

# Integrated Urban Water Cycle Management System in Korea

**Jin Chul Joo, PhD**  
**Research Fellow**

**Korea Institute of Construction Technology**

## Any Problems in Conventional City?

### Urbanization side effect

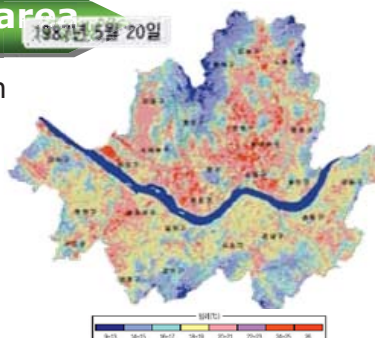
- 48% of total area in Seoul  
-> impermeable pavement
- 73% of urban area in Seoul  
-> Urban Desert

■ Pavement area  
■ Green area



### Heat island in urban area

- Temp. difference between urban and rural area of Seoul
- Summer : 1~4 Celsius
- Winter : 2~8 Celsius





# Any Problems in Urban Water Management?

## As is



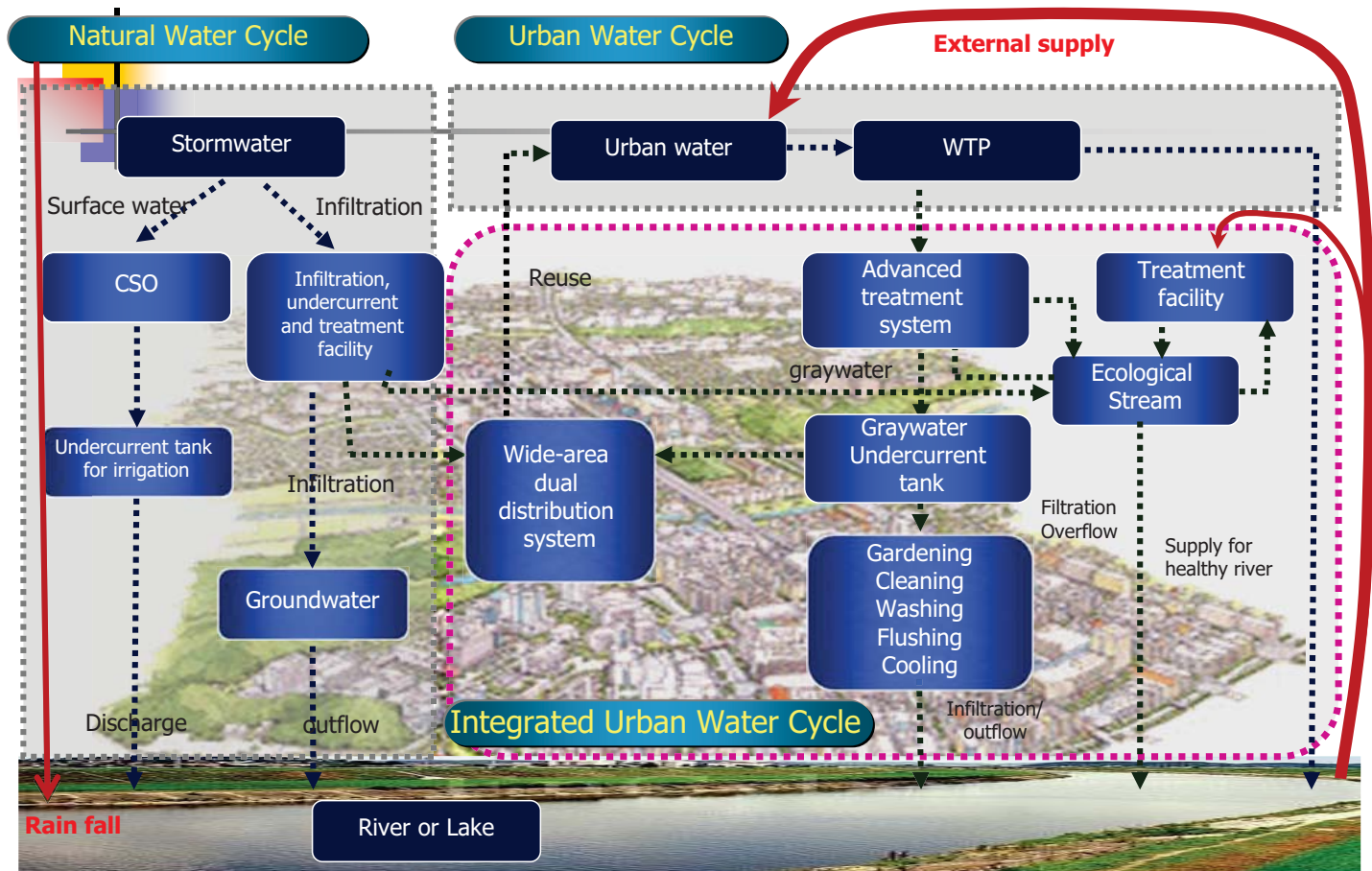
- Repeated disasters (flooding, draught etc.)
- Limited usage for gray water and rainwater
- Small scale individual permeation and reservoir facilities
- Absence of integrated water management system

## To be



- No disasters by early warning and preparation
- Best use of rainwater/wastewater
- Large scale network permeation & reservoir facilities
- Construction of integrated urban water cycle management system

## Scheme of Integrated Urban Water Cycle





# Driving forces for U-Urban Water Cycle

## Development of Geomatics

- Advance in GIS/RS/GPS Technology  
-> 3-D Environmental System can be monitored
- Satellite Ecology, LiDAR, Surface Scanning  
-> Realtime 3-D City monitoring



## Emerging USN & Sensor

- Advance in USN, U-IT based Technology  
-> Realtime data transfer and response
- Newly-developed cutting-edge sensor  
-> Realtime monitoring for water, energy, climate, etc.



# Composition of U-Urban Water Cycle

## Integrated Urban Water Cycle Management System

Enhancement of natural and urban water cycle sustainability

Monitoring and network

Wide-area dual distribution system

Urban water management system

Decentralised rainwater management system

Urban water cycle management

Natural water cycle management

Decentralised rainwater management



Integrated water cycle management system



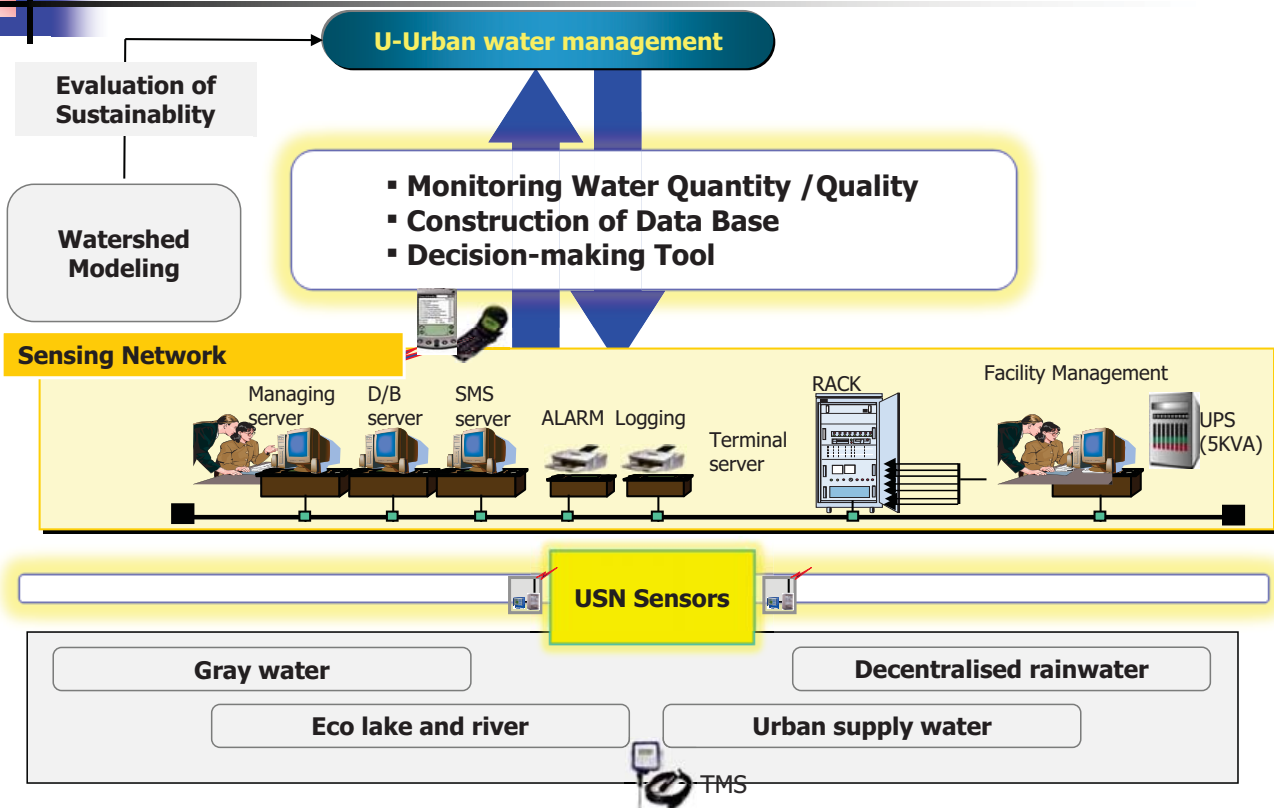
Urban water management

Wide-area dual distribution system

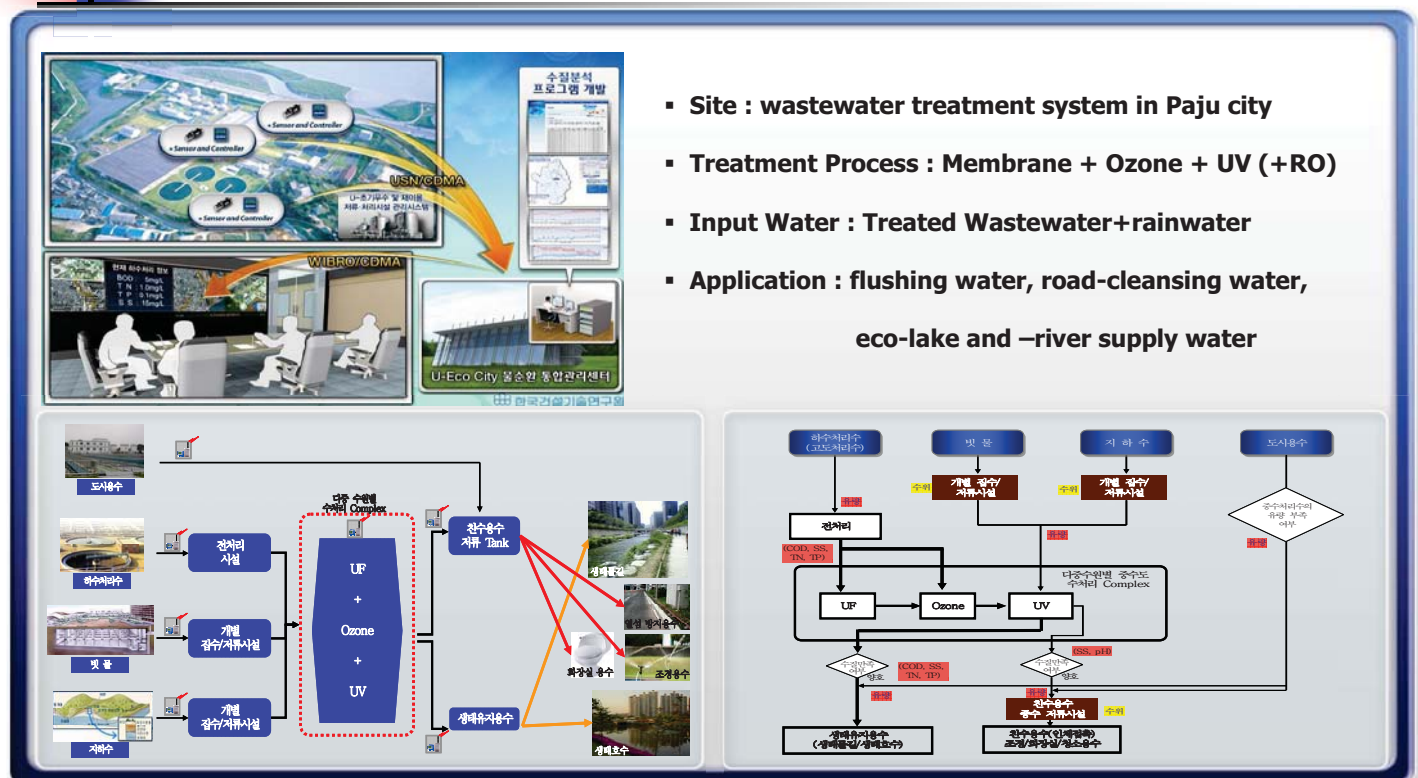
Ecological stream and lake sup



# U-Urban Water Management System



# U-Wide Area Dual Distribution System (Prototype)





# U-Wide Area Dual Distribution System (Pilot Plant)

WTP



Pilot Plant System



Rainwater Storing Tank



Screen



In-line mixer



UltraFiltration



RO

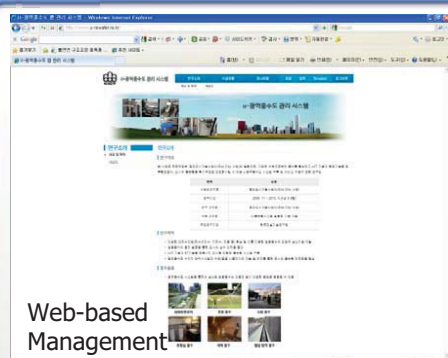


Reservoir Tank



# U-Wide Area Dual Distribution System (Web-based Management System)

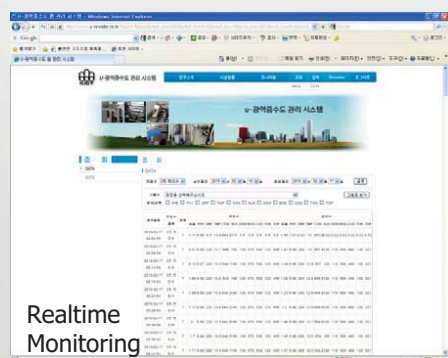
Web-based  
Management



Report &  
Warning message



Realtime  
Monitoring



Simulation of  
Available Site



**Selection of  
Treatment  
processes**

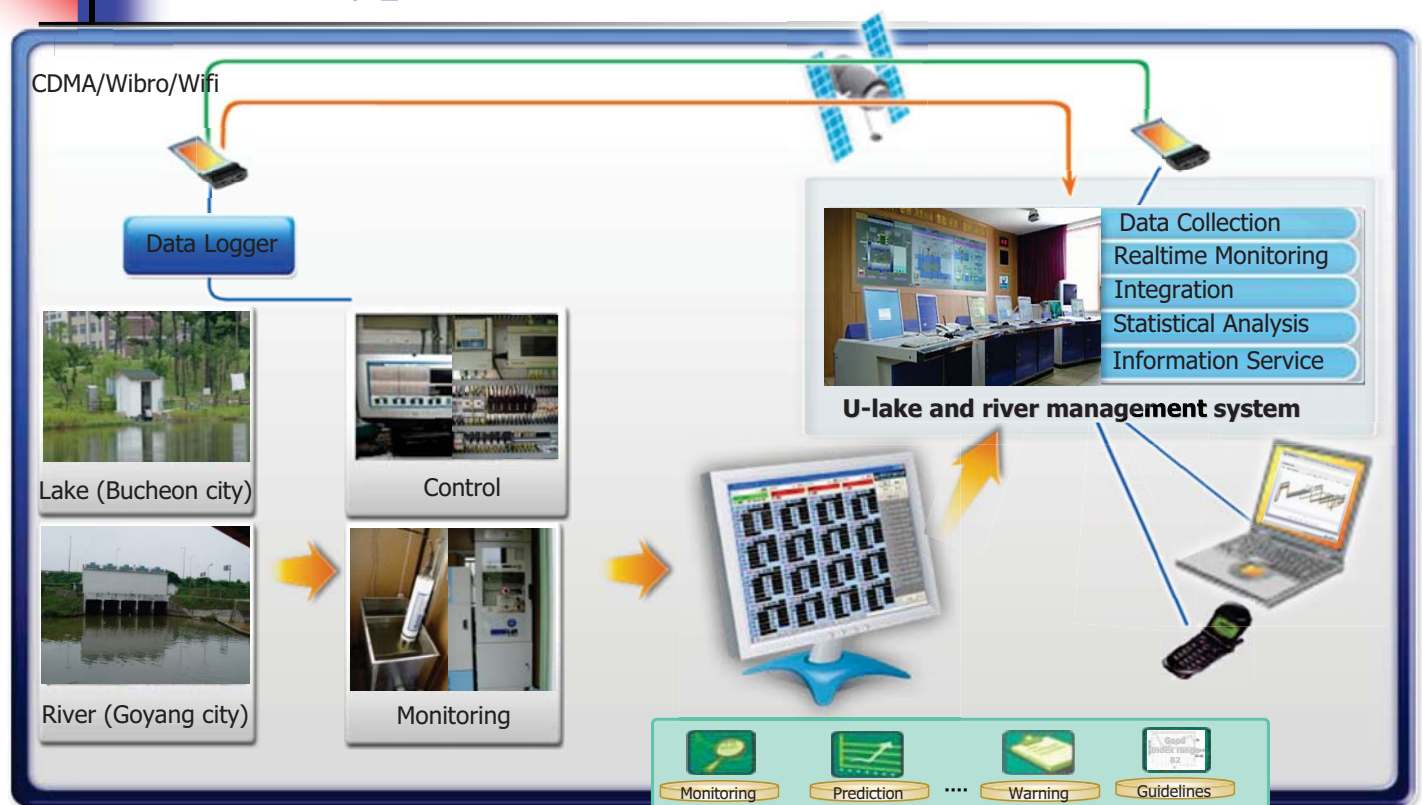
**Simulation of  
Available Sites**

**Decision-making  
Tools**

**Analysis of  
Water Balance**



## U-Lake and River Management System (Prototype)



## U-Lake and River Management System (Pilot Plant)



▪ Site : Bucheon City / Goyang City

▪ Equipment : rainfall meter, water guage, multiprobe water quality sensor (SS, pH, EC, Temp, DO, Chl-a), flow meter, autosampler, T-N, T-P



River Measurement



Lake Measurement



Rainfall Meter



Water Guage



Water Quality Sensor



TN-TP Equipment



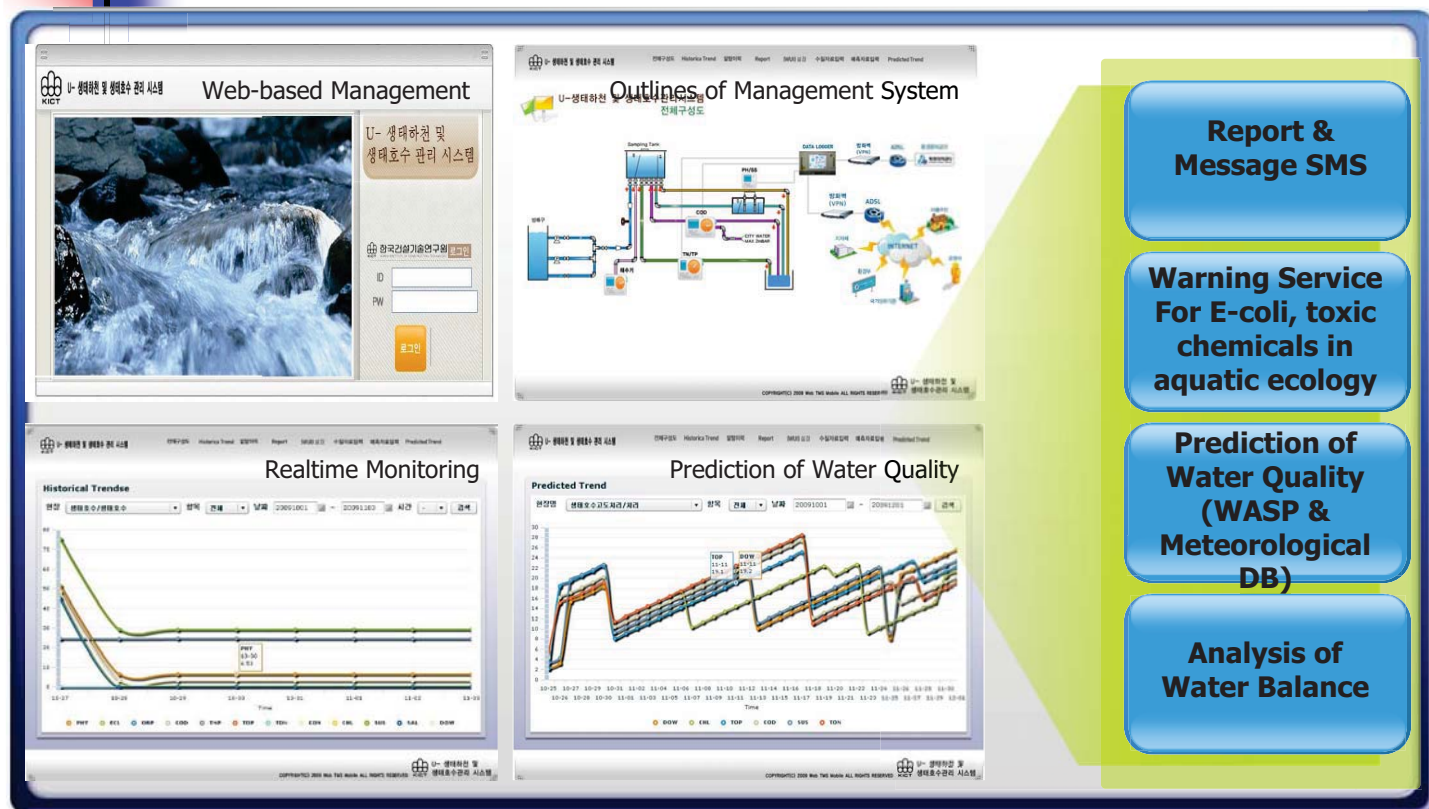
24-hr Auto sampler



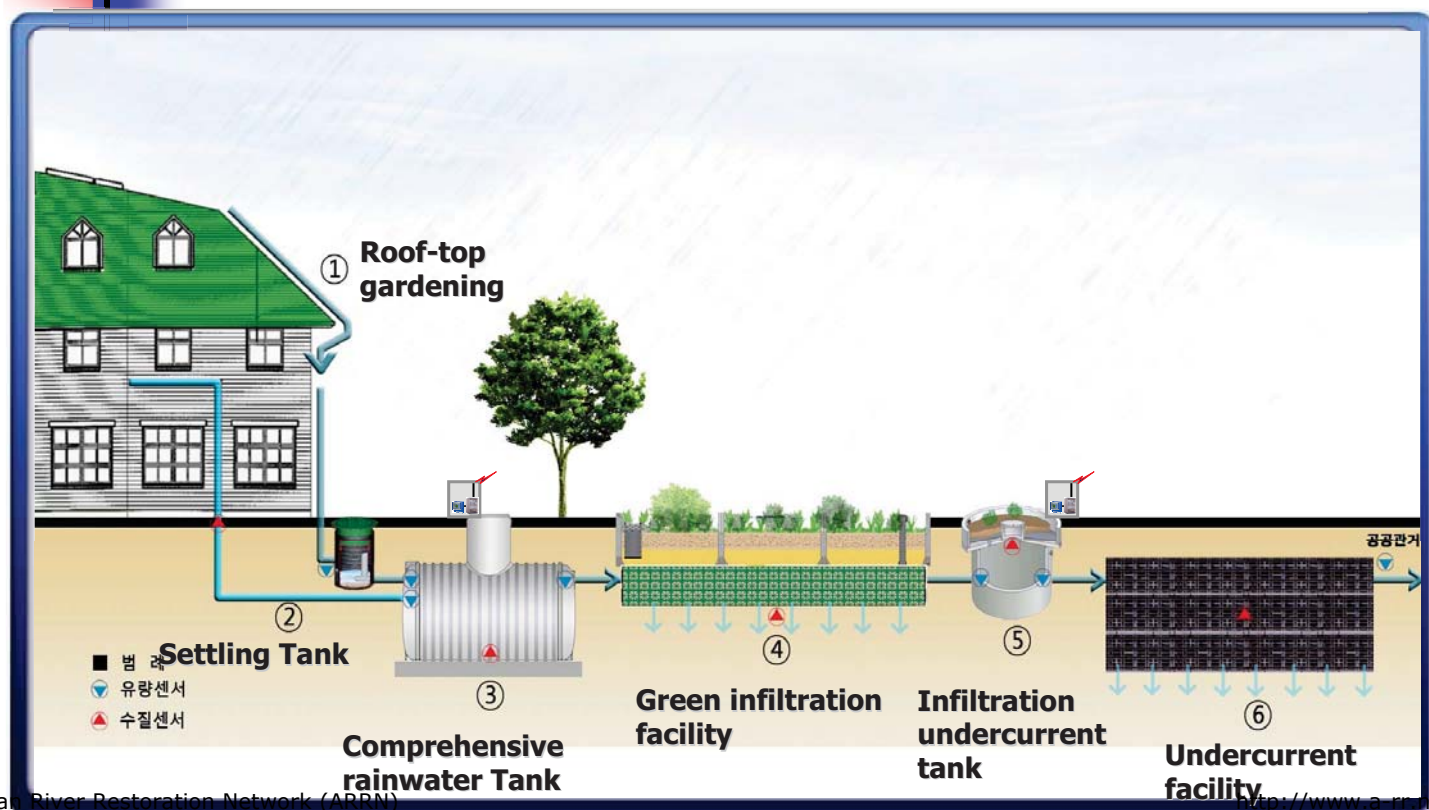
Control & Communication



# U-Lake and River Management System (Web-based Management System)



# U-Decentralized Rainwater Management System (Prototype)





## U-Decentralized Rainwater Management System (Pilot Plant)

**• Green Infiltration Facilities**

1. 지붕녹화  
2. 생태녹지  
3. 녹지통합형 빗물이용 시설 - 녹지면  
4. 녹지통합형 빗물이용 시설  
5. 녹지통합형 빗물이용 시설 - 빗물저장탱크  
6. 녹지통합형 빗물이용 시설 - 정화시설

**• Roof-Top Gardening**

## U-Decentralized Rainwater Management System (Web-based Management System)

**• Realtime Monitoring Data Base**

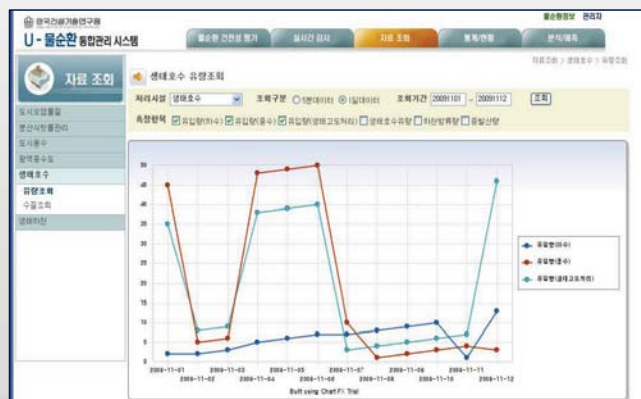
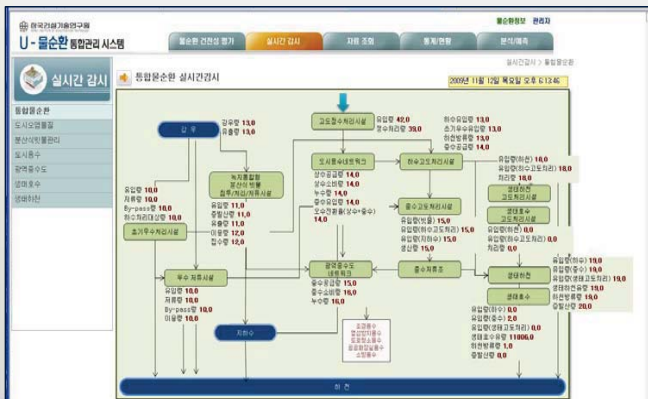
**• Decision-Making Tool**



# U-Urban Water Management System (Web-based Management System)

## ❖ Major Functions

- **Evaluation of Water Sustainability**
  - reduced amount of water supply
  - increased amount of water reuse
  - reduced amounts of surface runoff and contaminants
- **Realtime Monitoring of Water Quality & Quantity**
- **U-service & two-way interactive response**

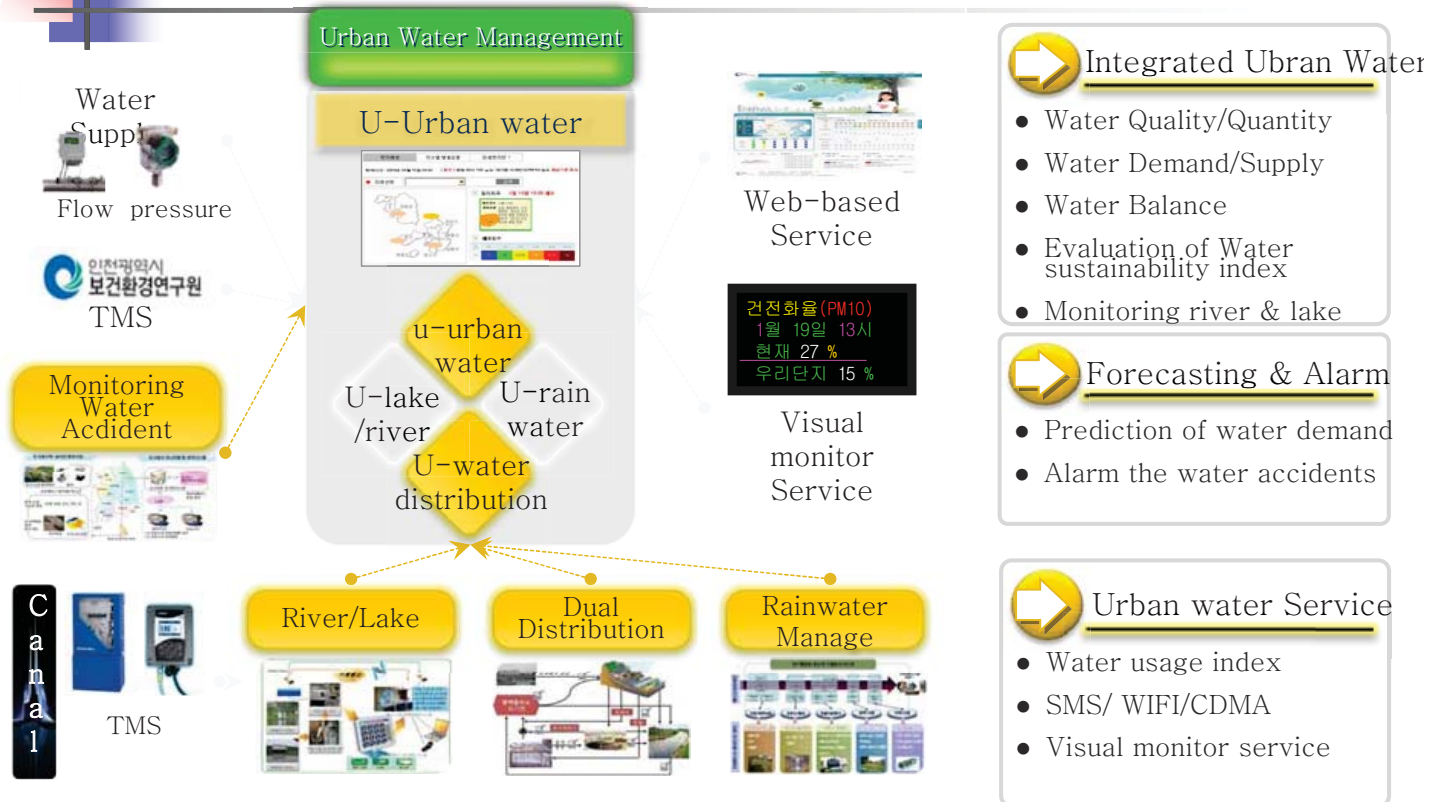


## Case Study : Incheon Free Economic Zone (Chungra city)

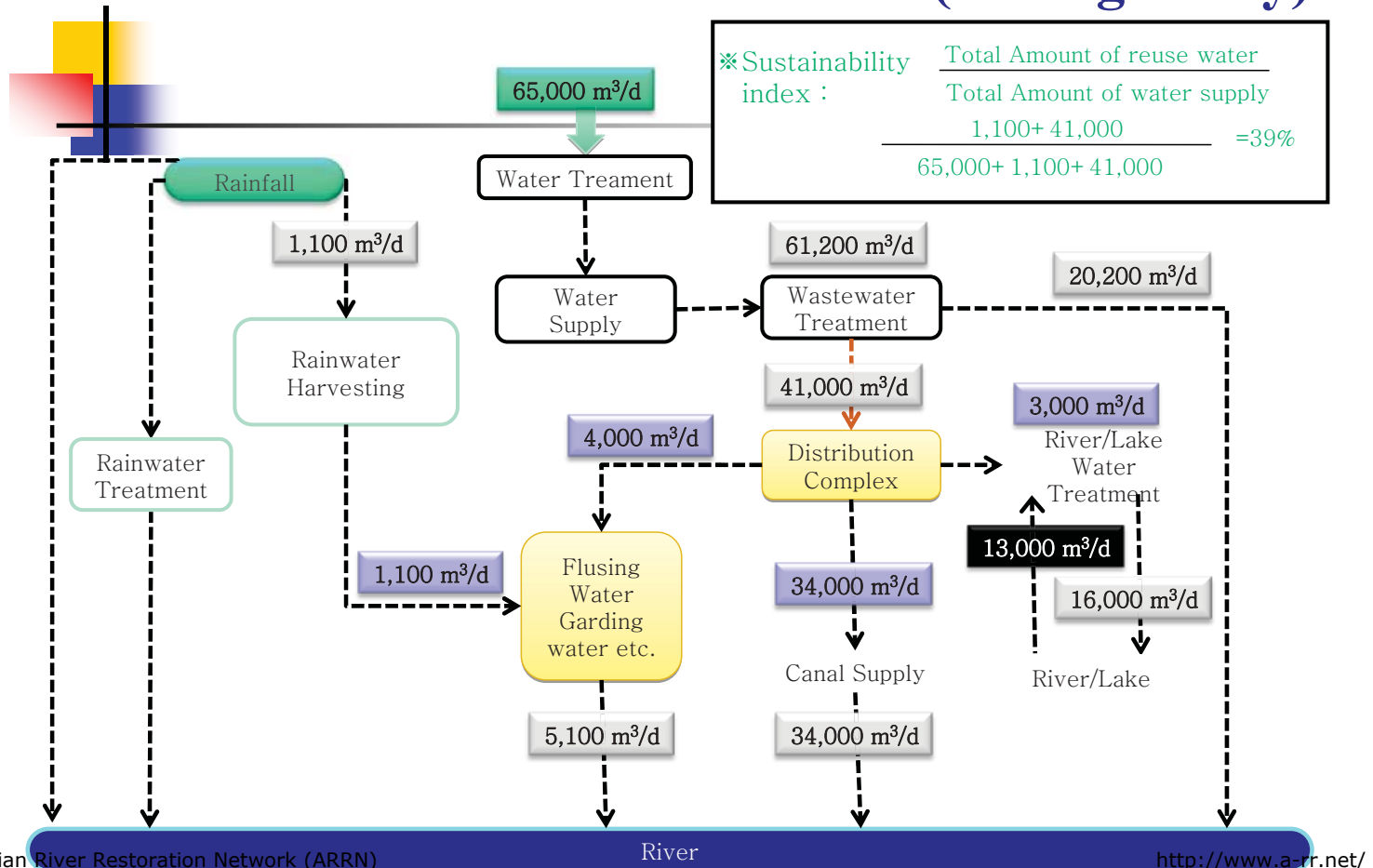




# U-Urban Water Management System (Web-based Management in )



## Sustainability index: Incheon Free Economic Zone (Chungra city)







## Conclusions (1)

---

- Benefits of integrated water cycle management system
  - Restoration of natural water cycle w/o too much uptake;
  - Saving the urban water demand and cost;
  - Improvement of nonpoint source treatment after the urban development;
  - Reducing the air-conditioning energy and rain water runoff using the distributed rain water management system;
  - Assurance of enough ecological area;



## Conclusions (2)

---

- Benefits of integrated water cycle management system
  - Improvements of distribution for urban water supply;
  - Assurance of safe water usage by predicting demand;
  - Improvement of environmental awareness and life amenity by using gray and rainwater;
  - Construction of safe city against water-related disasters by providing the web-based water cycle information and management;
  - Restoration of the sustainability of water cycle for the conventional city by managing the distributed urban water management;





Thank you for your attention!

---