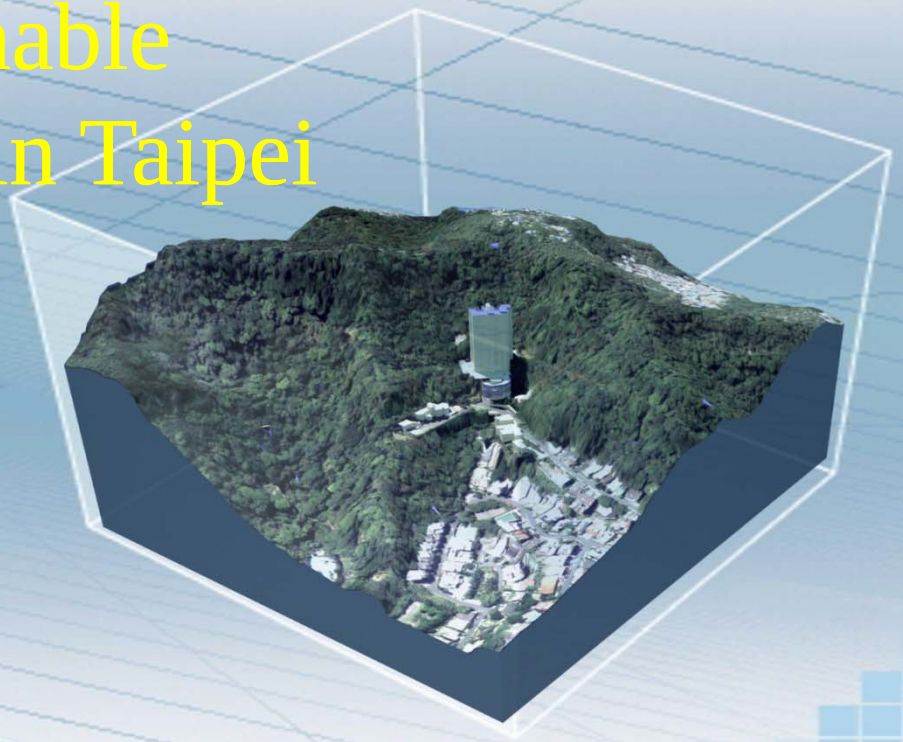
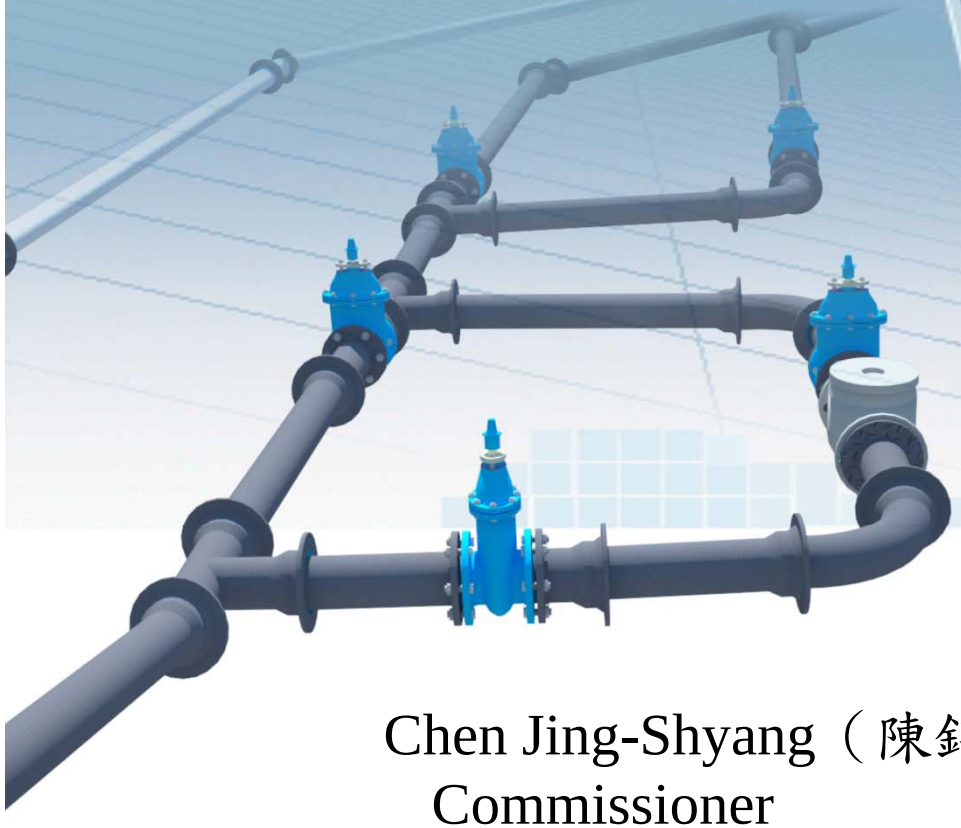
Safe & Sustainable Water Supply in Taipei



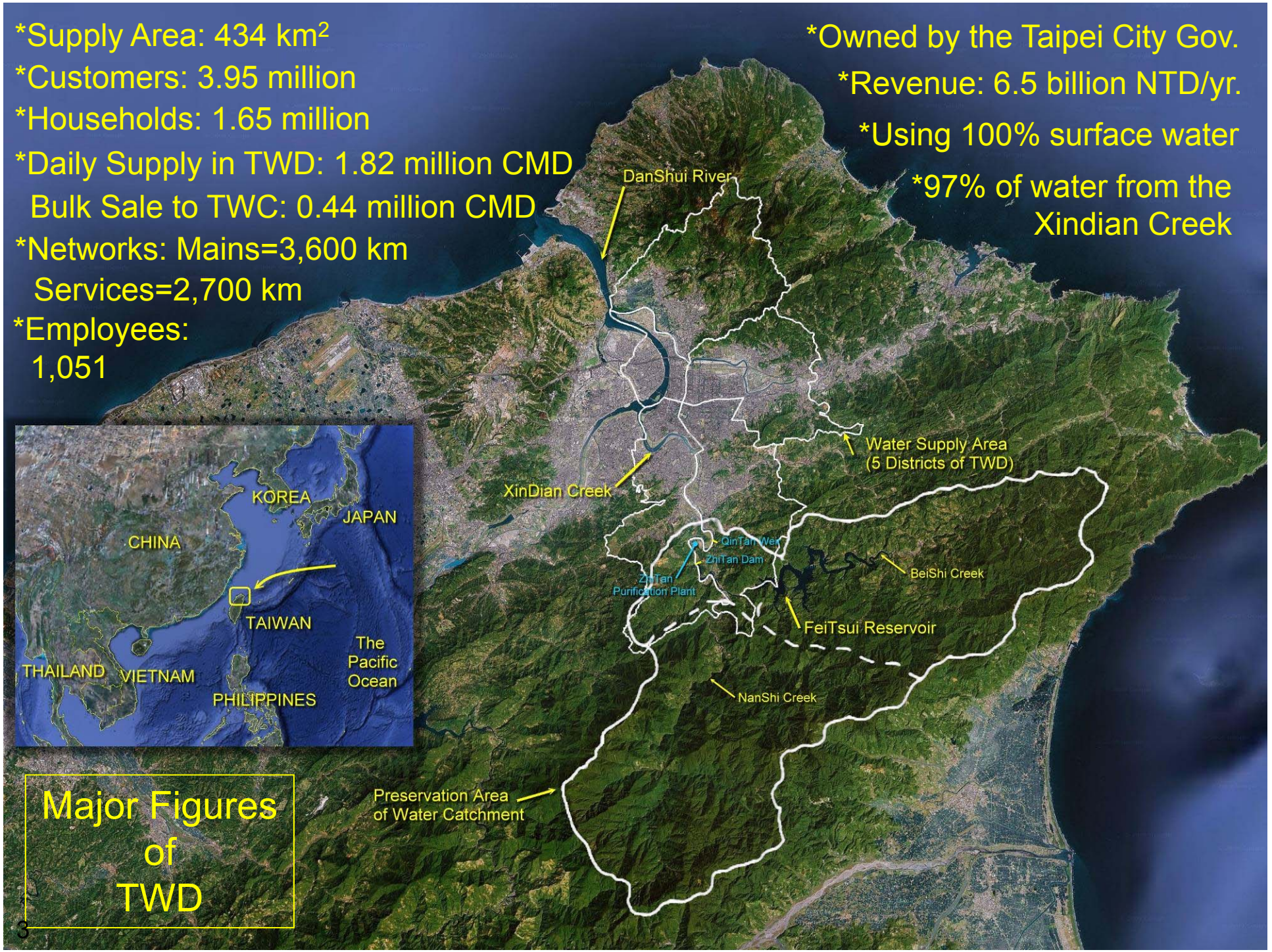


Chen Jing-Shyang（陳錦祥）
Commissioner

2018/8/31

臺北自來水事業處
TAIPEI WATER DEPARTMENT

Outlines

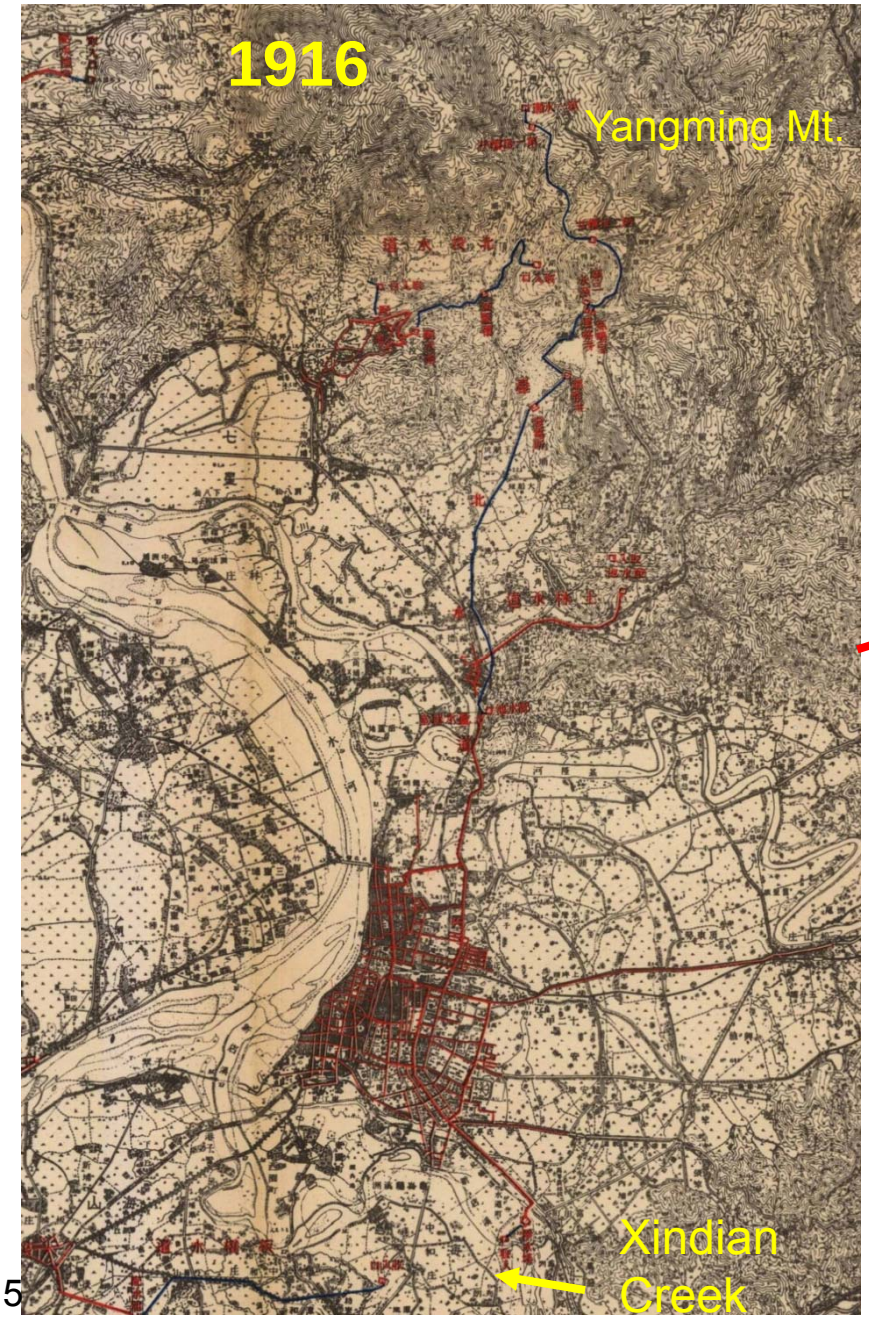

*Supply Area: 434 km²
*Customers: 3.95 million
*Households: 1.65 million
*Daily Supply in TWD: 1.82 million CMD
Bulk Sale to TWC: 0.44 million CMD
*Networks: Mains=3,600 km
Services=2,700 km
*Employees:
1,051
*Owned by the Taipei City Gov.
*Revenue: 6.5 billion NTD/yr.
*Using 100% surface water
*97% of water from the Xindian Creek
DanShui River
XinDian Creek
Water Supply Area
(5 Districts of TWD)
QinTan Weir
ZhiTan Dam
ZhiTan
Purification Plant
BeiShi Creek
FeiTsui Reservoir
NanShi Creek
Preservation Area
of Water Catchment
KOREA
JAPAN
CHINA
TAIWAN
The
Pacific
Ocean
THAILAND
VIETNAM
PHILIPPINES
Major Figures
of
TWD

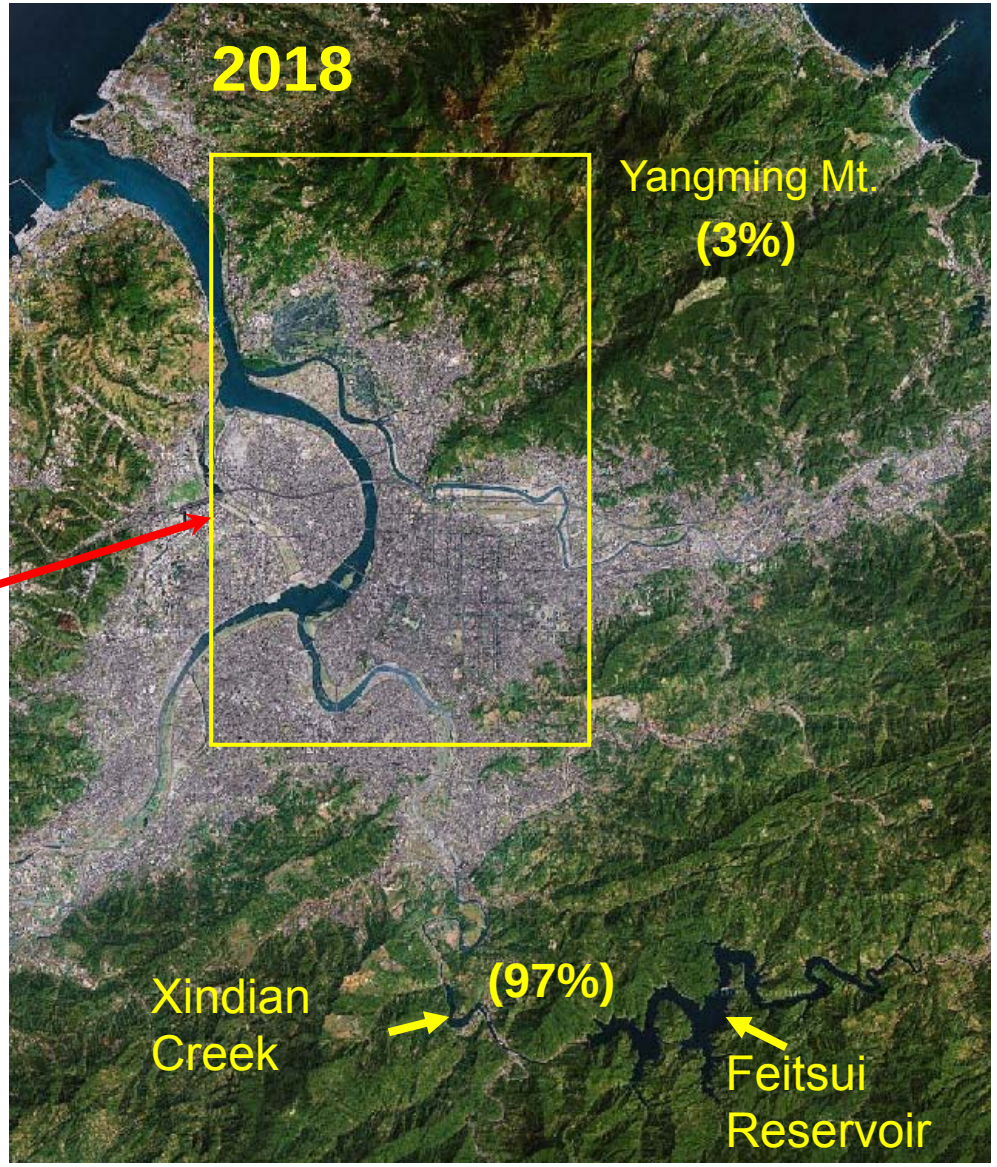
Challenges

Limited water resource

Only one main water source for a century

面對挑戰



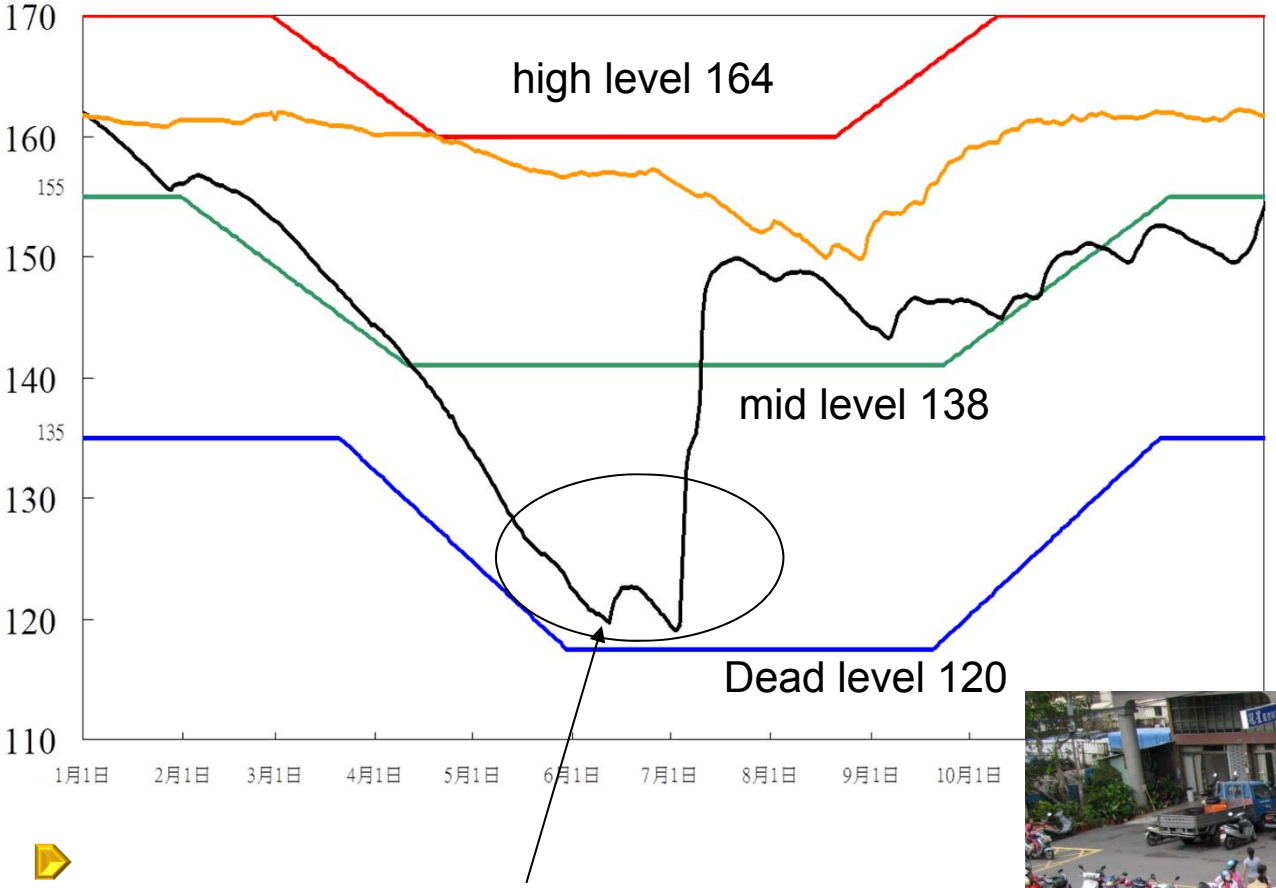


Drought

Year 2002 insufficient rainfall in Q1 & Q2

water level (m)

Feitsui Reservoir



Worse nightmare came true:

Water rationing for 2 months

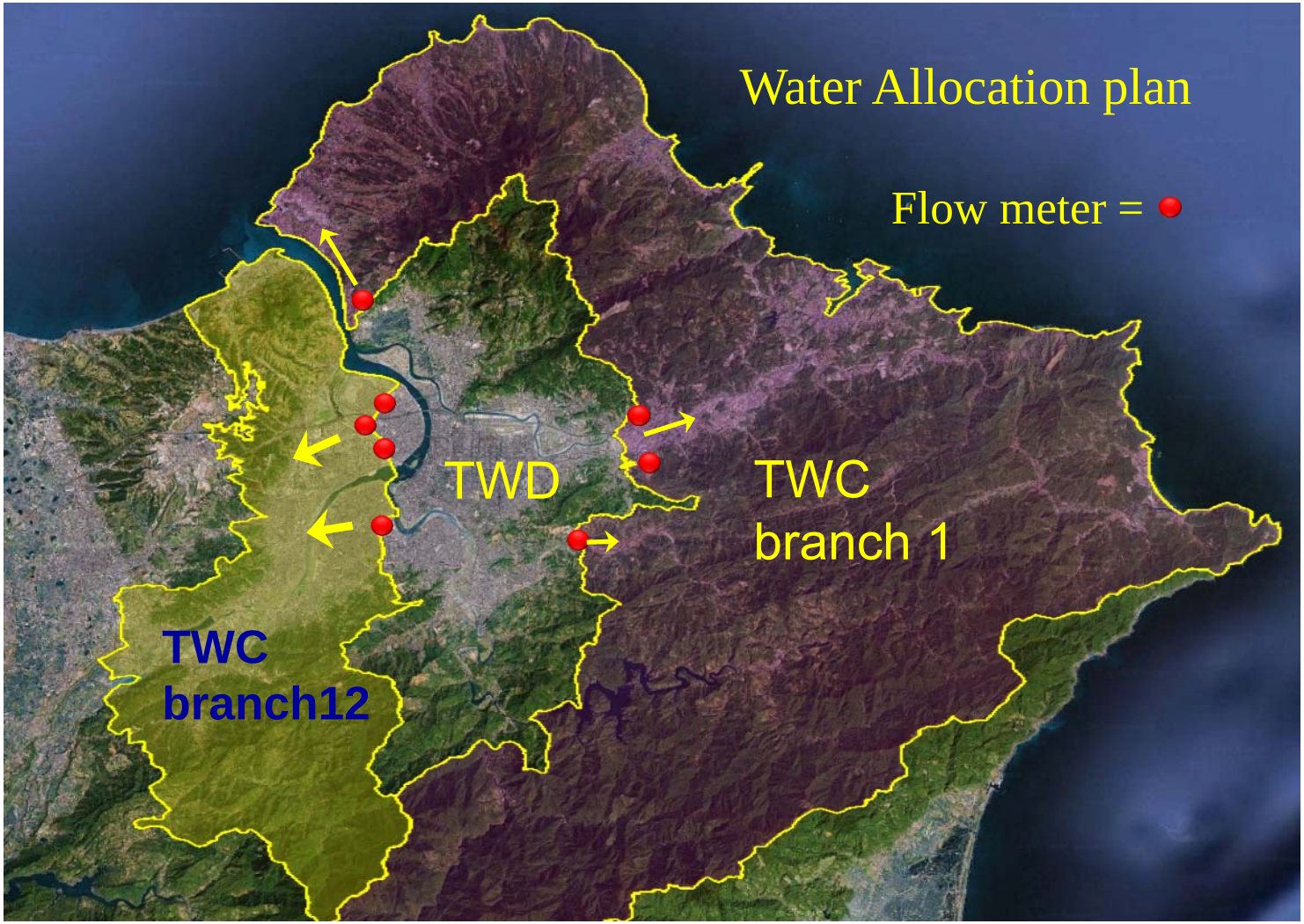
Northern Taiwan Water Allocation

According to the allocation plan of central government, TWD sharing water with TWC

Maximum volume sharing to TWC

Phase 1：
2004, 530 kCMD

Phase 2：
2015, 720 kCMD
2018, 1005 kCMD



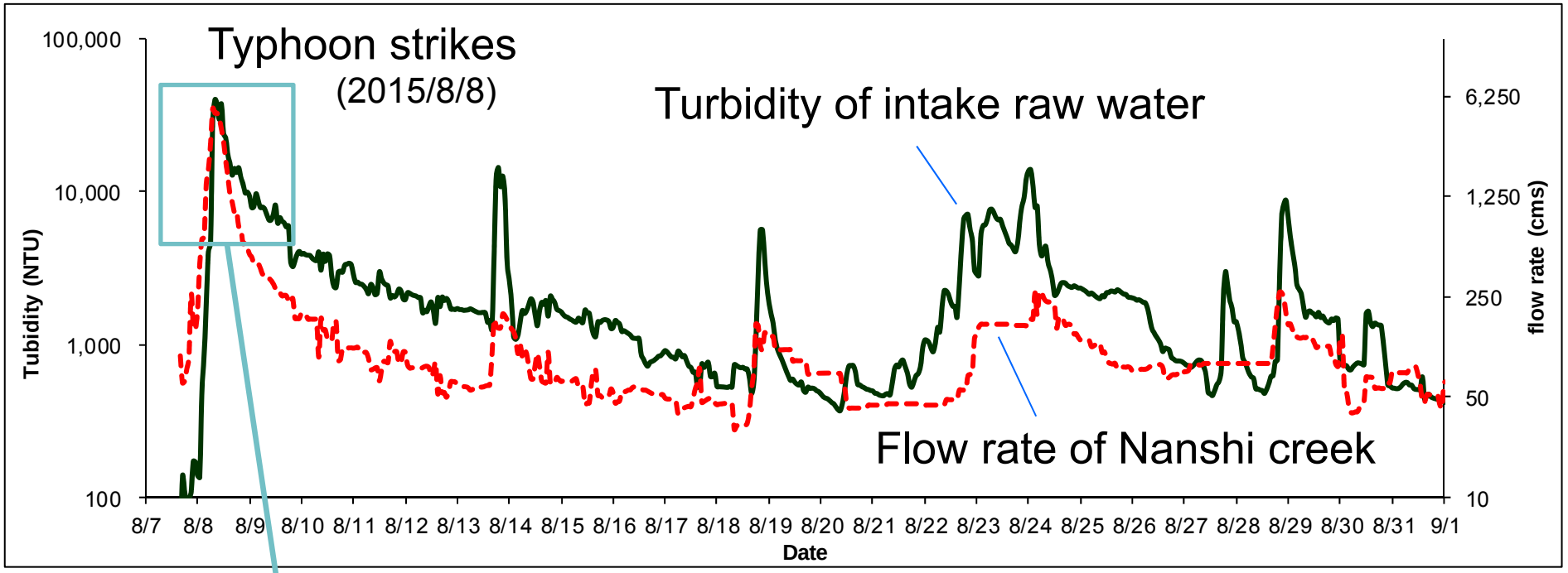
Heavy rain from typhoons Taking its toll on fragile water supply sys

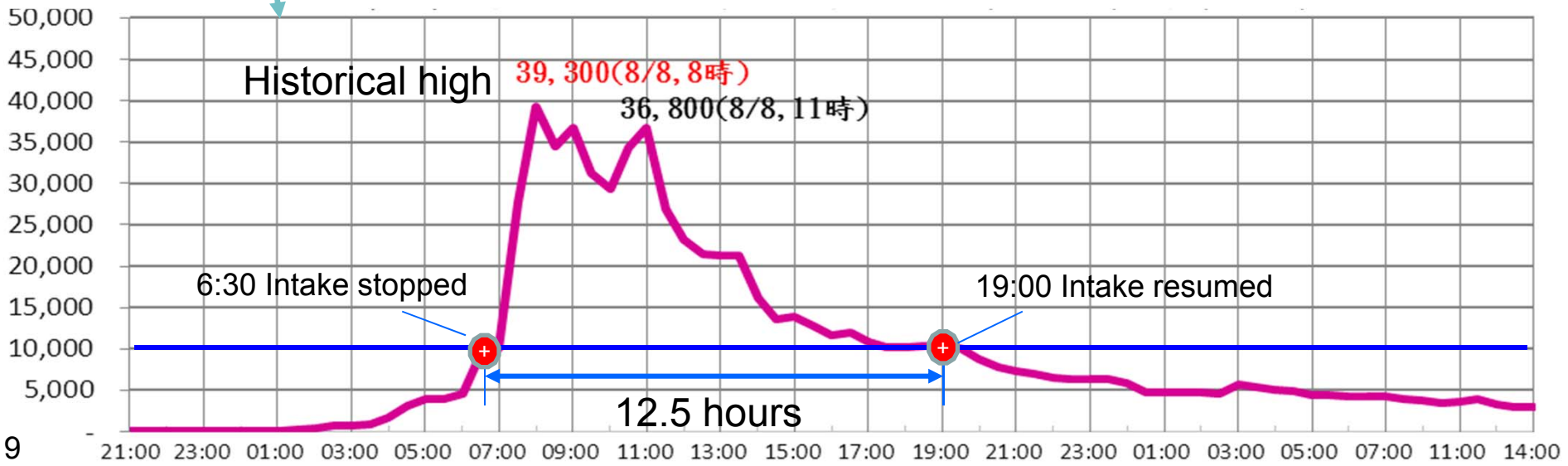
high intensity rainfall in a short period of time

Turbidity soaring

a turbidity surge beyond treatment

面對挑戰



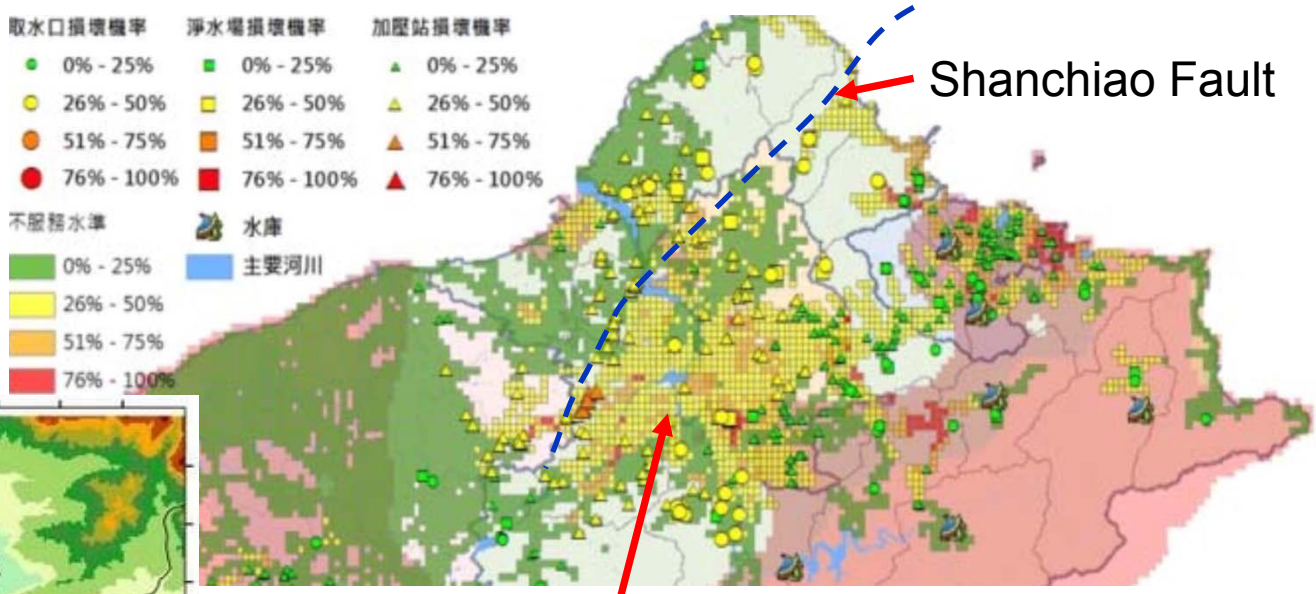


Earthquakes

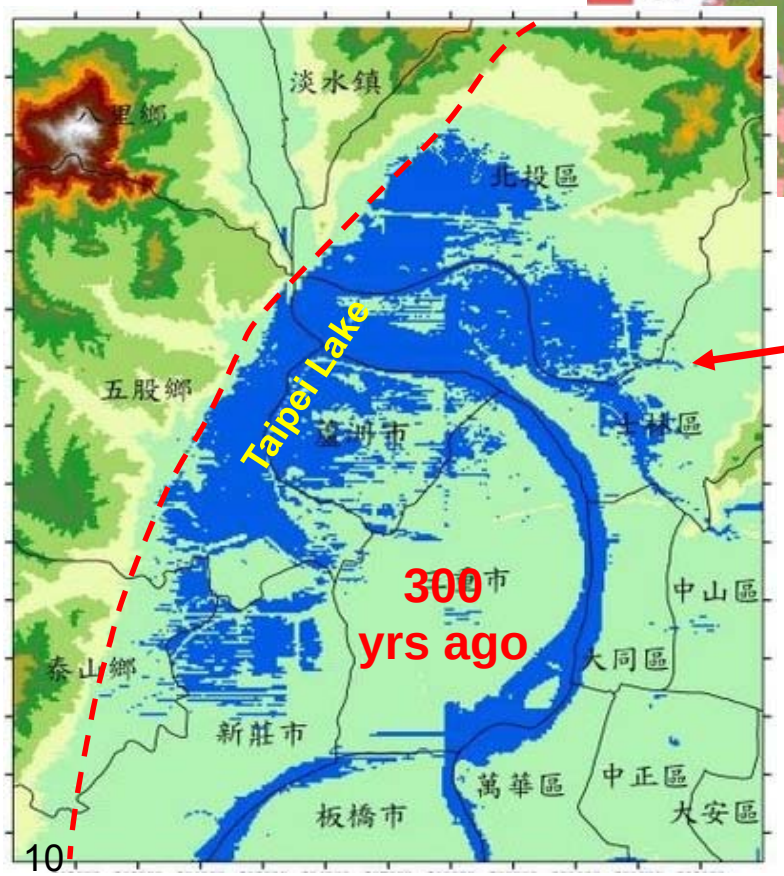
Taipei basin has soft soils & an active fault

面對挑戰

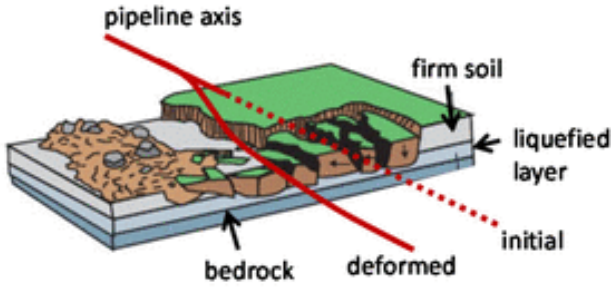
Shanchiao Fault may create a large-scale earthquake up to M 7.0 in the Taipei area



Water supply outage concentrating in the basin



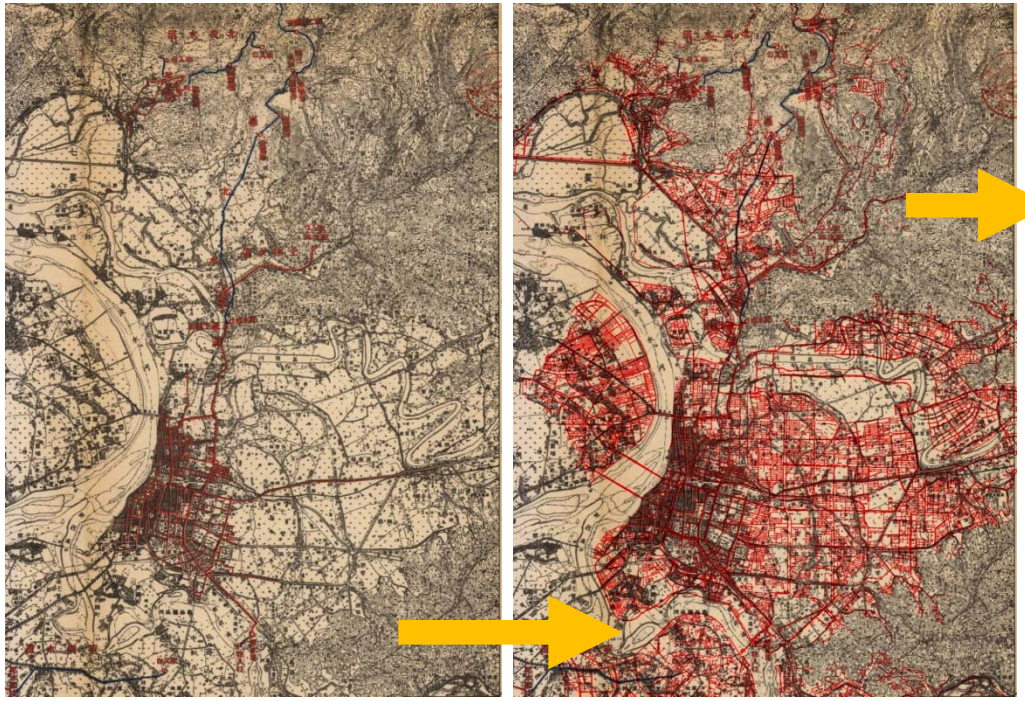
Soft soil may intensify the earthquake motion & result in soil liquefaction



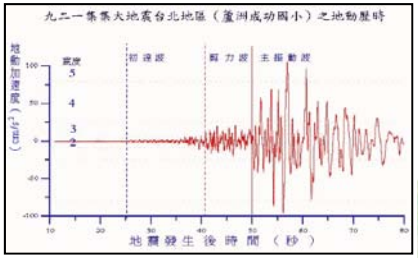
Measures

Severe leakage

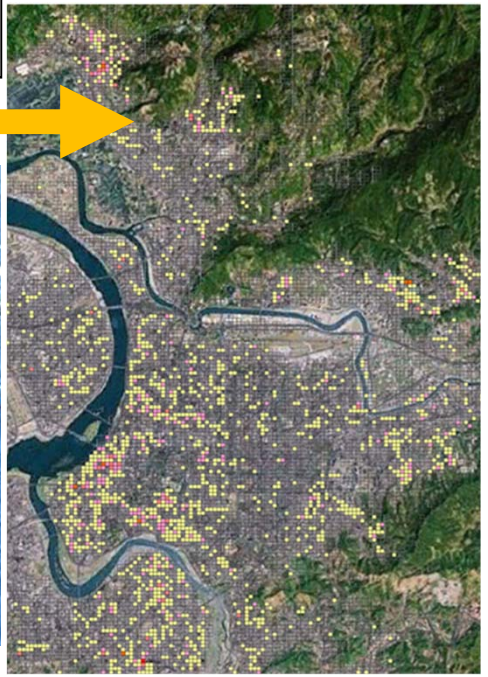
Invested all the money into expansion of system for water supply, leakage control was never a consideration in the past.



Expansion period (1910-1990)



Earthquakes



Leaks in 2003-2006

Lack of replacement resulted in Taipei's heavy leakage

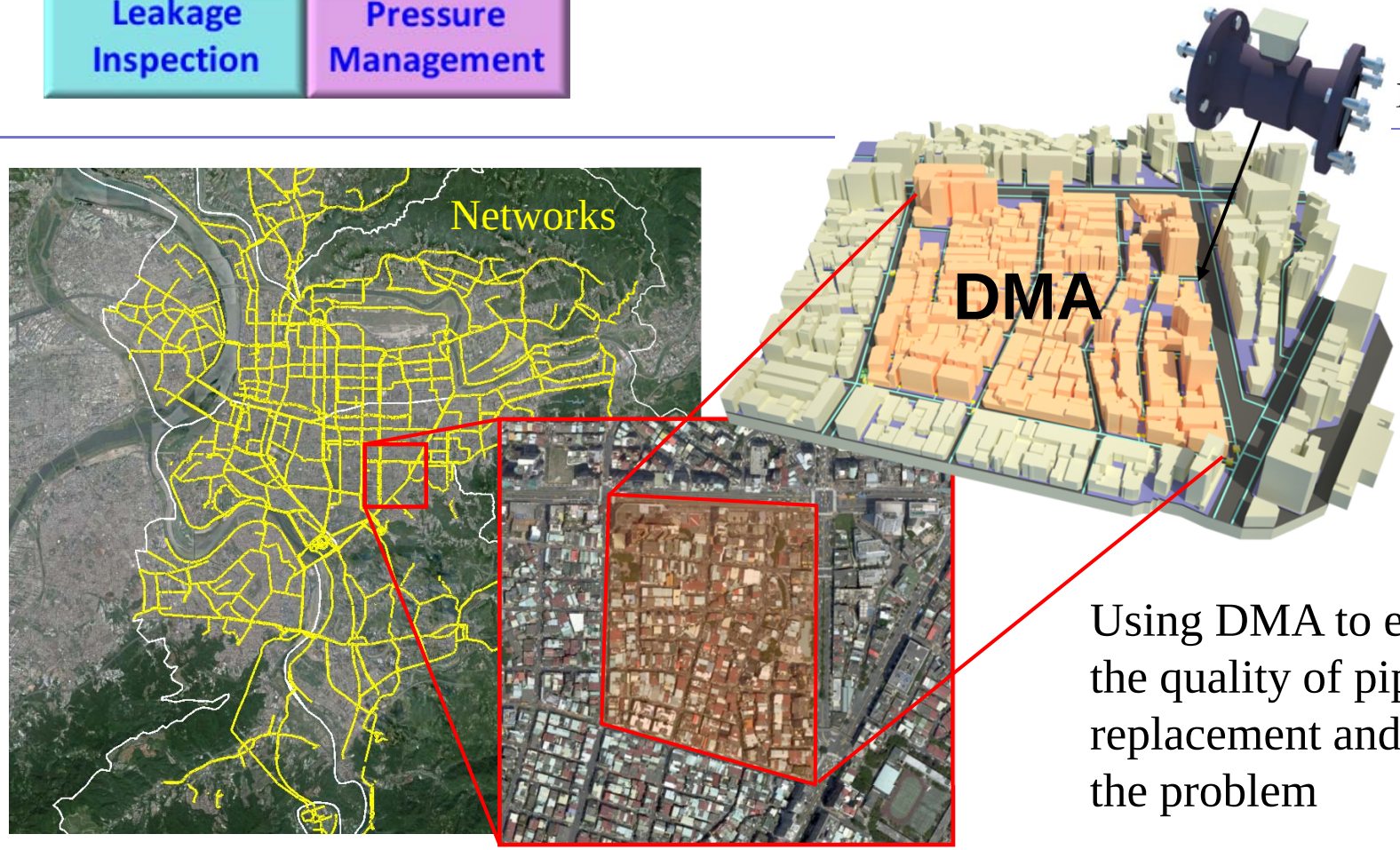
Leakage Control

Implementing a 20-yr long term project (since 2006)

現有措施

With multi-pronged approach：

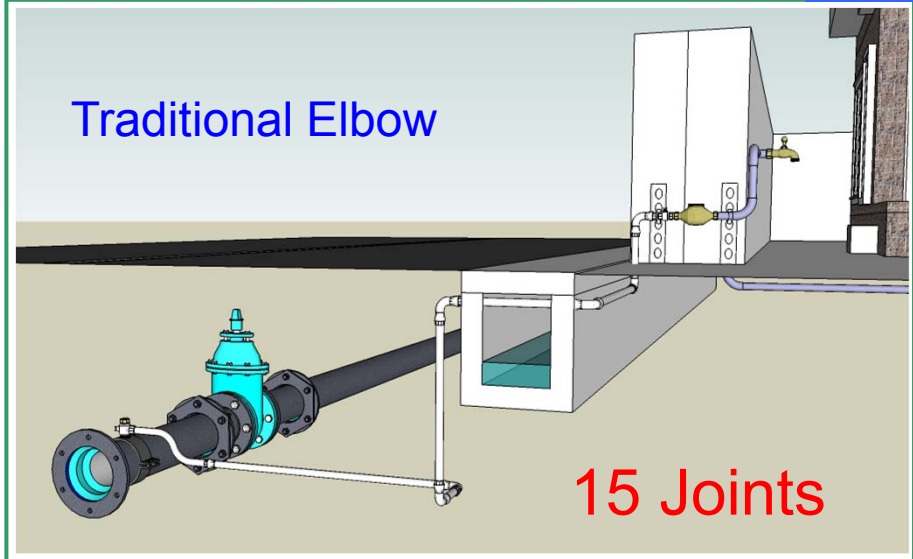
4 axes of leakage mgt.

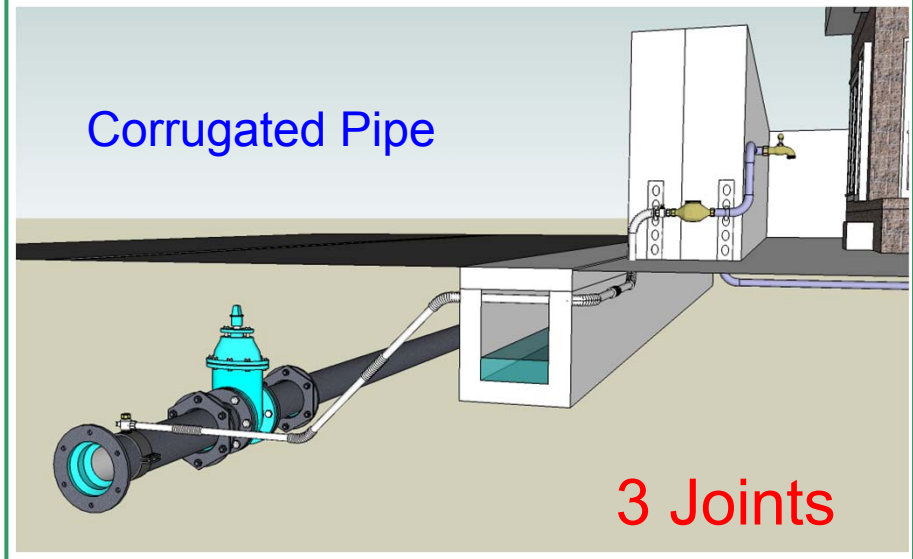


Using DMA to evaluate the quality of pipeline replacement and to fix the problem

Adopting High Quality Pipes -Service pipes

現有措施





Potential leaking probability reduce to 1/5

現有措施

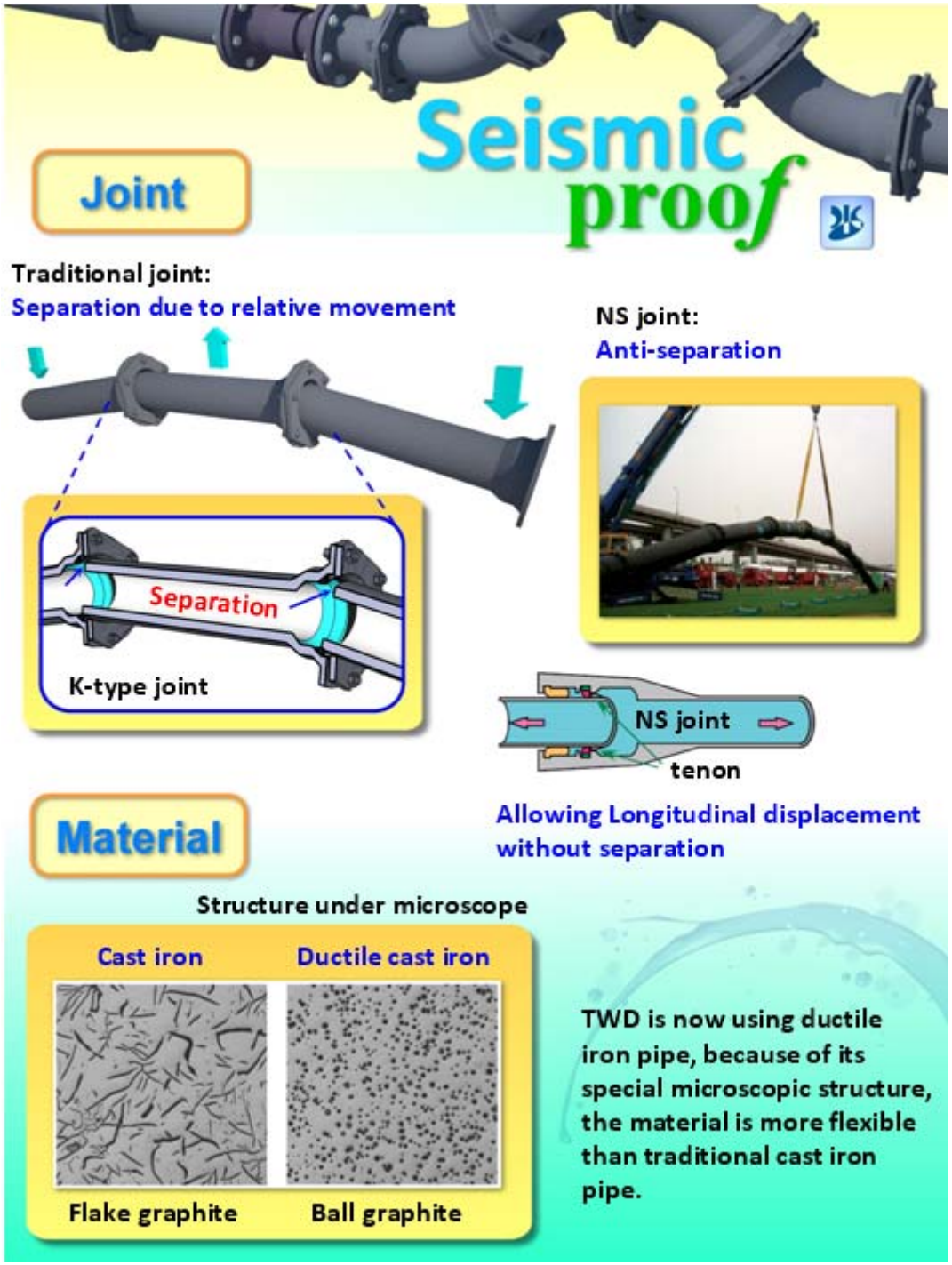
-Water mains

NS joint

(A pilot being implemented)

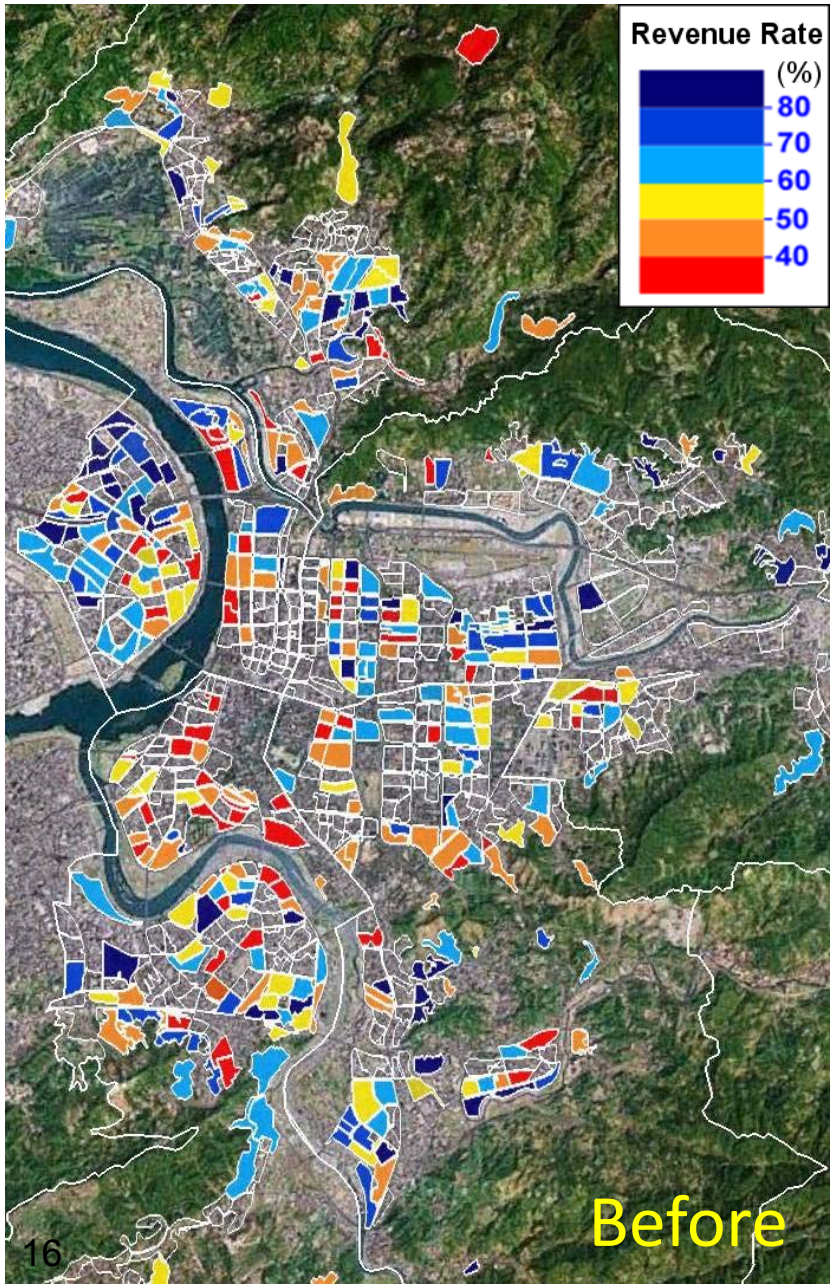
DIP

(Being use for 30yrs)



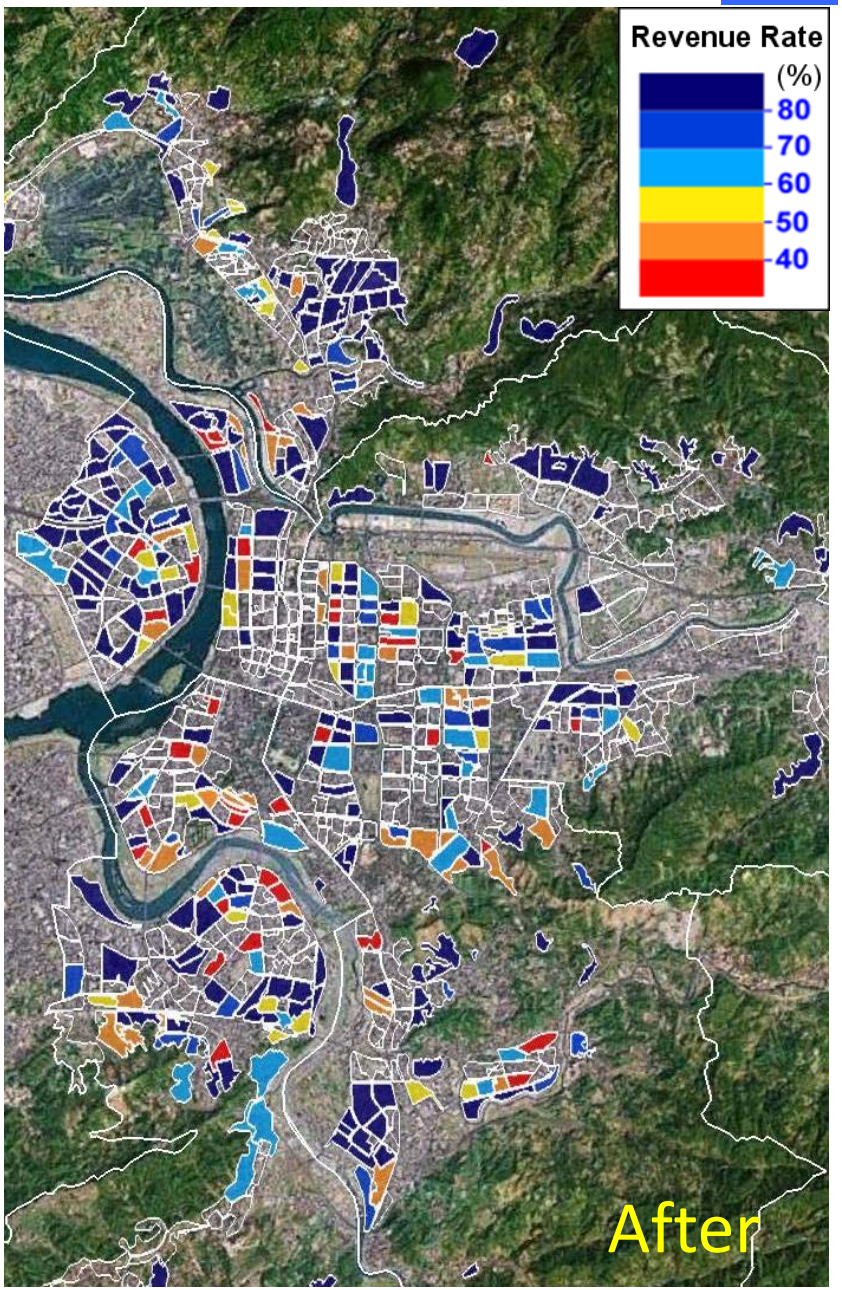
Revenue rate increased in DMAs

现有措施



305 DMAs'

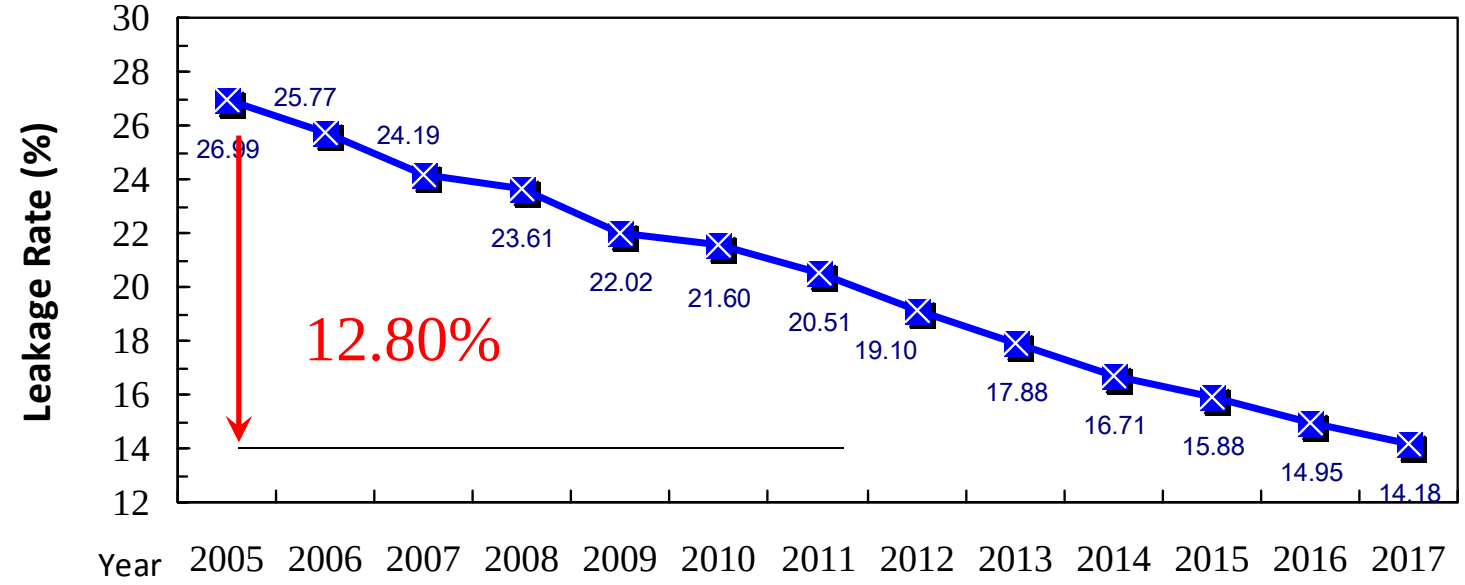
pipeline being replaced

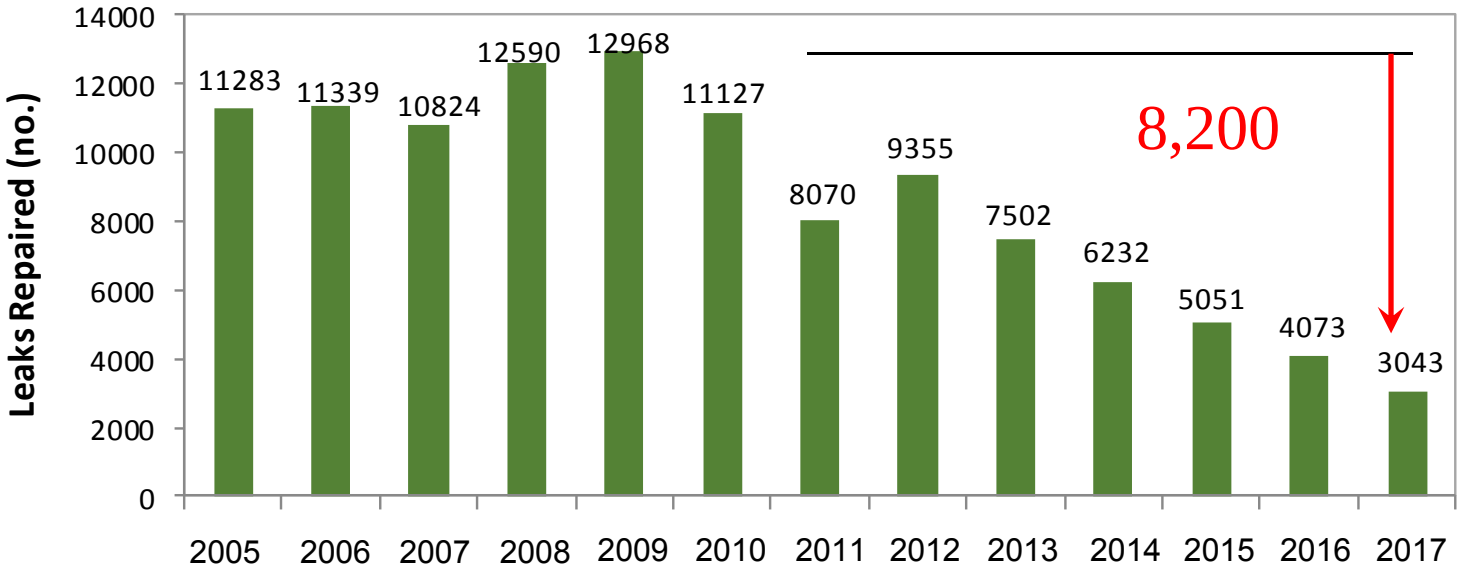


Leakage being reduced

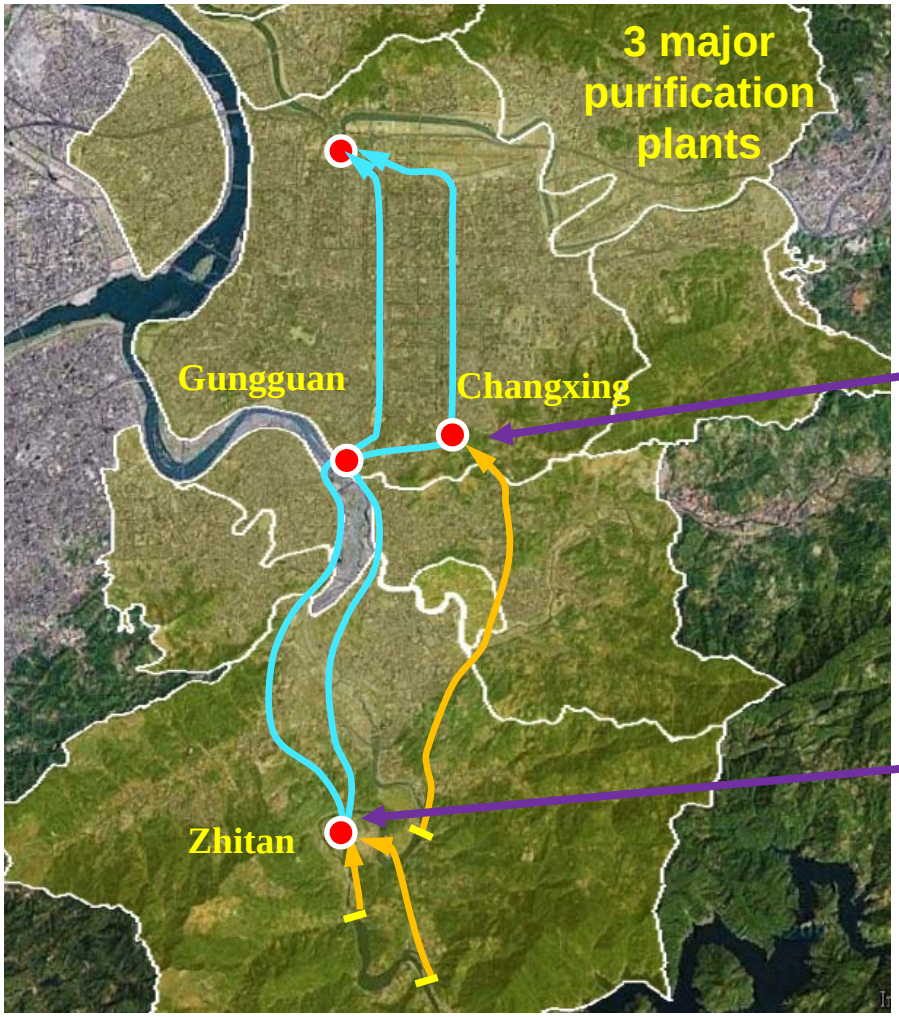
Both in leakage rate & leaks no.

現有措施

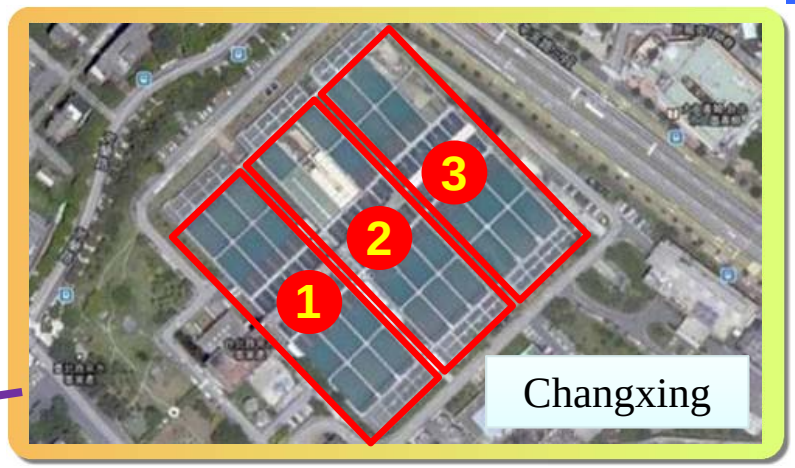




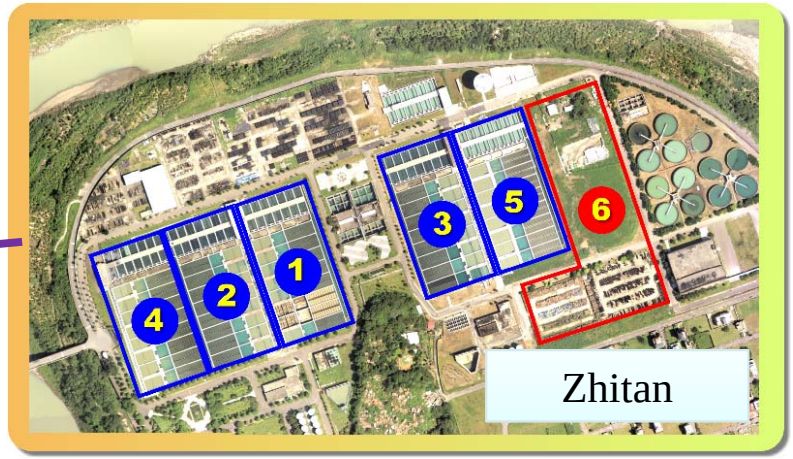
System Backup



Operating Reserve：



Increasing 180 kCMD output after improvement



Increasing 700 kCMD output by adding 6th unit

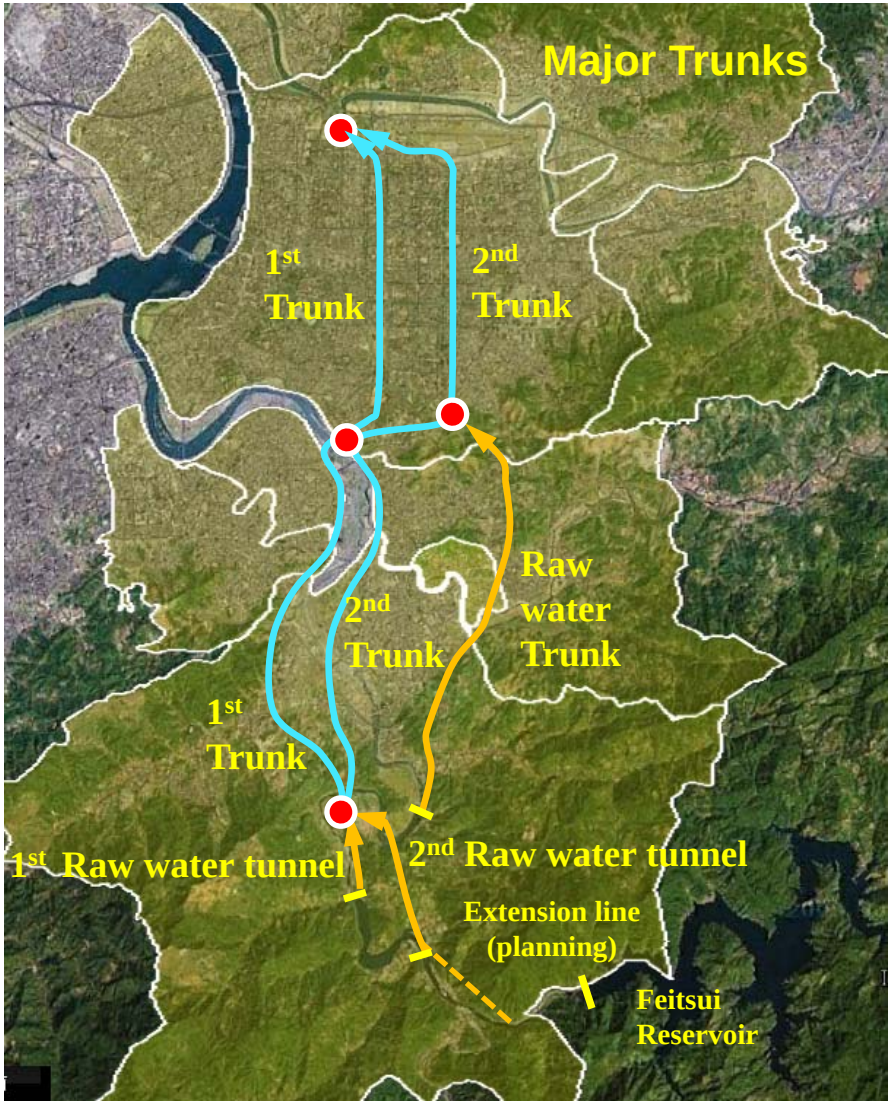
Operating reserve %：

13% (2006) → **34%** (2013) → **40%** (2015) ⋯→ **56%** (2021 (year))

Dual-line Redundancy：Dual trunks increasing viability

現有措施

After 5 stages of construction, transmission trunks are nearly complete in Taipei



1st and 2nd trunks are the arteries of Taipei

Dual lines are important

As an accident insurance

1st trunk was severe damaged by accident in 2004. luckily owing to the backup of 2nd trunk, TWD continue supply water to Taipei during 3-week repair.

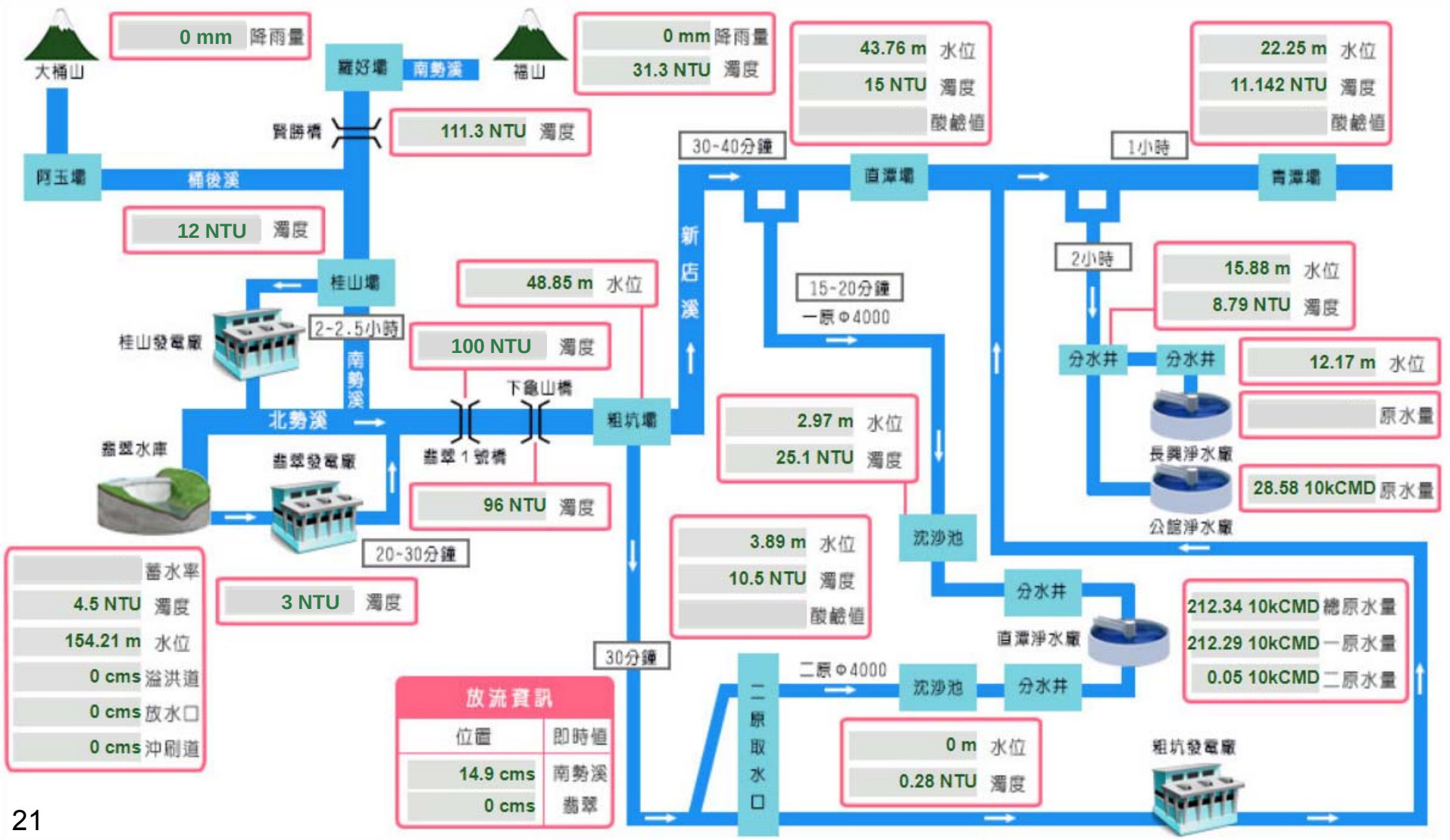
For inspection & maintenance

Any maintenance job requires diverting water by backup system to allow working inside.

Pre-warning sys： Turbidity pre-warning in advance by 6 hours

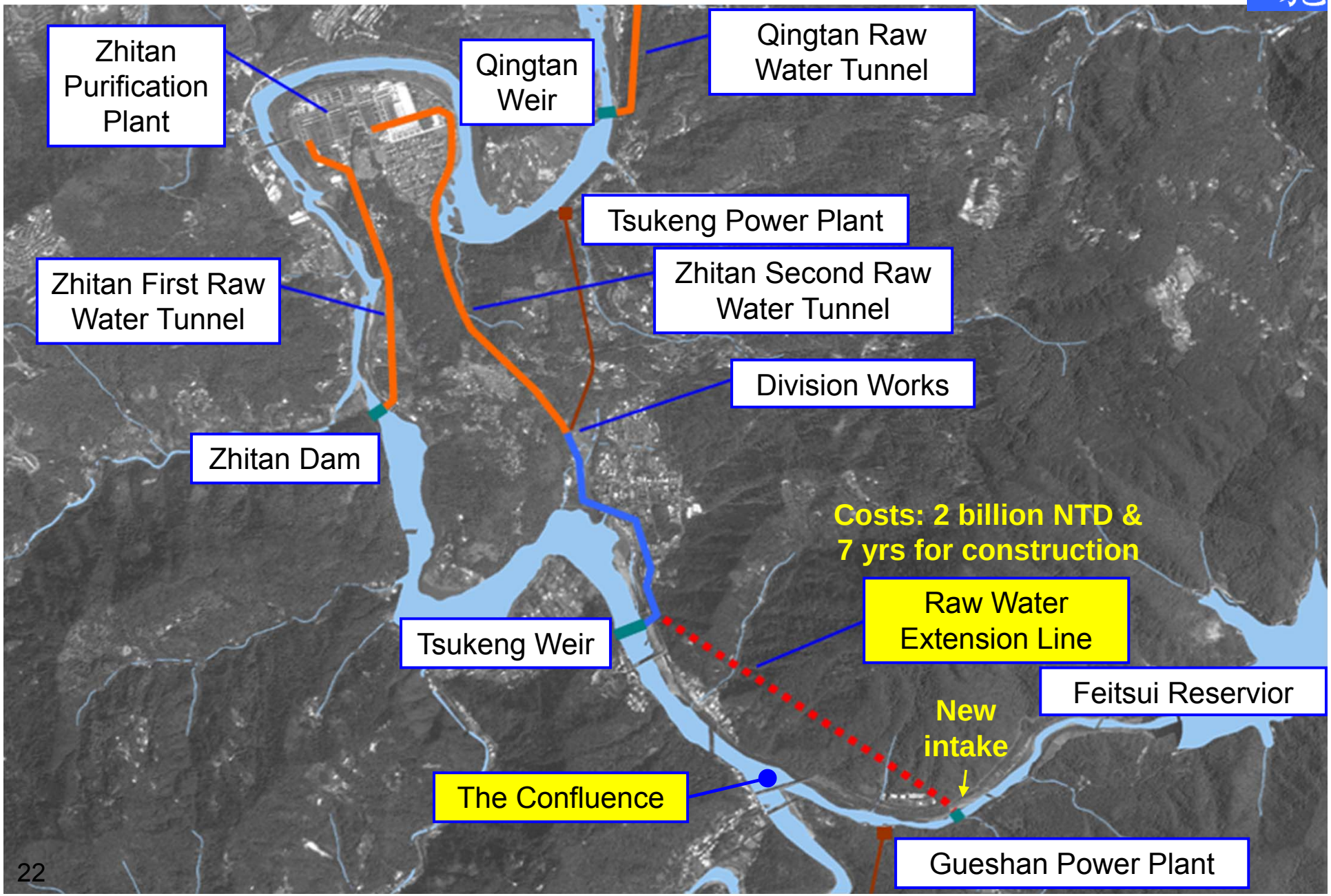
現有措施

Setting monitoring sensors from upstream catchment to downstream intake, turbidity rising events can be predict by upstream rainfall & flowrate signals

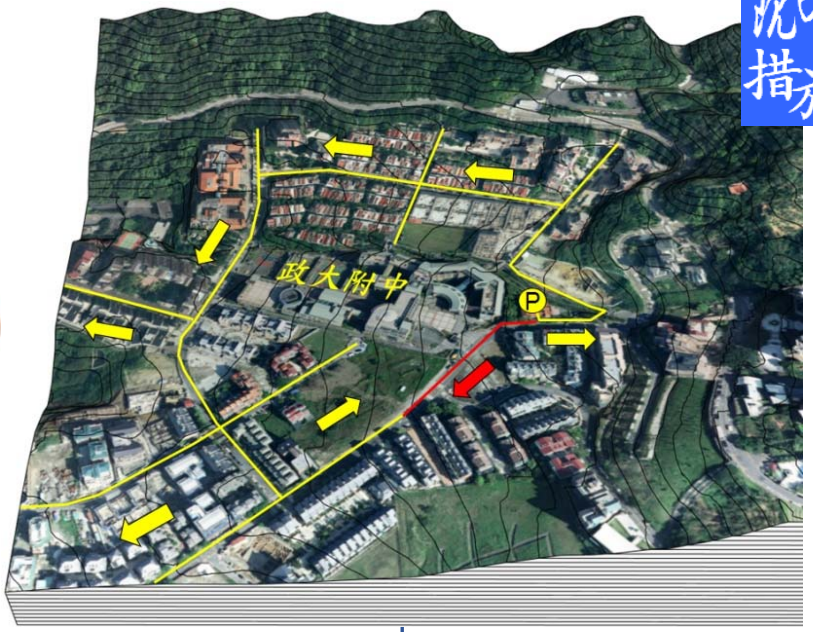


Extension Line： A backup intake to avoid muddy water

現有措施



Smart water management



AMR

SCADA
GIS, MIS

Forecast
Optimization

Decision
Prediction

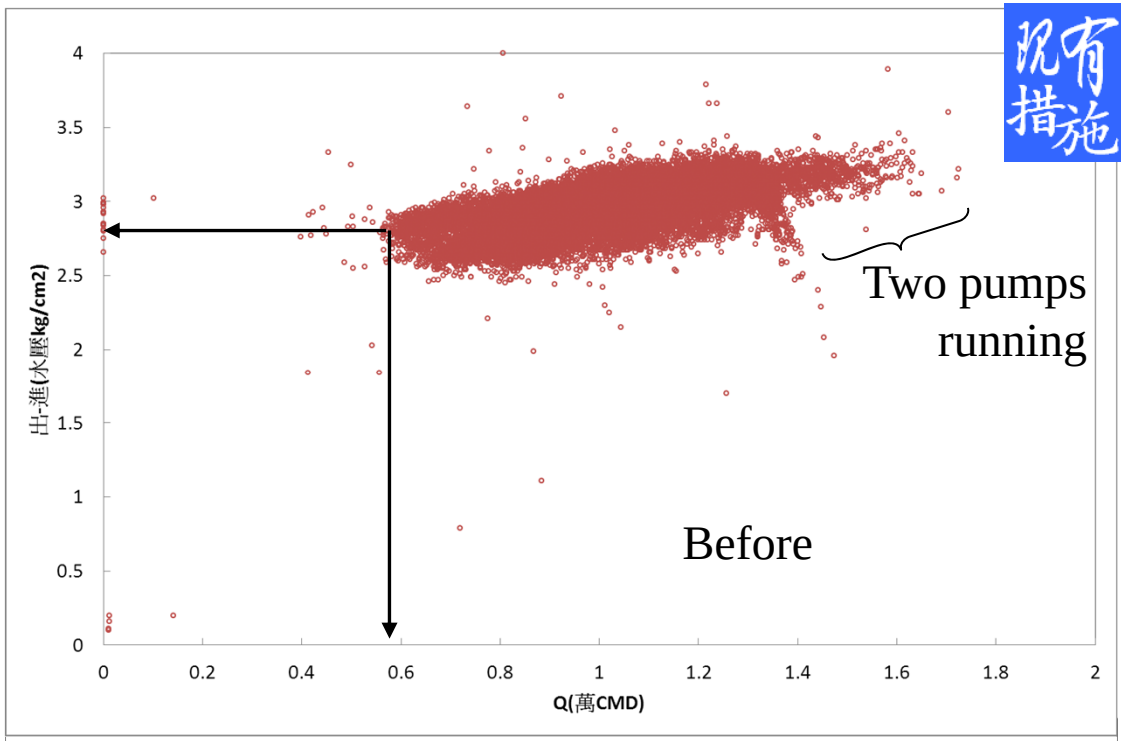
Water Supply	Household Management	Energy Conservation	Leakage Control
Quantity Quality	Bulk customers Metering error	Pumping eff. Electricity mgt.	Pressure mgt. Pipeline replacement

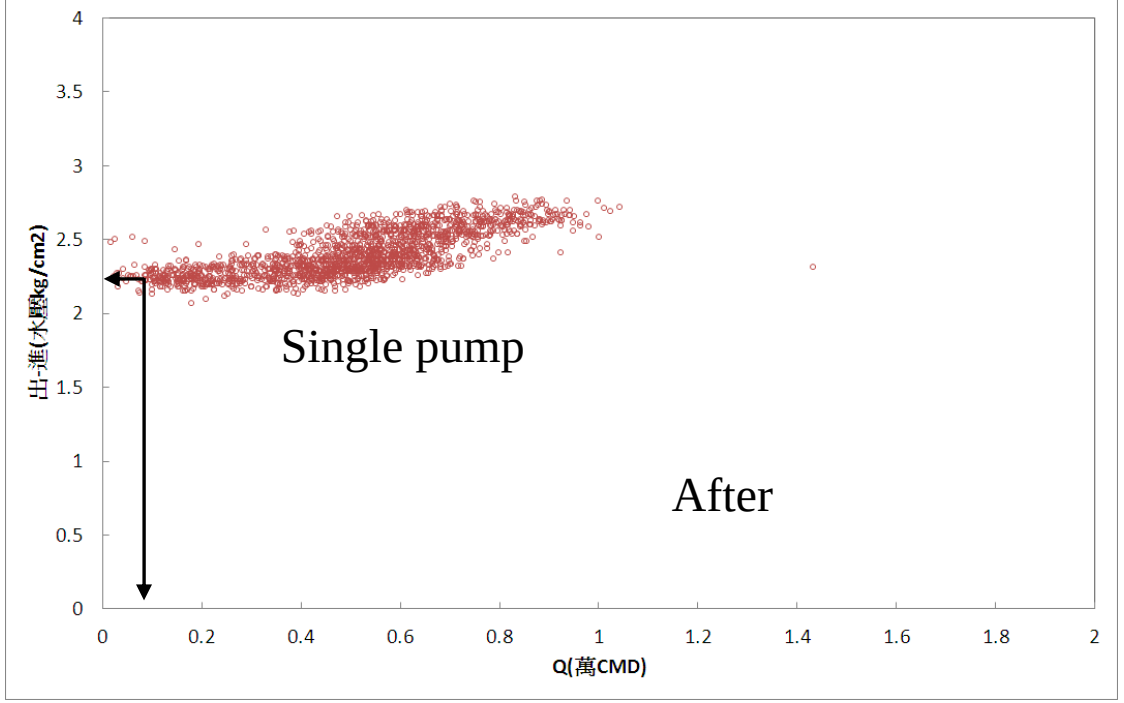
Leakage reduction = Energy saving

2014, a DMA being replace its leaking old pipelines

	before (Nov. 2013)	after (Nov. 2014)
Leakage rate (%)	54%	14%
Pumped volumes (CMD)	10,325	5,053
Energy Consumption per month (kWh)	45,097	21,318

Leakage reduced 40%,
Energy reduced 53%





TWD's Energy Conservation

Contributions of pumping efficiency & leakage control

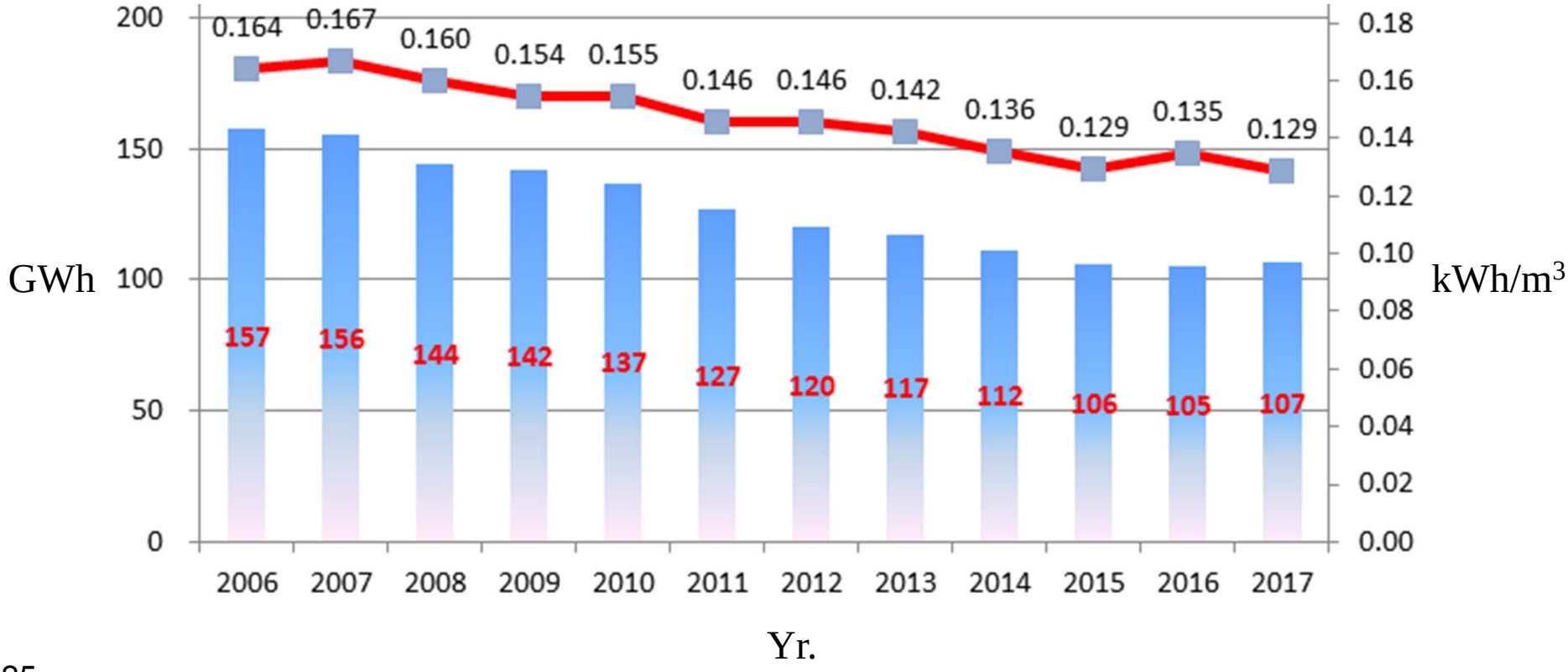
現有措施

Pumping efficiency + leakage control

Electricity：from 157 GWh in 2006, decreased to 107 GWh in 2017 (32%reduction)

Pumping energy per m^3：from 0.164 in 2006 to 0.129 kWh/m^3 in 2017 (21%reduction)

Pumping efficiency

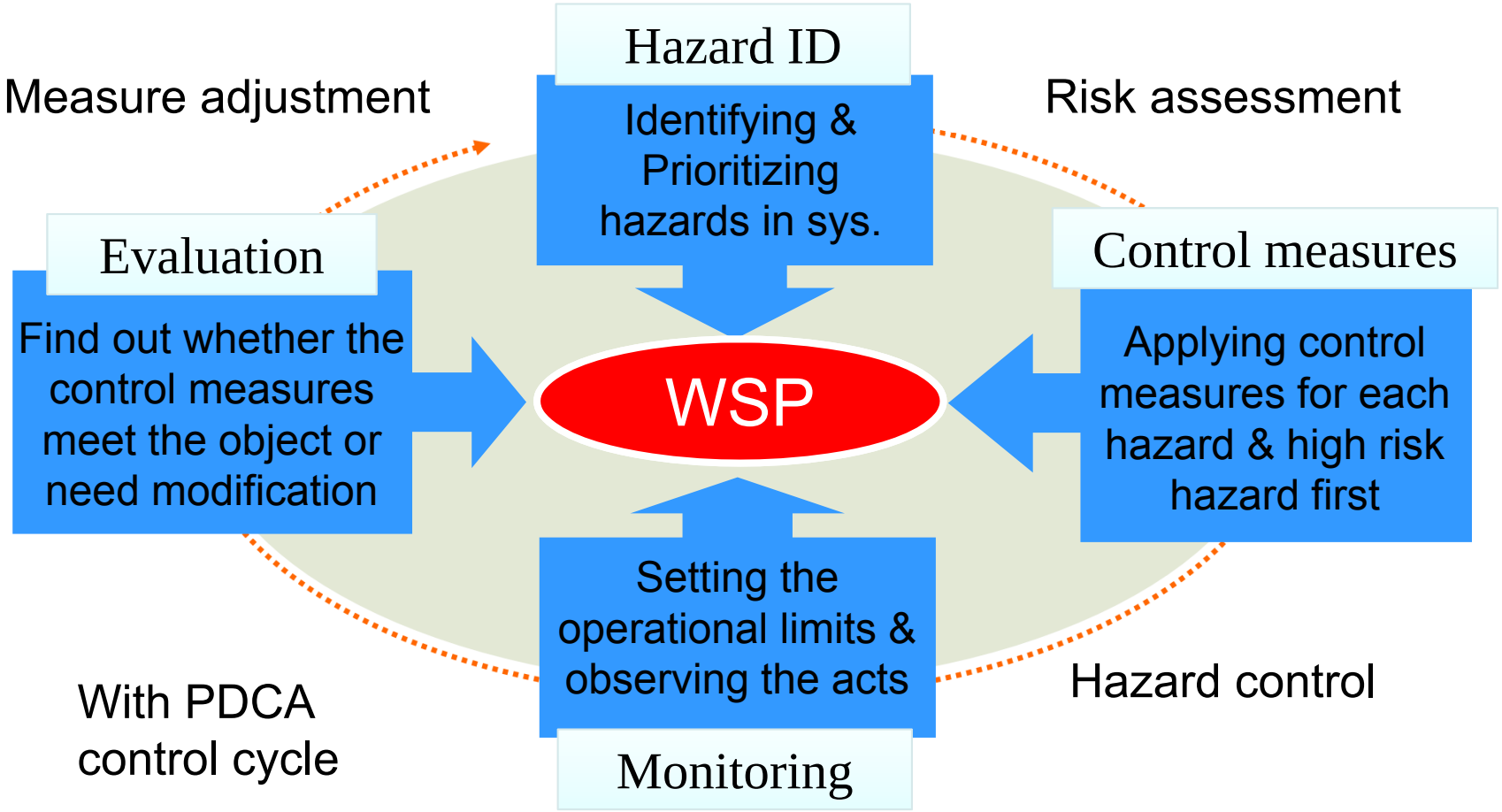


Safe for Drinking

Direct drinking in Taipei

Water Safety Plan（WSP）

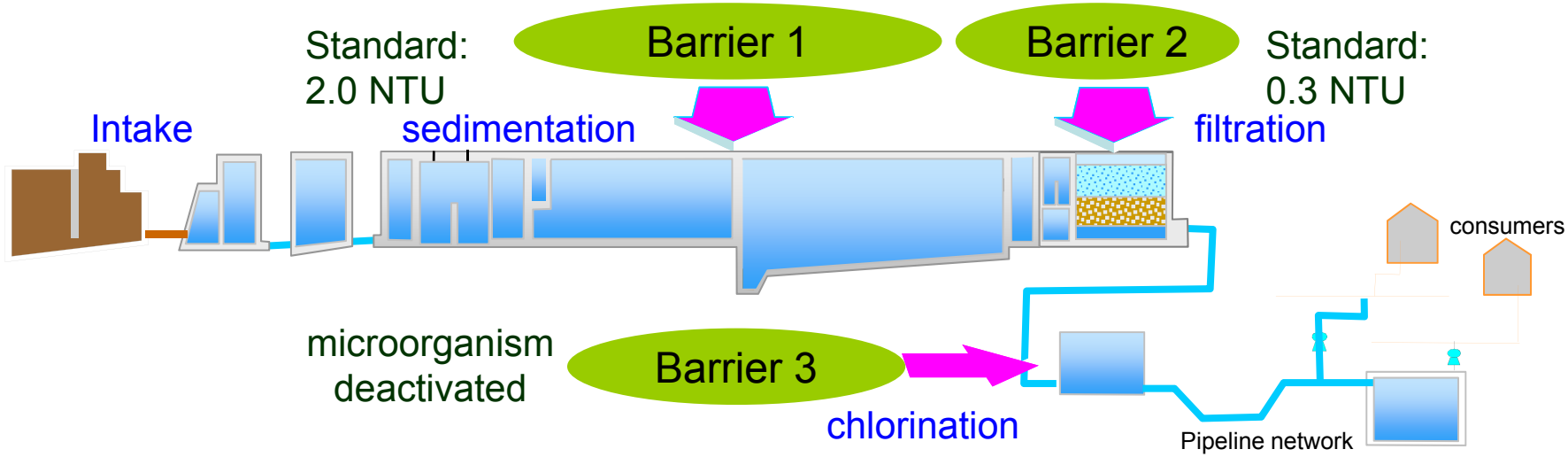
A comprehensive risk assessment and risk management approach

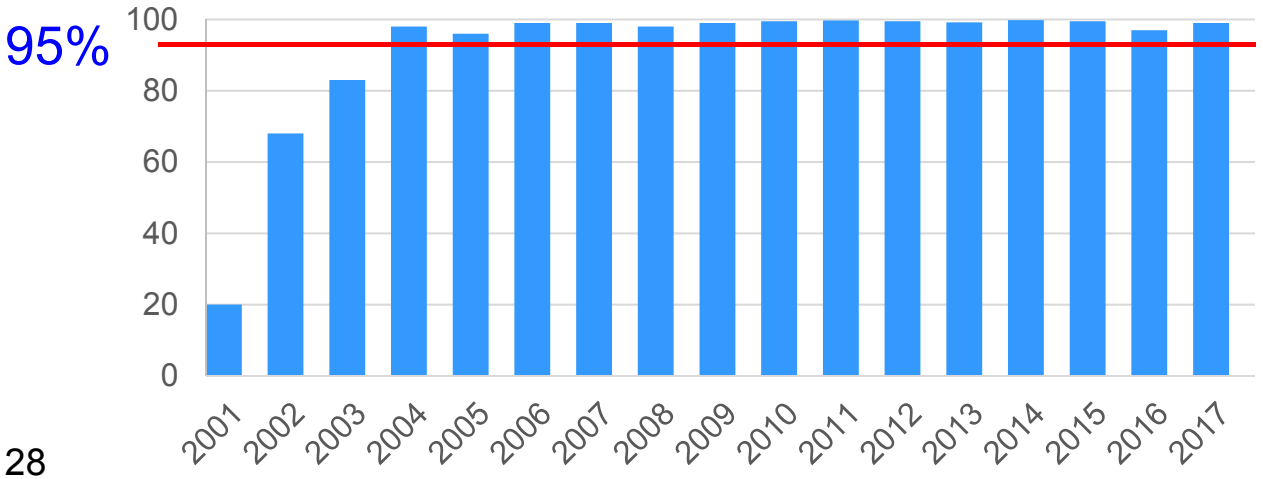


Treatment： Multi-barrier approach

Reducing the penetration risk of bacteria & contamination

Setting control standards of each unit in purification to construct barriers against hazards





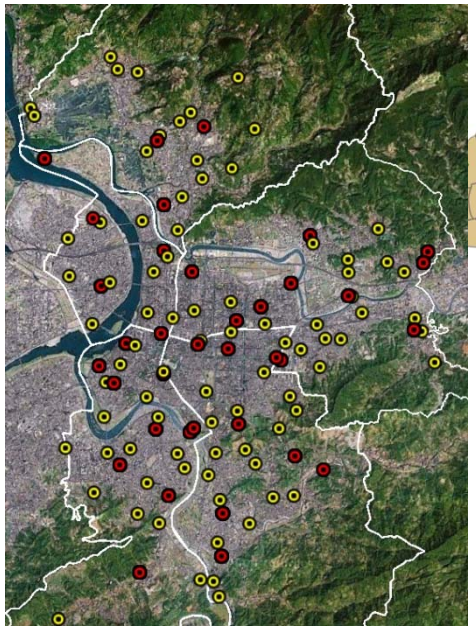
Treated water is steady with good quality:

Over 95% accumulated frequencies for turbidity < 0.1NTU since yr 2004

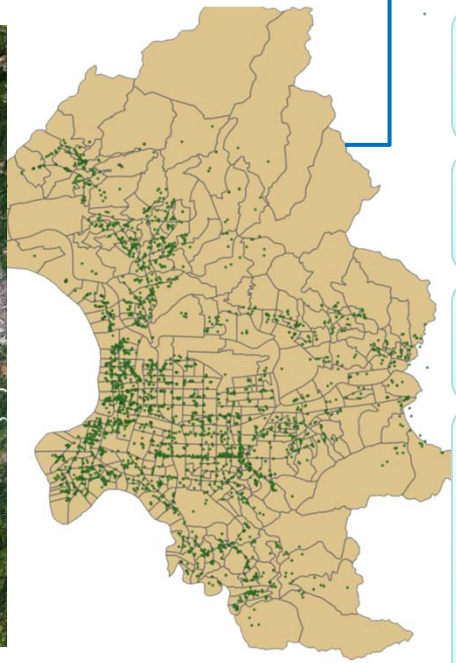
Network sys：SCADA control & quality monitoring

Applying feedback control using network's on-line signals by SCADA

With massive off-line water sampling for research & advanced study



On-line quality & pressure sensors(95+180)



Massive off-line sampling sites(4,900)

Items	Results of test
Heavy Metals	N.D. or far lower than allowance
Pesticides	N.D.
Disinfection by-products	THMs：6.0μg/L (allowance: 80 μg/L) HAAs： 2.4μg/L (allowance: 60 μg/L) NDMA ： ND

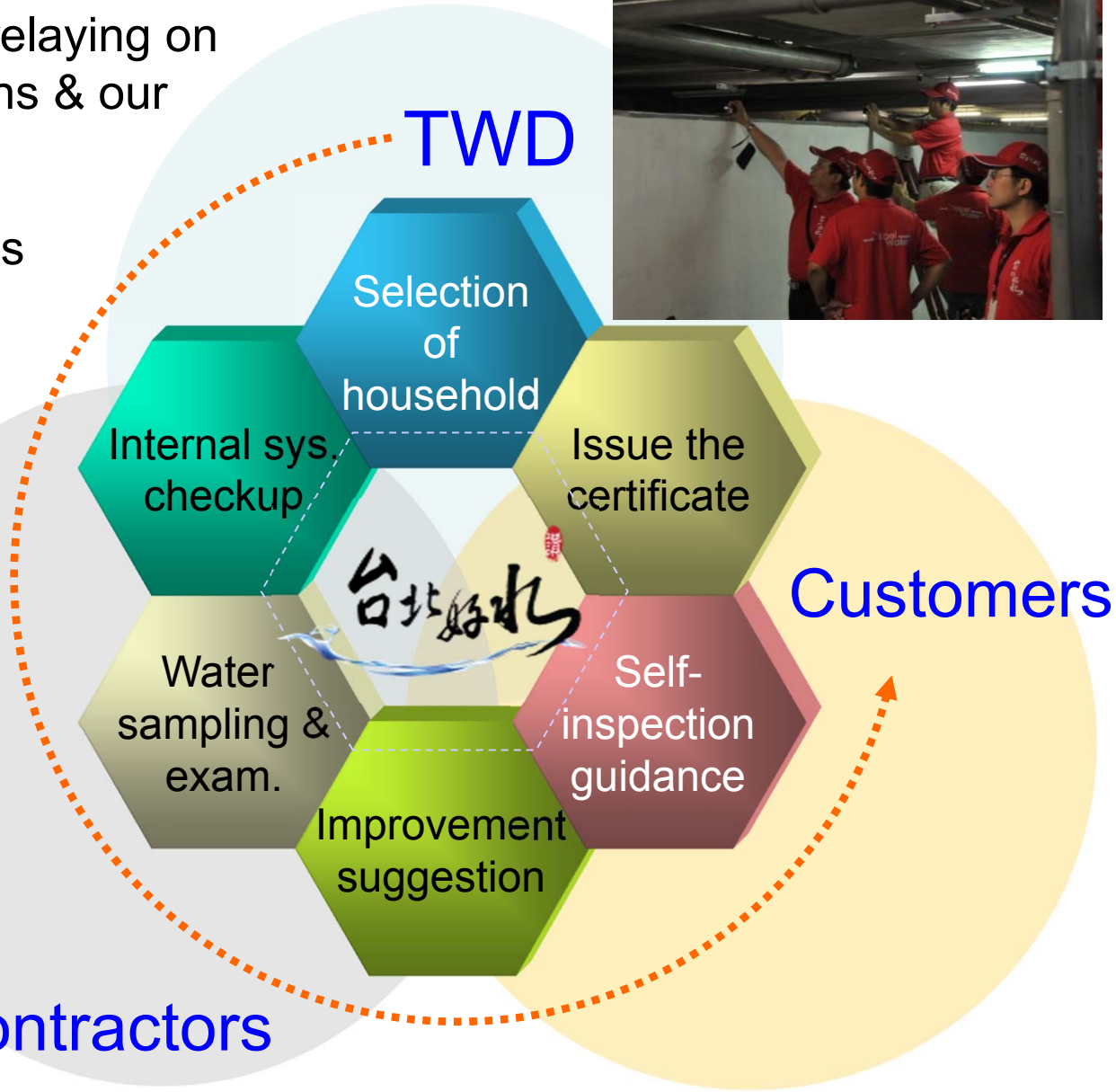
All the sampling fit for drinking

Household： Offering improvement aids

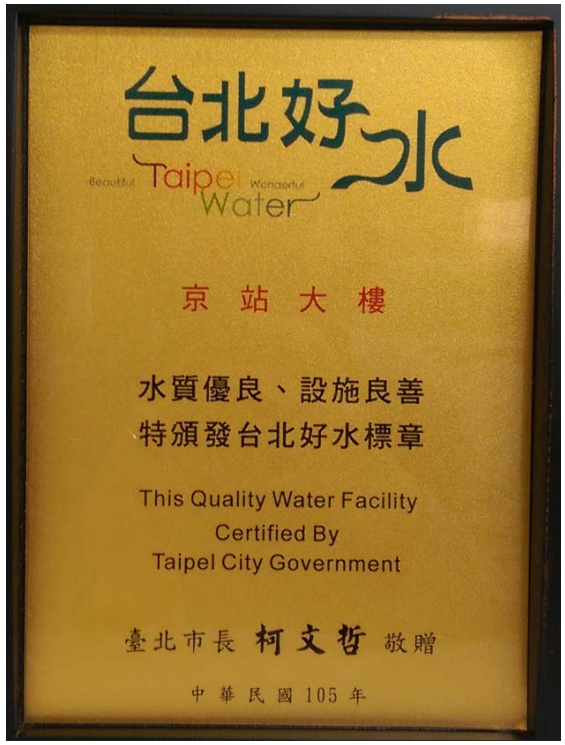
Last-mile water quality relaying on the awareness of civilians & our little helps

Public buildings & places being given high priority

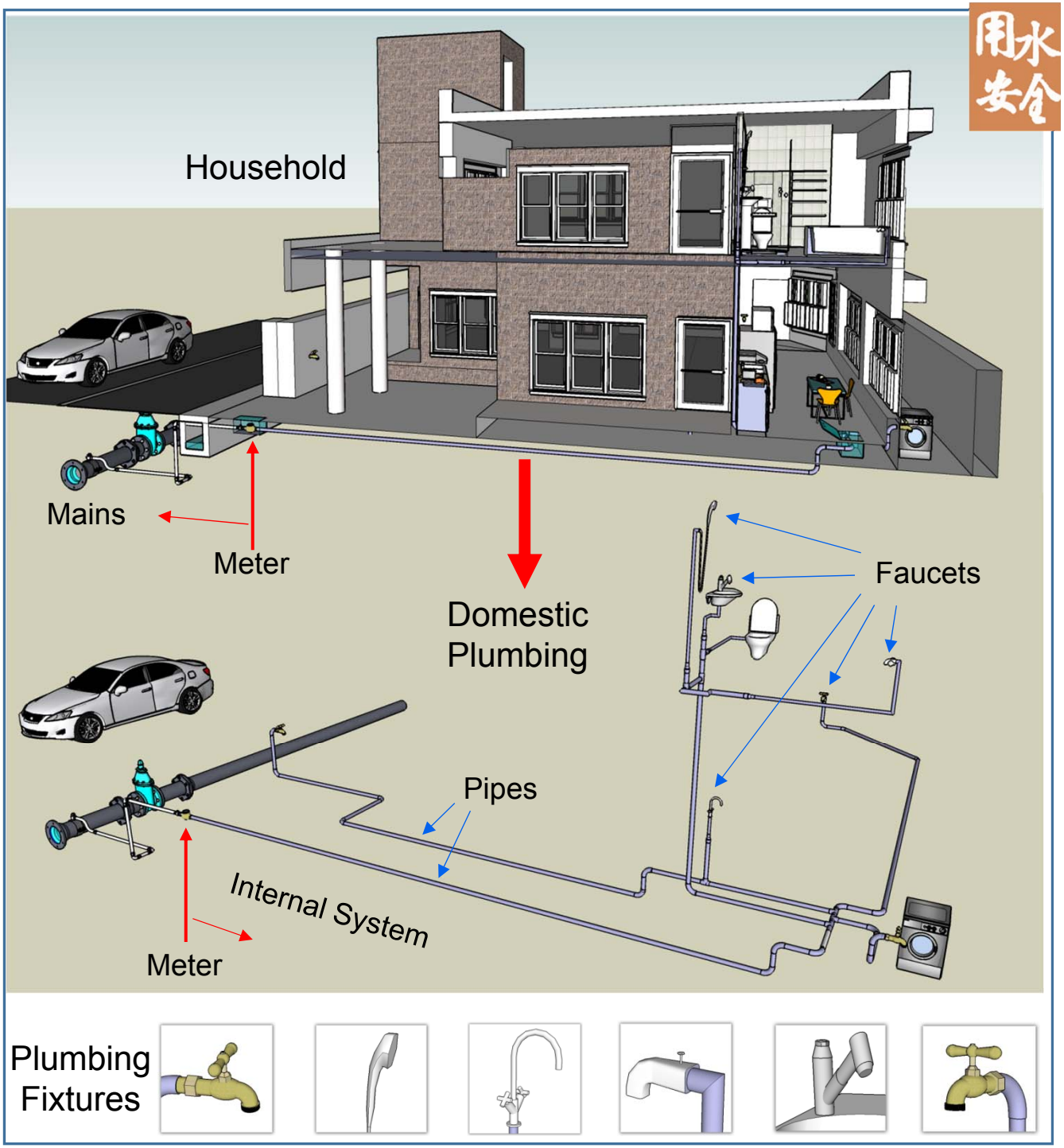
700+ households being inspected since 2015



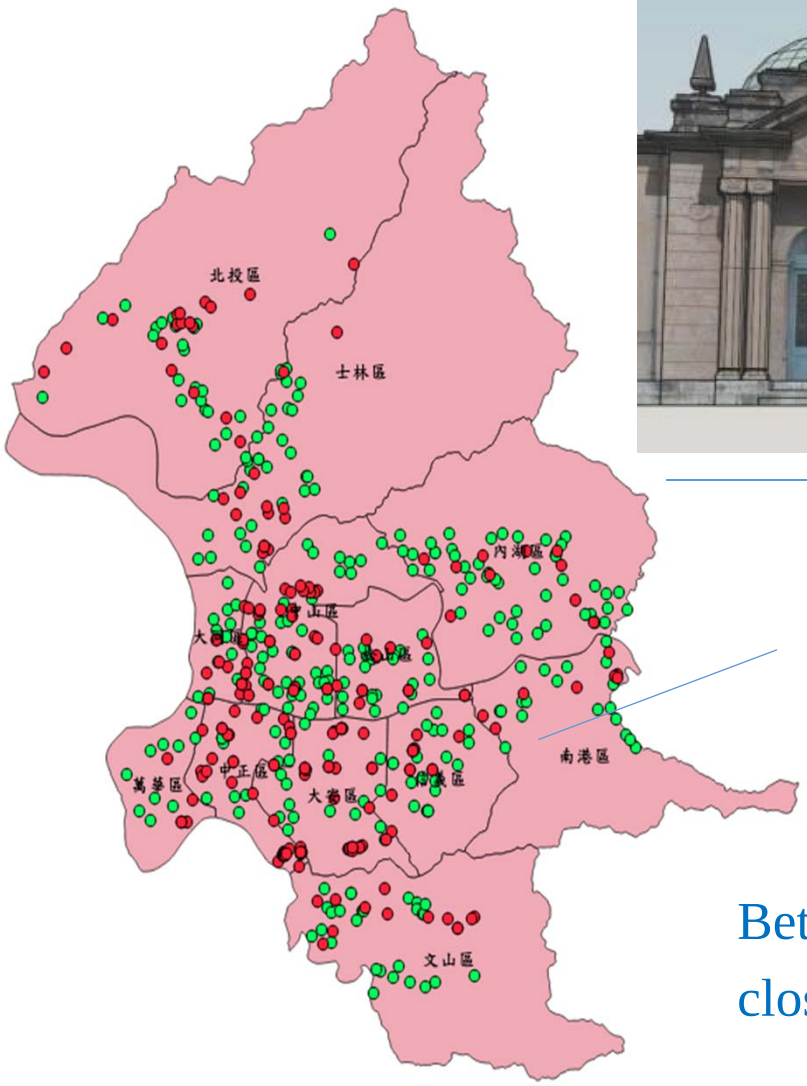
Direct drinking in household

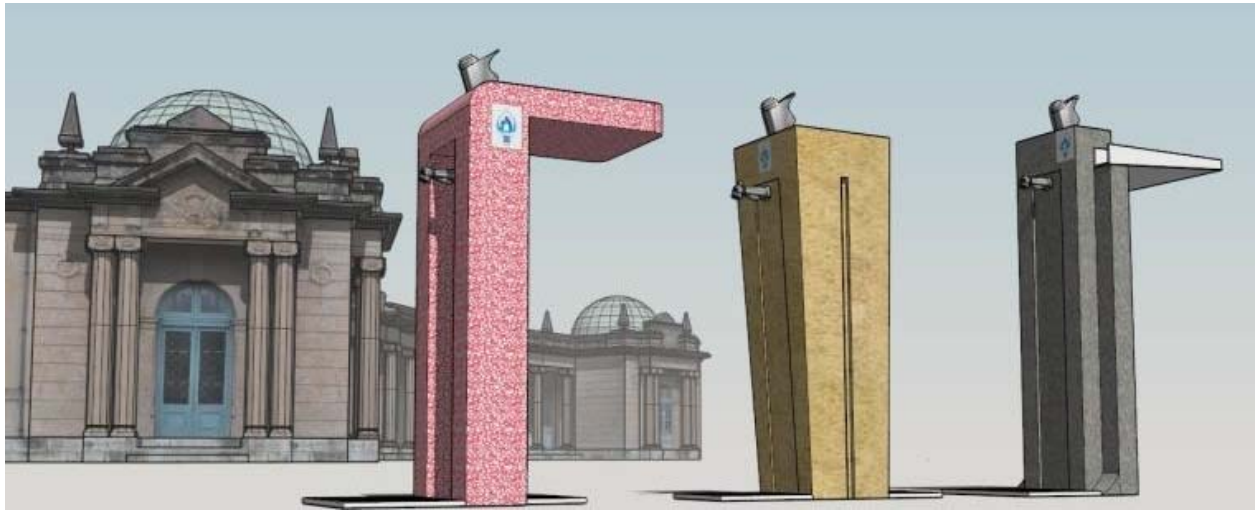


Who passes the inspection will be given a certificate



Drinking Fountains： Providing outdoor direct drinking





More than 500 outdoor fountains

Serviceability:

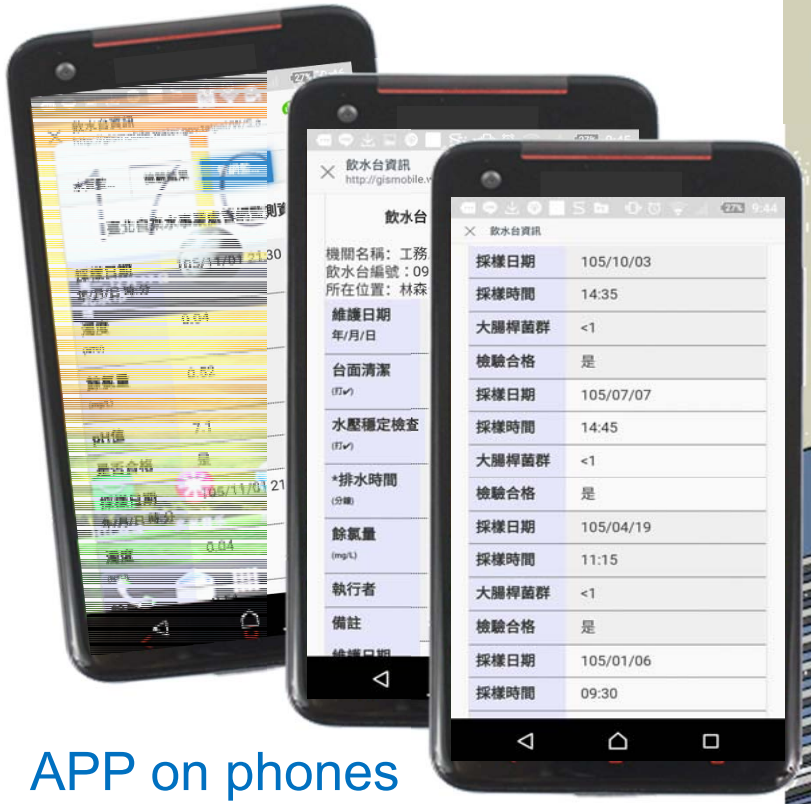
1 fountain for 5,000 persons

Better than San Francisco & closed to Paris

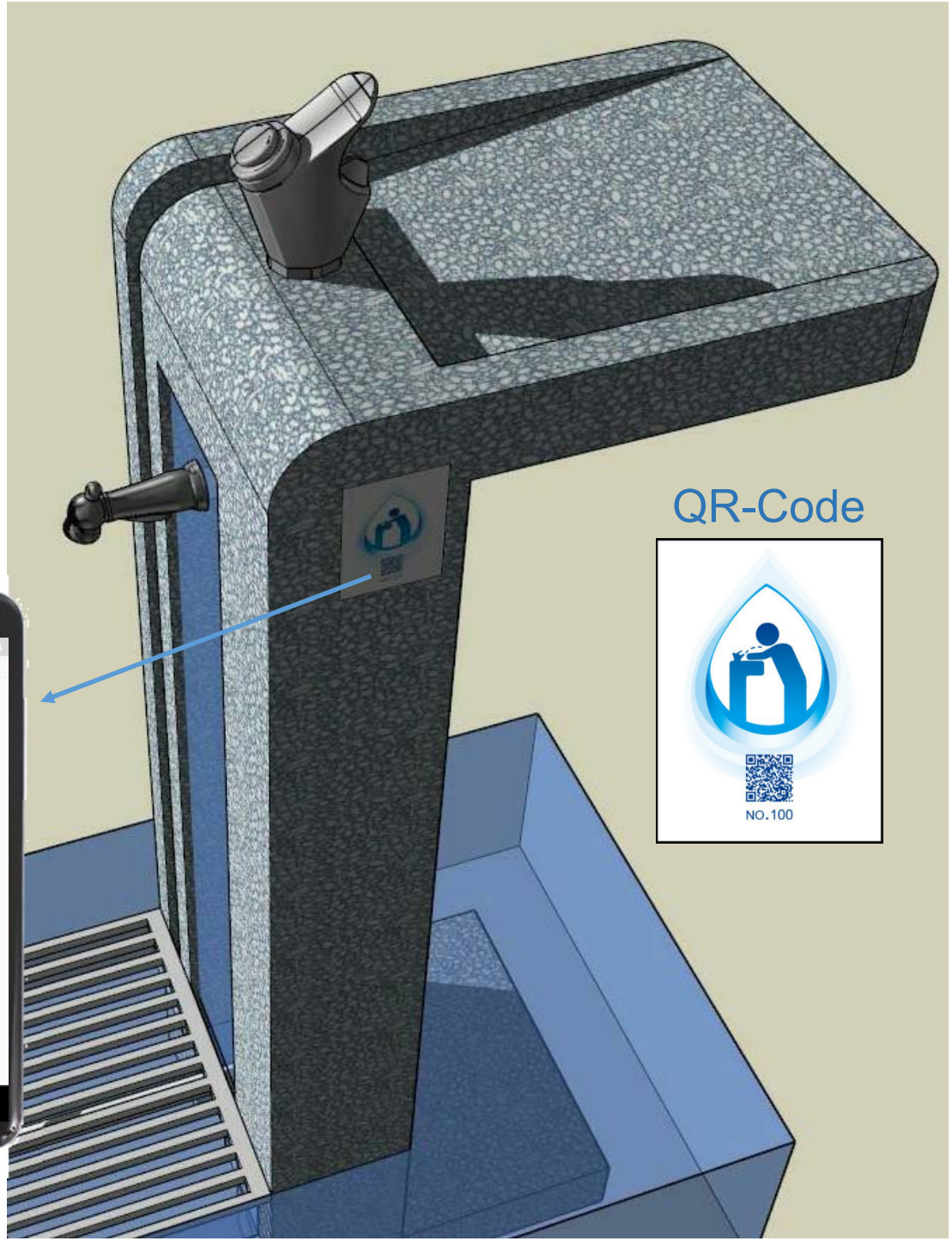
QR-Code for management

You can check:

Maintenance frequencies, Water qualities data by manual or nearby online sensors



APP on phones



Fountains everywhere

Even setting up on hiking trails


Thank you
臺北自來水事業處
TAIPEI WATER DEPARTMENT