HKU MSc Programme in Electronic Commerce and Internet Computing

Guest Lecture

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Water Supplies Department

Contents

- **Water Supplies in Hong Kong**

- **IT Systems in WSD**

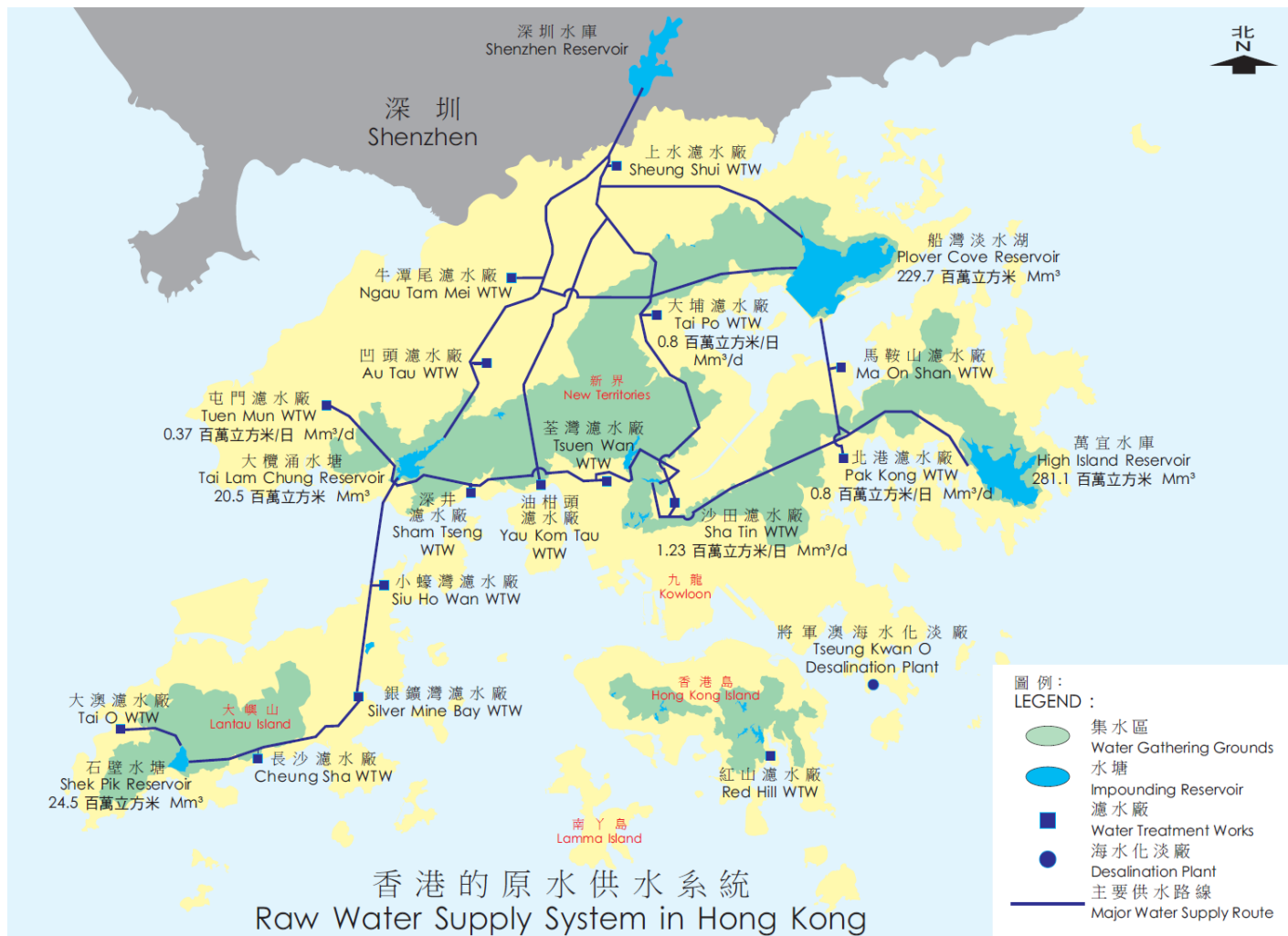- **IT Initiatives in WSD**
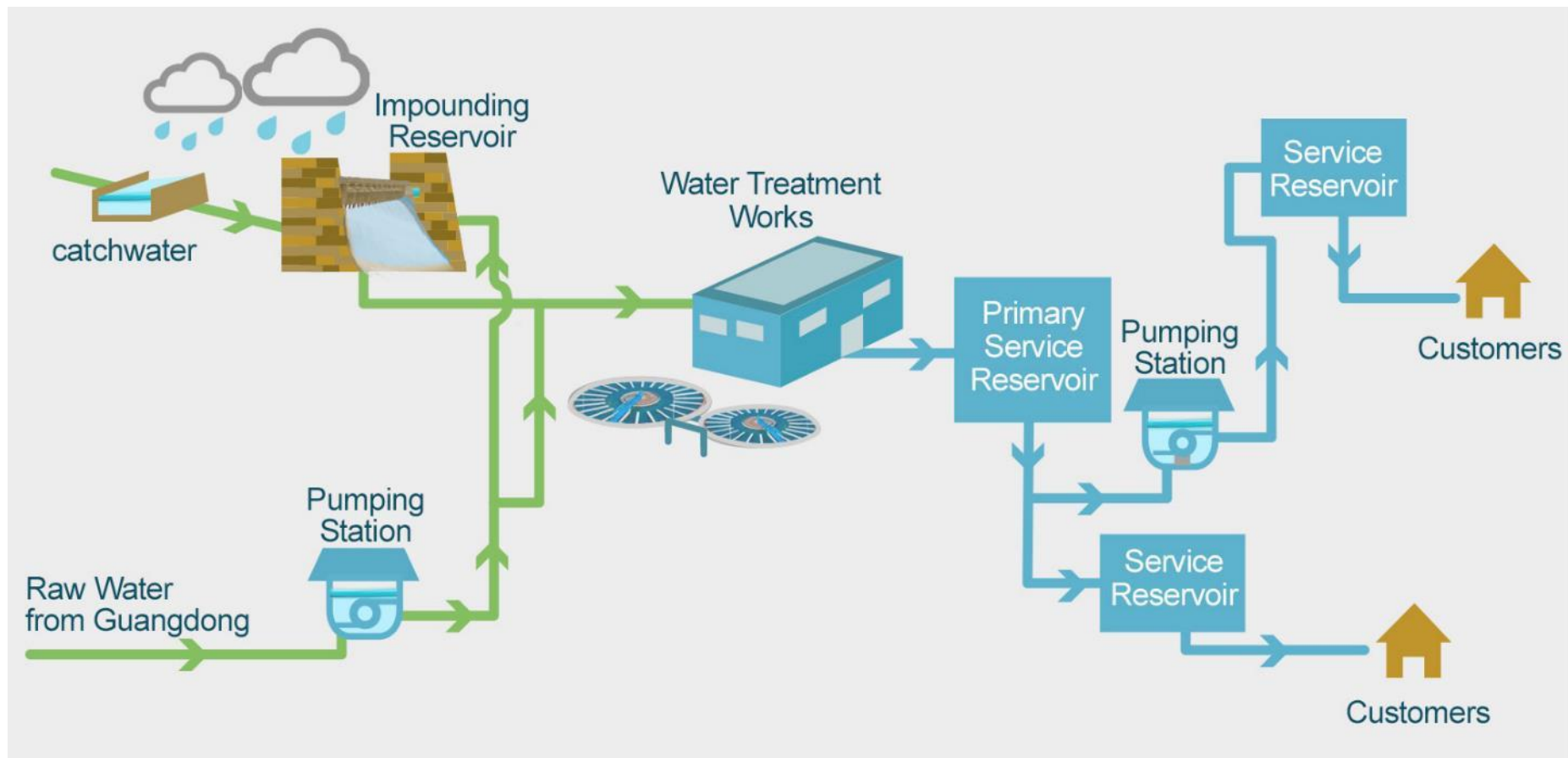
Water Supplies in Hong Kong

Raw Water Supply System in Hong Kong

香港的原水供水系統
Raw Water Supply System in Hong Kong

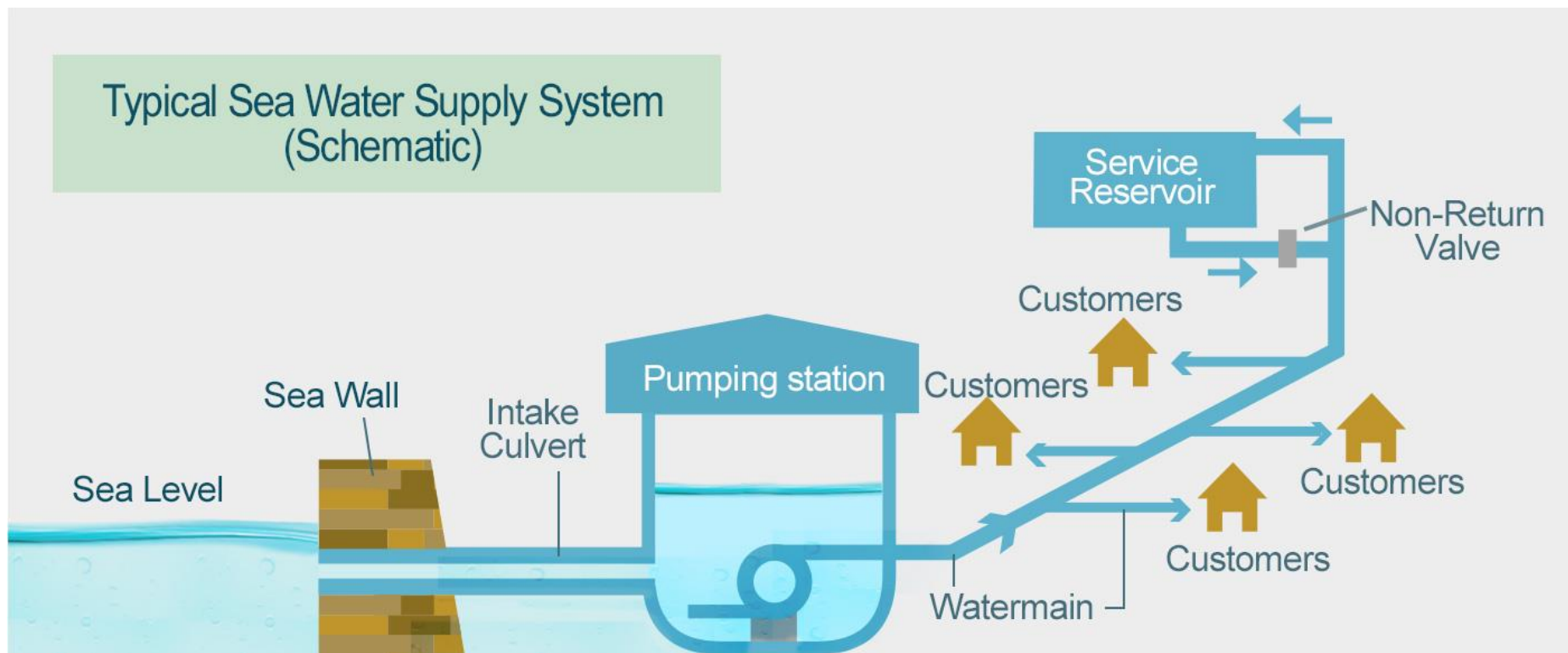## Typical Fresh Water Supply System (Schematic)

Typical Sea Water Supply System (Schematic)

Typical Sea Water Supply System (Schematic)

INTAKE CULVERT

Asset Management

- Manage the life cycles of all waterworks infrastructure to achieve the optimal level of service in the most cost-effective manner

- Regular maintenance of surface and water main assets under four Regions

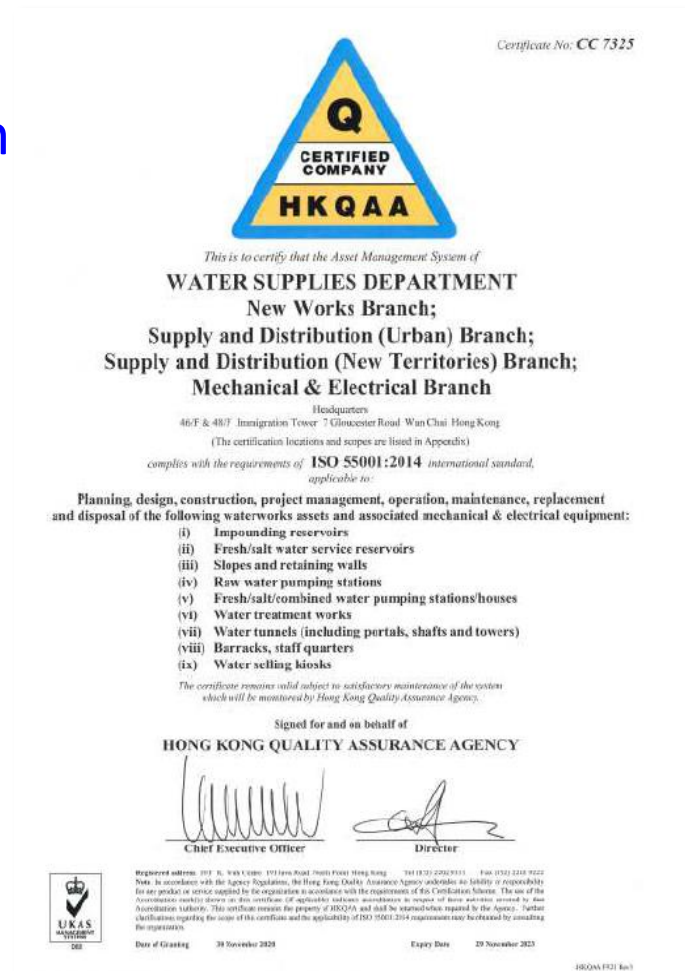- WSD issues about 21,000 works orders at a total value of about $1,260M each year

Asset Management

- Obtained ISO 55001:2014 certification in Nov 2020 covering 9 types of surface assets including:-

  - ✓ **impounding reservoirs**

  - ✓ **water tunnels**

  - ✓ **pumping stations**

  - ✓ **water treatment works**

  - ✓ **service reservoirs**

  - ✓ **slopes and retaining walls, etc.**

Certificate No: CC 7325

This is to certify that the Asset Management System of

WATER SUPPLIES DEPARTMENT
New Works Branch;
Supply and Distribution (Urban) Branch;
Supply and Distribution (New Territories) Branch;
Mechanical & Electrical Branch

Headquarters
46/F & 48/F Immigration Tower 7 Gloucester Road Wan Chai Hong Kong
(The certification locations and scopes are listed in Appendix)

complies with the requirements of ISO 55001:2014 international standard, applicable to:

Planning, design, construction, project management, operation, maintenance, replacement and disposal of the following waterworks assets and associated mechanical & electrical equipment:

(i) Impounding reservoirs
(ii) Fresh/salt water service reservoirs
(iii) Slopes and retaining walls
(iv) Raw water pumping stations
(v) Fresh/salt/combined water pumping stations/houses
(vi) Water treatment works
(vii) Water tunnels (including portals, shafts and towers)
(viii) Barracks, staff quarters
(ix) Water selling kiosks

The certificate remains valid subject to satisfactory maintenance of the system which will be monitored by Hong Kong Quality Assurance Agency.

Signed for and on behalf of

HONG KONG QUALITY ASSURANCE AGENCY

Chief Executive Officer   Director

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Customer Service

- To excel in satisfying customers' needs for the provision of quality water services

- To adopt a customer-oriented approach in our services

Customer Service

Change of Consumership

Application for Re-connection

General Enquiries and Complaints

Application for Meter Test

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Number of water accounts (as at 31 March 2020)

Type		No. of Accounts
Domestic	:	2,771,850
Trade	:	251,331
Government	:	13,411
Flushing	:	39,167
Miscellaneous (e.g. Construction)	:	2,078
Total		**3,077,837**

IT Systems in WSD

- **Supervisory Control And Data Acquisition (SCADA)**

- **Geographic Information System (GIS)**

- **Maintenance Works Management System (MWMS)**

- **Customer Care and Billing System (CCBS)**

SCADA

■ For real-time remote monitoring and control of the operations of waterworks installations including water treatment works, pumping stations and service reservoirs

■ Each Region has its own Regional Control Centre to oversee the operations of water transfer and distribution facilities
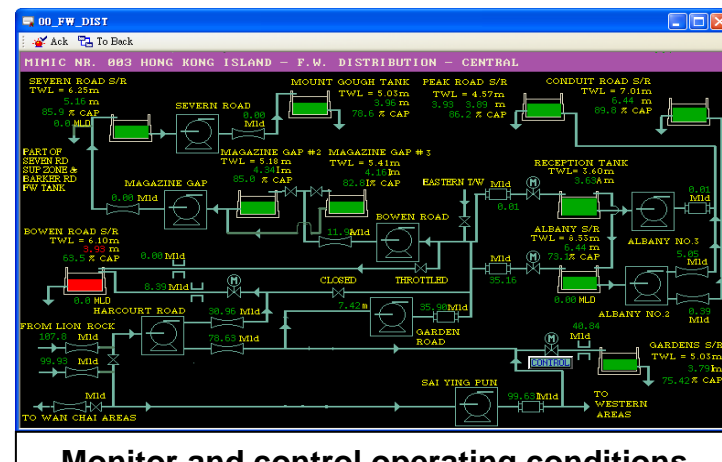
Monitor and control operating conditions for pump/motor

Analysis water using in Header Tanks/ SRs

SCADA Topology
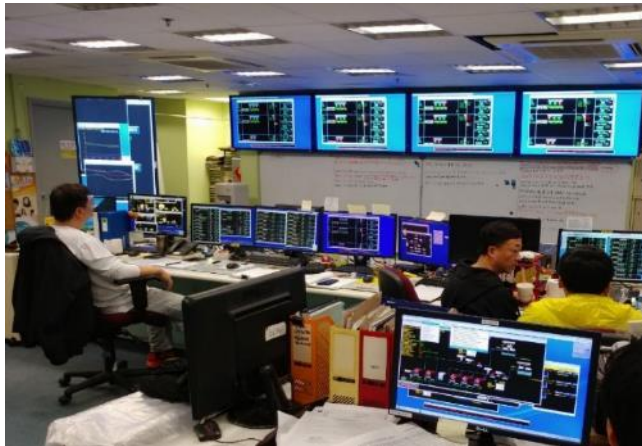
HK&I Regional SCADA Control Room

K Regional SCADA Control Room

NTE Regional SCADA Control Room

NTW Regional SCADA Control Room

Architecture of SCADA

Management Level

Intranet

Private Broadband Network

Operation Level

Network

TCP/IP Network

Operation Terminals

WSD cable, leased line, low power radio, fixed/mobile broadband… etc.

Process Level

GIS

Customers

Buildings

Streets

Reality

Digital Mapping System (DMS)

China

Pearl River Delta

Hong Kong Special Administrative Region
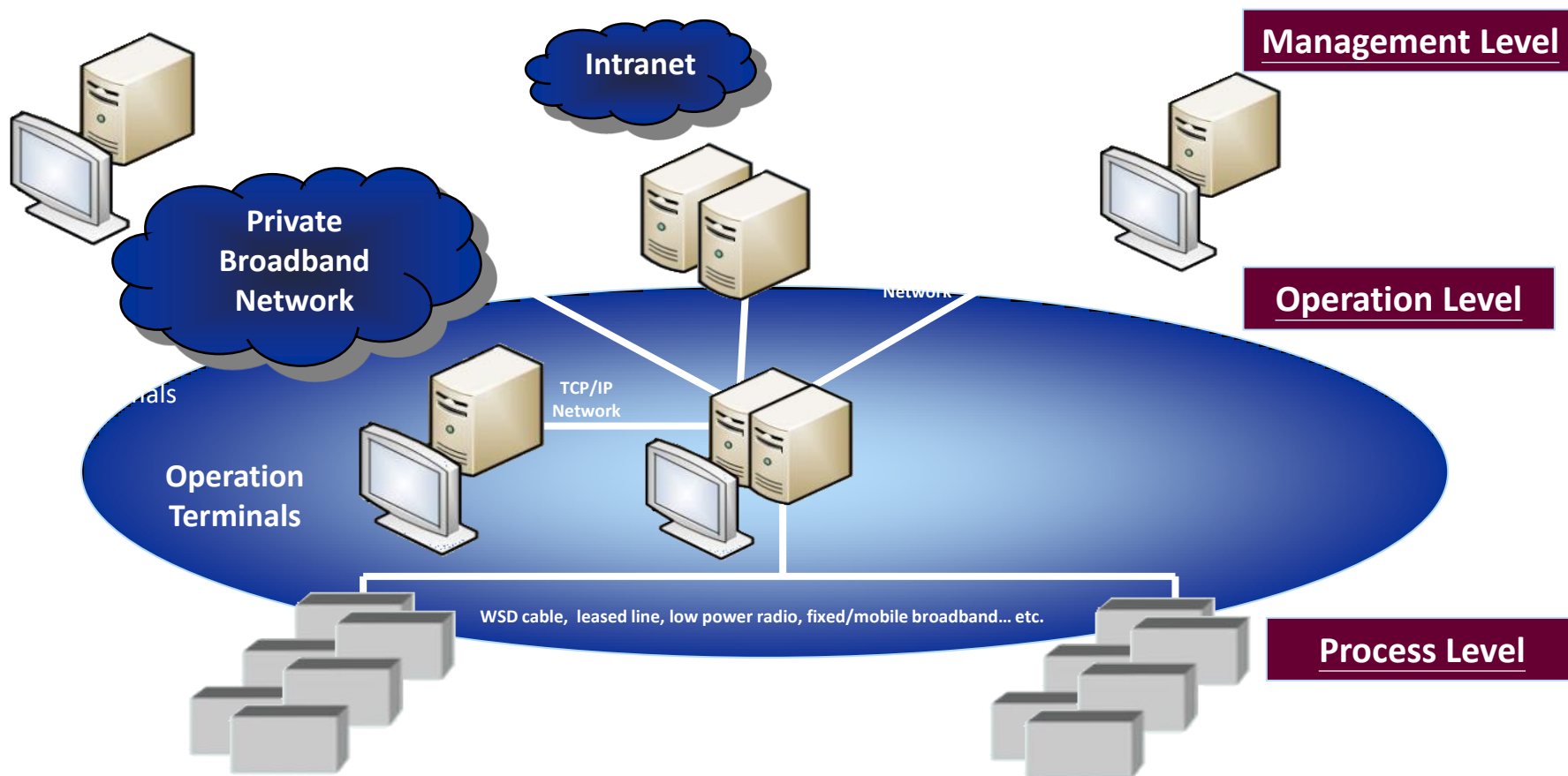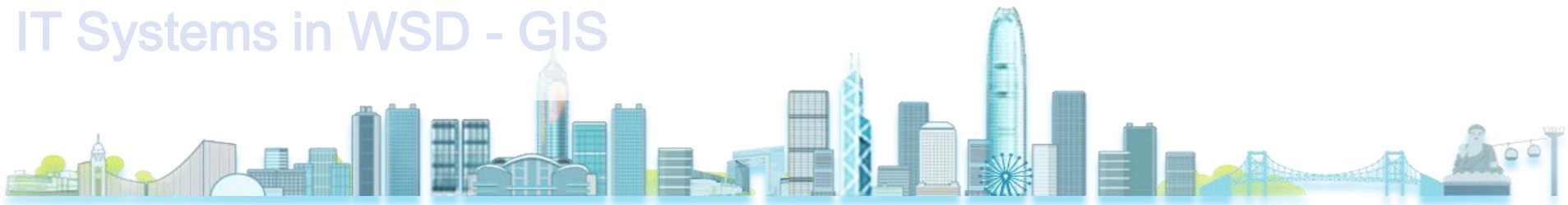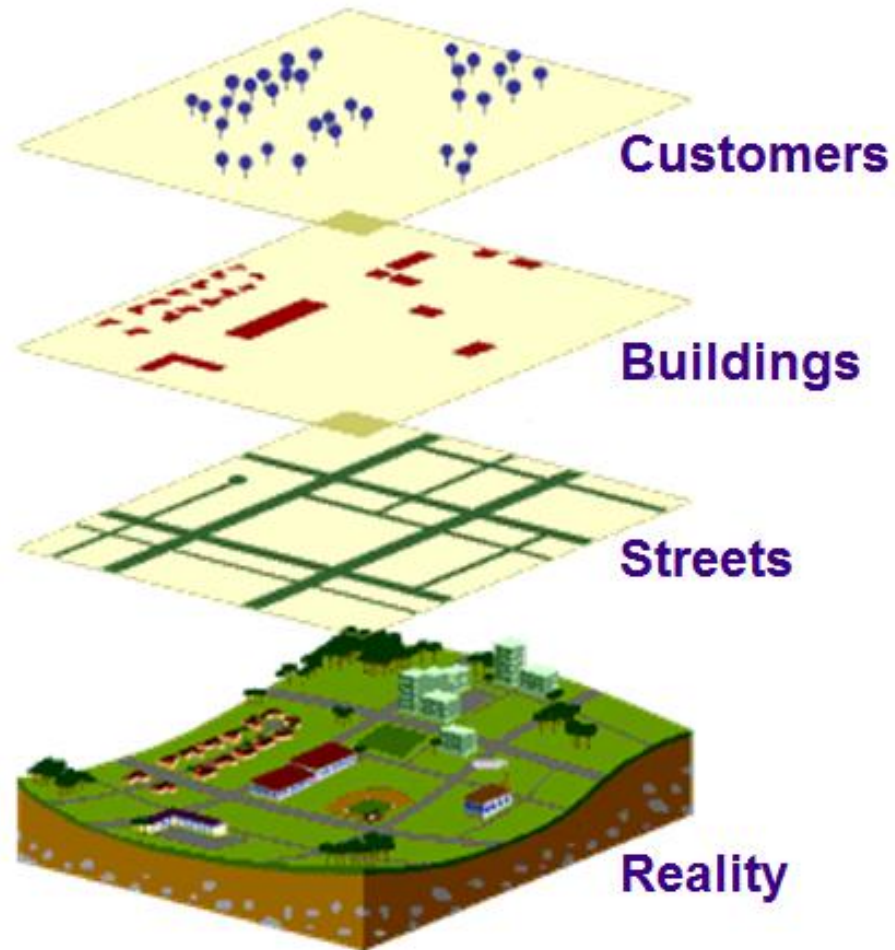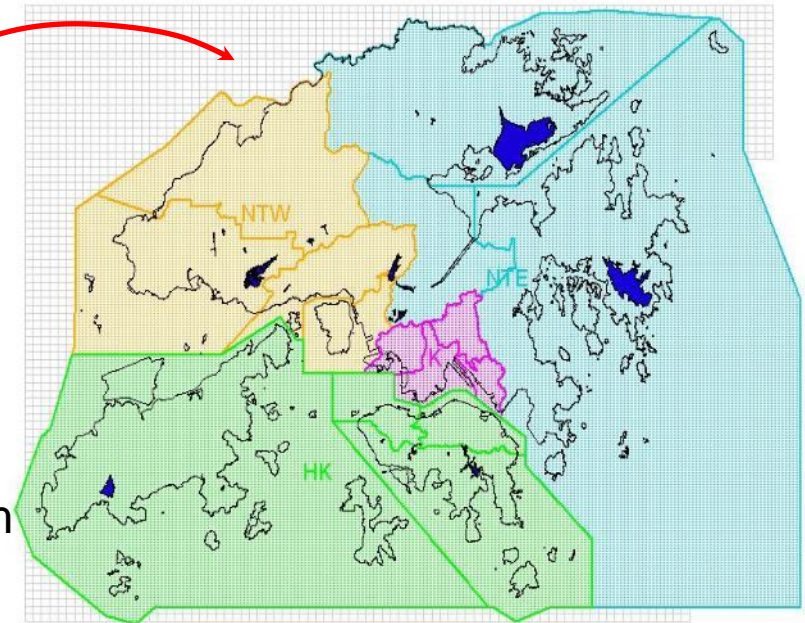
- **Underground Assets:** More than 8,000 km government fresh and salt water mains.

- **Surface Assets:** 17 impounding reservoirs, 20 treatment works, around 230 service reservoirs and around 190 pumping stations.

WATER SUPPLIES DEPARTMENT
DIGITAL MAPPING SYSTEM B1000

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Digital Mapping System (DMS)
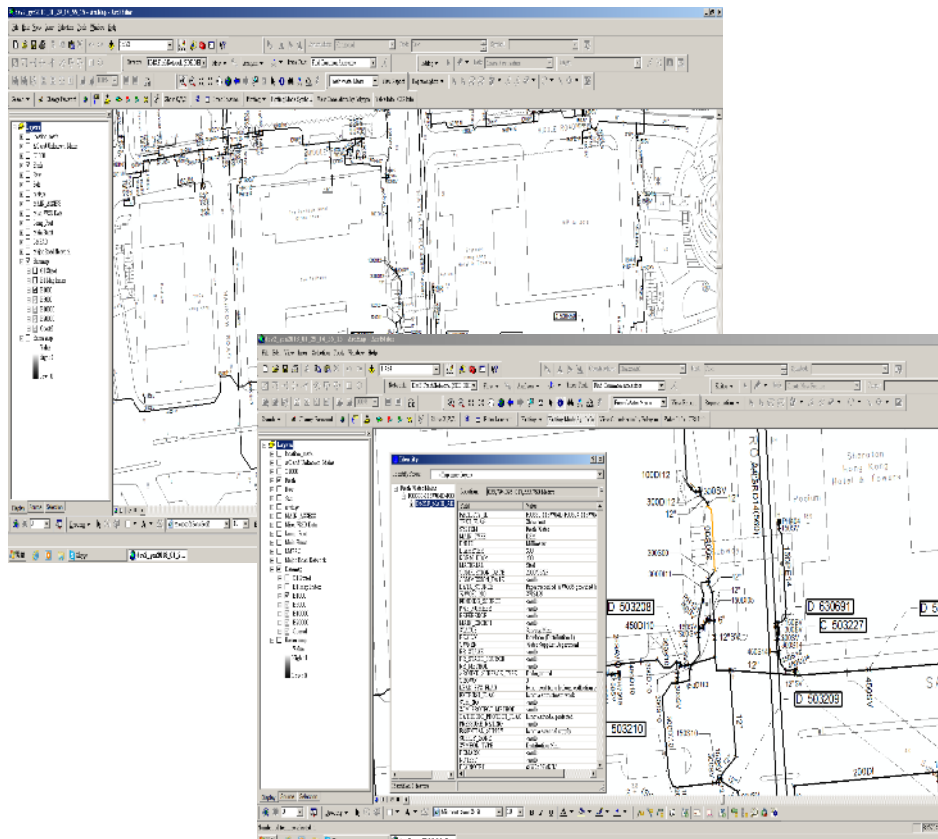
- Store underground assets information

- Facilitate operation and maintenance of underground assets

- Facilitate hydraulic analysis modeling, pressure management and continuous system monitoring

MWMS

- An integrated solution to meet the requirements on the management of maintenance works in WSD

  - schedule and manage works orders

  - schedule staff resources for site supervision

  - maintain history of maintenance works

  - process job records submitted by contractors for

    measurement and payment

MWMS – Mobile Solution

MWMS
Servers
(Task
Records)

Download Tasks/Data
via 4G Mobile Network

Work Gang
on site

(Perform
maintenance
works, fill in and
save e-Form
Record)

Upload Tasks/Data via 4G Mobile Network

MWMS – Private Intranet Solution

MWMS Servers (Task Records)

Download Tasks/Data via WSD Intranet

Client Terminal

Work Gang at Waterworks Installation such as Pumping Station and Water Treatment Works

Upload Tasks/Data via WSD Intranet
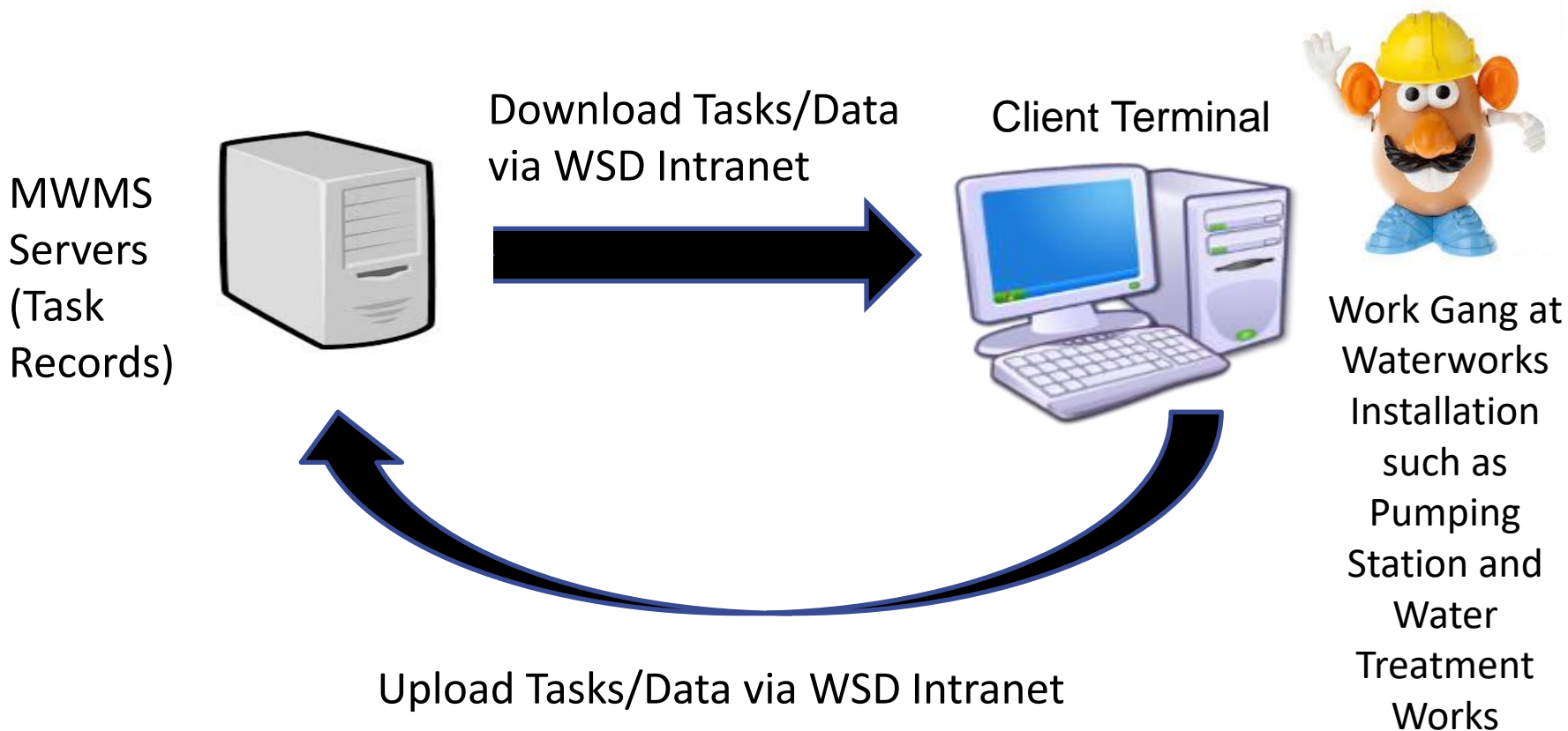
MWMS – Secured Internet Solution

Term Contractor on the Internet

Download Tasks/Data
via Internet using HTTPS connection

MWMS Servers on the WSD Intranet (Task Records)

Firewall

Servers in DMZ

Firewall

Upload Tasks/Data via Internet using HTTPS connection

e-Bill and e-Payment

IT Initiatives in WSD

Building Information Modelling (BIM)

Water Intelligent Network (WIN)

Automatic Meter Reading (AMR)

Hong Kong Smart City Blueprint 2.0

Other Smart Network Initiatives

Building Information Modelling

- management of information through the whole life cycle of a built asset

- avoiding design alterations, reducing risk and abortive work

- enhancing collaboration and increasing productivity in design and construction

- facilitating asset and facility management
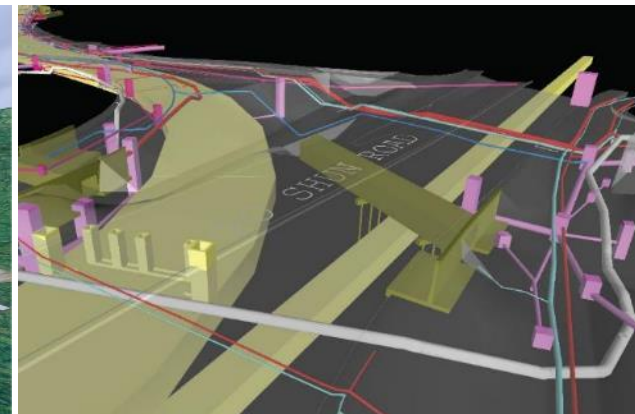
Development of Asset Management Information System (AMIS)

- A building management system
- Maintaining and operation of facilities or assets such as buildings, infrastructures, systems and equipment
- To develop a pilot Asset Management Information System (AMIS) with BIM Integration

District Metering Areas (DMA) and Pressure Management Areas (PMA)
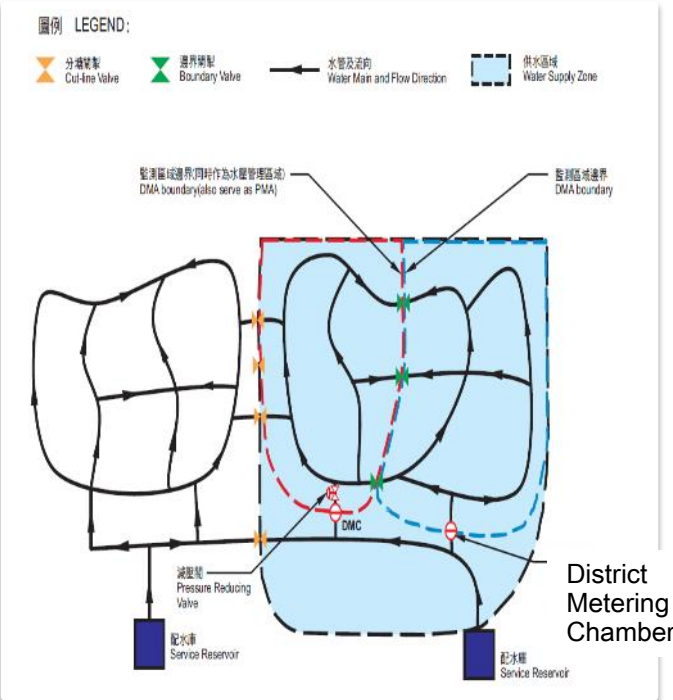
"Divide & Conquer" and Continuous Monitoring

Fresh water distribution network will be divided into some 2400 DMAs/PMAs

Water Intelligent Network Management System

Data
Collection

Information
Analysis

Insight
Dashboard
Alarm
Prioritization

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Water Intelligent Network Management System

Key Indicators

- Discrepancy Ratio (DR): total supply to DMA / total consumption in the DMA

- Minimum Night Flow (MNF)

DR

Unauthorized consumption	Leakage and/or unauthorized consumption
Healthy	**Probably healthy as the MNF should be due to legitimate night use**

MNF

Enforcement Actions

Probable Unauthorised Consumption → Investigation → Take Enforcement Action as Necessary
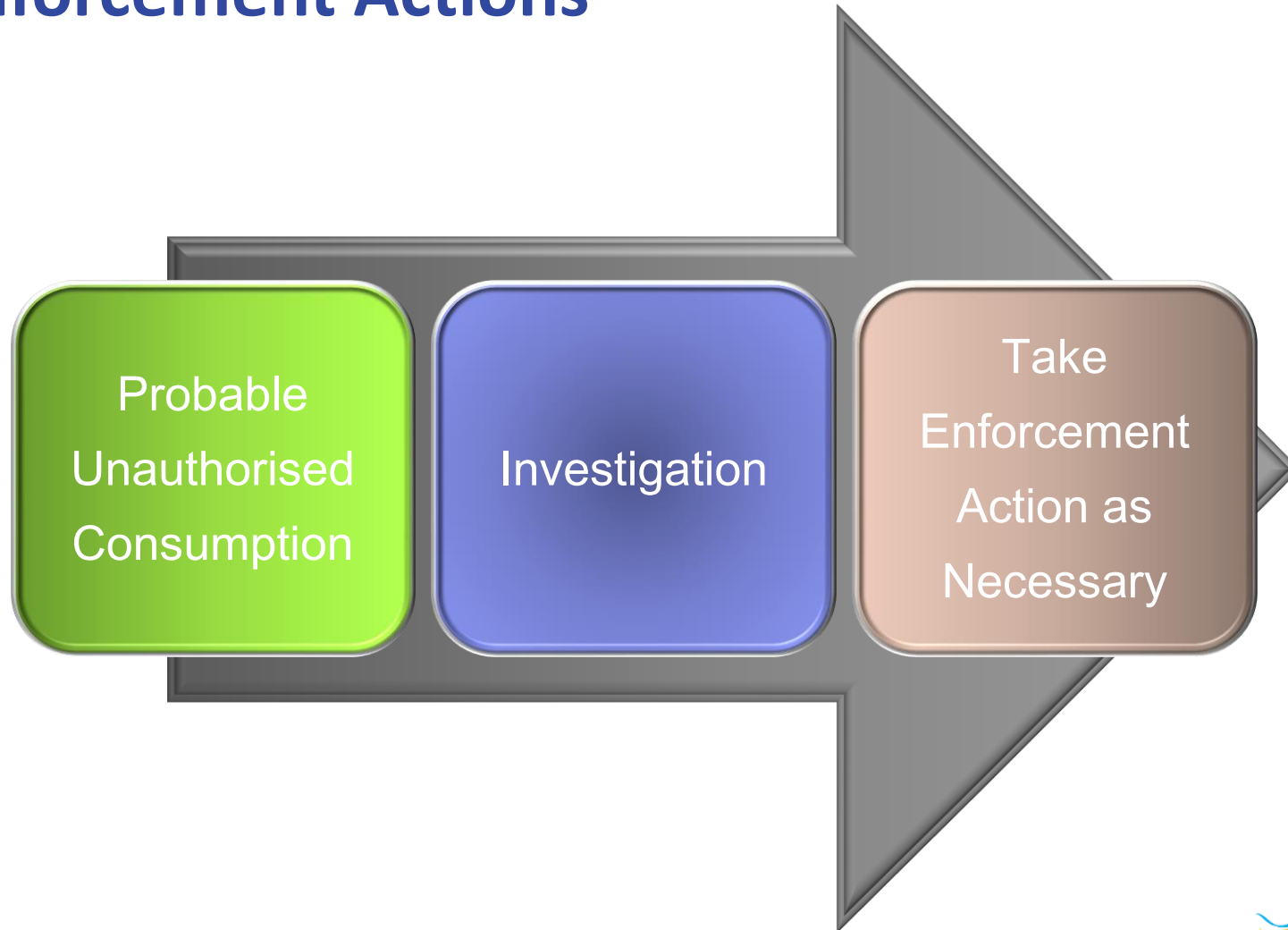
Network Management Measures – Four Pillars

Determination of the most effective network management measures

Active Leakage Detection & Control

Pressure Reducing Valve

High Pressure Area
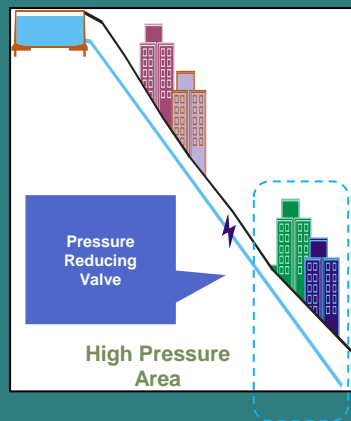
Pressure Management

Quality & Speedy Repair

Reprovisioning of Water Mains

Active Leakage Detection and Control

- **Acoustic Leak Detection (e.g. Leak Noise Correlator (LNC) and Noise Logger)**
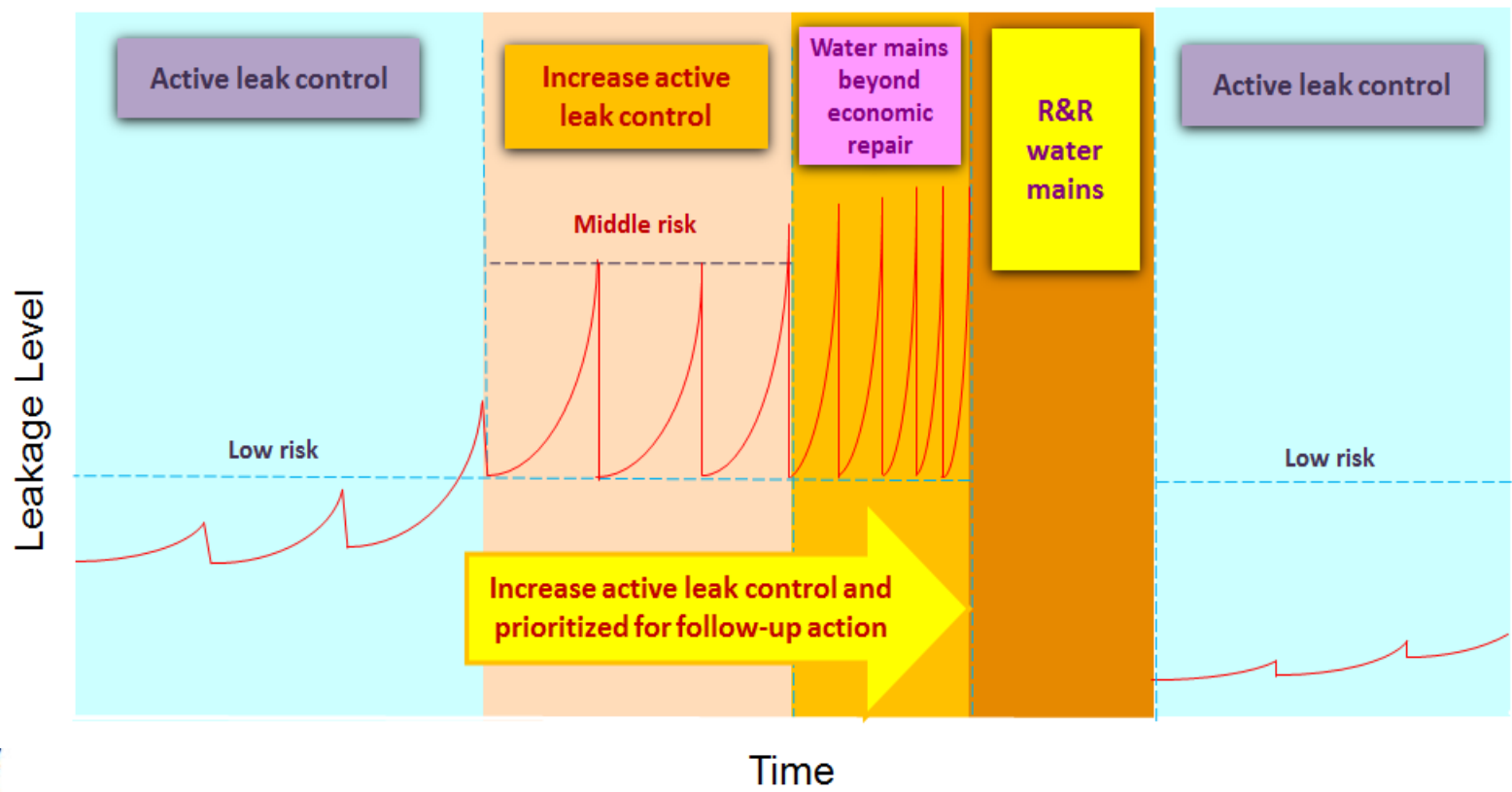
- **Inline Inspection (e.g. Trials of "Sahara" and "Smartball")**
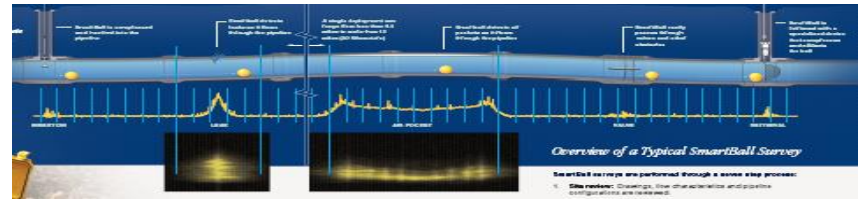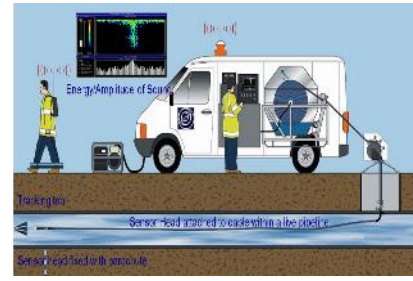
Pressure Management
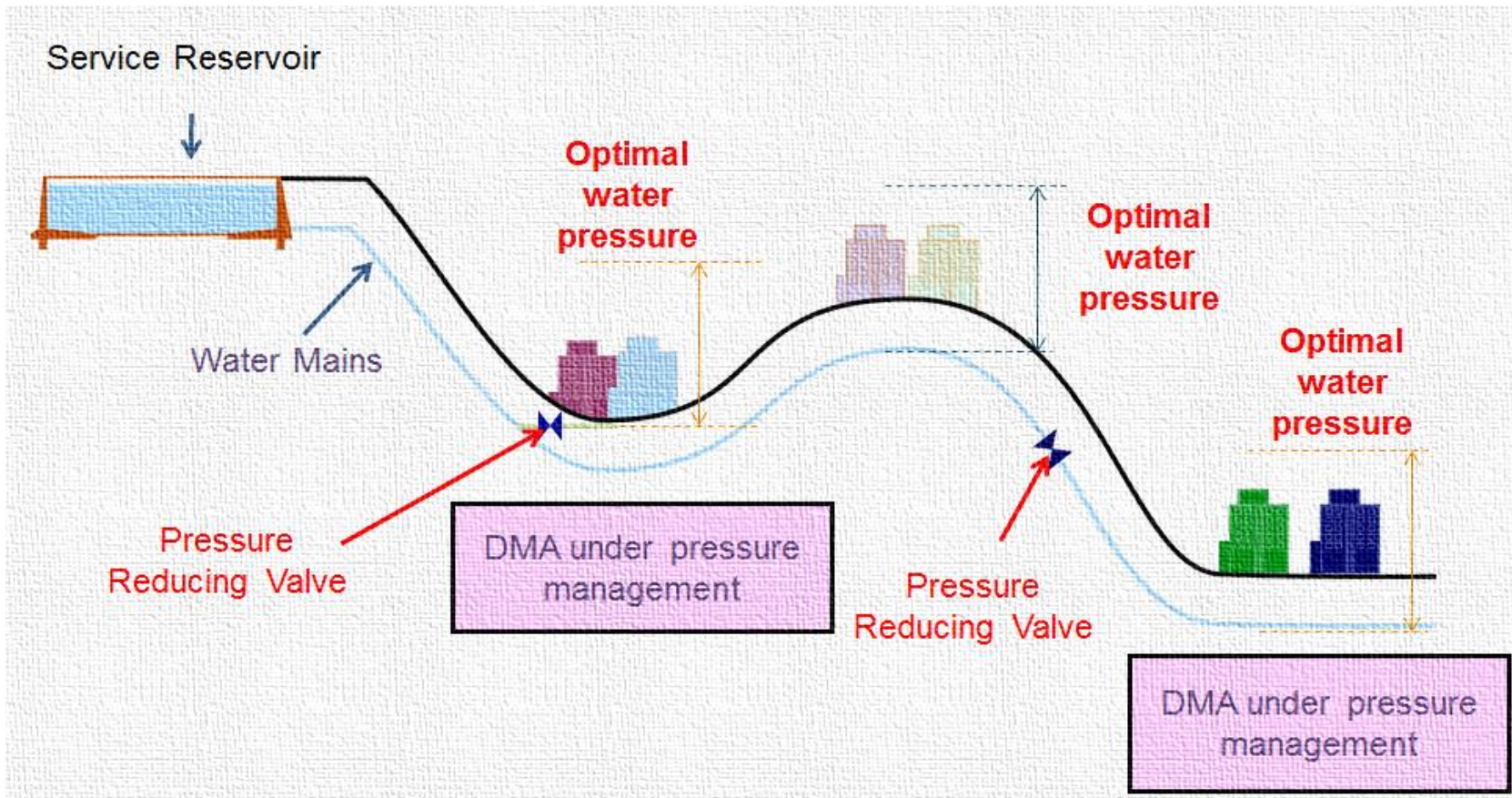
Reprovisioning of Water Mains beyond Economical Repair

AMR Benefits

- **Water consumption**

- **Benchmarking**
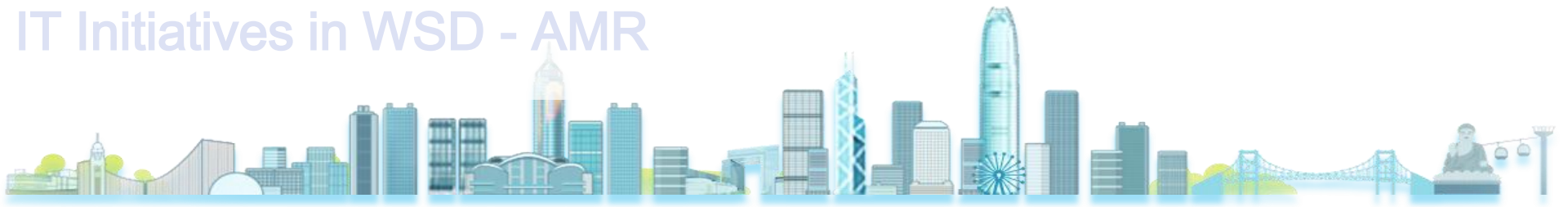
- **Leakage alert**

- **Water conservation**

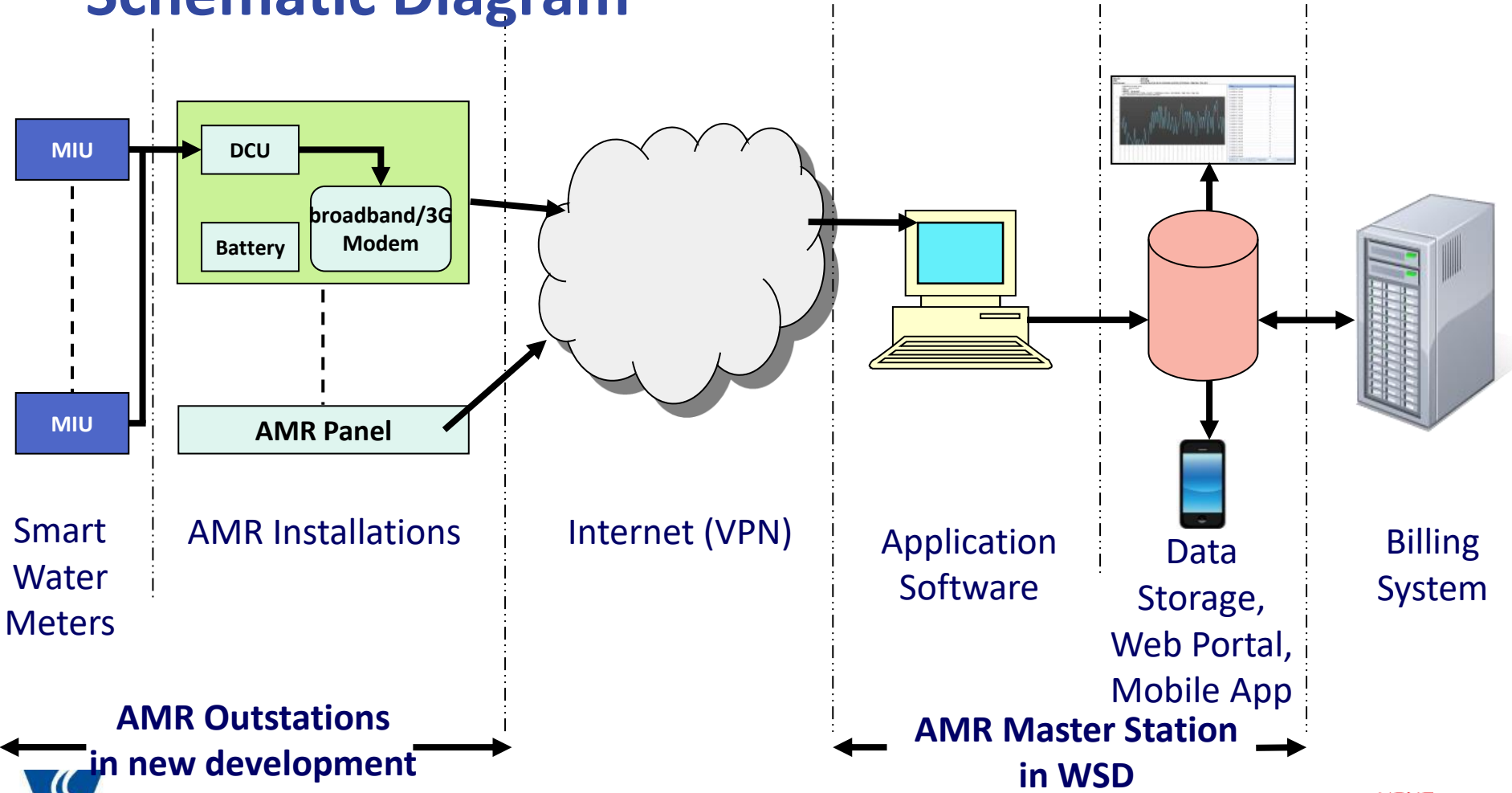Web Portal

Smartphone App

AMR in Smart City

- Implementing AMR in Kowloon East to help forge it as a smart city

- ~42,000 smart water meters to be installed in 2018-2023

Photo from http://www.ekeo.gov.hk/en/key_projects/index.html

Schematic Diagram

| MIU |
| DCU |
| Battery | broadband/3G Modem |
| AMR Panel |

Smart Water Meters

AMR Installations

Internet (VPN)

Application Software

Data Storage, Web Portal, Mobile App

Billing System

AMR Outstations in new development

AMR Master Station in WSD

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Smart Meters and Meter Interfacing Unit (MIU)

- Use of transmission modules
- Multi-features (tampering detection, low battery alarm)
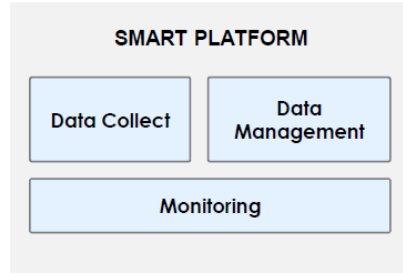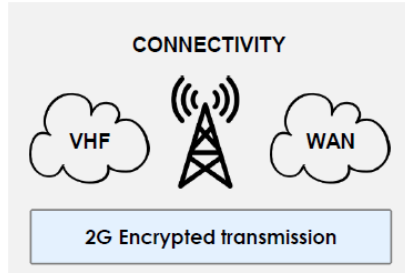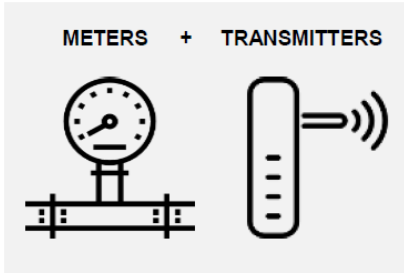- Built-in battery
- Reading meters remotely

AMR Pilot Scheme

- 357 numbers smart meters and 3 AMR Outstations installed in 3 high-rise residential buildings in 2013. Some 500 smarts meters commissioned in e-Residence in 2020.
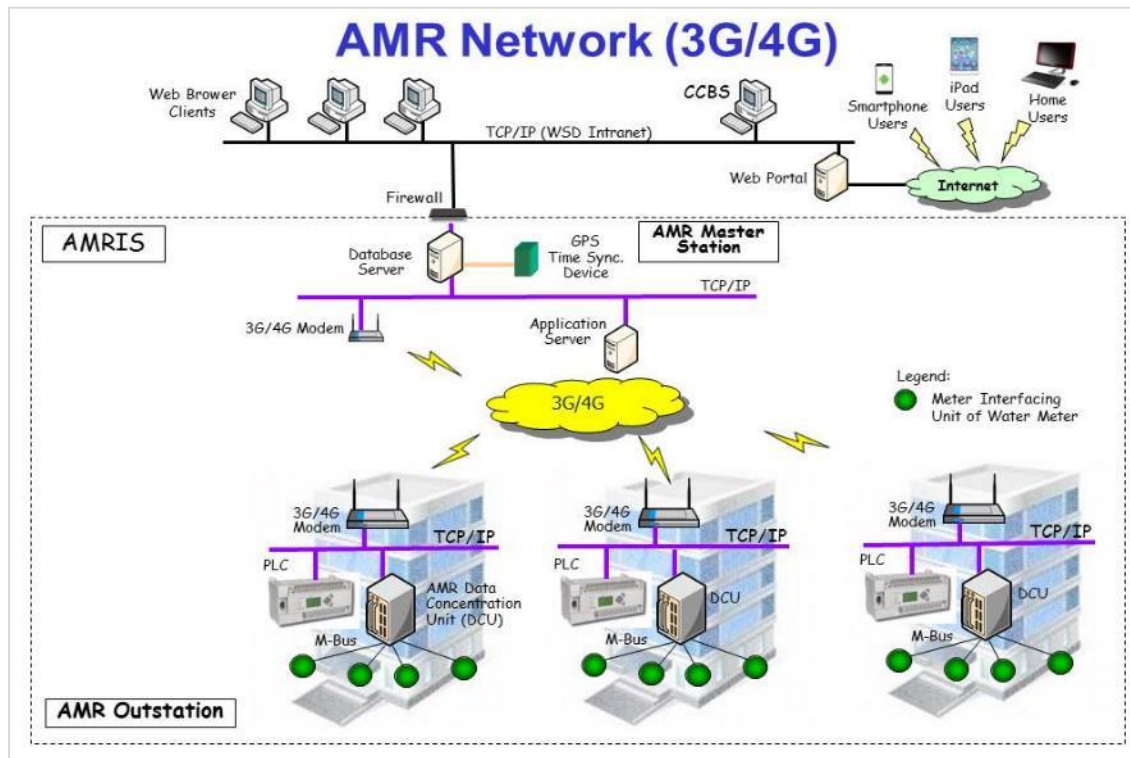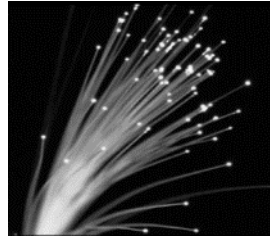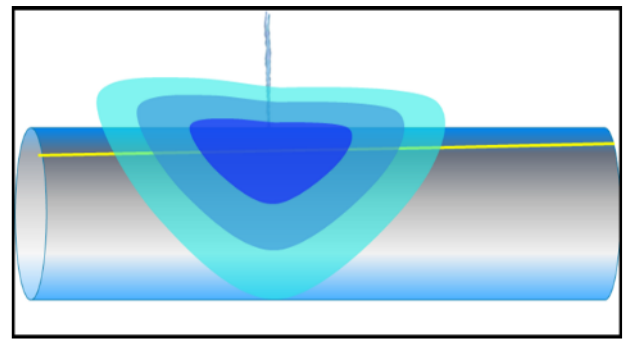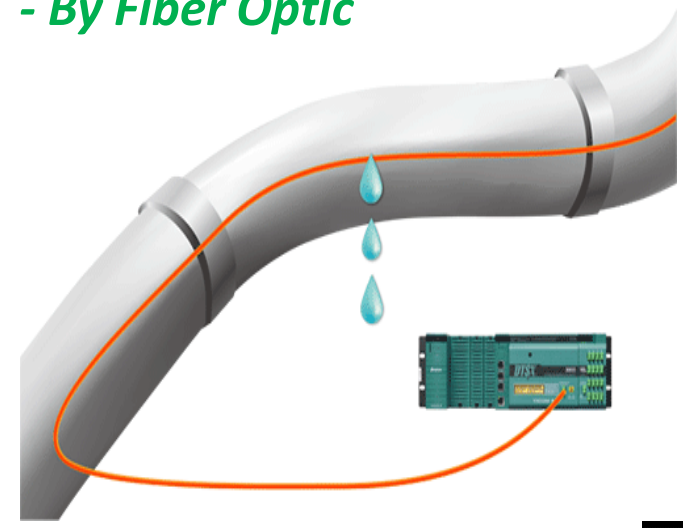
Wireless AMR Concepts under Trial

Field Data Collection	Wireless Transmission	Reception & Publication	Consumption (by Business applications)

METERS + TRANSMITTERS	CONNECTIVITY	SMART PLATFORM	WSD SYSTEMS

VHF · WAN

2G Encrypted transmission

Data Collect · Data Management

Monitoring

CCBS · INMS

AMRIS
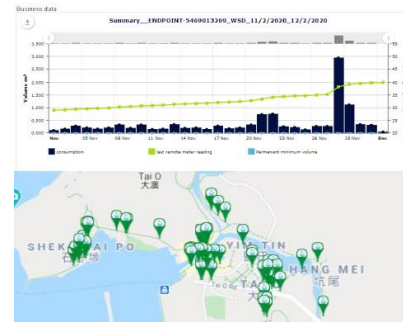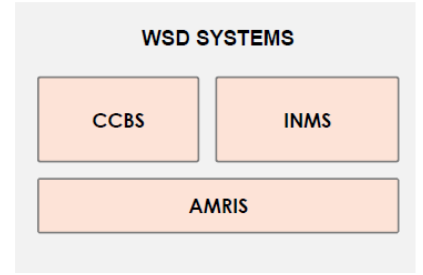
Leak Pin-pointing Technology
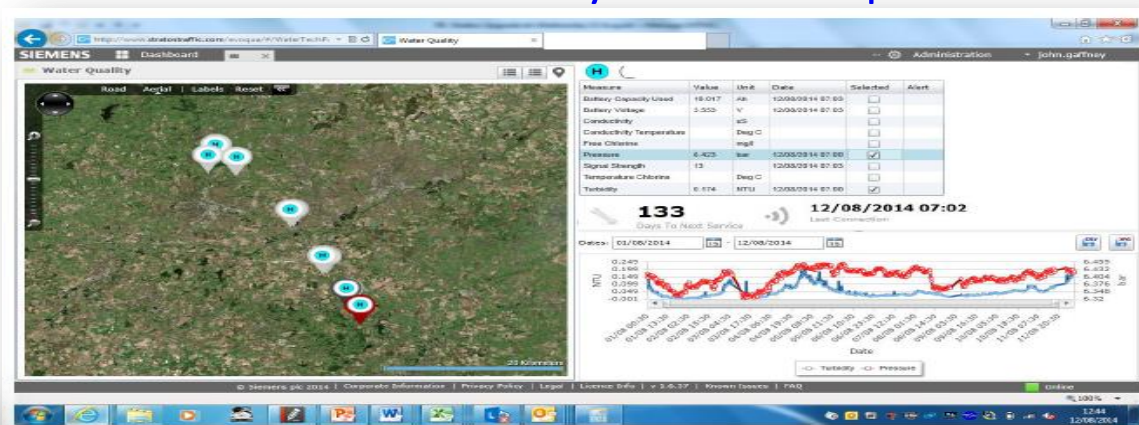
- By Fiber Optic

- By Hydraulic Modelling

On-line Water Quality Monitoring

Parameters to be measured in Anderson Road Quarry Site Development

- Chlorine
- Turbidity
- Conductivity
- Temperature
- pH

Monitoring of Water Quality (turbidity) on Web Portal

Water Quality Monitoring Station

Water Quality Sensors, e.g. chlorine, turbidity

Turbidity & pH Viewing Panel

Water Suspension Notification System (WATSUN)

■ Existing Valve Isolation Computation Programme (VICP) – analyse affected mains and valves in a main burst incident

■ Establish correlation between supply network and affected buildings → Identify the buildings which water supply will be affected

Water Suspension Notification System

- Inform the Management Office (MO) of affected buildings by sending suspension notification via various channels

- WATSUN will be rolled out in phase

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THANK YOU