

Sustainable Water Supply in Tokyo

- Through the Creation of a Water Saving City –



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Efforts for sustainable water supply in Tokyo

1. Outline of Tokyo Water
2. Tokyo's Experience
3. Creation of water saving city
4. Result of NRW reduction measures
5. Fruits of our efforts
6. Efficient Water Supply Operation Management

1. Outline of Tokyo Water Supply

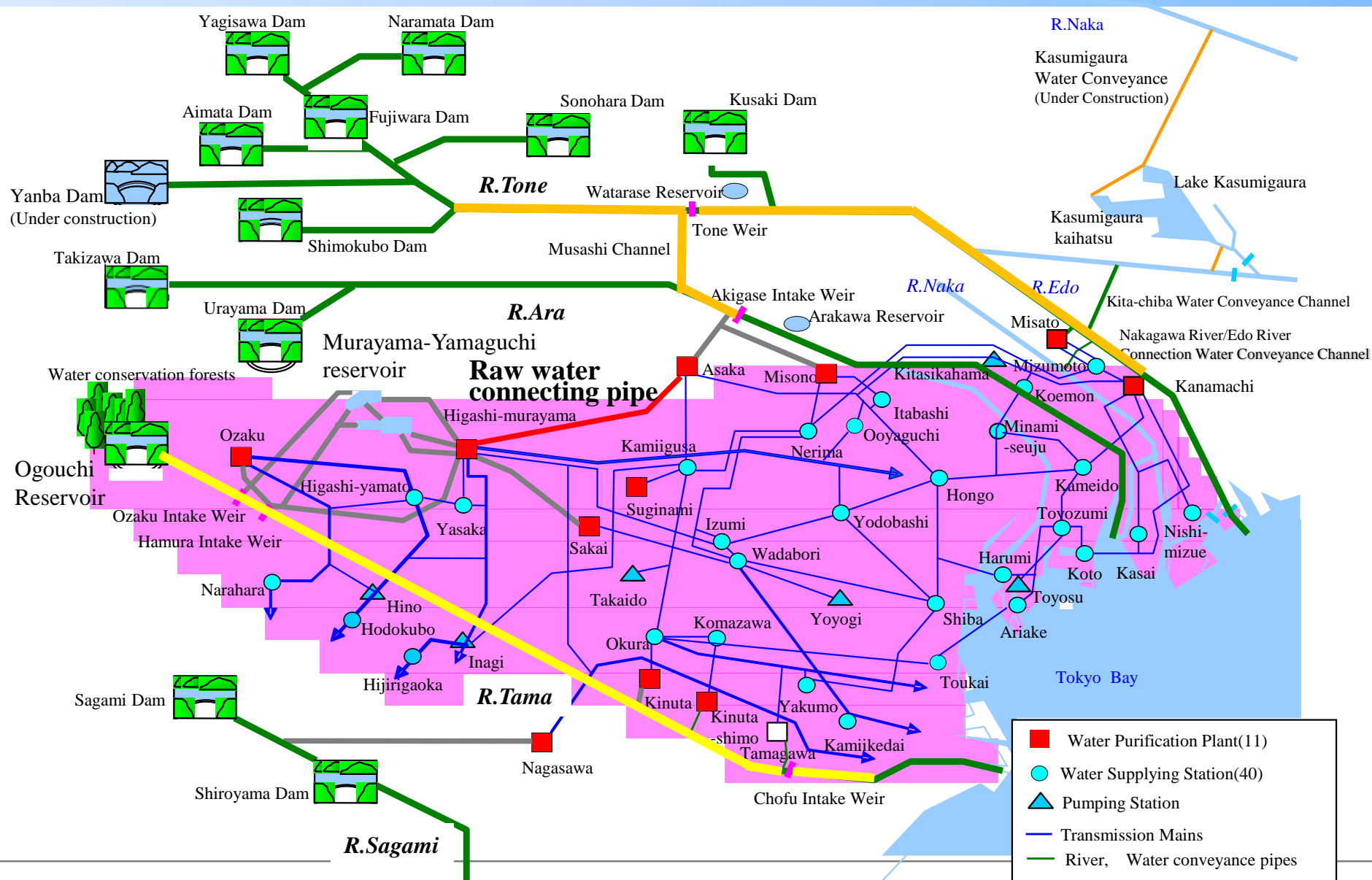
1.1 Tokyo Now

Since the start of modern water supply in 1898, Tokyo Metropolitan Waterworks Bureau (TMWB) has been supporting the urban prosperity of Tokyo, one of the big cities in the world.



	Tokyo(2017)
Start of Service	1 st , December 1898
Service Area	1,239 km ²
Population Served	13.4 million
Non Revenue Water Rate	4.2 %
Total Pipe Length	27,125 km
Water Supply Capacity	6.9 million m ³ /day
Average Daily Supply	4.2 million m ³ /day
Water Availability	24 hours

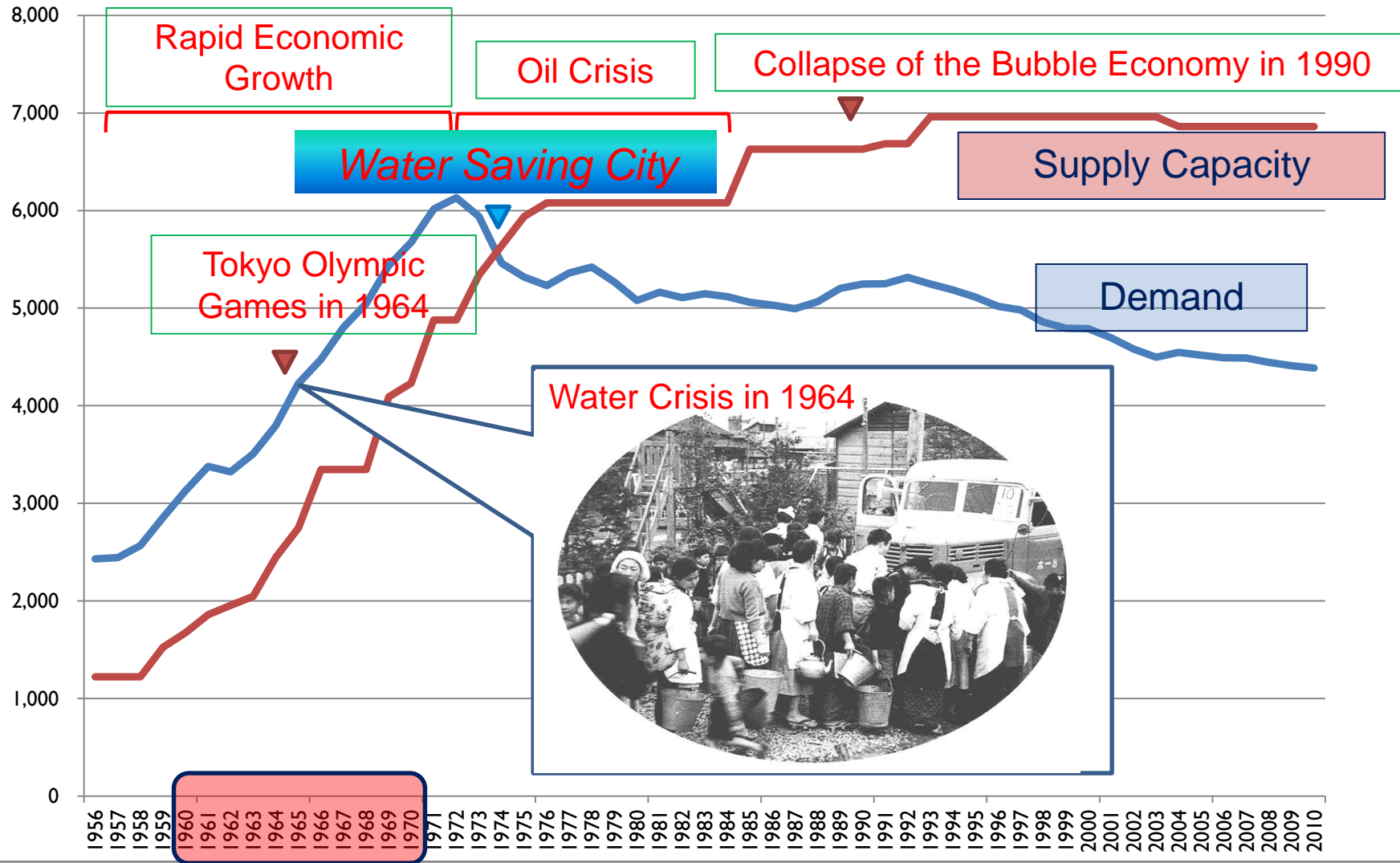
1.2 Water Supply Network in Tokyo



2. Tokyo's Experience

2. Tokyo's Experience

Water Crisis in Tokyo : Water Demand & Supply Capacity



3. Creation of water saving city

3. Creation of water saving city

3.1 Tariff system for water saving

3.2 Promotion of water recycling

3.3 Development/Diffusion of water saving devices

3.4 Enhancement of water saving consciousness

3.5 Promotion of leakage prevention measures

3.6 Proper management & maintenance

3.1 Tariff system for water saving

Table of Charges

Gradually increasing

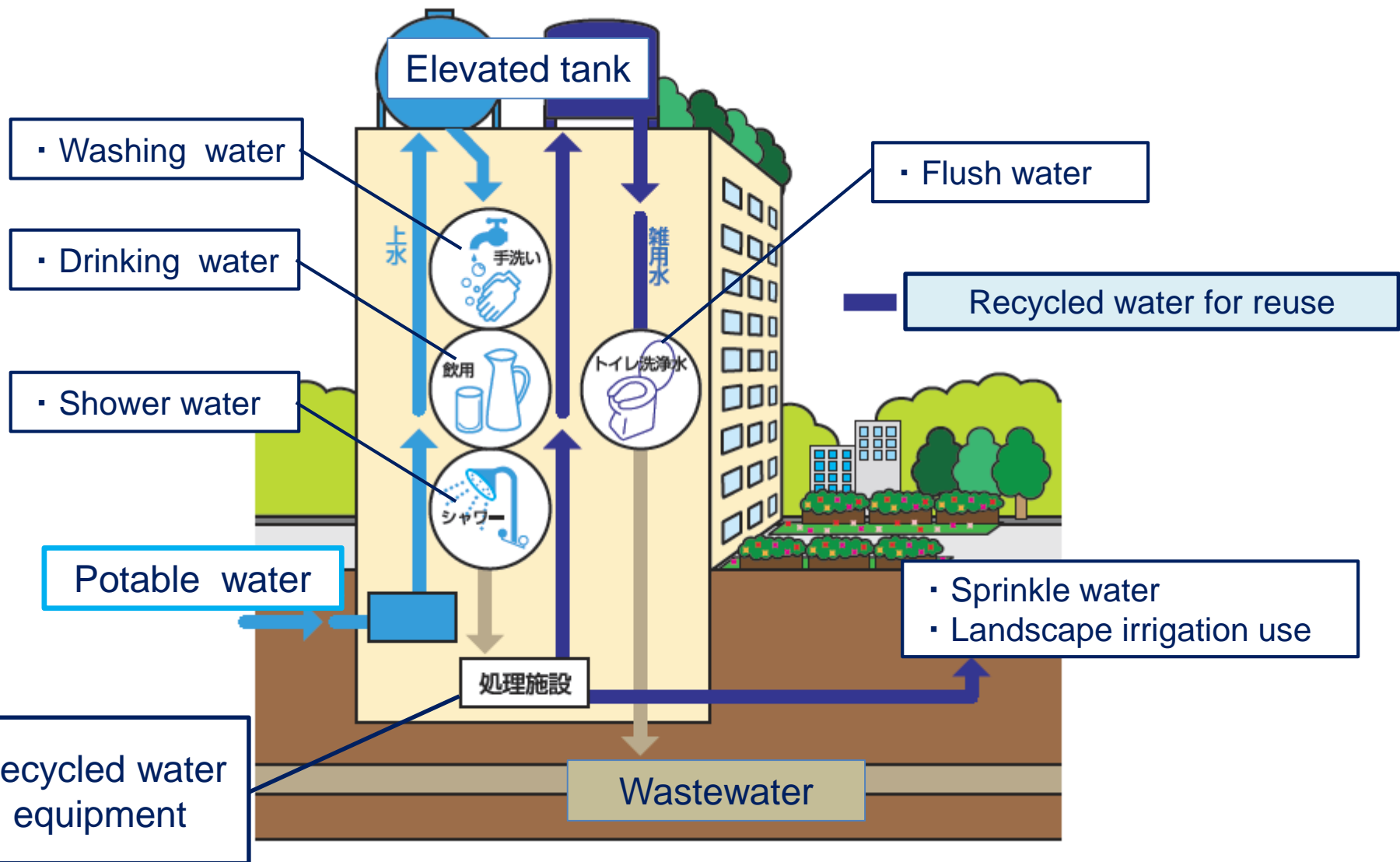
Class of Charges		Minimum Charges (Yen)	Commodity Charges								
			1 ~ 5 m ³	6 ~ 10 m ³	11 ~ 20 m ³	21 ~ 30 m ³	31 ~ 50 m ³	51 ~ 100 m ³	101 ~ 200 m ³	201 ~ 1,000 m ³	1,001 ~ m ³
			(Yen/m ³)								
General use	φ 13mm	860									
	φ 20mm	1,170	0	22	128	163	202	213	298	372	404
	φ 25mm	1,460									
	φ 30mm	3,435									
	φ 40mm	6,865						213	298	372	404
	φ 50mm	20,720								372	404
	φ 75mm	45,623									
	φ 100mm	94,568									
	φ 150mm	159,094									
	φ 200mm	349,434									404
	φ 250mm	480,135									
	φ 300mm~	816,145									
Public bath use			0	22							109

Same as the general use 6,865 Yen for 40mm or larger

* Water charges include the amount equivalent to the consumption tax.

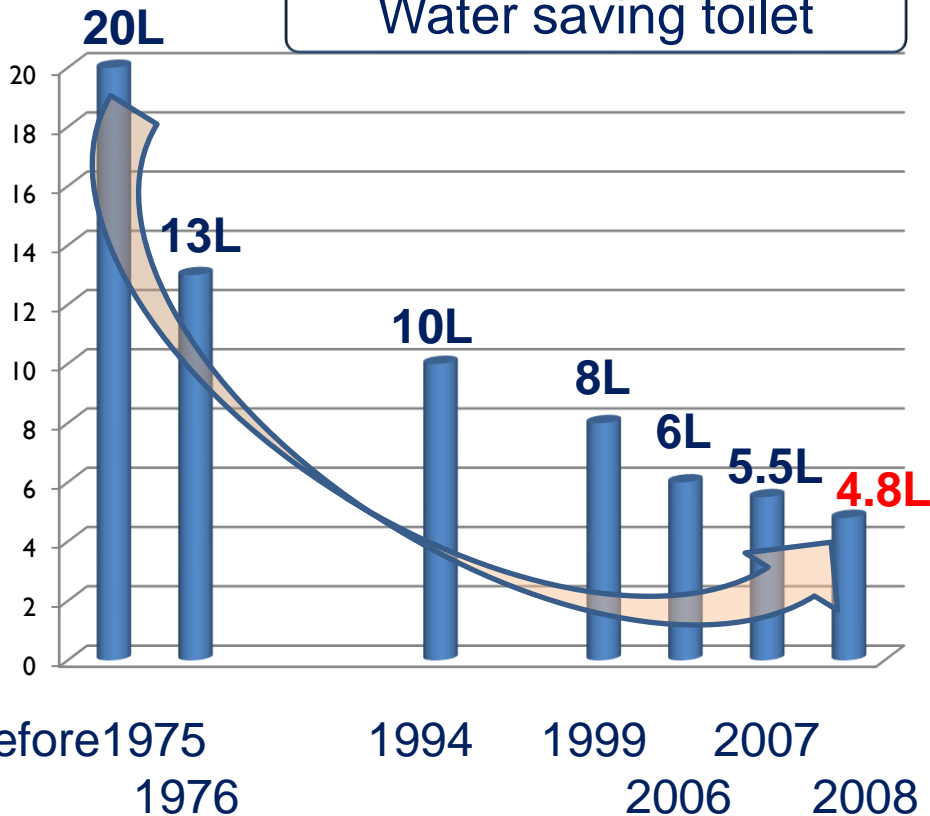
** Water charge = (Minimum charge + Commodity charge) × 1.08

3.2 Promotion of water recycling



3.3 Development/Diffusion of water saving devices

Water saving toilet



Saved Water by 3/4 !



20L/One use
(Before 1975)

-15.2L

4.8L/One use
Current

Water saving
washing machine



3.4 Enhancement of water saving consciousness

Short plays



Experiments



The Waterworks Caravan for elementary school students



Guidebook



“Water Day” event



Direct water service



Poster (Save Water!)

3.5 Promotion of Leakage Prevention Measures

3.5.1 Leakage Control and Prevention Measures

➤ Control

- Detection and repair



➤ Prevention

- Replacement of pipes
 - Ductile cast iron pipes for distribution mains
 - Corrugated stainless steel pipes for service connections



➤ Technological developments

- Leak detection/prevention technologies

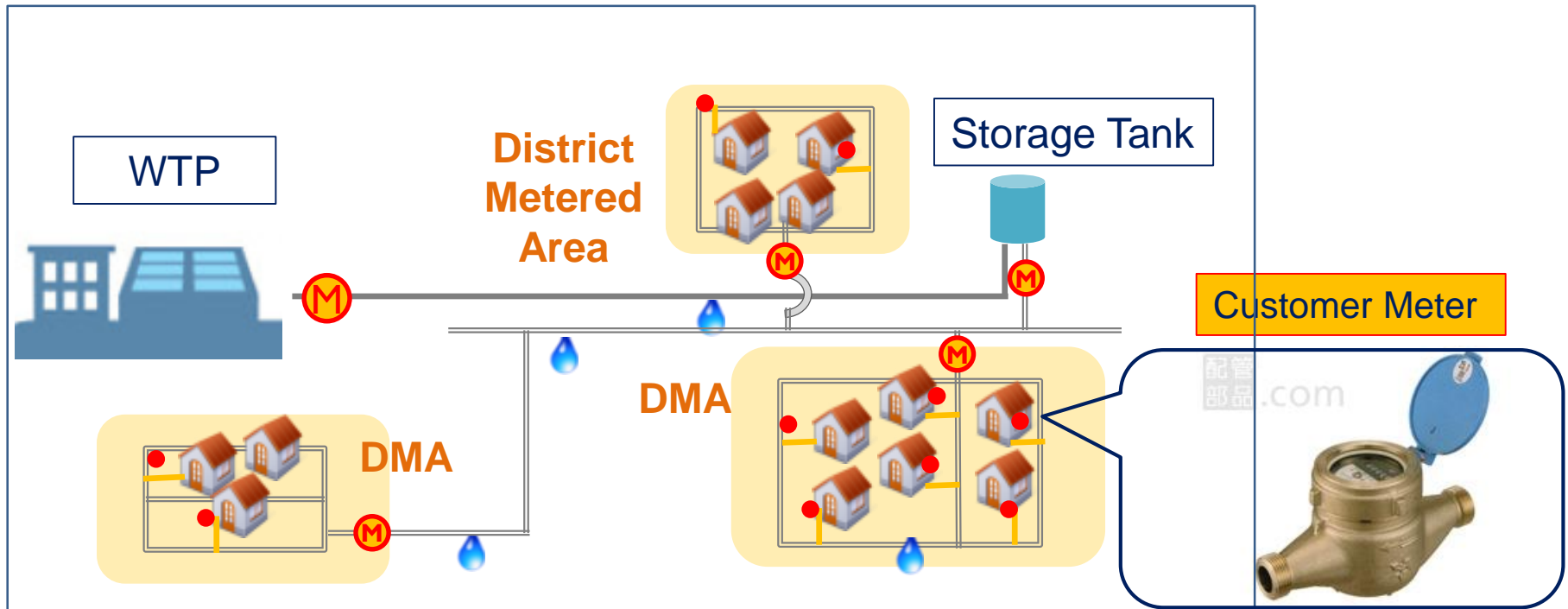


3.5 Promotion of Leak Prevention Measures

3.5.2 Water Flow Management

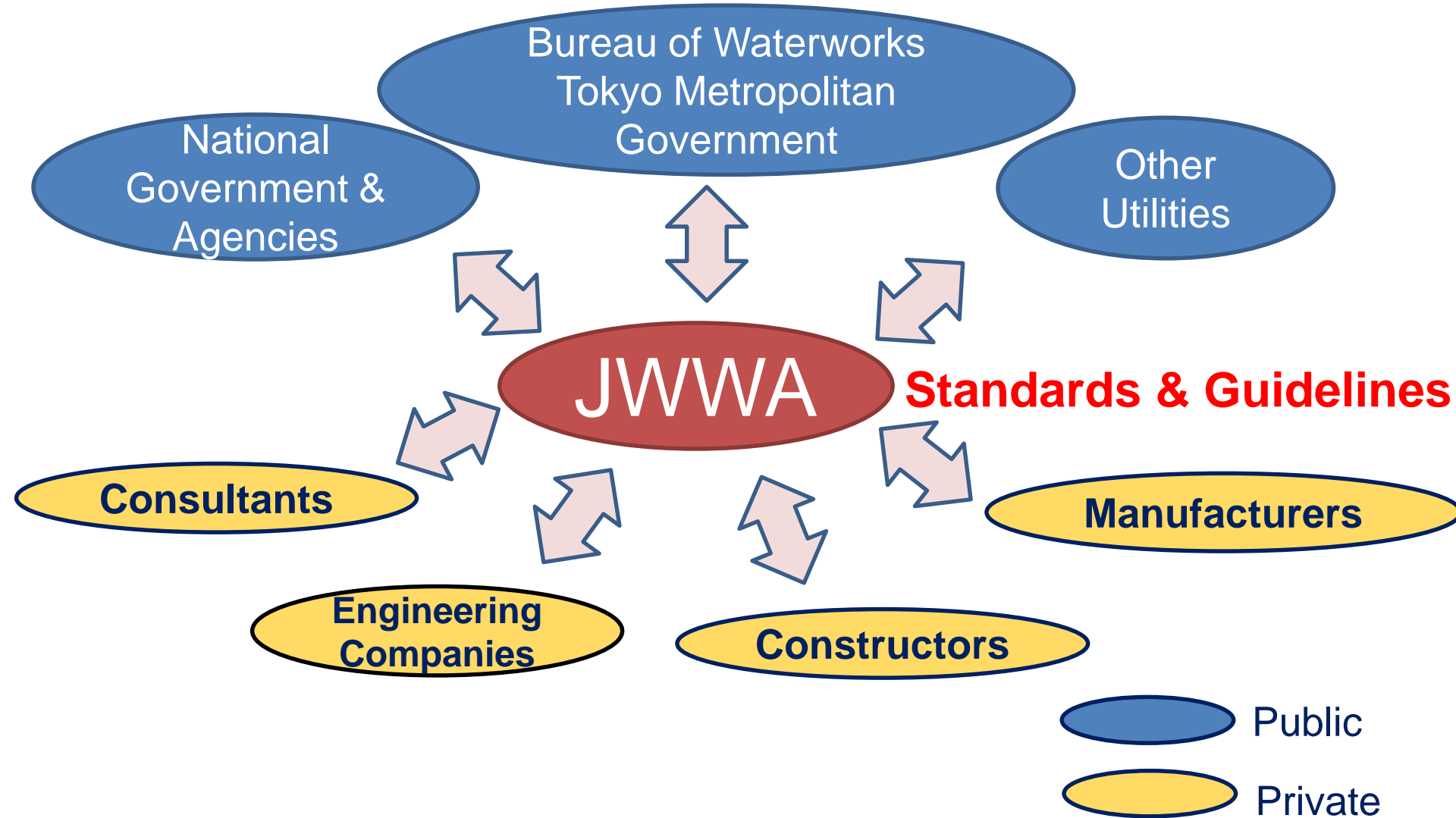
Water Flow management is very important !

- Transmission Pipes
- Distribution pipes
- Service pipes
- Leakage
- Meter
- Customer Meter



3.6 Proper management & maintenance

3.6.1 Developing Standards and Guidelines



3.6 Proper management & maintenance

3.6.2 Technological innovations (R&D with Private sectors)



Balance Type Filters



Anti-Seismic Pipes



5,000kW IGBT Scherbius Pump

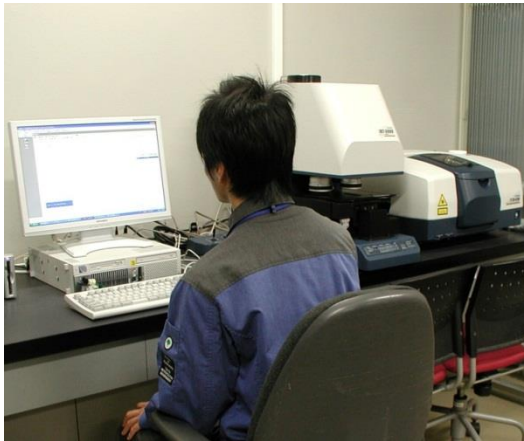


Corrugated Stainless Steel Pipes

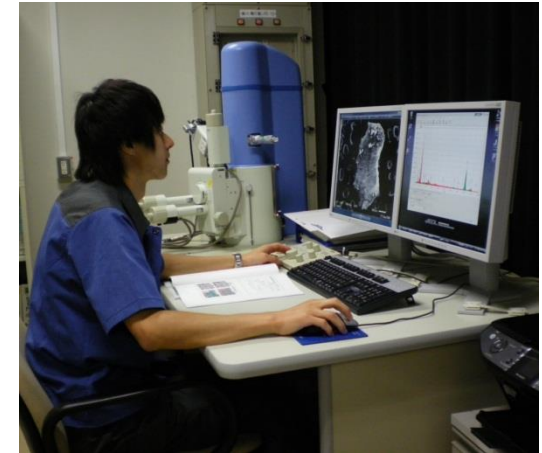
3.6 Proper management & maintenance

3.6.3 Technological innovations

(Water Quality Management Center established in 1979)



The Center
acquired
accreditation of
ISO/IEC17025
in March 2004



Water quality analysis



Water Sampling



Mobile Laboratory



3.6 Proper management & maintenance

3.6.4 Technological innovations (Water Supply Operation Center)

Tokyo Water established the Water Supply Operation Center in 1979 to monitor and control water supply facilities comprehensively and with less staff.



3.6 Proper management & maintenance

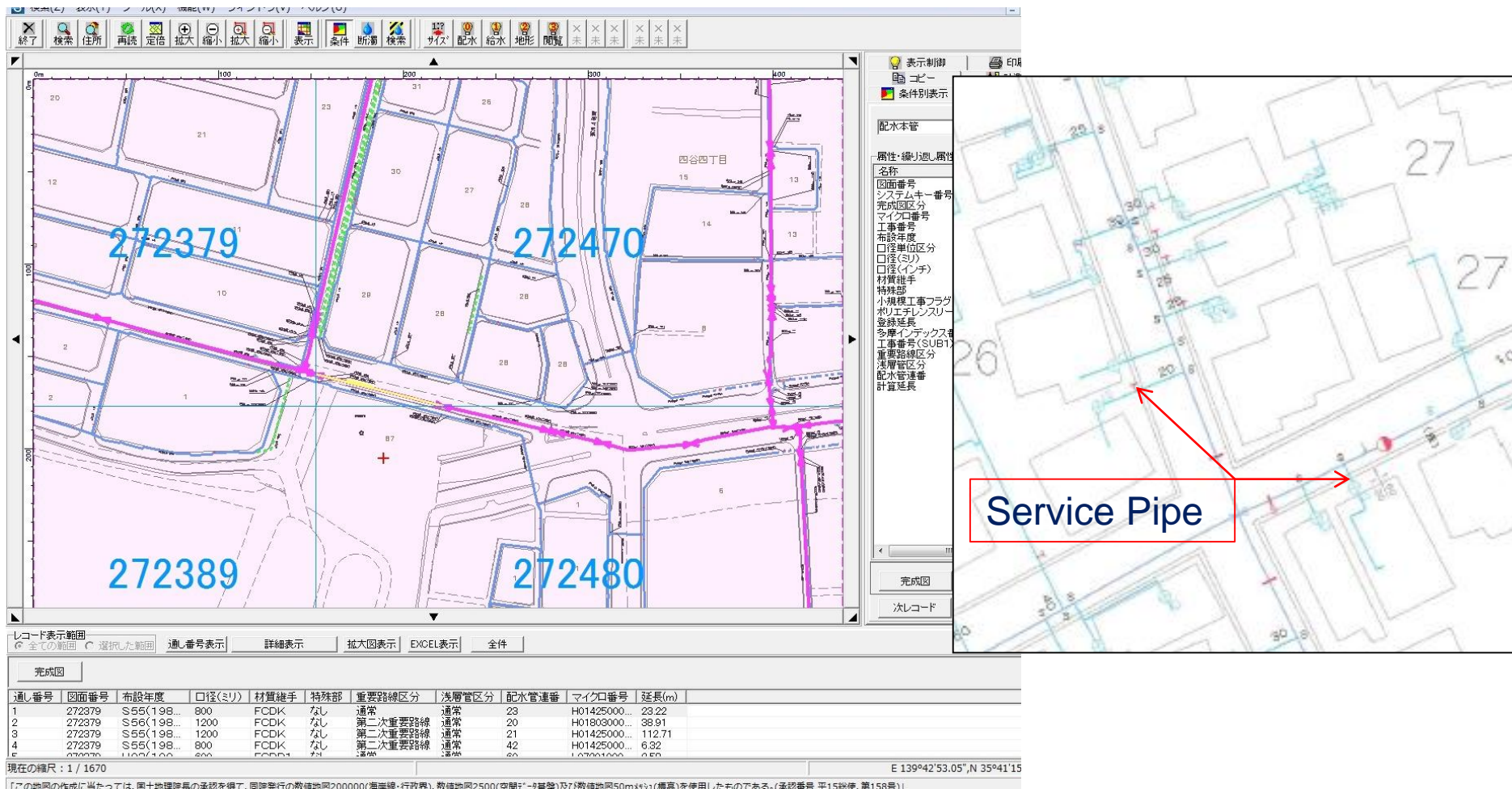
3.6.5 Technological Innovations (Water Quality Monitoring Unit)



3.6. Proper management & maintenance

3.6.6 Technological innovations (Pipeline information)

Tokyo Waterworks developed a GIS-supported pipeline information system in 1991.



3.6 Proper management & maintenance

3.6.7 Technological innovations (Pipeline Diagnosis)



Pipe Offset Measurement



Pipe & Soil Investigation

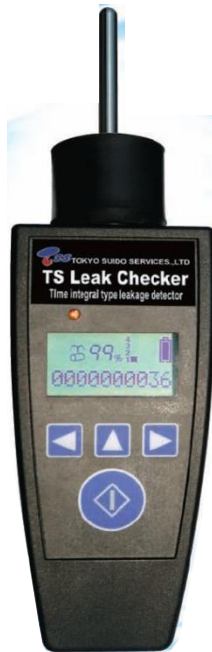
3.6 Proper management & maintenance

3.6.8 Technological innovations (Leak detection)

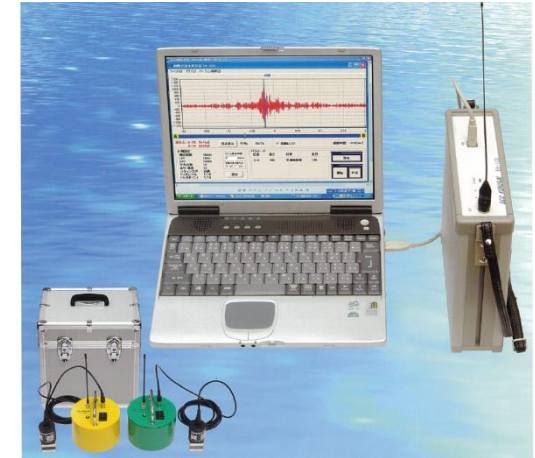
- Received the East Asia Regional Project Innovation Award of IWA in 2010.
- Detect the possibility of leak within 3 seconds even on PVC pipes.



TS Leak Checker



Electronic Leak Detector



Correlation Leak Locator



Helium Gas Type Leak Detector

3.6. Proper management & maintenance

3.6.9 Technological innovations (Water Supply Equipment)

Water faucet with saddle



3.6 Proper management & maintenance

3.6.10 Efficient management (Capacity Building)



Jointing Large-Diameter Distribution Pipes



Emergency Remedy of Leakage



Leak Prevention Training

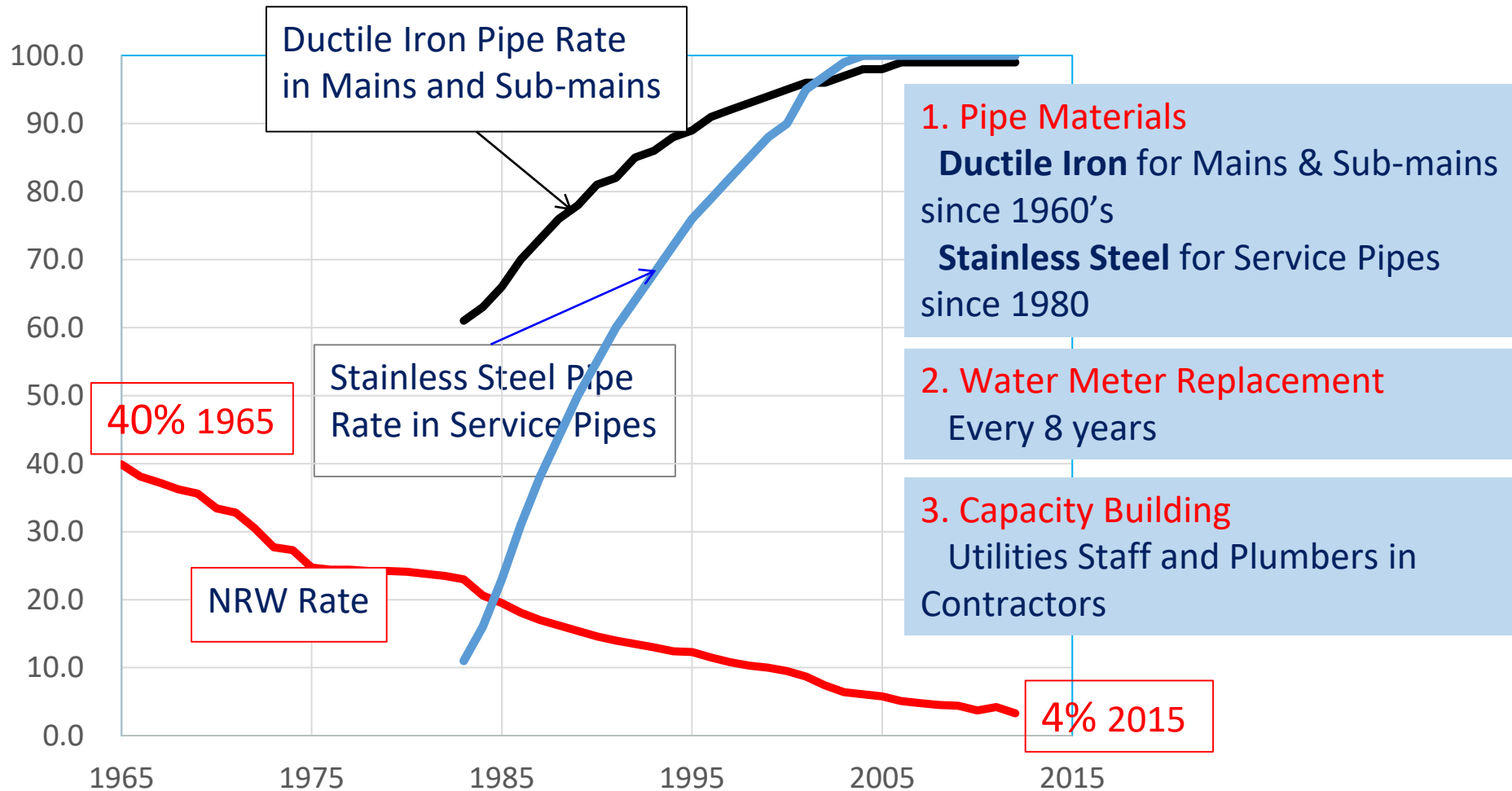


Lecture

4. Result of NRW reduction measures

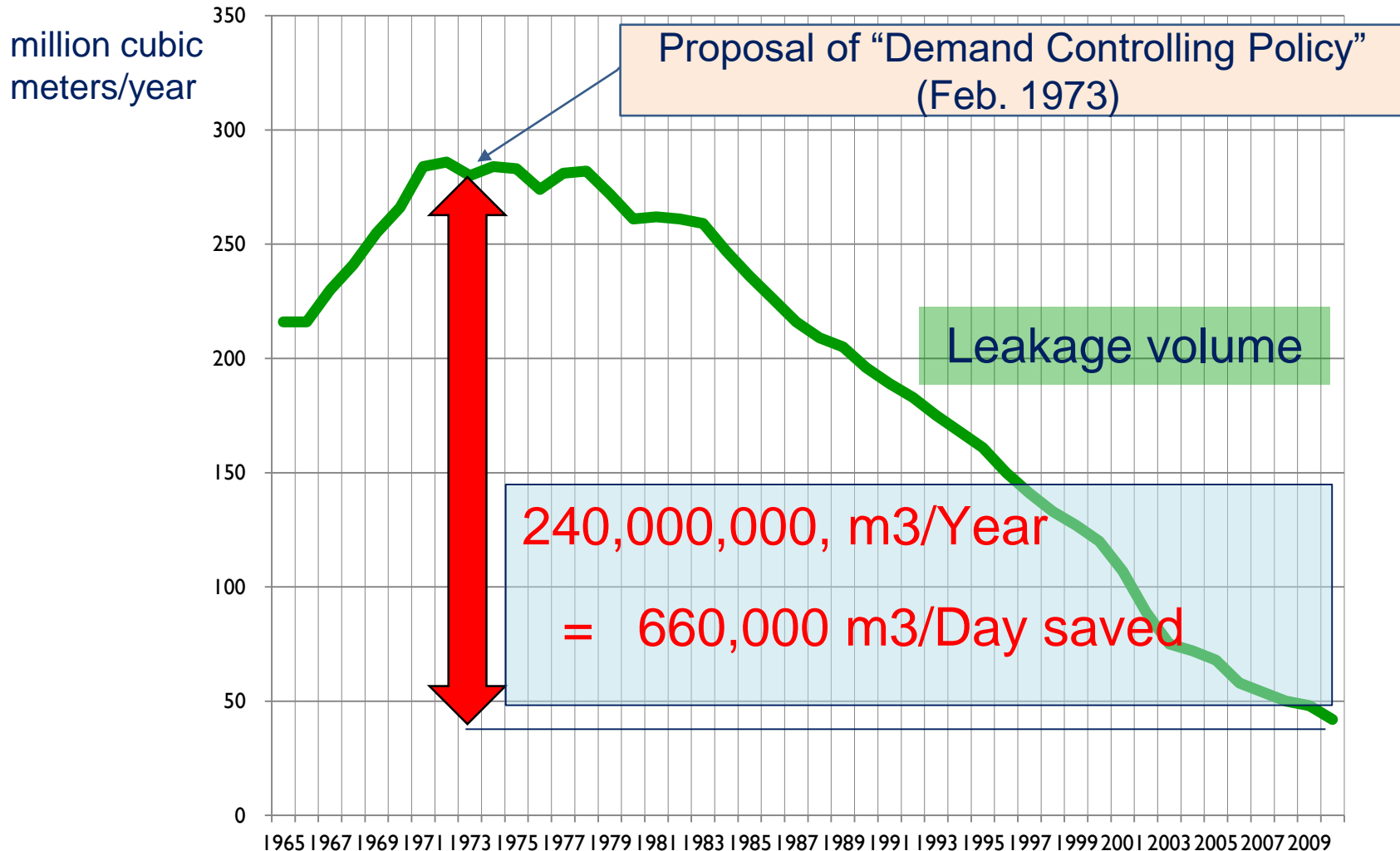
4. Result of NRW reduction measures

4.1 Comparison of NRW and Pipe Replacements



4. Result of NRW reduction measures

4.2 Saving Leakage Volume



5. Fruits of our efforts

Excellent Water Supply

*Steady supply
under adequate
water pressure*

*Safe and
high-quality
water*



6. Efficient Water Supply Operation Management

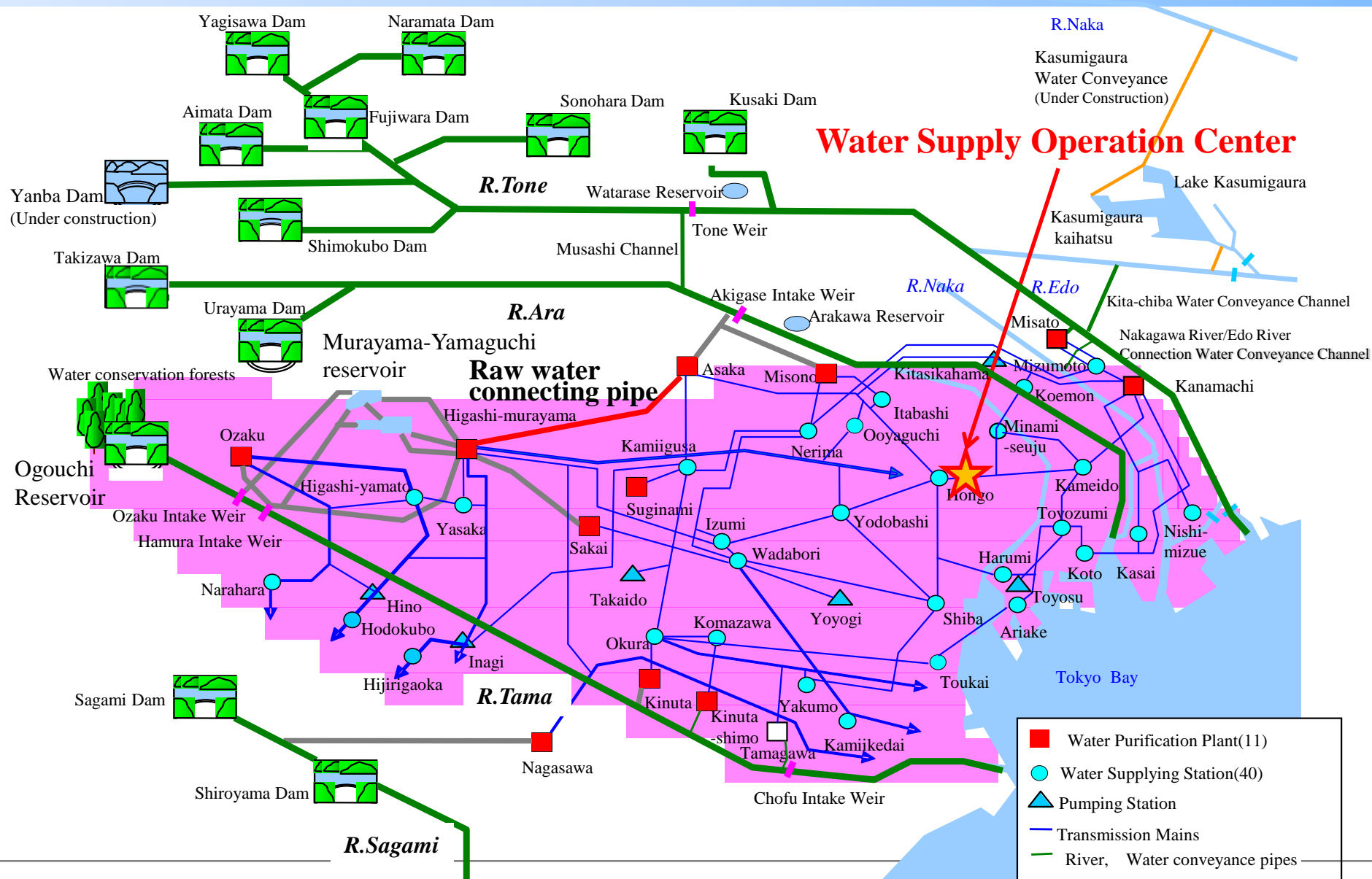
6.1 Water Supply Operation Center



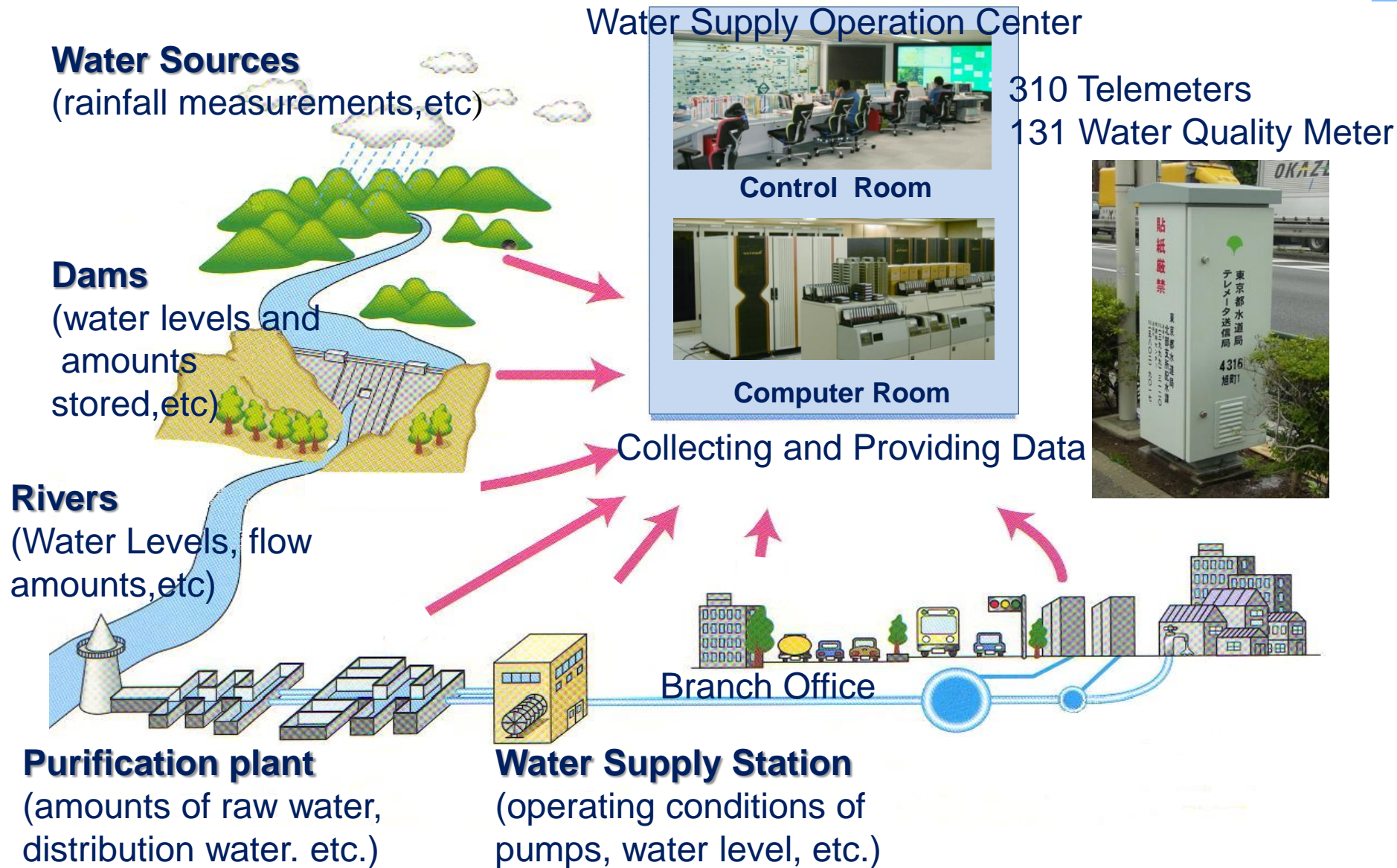
Established in 1979

- Water Supply Operation System consists of host to meticulously operate the pumps of each facility computers and communication equipment.
- The system allows the center in accordance with demand fluctuations through monitoring data from the whole service areas.

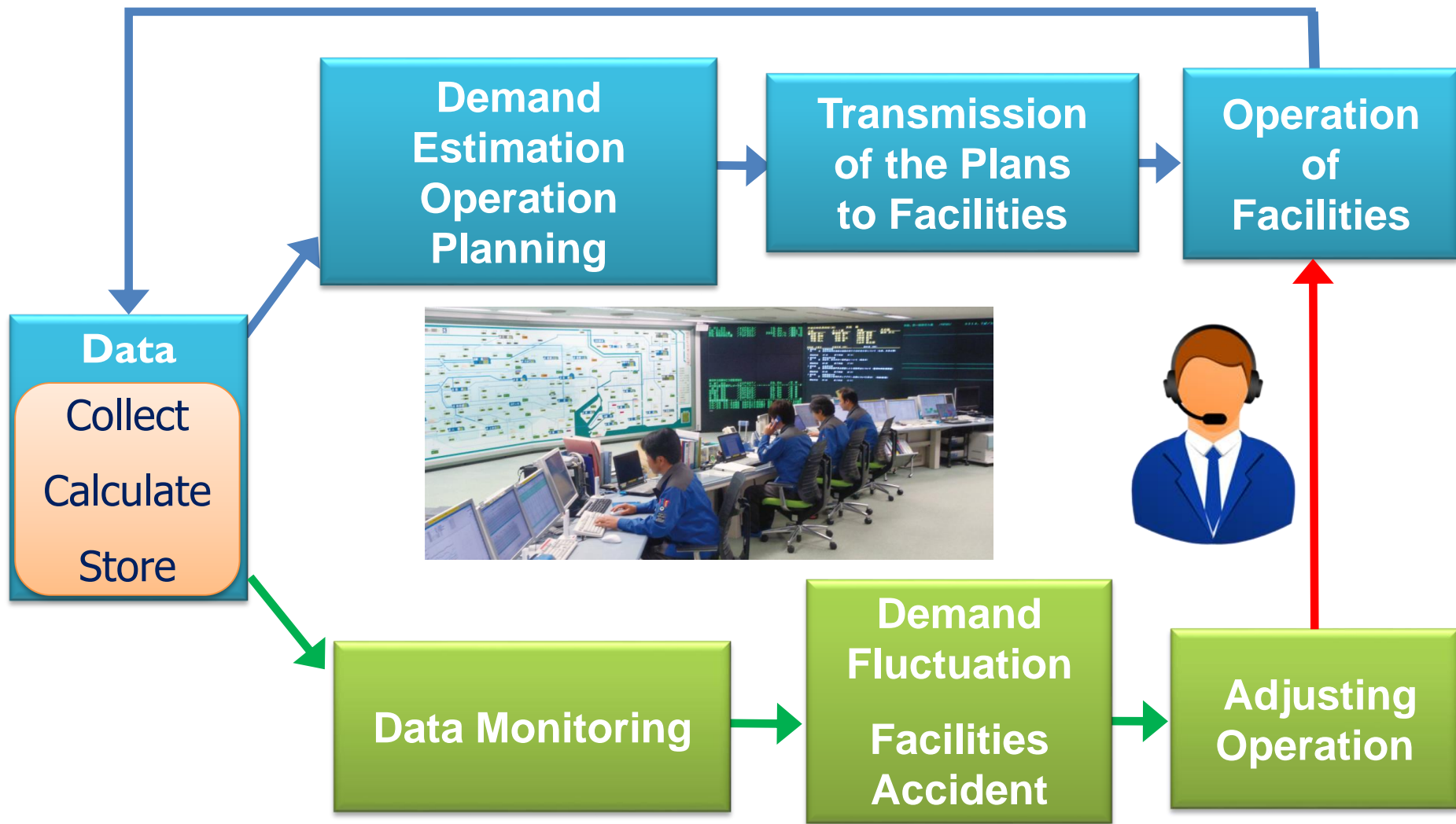
6.2 Water Supply Network in Tokyo



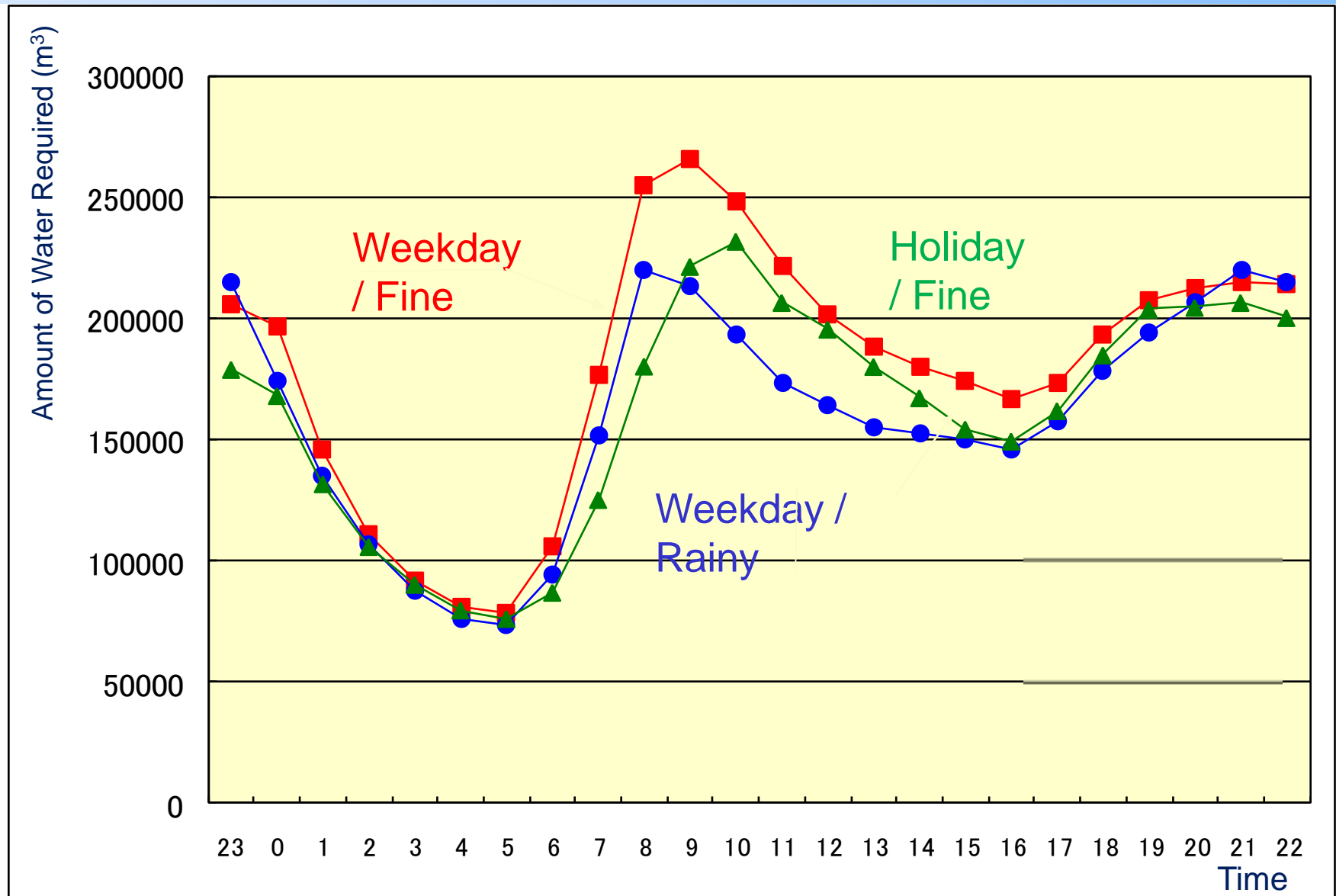
6.3 Water Supply Operation Center



6.4 Data Accumulation and Water System Monitoring



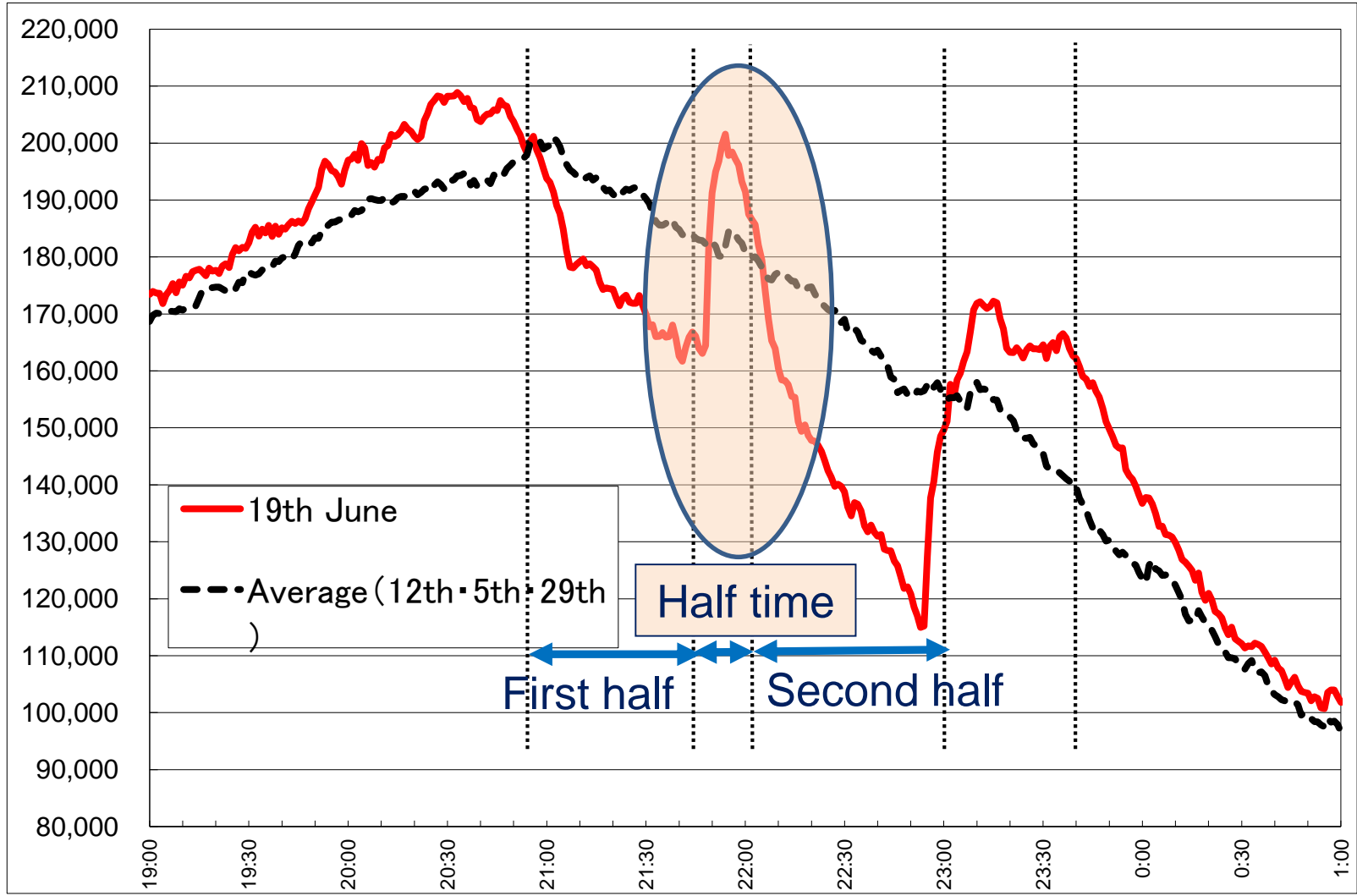
6.5 Shifts in Daily Water Requirements



6.6 Water Demand Fluctuation on FIFA World Cup Russia

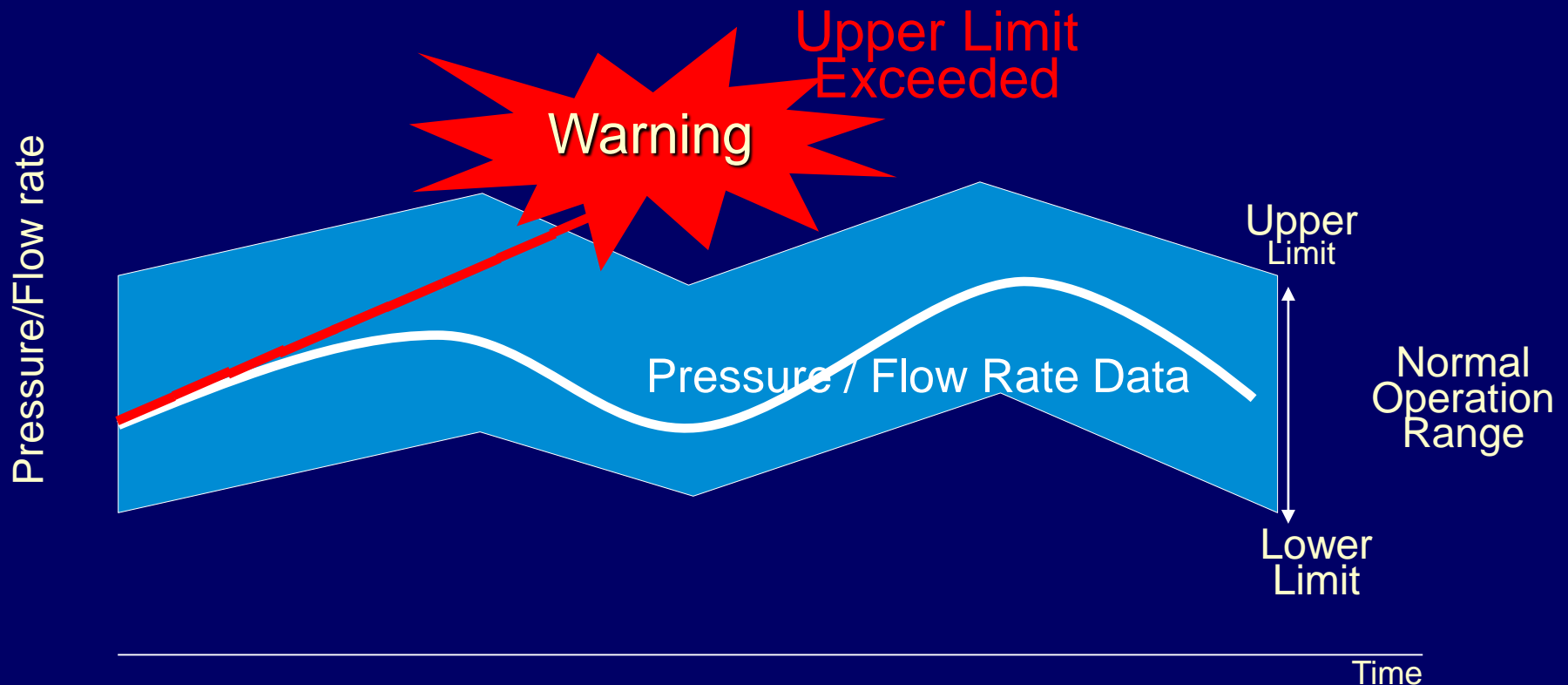
(Japan VS Columbia, on Tuesday, 19th June, 2018)

m3/hour



Time

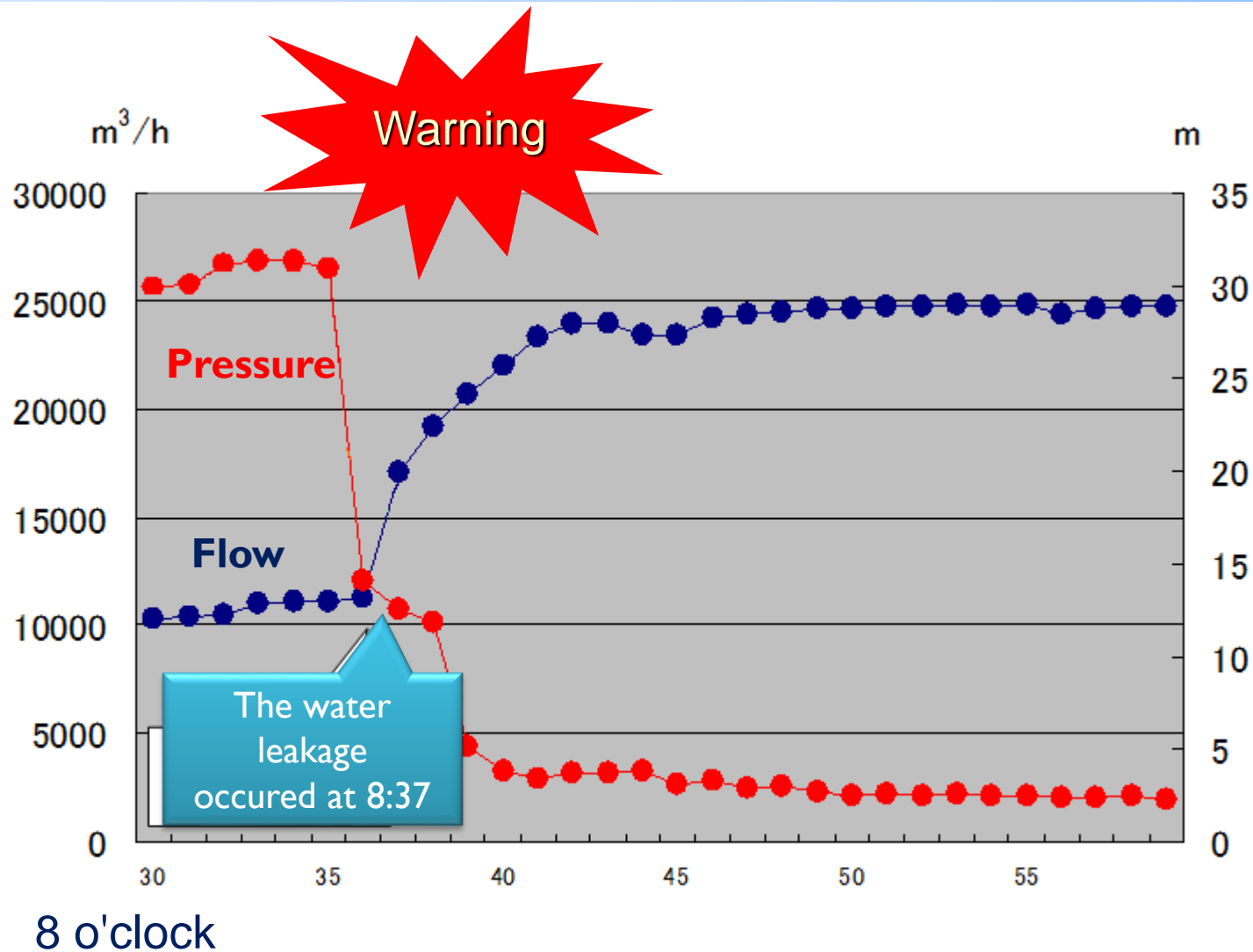
6.7 Abnormal Data Detection System (1/2)



If the upper or lower limits defined are exceeded, a warning is issued.

※ When an alarm sounds, the condition is displayed on the multiscreen.

6.8 6.7 Abnormal Data Detection System (2/2)



8 o'clock

6.9 Example of Pipe Burst (1/2)

金町、3配系寺島線流量	20F300	24000.0	0m ³	h	管	常
八里八里	20F306	7100.0	0m ³	h	管	常
八里八里	29F300	7000.0	0m ³	h	管	常
八里八里	29F317	7075.0	0m ³	h	管	常
八里八里	29F331	-2385.0	0m ³	h	管	常
八里八里	29F331	15.6	m		管	常
八里八里	29F331	19.7	m		管	常
八里八里	29F331	18.0	m		管	常
八里八里	29F331	13.0	m		管	常
八里八里	29F331	14.0	m		管	常
八里八里	29F331	11.3	m		管	常
八里八里	29F331	9.1	m		管	常



Φ1500 Cast Iron Pipe



Arakawa River

Collapse resulting from the leak.

山草庵2	08/2
井馬周袋	08/2
松馬池	08/2
西	08/2
双葉町	08/2

6.10 Example of Pipe Burst (2/2)

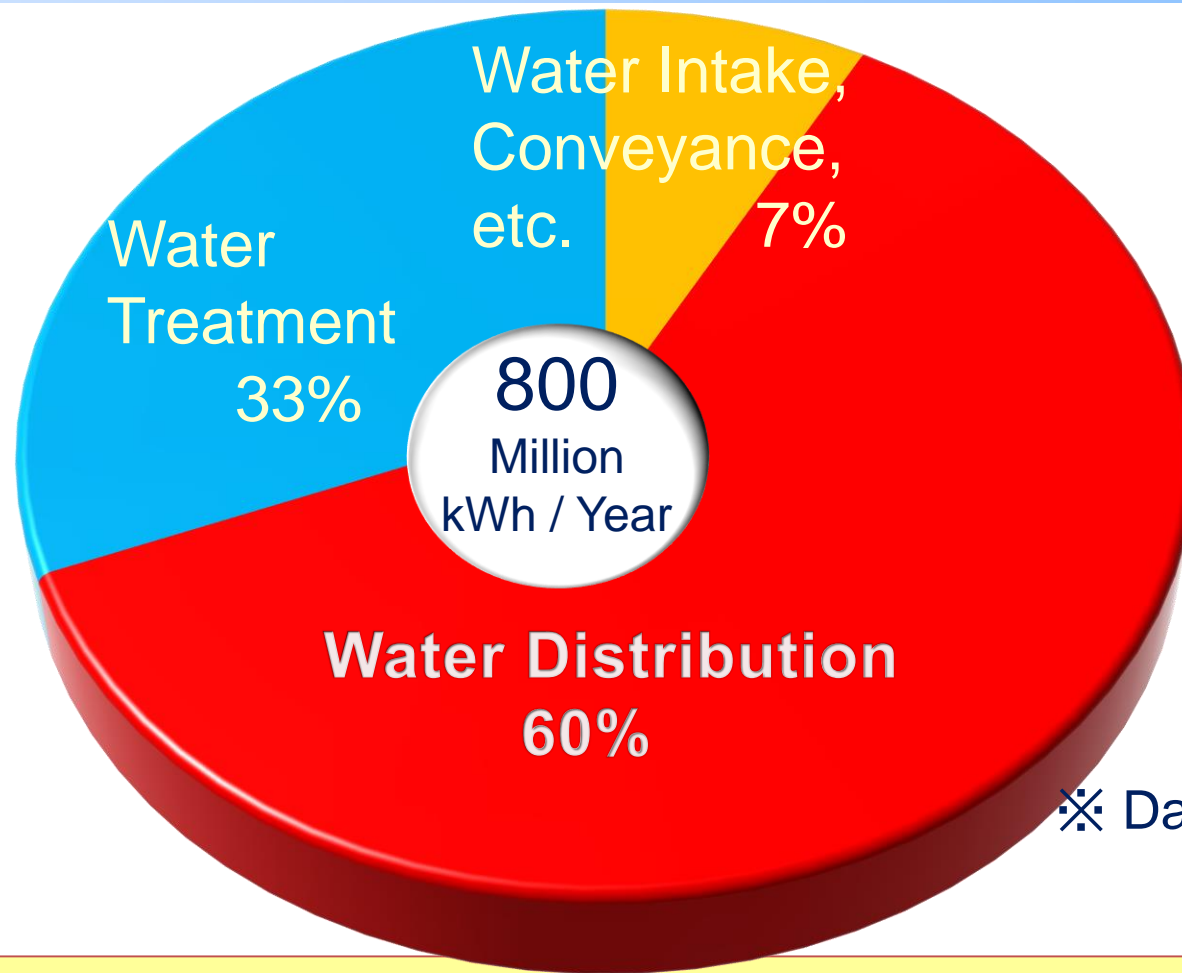
Aging Pipe ($\Phi 500$) Burst (2005)



6.11 Great East Japan Earthquake on 11 March, 2011



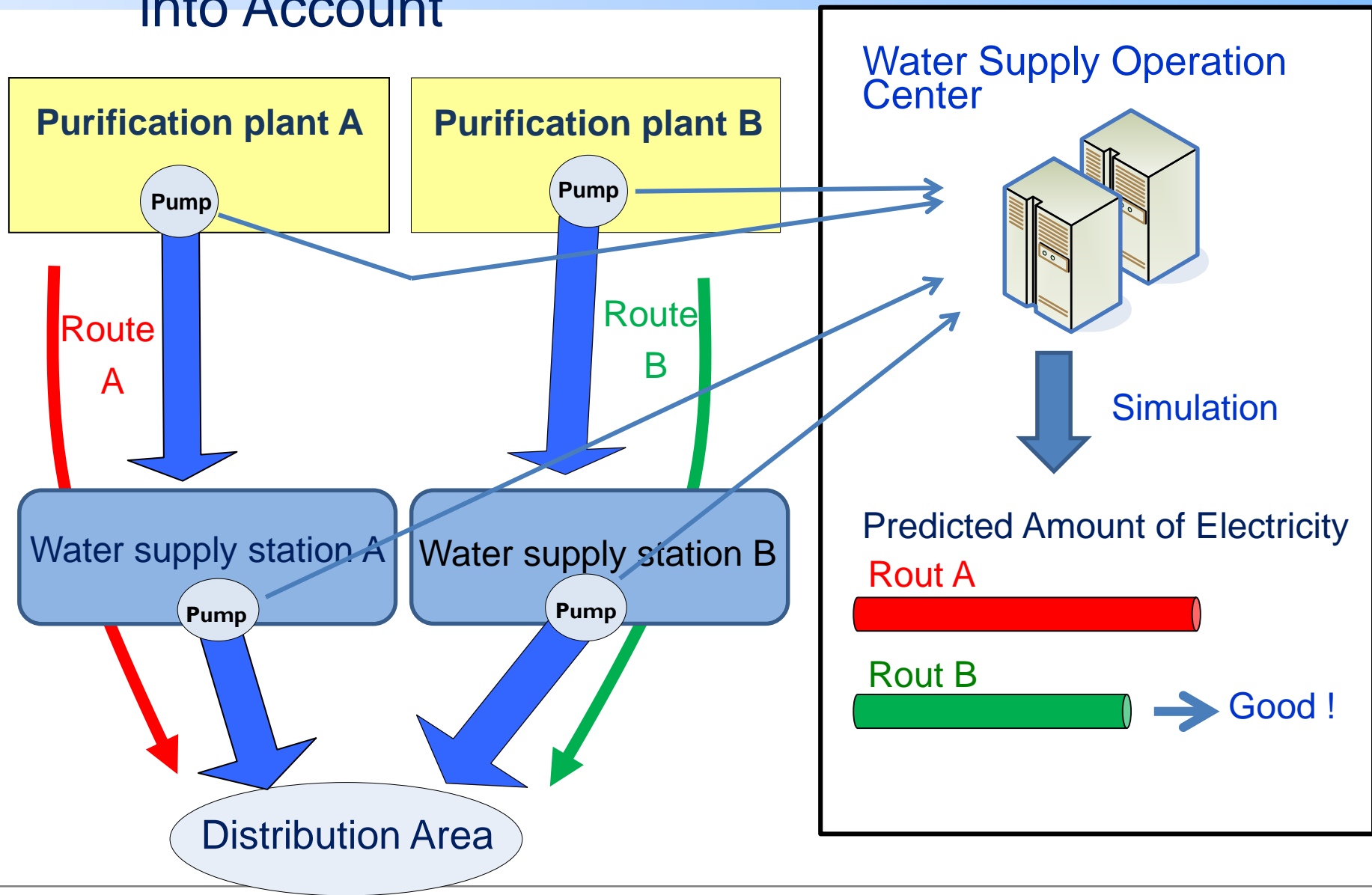
6.12 Waterworks Bureau Electricity Consumption



※ Data from 2014

800 million kWh per year is comparable to
1% of Tokyo's total electricity consumption.

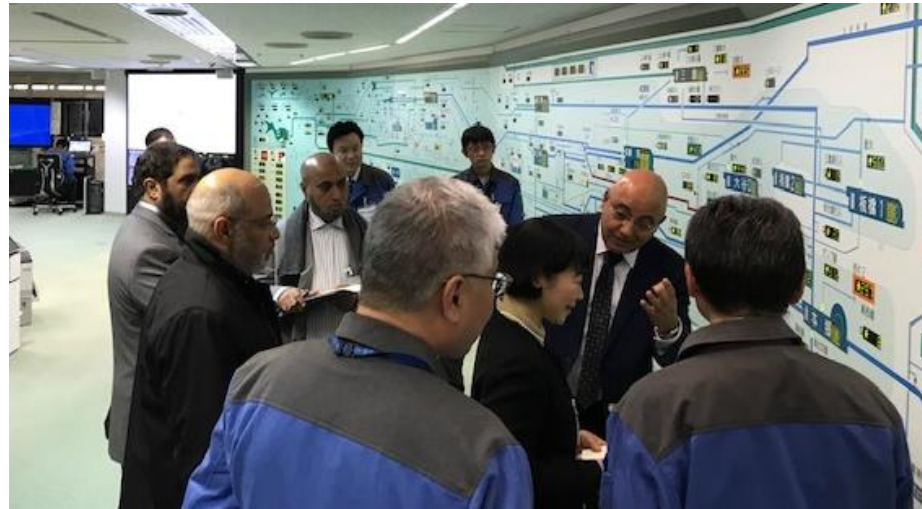
6.13 Operation that take energy Consumption into Account



6.14 Backup Center (Control Room)



An official visit by SWCC members on 5th February, 2019



***Provide safe and
secure water to the world***



Thank you for your attention