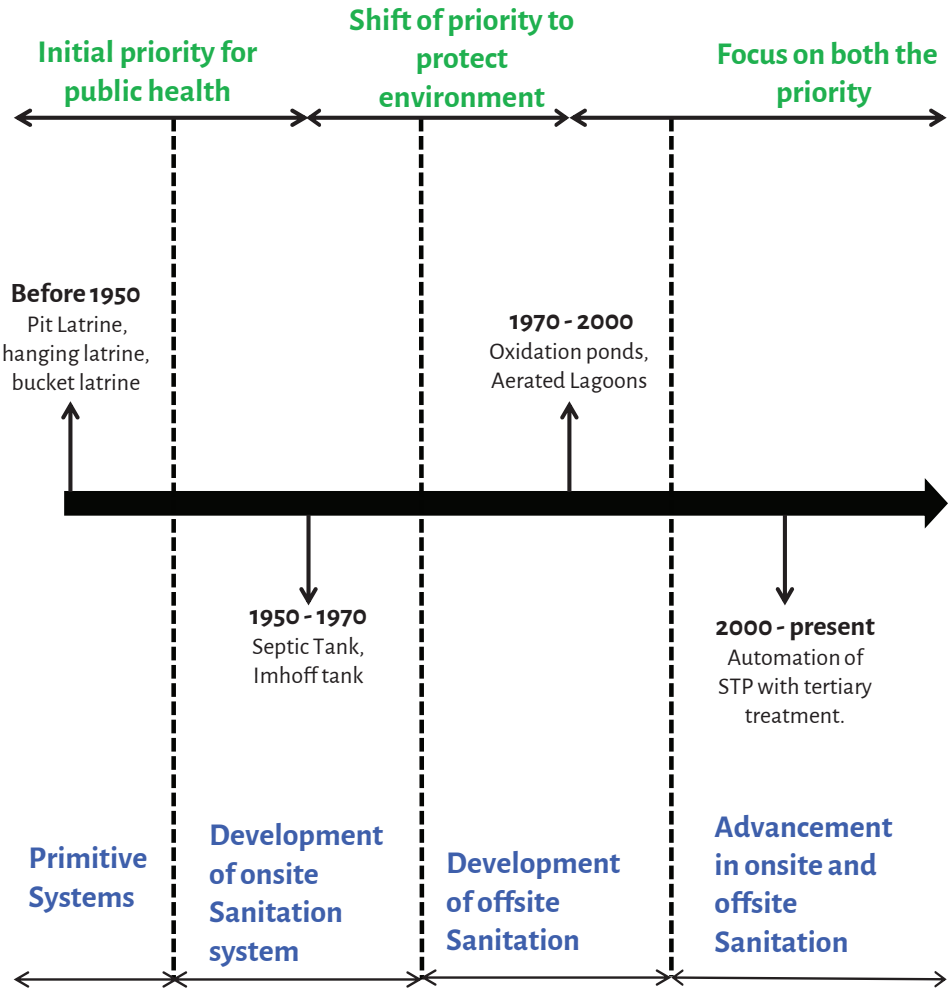
Figure 6: Typical Performance of Extended Aeration Activated Sludge System



the supervisory control and data acquisition (SCADA) system in 1990s. A PLC is a digital computer used for the automation of various electro-mechanical processes in waste water treatment plants. These controllers are specially designed to survive in harsh situations and shielded from heat, cold, dust, moisture, etc. A PLC consists of a microprocessor that is programmed using computer language (Engineers Garage, 2012). SCADA is a category of software application programme for process control, the gathering of data in real time from waste water treatment plants at remote locations in order to control equipment and conditions (Tech Target, 2017). Advancements in computer technology and microelectronics allowed for the enhancement and optimization of sewage treatment systems. For example, the use of PLC allowed for better control of the sequencing batch reactors processes or intermittent decanted extended aeration (IDEA) systems (Baki, 2005).

This evolution of treatment processes from primitive to primary and then to secondary systems was mainly due to the development of technologies in the sewerage industry. The evolution has also involved the movement from non-mechanical systems to more mechanical and automated systems. New and improved equipment has also been continuously introduced due to technological advancements. Over time, this has increased the expectations regarding environmental standards and the skill level in the design, construction and operations of new sewerage works.

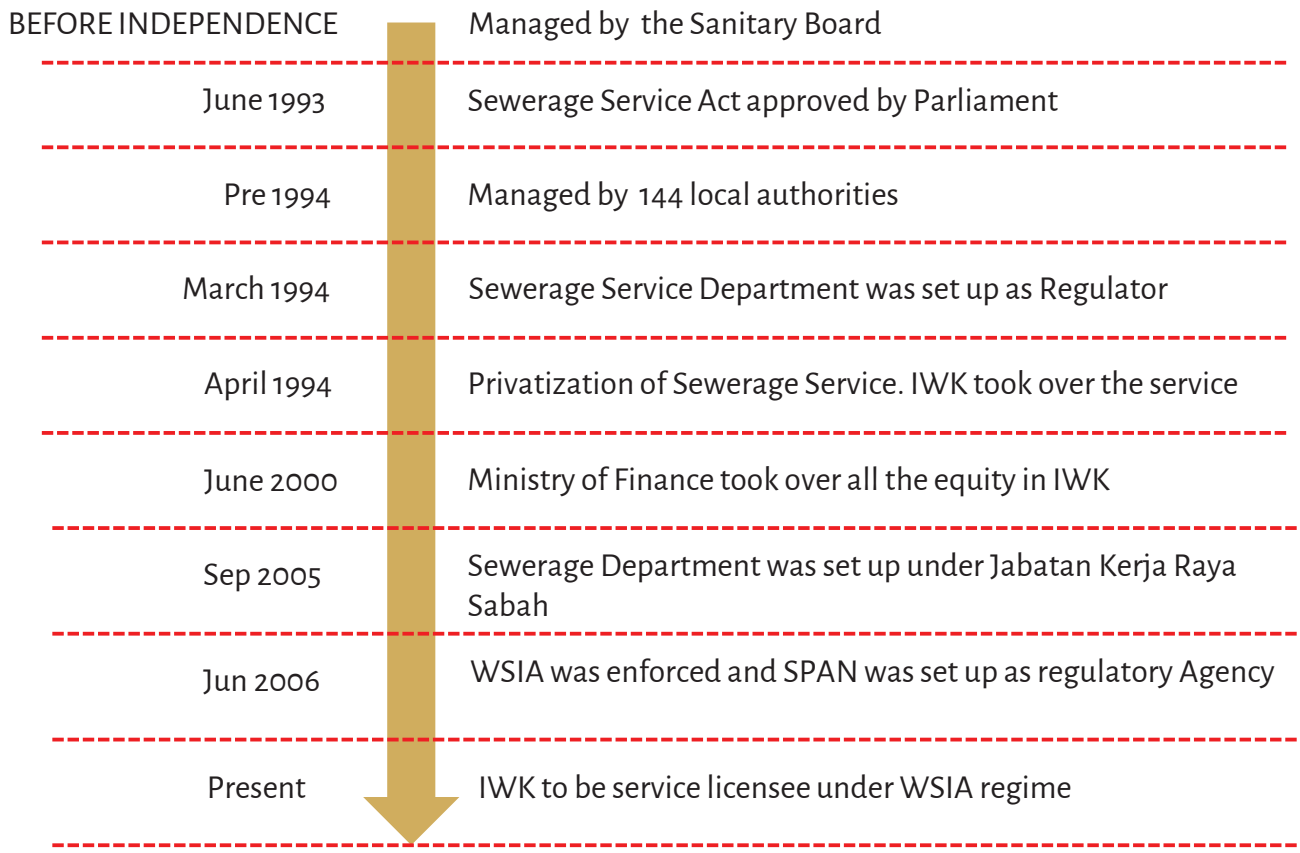
Figure 7: Evolution of the Sewerage System in Malaysia



REGULATORY FRAMEWORK OF SEWERAGE MANAGEMENT IN MALAYSIA

Malaysia is a federation of 13 states, 144 local authorities and three federal territories. The Federal Constitution clearly indicates that water is a state matter which includes rivers, lakes, streams and groundwater but not wastewater. This, however, is not exclusive as under the Federal List of the Constitution, the federal government has power over certain water-based projects in the states, such as hydropower generation, navigation within ports, marine fisheries and mining. In addition, drainage and irrigation have been stipulated under the concurrent List, and hence fall under the jurisdiction of both federal and state governments. Under Article 76 of the Malaysian Constitution, the federal government has the power to enact any law under the State list for the purpose of achieving uniformity, in compliance with an international treaty, or simply at the request of a state. Nevertheless, these regulations will not be effective unless the state legislature approves them (World Intellectual Property Organization, 2010). The evolution of the regulatory framework of sewerage services in the country is depicted in Fig. 8.

Figure 8: Evolution of Sewerage Service Regulation in Malaysia



Note: The Sewerage federalization and Privatization took place in stages in various states, excluding East Malaysia (Sabah & Sarawak). In peninsular Malaysia, Kelantan state did not participate, and also Johor Bahru and Pasir Gudang Local Authorities. The coverage of Federalization and Privatization was only within the Local Authority areas (urban areas)

When it comes to the development, utilization and management of water resources excluding sewerage, both the federal and state governments are involved. This is because the responsibility for water resource administration is fragmented and is shared among a number of federal and state agencies, each having their own specific involvement in water-related issues. The jurisdiction and legislative power in the area of water is distributed between federal and state governments in accordance with the Legislative lists of the Federal Constitution which comprise the Federal List, State List and Concurrent List. Their association with water-related matters concerns the following three aspects: (i) planning, development and management of water resources; (ii) protection and conservation of water; and (iii) land-use control and watershed management (Mohamad et al., 2008).

Before 1957, when Malaysia declared its independence, local sanitation committees were responsible for sanitation in rural areas while local governments managed sanitation in urban areas. From the end of the 1960s, the Malaysian government launched a series of five-year plans which, among other things, proposed the construction of appropriate sanitation facilities in

both urban and rural areas. At that time, septic tanks constituted the main sanitation system. In the 1970s, the government started the National Sewerage Development Program to develop sewerage facilities in major cities with the aim of introducing modern sewerage systems in urban areas (Japan Sanitation Consortium, 2011). This programme was integrated into the five-year plans and resulted in the development of a series of master plans.

However, due to the inadequacy of existing financing structures and the government's difficulty in gathering sufficient resources, these master plans were implemented only in Kuala Lumpur, Butterworth, Penang, Ipoh and Kota Kinabalu. As a result, sewerage services and development in other places were fully entrusted to local governments, which also faced difficulties, such as financial shortage and lack of knowledge, in providing modern sanitation infrastructure (Japan Sanitation Consortium, 2011).

The sewerage system developed in Penang island, has sewerage treatment plants but the treatment efficiency is low due to which tons of sewage was not treated. The continued pollution of un- treated sewage was a threat to island resort tourism, now a big foreign exchange earner for Malaysia (JICA, 1999).

To mitigate the coastal water pollution, the Malaysian government introduced the Environmental Quality (Sewerage) Regulations in 1979, compelling developers of houses, hotels, tourist resorts and other building projects to build communal treatment plants and sewerage systems in their respective project sites. While developers have adhered to these requirements, the sewerage systems set up did not function efficiently. For instance, due to a rise in building and land costs, some developers looked for cheaper, but not necessarily appropriate, options. Many also failed to carry out proper maintenance of these systems due to shortage of manpower and lack of expertise (JICA, 1999).

Environmental deterioration caused by pollution from sewage and sullage thus pointed to the need to accelerate investment in sewerage infrastructure. Under the 6th Malaysian Plan (1991-95), for instance, only RM500 million was allocated for sewerage facilities. If this amount had been evenly distributed to the 144 local authorities, each would have received about RM3.5 million (US$1.4 million). This amount would have been totally inadequate for huge capital outlays such as construction of pumping station and STPs. The cost of building a medium to large STP is about RM300 million to RM400 million (JICA, 1999).

Until 1993, STPs, sewers and other sewerage facilities in Malaysia were managed by 144 local authorities. Due to a shortage of funds and human resource constraints, most local authorities placed low priority on the development of a centralized sewerage system. Between 1986 and 1990, only nine projects, out of a total of 19 feasibility studies on centralized sewerage systems for state capitals and major towns, were implemented (JICA, 1999).

Besides limited funding, local authorities also lacked expertise and technical know-how in maintaining the sewerage systems. As a result, until 1993, only 2% of septic tanks (6056 of approximately 3,02,800 septic tanks) were de-sludged and there was no proper treatment of fecal sludge. About 80% of more than 3,600 public sewage treatment plants did not function according to required performance levels or were completely out of order. In many instances, developers built substandard sewerage systems and technical supervision by the local authorities was lacking. Furthermore, many sewerage systems were left in the hands of private developers who failed to monitor and maintain them (JICA, 1999).

Until 1993, in terms of service delivery, 89% of the population under the jurisdiction of the larger local authorities had access to either connected sewerage systems or septic tank systems, while 11% were not serviced. In the case of the smaller local authorities, only 62% of the population had access to connected sewerage systems or septic tank systems, while 38% were not serviced (JICA, 1999).

All these factors, prior to 1993, prompted the government to privatize the national sewerage system. Before the privatization contract could be awarded, the country had to change its laws so that sewerage services, which were the responsibility of local authorities, would come under federal jurisdiction (JICA, 1999). The legislative change – the Sewerage Services Act (SSA) – came in July 1993.

The SSA not only allows for the privatization of sewerage services, but also approves the setting up of a national regulatory body to act as a monitoring and regulating agency for the government on sewerage services (JICA, 1999). In March 1994, a new regulatory body, the Sewerage Services Department (SSD), was set up under the Ministry of Housing and Local Government (now under Ministry of Energy, Water and Communications) to regulate sewerage management service provider and ensure that it fulfills the responsibilities set out in the concession agreement. The main purpose of the SSD is to regulate the service and the existing sewerage system which is operated by either the government or private parties. Currently sewerage operations of all local authorities in Peninsular Malaysia have been taken over by the SSD, except that of the state of Kelantan, Johor Bahru City Council as well as Pasir Gudang Local Authority and the state of Sarawak and Sabah (SSD, 2013). The SSD also acts as the licensing authority for all sewerage infrastructures. Besides the SSD, the Department of Environment (DoE) under Ministry of Natural Resources and Enviorment is responsible for monitoring the standard of effluents discharged from sewage treatment plants operated and maintained by service provider to ensure that they meet the prescribed environmental standards (JICA, 1999).

According to SSA, the federal government became responsible for controlling all sewerage assets and signed a concession agreement with Indah Water Konsortium (IWK) to which the management of sewerage services was entrusted. The contract included operation, maintenance and development (i.e. upgrading, rehabilitation and expansion of sewerage infrastructure) over a 28-year concession period (Japan Sanitation Consortium, 2011). IWK began operations in April 1994, starting with a clean-up of Kuala Lumpur. Up until March 1998, sewerage management of 84 local authorities had come under the management of IWK, with the states of, Kelantan, Sabah and Sarawak and the cities of Johor Bahru and Pasir Gudang remaining under the control of their respective local governments. By the end of 1997, IWK had spent some RM278.6 million on capital expenditure to upgrade the country's sewerage system. It is envisaged that by the end of the 28-year concession period, all the major towns in Malaysia will be serviced 85% by sewers and 15% by septic tanks, while the smaller towns will have 30% sewers and 70% septic tanks (JICA, 1999).

As part of efforts to regulate the sewerage sector, a Technical Working Group comprising the DoE, SSD and IWK was established in July 1996 to discuss various environmental and operational issues faced by IWK. The main objective of this Working Group is to facilitate compliance with the Environmental Quality Act, 1974, and Sewerage Services Act, 1993 (NC Tharavathy, 2013).

In the wake of the economic downturn in 1998, the federal government acquired shares in IWK through the Ministry of Finance during June 2000. At that time, IWK responsibility was limited to only the operation and maintenance of sewerage facilities as well as its collection and treatment (SSD, 2013). The new scenario has led to the SSD's functions expanding beyond regulation of IWK's concessions; it became directly responsible for development, acquisition, implementation, design of sewerage facilities.

By the early 2000s, state governments (with the exception of Penang) faced financial distress after borrowing heavily from the federal government and failing to raise additional capital or collect adequate tariff revenue to service their debts (Majidi, 2011). As a result, the federal government restructured the water and sewerage sector in 2005 (OECD, 2013). With a constitutional amendment passed in 2005, the responsibility for water and waste water services was transferred from the different states to the federal Ministry of Energy, Green Technology and Water, in order to develop a holistic water policy for the country. Other regulatory bodies in the country are the National Water Resources Council (NWRC), which is responsible for water resources and ensuring coordination between various state governments regarding inter-state river basins. River quality is monitored by the DoE under the Ministry of Natural Resources and Environment. But drinking water quality control falls under the responsibility of the Ministry of Health (Majidi, 2011).

Two Acts – the Water Services Industry Act (WSIA) and the National Water Services Commission Act – were introduced in May 2005 to regulate water services. The WSIA, which replaced the Sewerage Services Act of 1993, provides the regulatory framework of sewerage and septage management; it requires the owners and occupants of houses with septic tanks to take the responsibility of operating and maintaining them appropriately (Japan Sanitation Consortium, 2011).

Suruhanjaya Perkhidmatan Air Negara (SPAN) was established as the central regulatory body for water and sewerage services in 2006. It consists of ten members who are appointed by the federal government for a period of two years. SPAN was established with the main objective of improving the performance of the water and sewerage industry, mainly to address the problem of high non-revenue water and to improve river quality by means of raising waste water treatment standards (Pigeon, 2012). The SSD was no longer the regulating agency, instead becoming a project implementation agency in charge of defining the planning for new constructions and upgrades of sewers and waste water treatment plants. Through the monitoring and regulation of sewerage services, SPAN follows the performance of IWK (Japan Sanitation Consortium, 2011).

SPAN's role is crucial in that it co-delivers (together with the Ministry of Energy, Green Technology and Water) licenses and regulates all water and sewerage industry professionals active in the country (water services contractors, public and private water supply operators, public and private sewerage operators and contractors, manufacturers/suppliers and even plumbers),and made it compulsory since the WSIA states that anyone operating a water or sewerage system without such a license will face a heavy fine, and possibly even a prison term. Crucially, SPAN is meant to design a 'robust, stable and transparent framework for periodic tariffs reviews'. The current system forces operators to use industry-benchmarked costs determined by the regulator in order to keep these operators under competitive pressure. This means that tariffs are reviewed within a technical, rather than political, framework (Pigeon, 2012)

Pengurusan Aset Air Berhad (PAAB) was also established in 2006 as a company wholly owned by the Minister of Finance in order to manage water supply and sewerage system assets at the national level. PAAB's primary responsibility is to develop the nation's water and sewerage service infrastructure in Peninsular Malaysia in line with the WSIA (Majidi, 2011). Its main objectives are:

- To construct, refurbish, improve, upgrade, maintain and repair water and sewerage service infrastructure and all other assets in relation to the water systems.
- To source and obtain competitive financing for the development of the nation's water and sewerage service assets and lease such assets to water operators licensed by SPAN for operations and maintenance.

- To assist SPAN to restructure the nation's water and sewerage industry towards achieving the government's vision of efficient and quality water services.

PAAB has an authorized capital of RM3 billion (US$982 million) and currently, the paid-up capital is at RM410 million. The crux of the water reform process in Malaysia involves persuading all state and privately run water utilities to surrender their assets to PAAB. However, till date only four of the 11 states (not including Sabah and Sarawak) had signed up. It has not been plain sailing for the water reforms. The legislative process was only the tip of the iceberg, given that the current business model adopted by most state water operators does not promote sustainability of the water services industry. The negotiation process depends on the complexity and uniqueness of each state (Majdi, 2011). Currently, PAAB looks after only water supply system.

SPAN monitors the sewerage operators along Key Performance Indicators that look at water quality, water pressure and customer services in a benchmarking approach. SPAN's enforcement powers are important; it has the legal ability to take measures as far-reaching as replacing the entire management of an operator in the event the latter repeatedly fails to comply with its assigned targets. SPAN's monitoring also relies on direct consumer input, with an entire department tasked with receiving and handling complaints, in close cooperation with the Malaysian Water Forum, a consumer body specifically created for this purpose and funded by SPAN (Pigeon, 2012).

SPAN plays an essential role in safeguarding the public, social and environmental dimensions of Malaysia's water and sewerage services through its monitoring of operators constituted as corporations whose only structural objectives are to at least reach financial balance within their own accounting scope. The general rationale is that operational efficiency will stem from this arms-length relationship between the regulator and the operators, and that this efficiency will be the source of legitimacy for moving towards full cost recovery (Pigeon, 2012).

One of Malaysia's sanitation characteristics is that sewerage systems and septic tanks constructed by both the public and private sectors are considered to contribute to the improvement of sanitation. Therefore, based on this concept, the regulation, operation and maintenance of both systems are provided by SPAN. The ratio of connected houses to the sewerage system was 5% in 1993, but it increased exponentially to reach about 70% in 2010. Furthermore, the number of waste water treatment plants that conform to the standards for discharged effluents has increased year after year. In 2006, 69% of such plants met the BOD standard and 88% of them complied with the suspended solids standard (Japan Sanitation Consortium, 2011). The effluent discharge limits as prescribed by DoE are summarized in Table 2. All sewage treatment plants design shall take into consideration of this standard and shall comply with the proposed limits.

Table 2: Effluent Discharge Standards.

	Temp	pH	BOD	COD	SS	NH3-N	NO3-N	P	O&G
Category 1 (after 2009)									
Std A	40	6-9	20	120	50	10	20	n/a	5
Std B	40	5.5-9	50	200	100	20	50	n/a	10
Category 2 (1999-2009)									
Std A	n/a	n/a	20	120	50	n/a	n/a	n/a	20
Std B	n/a	n/a	50	200	100	n/a	n/a	n/a	20
Category 3 (before 1999)									
CST	n/a	n/a	200	n/a	180	n/a	n/a	n/a	n/a
IT	n/a	n/a	175	n/a	n/a	n/a	n/a	n/a	n/a
OP	n/a	n/a	120	360	150	n/a	n/a	n/a	n/a
AL	n/a	n/a	100	300	120	n/a	n/a	n/a	n/a
MP (Std A)	n/a	n/a	60	180	100	n/a	n/a	n/a	20
MP (Std B)	n/a	n/a	80	240	120	n/a	n/a	n/a	20

Source: Narayana, 2017

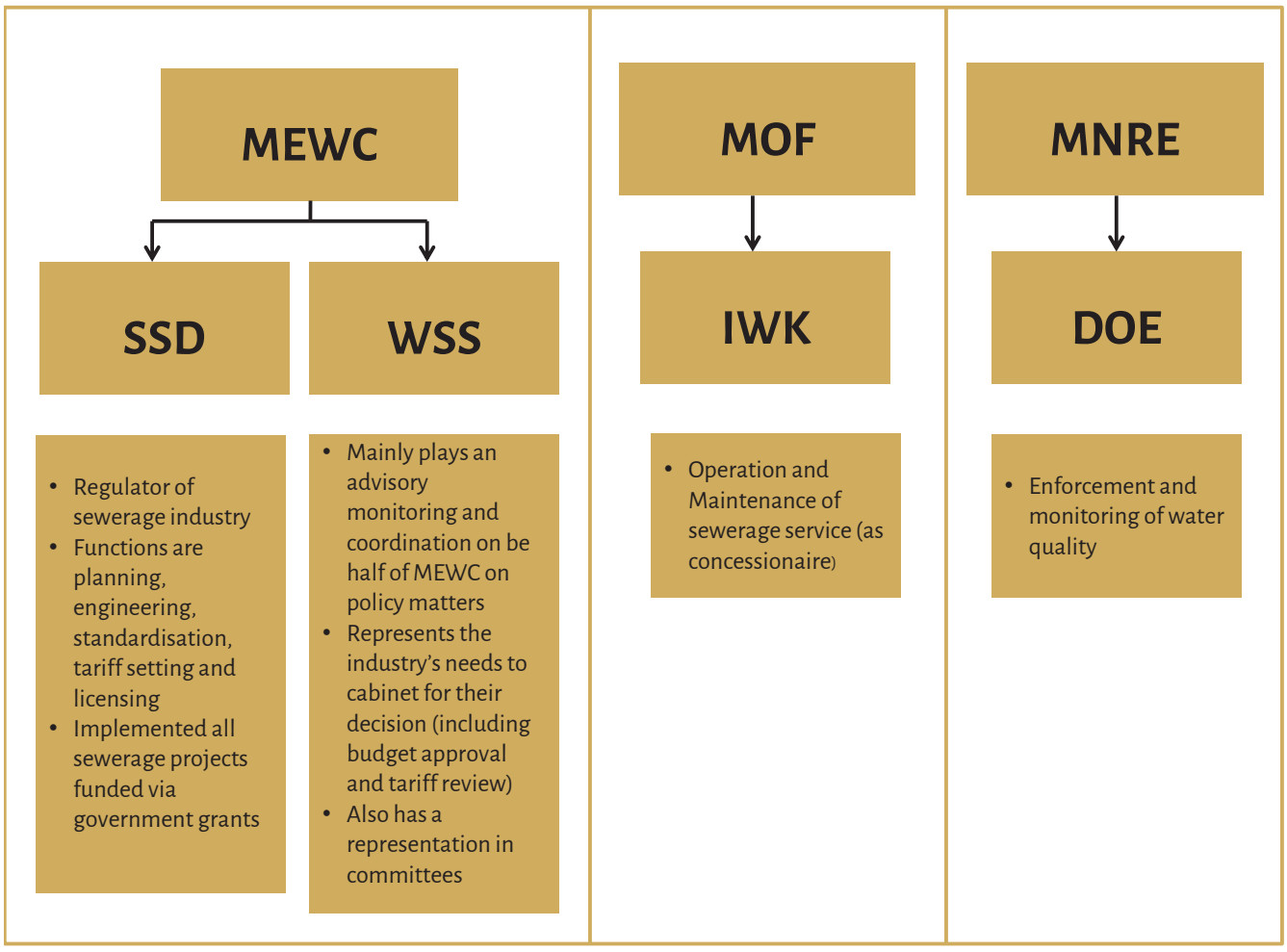
Note: Effluent Discharged at upstream of water intake must comply with Standard A, whilst effluent discharged at downstream of water intake must comply with Standard B.

The STPs built before 2009 was given 7 years' time to comply with Category 1 standards, if not they have to obtain License to Contravene from SPAN by submitting a plan with details of the startegies to achieve the standards and also paying specified fee..

The Malaysian national sewerage development policy envisions an industry that is managed in a holistic and sustainable manner so as to provide adequate and appropriate sewerage facilities and services that continuously protect public health, preserve national water resources and enhance the quality of the environment. The structure of sewerage sector, as illustrated in Fig. 9, shows that there are three Ministries – Energy, Water and Communications (MEWC), Finance (MOF), and Natural Resources and the Environment (MNRE) – that have major but distinct roles in promoting and advancing the sewerage industry of Malaysia (JICA, 2009).

The implementation of sector reforms, with the enforcement of the WSIA on January 2008, provided a new impetus to the sewerage services industry, given the rationalized roles of the MEWC and MOF, as shown in Fig. 10. The MEWC now consists of three departments focused on various sewerage services functions ranging from policy and policy coordination, planning, design and project implementation to regulation (tariff setting, engineering standards, licensing and enforcement of sewerage and sewerage-related laws and codes). With the integration of water and sewerage planning, the water supply sector is expected to play a very active role in advisory services and coordination. This may be the reason it has membership in select committees: to ensure that plans and programmes are managed to achieve the best results (JICA, 2009).

Figure 9: Structure of the Sewerage Sector as of 2007



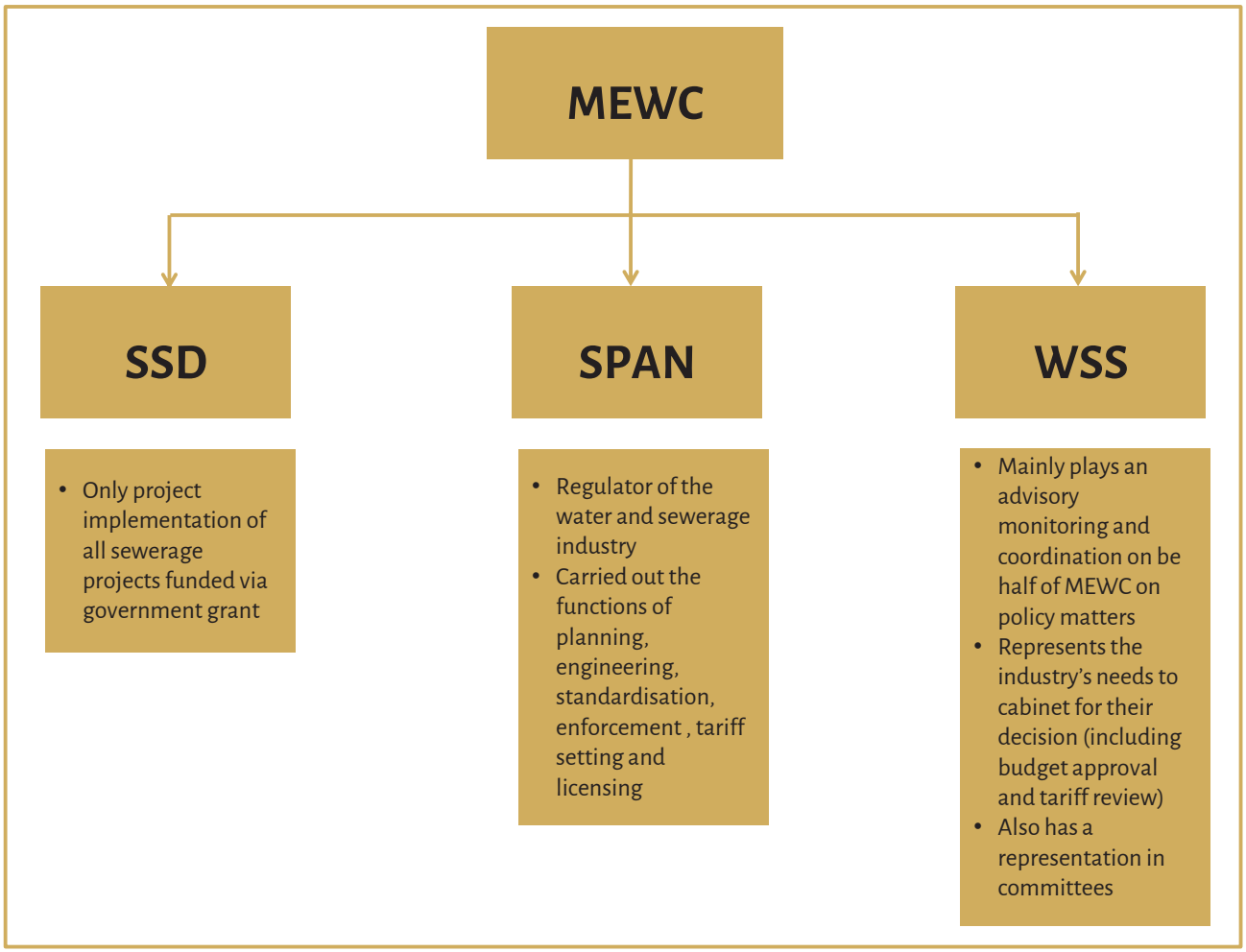
It is apparent that the SSD will eventually transfers its project-planning role to SPAN and its project implementation role to the Water Asset Management Company (WAMCO), especially for new water and sewerage infrastructures. However, WAMCO has not yet operational. This transition took several years, as this change not only affected the systems and processes but also the public. Since it is a new entity, it may take a few years for SPAN to reach a fully operational level (JICA, 2009).

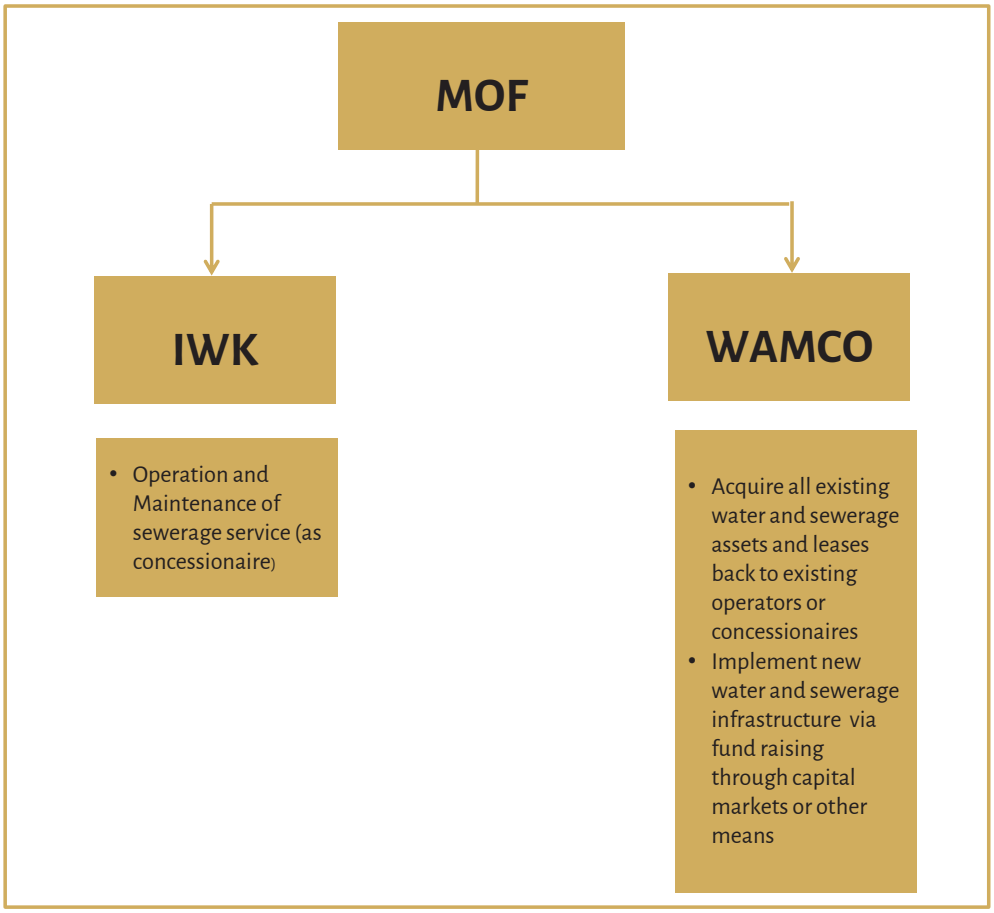
The MOF, through IWK and WAMCO (which is not yet set up), will operate and maintain the sewerage infrastructure. In addition, WAMCO will be implementing new pipeline water and sewerage infrastructure projects using a variety of financial strategies. This may involve private and public partnerships, loans and financing through the capital market. The possibility of raising funds through tariff increases cannot be ruled out.

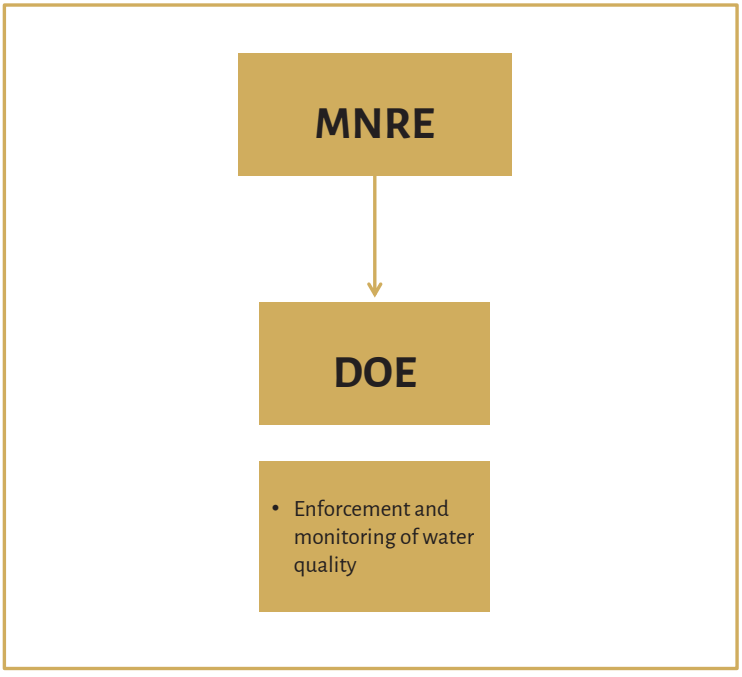
These measures are aimed at achieving the viable operation of water and sewerage infrastructure facilities in order to improve the quality of service over the long term without the need for government intervention or subsidies (JICA, 2009). The MNRE, through the DoE, continues to enforce and monitor compliance with laws pertaining to water quality, ensuring the quality of the environment for future generations of Malaysians.

All of these changes are necessary to coordinate policy implementation at the federal (central), state and local authority levels, contributing to the achievement of sector goals and objectives. The new framework created by the SPAN and WSIA aims to improve the autonomy and efficiency of sewerage sector by allowing comparisons among sewerage sector enterprises through the use of performance indicators measuring costs, efficiency and service quality (JICA, 2009).

Figure 10: Structure of Sewerage Sector after November 2007




MOF
IWK
WAMCO
• Operation and Maintenance of sewerage service (as concessionaire)
• Acquire all existing water and sewerage assets and leases back to existing operators or concessionaires
• Implement new water and sewerage infrastructure via fund raising through capital markets or other means


MNRE
DOE
• Enforcement and monitoring of water quality

PRIVATIZATION OF SEWERAGE SERVICE

The privatization of Malaysia's sewerage system needs to be understood within the context of the country's sewerage needs following three decades of neglect and underfunding. This was due to low priorities for sewerage development (compared to water supplies) and unwillingness on the part of most local government authorities to finance capital expenditure through higher user charges. The allocation of funds for sewerage development consistently and substantially lagged behind that for water supplies. Only US$330 million was allocated to sewerage services by the federal government between 1976 and 1995 compared to US$3,089 million to develop water supply infrastructure. As a result, coverage was low, and poor effluent quality from defunct STPs led to water pollution and health risks. Only 3.4% of the country's population was served by central sewerage systems in 1970, mainly in large urban centers, barely increasing to 5% in 1990, compared to 100% of urban populations and 66% of rural populations with access to safe water supplies. Around 80% of STPs did not meet the DoE effluent discharge standards. River and water quality deteriorated between 1% and 2% every year, with 72% of rivers polluted in the 1980s and early 1990s largely due to untreated sewage (Tan, 2007).

Low coverage was due to institutional and resource constraints. While safe water was perceived as a basic need and prerequisite for development from the beginning, the pace of economic development was seen as sustainable without a corresponding development of sewerage infrastructure. The Local Government Act, 1974, enabled local authorities to recover capital costs for the development of sewerage infrastructure through a 5% charge on the assessed annual value of properties, and charge for operating costs for sewerage services (Tan, 2007). But despite feasibility studies suggesting this was financially viable, most state authorities perceived this to be too expensive for consumers.

The water and sewerage system was also characterized by the lack of a single agency entrusted with overall responsibility for planning and management. As a public health concern, sewerage services came under the purview of both federal and state authorities. Jurisdiction and administration came under local municipal authorities, although a variety of other authorities were also involved, including Jabatan Kerja Raya (JKR, Public Works Department), the Ministry of Housing and Local Development, the Ministry of Health and the DoE (Tan, 2007). Federal ministries provided support but as they had only an advisory status with local authorities, policies were not always adhered to.

Prior to privatization, the federal government invited proposals for the private financing of infrastructure projects, and one local authority had signed a memorandum of understanding to accept a privatization offer, with another two in the process of doing so. IWK's proposal to take over 48 major local authorities was accepted by the federal government on condition that it also took over sewerage services from the remaining 96 smaller local authorities, with a common tariff nationwide to enable cross-subsidization from richer to poorer sectors to make sewerage services affordable. The proposal was initiated in 1991 by North West Water (NWW), a UK-based water supply and sewage treatment company, through its country manager, David Chew. Chew's job was to develop business in Malaysia which initially involved finding local partners willing to take a majority stake. He came up with the privatization proposal in consultation with Vincent Tan's Berjaya Group to enable NWW to progress with the project in Malaysia (Tan, 2007).

IWK was incorporated on 25 January 1991 and the consortium was led by the Berjaya Group, through Berjaya Industrial (20%), with the other shareholders being NWW (25%), Lembaga Tabung Angkatan Tentera (LTAT, Armed Forces Savings Board) (20%), the Royal Malaysian Police Investment Cooperative (20%) and AIMS Worldwide (15%) (Tan, 2007). As mentioned earlier, IWK was awarded a 28-year concession in 1993 to manage, operate and maintain a nationwide sewerage system previously administered separately by the 144 local authorities. Ownership of all public sewerage system assets would revert back to the federal government free of charge at the end of the concession period in 2020. Privatization aimed to:

a. improve service and quality through enhanced efficiency;

b. expand coverage through new capital investment to increase the number of households directly connected to centralized sewerage services;

c. develop and promote low-cost, indigenous sewerage treatment technology for export; and

d. develop Malay entrepreneurial capacity through the ownership and management of assets.

The privatization was characterized by several changes of ownership and management following public unwillingness to pay and tariff revision. Tariff revision and continued customer refusal to pay led to cash flow problems which affected the concessionaire's ability to meet operational and capital commitments. On 4 February 1999 the government became a special shareholder and on 23 June 2000 the MoF paid RM192.5 million in cash to Prime Utilities Bhd (PUB, the most recent owner of IWK) for its entire stake in IWK (Tan, 2007).

A. Performance

IWK commenced operations in April, 1994. Under the concession agreement, it had to meet coverage, capital investment and service targets, as well as environmental and performance standards set by the DoE. Its performance can be measured by examining whether it met the terms of the concession agreement in relation to: (i) system coverage; (ii) refurbishment

and capital works; (iii) service delivery; (iv) environmental standards; (v) the development of indigenous technology; and (vi) New Economic Policy (NEP) objectives, namely the Malay ownership and management of assets. IWK exceeded targets for taking over STPs, but failed to meet the overall coverage, capital investment, service and environment targets (Table 3). It also failed to develop local technology or Malay managerial expertise (Tan, 2007).

B. System Coverage

IWK was to take over sewerage services maintained by 144 local authorities within two years from the federal government. However, by 2000, the federal government's Sewerage Services Department (SSD) only managed to take over, and pass over to IWK, sewerage services of 84 local authorities, thus failing to meet overall coverage targets. The concession agreement also required IWK to take over 1,500 STPs and 2,200 km of sewer pipes. IWK exceeded this figure, taking over 6,457 STPs, 9,236 km of sewer pipes, and 906,785 septic tanks, along with 277 network and pump stations between 1995 and 2000, providing sewerage services to.13.52 million people (Table 4) (Tan, 2007). IWK had to improve coverage for connected sewerage services and septic tank use in 48 major (Category A) towns and 96 smaller (Category B) towns over six phases between 1994 and 2022 (Table 5). By the end of 2000, 9 million people were connected sewer network (about 45%) and 4.5 million served by septic tanks (22.5%) out of 20 million population (Tan, 2007).

At present, IWK operates and maintains about 6625 STPs, 1,106 pumping stations, 18,802 km of sewer line and, 3,637 CST. Apart from this, IWK also de-sludges 1.3 million individual septic tanks. Altogether a population of 23.61 million is covered under the IWK sewerage system.

Table 3 : IWK Performance, 1994-2000

Concession Target	Parameters	Targets	Actual
System Coverage	Number of Local Authorities	143	84
	STPs	1,500	6,457
	Sewer Pipes	2,200	9,236
Refurbishment	-	-	RM181 million (1995-2000)
Capital Works		RM600 million (1992-2002)	RM145.2 million (1997-2000)

Source: Tan, 2007.

Table 4: IWK: Sewerage System Operated and Maintained, 1994-2000

	Network Pipelines (km)	Network Pump Stations	Public STPs	Septic Tanks	Population Connected to Sewer Line	Population Connected to Septic Tank	Total Population Served
1994	2,317	74	1,043	3,02,800	2,448,700	1,514,000	39,62,700
1995	3,567	116	3,239	7,49,182	3,783,220	3,745,910	7,529,130
1996	5,921	160	4,068	8,36,306	6,235,900	4,181,530	10,417,430
1997	7,052	180	4,539	7,36,797	7,416,490	3,683,985	11,100,475
1998	7,868	209	5,571	7,76,602	7,544,180	3,883,010	11,427,190
1999	8,589	245	6,081	8,22,638	8,311,070	4,113,190	12,424,260
2000	9,236	277	6,457	9,06,785	8,996,028	4,533,925	13,529,953

Source: Tan, 2007.

Table 5: IWK: Sewerage Coverage Targets

End of Phase	Category A (48 Major Towns)		Category B (96 Smaller Towns)	
	Connected %	Septic Tank %	Connected %	Septic Tank %
Phase I (1997)	-	-	-	-
Phase 2 (2002)	63.8	29.0	15.8	50.6
Phase 3 (2007)	76.2	19.2	17.8	50.0
Phase 4 (2012)	82.6	14.3	19.4	49.5
Phase 5 (2017)	84.3	13.0	24.0	47.2
Phase 6 (2022)	84.3	15.7	29.5	70.5

Source: Tan, 2007.

Figure 11: IWK service Area

Source: Narayana, 2017

C. Refurbishment and Capital Works

The capital works programme targeted 84.3% sewerage connections and 15.7% septic tank coverage in 48 major towns, and 29.5% and 70.5% coverage respectively in 96 smaller towns by the end of 28 years at an estimated cost of RM6.06 billion over six phases (Table 6) (Engku Azman).

IWK was required to plan and undertake an infrastructure programme in six phases, which included constructing new STPs in areas identified by the government; refurbishing and upgrading existing STPs; connecting existing septic tank users to a centralized sewage treatment system through the construction of 15,000 km of new pipes; and constructing 40 modern mechanical centralized sludge treatment plants in designated locations over 15 years (Tan, 2007).

Under the concession agreement, IWK was to spend RM800 million on refurbishment (200 million) and capital works (600million) for Phase 1, and a total of RM5.26 billion for Phases 2-6 from 1997 to 2022 (Tan, 2007). Phase 1 (1994-97) of the capital works programme involved:

- refurbishing poor and non-functioning STPs and pump stations;
- constructing new STPs for Jelutong and Bayan Baru in Penang (where untreated sewage was being released into the sea);
- undertaking sewerage connection projects in Labuan, Port Dickson and Langkawi, and 12 connected sewerage projects in Johor Baru, Kuala Lumpur, Ipoh, Seremban, Melaka, Kangar and Kuching;
- replacing all biosoil type plants; and
- Constructing new sludge treatment.

IWK's refurbishment and capital cost estimates were based on data provided by all local authorities for 1,500 STPs. However, it was later discovered that the number of STPs in fact exceeded 6,000, raising operating and capital costs. Furthermore, an estimated 80% of STPs handed over by the local authorities were in a state of disrepair or disuse, requiring additional refurbishment costs, and failed to meet effluent. A refurbishment strategy was formulated and plans drawn up to upgrade sewerage systems. Refurbishment works to improve safety and aesthetic aspects were given priority to address public dissatisfaction with the condition of STPs. Refurbishment works were also carried out to restore the mechanical and electrical systems to working order (Tan, 2007).

Between 1995 and 2000, IWK spent RM181 million refurbishing 481 STPs. However, 92.5% of the 6,457 STPs had not been refurbished by 2000. IWK also carried out a total of 38 capital projects as part of Phase 1 of its capital works programme between 1995 and 2000. The total amount committed to these projects was RM224.3 million, with 37 projects completed by 2000 at a cost of RM145.2 million (Tan, 2007).

D. Service Delivery

IWK was to de-sludge all septic tanks in the local authority areas, in accordance with a schedule to ensure compliance with the original design requirements, generally once every two years. It was estimated that on-schedule de-sludging would reduce the pollution load of surface water sources by more than half within two years as 99% of septic tanks were found not to have been de-sludged since 1980 (Tan, 2007).

IWK was expected to de-sludge 736,797 individual septic tanks for the operational areas between 1994 and 1997, but only carried out 324,308 first-round septic tank de-sludging (44%). By 2000, IWK had de-sludged 491,685 out of 906,785 septic tanks (54%). However, an estimated 65% of homeowners with septic tanks did not allow IWK to undertake first-round de-sludging, without which the company was unable to register households for billing purposes. In addition, a total of 13,122 homeowners refused to connect their septic tanks to the sewerage network constructed by IWK as they did not want to pay RM2,000-RM2,500 (depending on the distance to the sewerage network) for this service. The de-sludging programme could not be carried out effectively due to a lack of proper sludge disposal sites, slow approval by state governments for land applications, public objections to temporary sludge disposal sites, and public refusal of de-sludging services (Tan, 2007).

E. Environmental Standards

STP performance is measured by its ability to meet effluent quality standards. The Environmental Quality (Sewerage and Industrial Effluents) Regulations, 1979, require effluents from STPs to comply with specified discharge standards (Table 2). IWK was required to carry out sampling analysis of effluent quality in accordance with the requirements of the concession agreement. It managed to meet the sampling requirements for 36% of the plants within the first year after takeover. The shortfall was mainly due to the poor physical condition of the plants handed over, some of which had been abandoned for years. Samples could not be taken from such plants since the outlets had either been buried or could not be traced. However, a year after takeover and refurbishment works, IWK managed to take the required number of samples from 88.7% of the plants (Tan, 2007).

The concession agreement also required IWK to analyze samples for BOD, suspended solids (SS), pH, ammonical nitrogen, and oil and grease. Most of the STPs were able to comply with pH and oil and grease standards, but compliance rates for SS and BOD were low. According to IWK, 80% of its STPs in 1999 had not reached the required (BOD) standards mainly due to lack of local expertise, which led to a reliance on unsuitable foreign-designed systems (Tan, 2007).

By 2000, 86.1% of plants maintained by IWK were small ones serving populations of less than 2,000 each, with a large number of these still being CSTs and Imhoff tanks which had difficulties complying with discharge standards. Furthermore, some sewerage systems, most notably in Georgetown, Penang, had no treatment system, with untreated sewage discharged through a marine outfall. The failure to undertake capital works in Penang state resulted in an estimated 78 and 44 million litres of raw sewage being released into the sea daily in Jelutong and Bayan Baru respectively. According to the Ministry of Science, Technology and Environment, despite improvements since 1997, water quality in Malaysia remained poor, with high levels of E. coli detected in the sea, indicating discharge of untreated sewage (Tan, 2007).

Less than 17% of the 5,571 STPs operated by IWK in 1998 complied with the discharge standards (Table 6). The remaining 83% of treatment plants were given contravention licences while they were being upgraded. Between 1994 to 1998, the DoE reported 13,398 cases of environmental pollution attributed to sewage discharges by households (42.3%), industry (37.5%), livestock (16.7%) and agriculture (3.5%). Because of not meeting environmental standards, IWK was issued with RM158.7 million worth of fines by the DoE between 1994 and April 1998. However, IWK was given an exemption by the MOF and only had to pay RM56.9 million (Tan, 2007).

F. Technology

Privatization was expected to promote the adaptation of imported technology for local needs and development of low-cost Malaysian technology for sewerage systems for export to developing countries. By IWK's own admission, the failure of the company's STPs to meet environmental standards was due to a lack of expertise and the inappropriateness of imported technology for local conditions (Tan, 2007). In recent years, IWK has built STPs with advanced treatment technology, such as sequential batch reactors, membrane bio reactors, etc.

G. Malay Ownership

The privatization of the sewerage system was an opportunity to further the National Economic Policy's 'restructuring' (to reduce ethnic disparities) as well as redistribution objectives by: (i) developing Malay entrepreneurial capacity through a Malay vendor scheme and (ii) through ownership and management of assets. The participation of Malay contractors in IWK's refurbishment/capital works programmes as well as operations and maintenance averaged only 37%. While privatization offered the opportunity for Malay ownership of assets, it was characterized by several changes of ownership and management following each tariff revision (Tan, 2007).

Shortly after commencing operations in 1993, IWK was acquired by the publicly listed Berjaya South Island (another Berjaya Group company) in November 1995 for RM450 million through a share swap. Berjaya South Island later changed its name to Prime Utilities Bhd (PUB). A condition of the sale was that PUB was guaranteed IWK's pre-tax profit for 1997-99 ('secured financial years') of not less than RM105 million for each financial year. Profit guarantee agreements following each sale were introduced by the Securities Commission in an effort to ensure that profit projections were realistic, with the seller having to compensate the buyer for the profit shortfall by payment in instalments or by way of issuance of new securities (Tan, 2007).

In August 1996, Wan Adli Wan Ibrahim, the Berjaya Group's executive director on the board of PUB, acquired 19.01% of PUB (through Transwater Corporation Bhd) for RM228.16 million at RM20 per share. Transwater later increased its interest in PUB to 26.53%. A Second Profit Guarantee Agreement of RM105 million a year, with the same conditions, was signed on 28 August 1997 for 1999-2001 following divestment by certain parties and revisions made to the sewerage concession requested by the government. On 15 September 1997, Idris Hydraulic Bhd acquired a 32% controlling stake in PUB for RM370 million cash. Of this, 10% (six million shares) was purchased from Ilham Desiran Sdn Bhd – a wholly owned subsidiary of Transwater, controlled by Wan Adli – for RM142.5 million at RM23.75 per share and 19% at RM20 per share, with the remaining 3% bought on the open market. The purchase price represented a 'hefty premium' based on PUB's price of RM14.50 on 15 September 1997 (Tan, 2007). The succession of ownership changes suggests that Malay ownership was only short term with little apparent gain in management experience.

Table 6: IWK: Sewerage Treatment Plants Meeting Effluent Standards, 1999-2000

Location	Year	Total Plants	Total Plants Tested	Those Meeting A Standard (%)	Those Meeting B Standards (%)
Catchment Areas	1,999	1032	805	1	-
Others	1,999	5,049	4,077	-	27
Catchment Areas	2,000	1242	617	2	-
Others	2,000	5,215	3,659	-	41

Source: Tan, 2007.

POST PRIVATIZATION CHALLENGES

A. Tariff Structure

Determination of appropriate tariff levels at the time of privatization was problematic because of insufficient information on assets and hence operational costs. It was also unclear whether IWK was to take over from 144 local authorities. IWK's original proposal involved a financial model of revenue streams based on a tariff structure with periodic tariff rate increases and assumed annual growth in customer numbers as well as capital and operating costs for the provision of sewerage services to meet this demand. If the rate of growth of customers exceeded the assumed growth, or the inflation rate for costs turned out to be lower than assumed, then IWK would stand to make more profits, and vice versa (Tan, 2007).

However, projecting growth in customer numbers, particularly those arising from new housing developments (for which IWK would not be required to incur capital costs, but for which it would gain from increased revenues by providing sewerage services), was difficult, and the government faced the burden of meeting the shortfall in the event of non-realization of revenue projections. The internal rate of return was eventually fixed at 14-18% to ensure the continued viability of projects, with the flexibility of varying tariff rates periodically, taking into account audited revenues and cost reviews by consultants.

The government was also to provide a RM478 million soft loan to help the concessionaire keep charges to customers bearable. IWK's initial financial forecasts were based on the original tariff rates and estimates of its customer base and assets to be taken over. However, the tariff rates could not be determined by the likely number of customers or operating costs given incomplete information on these. IWK's estimates of STPs proved to be incorrect due to poor record-keeping by the local authorities (Tan, 2007).

It was only over a two- to three-year period during IWK's rolling programme of taking over from local authorities that it discovered there were three times the numbers of plants it had originally accounted for. Barely 20% of these were functioning as local authorities often had no budgets to operate STPs. The remaining 80% of plants were in a state of disrepair or disuse, and required additional refurbishment costs. Additional costs were also incurred from having to take on a lot more staff than necessary from some local authorities as stipulated in privatization contracts. IWK also did not have its own customer database, and its initial charges were based on households receiving water bills from the various state government Departments of Water Works, on which IWK's sewerage charges were tagged (Tan, 2007).

Charging on the basis of water consumption was seen as a reasonable basis to estimate revenue provided there was access to water bills. This, however, proved problematic, with some state water companies refusing to provide data on water consumption figures for free. Without sufficient information about the operations and refurbishment costs of the sewerage assets to be taken over, the proposed tariff rates appear to have been based on a study commissioned by IWK on the willingness of customers to pay monthly charges if improvements were carried out by a private company. According to the Director General of Sewerage Services (DGSS), 75% were willing to pay RM5 a month, 50% were willing to pay RM10 a month, and 25% were willing to pay RM20 a month, with 76% believing that payment for sewerage treatment was justified (Tan, 2007).

Tariffs were commonly applied across the country to provide a cross-subsidy from large to smaller urban centres where the unit capital and operating costs were higher. As a result, tariff rates were based on different principles. The household rate was calculated from the annual assessed value of a property (i.e. the monthly basic charge) and actual water usage (i.e. monthly usage charge by cubic metres of water used), with separate rates for connected services and septic tank services. The government decided on RM5 per household as an acceptable monthly household sewerage charge, but to reduce the burden on lower income groups, the household tariff structure was based on the assessed value of the premises and water consumption. Tariff charges were then set between a minimum of RM2 a month (for lower income groups) and a maximum of RM10 a month, regardless of water consumption (Tan, 2007).

Higher rates for commercial/industrial customers estimated to contribute 50-60% of IWK's total turnover were then needed to recover the balance of capital and operating costs. After much negotiation, the rate agreed for the first five years was set at about the middle of the range for commercial/industrial water supplies, i.e. RM1.20/cubic metre for connected customers, and RM0.90/cubic metre for septic tanks (Tables 7 and 8). This represented 125% of the water bill in order to subsidize household users (Tan, 2007).

Industry was assumed to treat its own industrial waste water, only discharging household waste water into public sewers or septic tanks. Tariffs for the discharge of untreated or pre-treated industrial waste water into public sewers were to be negotiated on a case-by-case basis. Commercial/industrial rates were based on the number of occupants per day (for hotels), property size (for offices and shopping complexes) and production volume (for manufacturers). The public sector was also billed differently, with charges for the army and the police based on the number of serving personnel per day and dependent on the size of the camp. In reality, there was multi-level, multi-tier cross-subsidization, with industry subsidizing household consumers and larger towns subsidizing smaller towns. On the island of Penang, the large number of hotels subsidized other areas where IWK operated at a loss. By opting for self-financing, the government probably sought to keep tariffs affordable for household consumers without having to subsidize operations,

thereby avoiding the complexities involved in monitoring performance (Tan, 2007).

Illustration (refer table 7)
If a property is connected to a sewerage system and the assessed value of such a property is RM8,000, and if the water usage is 50 cubic metres per month, the sewerage bill will be:
RM5.32 + (RM0.14/cu.m x 50) = RM12.32 per month

In case of the septic tank:
RM3.61 + (RM0.07/cu.m x 50) = RM7.11 per month

B. Willingness to Pay
Assumptions about consumer willingness to pay the proposed tariff rates appear to have been based on IWK's commissioned survey. However, it is unclear what the sample size was or what survey methodology was employed. Respondents could evidently pick more than one answer given that the total choices expressed exceeded 100%. While 75% of domestic households were willing to pay RM5, 50% were willing to pay RM10 and 25% were willing to pay RM20. The percentage of businesses prepared to pay sewerage charges based on their water bills is also unclear. While the SSD blamed IWK for not ensuring public acceptability of the 'user pays' principle, it was also the federal government's responsibility to do so (Tan, 2007).

IWK's commercial viability ultimately depended on consumer willingness to pay, and the non-payment of tariffs was partly due to government failure to ensure this. The federal government apparently accepted the survey results despite the previous reluctance of state governments to finance sewerage improvements through higher charges for fear of public opposition. Perhaps not surprisingly, the initial tariff structure met with opposition from household customers whom the government hoped to cross-subsidize. More crucially, commercial/industrial customers rejected the substantial tariff increases needed to cross-subsidize households (Tan, 2007). Subsequent rejections of revised tariff rates suggest that fundamental opposition to the 'user pays' principle remained.

Opposition from household customers to the first round of sewerage bills centered on disparities in rates for the same usage, and on whether all water consumed was discharged into sewers. There were strong objections to the 'exorbitant fees' and having to pay more for a service that had previously not been separately billed, particularly as there was no corresponding reduction in council rates. Questions were also raised about the legality of charging for services not yet rendered, with customers perceiving no benefit from the charges or de-sludging services (Tan, 2007).

Table 7: IWK: Original Sewerage Charges for Household Customers, 1994

Category of Assessed Value	Monthly Basic Charge (RM)		Monthly Usage Charge (RM/cubic metre of water consumed)	
	Connected	Septic Tank	Connected	Septic Tank
Up to RM600	2.00	2.00	NA	NA
RM601-RM1,000	1.00	0.68	0.14	0.07
RM1,001-RM3000	2.11	1.43	0.14	0.07
RM3,001-RM10,000	5.32	3.61	0.14	0.07
Above RM10,000	10.00	10.00	10.00	NA

Source: Tan, 2007.

Table 8: IWK: Original Sewerage Charges for Non-household Customers, 1994

Type of User	Monthly Usage Charge (RM/cubic metre of water consumed)
Commercial (Connected)	1.20
Commercial (Septic tank)	0.90
Industrial (Connected)	1.20
Industrial (Septic Tank)	0.90

Source: Tan, 2007.

The 200% increase in sewerage charges for the commercial sector was seen as too drastic, unjustified and contributing to inflation. The strongest opposition came from business groups, whose monthly bill increases ranged from RM100 (e.g. for coffee shops) to RM24,000 for a five-star hotel. Increases in sewerage charges occurred at the same time as IWK sought to finance its capital works programme through a public flotation. This required high profit projections to secure a premium share price upon listing at the same time as the company was trying to convince the public to pay sewerage charges (Tan, 2007). This undermined public willingness to pay charges to what was supposedly going to be a highly profitable company.

C. Tariff Revision

The downward tariff revisions and continued non-payment of sewerage charges underlines the government's political failure to enforce payment. There were three tariff reviews (November 1996, April-June 1998 and September 1999), followed by revisions (January 1997, July 1998 and October 1999) and discounts (1997, 1998, 1999). The concession period was subsequently extended three times, following each tariff revision (1995-2022, with provisions for tariff revisions every three years after the first five years to adjust for inflation; 1996-2024; and 1998-2034) (Tan, 2007).

In August 1995, following widespread opposition, the government offered discounts of 40%, 30% and 20% respectively for the first, second and third years for all non-household customers. The government was to compensate IWK with RM300 million for losses resulting from these discounts. However, when billing was extended to the state of Perak in October 1995, accumulation of arrears (for charges for the period commencing from the original takeover date) led to more public dissatisfaction. In May 1996, the government initiated a tariff review exercise following further public complaints about rates, and in October 1996, ordered IWK to stop billing or collecting payment pending. The review exercise addressed issues related to billing, charges and services, as well as financing the development and management of a modern and efficient sewerage system (Tan, 2007).

On 20 November 1996, the Prime Minister announced that IWK was to write off RM180 million in unpaid sewerage charges and, in return, would be provided with an additional RM450 million soft loan. The government also announced new sewerage rates effective from 1 January 1997 based on the principles of affordability and equitability, with businesses, industry and government offices paying more to subsidize lower-income homeowners (Tan, 2007).

The first revision of rates not only reduced monthly charges, but also changed the basis of evaluation. Household customers (including government quarters) were charged fixed monthly rates from RM2 to RM8 (depending on type of premises), and were exempted from water usage charges. Commercial customers were levied a basic charge based on the annual value of the property plus RM0.65 per cubic metre of water usage exceeding 100 cubic metres a month (Tan, 2007). Industrial customers were charged a flat rate based on the number of employees (Tables 10-11).

Table 9: IWK Tariff and Ownership Changes

	1995	1996	1997	1998	1999	2000
Tariff Review		21 Nov		Apr-Jun	Sep	
Tariff Revision			1 Jan, household, commercial, industrial	1 Jul	1 Oct	
Tariff Reduction			40% commercial	30% commercial	5-20% commercial	
Govt Loans (RM millions)		450		433.7	503.8	545.5
Concession Extension	Until 2022	Two years to 2024		10 years to 2034		
Ownership	PUB (Ahmad Sebi)	PUB (Wan Adli)	I. Hydraulic (Ishak Ismail)	I. Hydraulic (Ishak Ismail)	I. Hydraulic (MOF)	MOF

Source: Tan, 2007.

Table 10: Revised Sewerage Charges for Domestic Customers

Category	Monthly Charges
Low-cost dwelling houses, dwelling houses with annual value of less than RM600 and government quarters in categories F, G, H and I receiving either individual septic tank or connected sewerage services.	RM2
Village dwelling house, new village dwelling house, estate dwelling house receiving either individual septic tank or connected sewerage services.	RM3
Domestic premises and government quarters in categories A, B, C, D and E receiving individual septic tank services	RM6
Domestic premises and government quarters in categories A, B, C D and E receiving connected sewerage services.	RM8

Source: SPAN, 2016b.

Table 11: Revised Sewerage Charges for Industrial Customers

Category	Monthly Charges
Industries getting individual septic tank services	RM2 per employee per month
Industries connected to sewerage network	RM2.50 per employee per month

Source: SPAN, 2016b.

Table 12: Revised Sewerage Charges for Commercial Customers

Annual Value of the Property in RM	Monthly Charge for Premises Connected to Sewer Network in RM	Monthly Charge for Receiving IST Services in RM
0-2000	8	7
2,001-5,000	14	8
5,001-10,000	20	14
10,001-20,000	26	19
20,001-30,000	29	21
30,001-40,000	32	23
40,001-50,000	35	25
50,001-60,000	38	27
60,001-70,000	41	29
70,001-80,000	44	31
80,001-90,000	47	33
90,001-100,000	50	35
100,001-200,000	180	120
200,001-400,000	495	330
400,001-600,000	522	348
600,001-800,000	1,980	1,320
800,001-1,000,000	2,160	1,440
1,000,001-3,000,000	4,320	2,880
3,000,001-5,000,000	8,800	5,400
5,000,001-7,000,000	9,200	6,000
More than 7,000,001	9,600	6,000
Rate on Excess Volume	0.30 per additional cubic metre if water consumption exceeds 100 cubic metres per month 0.45 per additional cubic metre if water consumption exceeds 100 cubic metres per month	

Source: SPAN, 2016A

On 5 April 1998, the government agreed to further reduce tariffs by 30% and 40% for the commercial sector following complaints, and IWK reduced commercial tariffs for the second time on 1 July 1998 by 30%. In exchange, IWK was granted further financial assistance for the next two financial years, a further soft loan of RM500 million, and an extension of its concession by 10 years to 31 December 2034. On 16 September 1999, the government announced a third reduction in sewerage charges, of 5-20%, for commercial properties, with effect from 1 October 1999. These tariff revisions were mainly for the commercial sector following a backlash against cross-subsidization (Tan, 2007).

The tariff revisions and bill collection problems had a negative impact on IWK's balance sheet and were reflected in its actual and projected collection and profit figures (see Table 13). The tariff review in May 1996 led to the write-off of RM256.3 million in unpaid bills for 1997 and was reflected in parent company PUB's RM241.3 million loss for the year, in addition to RM367.9 million in bills written off from May 1994 to October 1996. The first tariff revision on 1 January 1997 was estimated by PUB to have resulted in a RM42.5 million loss of potential pre-tax profits. Commercial tariff rates were reduced by 30% in July 1998 and by a further 5-20% in October 1999, resulting in a revenue shortfall of RM103.7 million (Tan, 2007). The 30% reduction of commercial tariffs in 1998 also accounted for a 12% drop in PUB's turnover and RM25 million loss in 1999. However, these losses were not sufficient to cause the company to fail. Rather, IWK's biggest problem was the non-payment of bills.

D. Non-payment of Sewerage Charges

The most serious problem for IWK was the absence of penalties for non-payment of sewerage charges. The non-payment of tariffs was partly the result of the government's unwillingness to legislate penalties, but primarily due to its inability to enforce payment of tariffs. Even after legislation, enforcement was weak, undermining revenue collection. Continued opposition even after downward tariff revisions and IWK's RM6 million public awareness campaign suggested an ongoing unwillingness to pay. During 2000, the National Audit Department recommended that the government raise public awareness about the importance of sewerage services to increase willingness to pay, and also review sewerage charges with the possibility of including them in water bills or as part of local council assessment rates (Tan, 2007).

While the downward revision of tariffs affected IWK, the company ran out of money when businesses, including hotels in Kuala Lumpur, refused to pay. At one point, IWK was only collecting 15% of what it was billing on a monthly basis. In 1998, only 37% of consumers (including 30% of 73,000 commercial customers) had settled their bills, leaving IWK with RM92.7 million (RM45 million from the commercial sector) in outstanding payments. In 1999, commercial users accounted for RM72 million of the RM121 million in arrears. IWK also faced difficulties collecting RM144.3 million in household tariffs in 2000 due to public opposition (Tan, 2007).

IWK's cash flow problems were compounded by the government's failure to provide the promised loans for capital investment. The government offered IWK cash as long as the company wrote off unpaid bills and refunded those who had paid when IWK needed all the money it could get (Tan, 2007). As a result, IWK's operating revenue was insufficient to cover its operating costs, with the company registering a RM32.2 million loss for the financial year ended April 2000 and an accumulated loss of RM332.9 million.

Table 13: IWK: Losses from Tariff Revisions and Non-payment of Sewerage Bills

Year	Tariff Revision (RM million)	Unpaid Bills (RM million)
1996	367.9	NA
1997	256.3	NA
1998	NA	92.7
1999	103.7	121.0
2000	NA	144.3

Source: Tan, 2007.

Despite the lack of information on customer numbers and assets, IWK was generally expected to cover its operating costs based on the proposed tariff structure and the original number of plants, provided there was 100% collection. Instead, operational viability was undermined by tariff revisions and the failure of the government to provide promised loans. By 2000, IWK was no longer considered a viable business, even with 100% bill collection, without a doubling of tariffs. The government's commissioning of an independent study of sewerage services around 1998-99 indicated official recognition of the project's unfeasibility (Tan, 2007).

SEPTAGE MANAGEMENT IN MALAYSIA

In its concession agreement , IWK agreed to expand sewerage coverage to 85% in major cities and 30% in smaller cities, as well as provide septage management. In 1993, it was estimated that only 2% of Malaysia's 302,800 septic tanks had ever been de-sludged and that scheduled de-sludging could reduce surface water pollution by half. The SSA mandates the owners and occupiers of premises with septic tanks to allow IWK to de-sludge their tanks every two years (AECOM and Sandec, 2010).

In tackling the transformation of the nation's sewerage system, IWK first conducted sewerage studies by catchment basins to gauge demand and capacity on a 30-year planning horizon. Based on this study, IWK developed a three-stage strategy. First, it located and rehabilitated the old local sewerage treatment plants, developing their septage collection capacity. Second, IWK used available oxidation ponds as an interim measure for septage disposal while identifying and constructing trenching sites as per DoE guidelines. In the third stage, since 2000, IWK has built centralized and mechanized sewage and septage treatment facilities for more densely populated areas (AECOM and Sandec, 2010).

In addition to building up the country's infrastructure, IWK has raised public understanding of the value of waste water treatment and acceptance of de-sludging and waste water fees. Over the years, IWK developed a database of properties that had septic tanks and conducted scheduled de-sludging by geographic area. This data is stored in a system called the Customer Operational Enquiry and De-sludging System (COEDS). Customer service operators contacted households prior to a visit to arrange specific appointments. IWK registers all house calls into its database before issuing requests to de-sludging teams. Through its promotion campaigns, which uses radio jingles, television and newspaper ads, school programmes and trainings, IWK has increased tank de-sludging from 2% of 302,800 tanks in 1993 to 58% of 938,886 tanks in 2001 (AECOM and Sandec, 2010).

Even so, only 50% of households with septic tanks in IWK's service area participate in scheduled de-sludging because most households do not want to pay for more frequent service or do not want to be inconvenienced (AECOM and Sandec, 2010). The charges for de-sludging are given in Table 14. Although the law mandates de-sludging, the sector's regulatory agency, the SSD, has never enforced it. As a result, most households wait to call IWK's customer service line until their tank becomes blocked or overflows.

IWK treats septage in several ways depending on the area's density and service demand. In rural areas, sludge may be buried in trenches in dedicated areas or in between trees on plantations of non-edible products. Once full, these sites are closed for several years to allow for natural decomposition and absorption. In controlled research studies, IWK has seen trees grow faster and thicker in areas with trenches of septage than those without (see Table 15). In medium-density communities, IWK treats septage at its sewage treatment plants by dewatering it in gravity-based or mechanized mobile dewatering units or sludge-drying beds, and then recycles the drained effluent back into the sewage treatment system. In highly urbanized areas, IWK has constructed three centralized sludge treatment facilities for the northern, central and southern regions of Peninsular Malaysia. At the same time, the country is also planning to build advanced sewage treatment facilities that will incorporate centralized sludge treatment technology. These systems dewater larger volumes of septage faster (AECOM and Sandec, 2010).

By 2010, Malaysia was producing over 6 million cubic metres of raw sewage and septage each year. This results in over 100,000 tons of stabilized sludge each year. Since septage is often dewatered along with sewage in the sludge-drying beds, and sewage sometimes contains high levels of chemicals, Malaysia does not use its stabilized sludge for edible crops. In 2000, 2% of stabilized sludge was used in horticulture, while the remainder was disposed of as landfill cover, mining cover or land reclamation. As landfill capacity diminishes and land prices increase, there is an increasing shortage of stabilized sludge disposal options in Malaysia. IWK is conducting research and development on alternative reuse options, such as vermiculture (AECOM and Sandec, 2010).

Table 14: De-sludging Service Charges, 1994-2008

Services	Rate per De-sludging
De-sludging upon request for:	
• Traditional toilet systems like pour flush	RM48
• Individual septic tank with a capacity of up to 2.5 cubic metres	RM150
• Private sewage treatment plant or individual septic tank with a capacity of more than 2.5 cubic metres and less than 4.5 cubic metres	RM220
• Private sewage treatment plant or individual septic tank with a capacity that is more than 4.5 cubic metres.	RM220

Source: IWK, 2017.

Table 15: Effect of Septage on Average Growth of Trees in Malaysia

Species	Basal Diameter (in cm)		Height (in cm)	
	With Trench	Without Trench	With Trench	Without Trench
Acacia mangium	8.3	4.6	765	308
Cinnamomum iners	3.4	1.3	207	83
Hoped adorata	3.1	1.6	210	64
Dyera costulata	3.1	2.5	248	91
Shorea ieprosula	1.6	0.8	125	51

Source: AECOM, 2010.

The SSA specifically required owners to ensure adequate access to septic tanks for the purposes of maintenance and de-sludging, to maintain all elements of septic tanks in good condition, and to have the septic tank cleaned by a licensed sewerage services contractor. It also authorized the SSD to ensure that tanks were in working order, enforce de-sludging, issue notices of non-compliance, and charge owners or occupiers de-sludging and sewerage fees. The SSD, IWK and the Malaysia Water Association also jointly developed a series of 'Guidelines for Developers', which regulate private sewerage infrastructure development in Malaysia (AECOM and Sandec, 2010). 'Guidelines for Developers: Septic Tanks' is much more stringent and provides important guidance on when to use septic tanks and how to maintain them. In addition to detailed design requirements, the guidelines mention the following:

- No development with more than 30 units or 150 person equivalents can use septic tanks as its sewerage system.
- 'It is of paramount importance…that septic tanks when designed and constructed must allow for regular de-sludging at a frequency of NOT less than once every two years' to meet effluent discharge standards and achieve environmental objectives.
- Developers should consult IWK's certification offices to determine which treatment system to install. Proposed developments must connect to public sewers if a pipe is located within 30 metres. Septic tanks should be designed to permit future connections to new sewerage lines.
- Septic tanks located in water catchment areas or close to sensitive waterways should adhere to more stringent requirements. Areas with flat topography that do not have drainage networks should provide for further on-site treatment and disposal.
- Owners and occupiers of premises with septic tanks are responsible for placing the tanks in accessible locations to allow for de-sludging.

WSIA introduced the standardization of septic tank design. The basic standards for proper septic tank design in Malaysia derive from the Code of Practice for Design and Installation of Sewerage Systems (Malaysian Standards 1228:1991). In general, the WSIA, which now replaces the SSA, provides the same guidelines for septage management. It does, however, ease the requirement for a two-year de-sludging cycle to a call for de-sludging 'from time to time as may be prescribed', which is generally interpreted as a three-year cycle. This policy is more flexible both to accommodate the new diversity of operators and because IWK's experience demonstrated that most septic tanks in Malaysia could function well even if emptied less frequently than every two years. The WSIA also notes that households connected to CSTs are jointly liable for the de-sludging fees, (AECOM and Sandec, 2010). The de-sludging charges were also revised, as shown in Table 16.

In comparison to the SSA, the WSIA significantly raises the fines to discourage owners and service providers from non-compliance. Any person violating maintenance and de-sludging requirements, or a licensed service provider acting in contravention to the WSIA is liable to pay a fine not exceeding RM50,000. Again, any person constructing, altering or disconnecting a septic tank without approval from SPAN is liable for a fine not exceeding RM50,000 or imprisonment for five years. As a newly established commission, SPAN has not yet enforced these fines. However, because water and waste water service provisions are linked under WSIA, Malaysian service providers could technically withhold water supply in order to obtain compliance with payment for waste water services or acceptance of scheduled de-sludging (AECOM and Sandec, 2010). IWK has issued standard operating procedures for its workers in collecting household sludge. Scheduled de-sludging and calls for on-demand de-sludging are logged in a computer database. Record-keeping and a GIS-based vehicle tracking system makes the de-sludging team responsible for delivering the waste at treatment facilities, regardless of whether they receive payment at the door (for on-demand service) or through monthly bills for scheduled service. Operators undergo trainings to ensure that they maintain health and safety standards. To promote public awareness and acceptance of services, IWK emphasizes professional behaviour and hygiene (AECOM and Sandec, 2010).

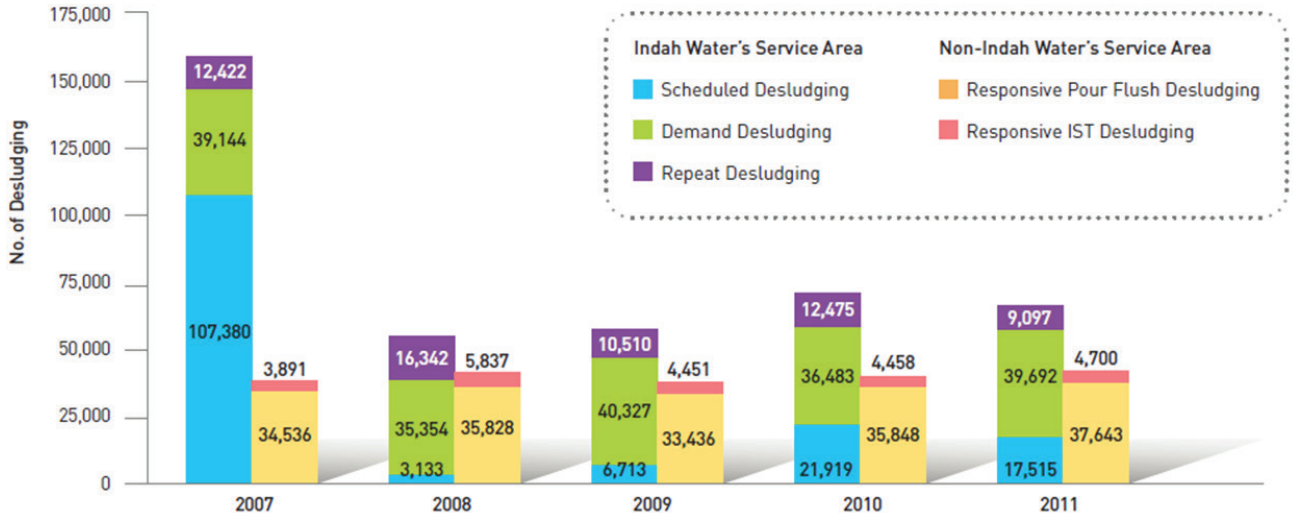
The de-sludging services in Malaysia from 2007 to 2011 are depicted in Fig. 12.

Table 16: Revised Charges for De-sludging

S. No	Services	Charges (RM)
1	De-sludging Residential IST • De-sludging of residential IST outside local authority • Applies to domestic premises and government quarters	180 /trip
2	De-sludging IST/private STP (up to 2.5 cu.m) • De-sludging of IST outside local authority/private STP with tank/plant size measuring 2.5 cu.m • Applies to commercial, industrial and government premises	360/service
3	De-sludging IST/private STP (> 2.5 to 4.5 cu.m) • De-sludging of IST outside local authority/private STP with tank/plant size measuring above 2.5 cu.m to 4.5 cu.m • Applies to commercial, industrial and government premises	650 /service
4	De-sludging IST/private STP (> 4.5 cu.m) • De-sludging of IST outside local authority/private STP with tank/plant size measuring above 2.5 cu.m to 4.5 cu.m • Applies to commercial, industrial and government premises	145 per cu.m
5	De-sludging pour flush (residential) up to 2.5 cu.m	230/service
6	De-sludging pour flush (residential) up to >2.5 to 4.5 cu.m	360/service

Source: Responsive De-sludging Service, 2017.

Figure 12: Desludging Rate



Source: IWK, 2011.

RECOMMENDATIONS

A. Sewerage Tariff Revision

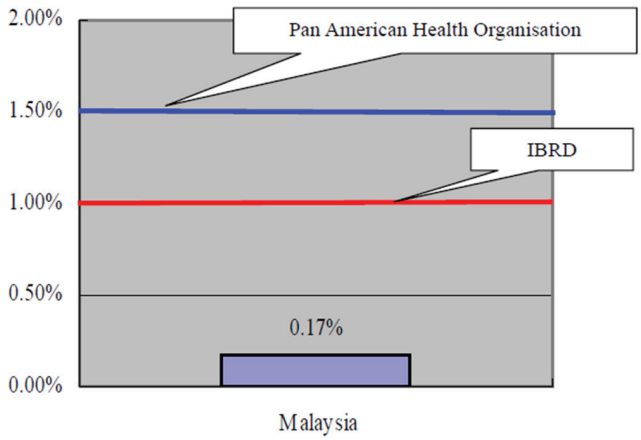
The sewerage tariff should be changed to reflect the water consumption volume that is metered by water supply operators. It is reasonable to charge in accordance with the effluent volume of each customer, since operational costs become larger as effluent volume increases. In keeping with a cost-based approach and to eliminate tasks associated with initial setting of rating a sewerage tariff corresponding to water consumption volume should be introduced early, in particular for industrial premises where the tariff is currently based on the number of occupants. With respect to the sewerage sector, it is believed that full costs should be recovered not only from customers but also from other beneficiaries, such as tourism, fisheries, agriculture and other sectors (JICA, 2009). Nevertheless, the present level of sewerage tariffs is not high enough. The average sewerage tariff is estimated to be 0.17% of the average household income as shown in Table 17. The International Bank of Reconstruction and Development (IBRD) and Pan American Health Organization estimate that 1% and 1.5%, respectively, of household income is the maximum level for sewerage service household affordability (JICA, 2009). In Malaysia, the sewerage tariff as a percentage of household income (0.17%) is only one-sixth of the maximum affordability level indicated by IBRD (1%) (see Fig. 13).

Table 17: Average Sewerage Tariff as a Percentage of Average Household Income

Area	Average Monthly Household Income 2004 (RM)	Average Monthly Tariff (Sewerage) (RM) 2001-07	Monthly Tariff as a % of Average Monthly Income (Sewerage)
Malaysia	3,249	5.5	0.17

Source: JICA, 2009.

Figure 13: Sewerage Tariff as a Percentage of Average Household Income in Malaysia and Affordability Limits According to International Agencies



Source: JICA, 2009.

An increase in the sewerage tariff is required to improve and maintain service quality. On the other hand, it is critical to avoid a dramatic increase in the tariff by setting clear cost recovery targets (rate of recovery by year) and implementing any increases in stages (JICA, 2009).

Currently, the billing of sewerage charges follows a six-month cycle. This is regarded as one of the reasons behind the large accounts receivables in the IWK balance sheet. Bills for sales of goods and services – even public services – should be issued as soon as possible. There are no good reasons to delay billing six months after costs for services have been incurred (JICA, 2009). Moreover, it is more difficult for customers to make large one-time payments than to pay in smaller amounts over the period. A more reasonable practice would be to bill customers every month or every two months.

B. Government Portion of Sewerage Charges to Cover Lower Tariffs for Low Income Groups

Under the current system, sewerage tariffs for domestic premises are set at lower rates for premises classified as low-cost or village housing. Sewerage tariffs should be set to recover necessary costs in order to prevent the degradation of long-term service quality with sound management. On the other hand, poverty reduction measures should be implemented by the federal government or municipal governments as distinct from sewerage services. When the tariff reduction is implemented for low-income groups, the difference between regular and discounted tariffs should be covered by the by the federal government or municipal governments to avoid deterioration in service caused by budget shortfalls (JICA, 2009).

For domestic premises connected to public sewers, RM8 per month is charged for houses with annual values greater than RM600 and government quarters in grades A, B, C, D and E. RM2 per month and RM3 per month are charged for low-cost or village houses. Amounts to be compensated by the government for each customer are equivalent to the gap between the normal and discounted rates: RM6 and RM5 per month, respectively. The government portion of sewerage charges to be paid to service providers has been computed by summing the differences for all connected customers with lower tariff rates. These subsidies are used to cover the excess O&M costs incurred by the service provider (JICA, 2009).

C. Setting Rules for Federal Government Subsidization of IWK

At present, sewerage tariffs are not sufficient to cover all necessary costs, including O&M and the cost of capital; therefore, subsidies from the federal government are provided to sewerage service providers. It is recommended that rules or criteria governing subsidies from the MOF to IWK be created. In the absence of such subsidy rules, sewerage enterprises may fall into a state of heavy dependence on subsidies, and, as a result, lose motivation to improve productivity. If the rules reflect an enterprise's rights and duties with respect to profit appropriation or loss

disposition, financial management responsibility and incentives to increase revenue and reduce costs can be maintained, leading to continuous improvements in productivity and efficiency (JICA, 2009).

The following are examples of rules for subsidy from the federal government to IWK:

a. Subsidies shall cover costs of depreciation, loan repayment and 50% of other O&M. IWK must cover other costs using tariff revenues.

b. Subsidies shall cover costs of depreciation and loan repayment costs. IWK must cover other costs using tariff revenues.

The unlimited expansion of subsidies using the governmental budget is regarded as inappropriate. By establishing certain rules for providing subsidies, IWK would be compelled to conduct stricter financial management to enhance cost savings and revenue generation. On the other hand, the federal government should expand IWK's right to set the sewerage tariff with more flexibility under SPAN's regulatory regime. Such a strategy can be proposed to SPAN via IWK's business plan, accompanied by a necessary plan to raise tariffs (JICA, 2009).

In general, sewerage service provides benefits not only to houses connected to sewerage pipes, but also to others, by removing dirty water from a certain area and treating sewerage. Those indirect beneficiaries without sewerage services suffering from water-borne diseases, users of groundwater, tourism, fisheries, the agricultural industry and members of the public who can take walks along a clean riverside, among others. Obviously, it is impossible to identify these beneficiaries and persuade them to pay the sewerage charge in proportion to their benefits. Therefore, it is reasonable to expect the government to pay part of the necessary costs for sewerage services using tax revenue. In other words, a certain (not unlimited) amount of subsidization of sewerage service is recognized as the federal government's share of the sewerage charge burden and shall account for the total sewerage revenue needed to realize full cost recovery.

Furthermore, it is recommended that the ideal (long-term objective) proportion of the government's portion of sewerage charges to customer charges be determined through discussion among relevant Ministries and by considering the appropriate level of cost sharing by these two parties. As a start, subsidy rules should be set based on current circumstances with the low sewerage tariff (0.17% of average household income). In the near future, IWK's business plan should define the ideal (long-term objective) allocation of cost sharing between customers and the government as a target and develop a staged implementation plan, including the target year (JICA, 2009).

D. Sewerage Capital Contribution to Encourage Integration and Rationalization

It is recommended that the criteria of the sewerage capital contribution (SCC) be reviewed. The SCC is currently paid by developers that connect to the existing public STPs at the rate of 1% of the developed property value. Therefore, the present SCC system encourages a developer to construct its own STP on the development site rather than connecting to the public sewerage system. This causes the problem of a large, and still increasing, number of STPs in Malaysia that exceeds the maintenance capacity of IWK. That is why rationalization (reducing the number) of STPs is strongly desired in Malaysia. In the interests of greater integration and rationalization of STPs in Malaysia, the SCC should be levied on developers that construct STPs within development sites without connecting to the public sewerage system (JICA, 2009).

In addition, it is recommended that the SCC fund be used as an incentive to encourage developers to reduce STPs. Incentives may be paid to developers that:

a. connect to the existing public sewerage system if the distance to public systems is determined to be far;

b. construct integrated STPs to treat sewerage from neighbouring developments by collaborating with other developers;

c. incorporate existing sewerage systems with new STPs; or

d. install larger sewers to connect to existing public sewers or construct larger STPs for future development following the direction of a certifying agency.

The above measures are expected to be a catalyst to encourage developers to connect to the public sewerage system and construct integrated STPs. This should, therefore, contribute to promoting the integration or rationalization of STPs or at least slow down the pace of STP growth. After monitoring the progress and effects of rationalization projects, it is recommended that the DoE and SPAN discuss the relevant rate of the SCC charges and incentives to achieve the purpose (JICA, 2009).

Annual SCC collections are currently not sufficient for many construction projects in the Malaysian Peninsula. It is also recommended that the SCC fund be utilized for planning, preliminary design and cost estimation only, for integration and consolidation projects, so as to prepare for construction budget appropriations in Malaysia's five-year plans. In order to achieve revision of the SCC, it is necessary for the federal government to declare a strong political intention to utilize the SCC for integration and rationalization of STPs, since the 1.65% SCC levied on developers that construct STPs was suspended in September 1999 (JICA, 2009).

E. Measures to Increase Public Sewer Connection

WSIA authorized SPAN to acquire premises and developers to connect to the public sewerage system (JICA, 2009). These clauses will contribute to a helpful increase in the number of customers utilizing the public sewerage system and the utilization rate of public STPs. Practical regulation shall be prepared based on these clauses. On the other hand, a revolving fund to allow installment payments of initial connection costs when septic tank users connect to the public sewer line should be established (JICA, 2009).

The costs of connecting septic tanks to the public sewer are usually large. While legislation requires connection to the public sewer, initial investment costs will present the biggest obstacle. Installment payments should, therefore, be provided to customers by establishing a revolving fund. If a septic tank user who applies for installment payment is qualified to utilize the revolving fund, a contract will be created between the customer and relevant organization regarding the loan amount, repayment period, annual repayment amount, etc. Money borrowed from the revolving fund must be paid directly to the sewerage connection contractor. Customers shall make repayments to the fund on a monthly or yearly basis. This installment system will alleviate the burden of one-time connection costs on customers (JICA, 2009).

The installment plan should initially be introduced as a trial with a small budget and limited number of loans. After monitoring user feedback on the loan repayment progress, loan amounts and conditions should be reviewed upon the next full implementation of the installment plan. It should also be noted that there is a risk that customers would take legal action and default on their loans. Loan agreements between responsible organizations and customers must include terms that prevent such defaulting (JICA, 2009).

THE WAY FORWARD

The sewerage privatization problems discussed in the above sections are quite diverse. Some are internal, while others are external to the company. Some problems were inherited from the local authorities, some were expected due to the nature of the industry itself, while others were by-products of privatization. There is no doubt that such problems can be expected in any form of privatization and for any industry, but the question is: how best can the problems be overcome? Apart from handling problems and issues at hand, IWK should also expect further challenges in any form and at any time, which will further effect the industry in general, and sewerage privatization in particular.

According to the 'Explanatory Note on the Enforcement of the Water Service Industry Act 2006 (ACT 655)' by SPAN, the following policies are clearly described regarding tariff review:

- A primary focus in the restructuring of the water services industry is the assurance of full cost recovery to secure long-term sustainability.
- Tariff reviews from licensees will be based on applications that need to be substantiated by each licensee.
- There will be no automatic tariff increase, and licensees will have to meet certain performance indicators before applications are considered by SPAN.

The DoE, in cooperation with SPAN, will conduct tariff reviews in the future, taking into consideration the following aspects:

- level of efficiency achieved by the operator
- operating effectiveness of the operator
- progress of continuous improvement programmes of the operator (e.g., Non-Revenue Water, bill collection)
- level of capital expenditures
- lease rental charges by WAMCO

Full cost recovery is highlighted as one of the major directions of water service management by SPAN. It is considered appropriate even though the realization of full cost recovery takes time, especially for sewerage services. Joint billing of water supply and sewerage is also emphasized in the Explanatory Note by SPAN. According to the Note, joint billing is expected to be implemented beginning with Penang, Johor and Labuan. However, this is still under consideration as of December 2016.

Joint billing is planned only for customers who connect to the public sewerage system and excludes customers with ISTs. Raising the collection efficiency of sewerage tariffs is one of the most vital tasks to be tackled and the introduction of joint billing is recognized as a valuable step towards improvement. Successful introduction of joint billing in these three areas will be significant, paving the way for the launch of such billing in other states.

In order to plan the tariff increase, licensees must apply with substantial evidence and meet the specified performance indicators. This is considered reasonable because operators must try to improve their management efficiency and service levels to apply for tariff increases. This will help to reduce customer dissatisfaction caused by tariff increases without satisfactory service provision to the customers.

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