"Underground Utility Survey Based on Nondestructive Testing, Surveying, Imaging and Diagnostic (NDTSID) Approaches" Webinar

Application of Leak Detection Technologies in Water Supplies Department of the Government of the Hong Kong SAR

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Outline of Presentation

01 Introduction to Water Supply in Hong Kong

02 WSD Water Loss Management Strategy & Leak Detection Technologies

- *Four pillars of Water Loss Management*
- *Water Intelligent Network (WIN)*

03 Development of Leak Detection Service Trade

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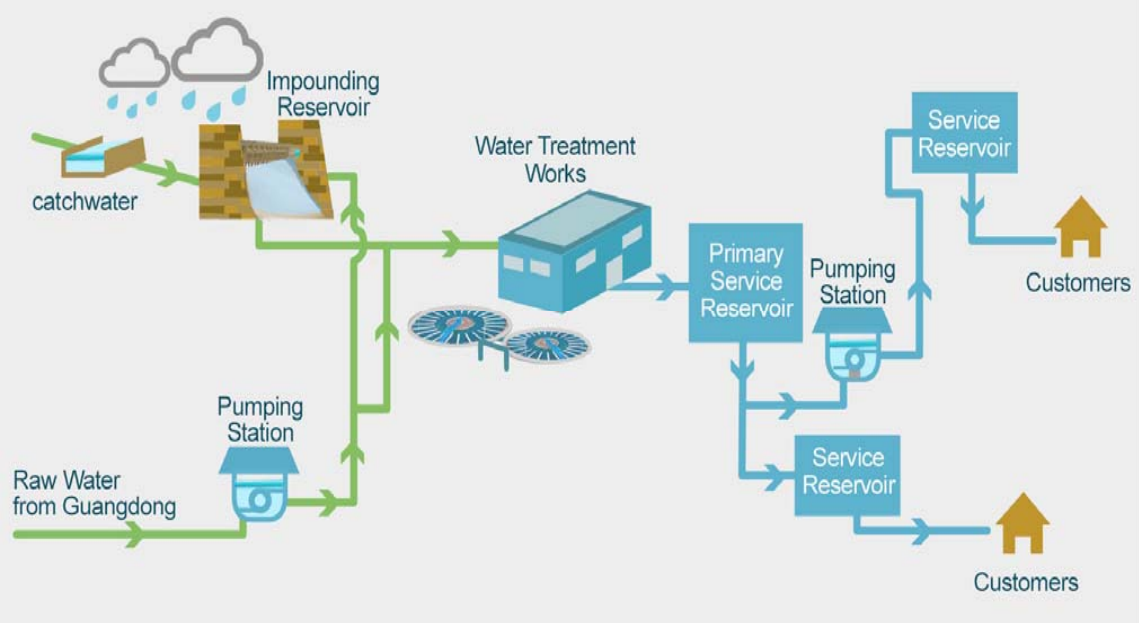
Water Supply in Hong Kong

Typical fresh water supply arrangement in Hong Kong

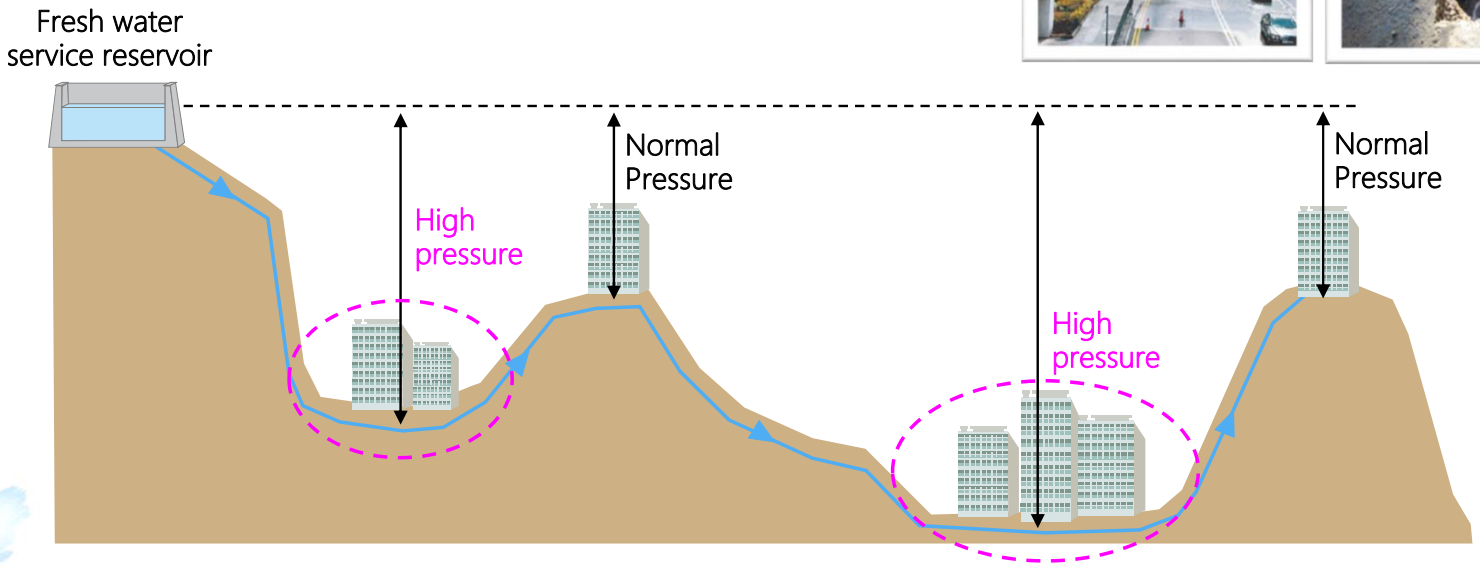


- Over **7.5 million population in mid-2020**
- Over **8 300km** long complex water supply network
- Mostly laid under our very **heavy traffic urban area** and **congested underground environment**

Water Supply in Hong Kong

- **High water pressure** as a result of our hilly terrain
- Increased risk of **water mains bursts and leaks**
- In year 2000, there were about 2 500 mains bursts

Water mains burst and leaks



Water Supply in Hong Kong

Before 1980's


Cast iron & asbestos cement pipe: strong but brittle

1990's

Ductile pipe material such as ductile iron and polyethylene pipe

2000 to 2015

Large scale Replacement and Rehabilitation (R&R) Programme

Water Supply in Hong Kong

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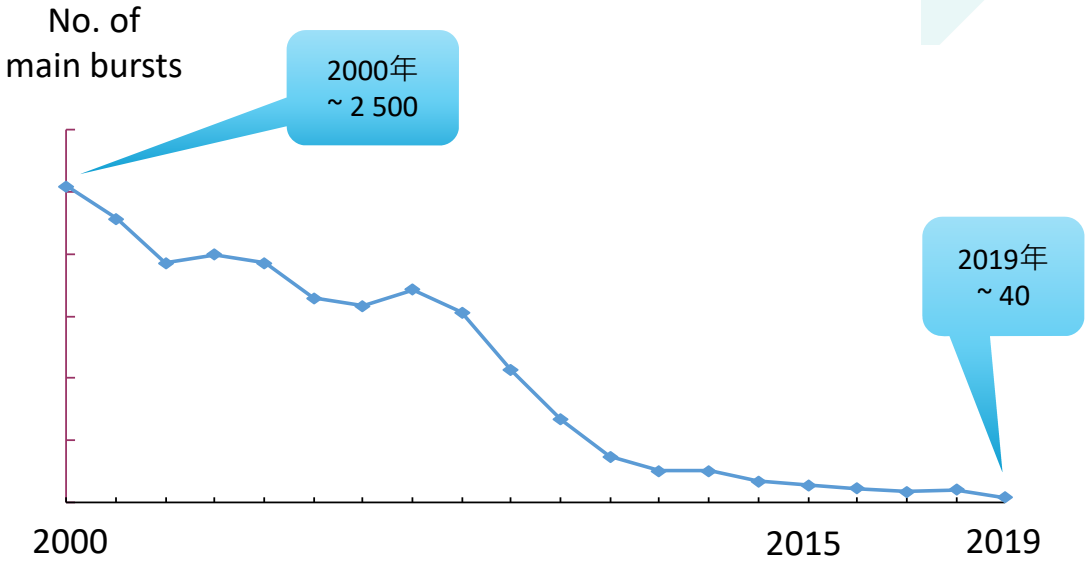
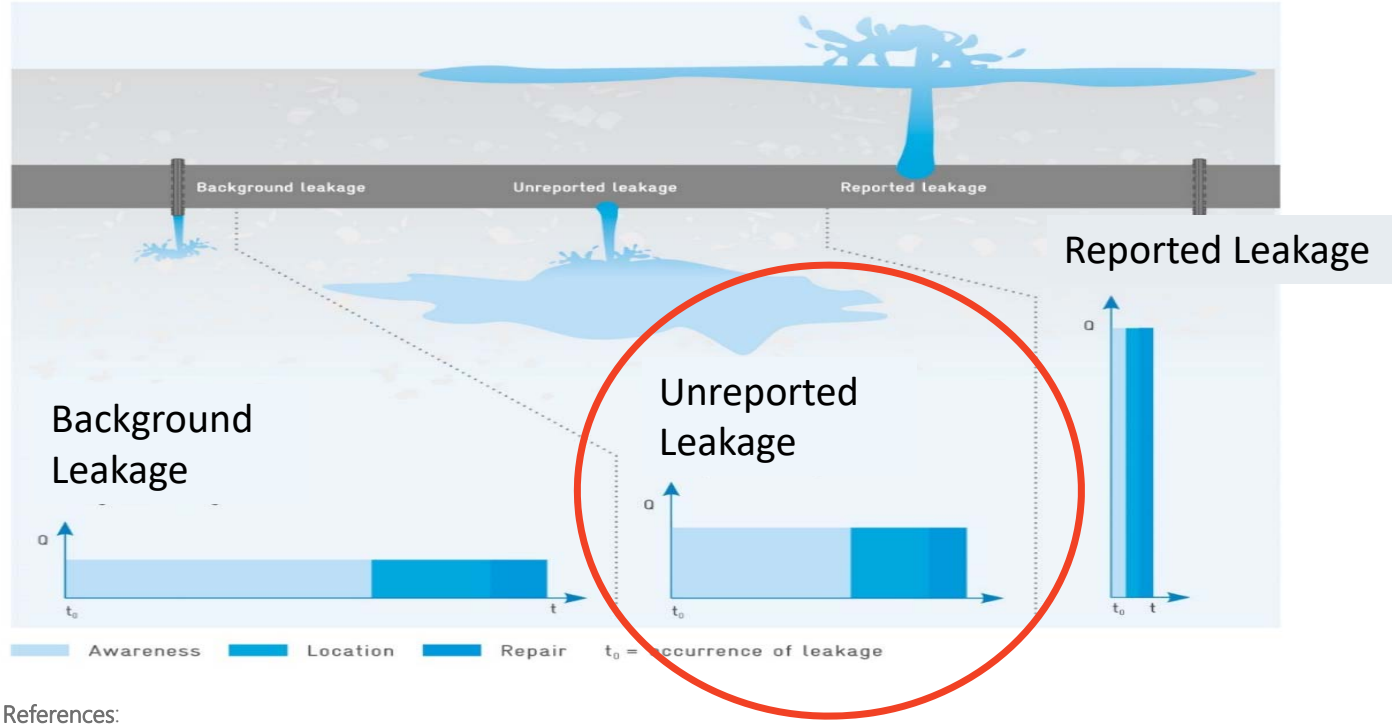


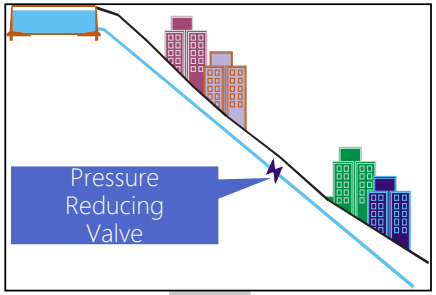
Water Loss Management Strategy



References:
Farley, M., Leakage Management and Control. WHO, 2001.
Thornton, J., Sturm, R. and Kunkel, G., Water Loss Control. McGraw-Hill, 2008.

Four Pillars of Water Loss Management

Pressure Management



Quality & Speedy Repair

Reduce Real Losses

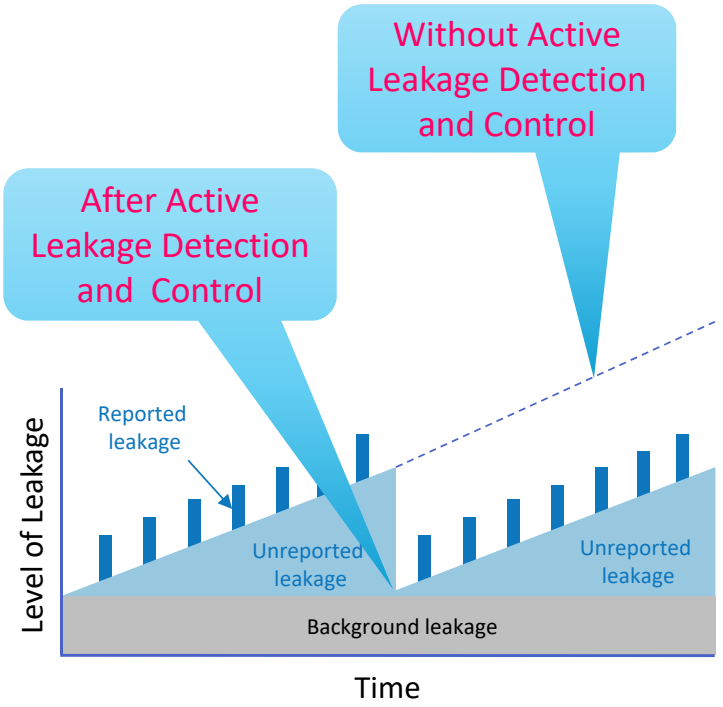
Active Leakage Detection and Control

Asset Management

Active Leakage Detection and Control

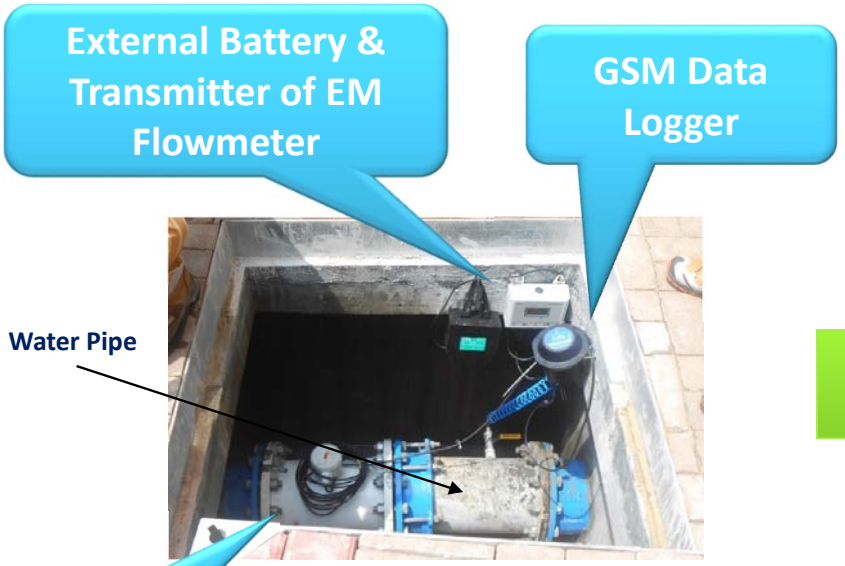
Typical Steps of Leak Detection:

1. 流量監察 (Monitoring)
2. 漏水管段探測 (Localisation)
3. 噪聲相關檢漏 (Pinpointing)
4. 漏水點確定 (Confirmation)



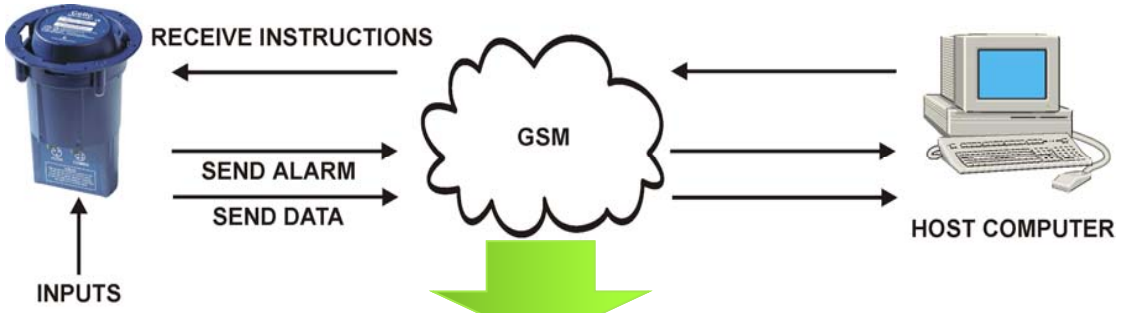
Active Leakage Detection and Control

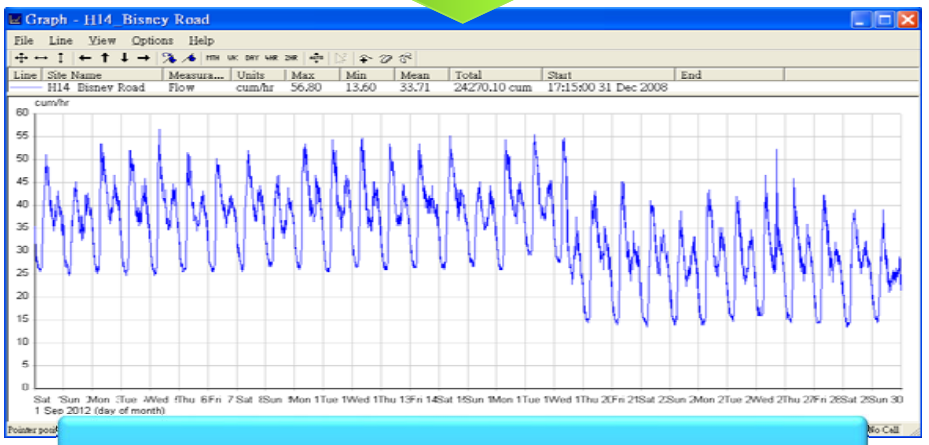
1. 流量監察 (Monitoring)



Typical Monitoring Chamber

GSM Data Logger:





24-hour Continuous Monitoring

Active Leakage Detection and Control

2. 漏水管段探測 (Localisation)

Sounding and Visual Inspection

Sounding Inspection on valve by listening stick

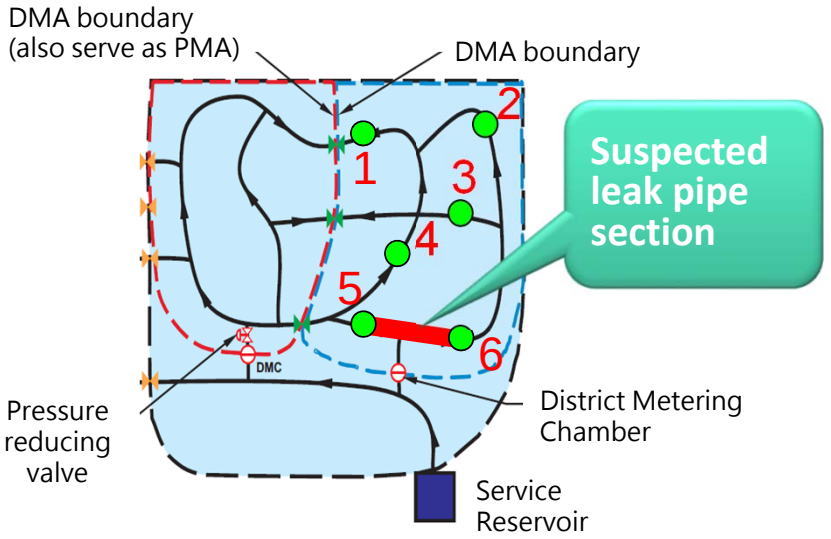
Visual Inspection: Water inflow to drainage manhole

Active Leakage Detection and Control

2. 漏水管段探測 (Localisation)

Noise Loggers monitoring

- Noise loggers are installed permanently or on a lift and shift basis
- Listen for and record the constant source of noise generated by a leak usually at 2am to 4am
- “Leak” or “No Leak” status by noise loggers
- Relatively low cost and easy to deploy

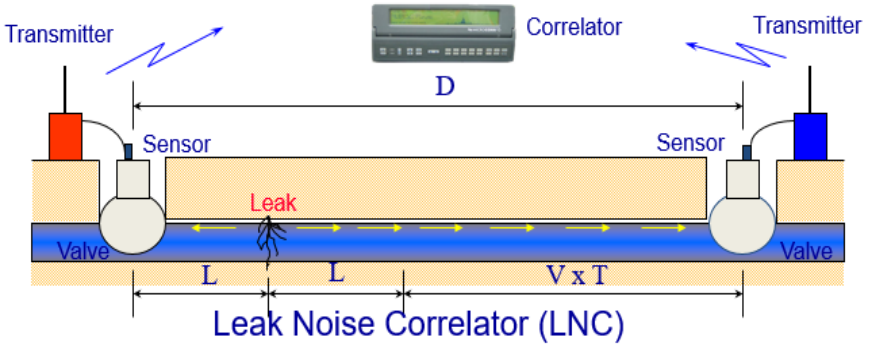


Active Leakage Detection and Control

3. 噪 聲 相 關 檢 漏 (Pinpointing)

Leak Noise Correlators (LNC)

- Acoustic detection is still the primary mean of detecting and pinpointing leaks on water mains
- Two sensors deployed on valves or fittings on either side of the suspected leak
- Leak noise transmitted to the sensors with a time difference, which allows the distance L to be calculated by the forumula $L = [D - (VT)]/2$



Active Leakage Detection and Control

4. 漏水點確定 (Confirmation)

Mechanical leak detector

- Direct contact with the ground
- Amplify the leak sound by mechanical means or listening sticks

Listening Stick

Electronic leak detector

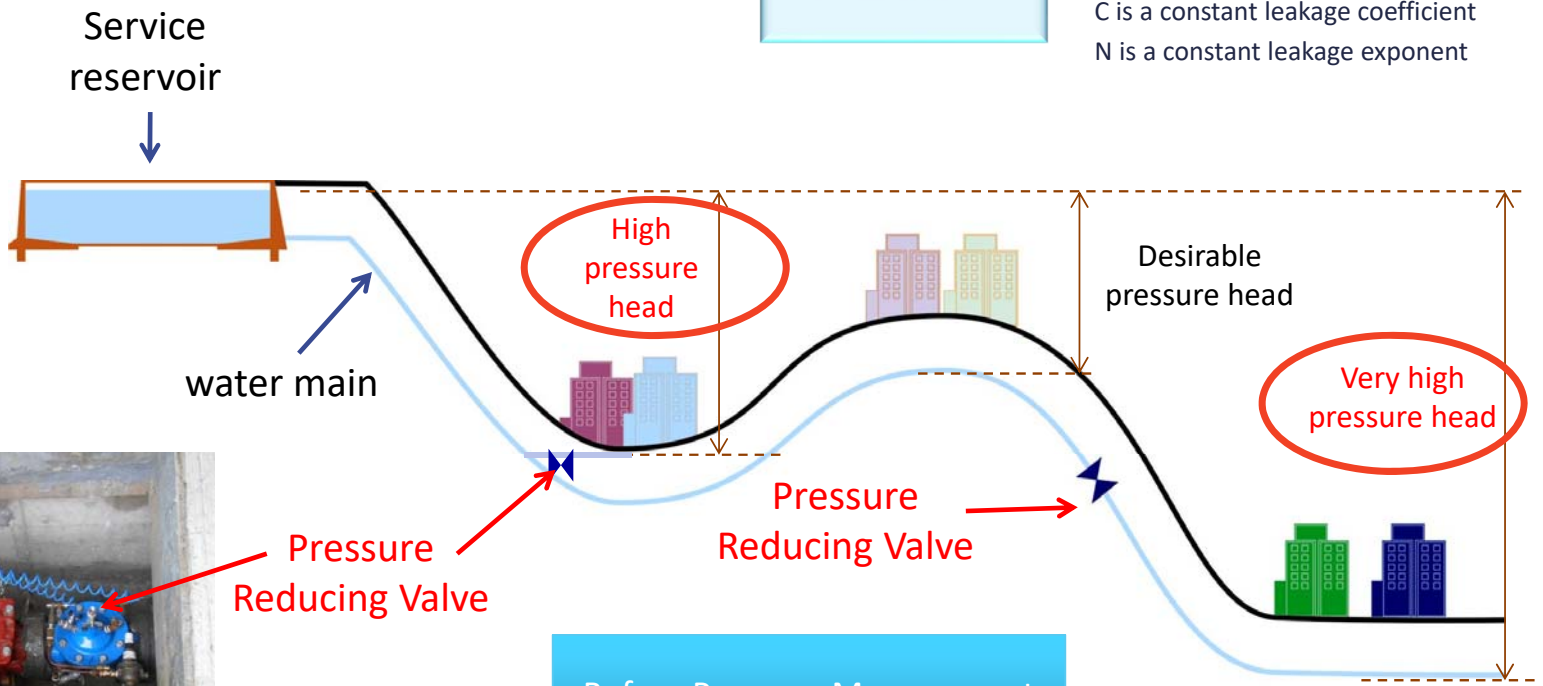
- Amplify the leak sound by electronic means
- Components: ground microphone, noise amplifier, headphones and frequency filters

Ground Microphone

Pressure Management

$$L = C\,P^{N}$$

Where
L is the leakage flow rate
P is the pressure head in the pipe
C is a constant leakage coefficient
N is a constant leakage exponent



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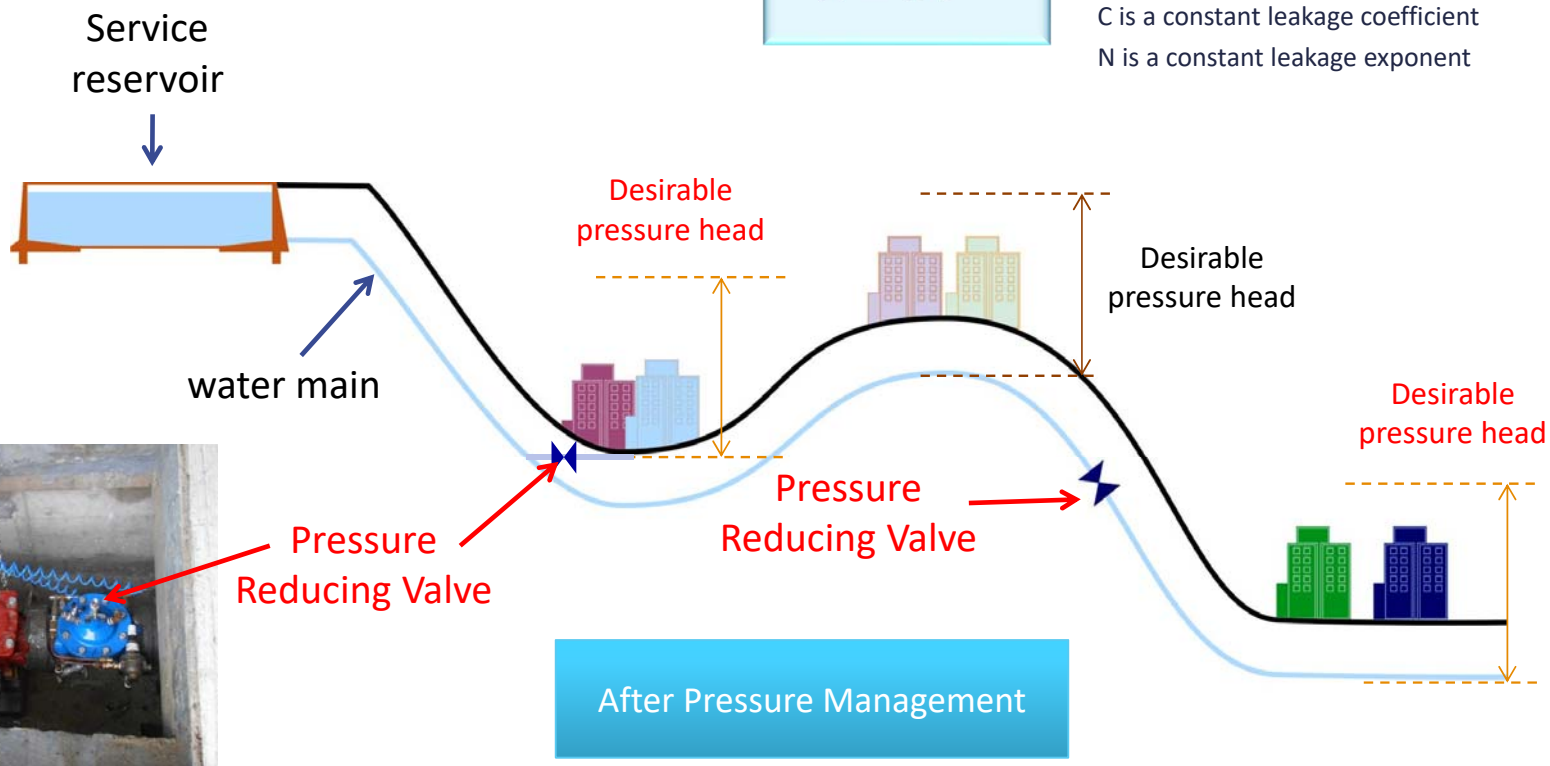
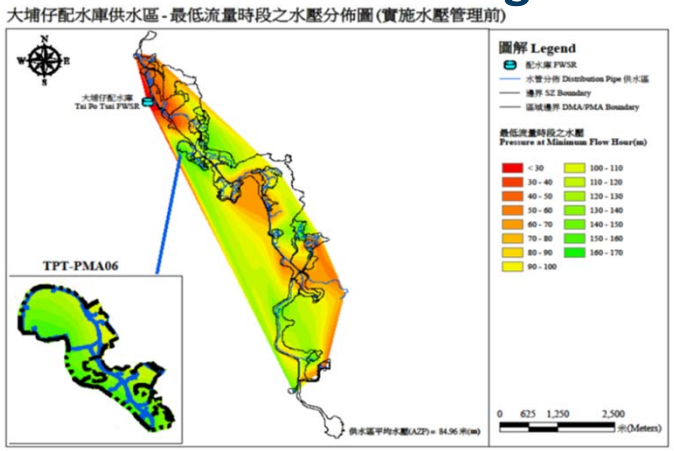
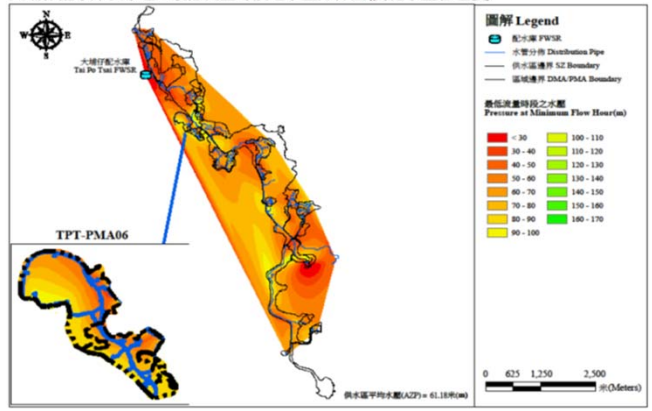


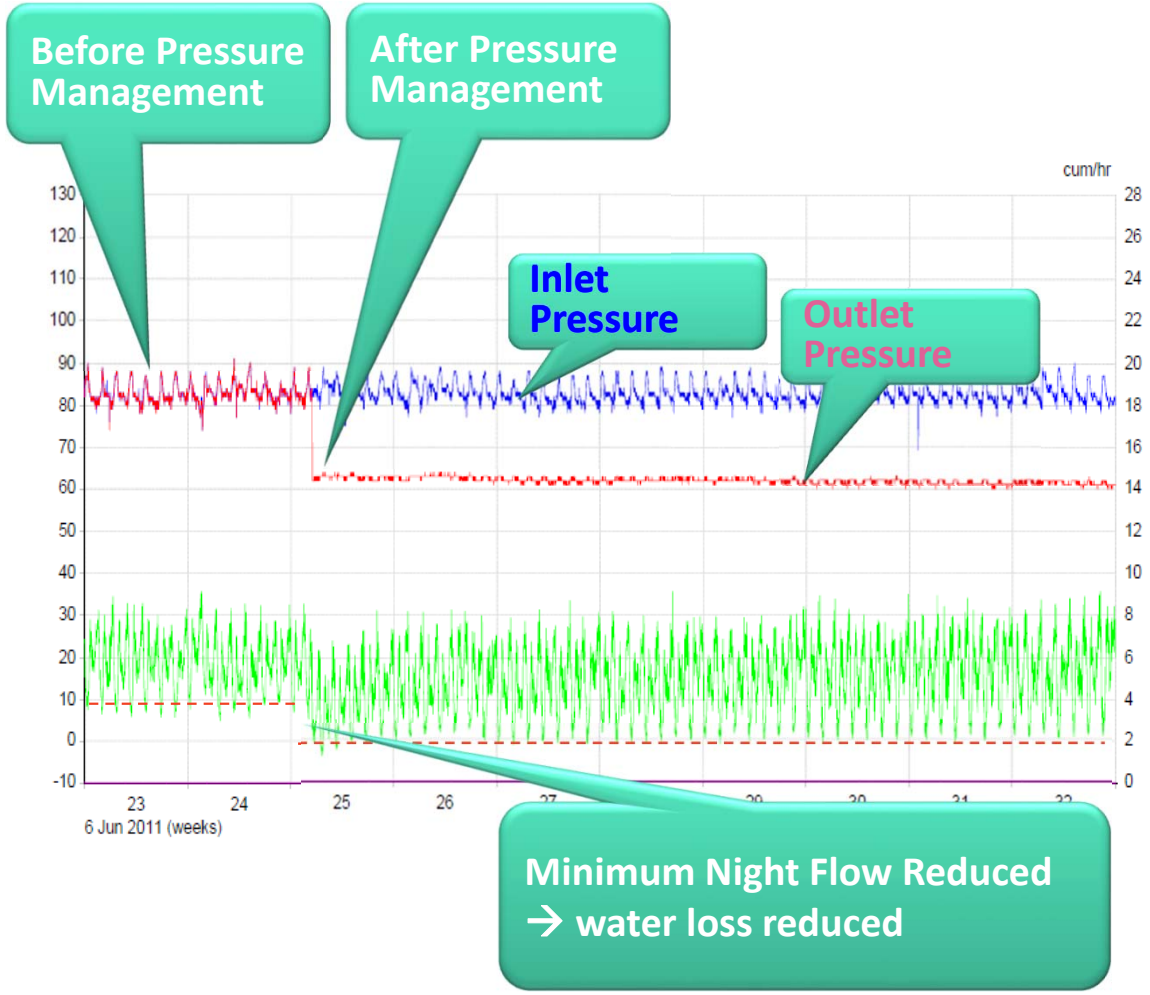
Pressure Management

Before Pressure Management



After Pressure Management





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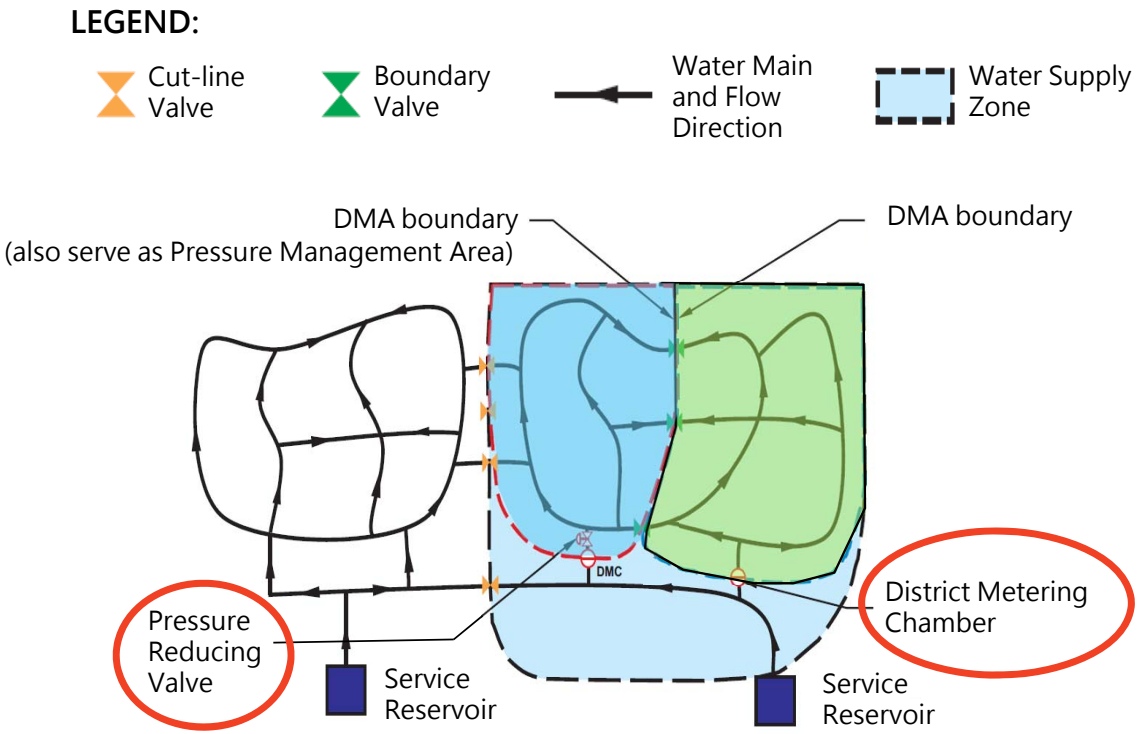
Quality and Speedy Repair

- Committed management/staff & effective organization/procedures
- Established partnership with experienced contractors
- Appropriate standards and workmanship

WSD Water Loss Management Strategy – Water Intelligent Network (WIN)

About 2 400 no. of
District Metering Areas (DMAs)

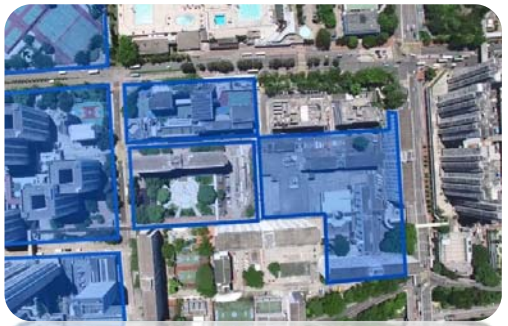
Divide and Conquer



Continuous Monitoring

Water Intelligent Network (WIN)

- First DMA established in 2001
- Currently, about 1 400 DMAs/PMAs established
- Schedule to complete the establishment of about 2 400 DMAs/PMAs by 2024
- Monitor the underground water supply network for determining appropriate network management actions



Water Intelligent Network (WIN)

Water Intelligent Network Management System (INMS)

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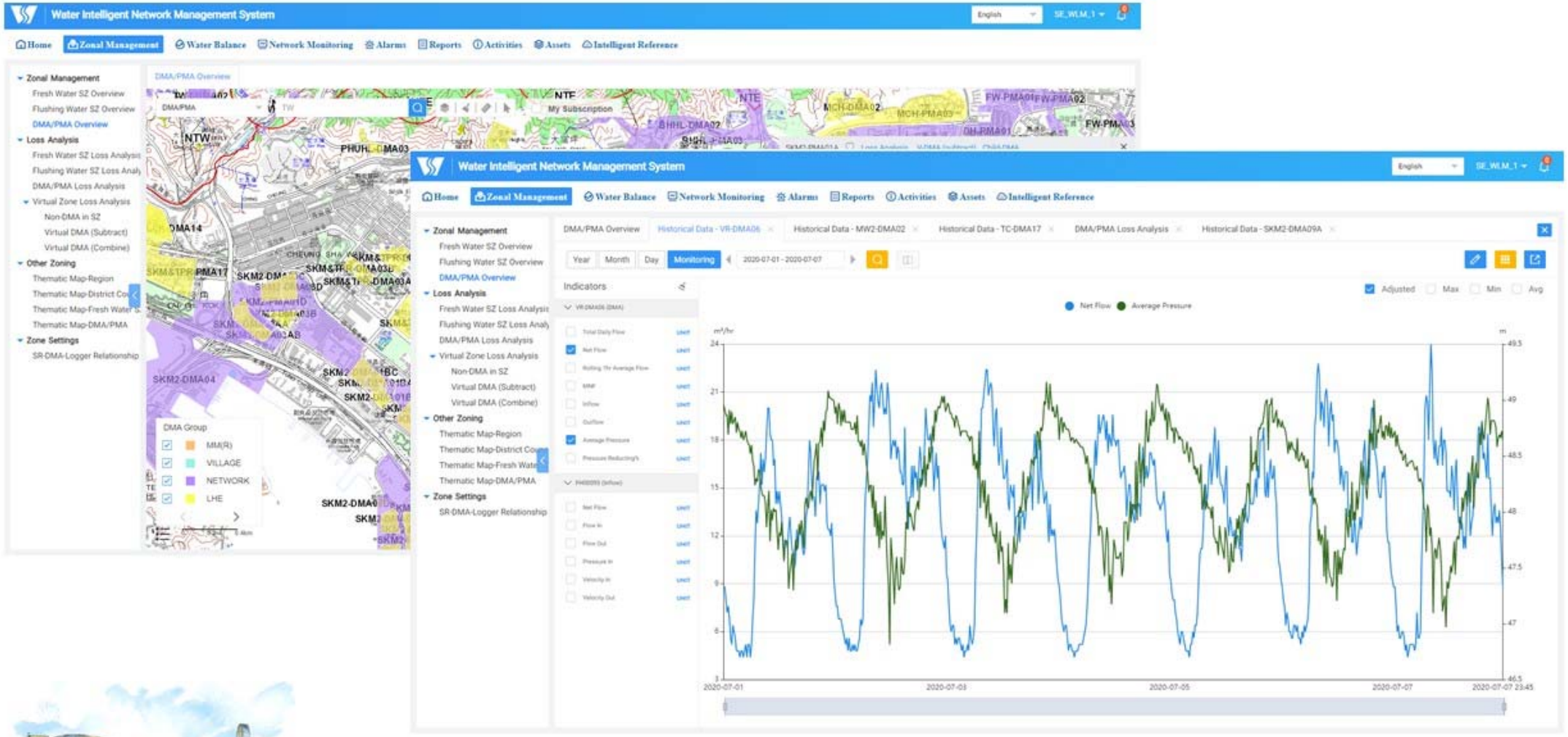

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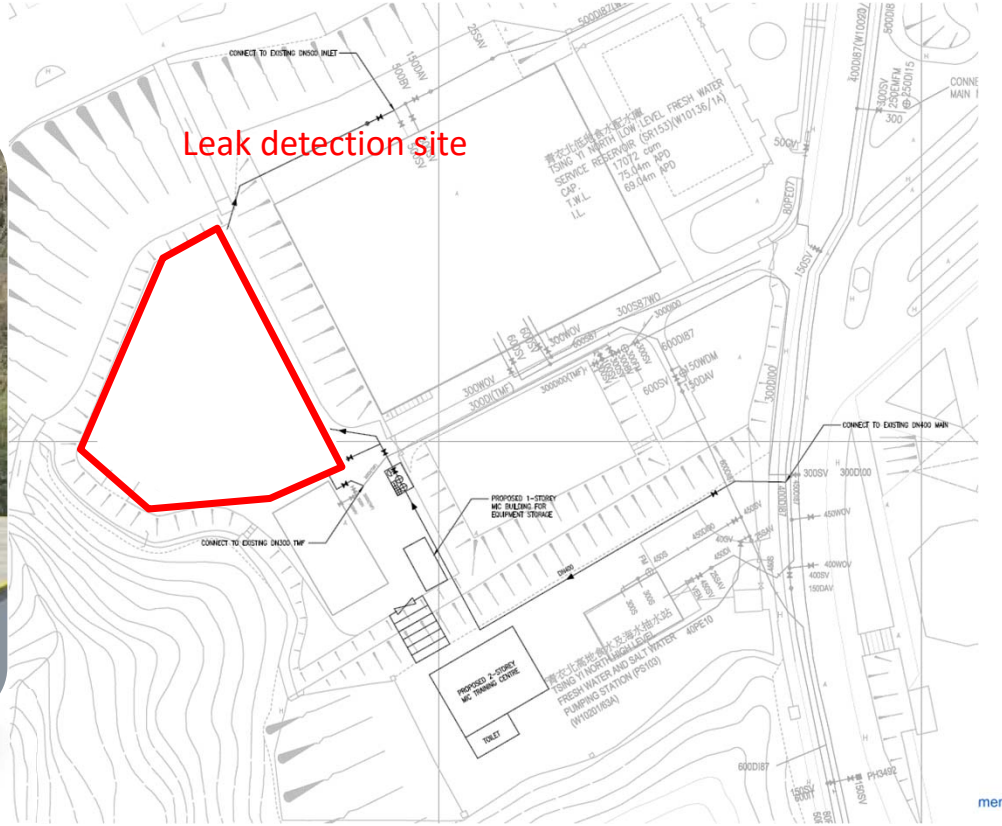
Collaborative Development of the Leak Detection Service Trade

- Collaborative project with HK PolyU on design and construction of a Leak Detection Training Ground in Tsing Yi
- Qualification System for Leak Detection Trade



Collaborative Development of the Leak Detection Service Trade

- **Training and Examination**
  - Provide a place for lectures with practical on-site training of leak detection service trade
  - Provide a venue of accreditation of leak detection practitioners
- **R&D and Collaboration**
  - Collaboration with research bodies and industry for Research and Development of leak detection technologies
  - Provision of facility for testing of advanced leak detection technologies

Thank you!