

LEGAL
ORGANISATION
OF WATER AND
WASTEWATER IN
COMPARATIVE
PERSPECTIVE
Case of **Malaysia**

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RESEARCH REPORT

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Introduction

'Water Regulation' is a broad term and can be interpreted to include an array of issues. This paper seeks to formulate a broad understanding of 'Water Regulation' in Malaysia with a focus on two aspects:- One is the supply of water to inhabitants and Second is its quality - which is assessed here in terms of pollution and environmental impact.

Malaysia has developed an interesting model to regulate its water resource which consists of a mix of top-down and bottom-up approaches, with some important lessons to learn from. While the top down approach ensures discipline and gives legal and institutional legitimacy to the exercise, the bottom up approach ensures comparatively smoother implementation through public participation and awareness. Two components that attract attention in the trajectory of the development of Water Regulation framework in Malaysia are (a) transfer of power from the local governments to the federal, and (b) privatisation of the water dissemination and treatment processes.

Part I of the Report examines the history of water regulation in Malaysia. Malaysia saw a rapid change in its sewage and other water systems post-independence in 1957. It went through an impressive journey from pits and pour flush to fully automated modern systems in a short span of about 6 decades. This took efforts from various stakeholders – the Federal government, the State governments, the Legislature, the public as well as private sector, and the common people. This Part is divided into three sections:

- A. Pre 90s,
- B. Early 90s, and
- C. Early 2000s.

These Sections coincide with different moments of history of the world as well as that of Malaysia. The first section encompasses the pre and post-independence era until the globalisation of the South East Asia began; the second section coincides with liberalisation and the onset of modernisation while the third includes the beginning of the 21st century. The three Sections are defined by difference in technology, legal framework as well as structural change.

Part II describes the current legal and regulatory framework of water regulation in Malaysia. This Part is divided into five Sections – the first deals with the issue of water supply while the second deals with sanitation and pollution. This division is in line with the general view adopted in understanding and assessing the water regulation system in Malaysia by the authors. While one deals with accessibility and quantity, the other deals with quality. The third section is descriptive and demonstrates the noteworthy examples of the Plant in Kuala Lumpur and Selangor.

Part III focuses on the challenges faced by Malaysia in water regulation. It lists out and discussed the various challenges in terms of the legal and structural issues, socio-economic issues and environmental issues. These include a myriad of aspects ranging from the law to the hopes and expectations of people. While it is difficult to offer any sound and original advice on how to improve matters without empirical research on the issue, this Part does offer some hints on where the gaps could be plugged and things changed for the better.

1 History of Water Regulation

The history of Water Regulation in Malaysia is one that can be majorly characterized by its shift of legal, financial and regulatory power from the local to the central. The seriousness of the commitment of the central government towards the issue is demonstrated by the multifaceted changes brought about in the legal and structural framework starting from the early 90s, interestingly coinciding with when a large part of South Eastern Asia was undergoing globalisation and opening up to the rest of the world. While there is unfortunately no room here to get into the political and socio-economic reasons for such change, this section confines itself to exploring the Constitutional amendments, legislative changes, creation of policies and subsequent bodies put into place to regulate the supply as well as sanitation of water in Malaysia. Malaysia's history of water regulation can be broadly read and understood in terms of a sequential investment pattern of first investing in collection of wastewater and then gradually increasing the level and sophistication of treatment and environmental protection over time – connection to a well-functioning septic tank that is de-sludged regularly and where the groundwater can safely absorb the overflow is accepted as a solution; this precludes the need to build expensive sewerage and treatment systems and in developing the sanitation strategy, the country also ensured that the cost and the level of treatment grew in tandem with the wealth of the population.¹

A. The Pre-1990 Era

Water Supply

Prior to Independence in 1957, water resource management, supplies and services were under the State Water Authorities and their agencies and the National government only provided loan for public water supply infrastructure and grants for rural water supply.² In 1955, the Water Supply Enactment of 1955 came into being which empowered the state water authorities in supplying water to domestic and commercial users, however, this only serves as a regulatory body to oversee operations of supply company and ensure compliance with drinking water standards but it had no legal power to enforce compliance.³

Water Sanitation and Pollution

The Water Act, 1920 applies only to states of Negeri Sembilan, Pahang, Perak, Selangor, Melaka, Penang and Federal Territory and the provisions cover property of rivers, resto-

ration, prohibition of diversions and pollution, licensing, penalties and compensation.⁴ The Pour Flush and Septic Tank facilities came up in the 1950s and 60s which decades are termed the phase of 'primitive treatment' in the history of sanitation in Malaysia; they focused on the impacts of sanitation on health, seeking to reduce water-borne diseases.⁵ In the 1970s and later, the government aimed at the secondary treatment of wastewater to purify polluted rivers as the next step of public sanitation.⁶ In 1975, the National government established the Jabatan Alam Sekitar (renamed as Department of Environment-DOE) under the Ministry of Natural Resources and Environment Malaysia, as an agency to enforce the Environmental Quality Act (EQA), 1974; the DOE's function was not only to administer and enforce the Environmental Quality Act, 1974 but also to ensure and sustain sound environmental management in the process of nation building.⁷ In 1979, the Environment Quality (Sewage And Industrial Effluents) Regulations came into being which brought in new restrictions on discharge of effluents and disposal of sludge while also bringing in regulations relating to Licenses.⁸ The decades 1970s and 80s also saw the introduction of more sophisticated systems like the Imhoff tanks and oxidation ponds and aerated lagoons and from 1970 to the mid-2000s and the focus also shifted to the impacts on the environment.⁹ In the 1980s, to slow a rise in population having no basic sanitation, the Malaysian government developed a new policy which obliged any development projects for 30 households or 150 people equivalent to install a sewerage system and meanwhile, septic tanks for individuals or communities prevailed in places with a more limited number of houses.¹⁰

B. The Early 90s

In the period 1990s until the mid-2000s, activated sludge and biological filters were promoted; this is termed the phase of partial and secondary treatment.¹¹ The 1990s were the beginning of the transfer of power and control from the local governments and bodies to the federal ones. Until 1994, 144 local governments controlled sewerage services all over the country but these services were not consistent and in many areas, standards were not met, so the federal government understood the need for improving the sanitation level of the country and passed the Sewerage Service Act (SSA) in 1993, according to which, the federal government became responsible for controlling all sewerage assets and signed a concession agreement with private bodies (IWK) to entrust the management of sewerage services.¹² There-

after the Sewerage Services Department (JPP) was set up as Regulator, and sewerage services were privatised with IWK taking over.¹³

Meanwhile, some state specific legislations also came up like the Water Supply (Territory of Kuala Lumpur) Act, 1998 – however, from a bare reading of the provisions it is clear that the legislation is subservient to Federal Legislation and Bodies. For instance, Section 3 of the Act of 1998 reads as follows:

- (1) The authority which is responsible for the supply and distribution of water in Selangor State shall carry out, on behalf of the Federal Government, the powers and functions under the law applicable to the Federal territory of Kuala Lumpur on matters relating to the supply and distribution of water in the Federal territory of Kuala Lumpur.
- (2) Nothing in subsection (1) shall prevent the Federal Government from running on behalf of their own powers and functions in relation to the supply and distribution of water under the law applicable to the Federal territory of Kuala Lumpur.
- (3) Any subsidiary legislation made under water supply Enactment and which are in force in the Federal territory of Kuala Lumpur shall remain in force until cancelled, amended or replaced by subsidiary legislation made in

respect of the Federal territory of Kuala Lumpur under laws relating to the supply and distribution of water in the Federal territory of Kuala Lumpur.¹⁴

C. The Early 2000s

In June 2000 Ministry of Finance took over all the equity in IWK and in January 2005, Parliament approved the amendments to the Ninth and Tenth Schedules of the Federal Constitution. The amendment to the Ninth Schedule involved the transfer of water supplies and services from the State List to the Concurrent List. The Tenth Schedule was also amended and as a result, the revenue from water supplies and services (previously assigned to the states) was now assigned to the Federal Government.¹⁵ As of 2004, there were no national plans specifically for water supply, though many states had prepared state plans for water-supply.¹⁶ In September 2005 Sewerage Department was set up under Jabatan Kerja Raya Sabah; in June 2006, the Water Services Industry Act (WSIA) was enforced and the National Water Services Commission (SPAN) was set up as a Regulatory Agency under the Suruhanjaya Perkhidmatan Air Negara Act 2006.¹⁷ Since 2006, the focus has broadened to include fully mechanised plants, keeping in mind the overall impact on the environment.¹⁸ However it must be kept in mind that the 2006 reforms of SPAN and WSIA apply only to Peninsular Malaysia.

2 Current Institutional Framework For Water Regulation

A. Water Supply

In recent decades, the Malaysian Government has embarked upon a privatization campaign that has seen the privatization of essential services including water supply. As of 2004, six states were served by Water Supply Companies (privatised), four states by Water Supply Board (corporatised), three states by Water Supply Department (under State Governments) and four states by the Public Works Department (Federal Body).¹⁹ 2006 onwards, water supply assets in peninsular Malaysia have been owned by the WAMCO (Water Asset Management Company), also called the PAAB (Pengurusan Aset Air Berhad). The PAAB develops these water supply assets and leases them out to public as well as private operators which execute the groundwork of supplying water services to people.²⁰

Two key facts may be noted about PAAB. First, as aforesaid, SPAN was established as the central water regulatory body for Malaysia in 2006. Accordingly, PAAB is also regulated by SPAN – before it can lease out the water assets to state water operators (i.e., the Service Licensees), therefore, PAAB is required to apply for a Facilities License from SPAN.²¹ Second, the PAAB functions only in Peninsular Malaysia. Arrangements for other parts of Malaysia differ. For instance, PBAPP (Perbadanan Bekalan Air Pulau Pinang Sdn Bhd – another privatized water company) is responsible for water supply in Penang State.²²

Overall, multiple agencies are responsible for water supply in the whole of Malaysia. In 2018, The Ministry of Natural Resources and Environment (NRE) was restructured to form the Ministry of Water, Land and Natural Resources (KATS).

The new ministry was formed from the amalgamation of the Land and Natural Resources components from NRE and the water sector from the Ministry of Energy, Green Technology and Water (KeTTHA).²³ After the amalgamation, the regulatory structure looks as follows: the PWD is responsible for public works in water supply while the Department of Water Supply (JBA) under the Ministry of Water, Land and Natural Resources (KATS) is responsible for water supply regulation in domestic as well as the industrial sector.²⁴ KATS is mainly responsible for water management from source to end use, irrigation & drainage management, and sewerage services.²⁵

B. Water Sanitation, Pollution and the Environment

Malaysia's sanitation policy framework, which broadly includes sewage and septage treatment, is said to have "exponentially" improved urban sanitation facilities in the country in the past two decades.²⁶ Much of this is attributed to the novel approach undertaken by the government. Some aspects of that approach deserve to be highlighted.

The Innovation in Malaysia's Approach

First, the government adopted a "sequential investment" model under which resources were spent differently in two phases: Phase I focused on waste collection, while Phase II focused on progressively improving the methods of treatment of the collected waste based on the wealth of the population.²⁷ This focused approach has delivered excellent results. As on date, 100% of Malaysia's population uses septic tanks for storage and treatment of wastewater.²⁸ Further, as of 2010, 70% of Malaysia's urban households were connected to a central sewerage system. This may be contrasted with the meagre figure of 5% that existed in 1993, the year before the reforms kicked in.²⁹

Second, capacity building was monitored by a single government ministry and executed extremely systematically with help from universities and technical colleges.³⁰ This process saw not just construction and improvement of sanitation infrastructure but also training of personnel in the equipment and technical processes involved in sewage & sludge storage and treatment.³¹

Third, Malaysia's innovative legal techniques had a key role to play in this growth. Some of these are worth noting:

- A. In 1979, taking skillful advantage of the growth of the real estate sector,³² the government passed regulations mandating housing developers to install proper sewerage facility as a precondition for operationalising housing complexes having size or capacity more than the prescribed limits.³³
- B. Privatisation has been a big part of the Malaysia model. In 1994, via a contractual arrangement made under the authority of the Sewage Services Act, 1993, the government handed over the responsibility to operate and maintain Malaysia's sewer service to IWK, a private company.³⁴ This company was tasked with the specific function of collecting and treating household sludge.³⁵ As of 2011, IWK was collecting sludge from more than 1.2 million septic tanks across Malaysia,³⁶ and its service areas had achieved 100% septage treatment.³⁷ It further acts as a concessionaire in granting licenses to other private companies for the operation and maintenance of the sewer service.³⁸
- C. In 2005, the Sewage Services Act, 1993 was replaced with the Water Services Industry Act, 2005 (WSIA). This Act brought about a change in the water management regime in Malaysia, especially in Peninsular Malaysia. One important introduction was Section 44(1) which obliged service licensees (i.e., individuals and companies licensed to distribute water to consumers) to desludge septic tanks as prescribed.³⁹ Under another key provision, water supply services were integrated with sanitation services,⁴⁰ and service licensees were authorised to disconnect any consumer's water supply upon such consumer's failure to pay the amounts due in lieu of services such as water supply, sludge removal etc.⁴¹ The Act also prohibits the operation of sewers without a license and punishes it with jail term.⁴² Further, Section 49 introduces extensive qualifications for being a license holder,⁴³ while Part III of the Act lays down extensive duties and obligations of license holders.⁴⁴
- D. The establishment of SPAN as the central water regulatory body was also influential. From 2006, Faecal Sludge Management (FSM) came to be regulated by SPAN under the WSIA. One important function entrusted to SPAN was the period determination and review of tariffs, which not only ensured competition among service providers but also resulted in regularly scheduled de-sludging of septic tanks.⁴⁵

E. A significant policy shift was made in 2008, under which the IWK was no longer responsible to execute de-sludging and maintenance of septic tanks. That responsibility now rested solely with the owner.⁴⁶

Fourth, IWK has a unique model for ensuring that citizens pay for the services they use (including water supply and sanitation). Instead of resorting to legal remedies to punish violators, IWK relies more on public relations and disseminates information encouraging people to pay the taxes/fees. It maintains an electronic database of all households, their locations, septic tank types, tax status etc. for better service delivery as well as compliance, and disseminates its messages widely using technological means such as e-mails, SMS, television etc.⁴⁷

Fifth, Malaysia's financing model is worth appreciating. The country managed to secure a huge grant-in-aid of 48.5 Billion Yen from Japan for its Nationwide Wastewater Treatment Project.⁴⁸ Its public-private partnership model has yielded good results for the conditions of sanitation in the country. At the same time, it has saved the government a lot of money.⁴⁹

Responsible Agencies

Department of Environment (DOE) was entrusted with the responsibility of enforcing the Environmental Quality Act (EQA), 1974, its subsequent Regulations of 1998, as well as other orders and notices under it such as the Environmental Quality (Environmental Impact Assessment) (Prescribed Activities) Order, 1987. DOE has the responsibility of protecting the environment through the control of pollution from sewage and faecal sludge discharge or disposal.

The other main players in sewerage management and FSM are the service providers which include the service licensee (IWK) and permit holders (private contractors) licensed by SPAN.⁵⁰ However, the role of private service providers comes in mostly at the stage of desludging facilities. IWK's operational scheme is based on the three-tier approach. First, to conduct a comprehensive study to locate and restore the old treatment plants, subsequently developing its septage handling capacity. Secondly, to use oxidation ponds for septage disposal while identifying and constructing trenching sites. Thirdly, is to construct centralised septage management facilities for densely populated area; IWK develops sewerage systems, takes

care of O&M and desludging activities.⁵¹ The IWK manages total 5960 Septage/Sewerage Treatment Plants (STP) across 12 States out of 14 states of Malaysia starting from very primitive technique such as Trenching System, Sludge Drying Beds, Geobags etc to most modern Sewage Treatment Plants (Reactors); IWK collects Septage (Sludge from Septic Tanks) by using various sizes of Suction Tankers following standards operating procedures and transports this Septage to nearby septage/sewerage treatment plant for treatment and generation of dry manure which is generally used for landfilling, manure for non-food crops such as rubber, floriculture, gardening etc.⁵² As of 2013, it was reported that IWK provided sewerage services in 88 out of the 144 local authorities in Malaysia while the remaining were still being handled on ad-hoc basis.⁵³ The IWK is responsible for planning and rationalizing the public sewerage facilities to reduce the number of treatment plants using the "multipoint concept" or regionalization and finally, sewerage pipeline networks are planned to be layered in urban areas to convey the domestic sewage to modern secondary treatment facilities.⁵⁴ As of 2014, 38% of public sewage treatment plants in the country were mechanical plants which operate using mechanical equipment that accelerates sewage break down.⁵⁵

Some states and local authorities (such as the states of Kelantan, Sabah and Sarawak, and the local authority of Johor Bahru) have not given up this responsibility to the federal authority and retain their respective roles for sewerage development and management.⁵⁶ For those that have given it up, federal departments discharge this responsibility. The Sewerage Services Department (JPP) was formed in 1994 under the Sewerage Services Act (SSA), 1993, as a federal department under the Ministry of Housing and Local Government. In the light of the formation of SPAN, it is now a department within Kementerian Tenaga, Teknologi Hijau dan Air KeTTHA, and has the main functions of planning and sourcing funding for new sewerage capital works and the rehabilitation of existing sewerage systems. The department's role is primarily administrative; it does not play a direct role in the regulation or management of sewerage services.⁵⁷

Tariff and Pricing Policies

Generally, domestic water tariff is cross-subsidized by industry tariff in Malaysia, hence, industry rates are higher than domestic rates; most of the developed states (such as

Selangor and Johor) have relatively higher industry water tariff but the exception is Pulau Pinang which may explain its high per capita water consumption.⁵⁸ The general principles underlying the water tariffs in Malaysia include the following:

- A. Higher rated for higher consumption to discourage wastage.
- B. Cross-subsidy for domestic consumers by industrial consumers.
- C. The incentives for efficient use of water are applied through the use of volumetric charges (based on measured water use) under an increasing block structure (where block price rises with use rise) – this approach is used for the water tariffs for residential homes (with the exception of Sabah which uses a flat rate).⁵⁹

States have different policies on tariffs. While some states have increasing tariff structure, some have flat rate tariffs and some subsidize residential use by commercial tariffs.

Financing Model

As aforesaid, the main Financing Model in Malaysian Water Regulation is the Public-Private Partnership (PPP). There are three models within this PPP – one is Government Funded (JPP and SPAN), another is Concessionaire Funded (IWK) and the third is Developer Funded (PNB, REHDA, etc.).⁶⁰ Concessionaire holders are lodged and terminated as per a Concessionaire Agreement (CA) and regulated by SPAN on a licensing regime. They are specifically authorised to continue operation (e.g. Indah Water Konsortium, SYABAS). PAAB sources funding from capital market and private companies can take part in water asset development, treatment operation or as sub-contractors to PAAB, while Operation & Maintenance (O&M) remains with water companies regulated by SPAN.⁶¹

C. Noteworthy Cases: Kuala Lumpur and Selangor State

Bunus Centralized Sewage Treatment Plant (Kuala Lumpur) was upgraded from the conventional aerated lagoon process to the two-step inflow nitrification and denitrification process. The plant has a disinfectant but carries out no sterilization because of lack of legal requirements; IWK has declared that water is to be

sterilized only when a water-derived infectious disease is found, however, sterilization is mandatory in the case of drinking water.⁶² The plant employs the two-step inflow nitrification and denitrification process to remove nitrogen and includes eight water treatment lines. Thereafter the Sludge treatment process begins. For excess sludge, polymer is added and then the mixture is concentrated with a drum-type thickener to reduce SS to about 2-4 percent, early settled sludge with an SS of 2-3 percent is added, and the mixture is methane-fermented in a middle-temperature digestion tank for 30 days and then all the methane gas generated is currently burned without effective use, but future gas power generation is being investigated, and the digested sludge is dewatered to reduce the moisture content to 82 percent and then landfilled.⁶³

Puncak Niaga Holdings Berhad (PNHB) was incorporated in 1997 under the Malaysian Companies Act, 1965 as a public company limited by shares, it was an investment holding company with interest in infrastructure activities specialising in water treatment engineering and water-related activities; thereafter PNBH became one of the largest water supply concessionaire in Malaysia.⁶⁴ PNSB operated, managed and maintained 28 water treatment plants with a total average production capacity of 1,882 million litres per day – this volume was equivalent to approximately 50.46% of the treated water requirement in the State of Selangor Darul Ehsan and the Federal Territory of Kuala Lumpur.⁶⁵ In 2004, PNBH's subsidiary, Syarikat Bekalan Air Selangor Sdn Bhd (SYABAS) was granted a concession for a period of 30 years, commencing from 1 January 2005 whereby SYABAS assumed all duties and functions of PUAS in the area of water supply and distribution of water to the consumers within the State of Selangor and the Federal Territories of Kuala Lumpur and Putrajaya involving a population of 6 million and industrial and commercial users through 1.4 million consumer accounts.⁶⁶ After being in the Selangor water services industry since 1994, in 2015, both PNSB Water Sdn Bhd (formerly known as Puncak Niaga (M) Sdn Bhd) (PNSB) and Syarikat Bekalan Air Selangor Sdn Bhd (SYABAS) were disposed to Pengurusan Air Selangor Sdn Bhd and ceased to be a wholly-owned subsidiary and jointly controlled entity of Puncak Niaga Group in line with the consolidation of the Selangor water services industry by the Federal Government and the State Government of Selangor.⁶⁷

3 Challenges In Water Regulation

The major issues outlined as challenges seem to be an overlap between authorities and bodies controlling water regulation and implementation of certain legislations and policies. In 2006, when radical reforms were introduced in Peninsular Malaysia, only about half of the peninsular state's water operators migrated from local to federal, which has been affecting the progress of restructuring the industry.⁶⁸ While important changes and transitions were brought about in Peninsular Malaysia by way of the 2006 reforms, the structures remained more or less same in Eastern Malaysia with little modernisation. Amendments to the Federal Constitution and the overlapping management among the departments have the public confused on which department is in charge of certain matter or who has the final say to water and it has also provoked conflicts of interest between the Federal and the State government in cases such as the dispute between the State of Selangor and SYABAS.⁶⁹

Another issue is that Malaysia is plagued by a Federal-State as well as inter-state dilemma. This is because states have the power over land and water although the federal government rules the country (and have influence over state governments). Hence, states are wary of losing their rights over water to the federal government or other states. This is the case when river basins cut across state boundaries and so each state develops its river basins independently, often resulting in conflicting developments and therefore Integrated Water Resources Management is still effectively lacking.⁷⁰

Enforcement of water supply and sanitation laws in Malaysia has been identified as "loose".⁷¹ Particular focus is laid in scholarship on the poor implementation of money collection from citizens.⁷² In fact, the IWK was so badly debt-ridden within 6 years of taking initial charge that the government had to "buy" it back in 2000, shredding a huge sum of public money in the process.⁷³ Fortunately, subsequent years have been better for IWK in this respect. Its cost collection ratios have gone up from 65% (pre-2000) to 85% (post-2000).⁷⁴

Scholars have also alleged that Malaysia's PPP model is not only narrow in its reach (with only 30% of the country's utilities being privatised)⁷⁵ but also impractical. The charges for both water supply and for sanitation services are very low. This has resulted in several failed PPP plans.⁷⁶

This is aggravated by ineffective cost recovery methods adopted by the IWK.⁷⁷ Further, the model is blinkered in its approach as it only seeks to address the *supply issues*. There is hardly any focus on *demand* management, which is an equally important component of water regulation, especially given the population boom.⁷⁹ There is no limit on the amount of water a citizen may use.⁷⁹

Even in respect of pollution, scholars have identified significant problems with Malaysia's present model. IWK has not managed to cover all sewage treatment plants in the country, and those outside its reach are, ironically, one of the major sources of water pollution.⁸⁰ Agro-based industries are another major source.⁸¹ Further, Malaysia has adopted a uniform discharge standard applicable to all rivers across the country, which is deeply inadequate as it does not consider individual qualities and characteristics of water from different rivers.⁸²

Some other issues identified are ineffective governance structure, unsustainable tariffs, huge investments required to develop the water supply and sewerage infrastructure, inefficient operation by the operators and high non-revenue water (NRW) losses; as mentioned above, the sectoral approach embedded in the present water management system and its transformation towards Integrated Water Resources Management is still in a state of inertia; reliable water accounting systems are found still lacking in this country, especially in the Agriculture and Environmental Sectors, where figures are still highly based on "traditional" assumptions.⁸³ One solution could be to transform from a "Supply" Management mode (a characteristic of a developing country) to a "Water Demand" Management mode (a characteristic of a developed country).⁸⁴

Apart from institutional and structural issues, some of the other challenges are:

- a) Increased competition for water:** The growth in population and GDP over the last three decades has resulted in heavy demand for water and the problem of population growth is particularly felt in the urban areas, due to rural-urban migration and growing urbanization.;
- b) Increased flooding problems:** Although floods are natural phenomena arising from excessive rainfall overwhelming existing waterways for a while,

uncontrolled development activities in watershed areas and along river corridors can increase the severity of floods and the high rate of sedimentation in the rivers has adversely affected their drainage capacity, leading to more frequent floods in downstream areas and to more intense flooding.;

- c) **Environmental degradation:** Economic development and the resulting rapid urbanization and industrialization have given rise to problems of increased water pollution apart from sources like industrial sewage, effluent from palm oil mills, rubber factories, animal husbandry, mining operations, housing, road development, logging, clearing of forest etc;
- d) **Low efficiency of water use:** Irrigation efficiency is in the range of 40 to 50 percent, because almost all of the irrigation systems are open systems designed to take advantage of flooding; and
- e) Increased expectations of citizens.⁸⁵

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SCALING CITY INSTITUTIONS FOR INDIA: SANITATION (SCI-FI)

Sanitation programme at the Centre for Policy Research (CPR) is a multi-disciplinary research, outreach and policy support initiative. The programme seeks to improve the understanding of the reasons for poor sanitation, and to examine how these might be related to technology and service delivery models, institutions, governance and financial issues, and socio-economic dimensions. Based on research findings, it seeks to support national, state and city authorities develop policies and programmes for intervention with the goal of increasing access to inclusive, safe and sustainable sanitation. Initiated in 2013, the programme is primarily funded by the Bill and Melinda Gates Foundation (BMGF).

