



# SES no Japão - enfoque pequenas comunidades e tratamento local

**FRANCISCO JOSÉ GUEDES PIMENTEL**

Eng. Sanitarista e Ambiental, Me, Esp.

Agência Florianópolis

Companhia Catarinense de Saneamento (CASAN)

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# Curso “Operação e Manutenção de SES”

Data: Janeiro e Fevereiro de 2018 – Local: Kitakyushu, Japão População: ~1 milhão hab

Welcome to JICA and

Operation and Maintenance of  
Sewerage System (B) Course  
2018



**Tunisia**  
Hichem - San

**Albania**  
Anisa - san

**Cambodia**  
Khok - san

**South Sudan**  
Dan - San

**Liberia**  
Augustina - San

**Papua New Guinea**  
Martin - san

**Samoa**  
Manu - San

**Brasil**  
Chico - san



アニッサさん



KATSUBE  
(Coordinator)



ISHIMATSU  
(JICA)



SUETA  
(Course Leader)



シコさん



ヒンエムさん



コークさん



マヌさん



ティナさん



ダンさん



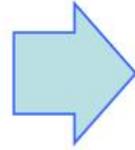
マーテインさん



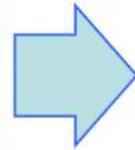
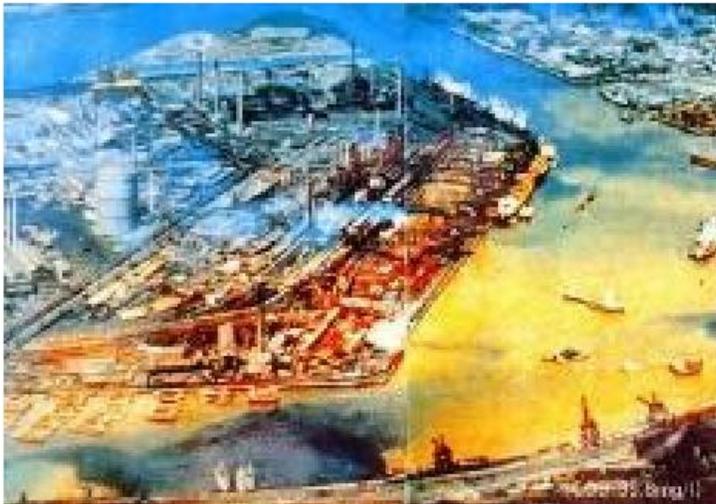
Promotor:  
Agência de Cooperação  
Internacional do Japão



# Kitakyushu: Exemplo Mundial de Controle da Poluição



Área Industrial



Baía Dokai

Década de 60

Dias atuais

# Kitakyushu: Exemplo Mundial de Controle da Poluição

Rio Murasaki

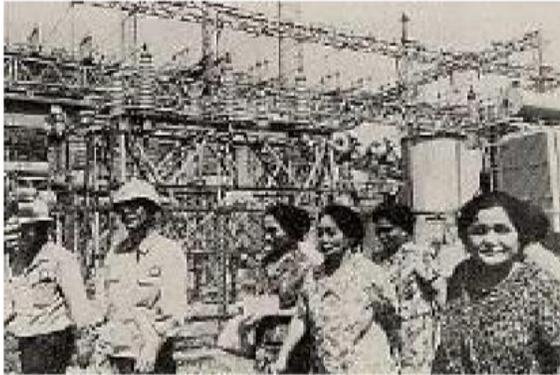


Década de 60



Dias atuais

# Ações para superar a poluição



Visita a plantas e mobilização



Aula nas Universidades

**CIDADÃOS**

**ACORDO FORMAL**

**GOVERNO LOCAL**

**SETOR PRIVADO**



Desenvolvimento do Sistema de Esgoto



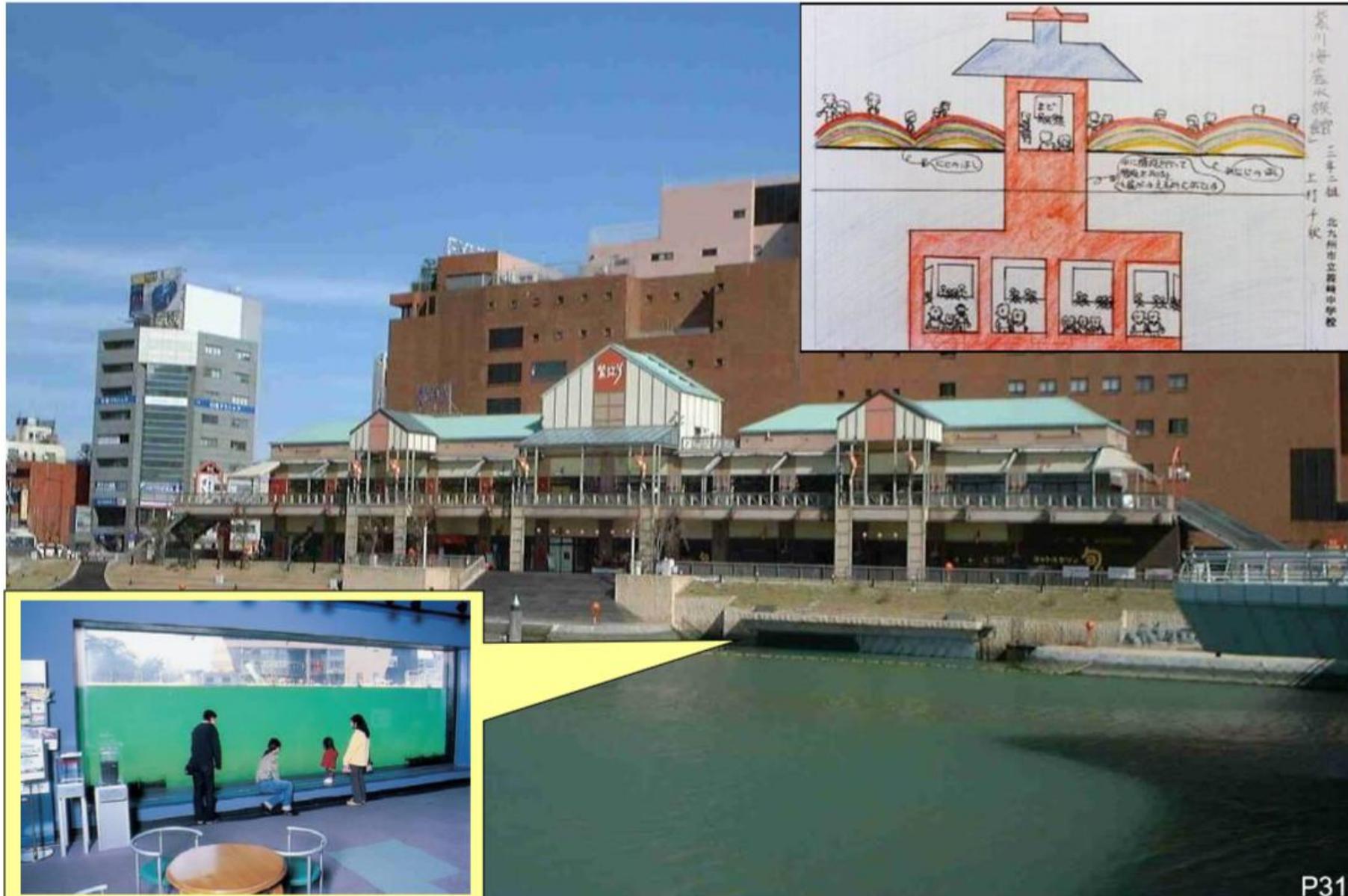
Forte Regulação e Supervisão



Desenvolvimento de Tecnologia de Controle da Poluição

# Kitakyushu: Exemplo Mundial de Controle da Poluição

Janela de observação do rio Murasaki



# Kitakyushu: Exemplo Mundial de Controle da Poluição



Museu do Meio Ambiente



Eco town



Espécies de peixe que voltaram a existir na Baía de Dokai

# Vaso sanitário Japonês



# SES no Japão

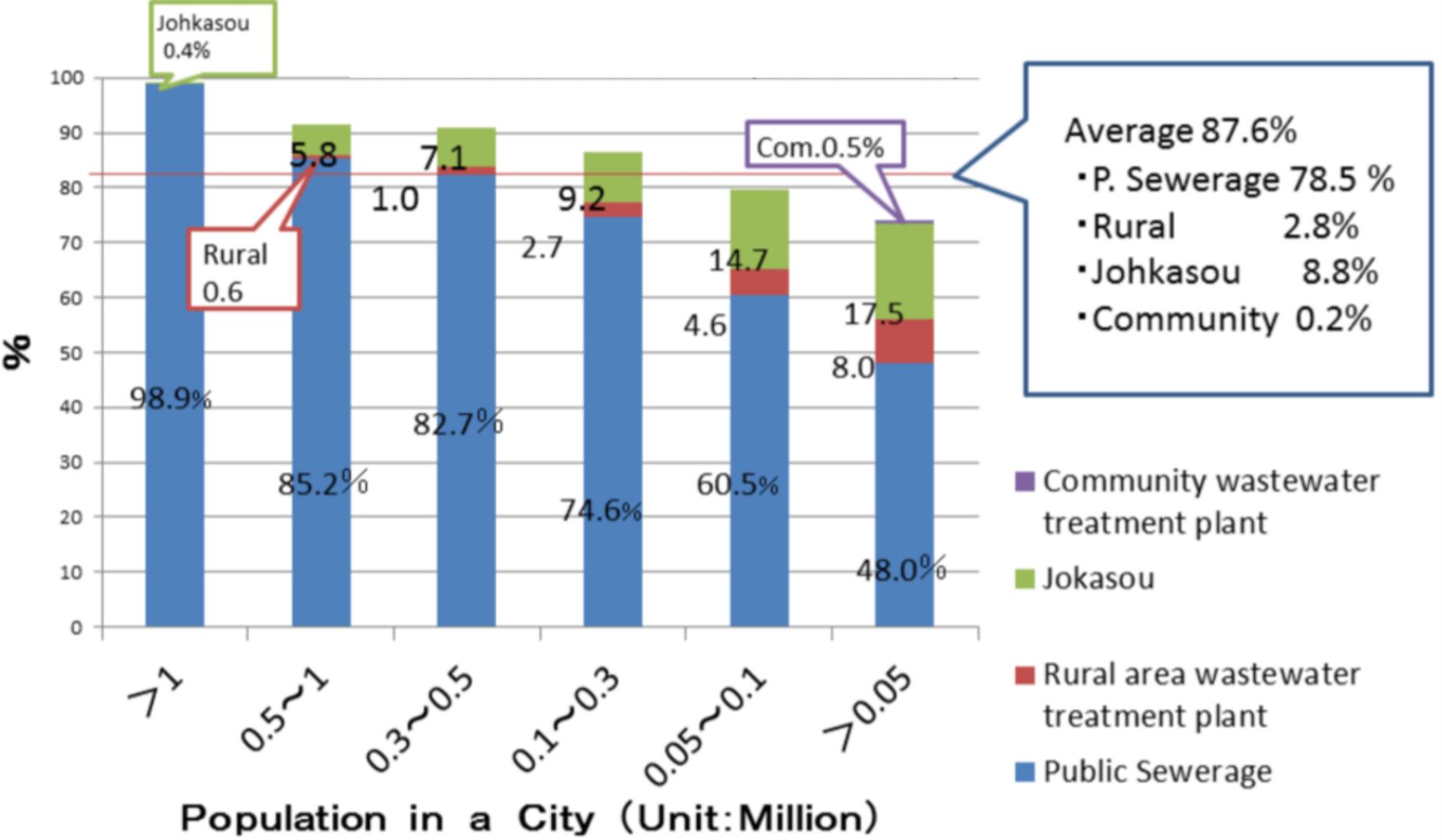
1. SES Público → área urbana

2. SES Rural → área rural (s/ industria); silvicultura; pesca

3. SES Privado (Johkasou) → unifamiliar; comunidades; industrial

# SES no Japão

## Percentual de cobertura de SES



# SES no Japão

## Padrões de lançamento

### Technical Water Quality Standards for Each Treatment Facilities

	pH	BOD(mg/l)	SS(mg/l)
Public Sewage Treatment Facilities	5.8~8.6	<15	<40
Rural area Wastewater Treatment Facilities	5.8~8.6	<20	<50
Jhokasou	5.8~8.6	<20	—

If more stringent water quality standards are regulated by another law or ordinances, the standards are applied.

# SES no Japão

## Padrões de lançamento

### Legislação Nacional → SES Público

- pH.....5.8~8.6
- Coliform Group..... $\leq 3,000/cc$
- SS..... $\leq 40mg/l$
- BOD..... $\leq 15mg/l$
- The items regulated by Water Pollution Control Law (about 30 items) ..... $\leq$  Each Standards
- Dioxins..... $\leq 10pg-TEQ/l$

▪ BOD.....<

▪ N.....<

▪ P.....<

Since the sewage treated water serves as a part of drinking water source, Munakata City has established stricter water quality standards.

- BOD: 7 mg/l
- Total nitrogen (T-N): 14 mg/l
- Total phosphorus (T-P): 0.6 mg/l.

# SES no Japão

## Processos de Tratamento das ETEs Japonesas

Process	Plant Capacity [thousand m <sup>3</sup> /d]						Total	
	<5	5 - 10	10 - 50	50 - 100	100 - 500	>500		
AS for C Removal	Conventional AS	41	70	316	102	91	11	631
	Step Aeration			2	3	2		7
	O <sub>2</sub> Aeration	2	3	2	2	2		11
	Extended Aeration	41	5	1				47
	Oxidation Ditch	856	88	25	* As of March 2015			969
	Sequencing Batch Reactor	64	5	1				70
	Rotating Biological Contactor	9	4	1	1			15
Biofilm	High-Rate Trickling Filter		1	1				2
	Contact Aeration	10				1		11
	Biological Aerated Filter	26	1					27
	Biological Anaerobic-Aerobic Filters	42	1					43
Nutrient Removal	Pre-Denitrification (MLE)	5	4	13	3	9		34
	Post-Denitrification	2	2			1		5
	Anaerobic Anoxic-Aerobic (A2O)	1	4	14	8	23		50
	Anaerobic-Oxic (AO)	13		5	3	13	1	35
	Step-feed pre-denitrification	1	2	18	11	10		42
	Oxidation ditch (N removal)	55	6	3				64
Other Processes	55	5	11	1	4			76
<b>Total</b>	<b>1,223</b>	<b>201</b>	<b>413</b>	<b>134</b>	<b>156</b>	<b>12</b>		<b>2,139</b>

> 80%



Lodo ativado para remover matéria orgânica

**Johkasou** (Johka = purificação; sou = tanque)

## Sistemas Privados



**JAPÃO**

**ETEs ~ 2.200**

**Johkasou (ETES privadas) ~ 8.000.000 !!!**

# Johkasou

## Pequena escala – unifamiliar (5 hab)

### Example of a Johkasou

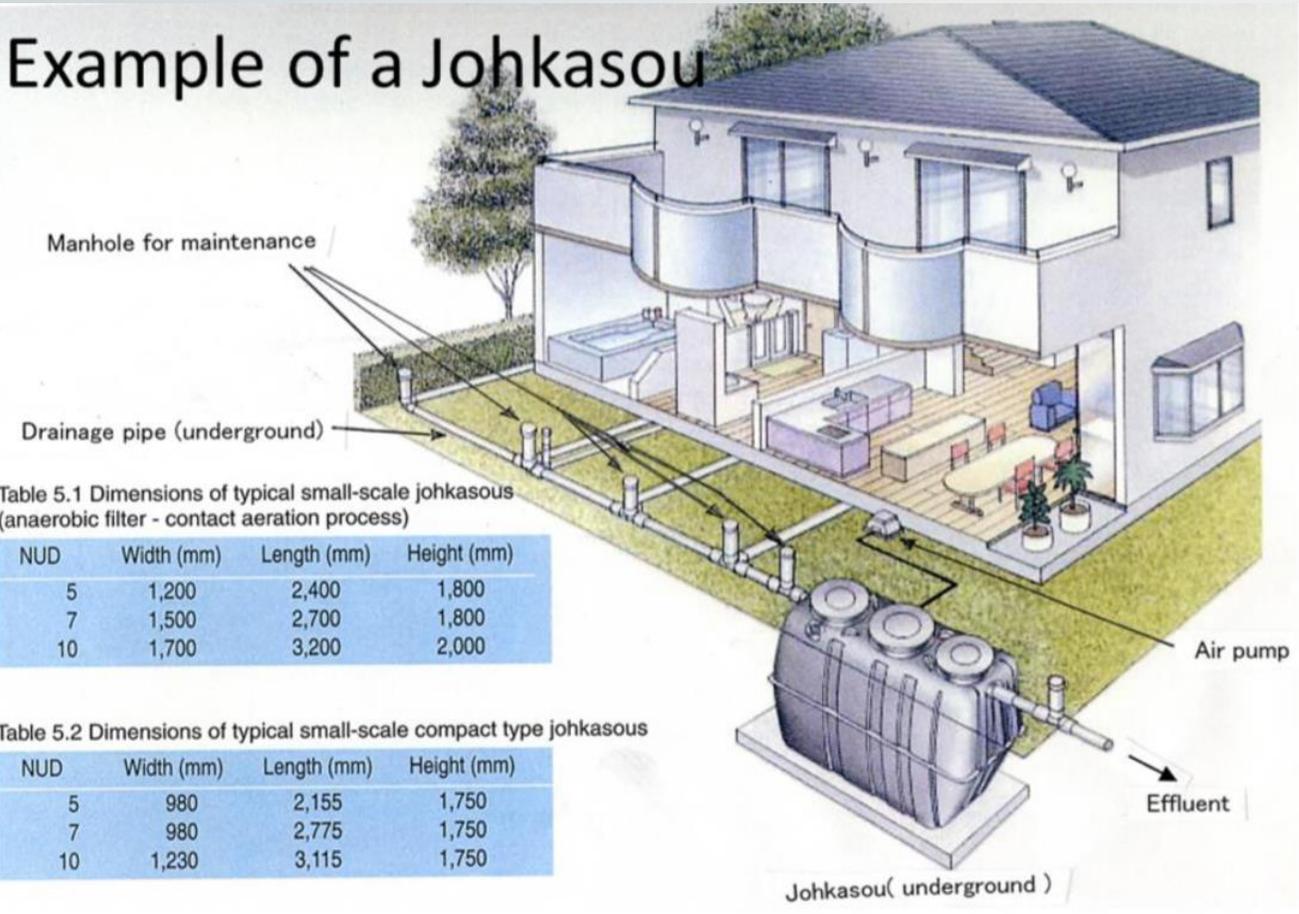


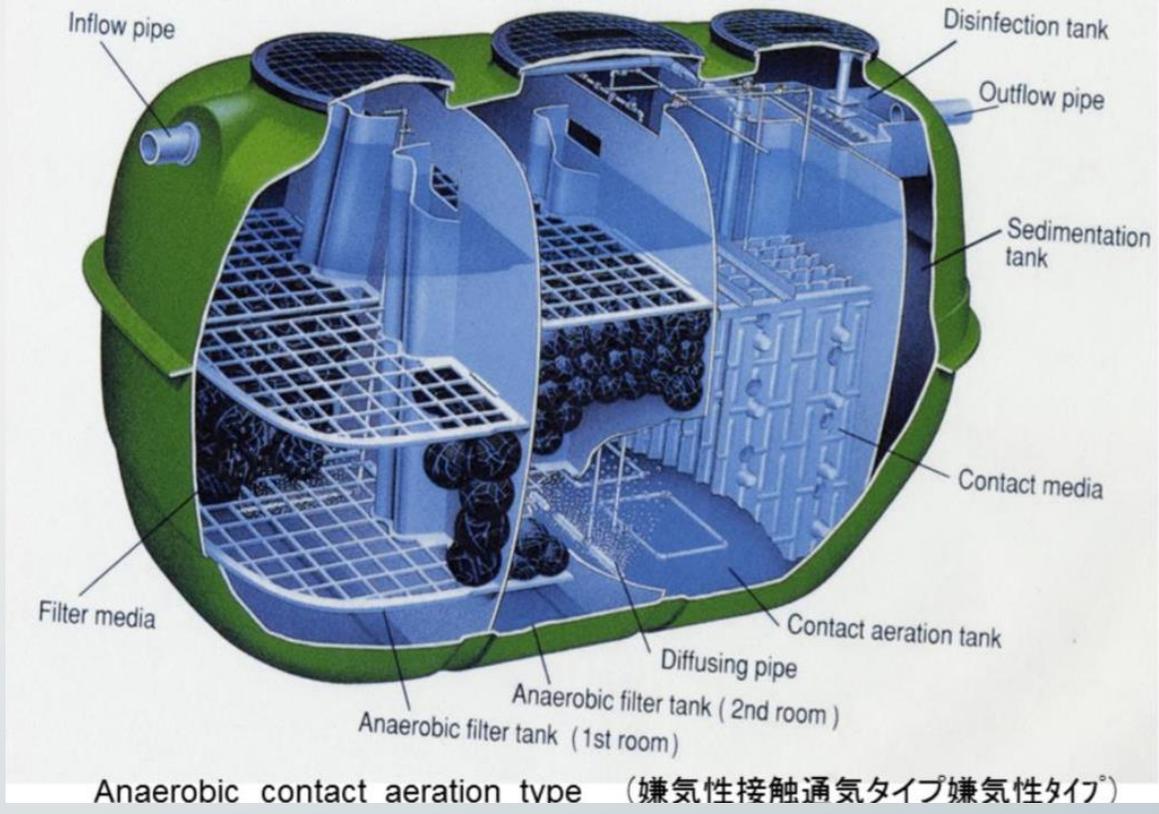
Table 5.1 Dimensions of typical small-scale johkasous (anaerobic filter - contact aeration process)

NUD	Width (mm)	Length (mm)	Height (mm)
5	1,200	2,400	1,800
7	1,500	2,700	1,800
10	1,700	3,200	2,000

Table 5.2 Dimensions of typical small-scale compact type johkasous

NUD	Width (mm)	Length (mm)	Height (mm)
5	980	2,155	1,750
7	980	2,775	1,750
10	1,230	3,115	1,750

### Structure of a Johkasou



Anaerobic contact aeration type (嫌気性接触通気タイプ嫌気性タイプ)

# Johkasou

Maiores escalas (industria, Aeroporto, hospitais...)



# Johkasou

## Retirada de lodo (*desludging*)



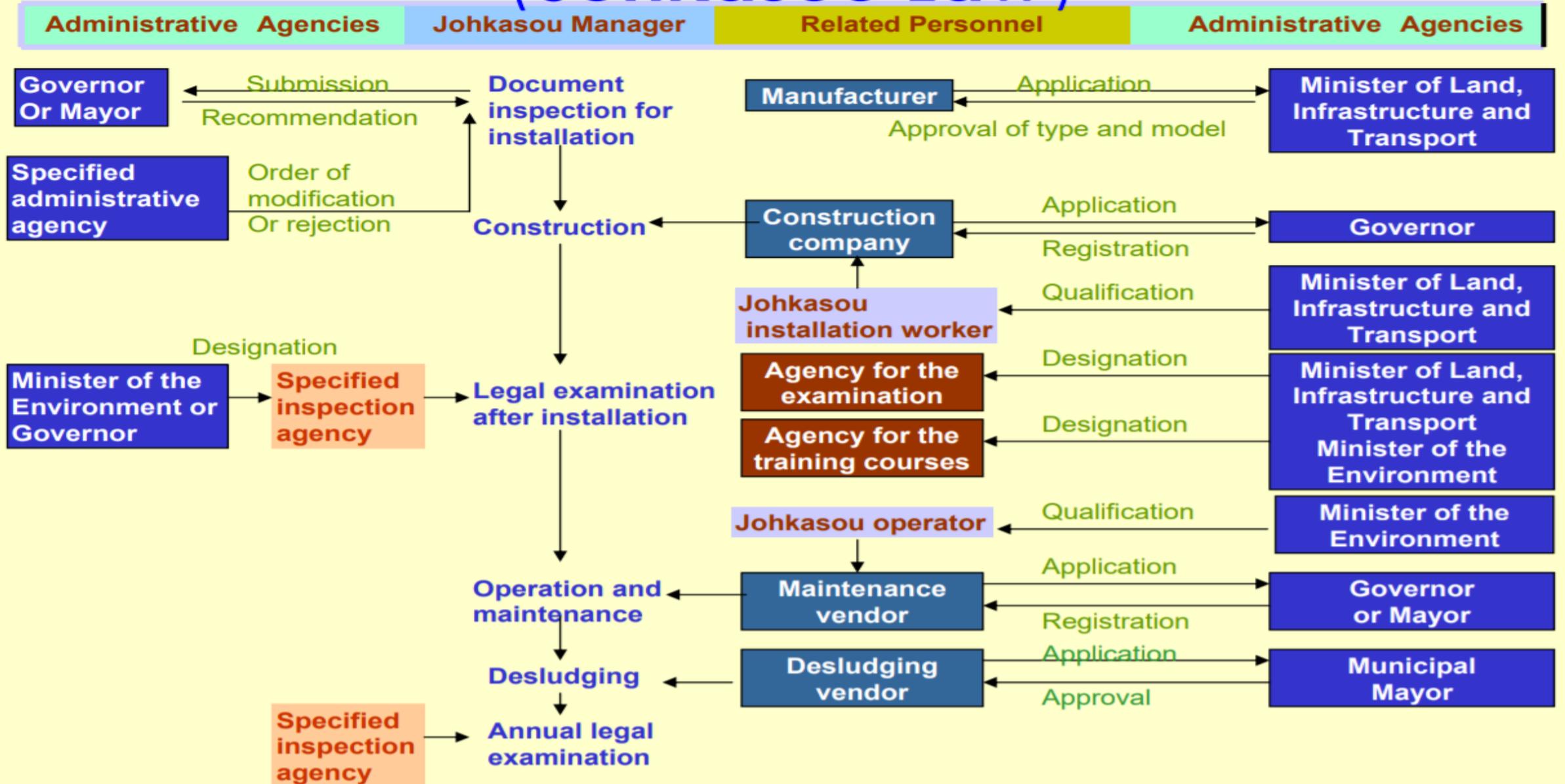
Sludge and scum accumulated in JOHKASOU are removed by a honey (vacuum ) truck.



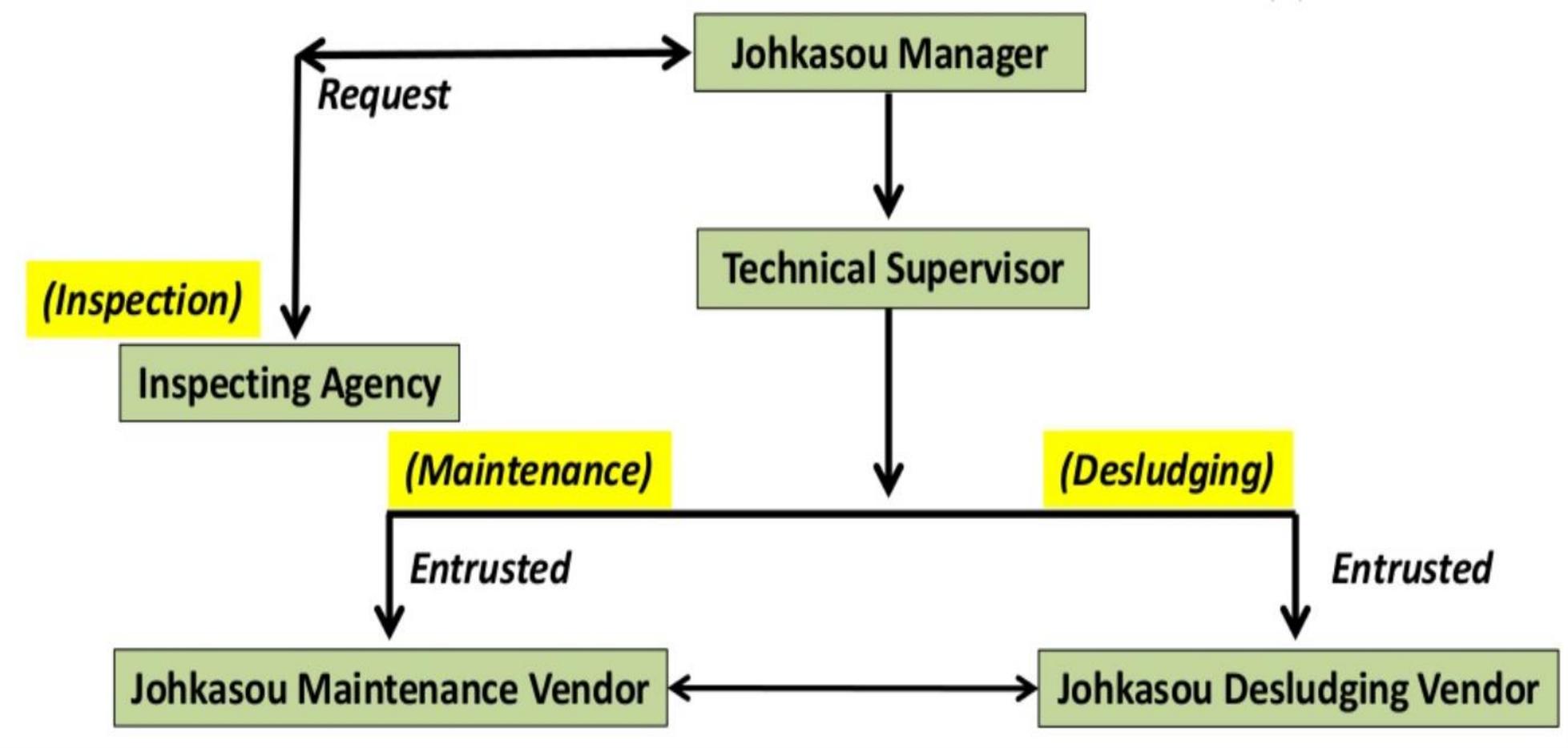
In Japan, sludge has been mainly treated and disposed of in night soil treatment facilities (93%), sewage treatment facilities (6%), and used as raw material for recycling (1%)

# Johkasou

## (Johkasou Law)



# Johkasou



# Johkasou

## Comparison of Different Subsidy Programs

(For installing a johkasou of 5 NUD, which will cost ¥860,000 if it is not subsidized)

**In the case of Johkasou Installation Promotion Program:**

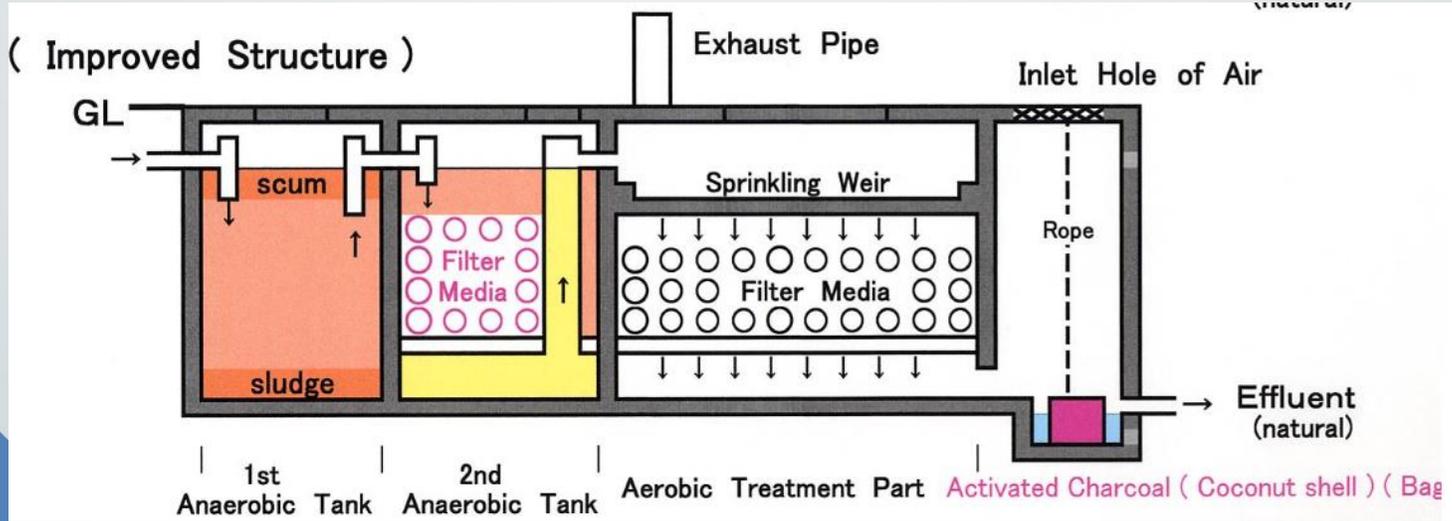
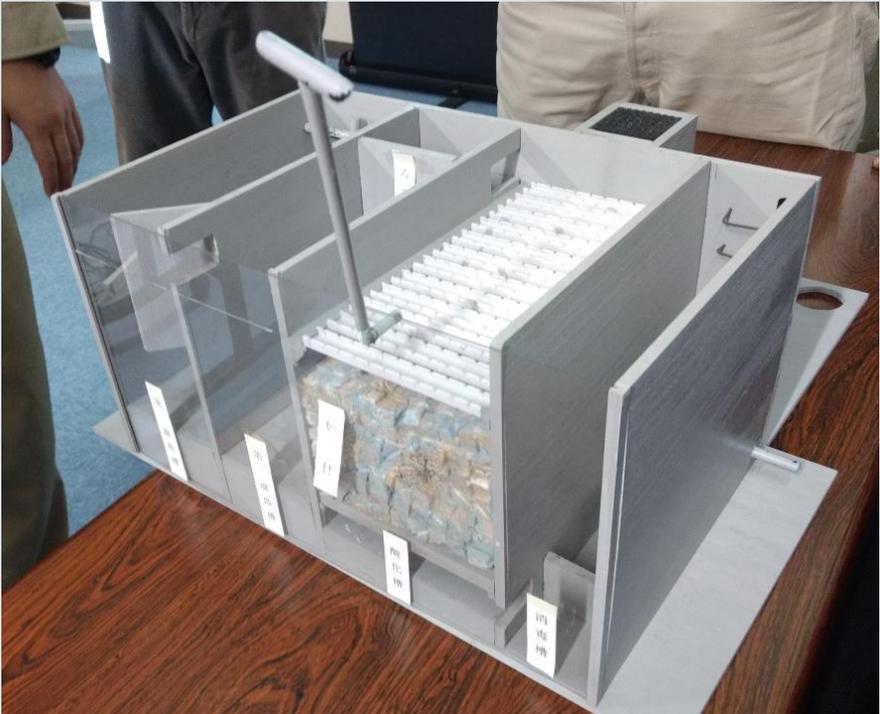
Amount subsidized by municipalities and the government( ¥ 340,000)	Amount borne by the house owner ( ¥ 520,000)
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**In the case of Johkasou Installation Program in Specified Areas:**

Sewerage works construction bond ( ¥ 480,000)	Amount subsidized by government funding ( ¥ 290,000)	Amount borne by the house owner( ¥ 90,000)
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**¥860.000 = R\$ 32.000,00**

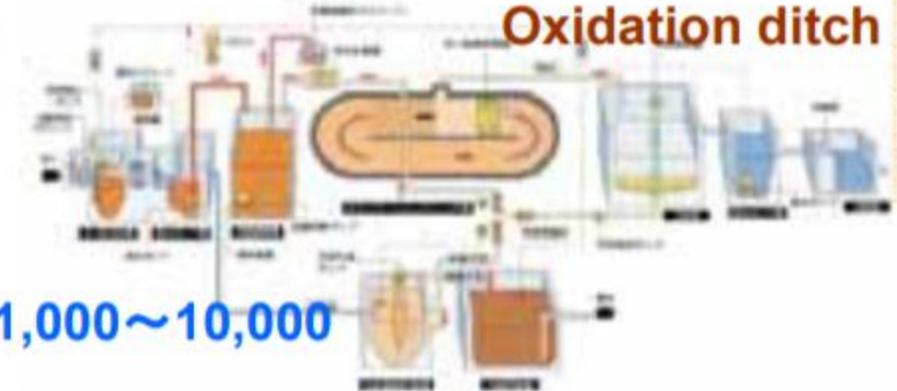
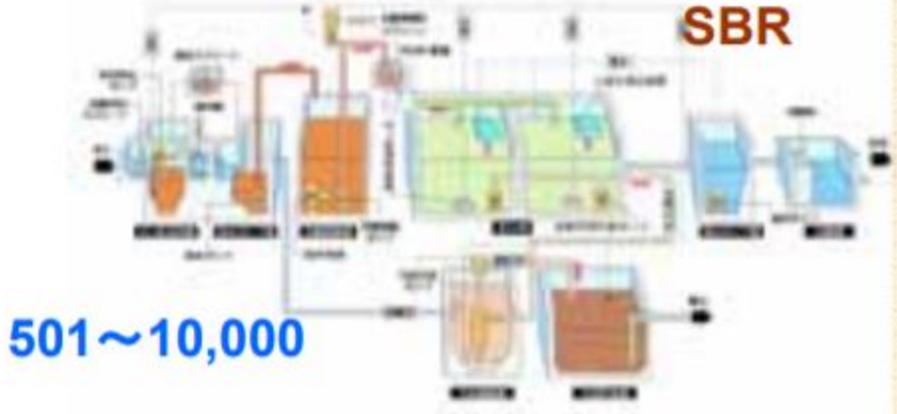
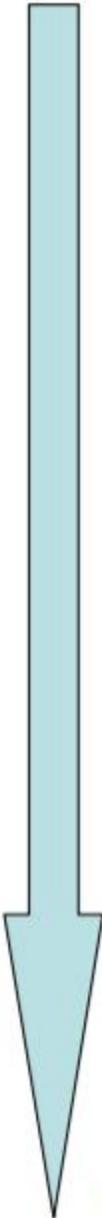
# Johkasou



# Johkasou



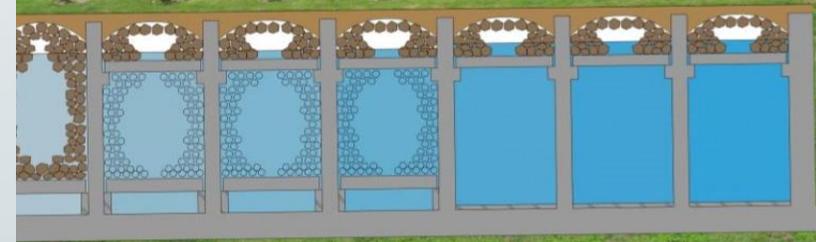
# SES Rural



# Sistema Dojo-Joka (Niimi system)

População de 300 a 5.000 hab

Vazão de 50 a 700 m<sup>3</sup>/d (8,0 L/s)



# Sistema Dojo-Joka (Niimi system)



Pop. – 2.000 hab  
Q – 300 m<sup>3</sup>/d (3,5 L/s)



Pop. – 1.500 hab  
Q – 220 m<sup>3</sup>/d (2,5 L/s)

# ETE Nantan - Sistema Dojo-Joka

Pop. – 1.600 hab

Q – 240 m<sup>3</sup>/d (2,8 L/s)



事業名	園部町農業集落排水事業(農林水産省補助事業)		
事業年度	平成7年度		
計画 流入水量	(日平均)197.1 M <sup>3</sup> /日	計画 流入水質	(BOD) 200 mg/l
	(日最大)240.9 M <sup>3</sup> /日		(SS) 200 mg/l
計画 放出水量	(BOD) 20 mg/l	処理方式	土壤被覆型レキ間接触ばっ気法 (ニイミシステム20)
	(SS) 50 mg/l		
事業主体	園部町		

# ETE Nantan - Sistema Dojo-Joka



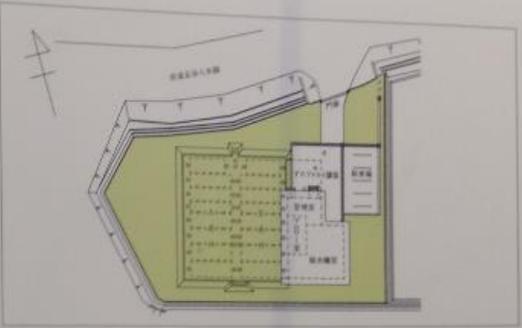
# ETE Nantan - Sistema Dojo-Joka



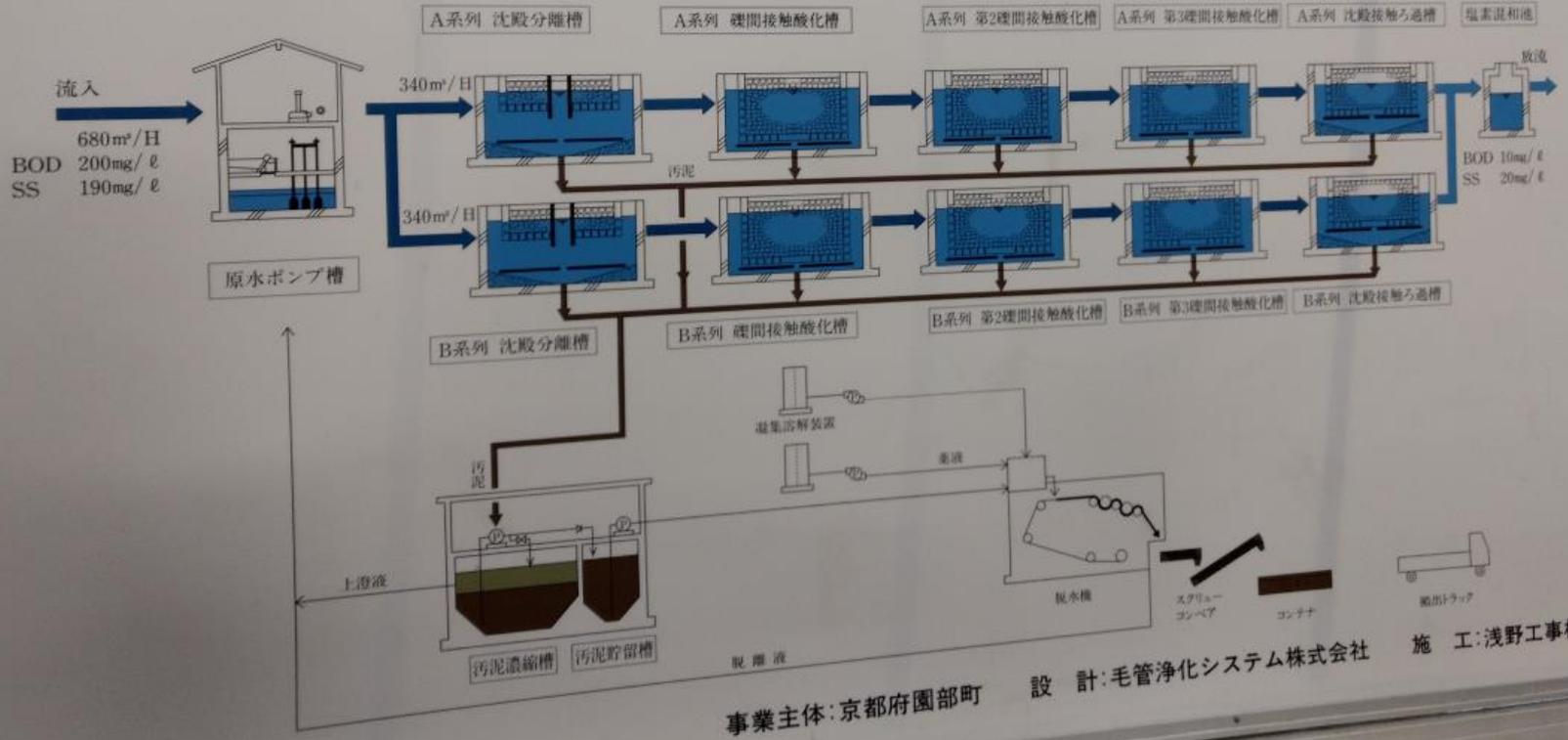
# ETE Nantan - Sistema Dojo-Joka

## 西本梅浄化センター (特定環境保全公共下水道事業)

処理区名	西本梅処理区	計画流入水質(BOD)	200mg/ℓ
計画人口	1,300人	(S S)	190mg/ℓ
計画汚水量(日平均)	540 m <sup>3</sup> /日	計画放流水質(BOD)	10mg/ℓ
	(日最大) 680 m <sup>3</sup> /日	(S S)	20mg/ℓ
処理方式	水処理: 碟間接触酸化法 汚泥処理: ベルトプレス型脱水機		

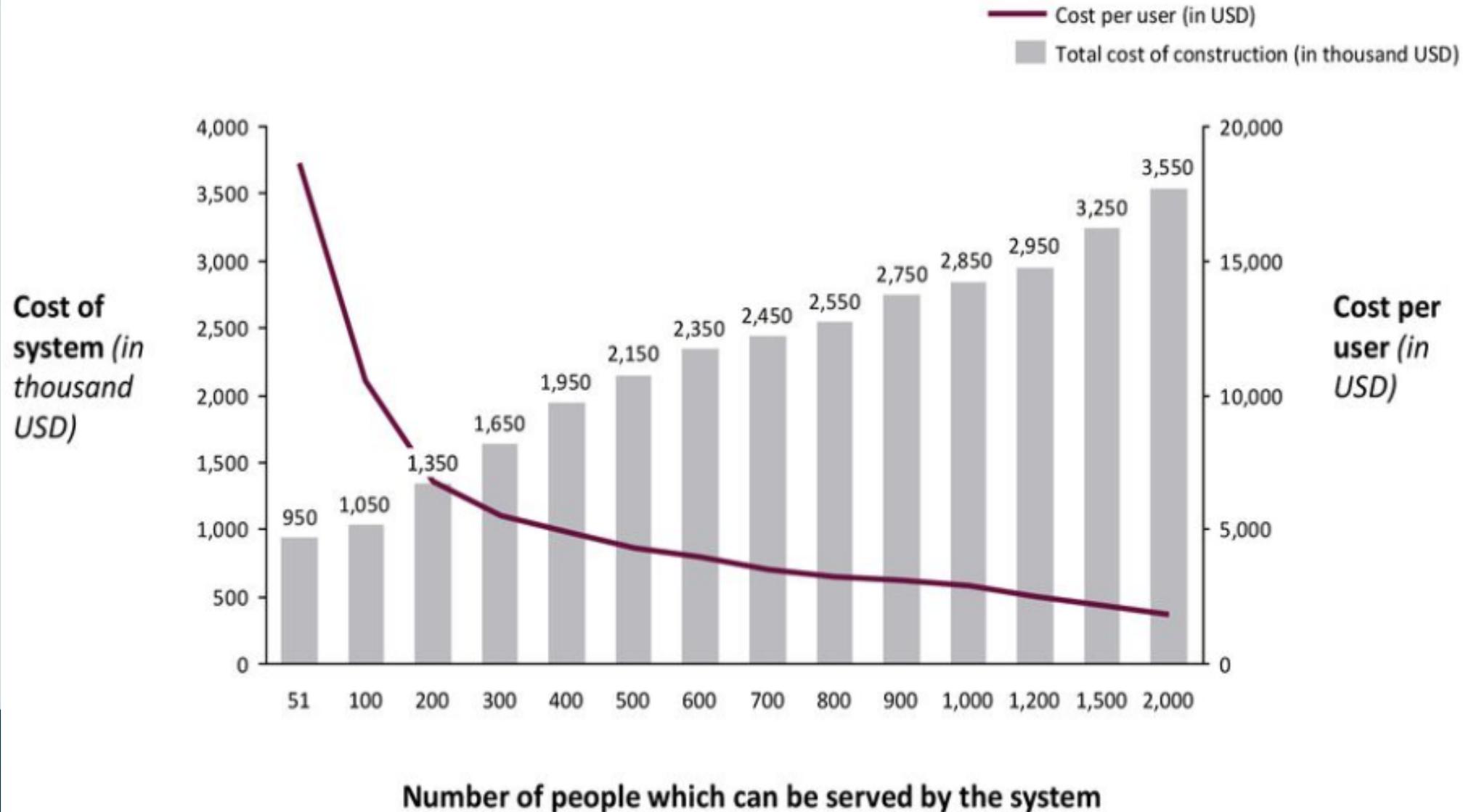


### 汚水・汚泥フローシート

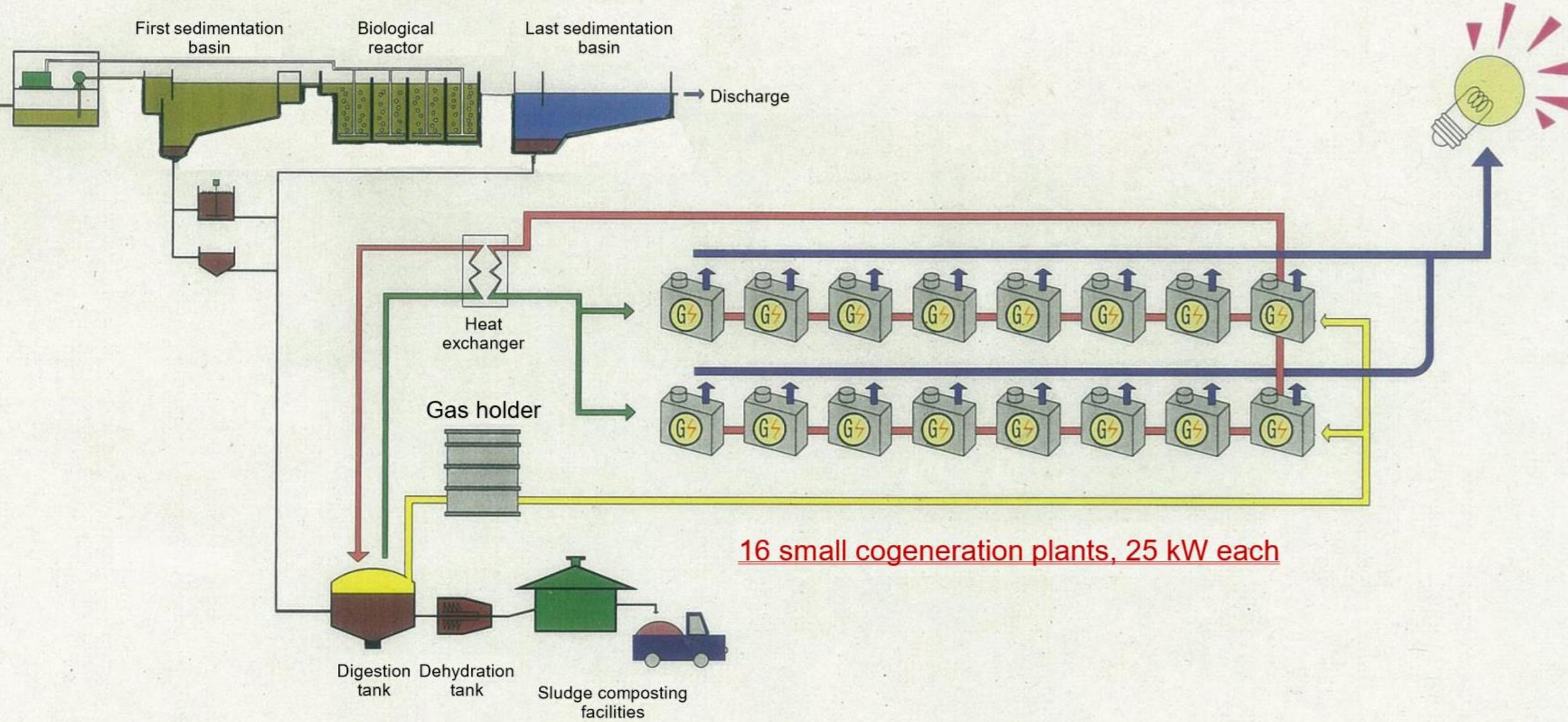
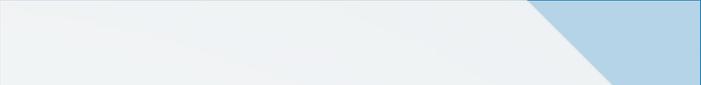


事業主体: 京都府園部町 設計: 毛管浄化システム株式会社 施工: 浅野工事株式会社

# Sistema Dojo-Joka



# ETE Saga - Saga



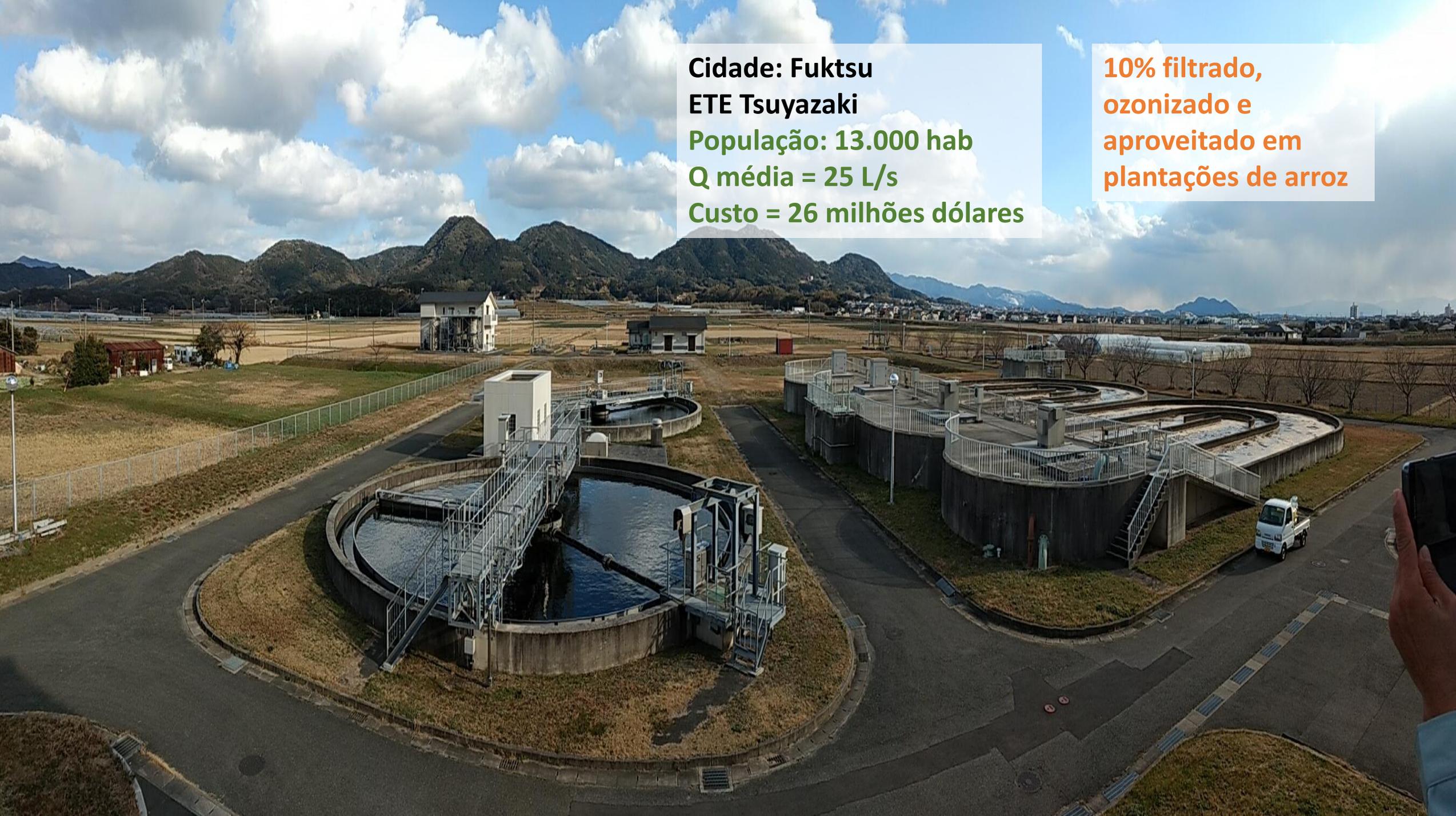
16 small cogeneration plants, 25 kW each

# ETE Saga - Saga



**Cidade: Fuktsu**  
**ETE Tsuyazaki**  
**População: 13.000 hab**  
**Q média = 25 L/s**  
**Custo = 26 milhões dólares**

**10% filtrado,**  
**ozonizado e**  
**aproveitado em**  
**plantações de arroz**





# Wetland construídos



	Name	Parameters								T-N		T-P	
		Vegetation	Influent	Treating flow (m <sup>3</sup> d <sup>-1</sup> )	Area (m <sup>2</sup> )	Length (m)	Water Depth (cm)	HRT (hour)	HLR (md <sup>-1</sup> )	Influent (mgL <sup>-1</sup> )	Effluent (mgL <sup>-1</sup> )	Influent (mgL <sup>-1</sup> )	Effluent (mgL <sup>-1</sup> )
Operating	1 Yasato Town	<i>Phragmites australis</i>	Domestic wastewater	38.9	1224	–	–	36.0	0.032	6.20	2.00	0.97	0.23
	2 Mizumoto Park	<i>P. australis</i>	Domestic wastewater	43.2	828	90	25	115.0	0.052	5.60	4.30	0.37	0.26
	3 Sanno Riv.	<i>P. australis</i> , <i>Zizania latifolia</i>	River water	2500.0	5600	40	10	5.0	0.450	3.40	2.30	0.23	0.14
	4 Seimei Riv.	<i>P. australis</i>	River water	18144.0	38000	40	10	5.0	0.480	2.55	2.11	0.17	0.13
	5 Watarase Retarding Basin	<i>P. australis</i>	Reservoir water	216000.0	200000	–	20	4.4	1.080	1.24	0.90	0.10	0.09
	6 Lake Kahokugata	<i>P. australis</i>	Lake water	103.7	1600	1000	5	18.5	0.065	1.73	1.09	0.12	0.08
	7 Lake Harutori	<i>Phalaris arundinacea</i>	River water	86.4	220	22	10	6.0	0.39	2.87	2.54	0.07	0.03
	8 Lake Harutori	<i>Phalaris arundinacea</i>	River water	86.4	198	22	10	5.4	0.44	3.48	3.38	0.20	0.10
	9 Lake Harutori	<i>Phalaris arundinacea</i>	River water	259.2	569	21	10	5.2	0.46	2.68	2.05	0.04	0.02

# Wetland construídos



Total bed area : 1,868m<sup>2</sup>  
Inflow rate : 180 m<sup>3</sup>/d

# Caixa de inspeção e ramal



# Sistemas privados - Kitakyushu

400 empresas certificadas para obras internas (interligações)

Cada empresa deve ter um engenheiro aprovado em teste específico

Prefeitura aprova projeto interno antes da empresa executar

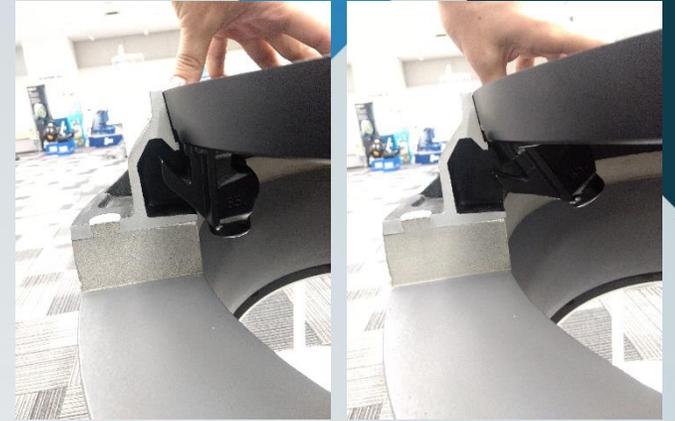
Final Prefeitura realiza testes com traçadores hidráulicos

## Empréstimo e Subsídio

- Soleira baixa: subsídio de  $\frac{1}{2}$  até  $\frac{2}{3}$  da construção
- Empréstimo: devolução até 4 anos



# Tampas de PVs



# Manutenção e operação - redes



Item	Inspection object	Age		Remarks
		0 to 30 years old	30 years old or more	
Manhole visual inspection	Inside of a manhole and upstream and downstream sewer pipes	Every 5 years	Every 3 years	
Visual inspection by going deeply into a pipe, etc.	Inner diameter of 800 mm or more	Every 10 years	Every 7 years	Including lateral sewers
Inspection by using a TV camera	Inner diameter of less than 800 mm	Every 10 years	Every 7 years	Including lateral sewers
	Inner diameter of 800 mm or more			

**Exemplo de frequência de inspeção**

# Manutenção e operação - redes

## Imagem com visão panorâmica da tubulação

TDVデータ表示 帳票の検索 帳票の表示 帳票の印刷 調査集計表 終了

前頁 次頁 帳票イメージ保存

TDV data display Doc. retrieve Doc. display Doc. print Survey summary End

記録番号: 222 (1/3)  
調査日付: 2000年03月31日  
下方展開

調査件名: 墨田区文花三丁目、四丁目付近 下水道管内調査1

0.0 m 20.0 m 40.0 m

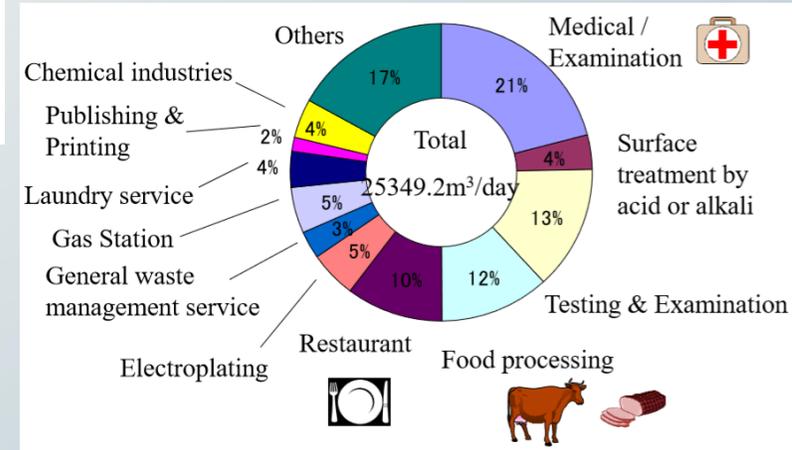
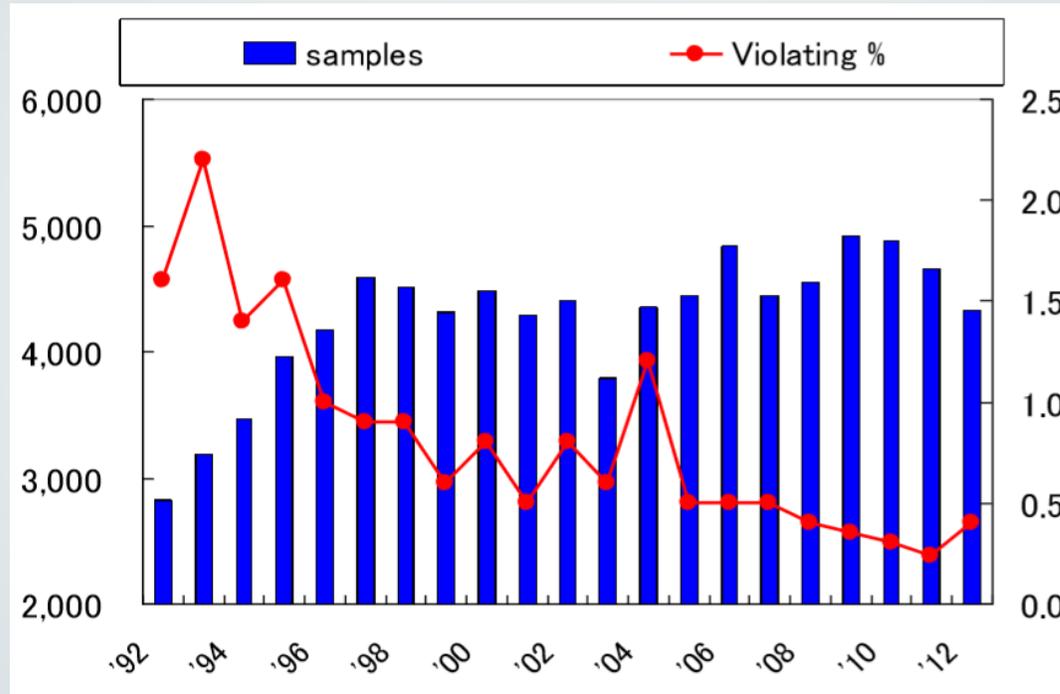
Development view of a conduit

上流人孔番号	人孔深	上流U	人孔深	下流人孔番号	人孔深
1	1.0	1	1	1	1.0
2	1.0	1	1	2	1.0
3	1.0	1	1	3	1.0
4	1.0	1	1	4	1.0
5	1.0	1	1	5	1.0
6	1.0	1	1	6	1.0
7	1.0	1	1	7	1.0
8	1.0	1	1	8	1.0
9	1.0	1	1	9	1.0
10	1.0	1	1	10	1.0

拡大図

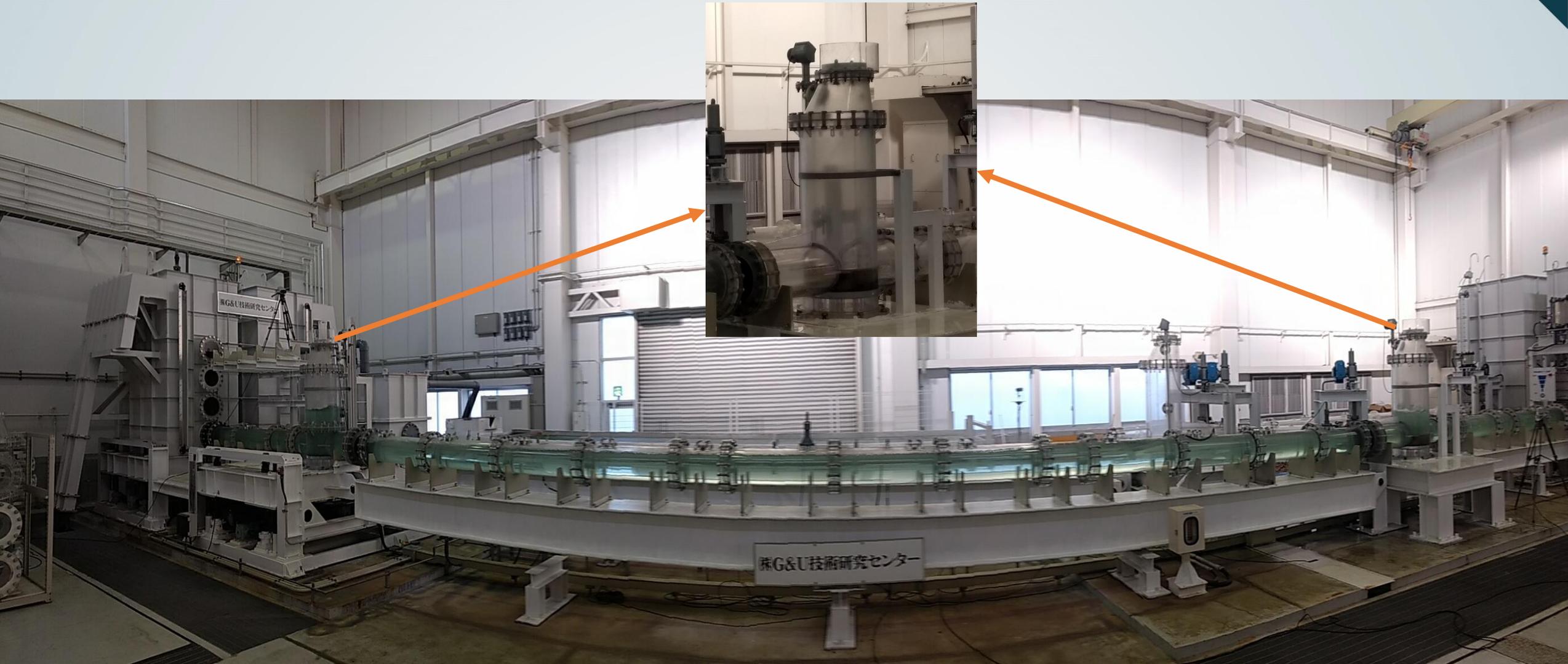
Magnified photos of damages

# Regulação para efluentes industriais e Grandes geradores



# G&U Technical Research Center (Tokyo)

Centro de pesquisa em Poços de Visita e Tampas



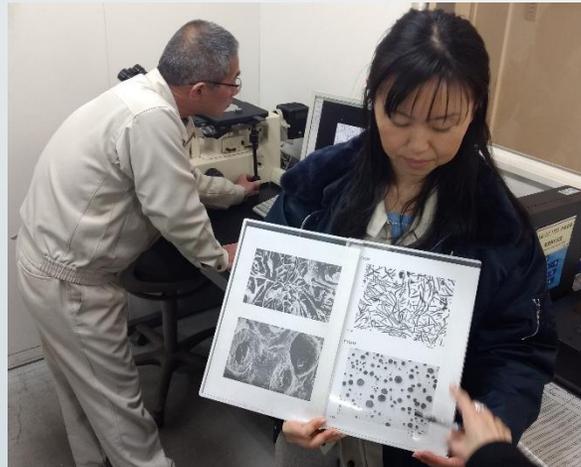
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## Centro de pesquisa em Poços de Visita e Tampas



# AGRADECIMENTOS





MUITO OBRIGADO!



Francisco José Guedes Pimentel  
[fpimentel@casan.com.br](mailto:fpimentel@casan.com.br)  
(48) 3221-5710