

## Keynote

# Pollutant load of gray water and the importance of its treatment

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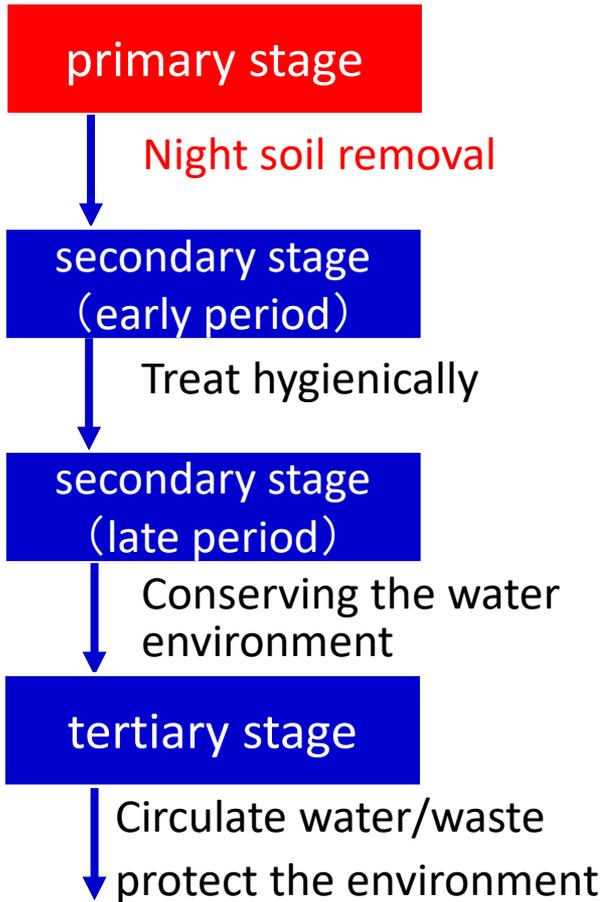


**Dr. Hiroshi Yamazaki**

Professor, Department of Civil and Environmental Engineering, Faculty  
of Science and Engineering, Toyo University

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# Changes in domestic wastewater treatment (primary stage)



Japan

「hauler of manure」

「Edo Meisho Zue」  
(Collection of the National Diet Library)

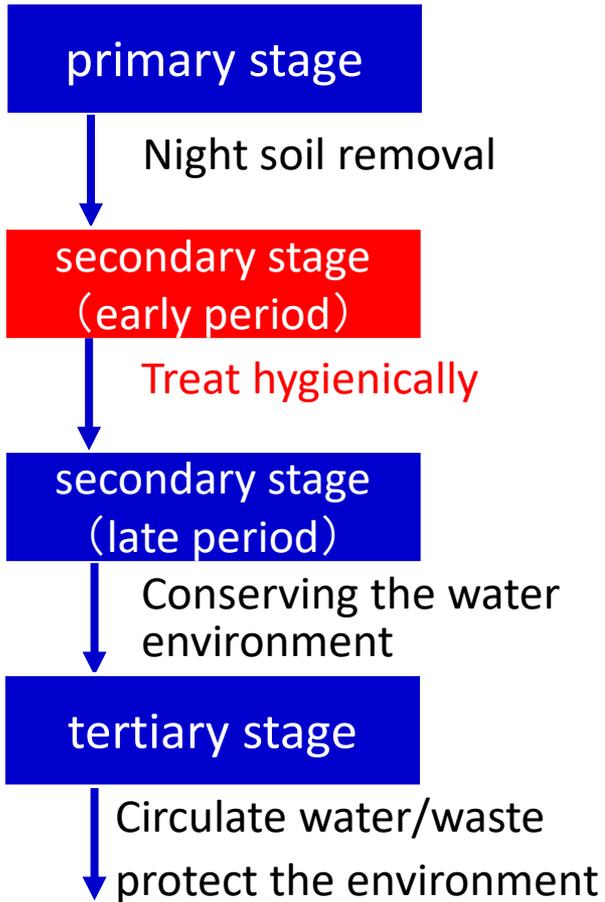
This section for Japan features a green header. Below it is a black and white illustration of a man carrying two wooden buckets on a shoulder pole. Below that is a caption '「hauler of manure」'. The main part of the section is a large illustration from 'Edo Meisho Zue' showing a street scene with many people. Two red circles highlight specific features: one on a building's facade and another on a person in the street.

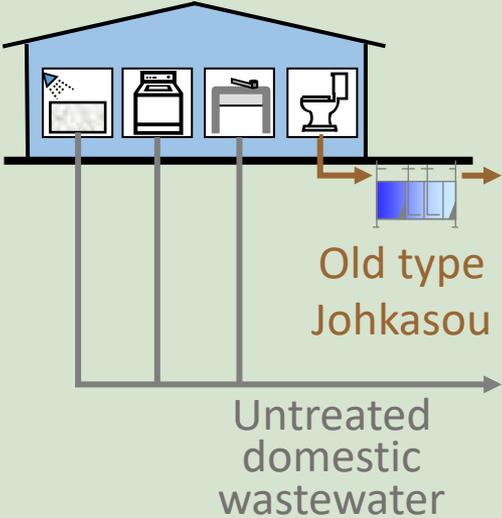
World (Asia)

「A night in London where the scum falls on the drunkard's head」  
( by Hogarth, 1738 )

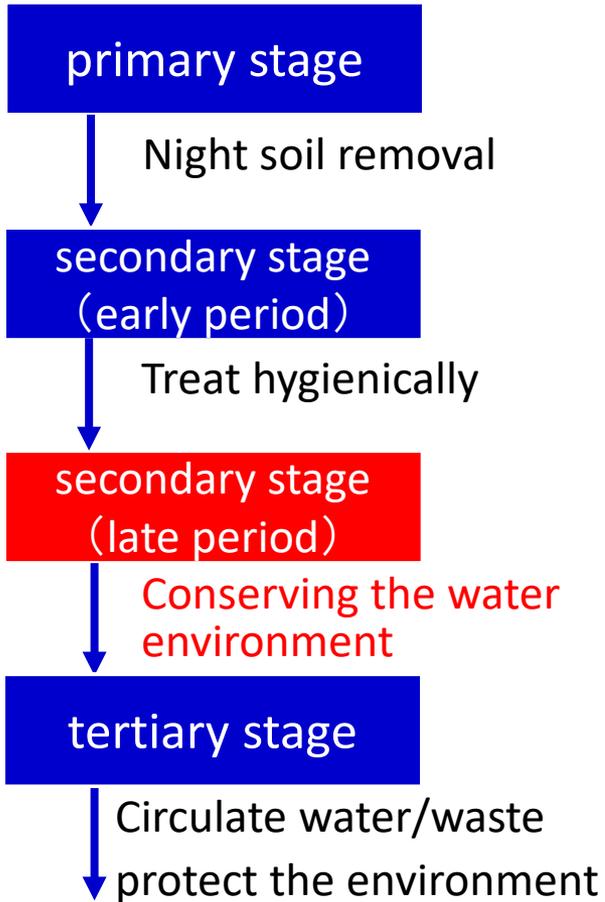
This section for 'World (Asia)' features a green header. Below it is a black and white engraving of a busy London street scene. A red circle highlights a person's head in the foreground. Below the engraving is a caption '「A night in London where the scum falls on the drunkard's head」 ( by Hogarth, 1738 )'. At the bottom is a color photograph of a wooden structure, possibly a boat or a small building, situated near water.

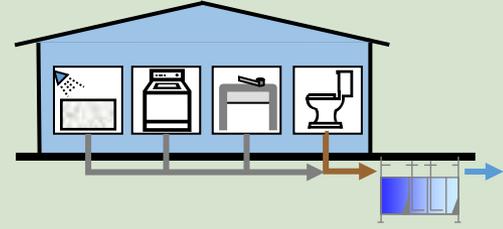
# Changes in domestic wastewater treatment (secondary stage at early period)



Japan	World (Asia)
 <p>Old type Johkasou</p> <p>Untreated domestic wastewater</p>	 <p>Septic tank</p>
 <p>Untreated domestic wastewater</p>	

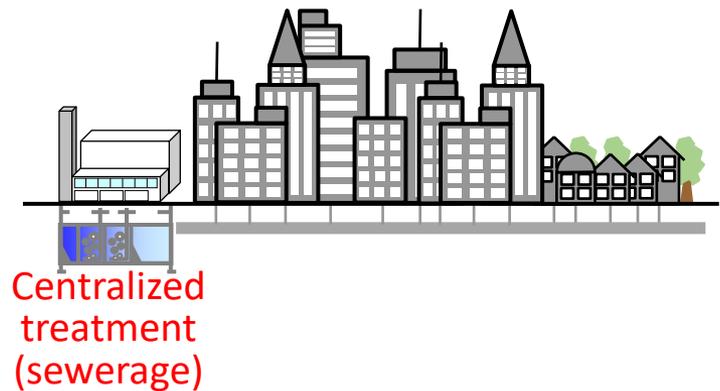
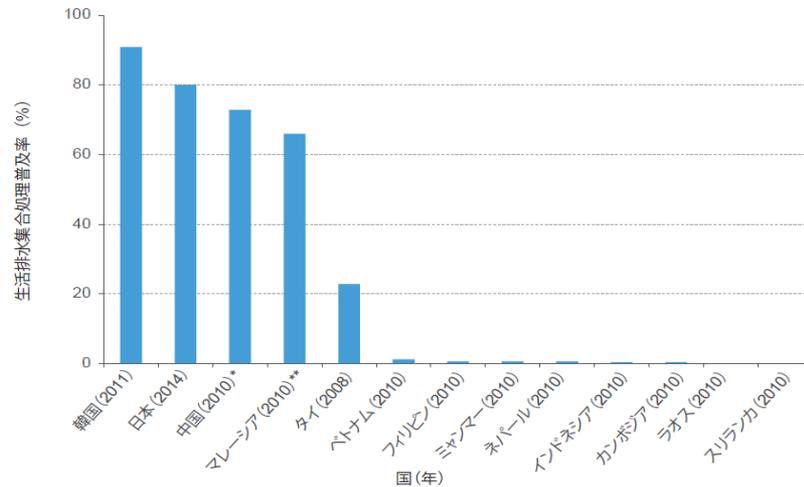
# Changes in domestic wastewater treatment (secondary stage at late period)



Japan	World (Asia)
 <p data-bbox="710 585 1304 628">Sewerage coverage ratio : 81%</p>	 <p data-bbox="1410 599 1796 771">Sewerage coverage ratio : 2-3% (Indonesia)</p>
 <p data-bbox="730 963 1290 1006">Johkasou coverage ratio : 9%</p>	
 <p data-bbox="1062 1306 1246 1349">Johkasou</p>	

# Situation of domestic wastewater treatment in Asian countries

## Penetration rate of domestic wastewater treatment by centralized treatment (sewerage) in Asian countries

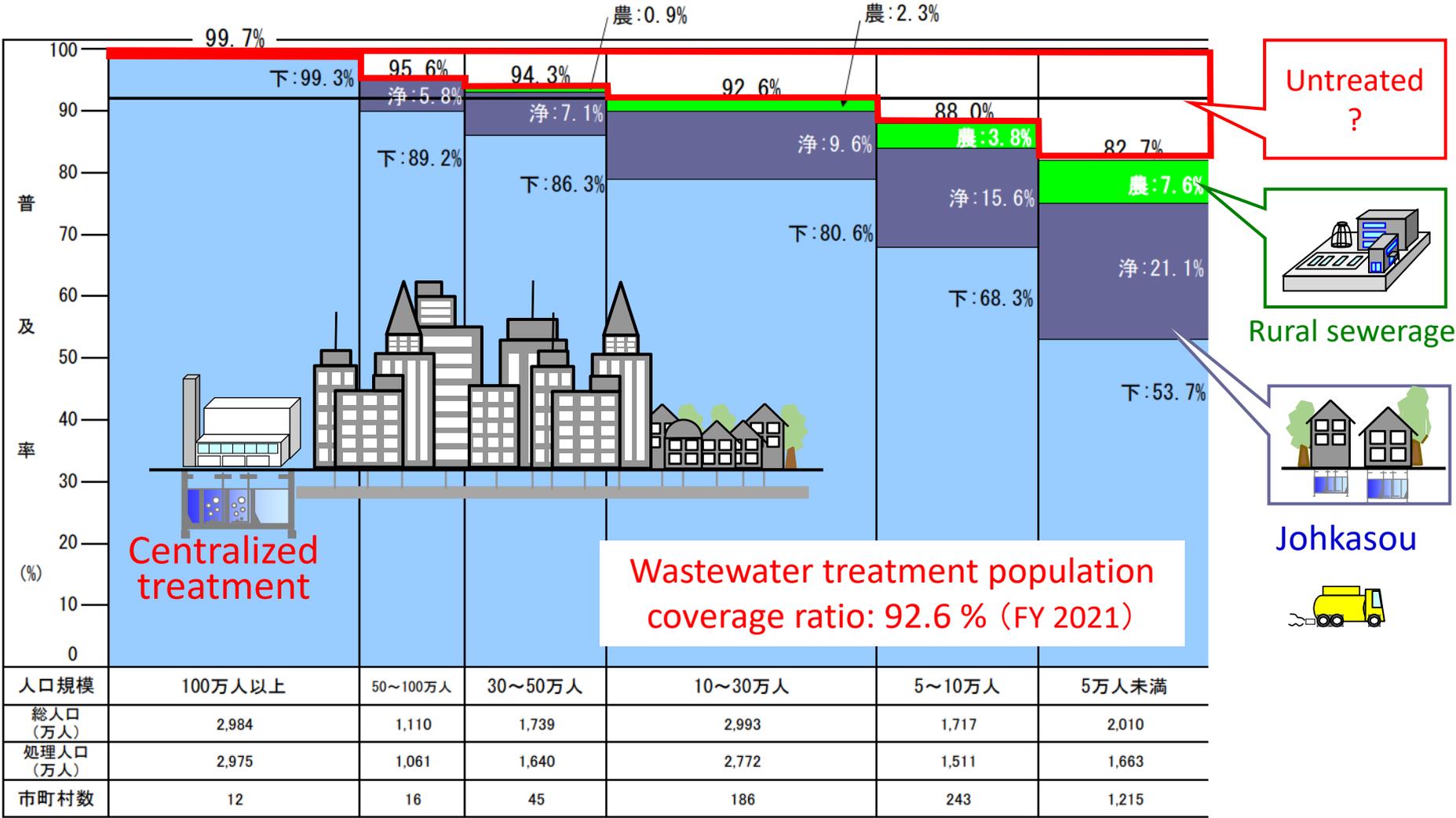


## Discharge of night soil and domestic wastewater into the water environment in Asian countries

country	feces (tons)	urine (m <sup>3</sup> )	Gray water (m <sup>3</sup> )	BOD (tons)
Cambodia	85,000	852,000	3 million	181,500
Indonesia	6,406,000	64,059,000	8,541 million	2,137,000
Philippines	4,237,000	33,900,000	1,962 million	762,000
Vietnam	2,275,000	22,754,000	610 million	357,500

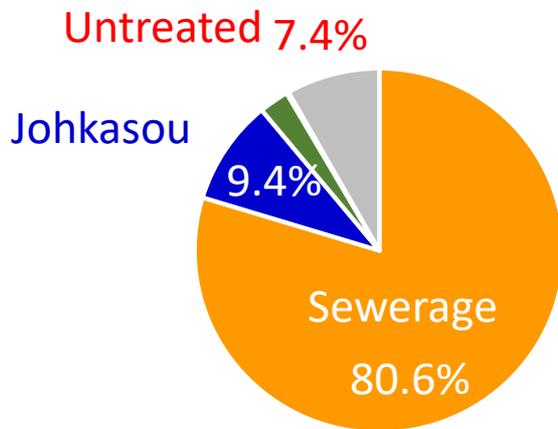
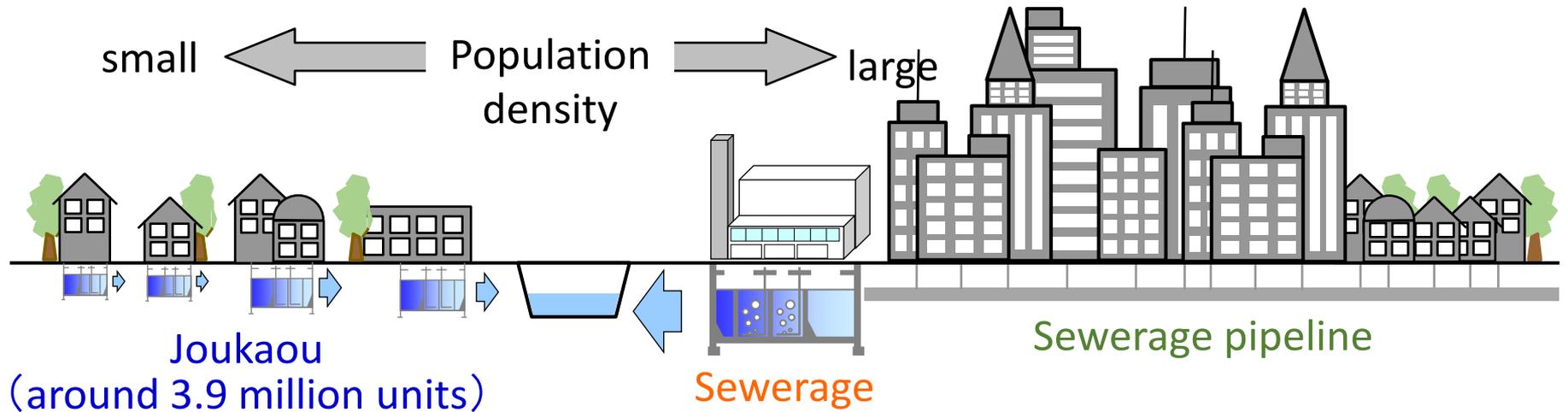
Source: WEPA, Economic impacts of sanitation in southeast Asia (2008) The World Bank

# Wastewater treatment population coverage ratio by urban population size in Japan

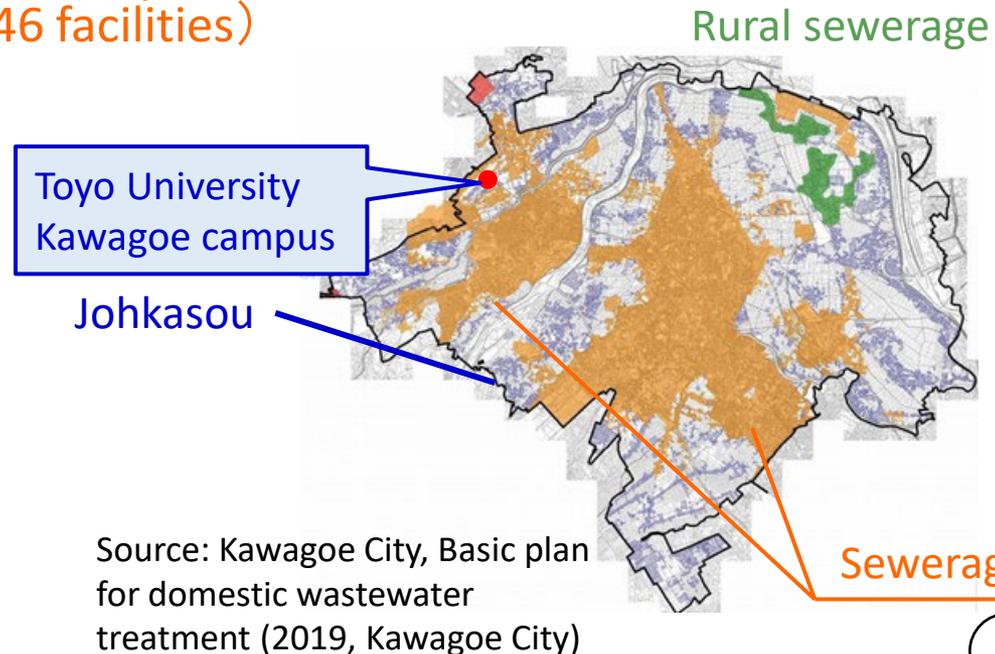


Source: Ministry of the Environment Johkasou website (<http://www.env.go.jp/recycle/jokaso/data/population/>), partially modified by the author

# Sewerage and Johkasou development in Japan

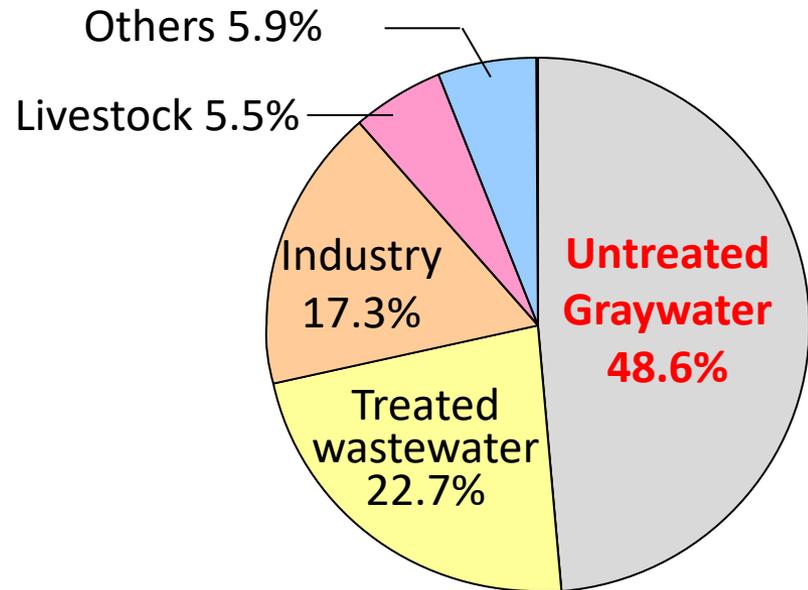
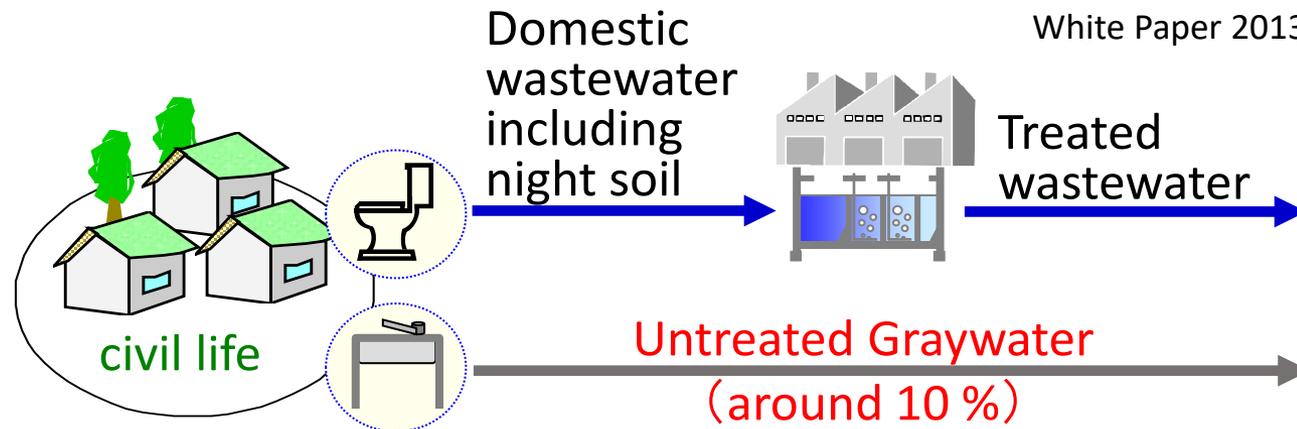
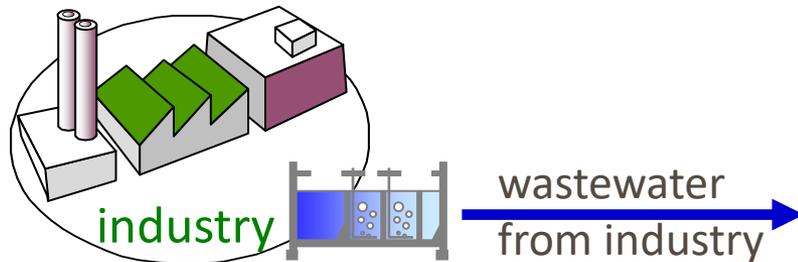
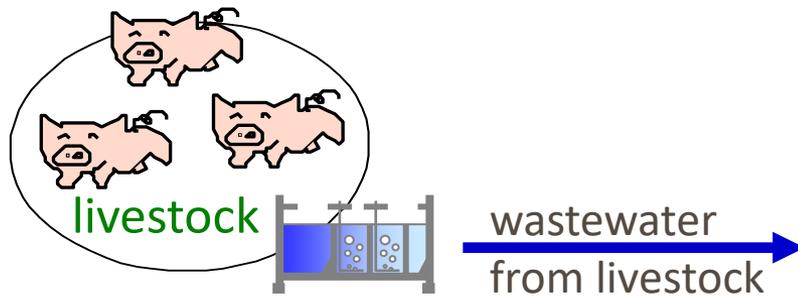


Source: Ministry of the Environment, Wastewater treatment population coverage ratio by treatment facility (FY 2021, nationwide)



Source: Kawagoe City, Basic plan for domestic wastewater treatment (2019, Kawagoe City)

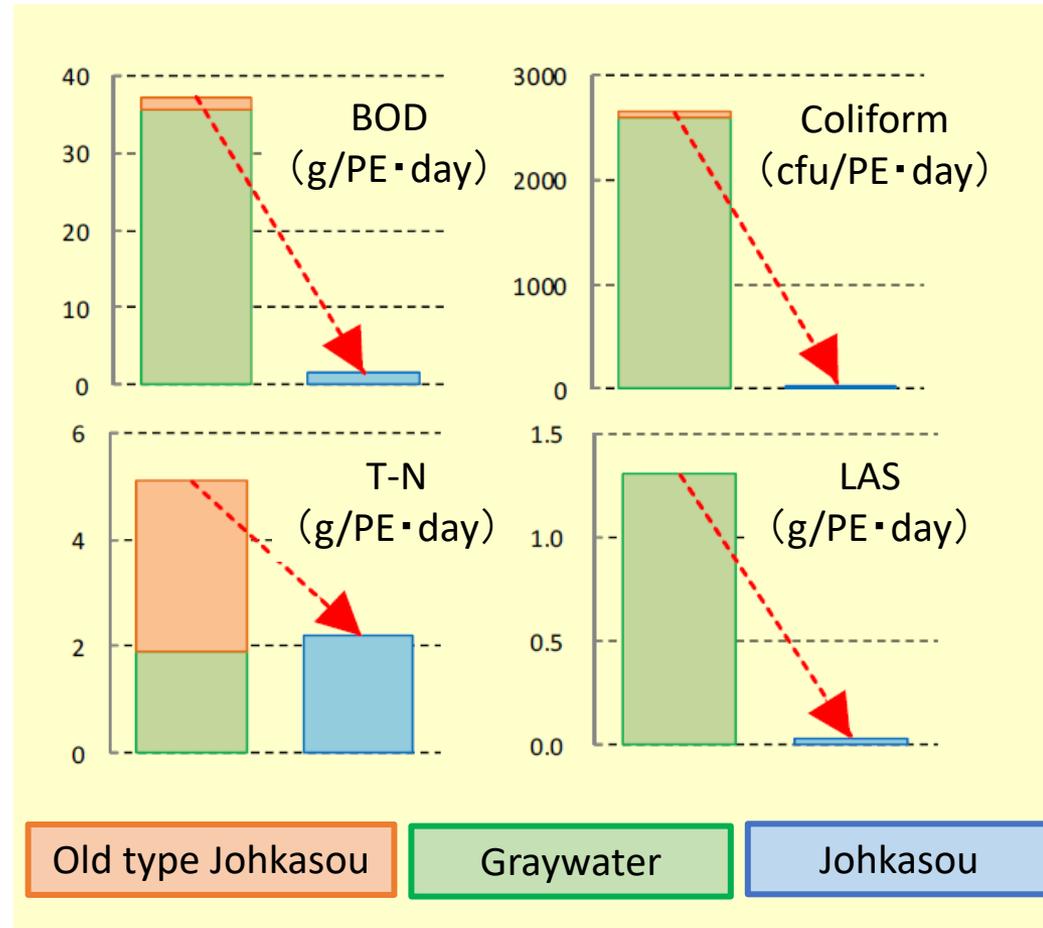
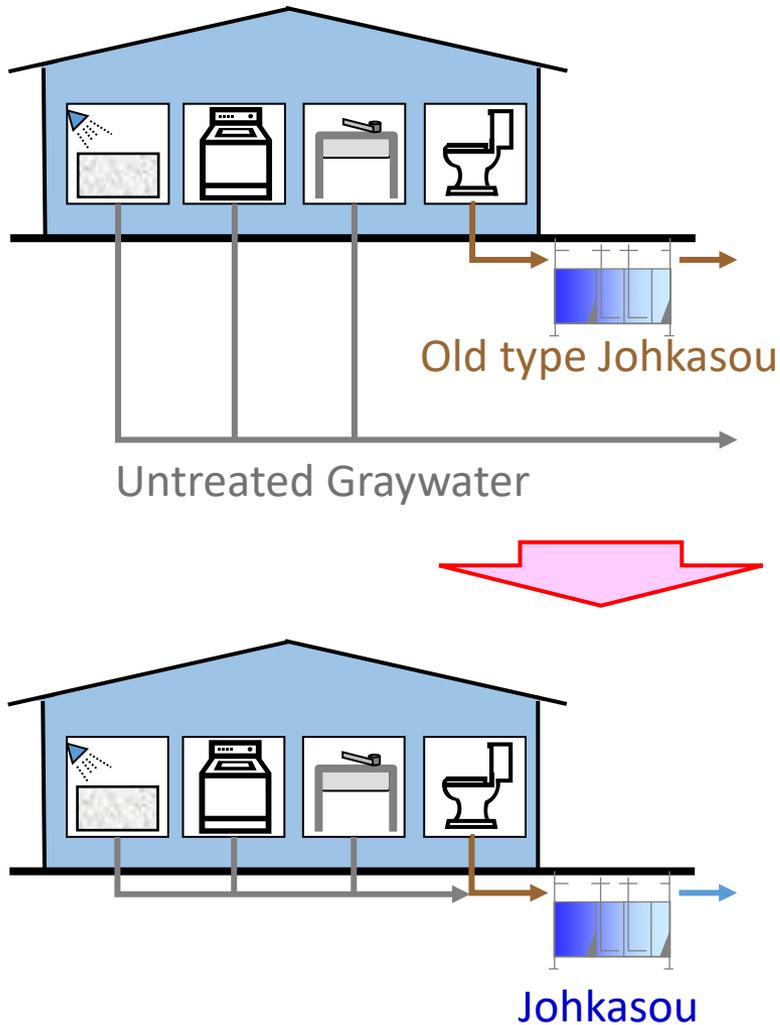
# Factors polluting rivers (BOD load ratio by emission source)



Pollution load ratio in rivers (BOD load ratio by emission source)  
Source: Saitama Prefecture Environmental White Paper 2013

About 50% of pollution causes

# Pollution load of each wastewater to the water environment



A large amount of pollutant load remains in the treated water from Old type Johkasou and Graywater

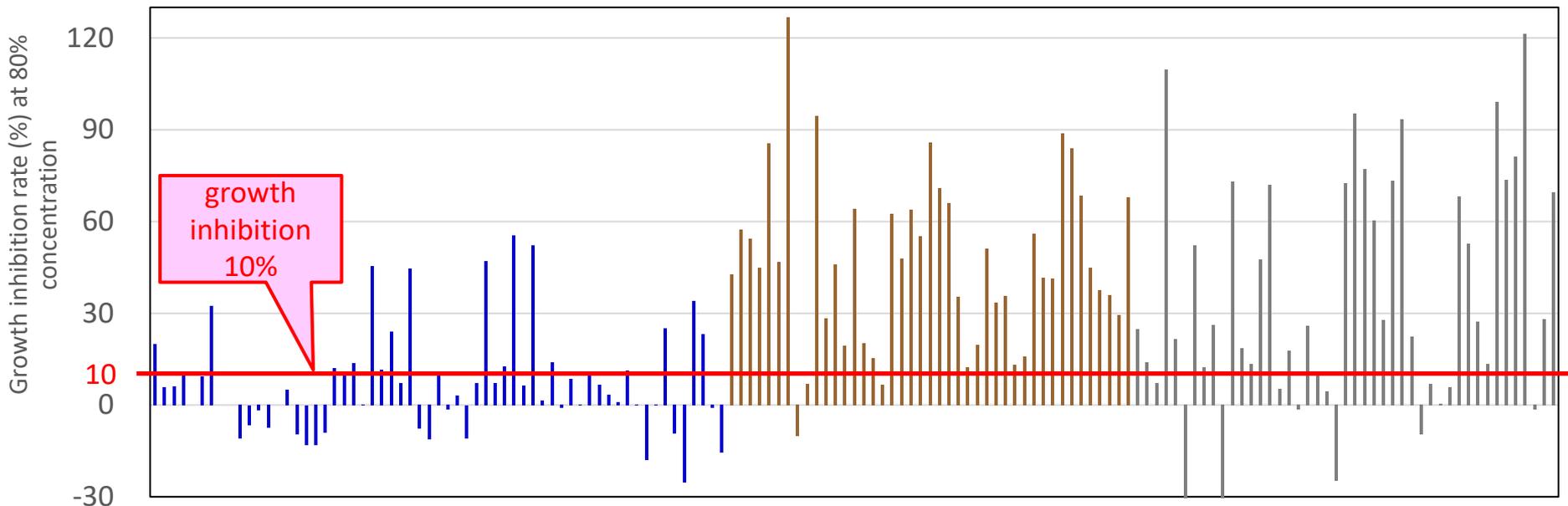
# Effects of each wastewater on aquatic organisms

## ● Effect of each effluent on algae growth (AGI)

【effluent from Johkasou】

【effluent from Old type Johkasou】

【Graywater】

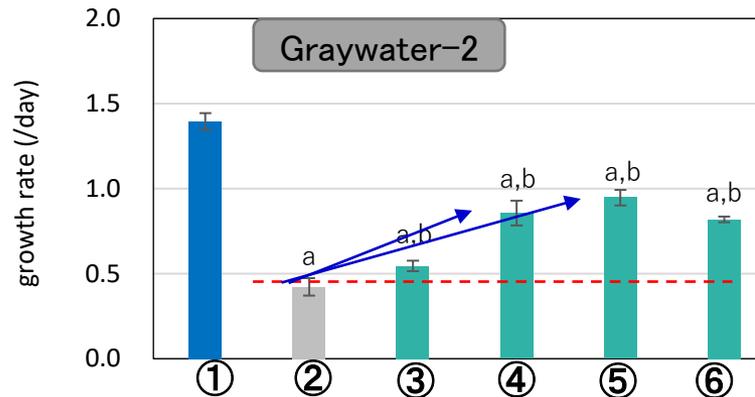
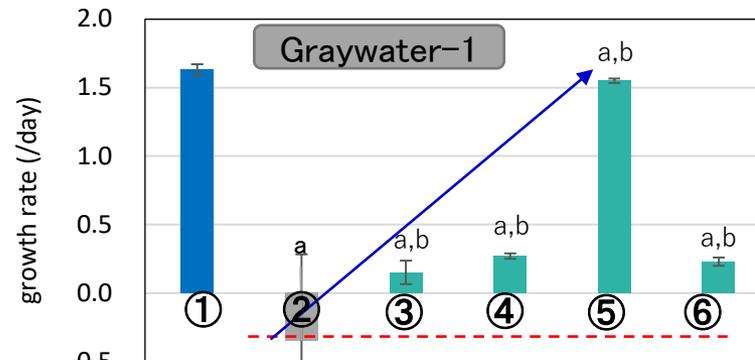
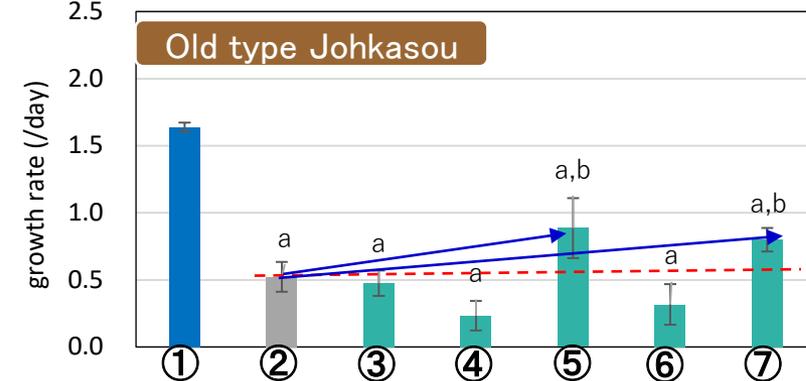
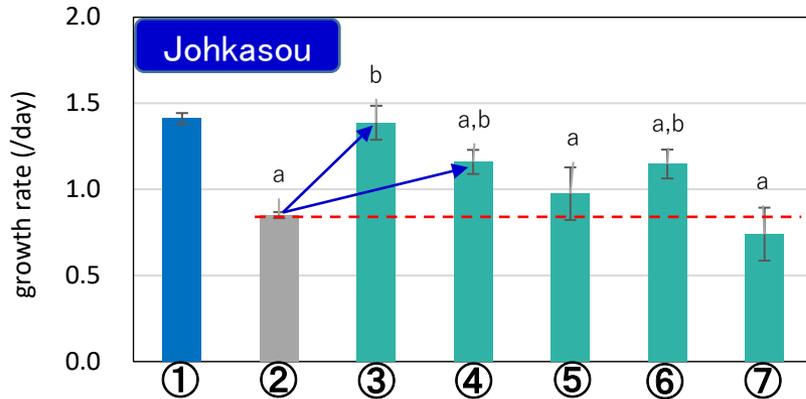


	Inhibited (80% concentration zone)	Average growth inhibition rate (80% concentration zone)
Johkasou	20/57	7.5%
Old type Johkasou	40/43	46.9%
Graywater	33/45	33.0%

Effluent from Old type  
Johkasou or Graywater  
inhibit the growth of  
aquatic organisms (algae)

# Effects of each wastewater on aquatic organisms

## Factors Affecting Algae Growth in Each Wastewater (TIE)



- ① control
- ② without pretreatment
- ③ EDTA
- ④ thio-
- ⑤ SPE
- ⑥ aeration
- ⑦ pH

a: Significantly decreased compared to control ( $p < 0.05$ )

b: Significant increase compared to unpretreated group ( $p < 0.05$ )

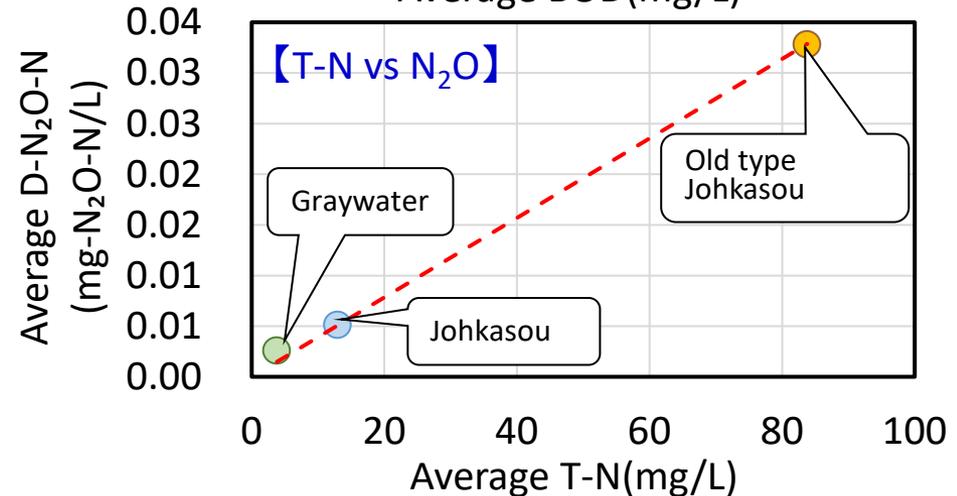
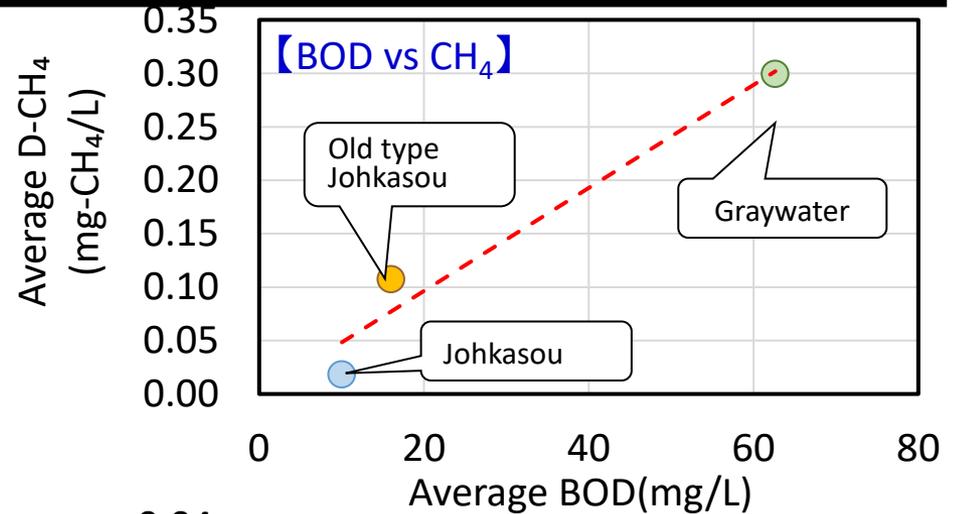
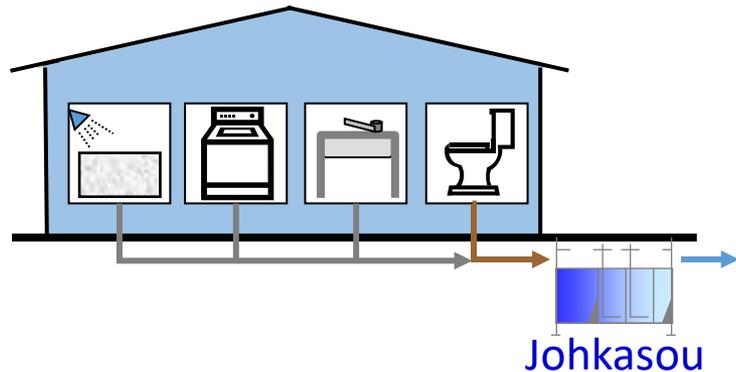
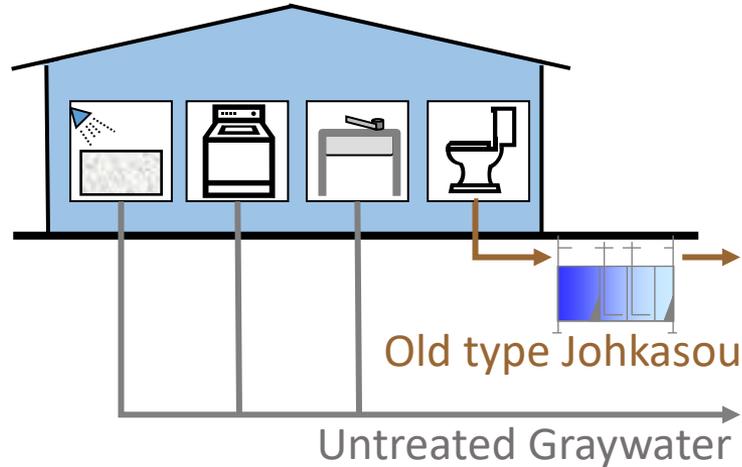
sample	Group of Suspected Toxic Substances
Johkasou	Cationic metals, oxidizing agents (disinfectants)
Old type Johkasou	Organic matter, NH <sub>4</sub> -N, others
Graywater	Organic matter
Graywater	Oxidizing agent, organic matter

**Factors Affecting Algae Growth**

- Organic matter remaining in Graywater
- Organic matter and NH<sub>4</sub>-N remaining in effluent of Old type Johkasou

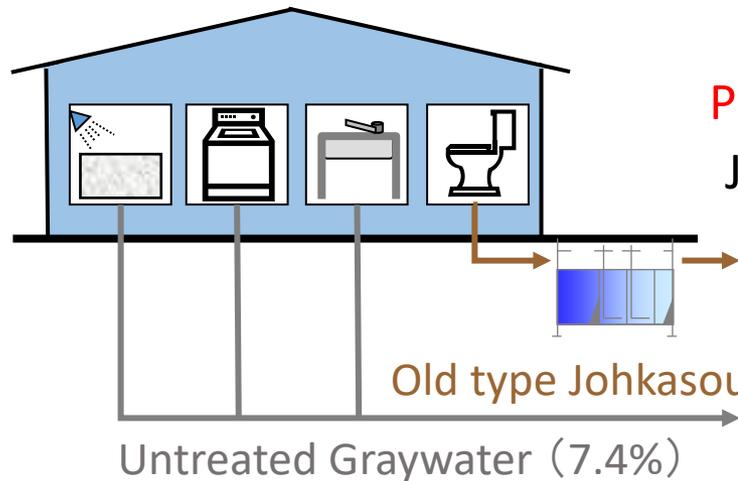
# GHGs remaining in each wastewater

## ● GHGs remaining in each wastewater

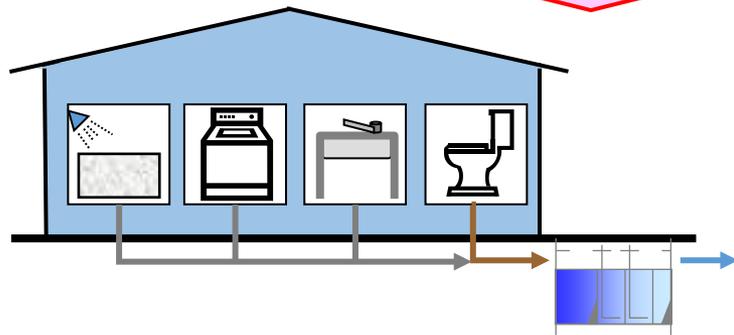


Effluent of Old type Johkasou and Graywater contain residual GHGs

# Conversion from Old type Johkasou to Johkasou



Prohibition of new installation of Old type Johkasou  
Johkasou Act revision (FY 2000)



Conversion from Old type Johkasou to Johkasou

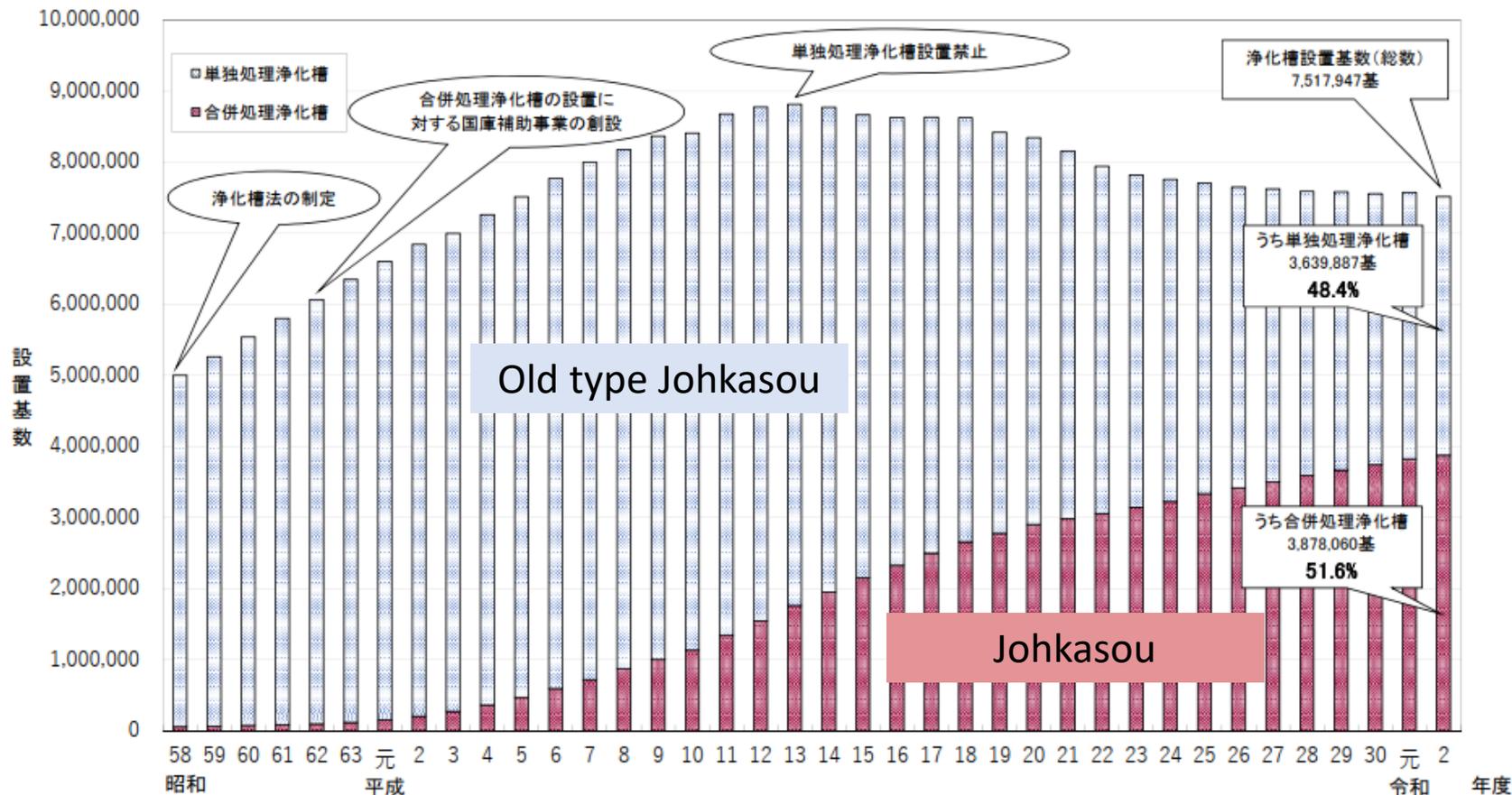
- Mid-term (about 10 years) General wastewater treatment
- Long-term (20-30 years) Building a sustainable sewage treatment system

Source: Prefectural Concept Formulation Manual (2014)

Conversion from Old type Johkasou to Johkasou is underway in Japan

# Conversion from Old type Johkasou to Johkasou

Changes in the number of installed units



After the Old type Johkasous were installed, those were converted to the Johkasou.  
**( Double Investment )**



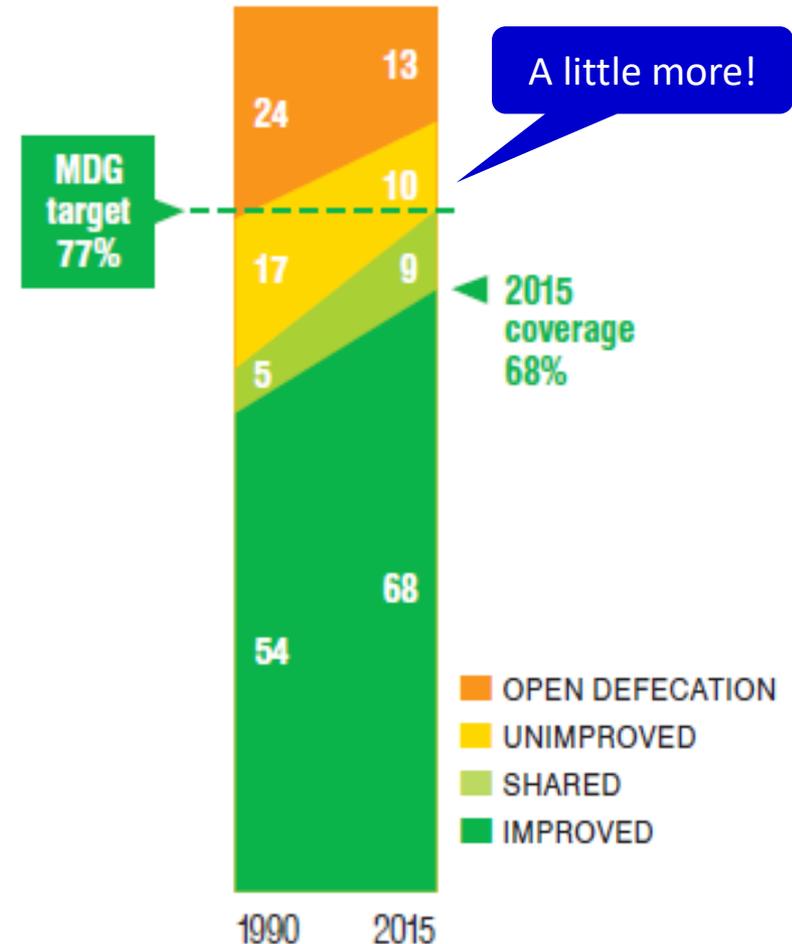


# Activities of the world (United Nations)

- Millennium Development Goals (MDGs)
  - With 1990 as the base year and 2015 is the deadline for achievement

## Target 7.C

Halve the proportion of people without sustainable access to safe drinking water and sanitation.



- 2.1 billion people have access to improved sanitation
- 2.4 billion people still use unimproved sanitation facilities
- 946 million people still practice open defecation

# Activities of the world (United Nations)

## ● Sustainable Development Goals (SDGs)

- With 2015 as the base year, 2030 is the deadline for achievement

### Target 6.2:

By 2030, **achieve access to adequate and equitable sanitation and hygiene for all** and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

### Target 6.3

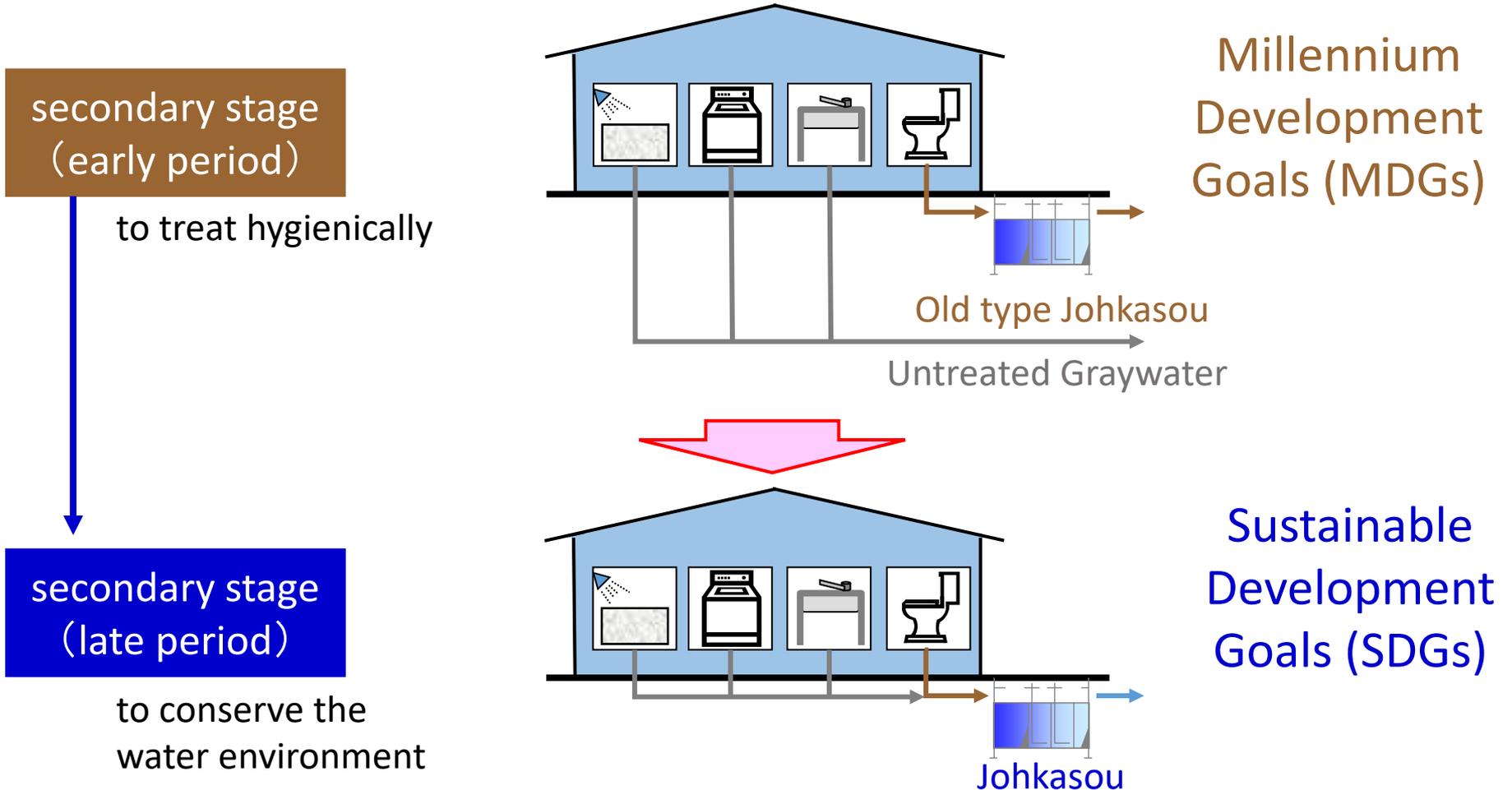
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, **halving the proportion of untreated wastewater** and substantially increasing recycling and safe reuse globally

## SUSTAINABLE DEVELOPMENT GOALS

世界を変えるための17の目標



# From hygiene improvement to environmental improvement

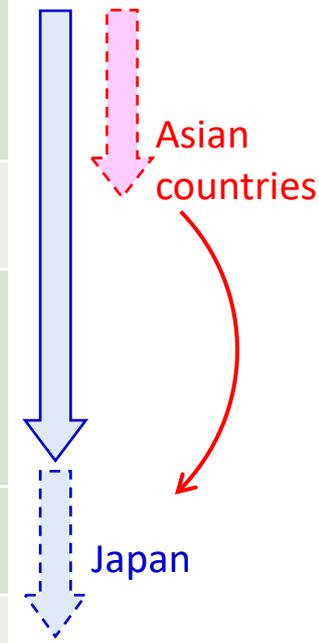


Millennium Development Goals → Sustainable Development Goals  
Sanitary treatment → Water environment conservation

# Major pollutants and technical countermeasures related to the water environment

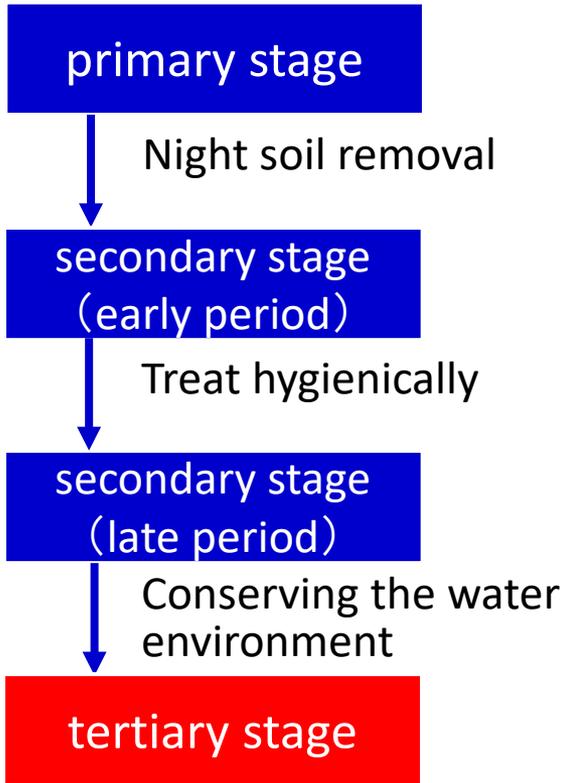
	Target substance	situation	
Primary stage to Secondary stage at early period (sanitation issue)	Pathogen	cholera	
Secondary stage at late period (water environmental issue)	organic matter (BOD)	River pollution/sludge	
	heavy metal	Pollution problem	Effects on aquatic organisms
	Nitrogen Phosphorus	eutrophication	
tertiary stage (environmental issue)	Water / waste	depletion of resources	
	greenhouse gas	Global warming	

shift



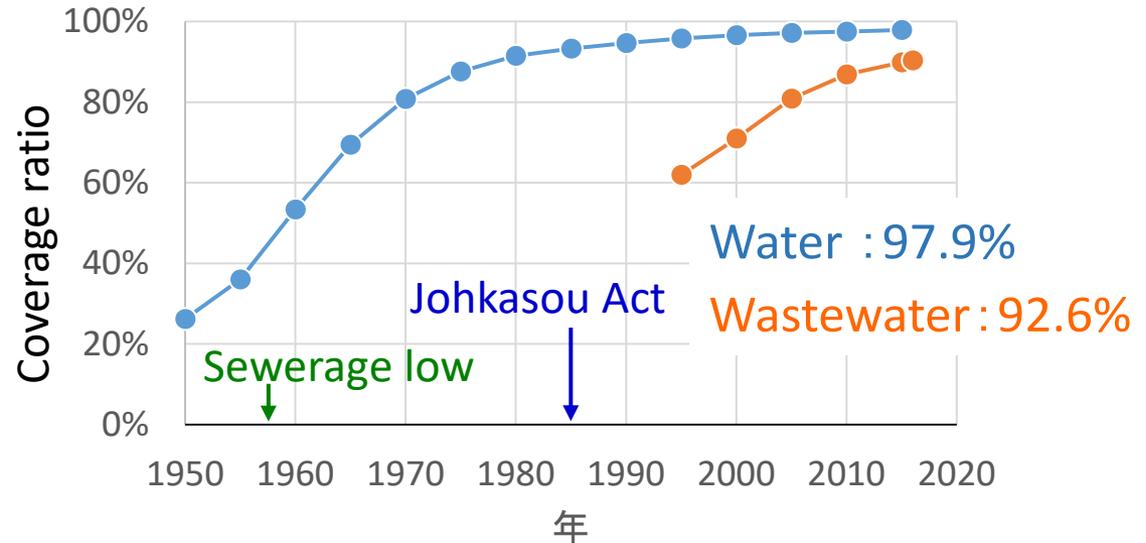
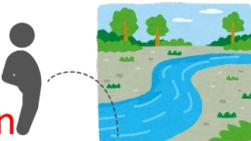
Asian countries need to develop wastewater treatment infrastructure in a leap

# Changes in domestic wastewater treatment (tertiary stage)



Circulate water/waste protect the environment

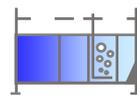
Primary stage generation



Changes in water infrastructure penetration ratio in Japan

secondary stage (early period)

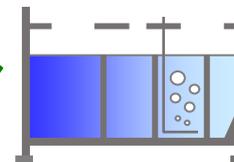
sanitation → environment



Old type Johkasou (Black water only)

secondary stage (late period)

BOD removal → Advanced treatment, Compact/Energy saving

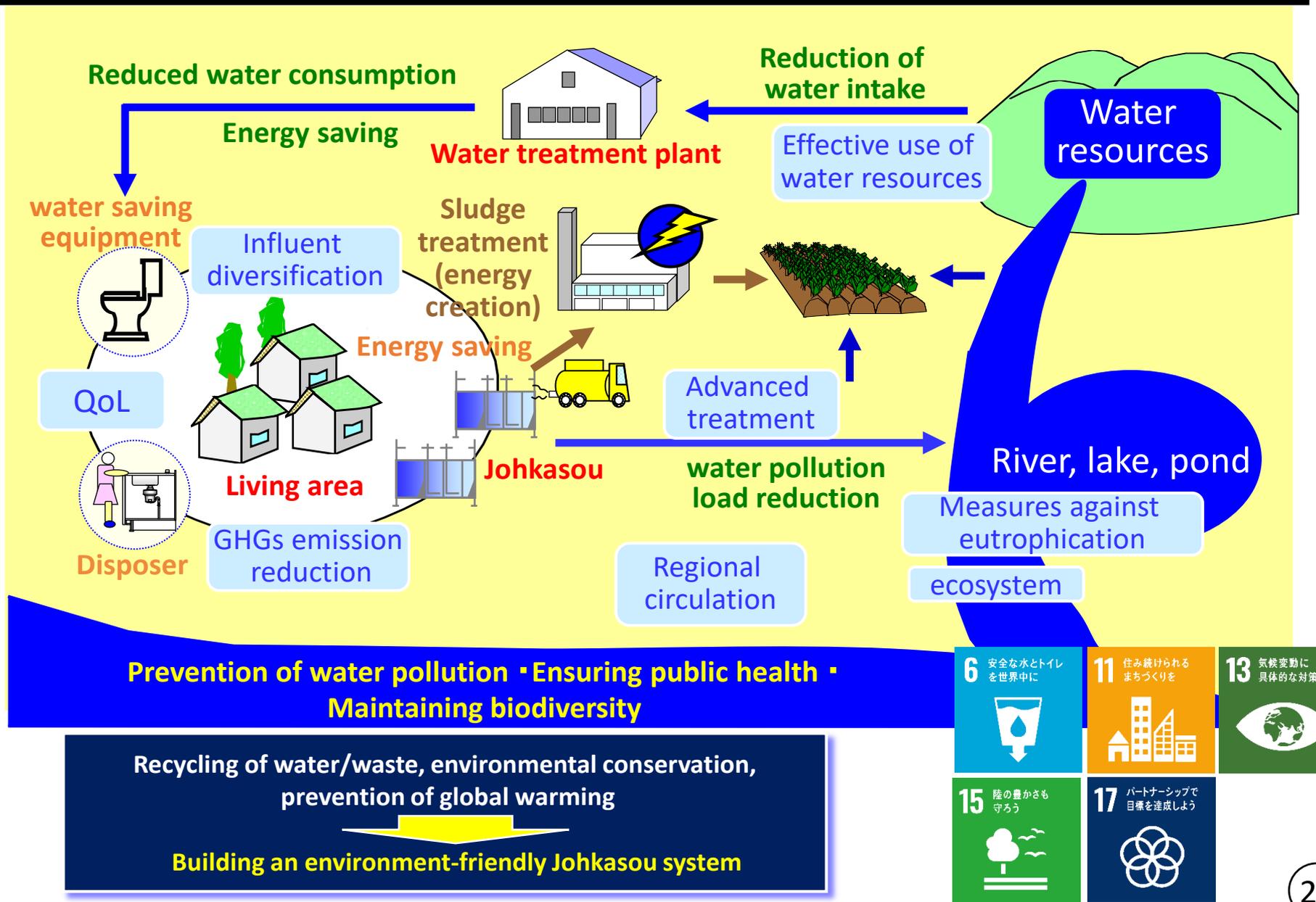


Johkasou (both Black water and Graywater)

tertiary stage

- Water/waste circulation
- Measures against global warming

# Building an environment-friendly Johkasou system



**At the end . . .**

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**Thank you very much for your attention.  
From now on, we would like to work together with you to  
research and act toward the construction of an environment-  
friendly Johkasou system.  
We look forward to your continuous support and cooperation.**

**Dr. Hiroshi Yamazaki  
Professor, Department of Civil and Environmental Engineering,  
Faculty of Science and Engineering, Toyo University**