



Water Environment
Partnership in Asia

WEPA

Third Phase Final Report



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Ministry of the Environment, Japan
Institute for Global Environmental Strategies (IGES)

Water Environment Partnership in Asia (WEPA) Third Phase Final Report

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Preface

Asia is home to 60% of the world's total population, with further population growth forecast in the future. In addition, the region accounts for 30% of global GDP and by 2050 this share is expected to exceed 50%, making Asia the region with the most dynamic growth in the world. Against this background, there is a worsening impact on the environment, and this is causing serious problems. Rapid population growth, extreme population concentration in urban areas, unregulated industrial development as well as changes in consumption patterns including a shift to foods such as meat that require more water to produce – all these factors put pressure on water resources both in quality and quantity, and there is a risk that this will become an obstacle for sustainable development. There is also concern that climate change will further exacerbate the situation.

Building on the outcomes of the Millennium Development Goals (MDGs), the Sustainable Development Goals (SDGs) were adopted by the UN member states in 2015. Targets on water environment were proposed under SDG 6 and emphasise not only the importance of on-site sanitation facilities but also the entire water cycle including management of water, wastewater and biological resources. However, it is not easy for countries in Asia to achieve the targets set out in SDG 6. For example, according to the report by UN Water in 2017, in South and Southeast Asia, between roughly 60 and 80% of wastewater is still being discharged without treatment. A WEPA survey revealed that the sources of water pollution in Asia are diverse, such as domestic wastewater, industrial wastewater, and agricultural wastewater, and the situation differs greatly depending on the country and watershed.

A great deal of time and expense is required to restore the water environment once it has been polluted. Therefore it is absolutely crucial to manage the water environment appropriately before recovery becomes too difficult. Water environment governance involves a wide range of actors including related officers in central and local governments, water experts, the private sector,

NGOs and citizens. Among these actors, officials in central government play a vital role as they have primary responsibility in planning and implementing the water environment management policy in each country. It is essential to improve their capacity to ensure that appropriate water environment management can be put in place. What is required for policymaking suited to each country's situation is proper information on water environment management systems and technologies, but unfortunately this information is often lacking in developing Asian countries.

Recognising this, the Ministry of the Environment, Japan proposed an initiative called the Water Environment Partnership in Asia (WEPA) in 2004, with the aim of strengthening water environment governance in the Asian region. WEPA conducts its activities on a 5-year cycle. Utilising the knowledge accumulated and the human network developed in the first phase, the second phase of WEPA focused on knowledge-sharing to find solutions to water environment problems. Subsequently, in the third phase which began in 2014, WEPA continued to conduct knowledge-sharing and also made progress with a new scheme called WEPA Action Programs. These are developed and implemented by a WEPA partner country with the aim of solving specific issues and thereby improving the water environment in the country. WEPA supports the planning and implementation of actions proactively carried out by each of the WEPA partner countries.

We have now reached the end of the third phase of WEPA, and as we reflect on the outcomes and experiences of the activities carried out so far, I hope that WEPA will continue to develop to further strengthen and improve water environment governance in the Asian region.

March, 2019

Mitsumasa Okada

Chair of WEPA Advisor Meeting



Message from the Ministry of the Environment, Japan

Recognising that the improvement of water environmental governance is essential to solve water pollution problems in the Asian region, the Water Environment Partnership in Asia (WEPA) was launched in 2004 by the Ministry of the Environment, Japan. During the first phase of WEPA (FY2004 to 2008), it was realised that information sharing among stakeholders is a key point for better water environmental governance. To this end, WEPA developed a human network which was made up of policymakers dealing with water environmental management in the Asian region, and at the same time developed an information platform on water environment in the region. In the second phase of WEPA (FY2009 to 2013), activities were conducted to improve the water environmental governance of WEPA partner countries by promoting information and knowledge sharing for finding solutions to priority issues such as “domestic wastewater treatment” and “climate change and the water environment” through workshops and dialogues. Subsequently, in the third phase of WEPA which began in FY2014, support was provided for specific actions by partner countries to overcome the challenges facing the regional water environment based on the information and knowledge shared up to the second phase.

This report aims to introduce the detailed activities and outcomes obtained in the third phase of WEPA. First, it reports on the current state of water environmental

governance and the challenges faced by WEPA countries. Second, it gives an overview and presents the outcomes of third phase activities, in particular activities implemented in Viet Nam (wastewater management of pig farms), Sri Lanka (groundwater management), and Indonesia (pollution load control for rivers) under a new scheme called “WEPA Action Programs” which are developed and implemented by WEPA partner countries with the aim of solving specific issues. The report also introduces the results of a questionnaire survey carried out to ensure future activities are in line with the needs of all partner countries and summarises suggestions received from partner countries for WEPA activities going forward.

Finally, I would like to extend my deepest appreciation to all WEPA partners who have made major contributions to activities in the third phase of WEPA. It is my sincere wish that many more people will take an interest in WEPA through this report.

March 2019

Kazuya Kumagai

Director of the Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment, Japan



The Water Environment Partnership in Asia (WEPA)

The Water Environment Partnership in Asia (WEPA) is a regional network aiming to improve the water environment in Asia by strengthening water environmental governance. It is intended to raise the well-being of the people in Asia by catalysing knowledge and action on water governance.

WEPA FACTS

When did it start?

WEPA was proposed at the 3rd World Water Forum held in Kyoto, Shiga and Osaka in 2003 by the Ministry of the Environment, Japan, and was launched in 2004; activities follow a 5-year cycle and the Third Phase started in April 2014.



Who are the constituents?

Currently, WEPA comprises 13 Asian countries: Cambodia, China, Indonesia, Japan, Republic of Korea, Sri Lanka, Lao PDR, Malaysia, Myanmar, Nepal, the Philippines, Thailand, and Viet Nam. Each partner country appoints focal points who actively participate in WEPA activities and facilitate the same in their respective countries.



How is it governed?

The plan of activities under WEPA is discussed and endorsed at the WEPA Annual Meeting. According to the plan, the WEPA Secretariat implements activities in close collaboration with partner countries.

What is the mission of WEPA?

Based on partnerships between policymakers and relevant stakeholders in Asia, especially through those of WEPA Focal Points, WEPA aims to:

- enhance capacity of policy planning and implementation of policymakers, mainly via the WEPA Focal Points, through facilitating exchange of knowledge and dialogue on water environmental management of the partner countries
- identify critical water environmental issues and key institutional issues for management thereof, support such efforts in resolving them, and share the lessons learnt from these activities with WEPA partner countries and related stakeholders
- enhance cooperation within WEPA partner countries and with international organisations and donor agencies to resolve existing water environmental issues and to improve water environmental management

The WEPA Database – an information platform for water environmental management

Developed in collaboration with the partner countries, this four-part database holds information on the related policies, technologies and NGO & CBO activities, as well as links to other resources.

The database also holds the bulk of WEPA meeting presentation material and publications.



What's new in the third phase?

The WEPA Action Program

To promote concrete actions for improving water governance in each country, a new scheme named “WEPA Action Program” was introduced in the third phase. WEPA Action Programs aim to take actions to resolve specific problems on water governance in partner countries, with support provided by WEPA. Practical lessons learnt from the program are shared with other WEPA partner countries.

WEPA Outlook on Water Environmental Management in Asia

Considering the importance of a common understanding among stakeholders to solve water quality issues in the region, the “WEPA Outlook on Water Environmental Management” has been published every three years and is based on the accumulated information and knowledge, as well as the human network developed under this initiative. The report aims to provide the most up-to-date and useful information on the water environment and its management in WEPA partner countries.



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Summary of the Third Phase of WEPA

Year	Month	Event
2014	Oct	<ul style="list-style-type: none"> Bilateral meeting with Viet Nam (Hanoi, Viet Nam) 23rd Meeting of the United Nations Secretary General's Advisory Board on Water and Sanitation (Tokyo, Japan)
	Nov	<ul style="list-style-type: none"> 11th International Symposium on Southeast Asian Water Environment (SEAW11) - WEPA Sessions on Water Environmental Governance in Asia
2015	Feb	<ul style="list-style-type: none"> The 10th Annual Meeting (Colombo, Sri Lanka) WEPA Workshop on Wastewater Management (Colombo, Sri Lanka)
	Others	<ul style="list-style-type: none"> Issued a pamphlet on the overview of the third phase of WEPA Developed plan of Action Program on Waste and Wastewater Management of Pig Farms in Viet Nam

Year	Month	Event
2015	Apr	<ul style="list-style-type: none"> 7th World Water Forum (Daegu & Gyeongbuk, Republic of Korea) - Official session "Strengthening Frameworks for Governing and Managing Water Quality"
2016	Jan	<ul style="list-style-type: none"> WEPA Workshop on Industrial Wastewater Management (Vientiane, Lao PDR) The 11th Annual Meeting (Vientiane, Lao PDR)
	Other	<ul style="list-style-type: none"> Conducted WEPA Action Program on Waste and Wastewater Management of Pig Farms in Viet Nam

Year	Month	Event
2016	Jul	<ul style="list-style-type: none"> Conference on Watershed Management for Controlling Municipal Wastewater in Southeast Asia (Nagoya, Japan) MOEJ and MLIT, Japan
	Nov	<ul style="list-style-type: none"> 12th International Symposium on Southeast Asian Water Environment (SEAW12) (Hanoi, Viet Nam) - WEPA Session on Groundwater Pollution Control 12th Annual Meeting (Hanoi, Viet Nam)
2017	Feb	<ul style="list-style-type: none"> WEPA group workshop on pig wastewater management in Asia (Chiang Mai, Thailand)
	Others	<ul style="list-style-type: none"> Conducted a follow-up study on Waste and Wastewater Management of Pig Farms in Viet Nam Developed plan of Action Program on Groundwater Monitoring for Industrial Effluent Management in Sri Lanka

Year	Month	Event
2017	Sep	<ul style="list-style-type: none"> WEPA International Workshop on Industrial Wastewater Management (Jakarta, Indonesia) The 13th Annual Meeting (Jakarta, Indonesia)
	Nov	<ul style="list-style-type: none"> Workshop for Introduction of Multistage Hybrid Wetland Systems (Hanoi, Viet Nam)
	Dec	<ul style="list-style-type: none"> Preparation Workshop on the Asia Wastewater Management Partnership (AWaP) (Yangon, Myanmar)
2018	Mar	<ul style="list-style-type: none"> 8th World Water Forum (Brasilia, Brazil) <ul style="list-style-type: none"> Official thematic session "Understanding the Water Quality from Ridge to Reef" Regional Process Workshop "Towards Improving Sanitation and Wastewater Management: Challenges and Good Practices in the Asia-Pacific Region"
Others		<ul style="list-style-type: none"> Conducted WEPA Action Program on Groundwater Monitoring for Industrial Effluent Management in Sri Lanka Developed Action Program on Pollution Load Management in Citarum River, Indonesia Started development of a WEPA action program in Cambodia Conducted an online survey to WEPA partner countries

Year	Month	Event
2018	Sep	<ul style="list-style-type: none"> IWA World Water Congress & Exhibition (Tokyo, Japan) <ul style="list-style-type: none"> Workshop "Toward the Achievement of SDGs Relating to Sanitation and Wastewater Management (SDG 6.2, 6.3)"
2019	Feb	<ul style="list-style-type: none"> International Workshop on Decentralised Wastewater Management (Tokyo, Japan) 14th Annual Meeting (Tokyo, Japan)
Others		<ul style="list-style-type: none"> Conducted WEPA Action Program Pollution Load Management in Citarum River, Indonesia Conducted WEPA Action Program on Groundwater Monitoring for Industrial Effluent Management in Sri Lanka (continued) Developing WEPA Action Program in Cambodia (continued) Conducted an online survey on feedback towards WEPA Conducted a survey on water environmental governance





Situation Analysis on Water Environmental Management

3.1. Overview

Deterioration of water quality is one of the most pressing environmental problems threatening human health and sound economic development. It remains a critical problem in many WEPA partner countries. The WEPA partner countries have developed their own policies and measures to combat the growing threat of water pollution in critical areas and to avoid future pollution risks in other areas.

Certain aspects of water environmental management differ across the partner countries – due to contextual factors such as the duration, gravity, cause and level of socio-economic development – but some, such as pollution source control, are common to all as basic measures. Conducting reviews of water environmental management in the partner countries is useful in order to understand what progress has been made so far and to identify common management challenges, as well as to promote more knowledge-sharing for future WEPA activities. To this end this summary on water environmental management in WEPA partner countries gives an overview of the state of water environmental management and some of the common challenges being faced.

3.1.1. Basic environmental law in WEPA countries

It is important to set clear policy objectives and targets. Clear goal-setting enables actions taken by governments and managers of facilities that discharge pollutants to be reviewed at a later stage. Most WEPA countries have set out a **basic environmental law** stipulating protection of human health, ensuring a safe human environment and protection of the environment as a basis for sustainable development, and these objectives also apply for water environmental management. More detailed definitions of water environmental management objectives are laid out in laws or acts specific to water pollution control in some countries, such as the Sub-Decree on Water Pollution

Control (Cambodia), Water Pollution Control Law (Japan) and Clean Water Act (the Philippines). Myanmar has no such basic law but did pass the “Environmental Conservation Law” in 2012, and in 2015 adopted the Myanmar National Water Policy with aims to establish a framework for developing relevant laws and institutions.

3.1.2. Ambient water quality standards in WEPA countries

Ambient water quality standards are the administrative targets dictating the levels of water quality that need to be maintained. Table 3.1.1 shows the status of standard-setting for ambient water quality in each partner country. With the exception of Myanmar, all WEPA countries have established surface water quality standards. Myanmar has yet to formulate ambient water quality standards but formulation of the National Environmental Quality Standards is underway as mandated by the Environmental Conservation Law passed in 2012.

3.1.3. Water quality monitoring in WEPA partner countries

Most of the WEPA partner countries conduct regular monitoring of ambient water quality except Nepal and Lao PDR. In Lao PDR, ambient water quality monitoring is carried out on an ad-hoc basis. In Nepal, different ministries and agencies carry out water quality monitoring, but there is no systematic ambient water quality framework. National or local government agencies conduct ambient water quality monitoring in public water bodies. Table 3.1.2 shows the number of monitoring stations and evaluation methodologies of water quality used in WEPA partner countries.

The methodologies of evaluation of water quality applied in the WEPA partner countries can be primarily divided into two types. In the first type, water quality is evaluated based on preset criteria and classes, which is practiced in Japan, Republic of Korea, Philippines, Thailand and Viet Nam. In this method, based on the results of water quality monitoring, governments determine whether each water body satisfies the Water

Table 3.1.1. Status of ambient water quality standards in WEPA partner countries

Country	Surface Water	Groundwater	Marine/Coastal Water	Sources
Cambodia	Water Quality Standards in Public Water Areas	Water Quality Standards in Public Water Areas	Water Quality Standards in Public Water Areas	<ul style="list-style-type: none"> • Sub-Decree on Water Pollution Control (No.27, 1999)
China	Environmental Quality Standards for Surface Water	Quality Standard for Ground Water	Sea Water Quality Standard	<ul style="list-style-type: none"> • Environmental Quality Standards for Surface Water (GB3838-2002) • Quality Standard for Ground Water (GB/T 14848-9) • Sea Water Quality Standard (GB3097-1997)
Indonesia	Water Quality Criteria	Water Quality Criteria	Standard Quality of Seawater	<ul style="list-style-type: none"> • Government Regulation Number 82 (2001) • Decree of the State Minister of the Environment Number 51 (2004)
Japan	Environmental Quality Standards for Water Pollution	Environmental Water Quality Standards of Groundwater	Environmental Quality Standards for Water Pollution	<ul style="list-style-type: none"> • Environmental Quality Standards for Water Pollution (1971, latest amended in 2016) • Environmental Water Quality Standards of Groundwater (1998, latest amended in 2012)
Republic of Korea	Environmental Standards for Water Quality and Aquatic Ecosystem	Environmental Standards for Water Quality and Aquatic Ecosystem*	Environmental Standards for Water Quality and Aquatic Ecosystem	<ul style="list-style-type: none"> • President Decree under Framework Act on Environmental Policy (1990)
Lao PDR	Surface Water Quality Standard	Groundwater Quality Standard*		<ul style="list-style-type: none"> • The Agreement of National Standards of Environment in Laos (2009)
Malaysia	National Water Quality Standards	**	Marine Water Quality Criteria and Standard	<ul style="list-style-type: none"> • National Water Quality Standards for Malaysia • Marine Water Quality Criteria and Standard
Myanmar				
Nepal	***	***	***	<ul style="list-style-type: none"> • Nepal Gazette (No.10, 16 June 2008)
Philippines	Water Quality Guidelines and General Effluent Standards of 2016	Water Quality Guidelines and General Effluent Standards of 2016	Water Quality Guidelines and General Effluent Standards of 2016	<ul style="list-style-type: none"> • Water Quality Guidelines and General Effluent Standards of 2016
Sri Lanka	****	****	****	<ul style="list-style-type: none"> • Potable Water Standards (SLS614) (2013) • Ambient Water Quality Standards
Thailand	Surface Water Quality Standards	Groundwater Quality Standards*	Marine Water Quality Standard	<ul style="list-style-type: none"> • Notification of the National Environmental Board, No. 8, B.E. 2537 (1994) • Notification of the National Environmental Board, No. 20, B.E. 2543 (2000)
Viet Nam	National Technical Regulation on Surface Water Quality	National Technical Regulation on Ground Water Quality	National Technical Regulation on Coastal Water Quality	<ul style="list-style-type: none"> • No. QCVN 08:MT2015/BTNMT National Technical Regulation on Surface Water Quality • No. QCVN 09:MT2015/BTNMT National Technical Regulation on Ground Water Quality • No. QCVN 10:MT2015/BTNMT National Technical Regulation on Coastal Water Quality

* For groundwater used for drinking, the groundwater quality standard for drinking is applied.

** Although no water quality standard is established, groundwater quality status is determined based on National Guidelines For Raw Drinking Water Quality from the Ministry of Health (Revised December 2000) as the benchmark in Malaysia.

*** Nepal sets water quality standards according to objective (for drinking water, irrigation water, livestock watering, and industry).

**** Sri Lanka evaluates water quality according to objective category (potable water, water source for simple treatment, bathing and contact recreation, fish and aquatic life, water source for general treatment, irrigation and agriculture, minimum water quality). The first ambient water quality standards and classifications have been approved and are in the process of publication as of 2018.

Quality Standard or not, which is used to express the overall water environmental standard for these countries as a percentage. This evaluation methodology also classifies water bodies for suitability for different uses.

In the second type of evaluation methodology, water bodies are classified based on the results of water quality monitoring and classification in the Environmental Quality Standard. For example, in China, river sections are

categorised into six classes (I, II, III, IV, V and worse than V) based on the classification stipulated in its Environmental Quality Standard. In Malaysia and Thailand, the same evaluation methodology concept is applied, but these countries use the Water Quality Index (WQI) instead of the classification within the Environmental Quality Standard.

Table 3.1.2. Number of monitoring stations and methodologies of evaluation of water quality in WEPA partner countries

Countries	Number of monitoring stations				Water quality evaluation methodology
	River	Lake	Groundwater	Coastal	
Cambodia	10	2	N/A	5	
China	2,424	343	6,124	147,940 km ² (Spring) 135,420 km ² (Summer)	Classification, using monitoring stations, based on results of monitoring and Environmental Quality Standard (Surface water, marine water and groundwater)
Indonesia	598	N/A	N/A	N/A	Achievement rate of environmental standard for water in public water zones (Surface water)
Japan	3,934 ^a 4,578 ^b 1,783 ^c	401 ^a 477 ^b 168 ^c	3,196 ^d 818 ^e 4,313 ^f	1,060 ^a 2,054 ^b 293 ^c	Achievement rate of environmental standard for water in public water zones (Surface water, marine water and groundwater)
Lao PDR	-	-	-	-	
Malaysia	904	90	105	151 (coastal) 76 (estuary)	Classification of monitoring stations, based on monitoring results and Water Quality Index (WQI)
Myanmar	-	-	-	-	
Nepal	-	-	-	-	
Philippines	172	42	-	28	Achievement rate of environmental standard for water in public water bodies and rating based on the achievement rate of each water body (Surface water and marine water)
Republic of Korea	1,745	191	3,353	N/A	Achievement rate of environmental standard for water in public water zones (surface water and groundwater)
Sri Lanka	-	-	-	-	
Thailand	600	35	620	221	Classification of monitoring stations, based on monitoring results and Water Quality Index (WQI)
Viet Nam	522	-	-	145	Achievement rate of environmental standard for water in public water zones

a: indicators for human health protection, b: indicators for living environment, c: indicators for aquatic biodiversity, d: summary survey, e: survey of area surrounding polluted wells, f: continued surveillance (a-c: 2016, d-f: 2017)

(Source: See References)

3.1.4. Effluent quality standards and compliance status

Except Myanmar, all WEPA partner countries have set industrial effluent standards. Standards for effluent discharge vary from country to country – China, Lao PDR, Nepal, Sri Lanka, Thailand and Viet Nam based theirs on the type of industry, whereas Cambodia's was set up according to proximity of pollution sources to sensitive

environmental or ecosystem conservation areas. Japan and Republic of Korea introduced a system to control total pollution loads in specific water bodies in addition to effluent control via pollutant concentration. For further strengthening of water environment management, Indonesia is developing a methodology for total maximum daily load (TMDL). Although Myanmar does not have an industrial effluent standard, it has developed guidelines for industrial effluents. Of the 13 WEPA partner

countries, eight have established effluent standards for agro-industries.

Monitoring of effluent quality is necessary to check on levels of compliance with standards. Despite obligations on owners or managers of pollution sources and wastewater treatment facilities to monitor effluent quality, this is not comprehensively carried out in all countries and results sometimes do not reach the intended authorities. In Cambodia and Sri Lanka the central government conducts monitoring at sites suspected of discharging high concentrations of effluent. On the other hand, in Republic of Korea, centralised monitoring of effluent using tele-metering was introduced for pollution sources

(industries and domestic wastewater treatment facilities) exceeding certain volumes. Malaysia introduced an on-line reporting system for industry to self-report effluent monitoring results through a website. In Japan, recording of monitoring results became mandatory under a revision to the Water Pollution Control Law in 2010. According to a recent survey conducted by the WEPA Secretariat and other sources, the compliance rate of industrial effluent varies from country to country – it is 100% in Japan and the Republic of Korea, 99% in Malaysia, 90% in Cambodia, 87% in Indonesia, 82% in Sri Lanka and 75% in the Philippines (Figure 3.1.1).

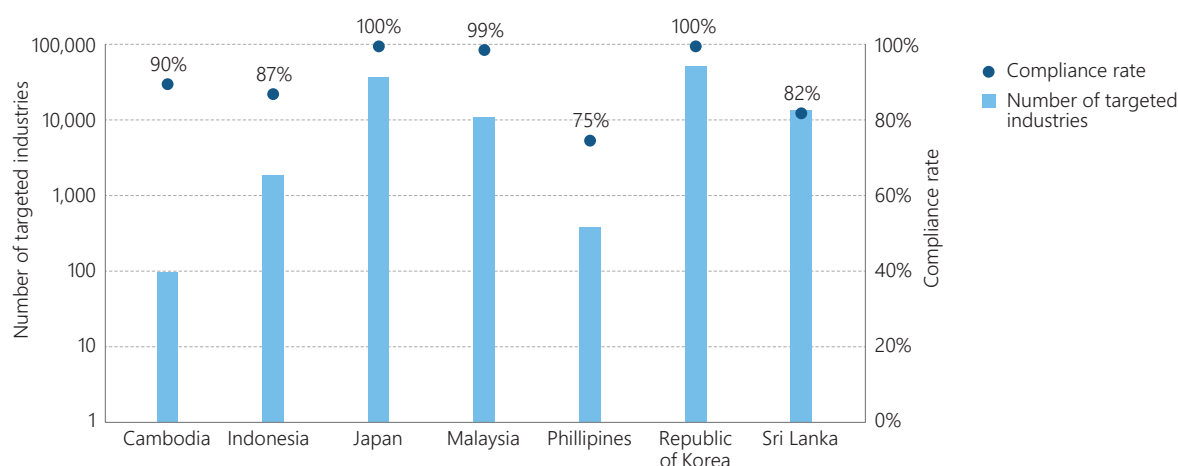


Figure 3.1.1. Compliance rates of industrial effluent in selected WEPA partner countries (Source: See References)

All WEPA partner countries have legislations in place to prevent or mitigate pollution from untreated or partially treated industrial wastewater. For enforcement of existing legislations, various measures including onsite inspection provision, governmental guidance and violation penalties have been introduced to ensure industrial effluent quality complies with effluent standards. For example, economic instruments such as Viet Nam’s environmental protection fee on industrial wastewater have been introduced, and polluters will be charged depending on the pollutant and load emitted (MoEJ, 2018). Inspections and penalties play an important role in addressing non-compliance.

Some WEPA partner countries have attempted to encourage industries to comply with regulation using alternative measures. For instance, Japan has introduced provisional effluent standards for specific types of industries that face difficulties to comply with original effluent quality standards in order to encourage technical improvements by specifying a time limit. Malaysia also has introduced lax policy that exempts industries from the immediate need for compliance with effluent standards

for treatment facilities under construction or being upgraded. Indonesia launched its Program for Pollution Control Evaluation and Rating (PROPER) to encourage industries to comply with environmental regulations by publishing their environmental performance, including whether they meet designated effluent qualities or not.

3.1.5. Institutional arrangements

In general, the environmental line ministry and agencies are in charge of pollution control. However, national and local government agencies play distinct roles in water quality management that differ in respective WEPA partner countries. In general, national governments develop policies, laws and set overall goals, targets and rules, which are implemented by local governments. Local governments handle local water environmental management in many countries. Further, the concept of ‘basin management’ has been gradually spreading in water environmental management in WEPA partner countries. In Viet Nam, for example, a basin-level

management plan covering water quality aspects in three major river basins is underway; in the Philippines, “water quality management areas” (under the Clean Water Act) have been created, which are designated by hydrological instead of administrative boundaries. To incorporate the basin management concept and further raise the water quality of water bodies, it is necessary to encourage stakeholder participation and increase awareness. The overlap of responsibilities and institutional coordination is one of the major challenges for water environment management in WEPA partner countries. In 2018, China established a new Ministry of Ecology and Environment to minimise this problem and strengthen institutional coordination on ecological environmental protection responsibilities.

3.1.6. Data availability on wastewater management

Reliable and timely data on volume of wastewater generation and treatment is important in evidence-based decision-making to ensure good water governance, and also facilitates effective monitoring of SDG targets on water and sanitation. However, comprehensive assessments of water have not been carried out in WEPA partner countries except Japan, Republic of Korea and Philippines. A survey conducted by the WEPA Secretariat in 2019 found that data on wastewater generation and status of treatment are not available or publicly accessible in the other 10 WEPA partner countries.

Most WEPA partner countries have policies to disclose ambient water quality monitoring, and many partner countries including China, Japan, Republic of Korea, Malaysia, Thailand, and Viet Nam make results of ambient water quality monitoring available to the public by publishing environmental quality reports. Some countries such as China, Republic of Korea, Thailand, and Viet Nam disclose real-time monitoring data from automated monitoring stations on designated websites.

3.1.7. Recent developments and future challenges

All WEPA partner countries have attempted to strengthen their water environmental management systems over the past decade. The “WEPA Outlook on Water Environmental Management 2018” (WEPA Outlook 2018) (MoEJ, 2018) identified the following key developments in WEPA partner countries:

i. Strengthening of effluent management, including

setting up and revisions to effluent standards.

- ii. China, Japan, and Republic of Korea apply the Total Pollutant Load Control (TPLC) system to the whole country or specific water bodies in addition to effluent control via wastewater quality control.
- iii. Some countries such as Indonesia and Thailand have attempted to introduce the TMDL system to strengthen water environment management.
- iv. Strengthening institutional coordination and minimising overlapping responsibilities by institutional restructures, such as China’s establishment of the Ministry of Ecology and Environment, with broader mandates for pollution control and ecological protection, including for air, water, sea, soil, noise, light, odor, solid waste, chemicals, vehicles, and nuclear facilities¹.
- v. Incorporation of concerns surrounding ecosystem conservation.

WEPA Outlook 2018 identified the following challenges for water environment management in this region:

- i. **Absence of detailed rules and guidelines for wastewater management:** In the absence of rules and guidelines, industry uses different effluent monitoring procedures and analytical methods that make the assessment of effluent quality data less reliable and less comparative, which creates problems in proving non-compliance.
- ii. **Weak institutional coordination:** Multiple agencies (covering environmental and industrial sectors) have been assigned water environment management mandates, which leads to overlapping responsibilities, weak coordination and conflicts of interest.
- iii. **Availability and accessibility of reliable data:** Information on industries and their wastewater – not only number and type of industry but also wastewater volume and quality data – is insufficient in partner countries. Reliability of data of effluent quality is another challenge as most WEPA partner countries lack lab-based capacity, standardised sampling and analysis methodology.
- iv. **Lack of human resources:** In most WEPA partner countries, water environment management agencies often suffer from human resources shortages both at national and local government levels, which creates a barrier to enforcing regulations in terms of not only staffing levels but also implementation capacity.
- v. **Lack of financial resources:** resources are required for establishing databases and inventories, as well as conducting water quality monitoring.

1 Partially updated with information from the Ministry of Ecology and Environment, 2015-2016 (See References)

3.2. Domestic Wastewater and Septage Management

The Asia-Pacific region continues to experience rapid population growth, urbanisation, industrialisation and changes in consumption patterns, including shifting diets toward highly water-intensive foods such as meats, which combined have led to a significant increase in water demand, placing a huge burden on water infrastructures in many countries of the region. Consequently, the quantity and pollution loads of wastewater produced are constantly increasing. Unfortunately, a considerable amount of wastewater in this region is not properly treated before being discharged. Estimates show that 85–89% of generated wastewater in Asia is discharged directly into water bodies without any treatment or only partially treated by simple on-site sanitation systems such as septic tanks (Kuyama, 2017), causing substantial levels of contamination in drinking water sources, as well as inland and coastal ecosystems.

3.2.1. Predominance of septic tanks with poor performance in urban areas

Asia's developing countries share several challenges in common for effective wastewater management, including a low percentage of improved sanitation systems, especially in rural areas, inadequate sewerage network coverage, and insufficient sewage and sludge treatment facilities. WEPA partner countries, especially those in Southeast Asia, are still heavily dependent on septic tanks and other low-cost on-site sanitation facilities such as ventilated improved pit toilets, double-vault latrines, composting toilets, and pour-flush toilets with twin pits. It is reported that approximately 88% of households in urban areas of Viet Nam have a septic tank –with respective figures for Thailand, Philippines, Lao PDR, Indonesia and Cambodia being 83%, 72%, 58%, 63% and 44% (WHO and UNICEF, 2017).

The number of septic tanks is expected to accelerate in the future. Although the presence of septic tanks is an improvement over having no sanitation facilities at all, in many cases there is still much to be done in terms of the design, construction, operation and maintenance of septic tanks. In addition, the low contribution of septic tanks to water quality conservation is pointed out as a problem, since septic tanks in most areas treat only black water, while gray water is directly discharged to the environment without any treatment, thus causing

negative impacts on the nearby water environment. Low treatment efficiencies, often ranging from 30–60% based on results from several studies, which is lower than centralised sewerage systems using aeration, have been observed in these countries (MOEJ, 2015). Although septic tanks are widely used in WEPA countries, most of these countries lack specific policies and legal/institutional frameworks covering appropriate design, construction, operation and maintenance. A recent estimate showed that 75% of septic tanks in Viet Nam and 66% in Indonesia, for example, have never been emptied (World Bank, 2015).

3.2.2. Lack of proper septage management

The sludge generated from these on-site systems (hereafter referred to as “septage”) is rarely collected, and even when collected is often illegally dumped or improperly or only partially treated before discharge into the open environment. Figures reported for safe disposal or treatment of septage vary widely – 4% in Indonesia, 10% in Philippines (mainly in Metro Manila), 4% in Viet Nam (World Bank, 2013), less than 1% in Nuwara Eliya of Sri Lanka, and 30% in Thailand (AECOM & SANDEC, 2010). In many cases, septage is not prioritised by either central or local governments, and is often handled by private service providers, as practiced in Indonesia, Philippines, Thailand, and Viet Nam. In Indonesia, for instance, more than 150 septage treatment plants were constructed since the 1990s, but due to the lack of effective septage emptying services, many plants stopped functioning and less than 10% still operate – many of which do not function properly either (World Bank, 2016).



Figure 3.2.1. Discharge of collected septage at “dumping points” in Bandung, Indonesia (Source: Bao, 2018)

3.2.3. Poor management of domestic wastewater and septage

As a result of poor domestic wastewater and septage management, many major rivers and lakes in WEPA countries have been polluted, mainly by organic contaminants and nutrients (nitrogen and phosphorus). In Indonesia, for instance, results of water quality analysis showed that most analysis parameters for water samples collected from rivers across the country have exceeded the national water quality standard; and these rivers have been severely polluted due to poor management of domestic wastewater and septage from septic tanks. In addition, it is estimated that about 70% of groundwater in cities in Indonesia is heavily polluted with sewage bacteria as a result of leaking septic tanks – yet half of city dwellers use groundwater for their daily needs (World Bank, 2013).

Water pollution due to poor sanitation not only affects the environment and human health, but also has huge economic impacts. A study from the World Bank in the East Asia and Pacific region covering Indonesia, Philippines and Viet Nam showed that the previously described situation has caused negative socio-economic, ecological and environmental impacts in these countries. The economic impact of inadequate sanitation in these three countries is rising, with total costs estimated at 8.5 billion USD. The breakdown of this cost is comprised of Indonesia with 6.3 billion USD (2.3% of GDP), Philippines with 1.4 billion USD (1.5% of GDP) and Viet Nam with 780 million USD (1.3% of GDP) (World Bank, 2008).

3.2.4. Limits to centralised wastewater treatment

The urban wastewater treatment rate in Lao PDR, Cambodia, Myanmar, Nepal, Viet Nam, Sri Lanka, and Indonesia continues to be below 35% and mainly relies on conventional centralised wastewater treatment methods. Meanwhile, in emerging economies like China, Malaysia and Thailand, this rate ranges from 60 to 80%. In Japan and the Republic of Korea, the rate is much higher and exceeds 90% (Bao and Kuyama, 2013). Meanwhile, the wastewater treatment rate in rural areas is much lower in most countries, with the exception of Japan, Malaysia and the Republic of Korea. Time, continuous investments, capacity development and a vast amount of infrastructure construction will be required for developing countries to build, operate and maintain centralised wastewater systems in order to gain similar rates of

domestic wastewater treatment as developed countries. This may not always be an economically/environmentally feasible option, and alternative solutions to conventional centralised wastewater management are being explored. Meanwhile, decentralised wastewater treatment systems (DEWATS) have received increasing attention from WEPA partner countries as a promising approach to address the limitations described above.

Advocates of decentralised wastewater management opine that the construction of conventional, large-scale centralised wastewater treatment systems with advanced technologies, often imported from developed countries, have failed in many cases as these are not considered feasible, cost-effective options for many developing countries in Asia. Instead, decentralised wastewater management has been shown to be a viable alternative for developing countries in Southeast Asia with rapidly accelerating populations and urbanisation, which lack adequate wastewater treatment facilities (Figure 3.2.2).

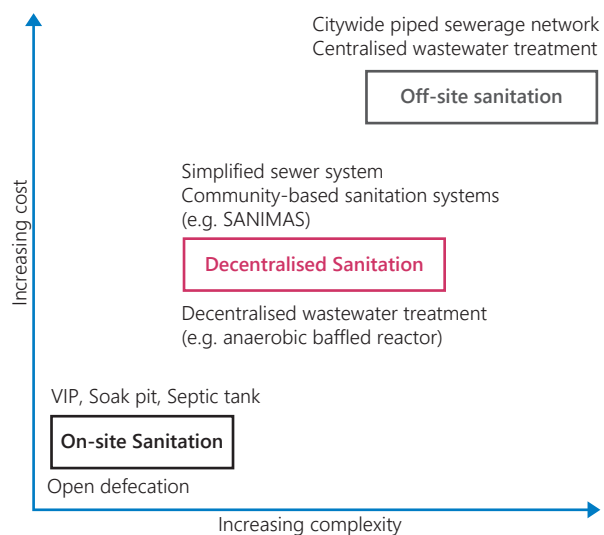


Figure 3.2.2. Decentralised sanitation fills the gap between on-site and centralised sanitation options

(Source: Modified from WSP, 2013)

Interest in DEWATS is rising due to their potential to reduce treatment costs over the long term, minimise environmental impacts and facilitate wastewater reuse (Daigger, 2009; Nhapi, 2004). In Japan, sewer networks in centralised systems can cost five times more than the sewage treatment plant itself. In contrast, DEWATS reduces sewer costs significantly (Figure 3.2.3), and can reduce costs of treatment units too if anaerobic treatment technologies are utilized. The areas with highest potential to implement DEWATS are peri-urban and rural areas with a low-income population. Good examples have been observed in case studies from Indonesia, Malaysia, and Manila City in the Philippines.

Successful cases of decentralisation are also recognised in Japan, where about 2,500 decentralised systems with modern treatment technologies are associated with large residential blocks that treat and reuse their own wastewater (Yamagata et al., 2012). It is strongly believed that decentralised wastewater treatment systems could fill the gap between on-site systems like septic tanks and centralised treatment options. Thus it is considered a promising solution for effective domestic wastewater management in many Asian countries, although anaerobic DEWATS is not a universal solution

for all local problems and still incurs the issues of sludge management and unsatisfactory effluent water quality.

Since there is no single solution to all problems, the selection of any technological option should take into account local contexts, including in particular technical, socio-cultural, institutional and economic factors such as consumer affordability and willingness to pay, cost effectiveness, as well as use of environmentally sound, socially and technically acceptable, highly reliable, simple, easily maintainable technologies, especially in developing countries.



Figure 3.2.3. Example of an anaerobic type DEWATS system installed and managed by a community-based organisation in Bandung, Indonesia

3.3. Industrial Wastewater Management

The rapid pace of population and economic growth in disparate developing WEPA partner countries have led to a huge gap between the amounts of industrial wastewater generated and the infrastructure available to treat it. As a major cause of water pollution, this poses a serious threat to the environment and human health, as well as a serious challenge for governance. The main challenges regarding wastewater treatment and management, especially in developing countries, are the lack of monitoring data, especially for small to medium scale industries, insufficient treatment infrastructure and lack of strict enforcement. While most WEPA countries have made significant progress in effluent/septage treatment and management over the last decade, a significant amount of industrial wastewater is still unaccounted for and released in the ambient environment without proper treatment – Japan, Republic of Korea, and China are exceptions (MoEJ, 2018). In addition, the market for industrial wastewater and its treatment in Southeast Asia alone is estimated at over 4 billion USD by year 2020,

with Indonesia representing the largest market and the Philippines the highest growth rate (ADB, 2016). For industries in most WEPA partner countries, managing sludge in addition to wastewater remains a challenge, owing to the lack of infrastructure, poor governance, lack of awareness and limited capacity.

The following describes country-specific findings on the status of industrial wastewater management, as well as future challenges and opportunities (WEPA Website).

- 1 **Cambodia** – Of 1,144 industries, around 10% were non-compliant with effluent standards when inspected by responsible ministries. After inspection, facilities in 99 industries were improved for small malfunctions; however, 10 industries were issued legal orders and penalised for not following the effluent standard issued by the Ministry of Environment. The government is increasing efforts to revise the sub-decree on water pollution control by streamlining the guideline on effluent treatment and management, and developing capacity (MoE Cambodia, 2019).
- 2 **China** – In 2015, the Action Plan for Prevention and Control of Water Pollution was issued by the government, and in response, industrial wastewater treatment facilities with a total capacity of up to 10 million

m³/day have been built in industrial agglomeration areas. Total COD discharged into the environment from sources with daily discharge volume over 100 m³ is estimated at 172,414 t/year (MEE, 2017).

3 Indonesia – The Program for Pollution Control Evaluation and Rating (PROPER) evaluated 1,872 industries in 2017-2018, and found that 13% of the industries failed to comply with environmental regulations. Lack of pollution prevention policies especially for small-scale industries/enterprises and insufficient capacity of wastewater treatment plants resulted in severe pollution of river bodies. The national government is dealing with this issue on a priority basis and is implementing/amending different rules and policies such as the Decree of the Ministry of Environment in 2014 for the next 5 years on wastewater quality standard to improve effluent treatment (MoE Indonesia, 2019).

4 Japan – With strict enforcement of the Water Pollution Control Law as defined by the national government as well as stricter regulations by local governments, most stakeholders are aware of their responsibilities to maintain the quality of treated effluent before discharging it to ambient water bodies. Approximately 40,000 site inspections were conducted each year, of which around 10 improvement orders for existing treatment systems were issued, and only a few violations of effluent standards were observed. Increasing importance is placed on: a) improving water quality of enclosed water bodies, b) improvement of waterfront areas, and c) consideration of effects of climate change in wastewater management (MoEJ, 2019).

5 Lao PDR – Despite having 62 river basins, most surface water is rapidly deteriorating due to regular discharge of untreated industrial effluents, poor laws and governance. The main challenge is lack of regular monitoring, policy enforcement and lack of budget for wastewater treatment infrastructure.

6 Malaysia – With significant progress over the last 10 years, about 99% of 11,410 industries inspected were showing environmental compliance for industrial effluent discharge in 2014. However, major pollutants identified for the rivers are BOD, ammonium nitrogen and suspended solids with respectively 11%, 5.7 % and 12% of contribution coming from the industrial sector. The government has introduced performance monitoring through its Industrial Effluent Treatment System (IETS), which involves a self-regulatory mechanism based on online monitoring and reporting.

7 Myanmar – Rapid industrial development with limited monitoring capacity, infrastructure and

coordination among different stakeholders are the main drivers for poor water environment in the country. Therefore, the government is attempting to strengthen institutional and governance capacity on a priority basis.

8 Nepal – Despite very low industrial growth, water bodies are severely polluted in the country due to the lack of wastewater management infrastructure and policies/regulations. Since Bagmati River in Kathmandu is the most polluted river in the country, the government considered prioritised effluent management in Kathmandu Valley.

9 Philippines – According to an Environmental Management Bureau, Department of Environment and Natural Resources (DENR-EMB) annual report (DENR, 2016), only around half (45.4% Manila Bay, 50% whole country) of the total inspected industrial establishments were complying with the effluent discharge guideline issued by DENR, mainly due to insufficient effluent treatment plants as well as poor governance. The government is addressing this through efforts to increase the capacity of treatment plants. Further, violations of the General Effluent Standards are dealt with by the Pollution Adjudication Board and a “Cease and Desist Order”, with penalties for non-compliance and closure of the facility in the worst case.

10 Republic of Korea – 92% of the industries were found to be compliant with environmental effluent regulation (MoEJ, 2018). However, to further improve surface water quality and conserve aquatic ecosystems, the Korean government is planning to increase the number of parameters from 20 in 2012 to 35 from year 2025. New parameters planned include pharmaceuticals and personal care products, pesticides, micro-plastics, nanomaterials, persistent organic pollutants, and other micro-pollutants.

11 Sri Lanka – As of 2018, 85% of 23,495 surveyed high- and medium-polluting industries, complied with national wastewater guidelines. On the other hand, for most small-scale industries, regular monitoring data on effluent treatment and discharge is not available due to financial constraints. Major actions being considered include implementation of a monitoring plan for major water bodies, provision of proper guidance to industry through relevant authorities and establishment of public-private partnerships for improved coordination.

12 Thailand – It is reported that industrial effluents contribute to about 33% of point sources of pollution load discharged to the different surface water bodies. Also, only around 48% of industries comply with the law on wastewater treatment and management. The

main challenge identified is the lack of an industrial zone effluent standard.

13 Viet Nam – Between 2016–2017, 3,225 industrial facilities located in the three largest river basins in Viet Nam were investigated for effluent treatment and management. 939 industries were found to be non-compliant with environmental effluent regulations, and financial penalties were imposed according to the extent

of non-compliance. In addition, it is planned for the monitoring frequency to be increased in certain monitoring points to stem industrial non-compliance with effluent standards.

The prime regulatory bodies and recent developments in policies and guidelines taken by these agencies are summarised in Table 3.3.1.

Table 3.3.1. List of key regulatory bodies for industrial effluent management and recent developments in policies and frameworks to further improve effluent treatment and management

Country	Regulatory bodies for industrial wastewater management	New developments in laws, policies and guidelines regarding industrial wastewater management
Cambodia	<ul style="list-style-type: none"> • Dept. of Environmental Pollution Control • Office of Water and Soil Quality management 	<ul style="list-style-type: none"> • Management of wastewater treatment system and better coordination between central and sub-national level
China	<ul style="list-style-type: none"> • Ministry of Ecology and Environment (MEE) 	<ul style="list-style-type: none"> • New environmental protection law with priority on stricter effluent discharge standard and penalty for non-compliance
Indonesia	<ul style="list-style-type: none"> • Ministry of Environment 	<ul style="list-style-type: none"> • Strict implementation of industrial effluent quality guidelines • Ambient water quality monitoring and enforcement of penalty for non-compliance
Japan	<ul style="list-style-type: none"> • Ministry of Land, Infrastructure, Transport and Tourism • Ministry of the Environment • Government Ordinance City 	<ul style="list-style-type: none"> • Establishment of more stringent environment quality standard • More stringent effluent standards • Regulations for private companies
Lao PDR	<ul style="list-style-type: none"> • Ministry of Industry and Commerce • Department of Communications, Transport, Post and Construction (DCTPC) at provincial level. • Special municipal committees under provincial governors 	<ul style="list-style-type: none"> • Revision of national environmental standard • Revision of water and wastewater resources management law • Strict industry wastewater discharge regulation • Introducing industrial processing law
Malaysia	<ul style="list-style-type: none"> • Department of Environment 	<ul style="list-style-type: none"> • Revision of national water quality standard • Revision of the industrial effluent discharge standard for water ways and land
Myanmar	<ul style="list-style-type: none"> • City Development Committees • Ministry of Industry 	<ul style="list-style-type: none"> • Recently adapted National Environmental Quality Guidelines • Recently adapted National Water Policy
Nepal	<ul style="list-style-type: none"> • Ministry of Energy, Water Resources and Irrigation • Department of Environment • Water and Energy Commission Secretariat 	<ul style="list-style-type: none"> • Strict implementation of the right to a clean environment, with industries obliged to abide by effluent standards and compensate victims in event of failure to comply
Philippines	<ul style="list-style-type: none"> • Local Government Unit/ Dept. of Interior & Local Government • Department of Environment and Natural Resources 	<ul style="list-style-type: none"> • Revision of water quality standard and effluents standards for different types of industries • Introduced penalties and liabilities for non-compliance with effluent standards
Republic of Korea	<ul style="list-style-type: none"> • Ministry of Environment 	<ul style="list-style-type: none"> • Increasing water quality and effluent standards • Strengthening water quality monitoring
Sri Lanka	<ul style="list-style-type: none"> • Water and Energy Commission Secretariat • Water Resources Board • National Water Supply & Drainage Board 	<ul style="list-style-type: none"> • Introduction of regulatory tools like EIA, EPL, WML to improve wastewater discharge standards
Thailand	<ul style="list-style-type: none"> • Ministry of Science, Technology and Environment • Department of Industrial Works 	<ul style="list-style-type: none"> • Designed effluent control standards for specific industries related to desalination, leather processing and pulp and paper • Set plan for legal and economic measures to control industrial wastewater discharge
Viet Nam	<ul style="list-style-type: none"> • Ministry of Science, Technology and Environment • Urban Environment Companies 	<ul style="list-style-type: none"> • Diligent monitoring and introduction of penalties and liabilities for non-compliance with effluent standards • Strengthen law on environment protection for control of discharge

Summary and way forward

Common challenges for wastewater management among many WEPA partner countries include: a) lack of sufficient state-of-the-art infrastructure for effluent/septage treatment and management, b) lack of inventory

data or information, c) lack of coordination between key players involved in wastewater management, and d) absence of proper law enforcement mechanisms.

In this context, the platform for sharing knowledge and experience which WEPA has made available in these

countries plays a pivotal role in providing the necessary tools to enable the required actions to take place in a timely manner for improving effluent management systems, and ultimately revitalising the ambient water environment. As stated in section 5 of this report, it is expected for WEPA to play an increasingly important role in monitoring progress to achieve the Sustainable Development Goals (SDGs).

3.4. Groundwater Pollution Control

3.4.1. Status of groundwater pollution

Groundwater is an important source of water in WEPA countries and many cities heavily rely on it for their water supply. For instance, over 30% of water supply for domestic and industrial use comes from groundwater in Thailand. In China, over 60% of cities utilise groundwater for drinking. Groundwater pollution mostly occurs through the disposal of untreated domestic and industrial effluents, leaching of agro-chemicals and organic waste from farmlands, illegal dumping of wastes, and unsafe sanitation practices. In addition, geogenic arsenic, iron, fluoride, and seawater intrusion are other challenges in groundwater quality management in WEPA countries. Groundwater contamination is also associated with mining activities and leaching from certain industrial settings. In China as of 2017, the main indices found to be over the standard limits for groundwater quality are total hardness, total dissolved solids, iron, manganese, nitrogen, fluoride, sulfate and chloride. Heavy metals including arsenic, hexavalent chromium, lead and mercury exceeded standards in some monitoring sites (MEE, 2017). In Japan, nitrate/nitrite, arsenic, fluoride, boron, trichloroethylene, chloroethylene, lead, tetrachloroethylene, and cadmium exceeding standards were detected in groundwater (MoEJ, 2017). Faecal coliform was found to be a common issue in Cambodia and the Philippines. In the Philippines, groundwater quality was assessed through the Tap Watch Program of the Environmental Management Bureau, and 27 out of 88 shallow wells were found to have faecal coliform levels exceeding the standard for drinking water (MoEJ, 2018).

Arsenic exceeding limits were observed in some areas of China, Japan, Lao PDR, and Nepal. Salinity or saltwater intrusion is a growing concern in some areas of Myanmar and Viet Nam (MoEJ, 2018). In Viet Nam, the coastal zones, especially in the Central South Region, Dong

Nai Province and Mekong delta face the problem of groundwater salinity. Groundwater pollution is a serious problem for many WEPA partner countries, as it requires extensive time and financial resources to treat polluted groundwater. Similarly, monitoring and assessment of groundwater are challenging due to inherent invisibility of the aquifers and pathways of contamination.

3.4.2. Legislative frameworks

Groundwater pollution control is addressed by one or more legislative frameworks in most WEPA partner countries. In China, the Water Pollution Prevention and Control Law is the main legislation for groundwater pollution control. China also has its Action Plan for Prevention and Control of Water Pollution which outlines specific measures on pollution control. In Indonesia, groundwater protection is covered by the National Constitution (# 32, 2009), individual government regulations (# 43, 2008; #69, 2014; # 121, 2015), and the Decree of Ministry of Energy and Mineral Resources (#1451, 2000). In Japan, the Water Pollution Control Law and Soil Pollution Control Law, as well as other legislations related to solid waste, chemical substance, and air pollution are relevant for groundwater pollution control. The Republic of Korea has the Groundwater Act for pollution control and legislates measurement of water quality pollution, water quality testing, and enforcement decrees outlining measures and orders to prevent groundwater pollution.

3.4.3. Institutional arrangements

WEPA partner countries generally have one or more agencies to deal with groundwater pollution: in Indonesia, multiple agencies and institutions are responsible for groundwater pollution control, thus inter-agency coordination represents a big challenge; in Japan, the Ministry of the Environment is the key agency dealing with groundwater pollution; in the Republic of Korea, the Ministry of Land, Infrastructure and Transport and Ministry of Environment can order enforcement of the Groundwater Act; and in Thailand, the Department of Groundwater Resources and the Pollution Control Department are the lead agencies dealing with groundwater pollution.

WEPA partner countries have adopted different strategies to control groundwater pollution. China places higher emphasis on prevention and control of groundwater pollution by strengthening groundwater environmental supervision and management of key

industries, which involves regular assessments of safety risks related to the groundwater environment of relevant enterprises and their surroundings, focusing on the industries that discharge heavy metals and other toxic and hazardous pollutants such as oil refineries, coking, ferrous metal smelting and rolling processing, and publishes lists of key enterprises polluting groundwater. It can shut down industries in the event of a severe groundwater pollution accident. According to the National Plan for Groundwater Pollution Prevention and Control (2011-2020), China also takes special measures to prevent groundwater pollution by petrochemical industries, which include seepage prevention measures at collection, storage, treatment and disposal facilities of wastes and avoiding installation of oil and gas pipelines near protected areas of drinking water sources. Similarly, any newly built, refurbished or expanded construction of underground oil tanks after 2012 is mandated to be of double layer structure or installed with leakage prevention tanks. Under the Water Pollution Control Law, Japan has adopted a prevention, remediation and self-management approach to control groundwater pollution, in which prevention regulates handling and storage of hazardous waste to avoid potential seepage underground, while remediation outlines measures to be taken after accidental spills and orders issued by local governments to polluters to undertake remediation. Thailand has adopted risk management, regulation and remediation for contaminated sites, under which notices are issued on groundwater pollution, suggestions are issued for well cleanup, and alternative water supplies are arranged. Regulations set the standards for groundwater and soil contamination such as regular monitoring after contamination and remediation. There are manuals and guidelines on risk assessment, damage assessment, and remediation.

3.4.4. Monitoring and inspection

WEPA partner countries have established a system of groundwater monitoring. In the case of Japan, baseline monitoring takes place via observation wells. If a contaminated well is found, detailed monitoring in the surrounding area is conducted. For contaminated wells, follow-up monitoring is also conducted to comprehend historical changes in contamination over time. In Malaysia, groundwater monitoring is carried out by multiple agencies, such as the Minerals and Geoscience Department (JMG), Department of Environment (DOE), local councils, water agencies, universities (special projects), and National Hydraulic Research Institute of Malaysia

(NAHRIM) (research and modelling). The objectives of groundwater monitoring by JMG are to determine ambient/background water quality and regional water quality trends, meet regulatory requirements, determine contamination/pollution effects of a facility discharging to the groundwater, examine the effects of particular activities on the groundwater environment and provide early warning of onset of contamination. In the case of DOE, groundwater quality monitoring is practiced to establish groundwater quality status within the country, develop a Malaysian standard for groundwater quality, identify locations requiring intervention, and for initiating remedial action at sites identified as contaminated. In Thailand, the Ministry of Industry Decree on Soil and Groundwater Contamination Control B.E. 2559 (2016) obliges business owners to collect soil and groundwater samples and maintain contamination (esp., VOC, heavy metals, pesticides/insecticides) below a specified level. Initial sampling must be conducted within 180 days after this regulation and monitoring reports must be compiled within 180 days after monitoring. After the first inspection, a second sampling is conducted within 180 days and the results reported within 120 days. When contamination is detected above a permissible level, the business in question is required to propose and undertake remediation measures within 180 days.

3.4.5. Challenges and next steps

WEPA partner countries also face challenges in controlling groundwater pollution. Contamination of groundwater by industrial activities has become a growing concern in Sri Lanka (MoEJ, 2018), leading the Central Environment Authority to address the issue through a WEPA action program (see section 4.3). In Viet Nam, planning, licensing and assigning restricted zones are the key issues. Improvement in groundwater quality monitoring, enhancing coordination among agencies and stakeholders, and enforcement of regulations are other problems faced by some of the WEPA countries including Indonesia and Viet Nam, as are prevention and control of groundwater contamination. These require strengthening of enforcement capacity as well as introduction of measures to monitor contamination and undertake remediation in contaminated areas.

WEPA countries have different capacities in terms of monitoring as well as regulating compliance in groundwater management. Further information exchange could be carried out for sharing of good practices and lessons learnt, including monitoring approaches and regulatory tools.



WEPA Action Programs

4.1. Introduction

WEPA Action Programs were introduced in the third phase to address requests from WEPA partner countries to resolve specific problems in the water environment. Practical lessons learned and good practices from the implementing countries were shared with other WEPA partner countries at WEPA International Workshops and WEPA Annual Meetings, and were published on the WEPA

database. They were also shared with other countries at international forums such as the World Water Forum and Asia Pacific Summit.

During the third phase, three WEPA Action Programs were officially proposed by WEPA partner countries and developed in consultation with the WEPA Secretariat and the Ministry of the Environment, Japan (MoEJ), with funding from MoEJ. Table 4.1.1 gives an overview of the programs. Regarding Cambodia, the Action Program is being developed by the WEPA Focal Points as of March 2019 and details are pending.

Table 4.1.1. Overview of WEPA Action Programs in the third phase

Country	Term	Title of Action Program	Objectives	Outputs/Outcomes
Viet Nam	2014 – 2017	Waste and Wastewater Management of Pig Farms in Viet Nam	To determine pollution load units in pig wastewater in Viet Nam	Establishment of Effluent Standard for Livestock Industry (QVCN62-2016/BTNMT)(2016)
Sri Lanka	2015 – 2019	Improving Industrial Waste and Wastewater Management in Gampaha District, Sri Lanka	To develop/improve policy/guidelines related to industrial siting and waste/wastewater disposal to prevent groundwater pollution	Provision to legalise the industrial siting procedure as amendment to National Environmental Act No.47 of 1980 (planned)
Cambodia	2017 – ongoing	(Action Program currently in development)		
Indonesia	2018 – ongoing	Application of Total Maximum Daily Loads (TMDLs) for Effluent Discharge Permit and Capacity Building for Local Officials to Implement the TMDLs in Indonesia	To improve the water quality of Citarum River	Establishment of new regulation for TMDLs in Indonesia (planned)

4.1.1. Selection criteria

In identifying critical and common issues among WEPA countries to be addressed under the Action Program, the following points have been considered in the selection process of the proposals:

a) Needs of the country

- The government of the proposed WEPA country has assigned urgent priority status to an issue in water environmental management.
- An issue is a prioritised area in national policy (e.g., national long/mid-term development plans include an issue as an action plan, policy commitments include an issue).

- Social needs regarding an issue is high in an area where an Action Program will be conducted.

b) Sustainability

- Addressing the issue can or is expected to be funded internally by the government even after WEPA support ends.

c) Influence on other areas and countries

- Addressing an issue is expected to positively influence other areas in the country.
- The Program on an issue can be applied to or serve as a lesson for other WEPA partner countries.

d) Feasibility

- The Program on an issue is feasible in terms of

duration (within the action program period) and can achieve a certain result.

4.1.2. Implementing structure

- Implementing agency
 - In most cases, implementing agencies are the WEPA Focal Points or a local agency assigned by the Action Program.
- Support team
 - A support team is formed to ensure implementation of the Program.
 - Comprises five members: a Focal Point (unless assigned as implementing agency), domestic and neighbor WEPA countries' experts (academics), a WEPA Secretariat member and a Japanese expert (academics, private companies and local governments).
 - Is responsible for providing advice and guidance on practical problems, and conducting monitoring. WEPA basically supports costs for these support team activities.
- Other WEPA partner countries
 - In accordance with requests from the WEPA Secretariat, other WEPA countries will make

available their practices and experiences related to Action Programs via meetings or introduction of experts.

- At WEPA Annual Meetings, partner countries will advise on the feasibility of Action Programs in other countries as well as in their own country considering their experiences and conditions. If an Action Program appears to be feasible in their own country, they will convey the information to related persons at home.

- WEPA Secretariat
 - The WEPA Secretariat will coordinate communication between an Action Program country and others related to the Program, such as the support team and other WEPA partner countries.



4.2. Waste and Wastewater Management of Pig Farms in Viet Nam

4.2.1. Overview

Official Title of Action Program	Situation Analysis on Pig Manure and Effluent Management in Viet Nam
Term of the Action Program	2014 – 2017
Location of Action Program	Hanoi, Hung Yen, Thai Binh, Thanh Hoa and Bac Giang (Viet Nam)
WEPA Focal Person(s) responsible for program	Dr. Dinh Thi Hai Van Deputy Head of Environmental Management Division Department of Environmental Management Faculty of Environment, Viet Nam National University of Agriculture

4.2.2. Background and objective

Pig farming represents a key contribution to the economic development of Viet Nam as it creates jobs and raises income for millions of households in the country. However, rapid growth of the sector has recently resulted in negative impacts to the environment due to the large amount of untreated or improperly treated wastewater and manure discharges from the farms. A key related problem is the lack of accurate data on discharge pollutant loads, which leads to inaccurate forecasting of generated waste volumes and inappropriate design of treatment systems. This Action Program was therefore designed to plug this gap, and involved conducting a comprehensive, in-depth investigation of existing practices and technical approaches for wastewater and manure management involving 40 household pig farms and 25 large-scale pig farms located in five representative cities and provinces of the Red River Delta in Viet Nam – Hanoi, Hung Yen, Thai Binh, Thanh Hoa and Bac Giang. An innovative methodology has been proposed to accurately estimate units of pollutant load discharged per pig head for different types of pigs. Both primary and secondary data (including from literature reviews, field surveys such as those using questionnaires, sampling and water quality analysis, and laboratory tests) have been collected as important inputs for estimation. As a result, a reliable and comprehensive set of Viet Nam context-specific data on pollutant load discharge units

from pig farms has been established and proposed for future use.

4.2.3. Description

The study was conducted at 40 household pig farms and 25 large-scale pig farms across the selected provinces and cities in the Red River Delta, Viet Nam. For household farms, the survey was conducted in four provinces and cities, namely Thai Binh, Bac Giang, Thanh Hoa and Hanoi. In each province or city, 10 household pig farms were randomly selected from the obtained list of pig farms to conduct interviews using a questionnaire form. For large-scale pig farms, the survey was conducted in three provinces, namely Hanoi (in Ung Hoa, Son Tay, Gia Lam district), Hung Yen (Van Lam district) and Thanh Hoa (Van Xuong district). In each district, five large-scale farms were selected randomly to conduct the interviews and questionnaire surveys.

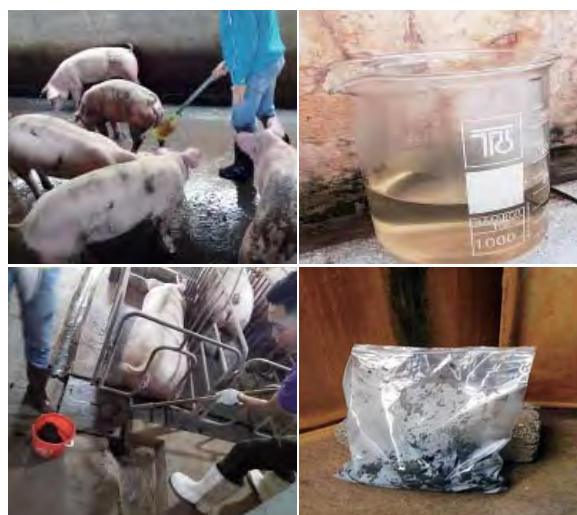


Figure 4.2.1. Urine and manure sampling

4.2.4. Outcomes

It was found that mixed waste (urine, manure, wastewater) led to complications in treatment. About 50% of surveyed households mixed waste prior to treatment and disposal at their pig farms; meanwhile this ratio rose to 65% in large-scale farms.

The material flow in a life cycle for different types of pigs was estimated as shown in Figure 4.2.2.

Accurate estimation of average pollutant load discharge units per pig (including urine, manure, and wastewater) in a life cycle plays an essential role for

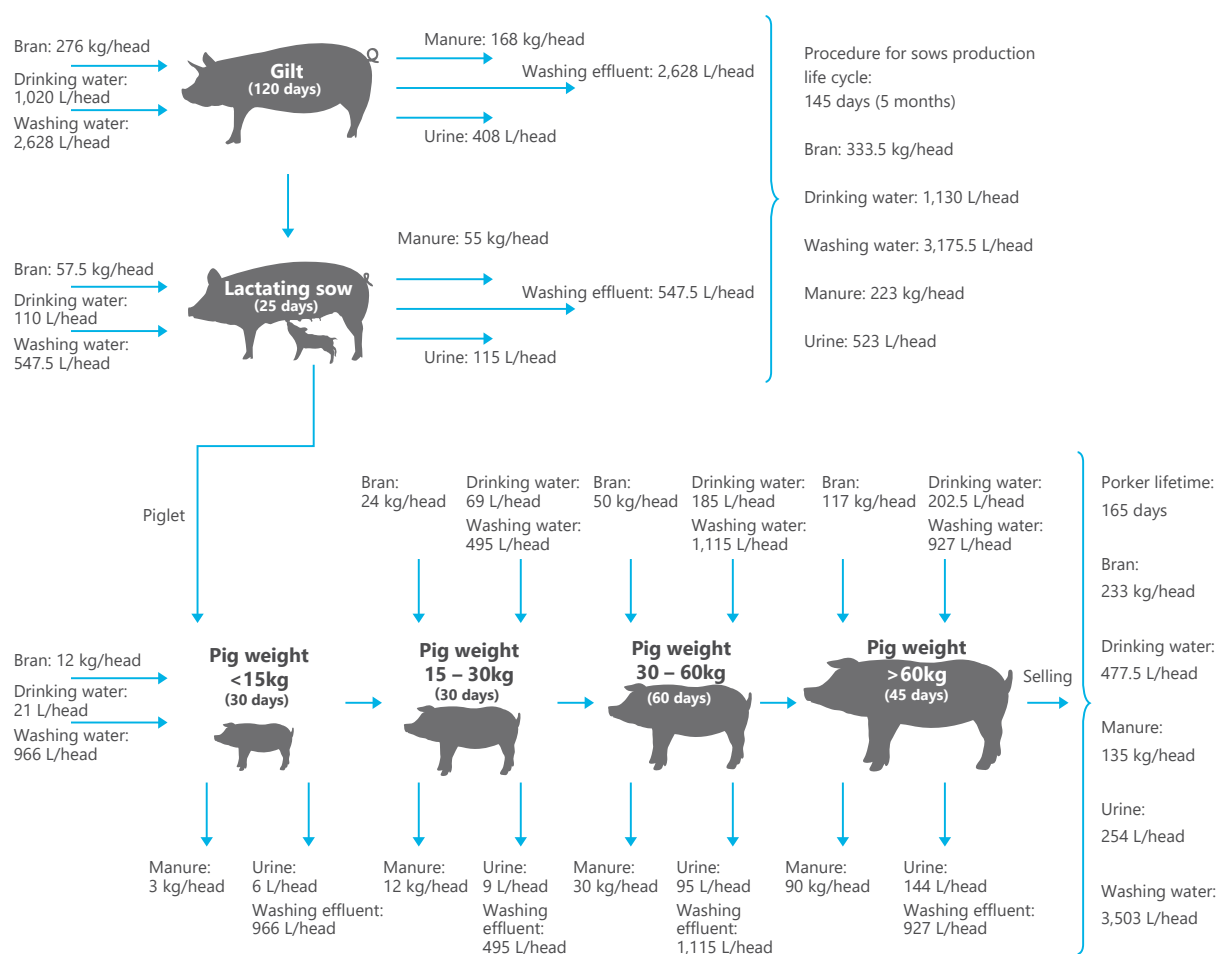


Figure 4.2.2. Estimation of input and output flows in large-scale pig farms

environmental protection and the decision-making process of policymakers. This data is crucial for calculating waste streams or flows when designing waste treatment systems/facilities as well as for the processes of inspection, pollution control and waste auditing carried out by state agencies. Quantifying pollutant load discharge units can also assist in calculating the greenhouse gas emission inventory due to pig production in Viet Nam. Results from the study have been utilised in the establishment of an effluent standard for livestock wastewater (QVCN62-2016/BTNMT).

4.2.5. Conclusions and recommendations

- Currently, most pig farms in the Red River Delta of Viet Nam fail to satisfy the National Technical Regulation

on the Effluent of Livestock QCVN 62-MT: 2016/ BTNMT, and urgent action is needed.

- Mixing different types of waste (urine, manure, and wastewater) complicates treatment, thus improved architectural and procedural design for farms is required.
- Separating solid and liquid contents of waste significantly reduces wastewater pollutants.
- Reducing cleaning/washing water in large-scale pig farms also leads to reduction of pollutants in wastewater.
- A combination or coordination of effective treatment options should be considered in both household-level and large-scale pig farms in Viet Nam.

4.3. Groundwater Monitoring for Industrial Effluent Management in Sri Lanka

4.3.1. Overview

Official title of Action Program	Improving Industrial Waste and Wastewater Management in Gampaha District, Colombo, Sri Lanka
Term of the Action Program	2015 – 2019
Location of Action Program	Gampaha District, Sri Lanka
WEPA Focal Person(s) responsible for program	R.M.S.K. Ratnayake Director, Environmental Pollution Control, Central Environmental Authority

4.3.2. Background and objectives

In Sri Lanka industries are categorised into three broad groups, namely Type A, B and C by the Central Environment Authority (CEA) depending upon the severity of their pollution potential and to guide the siting of such industries. According to the data, a total of 11,449 high polluting industry units (Type A) and 10,711 medium polluting industrial units (Type B) operate within Sri Lanka. It is mandated by law that effluents from industry be treated according to the designated national effluent standards prior to discharge; however, the rise in industry density, lack of firm commitments and loopholes in regulations have together led to an increase in the prevalence of industry-related pollution issues of late, chief of which is groundwater table pollution. The WEPA Action Program in Sri Lanka was launched in Gampaha District to evaluate wastewater pollution control strategies and sludge disposal methods in order to prevent groundwater pollution.

4.3.3. Description

The Action Program evaluated wastewater management in 13 Type A industries and conducted water quality surveys in wastewater treatment facilities (Fig 4.3.1) and 96 groundwater wells in the vicinity of selected industries. Data loggers were also installed in 13 reference wells to monitor water depth and temperature (Fig 4.3.2). Five rounds of surveys were conducted during 2017 and 2018 for all 96 wells to cover all four major seasons. The project also involved dispatching groundwater experts from Japan to provide on-site technical advice



Figure 4.3.1. Inspection at wastewater treatment facility in one investigated industry



Figure 4.3.2. Installation of well data logger

on program implementation. Wastewater treatment and sludge management systems for all 13 investigated industries were reviewed, which revealed that wastewater treatment systems are generally constructed in-house for the majority of industries. However, the level of treatment they offer is still very basic and at the primary level, mainly consisting of a settling tank, sand filter, aeration chamber and maturation tank. Some industries were in the process of upgrading treatment facilities such as through introducing ion exchange, ozonation or other tertiary treatments. For sludge, some industries still rely on off-site management facilities, while others are seeking environmentally and economically efficient solutions through using sludge materials as inputs to other by-product stage industrial processes.

4.3.4. Outcomes

Figure 4.3.3 shows a map of the investigated industries together with the COD concentrations in groundwater at various distances from the respective industries. From the multi-season survey on groundwater wells, it was found that the majority of water quality parameters did not exceed tolerance limits set by CEA for the majority of the samples. For COD, only one well which was 63 meters

from industries A & B on the map exceeded the 50 mg/L tolerance limit value for outfalls leading up to nearshore water. While no strong correlation between concentration and distance from wells was found, groundwater close to certain industries such as A & B showed significantly higher levels of COD compared to others.

Other parameters including temperature, EC, TDS, ammonia, nitrate, and Cl were analysed and results are

being processed. Parameters such as Pb, Cr, Cu, Fe, and phosphate were mostly below instrument detection limits. Further analysis is required to consider other parameters which may affect the data, such as depth of the surveyed well/aquifer, baseline groundwater quality, other pollution sources, quality of the actual industrial effluent discharged, or statistical analysis of daily/temporal fluctuations.

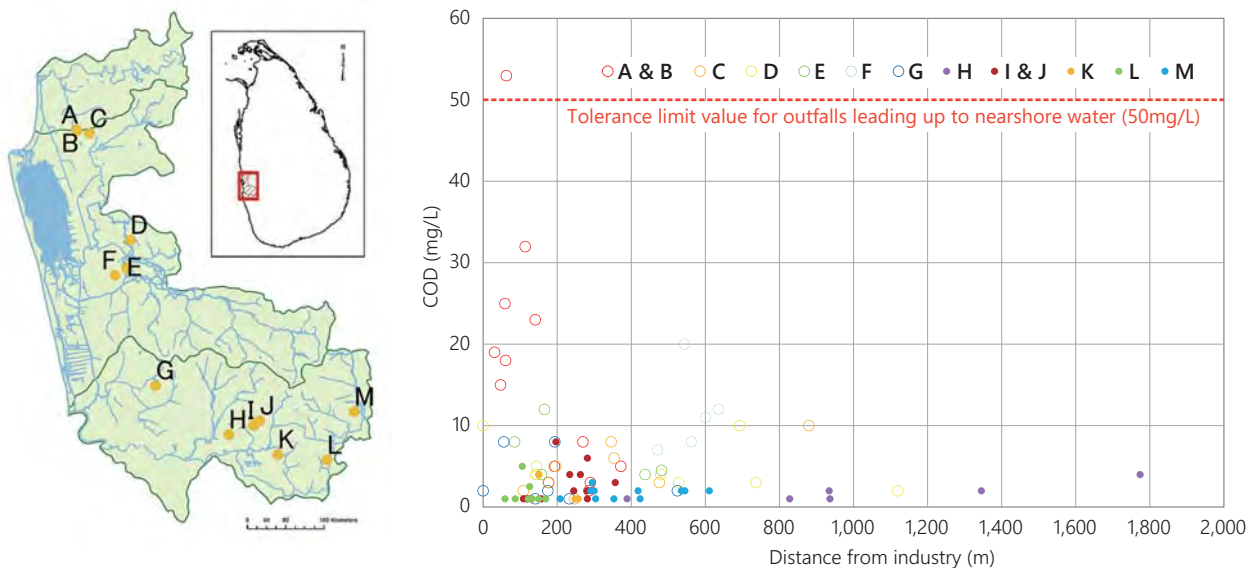


Figure 4.3.3. Map of investigated industries and COD concentrations of groundwater at different distances from the investigated industries² (Source: See References)

4.3.5. Conclusions and recommendations

- Further analysis on the raw industrial wastewater in addition to other potential pollution sources should be conducted to determine contamination pathways, especially for wells near industries A & B. Based on the contamination pathways identified, potential solutions can be investigated as the next step.
- The observed parameters could be used as a benchmark to assess any future changes or deterioration in groundwater quality in the area. The data obtained from the Action Program as well as follow-up monitoring could prove valuable in assessing future impact on groundwater due to the likely rise in industrial activity in this area, including that of small and medium enterprises which are not well regulated at present.
- Certain industries, especially the larger ones that generate high volumes of wastewater, could consider

improving their wastewater treatment to add tertiary treatment and appropriate sludge management practice, to avoid pollution of groundwater and surface water compared to the relatively unaffected current state. With a view that this will be beneficial to the local communities which utilise these water sources, financial instruments such as subsidies from the national or local government to these practices could be considered.

- Proper policies and regulations for zonation should be made effective and consideration should be given for areas where groundwater usage is common. Also, the siting of highly polluting industries as well as disposal options should be thoroughly scrutinised.
- Identification of general hydrology and hydrogeology of areas intended for industries and design of appropriate effluent discharge systems in accordance therewith should be considered.

² The industries are labelled from A to M for convenience of this report. Each dot in the scatterplot represents the mean value of COD analysed up to 5 times at different seasons in the same well.

4.4. Pollution Load Management in Citarum River, Indonesia

4.4.1. Overview

Official name of Action Program	WEPA Action Program in Indonesia - Application of Total Maximum Daily Loads (TMDLs) for Effluent Discharge Permit and Capacity Building for Local Officials to Implement the TMDLs
Term of the Action Program	2018 – ongoing
Location of Action Program	Citarum River Basin, Indonesia
WEPA Focal Point responsible for program	Budi Kurniawan Deputy Director, Inventory and Waste Load Allocation Ministry of Environment and Forestry, Indonesia

4.4.2. Background and objectives

The Citarum River is the largest river in West Java, with a length of 350 km and a catchment area of 6,600 km². The Citarum River Basin supplies 80% of the domestic water of Jakarta, and in recent decades serious pollution

such as sediment accumulation and eutrophication in downstream reservoirs has become a problem due to domestic and industrial wastewater inflows from urban areas and agricultural wastewater from rice paddies and fields upstream (Yoshida et al. 2017). The government of Indonesia prioritised addressing this challenge and issued Presidential Regulation No.15 of 2018 on Acceleration of Pollution and Damage Control in the Citarum River Basin to clean it up by 2025 (Government of Indonesia, 2018). Taking action towards this target, it introduced the concept of Total Maximum Daily Loads (TMDLs) in its new regulation on water pollution control and the new effluent standard, which is applied to textile industries. As an example, figure 4.4.1 shows the estimated BOD pollution loads from industries in the Citarum River Basin.

Although the TMDLs regulation was initially formulated in 2001, it was determined necessary to improve its implementation through capacity building activities. The WEPA Action Program in Indonesia started in 2018 with the aim of providing capacity building and promoting a better understanding among relevant central and local government officials in Indonesia on both TMDL and concentration-based regulations for improving the water quality of the Citarum River.

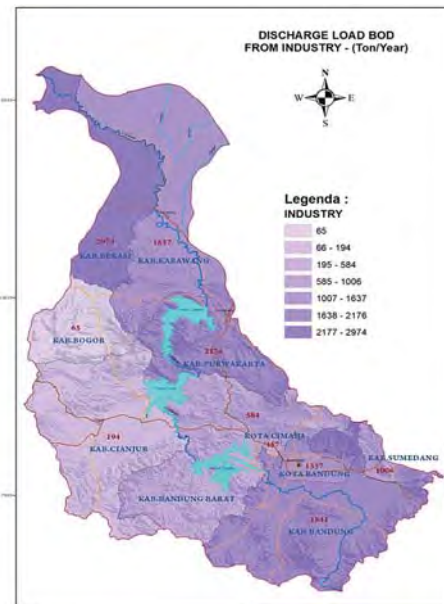
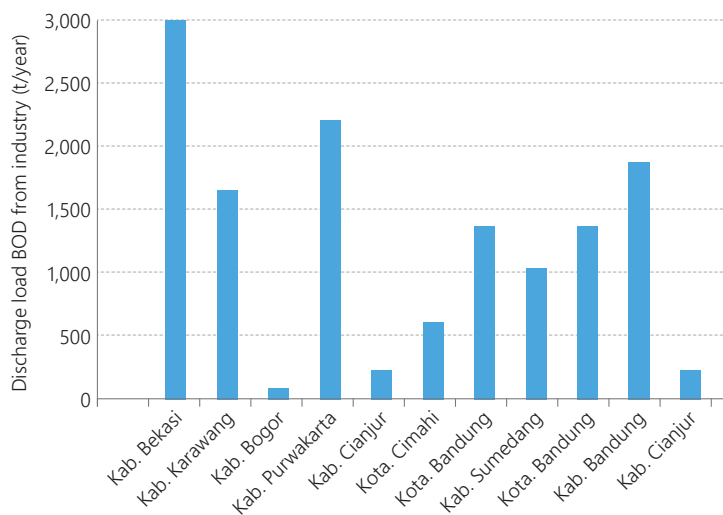


Figure 4.4.1. Citarum River Basin and annual BOD pollution loads from industries
(Source: Government of Indonesia)

4.4.3. Description

As the WEPA Action Program in Indonesia mainly focuses on developing capacity of central and local government officials on the new regulation and standards, several learning opportunities were provided as the first step. The following activities have been conducted to strengthen the knowledge and understanding of Indonesian officials on water quality management, especially on TMDL systems.

i) Jakarta Workshop

Date: 19 January, 2018 Place: Jakarta, Indonesia

Prof. Mitsumasa Okada, Chairman of WEPA Advisory Board gave a lecture about the Japanese experience of TMDL application and implementation to invited Indonesian officials.



Jakarta Workshop

ii) Follow-up research

The WEPA Secretariat visited the Citarum Basin in February 2018 and conducted a field survey in the area. Results of survey were discussed between Indonesia and the WEPA Secretariat to develop the Action Program proposal.



Citarum River

iii) Bilateral meeting

The WEPA Secretariat and the Ministry of Environment and Forestry, Indonesia (MOEF) held a bilateral meeting

in November 2018 and agreed to hold a workshop in Bandung under the Action Program to strengthen capacity of central and local government officials.

iv) Bandung Workshop

Date: 23 and 24 January 2019 Place: Bandung, Indonesia

The Ministry of the Environment, Japan (MOEJ) and MOEF co-hosted a workshop on the WEPA Action Program in Indonesia. This two-day workshop targeted Indonesian central and local government officials selected by MOEF and consisted of a Learning day and Training day. Participating officials were provided with opportunities to develop their capacity on water quality management, especially to deepen their understanding for TMDL application.



Bandung Workshop

4.4.4. Outcomes

To achieve measurable progress in improving water quality of the Citarum River, which Indonesia strongly desires in the short/medium term, it is necessary for central and local government officials to have a common understanding on appropriate approaches and their respective roles in implementing the newly applied TMDL systems. Through the activities conducted under the WEPA Action Program in Indonesia, participating officials have obtained key knowledge to bolster their respective actions for improving the water quality of the Citarum River, such as determining the load or quality and quantity of pollutants to allocate in each sector or industry, Japan's experience in appropriate systems operations and regulations, and details of Indonesia's new regulation and standards.

4.4.5. Next steps

The outcomes and impacts of the activities conducted so far under the Action Program will be reviewed, and the next steps and actions will be discussed and implemented as appropriate.



Feedback from WEPA partner countries

5.1. Results of Surveys

In 2017 and 2018, an online survey was conducted to obtain feedback from WEPA partner countries with the aim of fine-tuning plans for the Fourth Phase of WEPA in line with the needs of partner countries.

5.1.1. 2017 survey

An online survey was distributed to all participants after the annual meeting, and 13 responses were obtained. Regarding the international workshop, 11 participants replied that it was very useful and 2 replied it was useful, which meant that all participants found it beneficial to their work (Figure 5.1.1). A request for more discussion time was received. In response, a discussion session

was incorporated into the program of the international workshop in 2018.

Regarding the annual meeting, 10 participants (77%) replied that the presentations from private companies were useful, and 9 participants (69%) replied that presentations on future plans and activities of WEPA were useful.

Other comments received included a request for the annual meeting to be more formal and incorporate a review of activities or potential improvements in WEPA. As a direct response to a request for WEPA publications to be made available at annual meetings, the Secretariat provided copies of the WEPA Outlook at the annual meeting in 2018 for partner countries to freely take away. Five further responses concerned a request for industrial wastewater treatment and implementation of guidelines and standards to be discussed further at the annual meeting and international workshop of 2018.

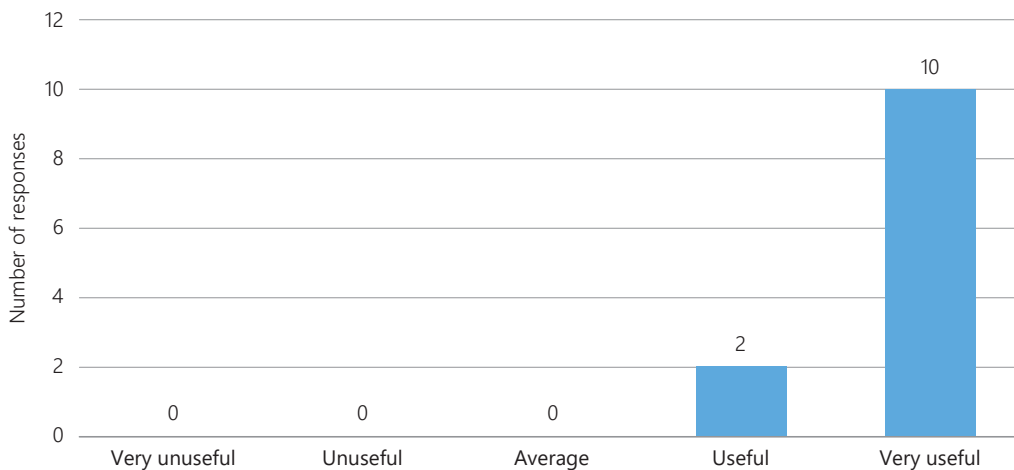


Figure 5.1.1. Responses to the question, "Was the international workshop useful?"

5.1.2. 2018 survey

In 2018, the survey was conducted prior to the annual meeting and international workshop in order for the results to be available to partner countries at the international workshop. The aim of this survey was to obtain inputs from WEPA partner countries to review the

outcomes of the Third Phase, and to strengthen WEPA activities towards the Fourth Phase. The survey was conducted online, and responses were obtained from 16 participants in 12 countries. Of the 16, 9 were WEPA Focal Points.

Regarding partner country feedback on WEPA's functions as (a) a platform for exchanging information,

(b) towards water environmental governance, (c) capacity building, and (d) international outreach, the rate of responses answering “very high” or “high” for satisfaction were 94%, 75%, 75%, and 81% respectively.

While satisfaction rates were high overall, two functions with room for improvement are water environmental governance and capacity building (figure 5.1.2).

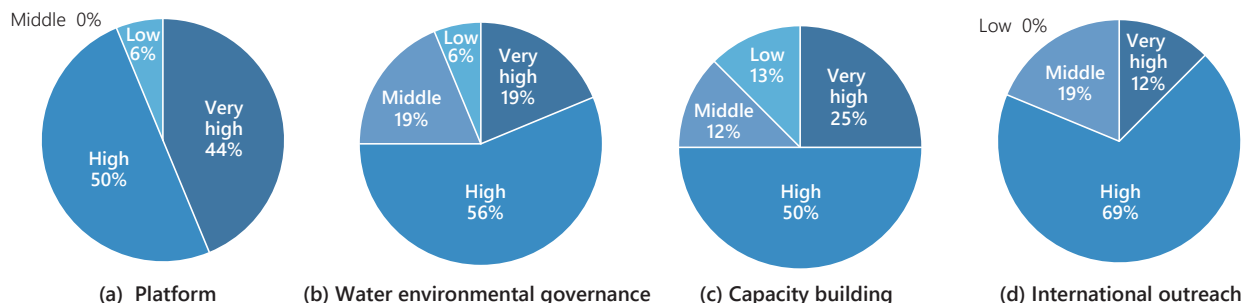


Figure 5.1.2. Satisfaction regarding functions of WEPA

Regarding water environmental governance, many countries identified a need for the scope of Action Programs to be extended, or for technical workshops to be held. Regarding capacity building, several countries requested cross-sectoral or cross-ministerial opportunities, as well as schemes including training of trainers, where local government representatives could gain capacity. From countries which have conducted or are currently conducting Action Programs, positive feedback regarding the participants’ capacities has been received. It is suggested for further capacity building to be conducted

through the Action Programs again in the Fourth Phase.

Regarding WEPA’s outputs, feedback was obtained for: (a) WEPA database, (b) meetings and events, and (c) knowledge products; and the rate of responses for “very useful” were 81%, 75%, and 56% respectively. It can be inferred from this that knowledge products have a relatively low satisfaction rate compared to web-based information (database); therefore, it is suggested that the WEPA database be focused on and printed outputs be reduced, which would also decrease the environmental burden.

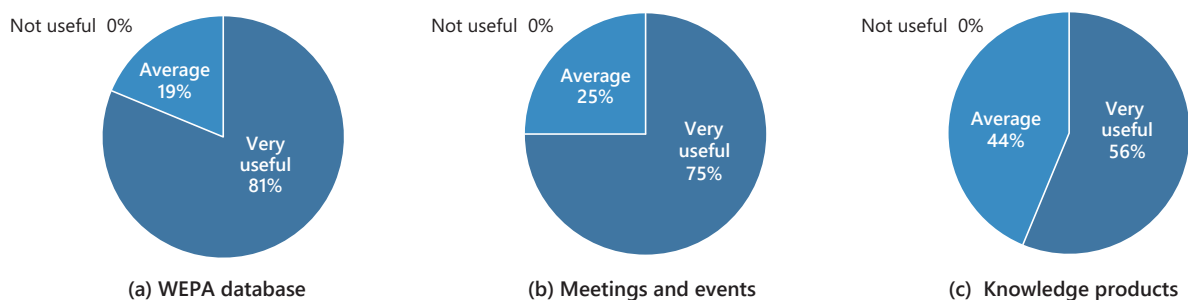


Figure 5.1.3. Satisfaction regarding WEPA outputs

When asked about the role WEPA could play in achieving the targets related to water environment in the Sustainable Development Goals (SDGs), potential actions were ranked in the following order:

1. Sharing/introducing new technologies, tools, and solutions to accelerate the implementation of relevant SDG targets
2. Establishing monitoring and reporting guidelines for SDG targets related to water environment
3. Updating progress on relevant SDG targets in the partner countries through the WEPA platform
4. Co-develop Action Programs targeting SDGs

Other requests and feedback included the following:

- Requests to increase the number of WEPA partner countries from Asia.
- Requests to create opportunities for partner countries to exchange information and knowledge through events such as annual meetings.
- Requests to increase the update frequency of the WEPA database, considering its heavy use in learning about legislations and information on other countries.
- Requests for WEPA to play a role in facilitating inter-ministerial information exchange through workshops and action programs of respective countries, due to difficulties expressed by delegates regarding information sharing between different ministries.
- Requests for the WEPA platform to also play a role as the source of information on partner countries' water environmental governance in regional and international frameworks such as the SDGs, and to aim for improved water environment through providing advice towards policy gaps or bottlenecks.
- Suggestions for some events to be co-sponsored by private companies.

5.2. Proposals from WEPA Partner Countries

During the 14th annual meeting and international workshop held in February 2019, partner countries discussed potential ways forward for the Fourth Phase of WEPA. The following suggestions represent the outcomes of the discussions.

5.2.1. Suggested topics

- Focus on implementation, monitoring and evaluation of SDG6
- WEPA partner countries are at various stages of development and have diverse needs regarding wastewater management. Therefore, it is suggested to cover all types of wastewater (domestic, industrial, agricultural) comprehensively without fixing on one type.

- Many countries voiced the need to identify pollution sources, especially non-point sources.
- Several countries requested support in developing legislative frameworks for water environmental governance, including laws, plans, guidelines, and enforcement mechanisms.
- Pollution of water environment to be reduced, especially total nitrogen and total phosphorus.
- Better collection and management of data, especially at local government level.
- Capacity building for improved water environmental governance.

5.2.2. Other suggestions

Other suggestions WEPA partner countries raised were:

- Improve communication between WEPA partner countries, as well as between the Secretariat and partner countries.
- Improve utilisation of WEPA database such as through conducting joint analysis or research on water environmental governance.
- Request for WEPA secretariat to provide a calendar of events at the beginning of each year of the program, including international events such as the World Water Forum. Some countries voiced interest in joining such international events with their own budget.
- Suggest WEPA Secretariat to conduct web conferences for partner countries to discuss and share information.

5.2.3. Next steps

The Ministry of the Environment, Japan and the WEPA Secretariat will go over these suggestions and incorporate those that are relevant into the planning of the Fourth Phase accordingly.



Appendix



WEPA Focal Points

Cambodia

Sokha Chrin

Deputy Director General,
General Directorate of Administration and Finance,
Ministry of Environment

China

Liping Li

Division Director,
Policy Research Center for Environment and Economy,
Ministry of Ecology and Environment

Indonesia

Budi Kurniawan

Deputy Director,
Inventory and Waste Load Allocation,
Ministry of Environment and Forestry

Japan

Kazuya Kumagai

Director, Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment

Yasumasa Watanabe (June 2016 – July 2018)

Director, Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment (Position during this period)

Eisuke Futamura (January 2015 – June 2016)

Director, Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment (Position during this period)

Takashi Ohmura (July 2014 – December 2014)

Director, Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment (Position during this period)

Masanobu Miyazaki (– June 2014)

Director, Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment (Position during this period)

Hiroki Hasegawa

Deputy Director,
Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment

Masaki Suehisa (April 2015 – March 2017)

Deputy Director,
Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment (Position during this period)

Masahiro Yasuda (– March 2015)

Deputy Director,
Water Environment Division,
Environmental Management Bureau,
Ministry of the Environment (Position during this period)

Lao PDR

Phengkhamla Phonvisai

Deputy Director General,
Pollution Control Department,
Ministry of Natural Resources and Environment

Malaysia

Ahmad Jamalluddin bin Shaaban (– April 2016)

Director General,
National Hydraulic Research Institute of Malaysia,
Ministry of Natural Resources and Environment
(Position during this period,
new Focal Point of Malaysia to be determined)

Hin Lee Lee (Acting Focal Point)

Director,
Research Centre for Water Quality and Environment,
National Hydraulic Research Institute of Malaysia,
Ministry of Water, Land and Natural Resources

Shin Ying Ang (Acting Focal Point)

Senior Research Officer,
Water Treatment Technology Research Unit,
Research Centre for Water Quality and Environment
National Hydraulic Research Institute of Malaysia,
Ministry of Water, Land and Natural Resources

Myanmar

Kyaw Lin Oo

Director, Hydrology Branch,
Irrigation and Water Utilization
Management Department,
Ministry of Agriculture,
Livestock and Irrigation

Khon Ra (February 2016 – February 2019)

Director of Hydrology Branch,
Irrigation and Water Utilization
Management Department,
Ministry of Agriculture,
Livestock and Irrigation
(Position during this period)

Tint Zaw (– January 2016)

Deputy Director General,
Irrigation Department,
Ministry of Agriculture and Irrigation
(Position during this period)

Nepal

Madhav Dev Acharya

Senior Divisional Engineering Geologist,
Water Resources Division,
Water and Energy Commission Secretariat

Philippines

Vicente, Jr. Bassig Tuddao

Assistant Regional Director for Technical Services,
Regional Office No. IV-MIMAROPA,
Department of Environment and Natural Resources

Erlinda Atienza Gonzales

Technical Adviser (Consultant),
Manila Bay Rehabilitation Program,
Department of Environment and Natural Resources

Republic of Korea

Tae Jin Park

Senior Researcher,
Water Environment Research Department,
Water Environmental Engineering Research Division,
National Institute of Environmental Research

Kyunghyun Kim (November 2016 – January 2019)

Director, Yeongsan River Environment Research Center,
National Institute of Environmental Research
(Current position)

Taegu Kang (– November 2016)

Director, Water Quality Assessment Research Division,
Water Environment Research Department,
National Institute of Environmental Research
(Current position)

Sri Lanka

R.M.S.K. Ratnayake

Director,
Environmental Pollution Control,
Central Environmental Authority

Thailand

Chao Nokyoo

Director of Inland Water Division,
Water Quality Management Bureau,
Pollution Control Department,
Ministry of Natural Resources and Environment

Wijarn Simachaya (– September 2017)

Permanent Secretary,
Ministry of Natural Resources and Environment
(Current Position)

Thiparpa Yolthantham (– September 2017)

Director of Planning,
Pollution Control Department,
Water Quality Management Bureau,
Ministry of Natural Resources and Environment
(Position during this period)

Viet Nam

Nguyen Minh Cuong

Deputy Director,
Department of International Cooperation,
Science and Technology,
Viet Nam Environment Administration,
Ministry of Natural Resources and Environment

Thang Nam Do (– November 2016)

Deputy Director General,
Department of International Cooperation,
Ministry of Natural Resources and Environment
(Position during this period)

Dong The Nguyen (– November 2016)

Deputy Director General,
Viet Nam Environment Administration,
Ministry of Natural Resources and Environment
(Position during this period)

WEPA Advisory Board Members

Special Advisor of WEPA Advisory Board

Motoyuki Suzuki

Professor Emeritus, The University of Tokyo

Chairman of WEPA Advisory Board

Mitsumasa Okada

Vice President, The Open University of Japan

Advisory Members

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Visiting Professor,
Strategic Research Planning Manager,
Institute of Advanced Sciences,
Yokohama National University
(From April 2017)

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Integrated Research System for Sustainability Science
(IR3S), The University of Tokyo

So Kazama

Professor, Department of Civil Engineering,
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Yoshitaka Ebie

Senior Researcher, Centre for Material Cycles and
Waste Management Research,
National Institute for Environmental Studies

Ikuro Kasuga

Associate Professor,
Water Environment Technology Laboratory
Department of Urban Engineering,
Graduate School of Engineering,
The University of Tokyo
(JICA Expert, Lecturer, Environment Engineering
Program Viet Nam Japan University from
September 2018)

List of Activities and Publications

Annual meetings			
	Month, Year	City, Country	Number of Participants (Number of countries)
10th Annual Meeting	February, 2015	Colombo, Sri Lanka	37 (11)
11th Annual Meeting	January, 2016	Vientiane, Lao PDR	40 (12)
12th Annual Meeting	November, 2016	Hanoi, Viet Nam	39 (13)
13th Annual Meeting	September, 2017	Jakarta, Indonesia	40 (13)
14th Annual Meeting	February, 2019	Tokyo, Japan	42 (13)

International Workshops/Seminars/Training Programmes			
Title of Workshops/Seminars/Trainings	Month, Year	City, Country	Number of Participants (Number of countries)
WEPA Workshop on Wastewater Management	February, 2015	Colombo, Sri Lanka	46 (11)
WEPA Workshop on Industrial Wastewater Management	January, 2016	Vientiane, Lao PDR	42 (12)

Conference on Watershed Management for Controlling Municipal Wastewater in Southeast Asia	July, 2016	Nagoya, Japan	156 (5)
WEPA Group Workshop on Pig Wastewater Management in Asia	February, 2017	Chiang Mai, Thailand	25 (9)
WEPA International Workshop on Industrial Wastewater Management	September, 2017	Jakarta (Indonesia)	70 (13)
Workshop for Introduction of Multistage Hybrid Wetland Systems in Viet Nam	November, 2017	Hanoi, Viet Nam	40 (5)
Preparation Workshop on the Asia Wastewater Management Partnership (AWaP)	December, 2017	Yangon, Myanmar	50 (6)
International Workshop on decentralised wastewater management	February, 2019	Tokyo, Japan	53 (13)

Other WEPA Activities at International Events

Title of Workshops/Seminars/Trainings	Month, Year	City, Country	Number of Participants (Number of countries)
The 7th World Water Forum Official session "Strengthening Frameworks for Governing and Managing Water Quality"	April, 2015	Daegu & Gyeongbuk of the Republic of Korea	(13)
WEPA Sessions in 11th International Symposium on Southeast Asian Water Environment (SEAW11)	November, 2014	Bangkok, Thailand	Approximately 100
WEPA session at 12th International Symposium on Southeast Asian Water Environment (SEAW12)	July, 2016	Nagoya, Japan	Approximately 50 (13)
The 8th World Water Forum Sharing Water Thematic session "Understanding the Water Quality from Ridge to Reef"	March, 2018	Brasilia, Brazil	Approximately 100
Regional Process Workshop "Towards Improving Sanitation and Wastewater Management: Challenges and Good Practices in the Asia-Pacific Region"			Approximately 50
IWA World Water Congress & Exhibition Workshop "Toward the Achievement of SDGs Relating to Sanitation and Wastewater Management (SDG 6.2, 6.3)"	September, 2018	Tokyo, Japan	Approximately 200

Publication

Title	Year
Report	
WEPA Outlook on Water Environmental Management in Asia 2015 (English)	2015
WEPA Outlook on Water Environmental Management in Asia 2015 (Japanese)	2015
WEPA Outlook on Water Environmental Management in Asia 2018 (English)	2018
WEPA Outlook on Water Environmental Management in Asia 2018 (Japanese)	2018
WEPA Third Phase Final Report (English)	2019
WEPA Third Phase Final Report (Japanese)	2019

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Others: based on survey of WEPA focal points.



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