Water Quality Monitoring Systems and Applications in Korea

Urban Infra Forum

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KORBI

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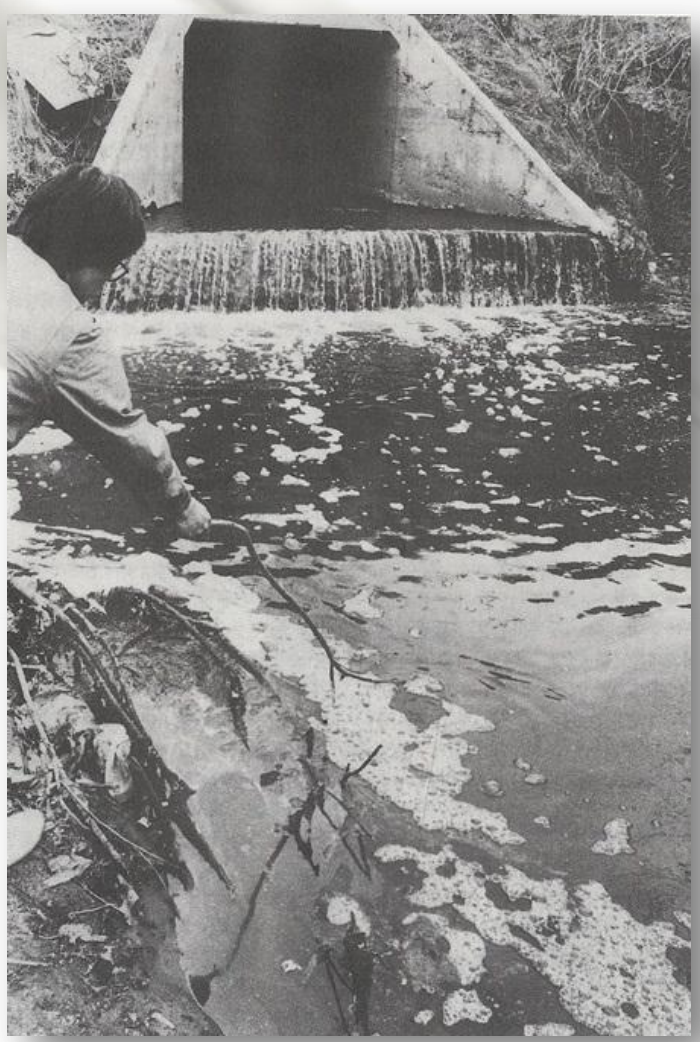


Phenol pollution at Nakdong river (1991)

Ⅰ.(1) Background of Online Water Quality Monitoring

Online Water Quality Monitoring

1 Comprehensive Environmental Management

Needs for Comprehensive System Set-up Concerning to Environmental Section

- Needs for environmental research data systematization and standardization
- Needs for scientific environmental policy-making based on various environmental data and report

2 Policy Introduction

Pollution Accident Management & Response Efficiency Improvement

- Needs for real time monitoring system for prompt response for pollution accident
- Needs for fast and systematic tracking pollution source when pollution accident

3 Public Service

Public Demand Increase of Environmental information

- Needs for access to environmental information by public environmental awareness

Ⅰ.(2) Types of Online Water Quality Networks in Korea

	National Online Water Quality Monitoring System	Water TMS	National Non-point Pollution Monitoring System	IP-USN based Water Quality Prediction System	Industrial Complex Water TMS	Bottled Water Manufacture Water TMS	Stereoscopic Algae Monitoring
Purpose	Monitoring & Management of Water Quality of surface water Early Warning System	Scientific Assessment of Effluent Allotment	Non-point pollution moving path tracking when raining	Auxiliary Networks	Monitoring & Management Effluent of Industrial Complex	Management & Monitoring of Water Quality of Bottled Water Manufacturer	Green Algae Monitoring & Prediction
Scope	4 Main River Lake	Wastewater Discharge Facilities (STP, IWWP, Water plant, etc.)	Watershed Unit	4 Main River (Mobile Type)	Industrial Waste Discharge Facilities (Before Centralized effluent treatment plants)	Bottled Water Manufacturer	4 Main River, Intake Water Source
Status	70	888	16	16	8	5	3

Online?
Automatic + Real time

Ⅱ. Online Water Quality Monitoring Applications

(1) National Water Quality Monitoring Network

(2) Water TMS (Point Source)

(3) Nonpoint Pollution Monitoring Network

(4) IP-USN based Water Quality Monitoring System

(5) Industrial Complex Water TMS

(6) Bottled Water Manufacturer Water TMS

(7) Integrated Water Quality Monitoring Center

Ⅱ. (1) National Water Quality Monitoring Network

Concept

Real time supervision of main river water quality

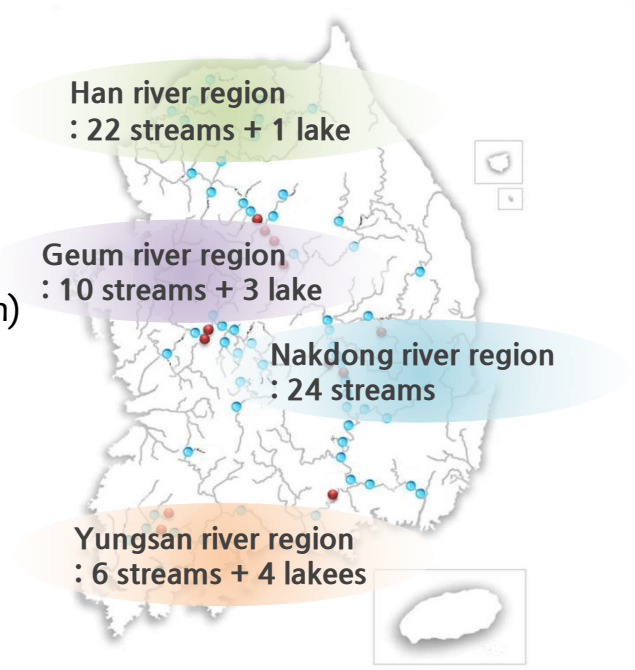
- Automatic monitoring station installation at each river or lake for real time water quality monitoring
- Prompt response and treatment when water pollution accident and secure water source

Water Quality Monitoring Station installation at each basin(river) system

- Site selection and station installation at main river or lake

Parameter

- Basic Items : Dissolved Oxygen (DO)
  Water Temperature,
  Electric Conductivity (EC),
  Total Organic Carbon (TOC)
- Optional Items : Organic Monitoring (Fish, Water Flea, Algae, Microorganism)
  Volatile Organic Compounds (VOCs, 9Types)
  Total Nitrogen (TN)
  Total Phosphorus (TP)
  Chlorophyll-a
  Ammoniac Nitrogen (NH_3-N)
  Nitrate-Nitrogen (NO_3-N)
  Phosphate- Phosphorus (PO_4-P)
  Heavy Metal (Cd, Cu, Zn, Pb)
  Turbidity
  Phenol



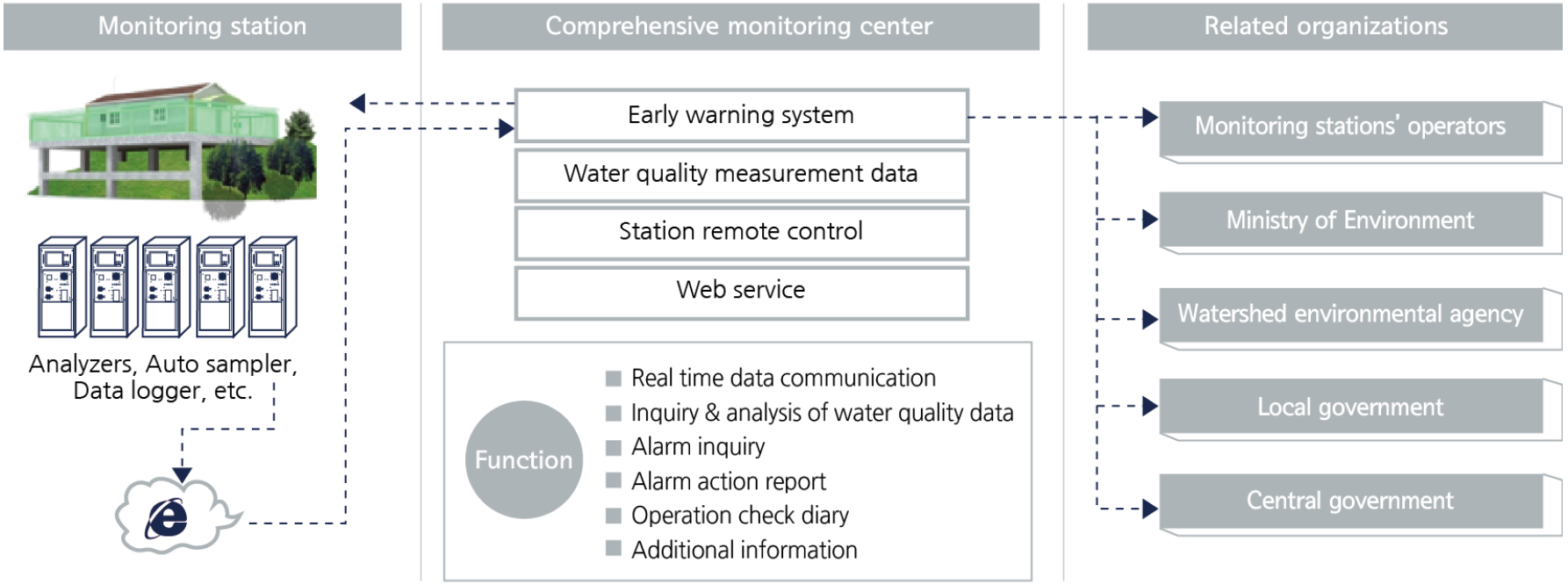
70 sites operating in Korea

Ⅱ. (1) National Water Quality Monitoring Network

Concept

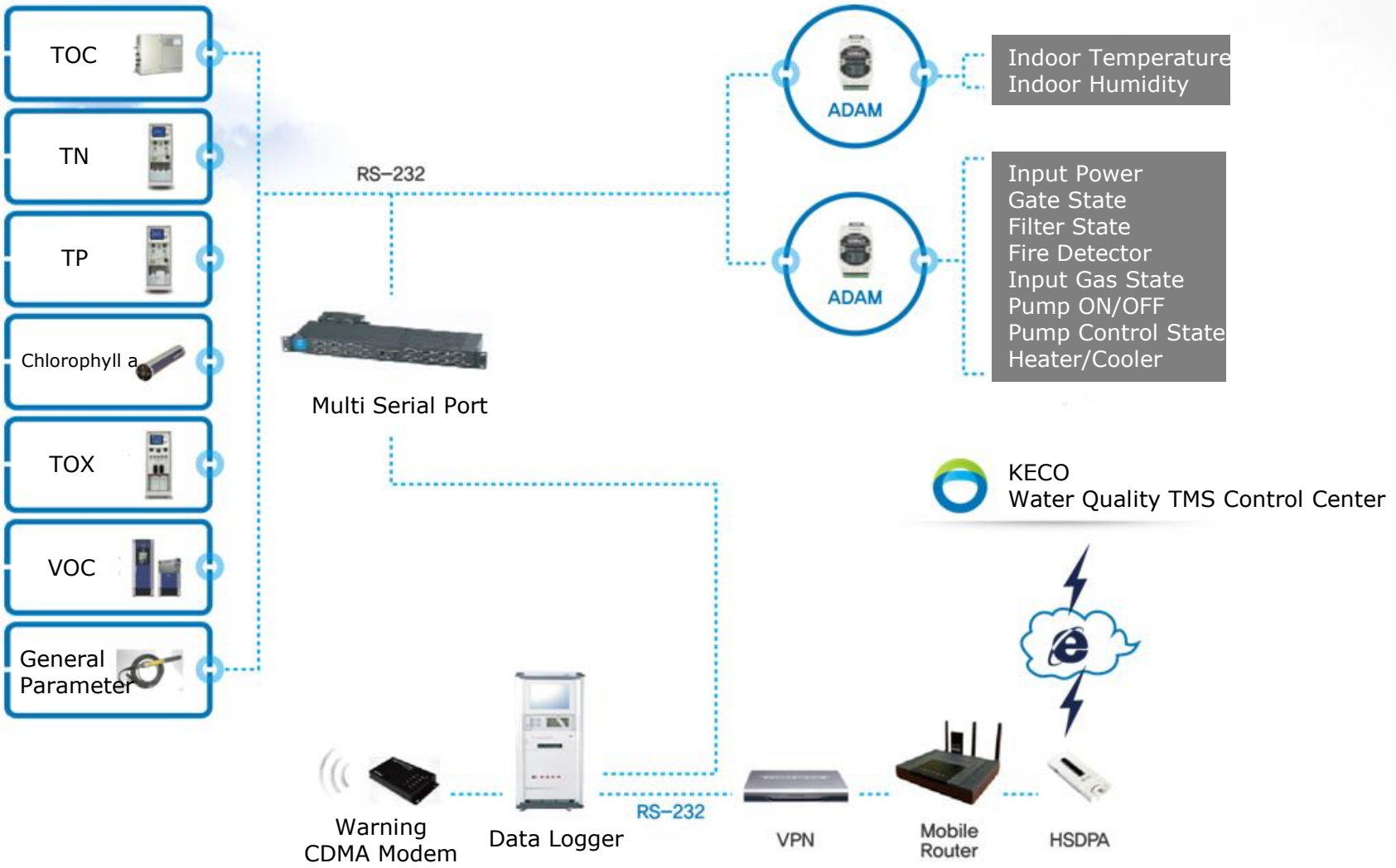
Water pollution accident Early Warning Operation

- To make a timely response to the water pollution accidents and protect the water supply through a real-time monitoring of water quality in 4 rivers (Han River, Geum River, Nakdong River and Yeongsan River)
- Pollution warning system that facilitates the preparation of effective response measures for protecting the water supply and prevent the spread of pollutants by detecting pollution accidents early through the real time monitoring of water quality



Ⅱ. (1) National Water Quality Monitoring Network

Concept



Ⅱ. (1) National Water Quality Monitoring Network

Construction Process

Site selection

Construction site secure

Station construction

Sampling system installation

Connection to Control Center

Construction completion

Measurement system installation

Ⅱ. (1) National Water Quality Monitoring Network

Actual Case

Outside vies of station building

Inside view of station building

Data logger

Auto sampler

Reservoir

Sampling system

Ⅱ. (1) National Water Quality Monitoring Network

Perfomance

Public Service

"Laboratory of Excellence"
by Environmental Resource Associate

Han river

Keum rive

Nakdong river

Yeongsan river

Ⅱ. (2) Water TMS

Concept

Water TMS : Real time supervision of wastewater effluent

- Real time effluent monitoring from STPs, WWTPs, factories and other point source
- Prevention of water pollution accident with analysis and management of data
- Rational calculation of emission charge from monitoring based on emission time

Water Quality Monitoring Station installation at each effluent of WWTP

- Effluent of STP, WWTP of Industrial complex or factories, and Potable water plant

Parameters : Pollution level / Flow

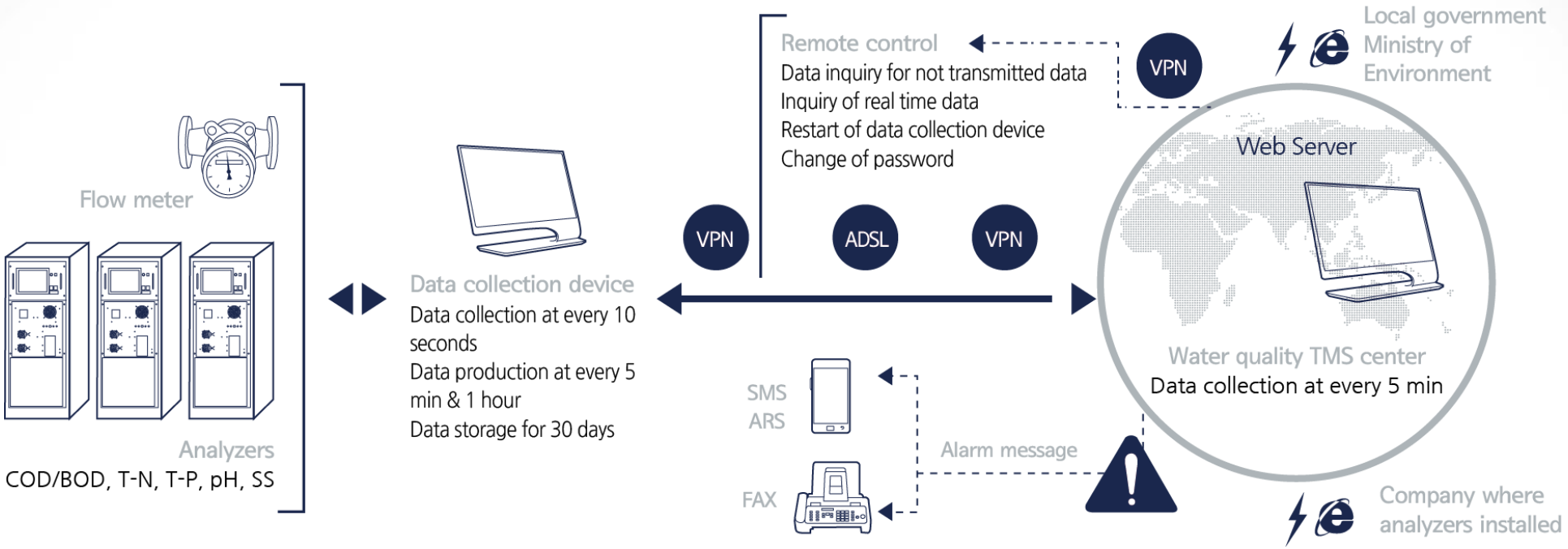
- Detection subjects : pH, Organic Matters (BOD, COD), Suspended Substances (SSs), Total Nitrogen (TN), Total Phosphorus (TP)
- Subsidiary facilities : Auto sampler, Data logger, Flow meter, Integrating wattmeter

	Public Wastewater	Industrial Wastewater	Private Wastewater	Total
Total	564	114	250	**928**
Seoul & Kyung-gi	212	24	90	326
Chung-cheong	96	42	64	202
Yeong-nam	148	33	56	237
Ho-nam	108	15	40	163

- TMS Obliged plant : Discharging or Treating volume ≥ 200 m^3

Ⅱ. (2) Water TMS

Concept



Ⅱ. (2) Water TMS

Construction Process

Site secure

Concrete cast- in place

Station construction

Sampling pump and pipe construction

Construction completion

Measurement system installation

Auxiliary facilities installation

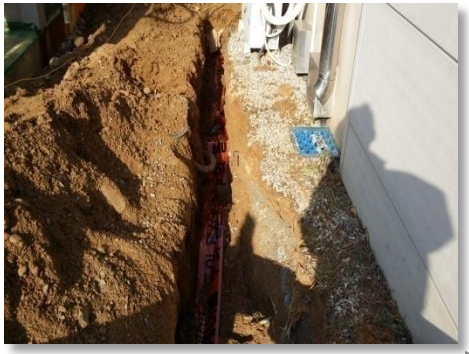
Pipe and electricity construction

Ⅱ. (2) Water TMS

Construction Process

Site secure

Basic cast-in place



Sampling pipe construction

Pipe & duct installation

Construction completion

Auxiliary facilities installation

Measurement system installation

Sampling pump installation

Ⅱ. (2) Water TMS

Actual Case

Outside vies of station building

Inside view of station building

Station inside

Sampling system

Sampling site : effluent

Ⅱ. (2) Water TMS

Actual Case

Analyzers installation

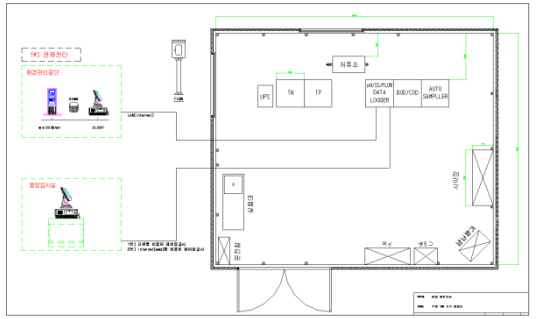


Outside & inside views of station building

Outside views of station building

Inside station building

Analyzers installation



Plan drawing of monitoring station

Ⅱ. (2) Water TMS

Perfomance

Public Service

Monitoring and management of the discharge

보 도 자 료		
보도일시	2013년 12월 30일(월) 조간(12. 29. 12:00 이후)부터 보도하여 주시기 바랍니다.	
담당 부서	감사관실	안승호 과장/명노일 사무관/이치우 주무관
	환경감시팀	044-201-6160 / 6161 / 6169
배포일시	2013. 12. 27.(금) / 총 9매	

환경부 — 넓게 듣겠습니다 바르게 알리겠습니다

수질자동측정기기 설치 업체 특별단속 결과, 35.1% 적발

◇ 환경부 중앙기동단속반, 수질TMS 설치업체 37곳 특별 점검, 13곳 적발

◇ TMS 기계조작 등 불법행위 근절을 위한 단속 강화 및 제도 개선 병행 추진

□ 환경부(장관 윤성규) 중앙기동단속반은 12월 초순에 실시한 수질자동측정기기(TMS) 설치 업체 특별단속결과, 위반 업체 13곳을 적발했다고 30일 발표했다.

보 도 자 료		
보도일시	2014년 3월 26일(수) 조간(03. 25. 12:00 이후)부터 보도하여 주시기 바랍니다.	
담당 부서	감사관실 환경감시팀	안승호 과장/ 조동욱 사무관
		044-201-6160 / 6166
배포일시	2014. 3. 24.(월) / 총 9매	

환경부 — 넓게 듣겠습니다 바르게 알리겠습니다

환경오염물질 배출단속사업장, 3곳 중 1곳은 위반

◇ 환경부 중앙기동단속반, 폐수다량배출사업장 47개소 특별단속, 14개소 적발

◇ 국민 안전과 환경법 질서확립을 위해 지속적 감시활동 펼치기로

□ 환경부(장관 윤성규) 중앙환경기동단속반은 지난 2월 24일부터 28일까지 실시한 환경오염물질배출사업장에 대한 특별단속결과를 발표했다.

Ⅱ. (2) Water TMS

Perfomance

● **Water TMS** is monitoring **96.8%** of discharge volume in real-time. ('2014)

Section	Nationwide operation		TMS installation & operation	
	Site	Discharge (㎥/day)	Site	Discharge (㎥/day)
Total	**17,190**	**22,488**	**880 (5.12%)**	**21,775 (96.83%)**
STP	3,774	19,877	533 (14.12%)	19,659 (98.90%)
IWWP	162	1,019	106 (65.43%)	1,008 (98.92%)
Discharge facility	17,190	1,592	241 (1.82%)	1,108 (69.60%)

● **Pollution load** has been decreased with **33%**. (Compared with '2008)

Parameter	Comparison Sites	**'08(A)**	'09(B)	'13(C)	**'14(D)**	Variation **(D-A)/A**
BOD (ton)	32	**3,822**	2,070	1,531	1,368	△64%
COD (ton)	464	**73,774**	68,136	70,950	68,719	△7%
SS (ton)	507	**34,357**	25,897	23,245	22,240	△35%
T-N (ton)	432	**98,514**	78,561	81,088	82,078	△17%
T-P (ton)	424	**8,196**	5,767	4,234	3,807	△54%

● **Improvement of Process / Cost reduction of O&M / Improvement of Maintenance & Management**

Ⅱ. (3) Non-point Pollution Monitoring Network

Concept

Non-point Pollution Monitoring

- To analyze accurate quantity and quality of non-point pollutions and sources of non-point pollution

Travel Path & Quantity of Non-point Pollutants When Raining

- Analysis of quantity, quality and behaviors of non-point pollution
- Identifying cause, runoff characteristic and priority of pollutions
- Evaluating reduction of pollution and improvement of water quality by implementation of policy
- Data for policy making

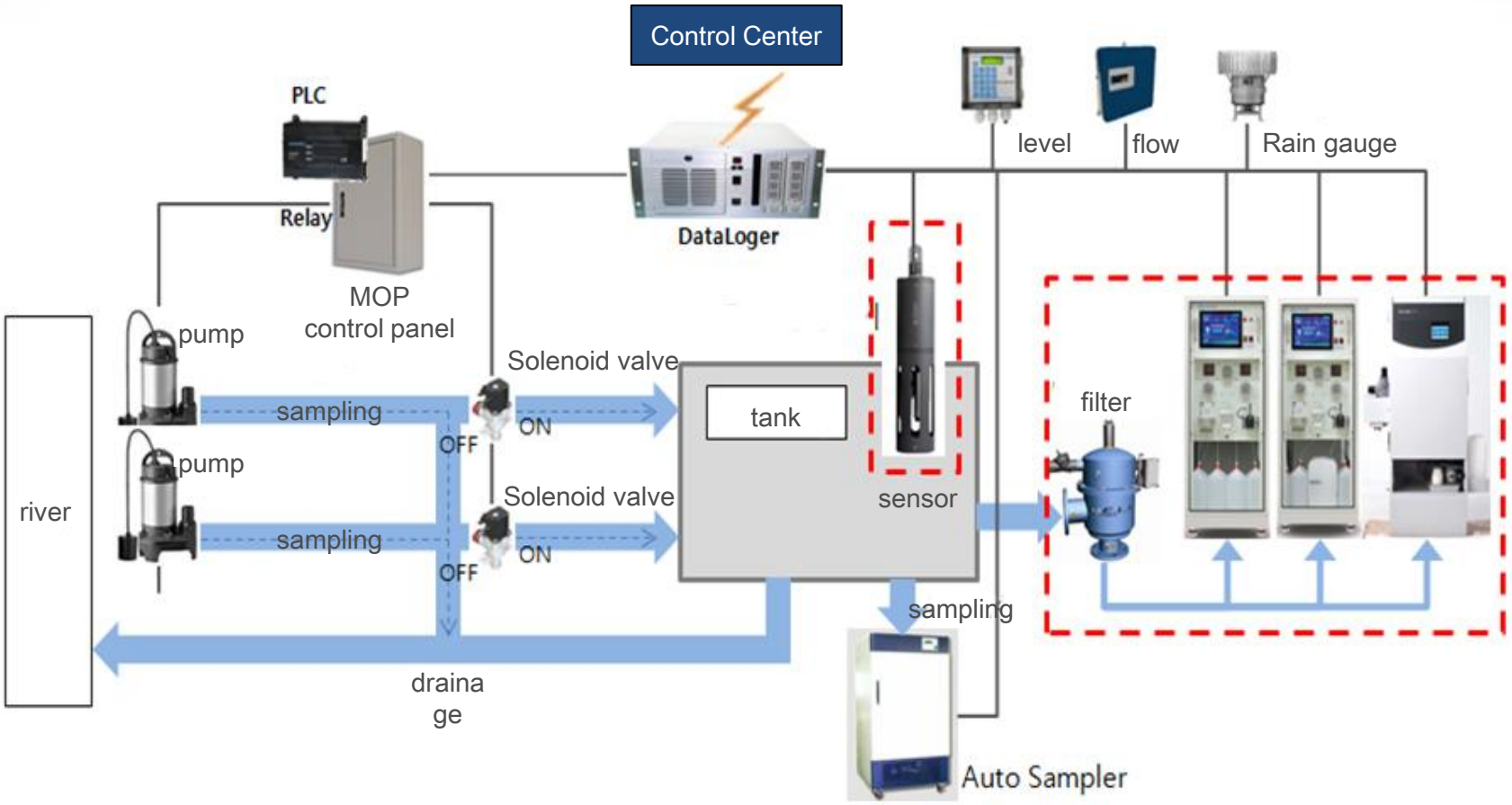
Parameters : Pollution level / Flow

- Detection subjects : Temperature, pH, Dissolved Oxygen(DO)
  Turbidity, Conductivity
  Total Nitrogen (TN)
  Total Phosphorus (TP)
  Total Organic Carbon (TOC)
- Other subjects : Flow meter(Water Level)
  Rain gauge
  Auto sampler, Data logger

16 sites operating in Korea

II . (3) Non-point Pollution Monitoring Network

Concept



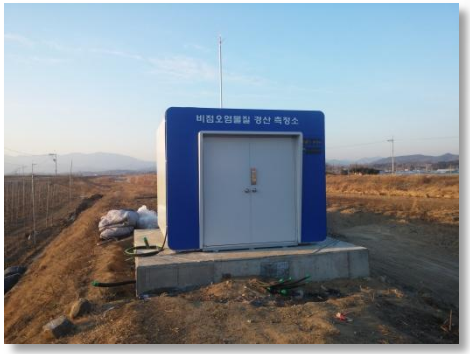
Ⅱ. (3) Non-point Pollution Monitoring Network

Construction Process

Site

Basic excavation

Concrete construction



Station setup

Construction completion

Measurement system installation

Sampling pipe construction

Sampling manhole installation

Ⅱ. (3) Non-point Pollution Monitoring Network

Actual Case

Outside vies of station building

Inside station building

Measuring equipment

Accessories

Sampling (Manhole type)

Sampling (Cantilever type)

Ⅱ. (4) IP-USN based Water Quality Monitoring System

Concept

Enhancement of regular monitoring and Complement of general water quality monitoring network

- Easy installation and relocation based on operation purpose as mobile type
- Economic operation by self- powered system using solar panel
- Parameter : Temp, DO, pH, EC, Turbidity, Chl-a

Actual Case


Buoy preparation


Lope connection


Anchor connection


Installation completion


Buoy move


Boat assembly


Mobile type monitoring system

16 sites operating in Korea

Ⅱ. (5) Industrial Complex Water TMS

Concept

Management of wastewater discharge facilities by the real data of discharged wastewater

Actual Case

- Real time & continuous data monitoring of industrial wastewater discharge facilities (with pretreatment) before the centralized wastewater treatment plant
- Enhancement of efficiency waste water monitoring & management by scientific and systematic system
- Parameter : Temperature, Conductivity, pH

8 sites operating in Korea

Excavation

Concrete block reclamation

Analyzer installation

Control board and solar panel installation

Connection to control center

Communication

Station completion

Ⅱ. (6) Bottled Water Manufacturer Water TMS

Concept

Water quality protection from pollution sources by continuous monitoring of ground water

Actual Case

- Contribution to ground water quality management policy by systematic ground water monitoring networks
- Parameter : Temperature, pH, Conductivity, ORP, Flow, Water Level

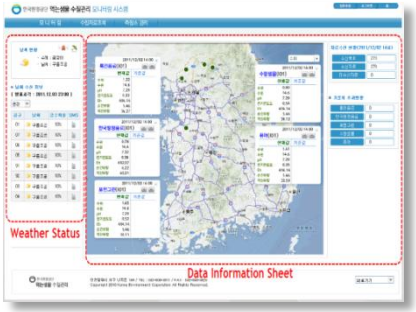
5 sites operating in Korea

Site selection

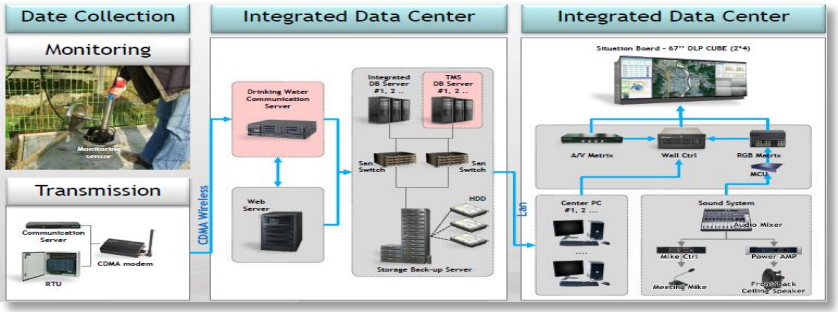
Support bean construction

Measurement system installation

RTU installation



Connection to management system



Integrated management system Concept

Ⅱ. (6) Water Pollution Prevention Information System

Data collection and analysis

- Real time & continuous data transmission of measurement data to control center
- Measurement data analysis & Decision of normal data

Administrative data supply

- Comprehensive monitoring of pollution measurement status by real-time sharing data with the related organization
- Data supply to the related organization when the data is over the standard limit

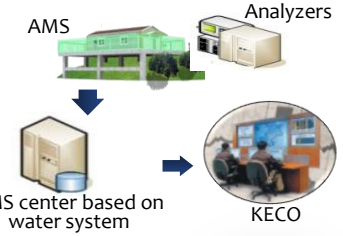
Forecast / Warning function

- Alarm or warning issuing when the measurement data is concerned about over limit
- Alarm or warning propagation by phone, message, fax, etc.

Ⅱ. (7) Water Pollution Prevention Information System

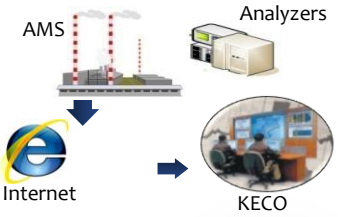
Concept

Water quality monitoring network



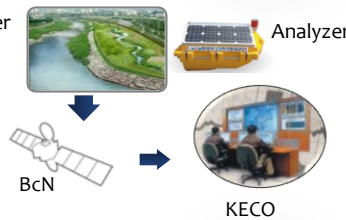
- Collected data : Water quality
- Type : Web service (SOAP)

Water quality TMS



- Collected data : Water quality
- Type : DB Link

IP-USN based monitoring system



- Collected data : Water quality
- Type : FEP collection → DB input

WATER POLLUTION PREVENTION INFORMATION SYSTEM

Integrated DB

Water Pollution Status Propagation


MoE


Related Organization


Local government

National Institute of Environmental Research

- WINS information
- Flow and water level information

Korea Metrological Administration

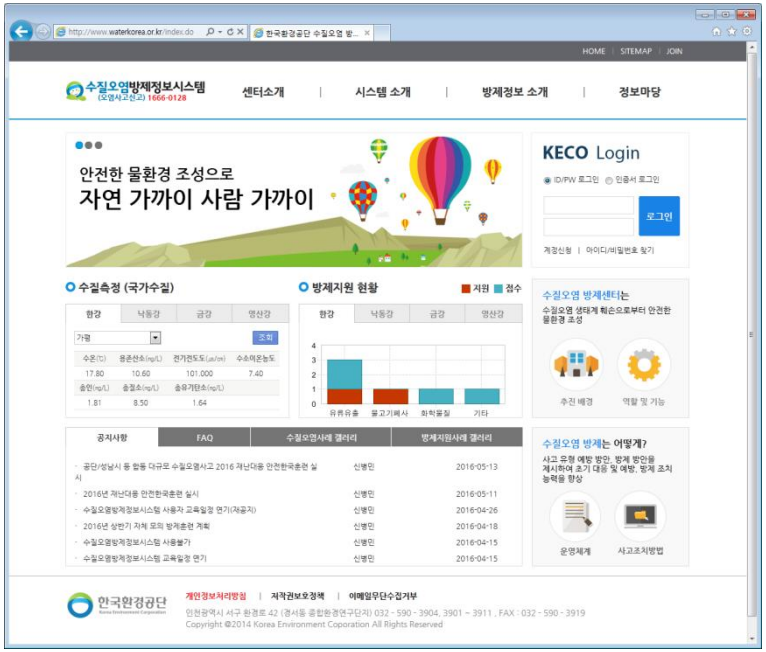
- Weather break news
- Regional forecast
- Rainfall information

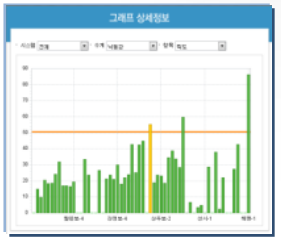
Flood Control Office

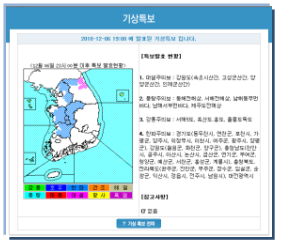
- Flow information
- Water level information
- Dam / reservoir operation

II. (7) Water Pollution Prevention Information System

Actual Case







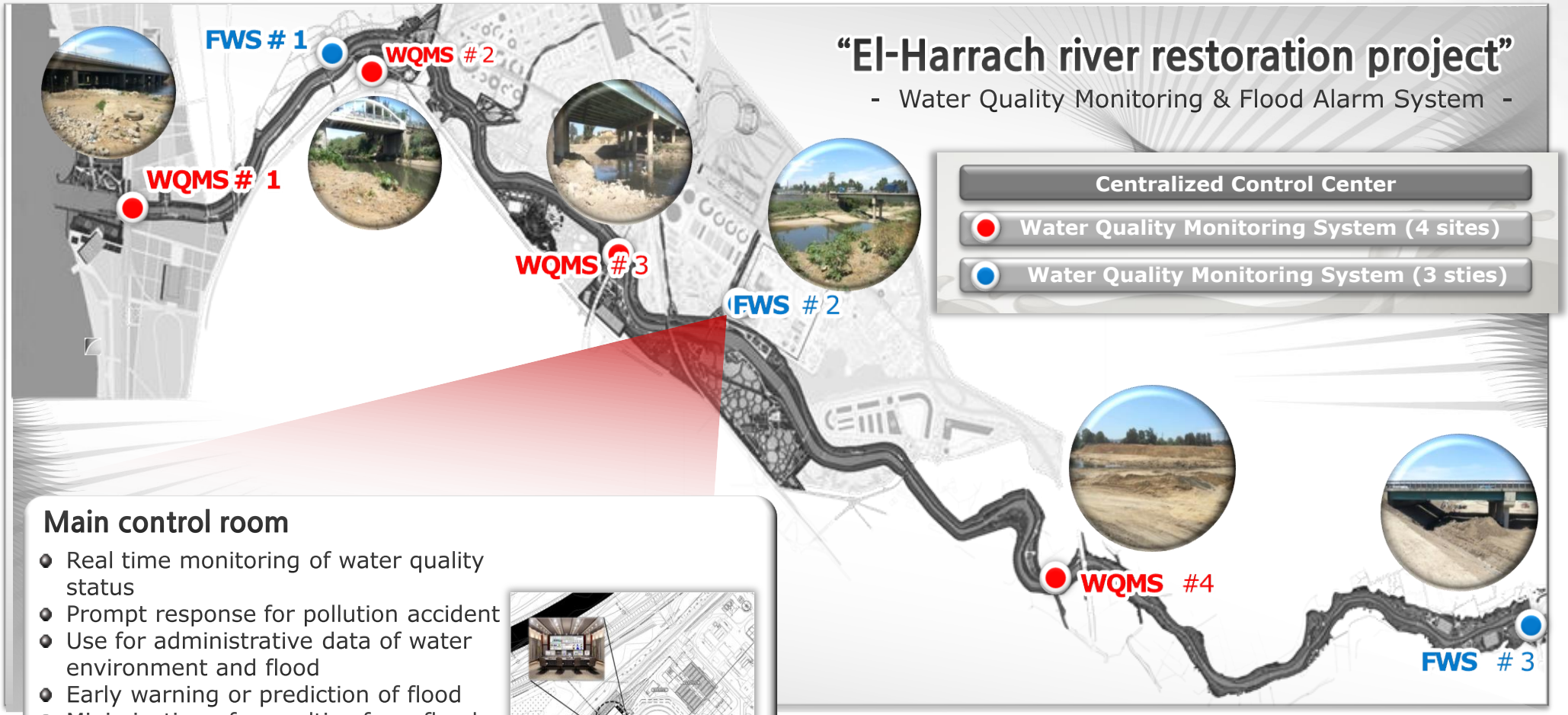
Ⅳ. International Cases

(1) Water quality and flood monitoring of El-Harrach river in Alger

(2) Surface water quality monitoring for drinking water in China

(3) Others

Ⅳ. (1) El-Harrach river in Alger



Main control room

- Real time monitoring of water quality status
- Prompt response for pollution accident
- Use for administrative data of water environment and flood
- Early warning or prediction of flood
- Minimization of casualties from flood
- Integrated water environment monitoring system

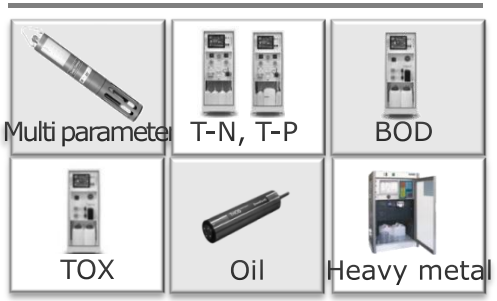
Ⅳ. (1) El-Harrach river in Alger

1 The point where El-harrash (fresh water) meets the Mediterranean sea (sea water)

2 The confluence of Smar stream and El-harrach main stream

3 Downtown area / Water quality monitoring from Baraki STP effluent

4 The confluence of Karma steam and upper stream of El-harrach

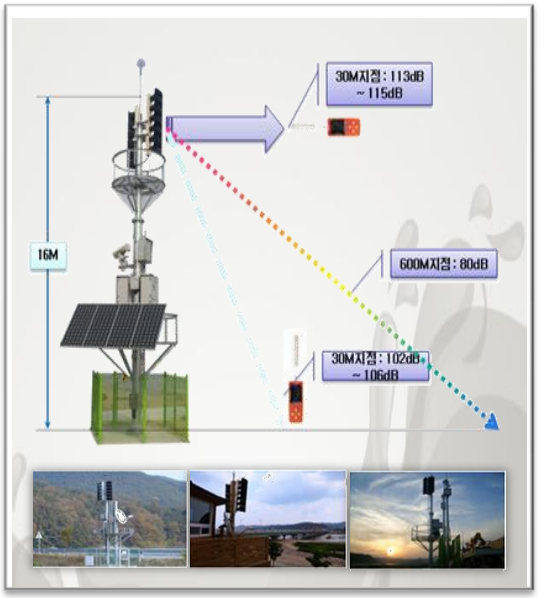


Ⅳ. (1) El-Harrach river in Alger

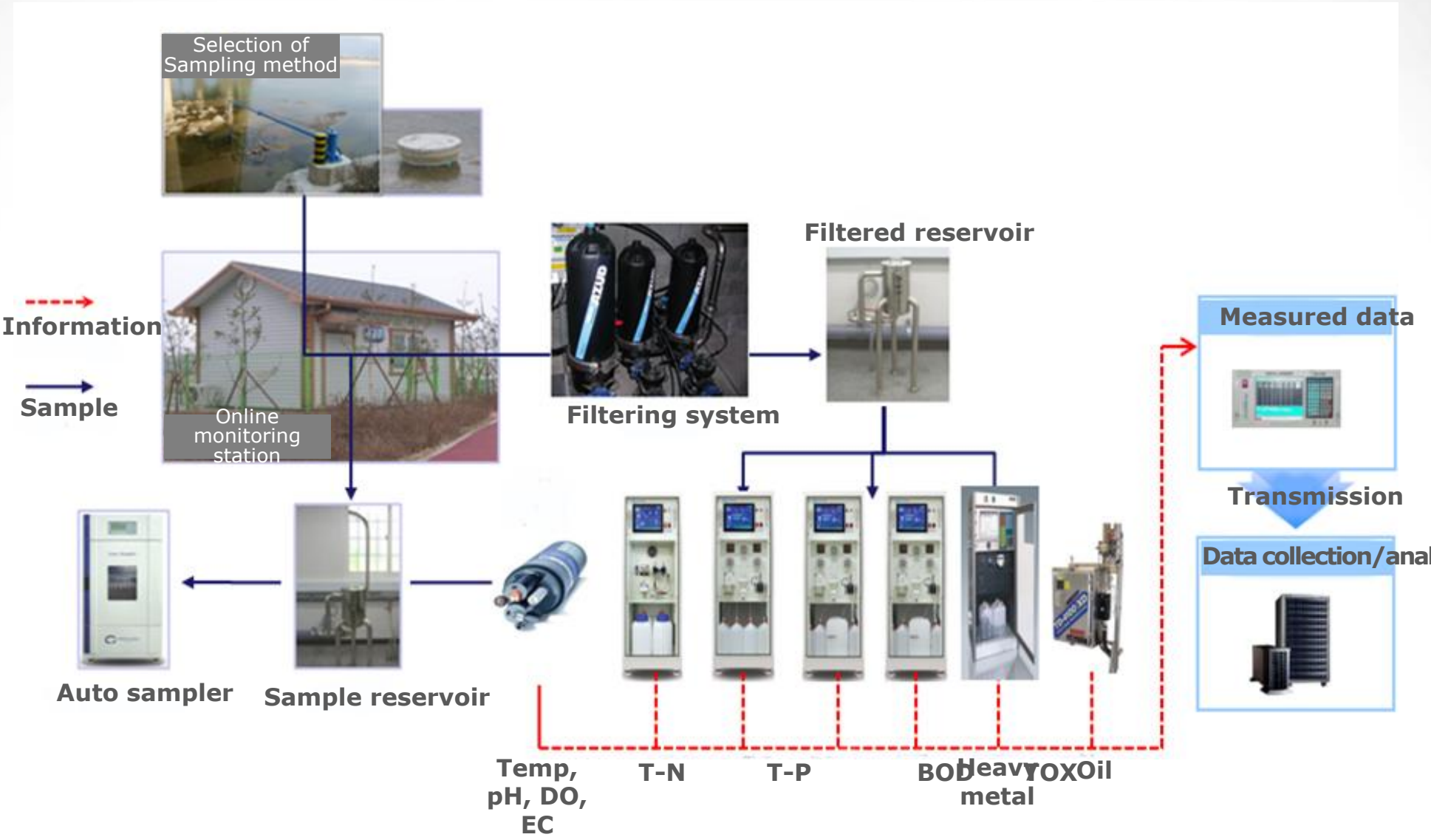
1 Downtown area

2 Downtown area, the location where water level meter and flow meter installed

3 Upstream of El-harrach restoration project



Ⅳ. (1) El-Harrach river in Alger



Ⅳ. (2) Online monitoring system in China

Application	Location	Items
Water resource Water plant	Haining water plant, Zhejiang Miyun lake, Bejing Chengdu water plant, Sichuan Linyi WQMS, Jiangsu Xuzhou WQMS, Shandong Guiyang WQMS, Guizhou Shaoguan WQMS, Guangdong Luochang WQMS, Guangdong Changsha WQMS, Hunan Macao water plant	TOX
Sewage Wastewater Plant	Guangrao STP, Shandong Lanzhou STP, Gansu Chifeng STP, Neimenggu	TOX, TP

Ⅳ. (2) Online monitoring system in China

Installation in China

• Haining water plant, Zhejiang

• Miyun lake, Bejing

• Chengdu water plant, Sichuan

• Linyi WQMS, Jiangsu

• Xuzhou WQMS, Shandong

Ⅳ. (2) Online monitoring system in China

Installation in China

• Shaoguan WQMS, Guangdong

• Changsha WQMS, Hunan

• Guangrao STP, Shandong

• Guiyang WQMS, Guizhou

• Luochang WQMS, Guangdong

Ⅳ. (2) Online monitoring system in China

Inspection & Performance Test Report of Biomonitoring system, HATOX-2000

- **Guiyang Hongfeng lake**


验收报告

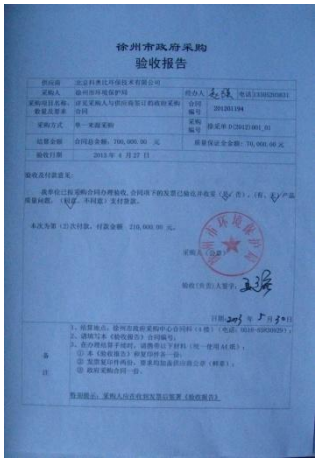
- **Linyi Dongwen river Huangfu ban**

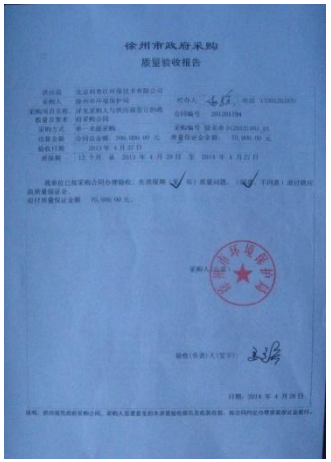

临沂市环境保护局

临沂市东汶河黄埠闸 HATOX-2000 生物监测系统验收意见

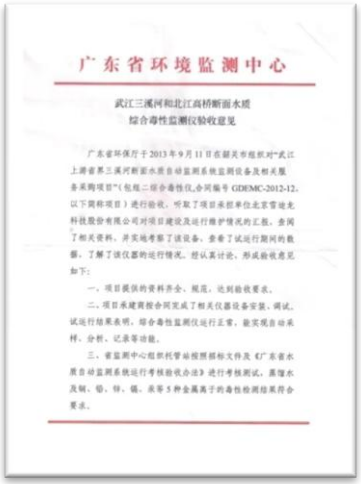

临沂市环境保护局

- **Jiangsu Xuzhou Xiaoyan river**


徐州市政府采购
验收报告


徐州市政府采购
质量验收报告

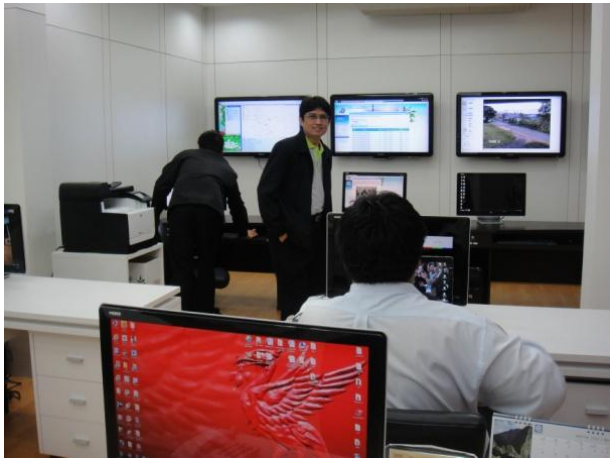
- **Guangdong Bei river, Wu river**


广东省环境监测中心

武江三溪河和北江高桥断面水质
综合毒性监测仪验收意见

Ⅳ. (3) Others

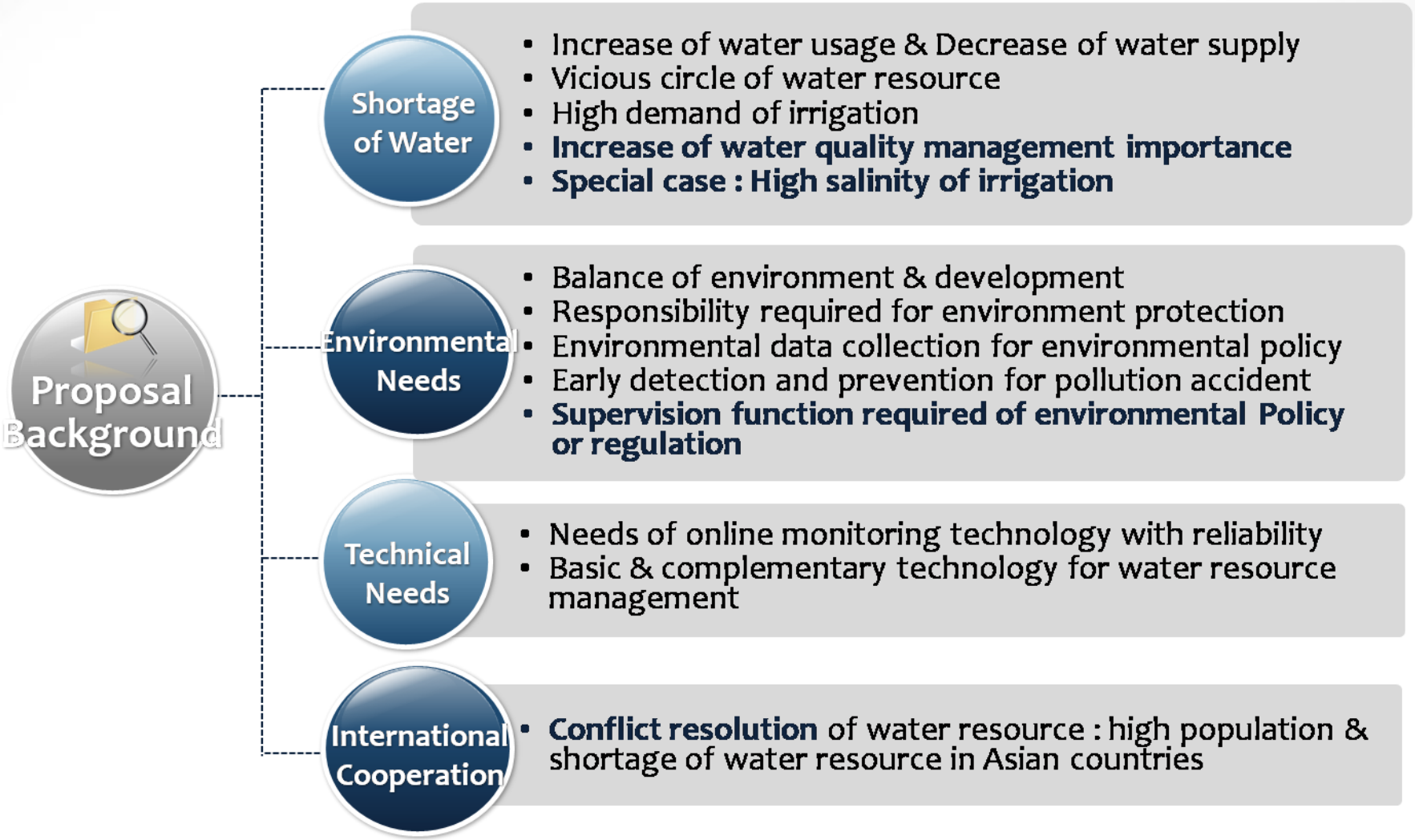
- Thailand



- Vietnam

Ⅴ. Proposal

V . Proposal


Proposal Background
Shortage of Water
• Increase of water usage & Decrease of water supply
• Vicious circle of water resource
• High demand of irrigation
• Increase of water quality management importance
• Special case : High salinity of irrigation
Environmental Needs
• Balance of environment & development
• Responsibility required for environment protection
• Environmental data collection for environmental policy
• Early detection and prevention for pollution accident
• Supervision function required of environmental Policy or regulation
Technical Needs
• Needs of online monitoring technology with reliability
• Basic & complementary technology for water resource management
International Cooperation
• Conflict resolution of water resource : high population & shortage of water resource in Asian countries

V. Proposal

Appropriate and reliable water quality monitoring technology based on purpose and needs

- Policy review and revisions / Environmental monitoring and enforcement / Information disclosure and public participation
- **Capacity building / Technical Assistance / Project Management**

1ST Main River or Lake Management (Surface water)

- Real time measurement data collection and monitoring of river, which is one of the most important water resource
- Pollution from fish farm
- Share of river water quality data with neighborhood countries
- Request for mutual management responsibility
- Regular operation as fixed station
- Connection to flood forecast system

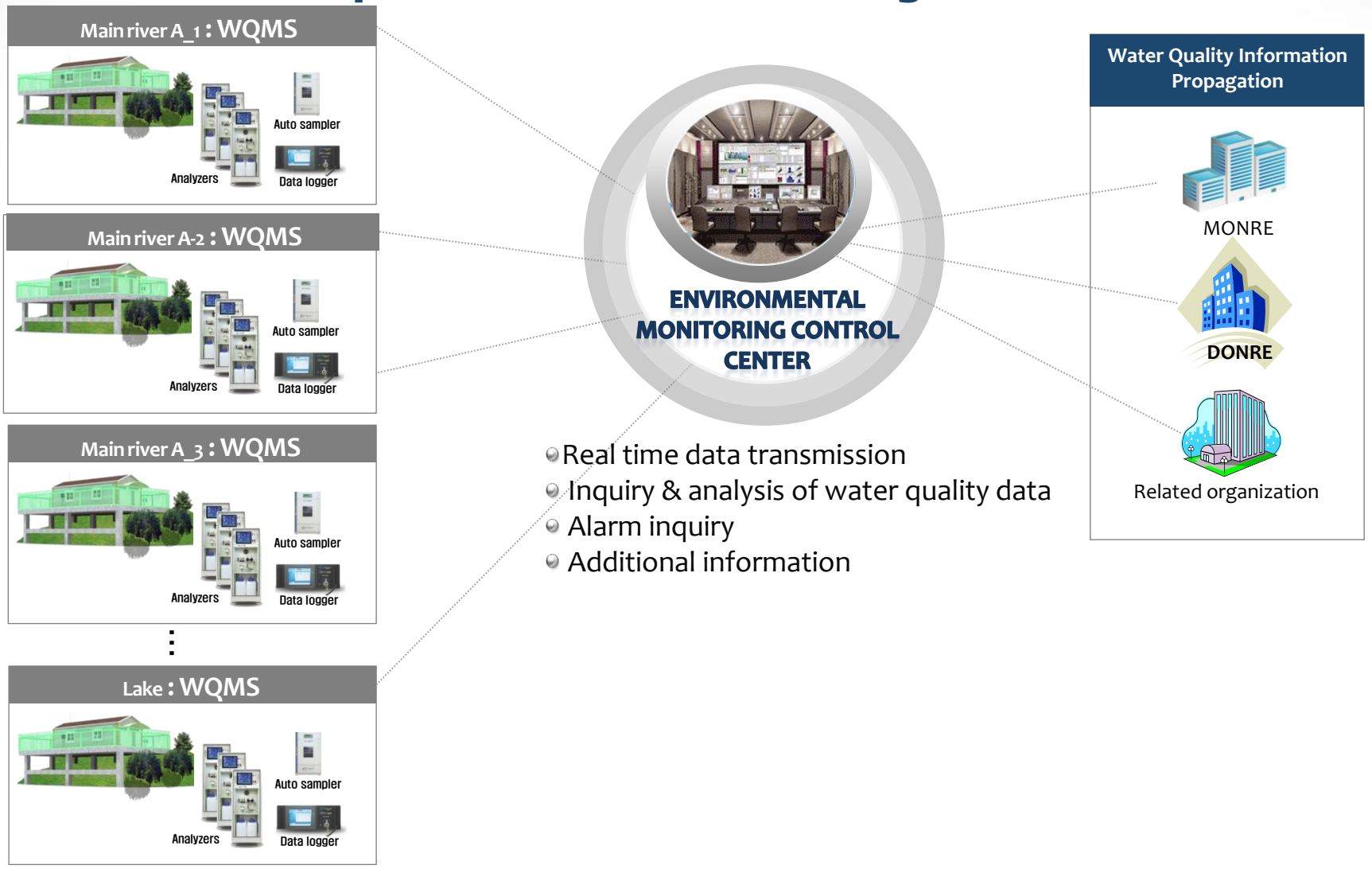
2ND Point source management

- Fundamental cut off of the effluent from point source, SWWTP, IWWTP and other effluent facilities
- Solution for environmental supervision capacity buildup
- Case : Thailand, Vietnam

3RD Irrigation Management

- Salinity monitoring for irrigation usage (Brackish water)
- Algae monitoring during dry season / Turbidity monitoring during rainy season
- Installation and operation as mobile / self-powered type when needed
- Case : Myanma, Vietnam, Bangladesh , Cambodia

General Concept for Online Monitoring of River or Lake



※ WQMS : Water Quality Monitoring Station

General Concept for Online Monitoring of IWWP Effluent

Factory 1

WQMS by Private sector

Factory 2

WQMS by Private sector

Factory 3

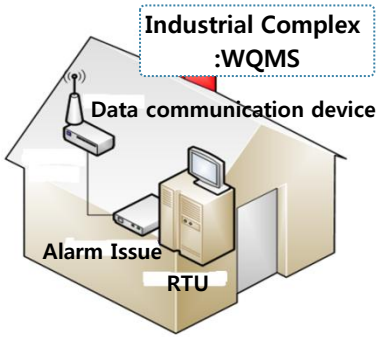
WQMS by Private sector

Factory 4

WQMS by Private sector

Local government or Ministry

CETP, Centralized effluent treatment plants



※ WQMS : Water Quality Monitoring Station

Ⅵ. KORBI Introduction

Ⅵ. KORBI Introduction

- Name: KORBI Co., Ltd.
- CEO: HYUN, MOONSIK (former KIST researcher)
- Founded: October 12, 1999
- Subsidiary Company:
  - KORBI E&C : Engineering
  - KORBI ES : O&M
  - CHINA KORBI (in Beijing)
  - SKORBI (in Beijing)
- Branch:
  - Yungnam HQ
  - Honam HQ
  - Seoul Branch
  - Jeju Branch

Ⅴ. KORBI Introduction : Business area

Water Equipment
Measure & Control Instrumentation

EQUIPMENT

Integrated Water Quality Monitoring
Water Informatization
Integrated Water Resource Management
Integrated Monitoring
Environmental Infra Operation System

SCADA

Online Analyzers
Flow • Level

MEASUREMENT & ANALYSIS

PLANT (EPC)

Environmental Plant
Water Treatment Technology
Engineering

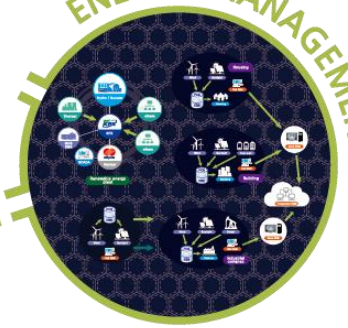
SOLUTION

Environmental Plant O&M
Environmental Consulting

SERVICE

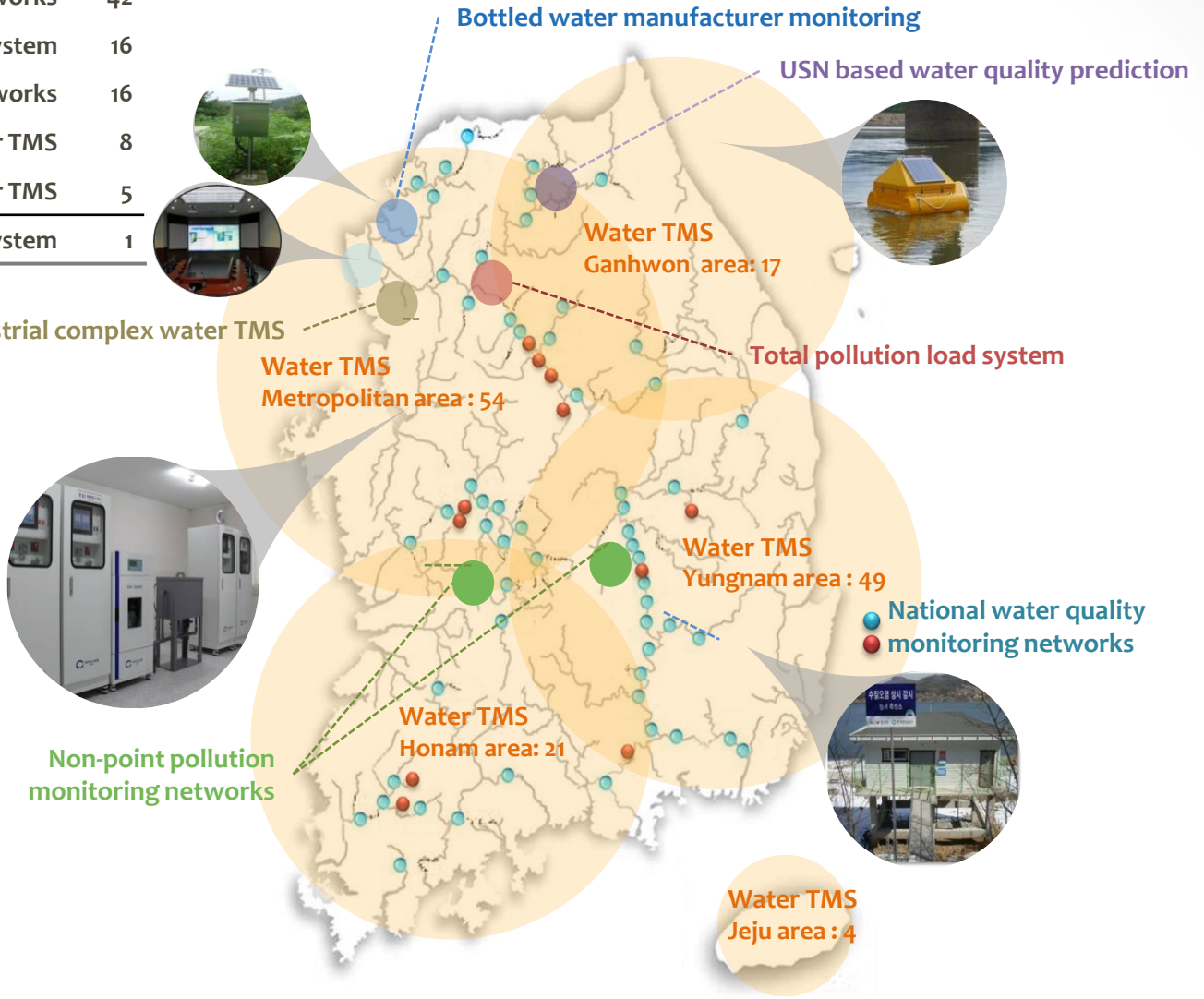
GREEN ENERGY

ENERGY MANAGEMENT



Ⅵ. KORBI Introduction : Monitoring-Main References

Water TMS	183
National Online Water Quality Monitoring Networks	42
IP-USN based Water Quality Prediction System	16
Non-point Pollution Monitoring Networks	16
Industrial Complex Water TMS	8
Bottled Water Manufacturer Water TMS	5
Water Pollution Prevention Information System	1



Ⅵ. KORBI Introduction : EPC-Main References

ENVIRONMENT


Yangpyung STP


Ansung 4th IWWTP


Yangju Gumjun IWWTP


Siheung Mokgam STP


Hwaseong Dongtan2 Clean Energy Center Food Waste Treatment


Paju LCD IWWTP Equalization Basin

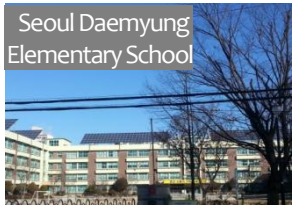

Hongcheon Livestock Biogas Plant


Mail & Seolgok STP


Gugal Respia

ENERGY


Seogwipo Solar Power Plant


Seoul Daemyung Elementary School


Seoul Myogok Elementary School


Hansan Elementary School


Jeju Solar Power Plant


Guui Subway Station


Seoul Shinmyung Elementary School


Seoul Seongnae Middle School


Seoul Konkuk University Subway Station


Seoul Guro Digital Complex Subway Station

Ⅵ. KORBI Introduction : SI-Main References

Integrated Water Quality Monitoring

- 2009 TMS Control System Supplement and Expansion
- 2009 Water Quality Prevention Information System Construction
- 2010 IP-USN-based Mobile Water Quality Prediction System
- 2011 USN-based Mobile Water Quality Prediction System
- 2011 National Water Quality Monitoring Network Construction Project
- 2011 Potable Spring Water Quality Monitoring System on Manufacturer Construction Demonstration Project
- 2012 Water Quality Monitoring System in Industrial Complex(IP-USN) Construction Demonstration Project
- 2012 National Water Quality Monitoring Network Construction Project
- 2013 National Water Quality Monitoring Network Construction Project
- 2014 Non-point Pollution Water Quality Monitoring Network Demonstration Project

Water and Wastewater Informatization

- 2012 Block Management & Maintenance Construction for Tap Water Pipe Network in Changwon
- 2013 Intelligent Integrated Management System of Tap Water Supply
- 2014 Real-time Tap Water Quality and Flux Management System

etc.

- 2010 Integrated Carry in Management System of Sudokwon Landfill
- 2010 National Voluntary Greenhouse Gas Reduction Project Registry
- 2011 Advanced Development of National Greenhouse Integrated Management System
- 2013 Refrigerant Information Management System
- 2013 Self-Diagnosis of Greenhouse Gas Reductions for Local Governments
- 2014 Indoor Air Quality Monitoring Network

Ⅵ. KORBI Introduction : Service-Main References

MP/FS Service

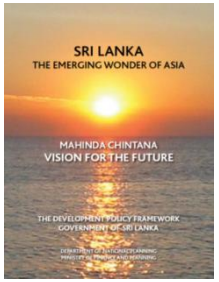
- Algeria El-harrach River Water Quality Management Master Plan
- Feasibility Study on SNR Technology Transfer in China
- Feasibility Study on Bio-energizing Sugar Cane Waste in Sri Lanka
- Sri Lanka Water and Wastewater Improvement Master Plan
- Feasibility Study on Construction of ESS Plant in Kazakhastan
- China Zhejiang STP Construction Project

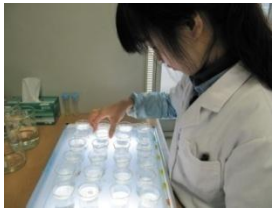
Water Quality TMS Operation & Management

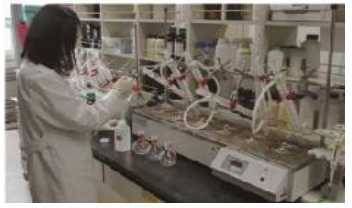
- 2009-2010 : 42 sites
- 2010-2012 : 45 sites
- 2012-2013 : 43 sites
- 2013-2014 : 41 sites
- 2014 : 46 sites
- 2015 : 70 sites

Service Business and Eco-toxicological Evaluation

- Service Business : 22 cases
  - Paldang Lake Settled Waste Examination and Management Plan
  - Multiple Water Resource Water Loop Management & Control Program Development Operation, et cetera.
- Eco-toxicological Evaluation : 30 sites
  - Other Equipment and Daphnia food supply : 18 sites







VI. KORBI Introduction : HUB Business

Thank you.

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