SWM Case Study

Pre-FS for Denpasar City, Indonesia

Hankuk Engineering Consultants
H. E. C

Agenda

01 About HEC

02 Why SWM?

03 SWM Concept

04 SWM for Denpasar

Hankuk Engineering Consultants

Year Established	• August 13, 1991	
Number of Employees	• 150	
Capabilities	• Annual Turnover for Last 10 years	25 Mil US$ (Ave.)
	• Annual Number of Projects for Last 10 years	130 Projects (Ave.)




Types of Services

- FEASIBILITY STUDY
- PLANNING
- BASIC DESIGN
- DETAILED DESIGN
- CONSTRUCTION MANAGEMENT & SUPERVISION
- ENVIRONMENT IMPACT ASSESSMENT
- ENGINEERING CONSULTIG SERVICES

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About HEC

Water Supply

Advanced Water Treatment Facilities of Gangbuk WTP

Wastewater Treatment

Water Quality Restoration Center & Clean Energy Center in Multifunctional Administrative City

Water Resources

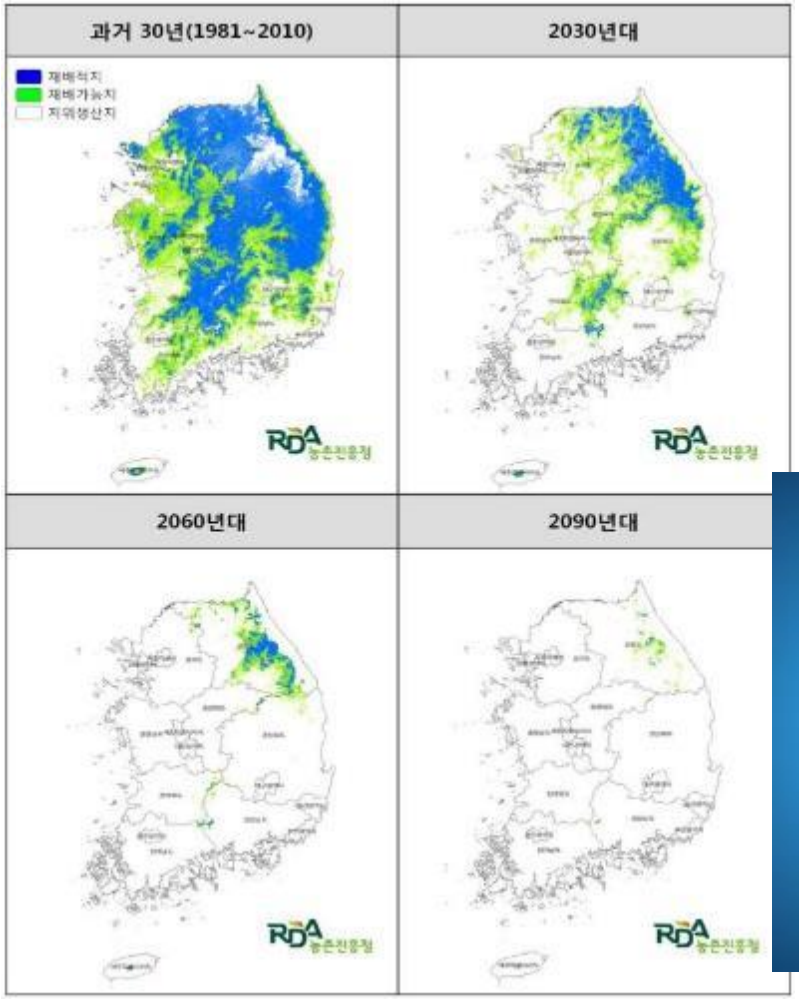
Basic plan of Youngju Dam

Urban Planning

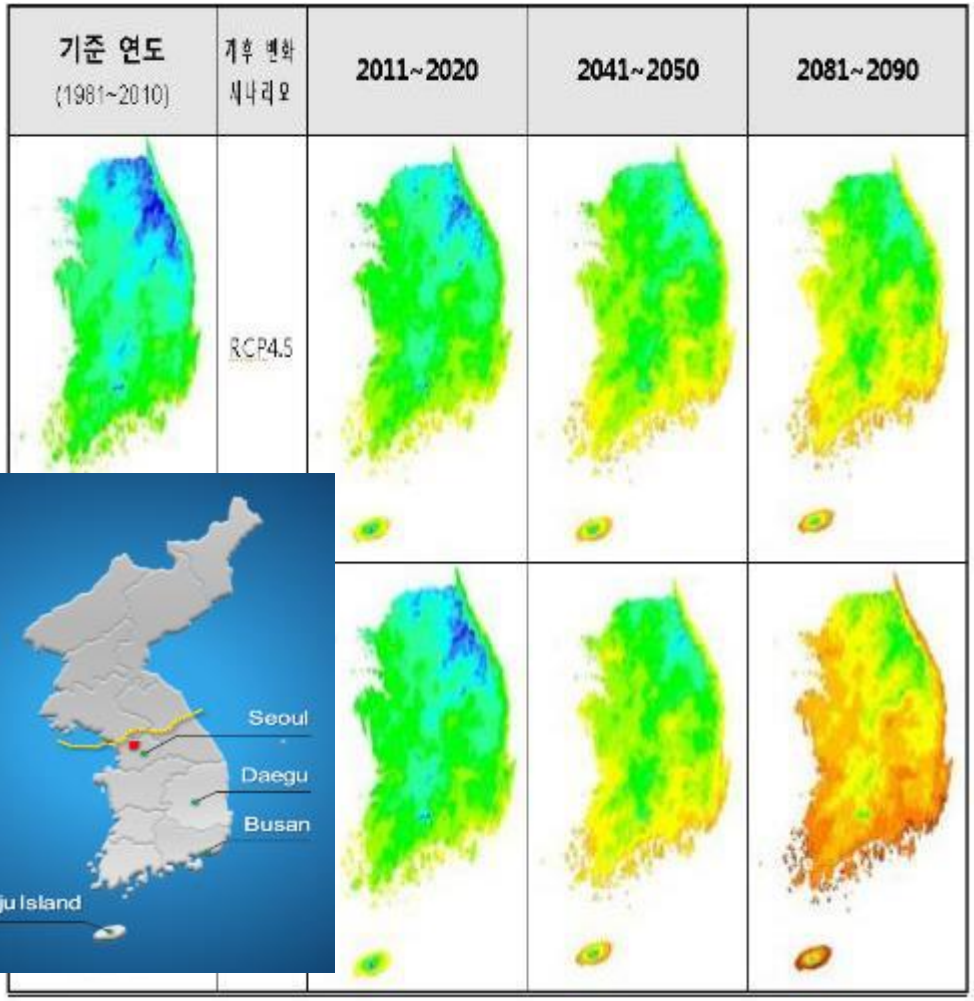
Development(Section 5) Project of Cheongna District in Incheon FEZ

Climate Change in Korea

Change of Apple Cultivation Region

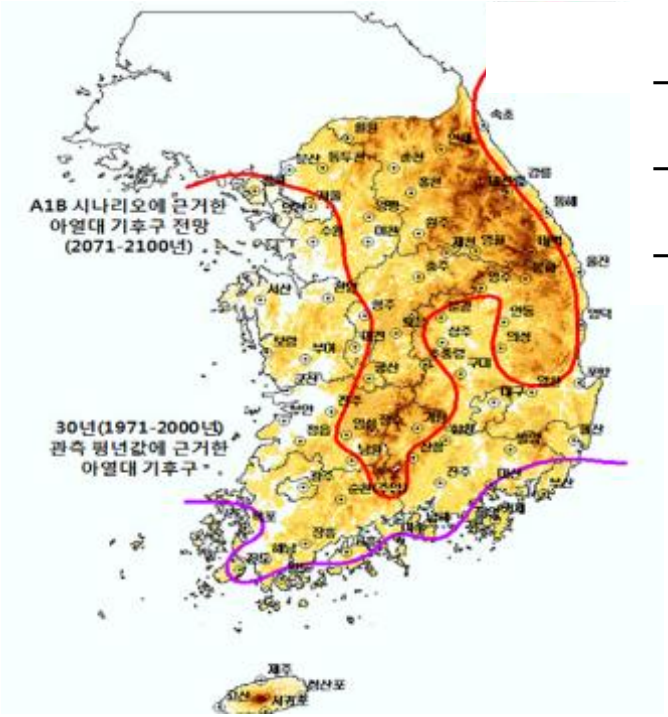


Projected Climograph based on emission scenario



Climate Change Impacts on Water Problems

- Changing into Subtropical climate
- Frequent, Extended drought alternating with spells of heavy rainfall



→ Water availability

→ Extreme events

→ Operational reliability

→ Water quality

We need more efficient and sustainable method for water security

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Why SWM

SWM enables to

Maximization of Limited Water Resources

SWM provides the optimal utilization system by combining every water resource available.
water can be provided and reused wherever necessary without construction of large scale infrastructures

Preventing Leakage incidents through Comprehensive Monitoring

SWM is capable of identifying leakage incidents through information collected from smart devices.
Improved response time to incident and pressure management is reducing the risk of incidents

Facilitation of Water and Energy Savings

SWM is capable of accurately predicting the needs and appropriate coordination of production and supply through the ICT-based analysis.
As such, water and Energy savings can be promoted.

SWM Concept

Basic Concept of SWM

- **SWM, an integrated water supply mgmt. for improving O&M**
  - ✓ This customized solution is integration of systems, software & smart devices
  - ✓ AMI is consisted of combination of Smart Meter, SCADA & Network sensors.
  - ✓ SWM is a fully tailor-made solution to solve water scarcity & inefficiency

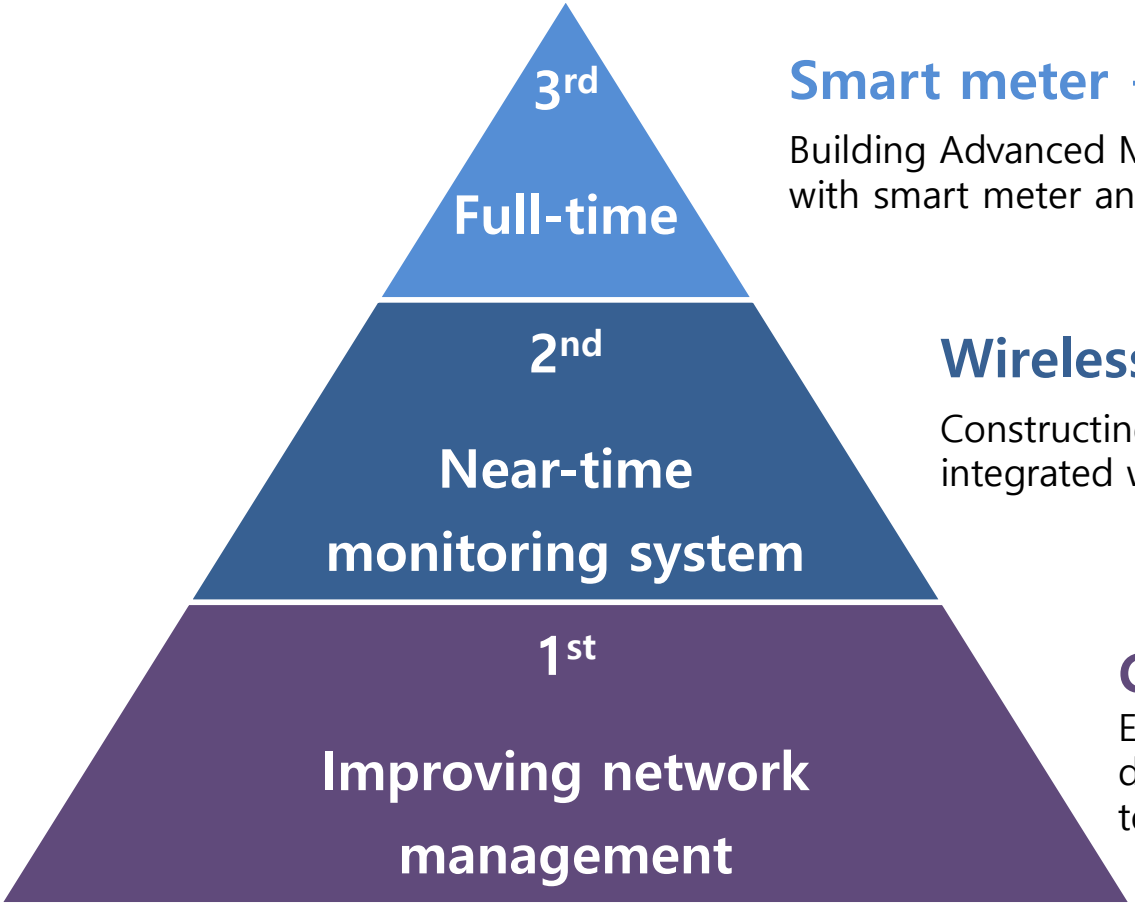
AMI — Hourly usage & water flow data acquisition

water-NET — Analysis min. night flow & optimized operation

WAPIS — Pipe inspection (Sahara, NQ-15, W-PIS100)

Basic Concept of SWM

Suggesting 3-step Framework for other Countries



Smart meter + User Interface

Building Advanced Metering Infrastructure with smart meter and pressure meter

Wireless Sensor + User Interface

Constructing near-time monitoring system with integrated wireless sensors in DMA

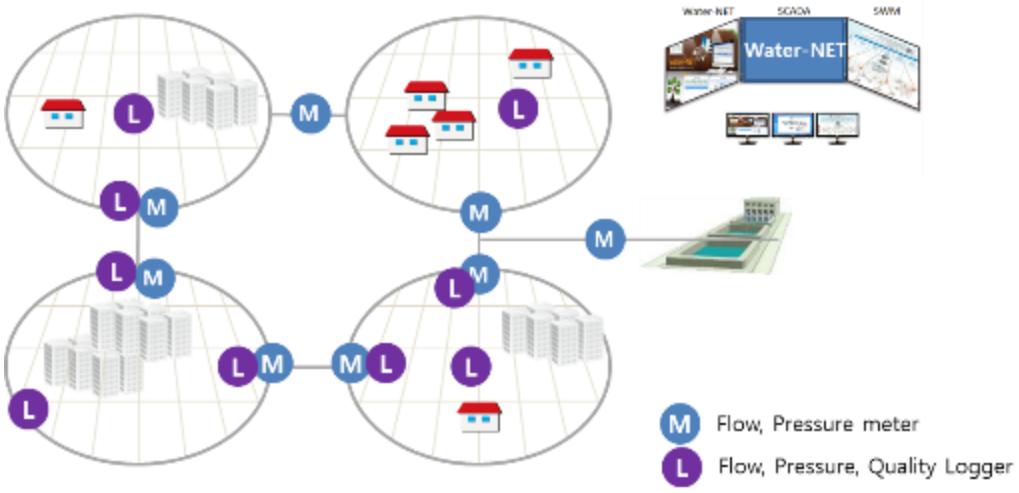
Construct DMA(&flow meter)

Establishing DMA(District metered area) and digitalize main data of water network with a technical training and support program

Basic Concept of SWM – 1st Step

Focus on countries operating basic facilities

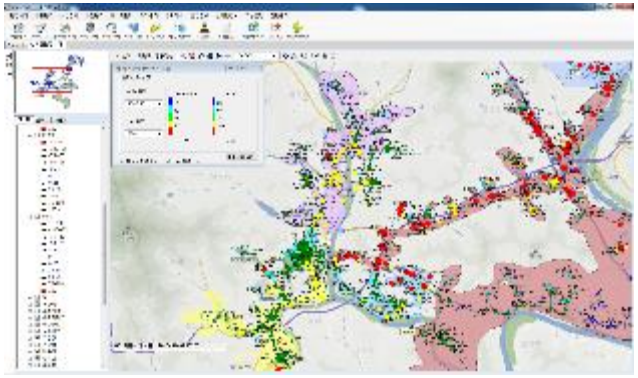
Improving network management



Establishing **DMA** and building a **water network model** and **D/B** by digitalizing data

Installing minimum meter(logger type) and sensor considering technical and economical issues in local area

Co-work with local engineer with the **technical training and support program**



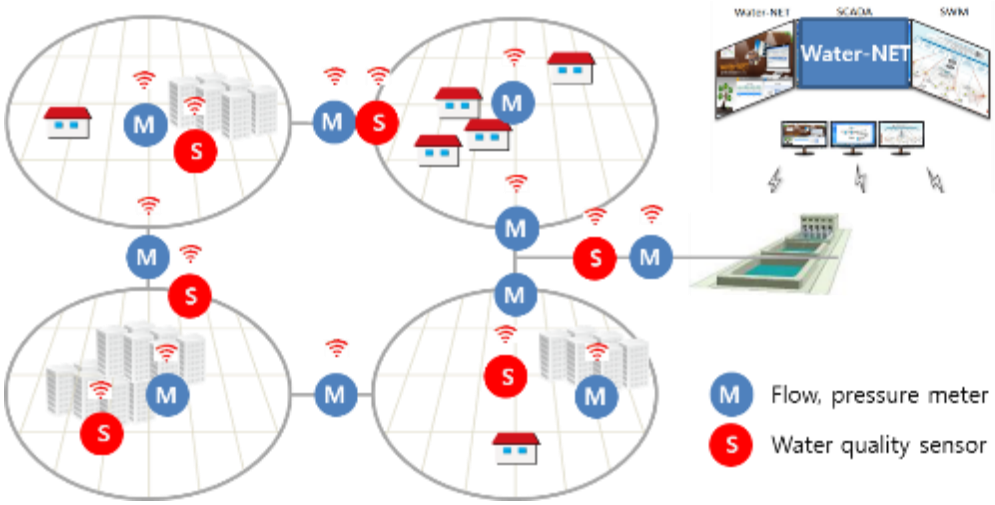
Main Objective of 1st Step

Initial NRW, Monthly NRW management(water audit), Water network analysis

Basic Concept of SWM – 2nd Step

Focus on countries requiring operation system for sensors

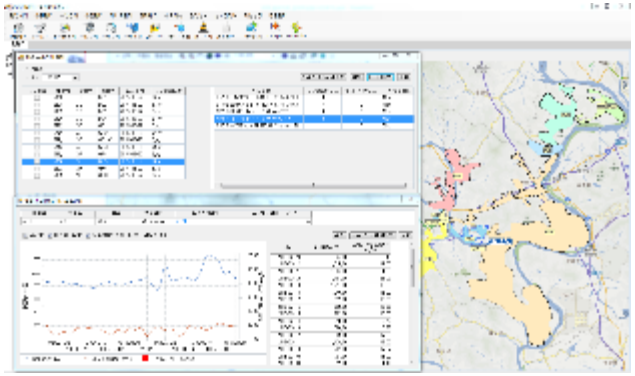
Near-time monitoring system



Upgrade water network with **wireless sensors and meters**

Install more meters and water quality sensors at main pipe and big customer

Operating **monitoring system** based on **near-time**(hour interval) for low power design



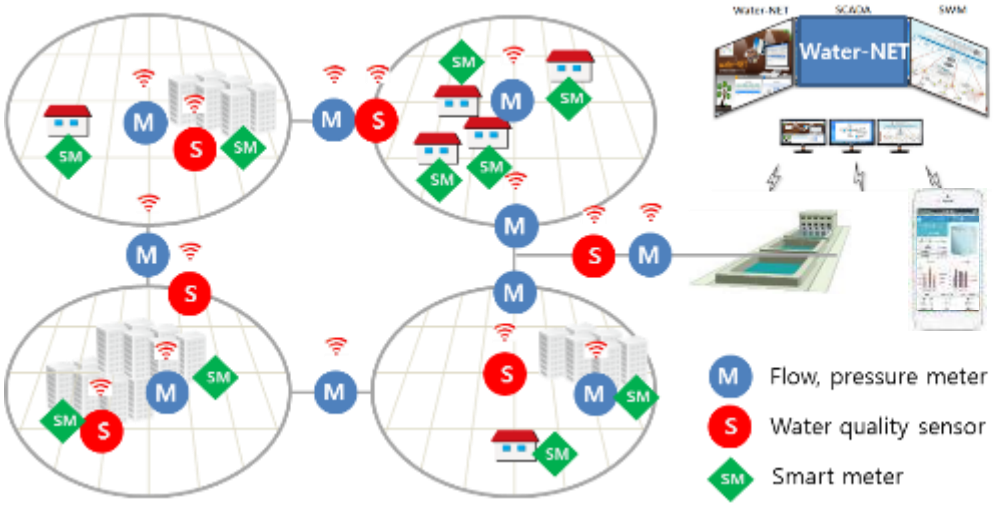
Main Objective of 2nd Step

Water network analysis, Daily auto leak detection with minimum night flow analysis

Basic Concept of SWM – 3rd Step

Focus on countries requiring SWM with smart meter

Smart water management



Establish Advanced Metering Infrastructure **(AMI)**

Install Smart Meters on every tap and provide information to customer (**smart phone app**)

Remote control main valve and upgrade to real-time monitoring system

Main Objective of 3rd Step

Real-time water network analysis, NRW management, auto leak detection with smart meter

SWM for Denpasar City

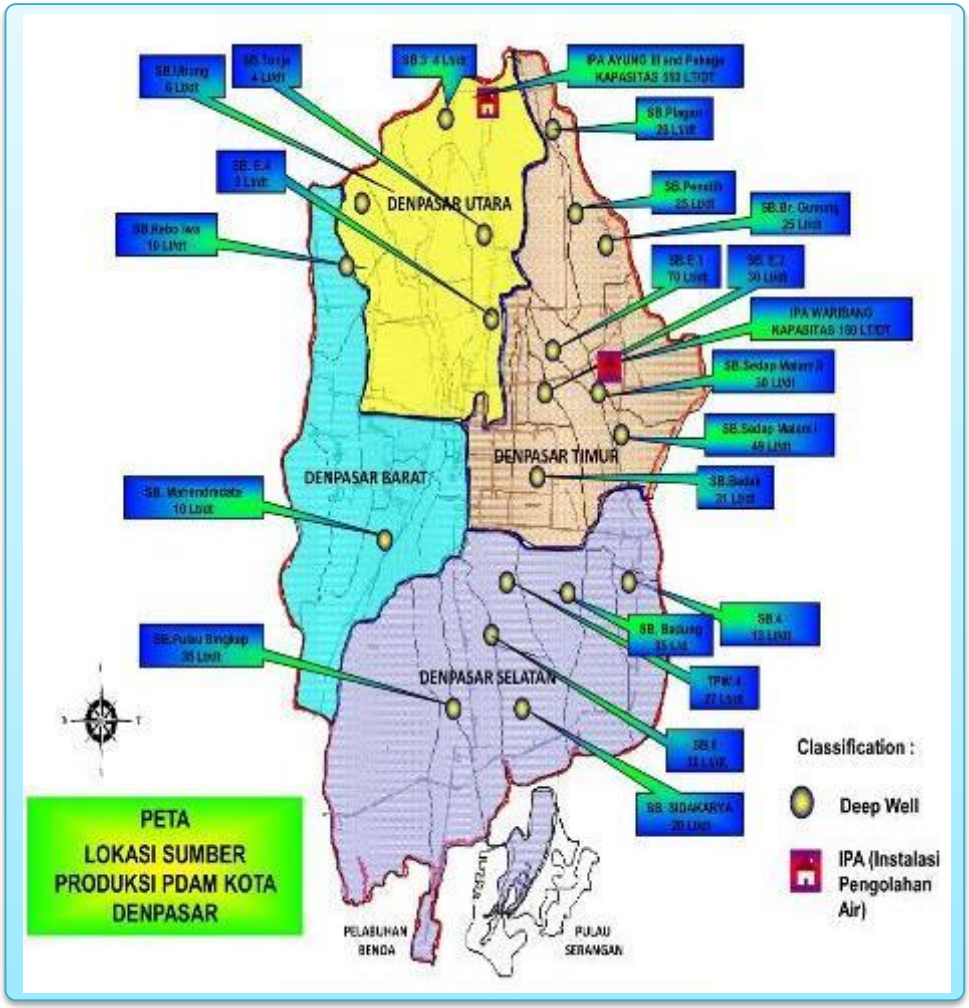
Smart Water Management Project

- AWC's 1st Water Project (HEC, K-Water, Wareco)
- Smart Water Management Project including Non-revenue Water Reduction in Denpasar City

Status of Denpasar Water Supply

Capacity (L/s)	WTP(L/S)	700
	20Deep well (L/S)	476
	Water from other province	70
	Total(L/S)	1,246
Water Supplied(L/S)		1,251
Water Billed(L/S)		794
Total Population(Ppl)		880,600
Served Population(Ppl)		401,125
Water Coverage (%)		45.6
NRW(%)		36.5
Lpcd	Consumed	171
	Supplied	269
Average Water Tariff (Rp./m^3)		4,382

Note) 2015 Data



Findings and Suggestions

Findings	Suggestions
➢ No hierachy between trunk main, distribution pipes and house connections. ➢ There are CAD drawings representing transmission and distribution pipelines. But the pipes and appurtenances may not updated regularly with field verification. • Enough staffs are required to manage updating and logging repair data	GIS(SIDAB) Update
➢ Insufficient water production capacity and very high load factor ➢ NRW tends to be increased. ➢ Detailed assessment of water balance is required with calibration of flow meters	DMA Establishment
➢ Lots of ACP and Aged (over 30years) pipes. • ACP : 94,172m, Old pipe(Installed Before 1986) : 157,534m of over 4” pipes	Rehabilitation based on pipe condition assessment
➢ PDAM Denpasar has only monitoring system ➢ With the DMA establishment, PDAM needs SCADA system	Integrated Control Center
➢ Training Program for PDAM Staffs will be required for DMA management, Consumer relation(meter reading, billing), GIS management, Asset management and so on.	Human Resources
➢ Considering the road, traffic conditions, it is very difficult to construct DMAs or to rehabilitate pipes and extensive complaints are expected. ➢ Temporary stoppage of water supply to some local area may happen during implementation	Support from central, provincial government and coordination with other departments are prerequisite

SWM for Denpasar City

Technical Proposal from preliminary Study

Key Challenges

- ✓ No Pipes Information Update
- ✓ Non-revenue Water and High Load
- ✓ ACP and Aged Pipes
- ✓ Monitoring System Only
- ✓ Insufficient Management Capabilities

Proposal

- ✓ GIS update with field verification
- ✓ Establishment of DMAs
- ✓ Rehabilitation of Infrastructures
- ✓ Integrated Control Center
- ✓ Capacity Building

Expected Outcome

- ✓ 36.5% → 15~20% NRW, which is able to save and secure 6.5 million ㎥/year or more
- ✓ Operation Cost Reduction, Enhanced Water Supply, Customer Satisfaction

Project Components

- Extensive Field investigation and DMA establishment have high priority
- Rehabilitation of pipe network and GIS will be implemented in later phase

	Project Components	Cost (million US$)
1	Field investigation, Design, Construction Supervision	7,0
2.	GIS system update	6,7
3.	**DMA system Establishment**	**5,1**
4.	**Rehabilitation of Facilities (with DMA construction)**	**19,5**
5.	Replacement of Pipes (after condition assessment)	12,1
6.	**SWM System establishment**	**3,7**
7.	TA(Technical Assistant)	3,0
8.	Human Resources(Capacity Building)	0,5
9.	Contingency	-
Total		57,6

Project Schedule

Phase I (2016)

- Challenge Recognition
- Pre-Feasibility Study
- 0.1mil. USD

Phase II (2017-19)

- Feasibility Study
- Pilot Project
- 1~4mil. USD

Phase III (2020-22)

- DMA, Rehabilitation
- Smart Water System
- 25~53mil. USD above

Expected Results

Items	Current	SWM
Decision Times	Slow, maybe several weeks (guessed decision)	Days (informed decision)
Performance indicators	Yearly ~ several times a yr.	Monthly ~ daily
Control room	No	24 hours a day
Control of Water input/output	No or Monthly	Daily ~ Real time
Leakage, Pressure control	No	Systematic
Control of Night Flows	No	Real time
Response to burst	Month ~ Week	Day ~ Hour
NRW	35% or more	15~20%

Benefits of SWM Project

- Opportunity costs in terms of NOT implementing SWM project
  - Additional investments for extending water supply facilities due to water loss
  - Capital costs : 25 million USD
    - Intake Pump Station, Water Treatment Plant : Q= 30,000㎥/d
    - Storage Reservoir : V=9.000㎥
    - Pipelines for enlargement of diameter to cope with additional supply
  - O & M costs of additional water supply due to NRW
    - 2.794Rp/㎥=0.21USD/㎥ (based on 2016 Denpasar PDAM Data)
- Preventing potential damages to properties and other utilities
- Preventing possible deterioration of water quality