GLOBAL BEST TAP WATER

Arisu

Office of Waterworks Seoul Metropolitan Government

CONTENTS

01 Organization and Personnel

Office Of Waterworks Seoul Metropolitan Government

Organization

- 1 headquarters(5 bureaus), 8 water supply offices, 7 centers(6 water purification centers, 1 waterworks equipment management center), 1 research institute

Personnel (1,854 people)

- Headquarters(225), water supply offices(1,067), water purification centers(441), Waterworks Research Institute(90), waterworks equipment management center(31)

Headquarters

- Management & Administration Bureau(6 departments)
- RevenueManagementBureau (4 departments)
- Production Bureau (4 departments)
- Water SupplyBureau (4 departments)
- Water Facility Safety Bureau (4 departments)

Offices

- Water supply office(8)
- Arisu water purification center(6)
- Waterworks equipment management center

Waterworks Research Institute

- Water Quality Analysis Bureau (5 departments)
- Waterworks Research Bureau (4 departments)
- Future Strategy Research Center (2 departments)


Liabilities
218.9 billion KRW
Total assets
5.2973 trillion KRW
As of December 31, 2017


Government subsidies 0 KRW
Budget
Revenue
820 billion KRW
2018 revenues and expenditures

03 Production and Water Supply Facilities

Office Of Waterworks Seoul Metropolitan Government

Arisu

start watering

- 1908, Dduk-do purification plant
- Start supplying tap water for 125,000 people

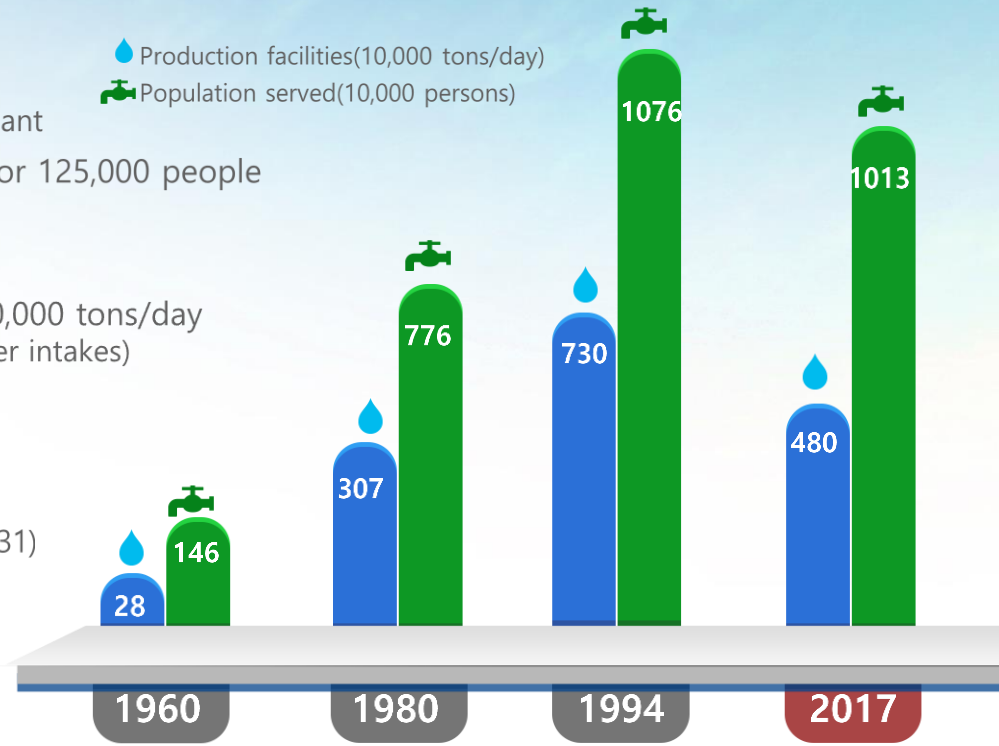
Production facilities

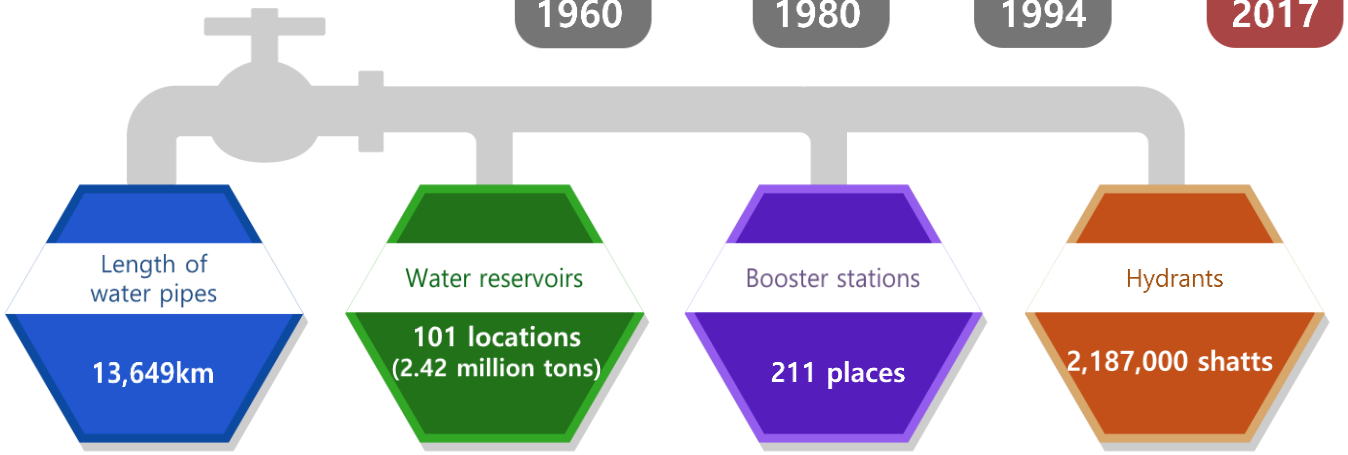
- Production capacity : 4,800,000 tons/day
  (6 purification centers, 4 water intakes)
- Average production:
  3,150,000 tons/day

Population served

- 10,125,000 people(2017.12.31)
- 4,220,000 households,
  distribution rate 100%

Water supply facilities





Arisu Recognized Worldwide

Office Of Waterworks Seoul Metropolitan Government

2000

ISO14001(Environmental Management)
Environment-friendly management to minimize environmental pollution

2009

UN Public Administration Service
Water Awards

2010

IWA(International Water Association)
Global Water Industry Project **Innovation Awards**

2010

International Business Awards

2016

Effective management harmful elements in the entire **ISO22000** (Food Safety Management) **production** and manufacturing process

Seoul's tap water Arisu that citizens trust and drink

- Preemptive water Quality management From a water source To A faucet
- Optimal management Of faucet disinfection Condition
- Maintaining The ISO22000

- Water supply pipe Which is vulnerable To rust maintenance
- Expansion of reservoir To stable water supply
- Even in a leak accident, Uninterrupted water Supply pipe network
- Improve GIS accuracy

- World's best revenue Water rate management
- Construction of Intelligent Water management system
- Expansion of renewable Energy equipment
- Promote international Status as an advanced City for water supply Facilities

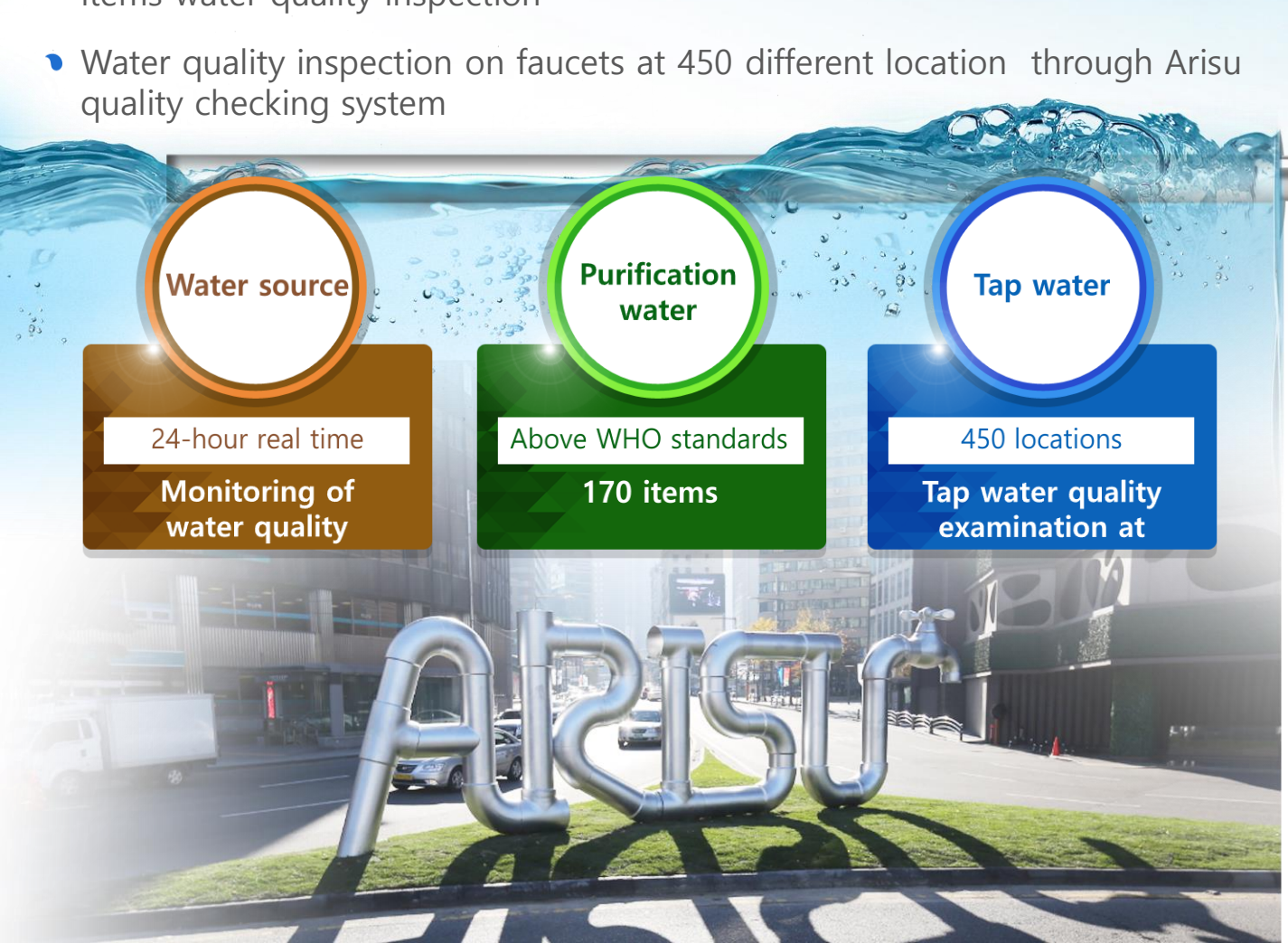
- Support for water Pipe replacement costs
- Converting to Direct-connection Water supply system For high-rise apartments
- Installing Arisu drinking fountain
- Improved awareness About Arisu through the right information Delivery

- Arisu Quality Checking System
- Provide information of Home water quality And supply path
- Water rate notification service

01 Strict Management of Water Quality

Office Of Waterworks Seoul Metropolitan Government

- 33 branch water quality inspection, Automatic monitoring of source water quality, Biological warning system
- 60 water quality standards + 110 self-monitoring standards, Total 170 items water quality inspection
- Water quality inspection on faucets at 450 different location through Arisu quality checking system

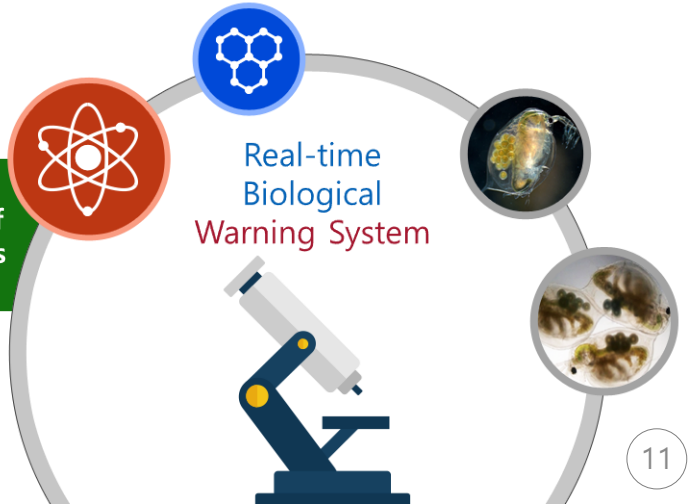


02 24-Hour monitoring of water source

Office Of Waterworks Seoul Metropolitan Government

- Use the surface water of the Han River as source water
- Installation of automated water quality measuringequipment at waterintake plants to detect the presence of algae and phenols 24 hours a day
- Reinforcement of monitoring of new microbial elements and secure safe source water
- Operation of Biological-Warning System using the Food Chain Index
  - Microorganisms, algae, waterfleas, fish

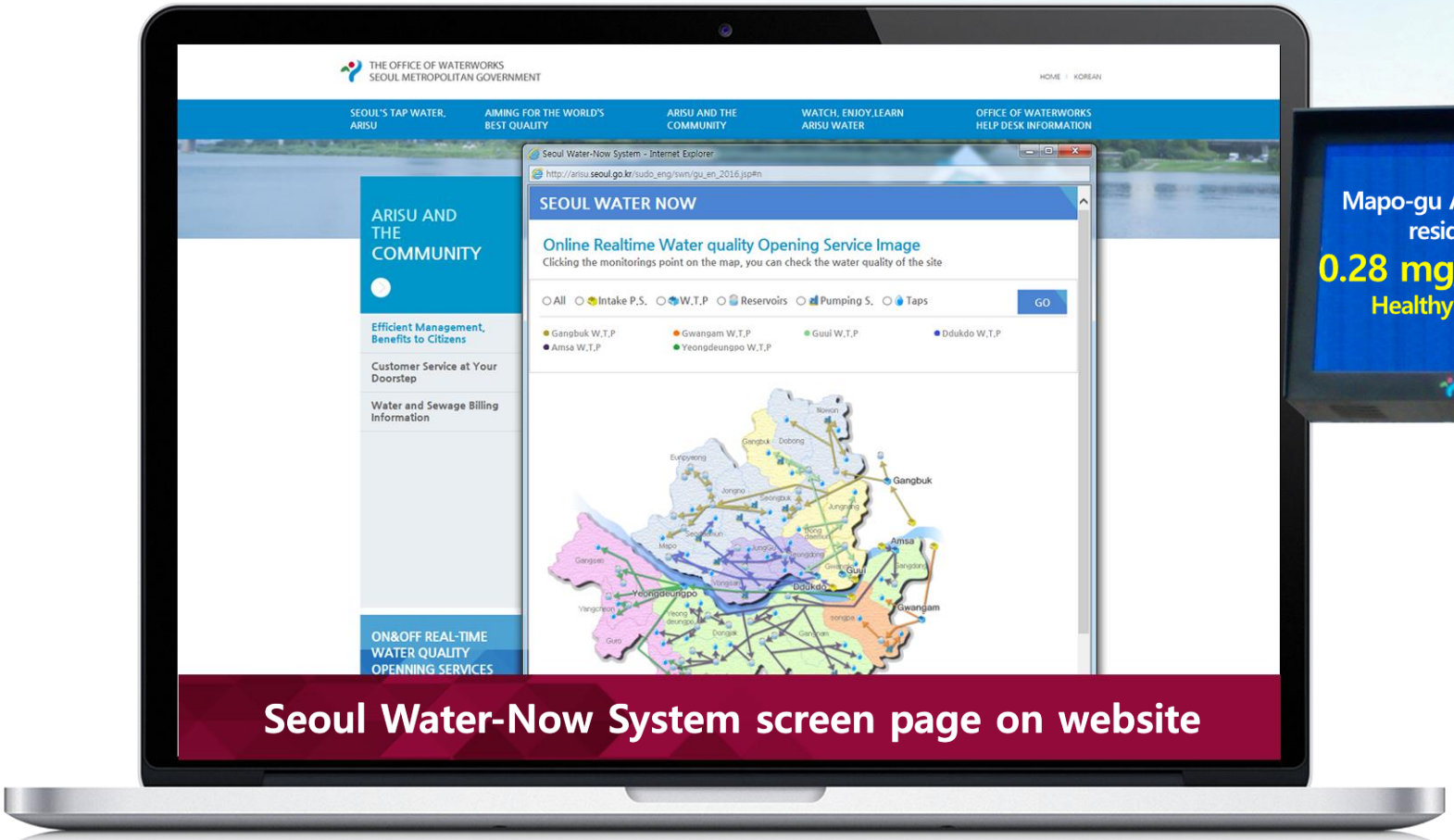
Real-time inspection of influx of toxic materials



03 Seoul Water-Now System

Office Of Waterworks Seoul Metropolitan Government

- Publication real-time water quality from Source water to faucet **200 spots**
- Water quality information available on Seoul City atmospheric environment electronic bulletin board **12 locations**



Seoul Water-Now System screen page on website

04 Advanced Water Purification System

Office Of Waterworks Seoul Metropolitan Government

Process

- Ozone and Granular Activated Carbon particle treatments added to process

→ Production of healthy and tasty tap wate

Installation and Operatior

- all Water Purification plants(3,570,000 tons/day)

Effect Advanced water treatmant

Safe from green algae

- **Completely remove** odor causing substances such as soil(geosmin) and mold(2-MIB) caused by algae

Safe from pesticides

- Eight insecticide components detected in eggs **were not Detected in Arisu**

Safe from micro-plastics

- **Microplastic was not detected in Arisu**

Safe from radioactive materi

- September, as a result of emergency water quality inspection, no radioactive material was detected in source water and purified water
- Even if a radioactive substance is detected in source water, It can be removed

→ I-131 100% remove, Cs-134, Cs-137 80% remove

05 Chlorine Disperse Injection System

Office Of Waterworks Seoul Metropolitan Government

Residual chlorine equalization across the entire area

the amount of residual chlorine in water at the faucet

Water purification center — Chlorine injection → Reservoir — Chlorine re-injection → Households

Past

Chlorine injection limited to **center**

- Local chlorine odor complaints
- Long-distance residual chlorine targets not met

Now

Decentralized injectionsin in water purification center and reservoir

- Reduction of chlorine odor
- Supply of tasty water (0.1~0.3mg/l of chlorine)

Construction of Chlorine DisperseinjectionSystem

- 15 reservoirs(Nakseongdae, Daebang and others)

06

Maintaining ISO22000 International Certification

Office Of Waterworks Seoul Metropolitan Government


bsi.

Certificate of Registration

FOOD SAFETY MANAGEMENT SYSTEM - ISO 22000: 2005

Certification date 2016.10.27.

Certification scope 6 water purification center systems from water intake to faucet (including bottled tap water)

Certification agency BSI (British Standards Institution)

Introducing a hygiene concept and Managing a facility
(Hazard Analysis and Critical Control Points)

Set up safety goals and operation plans
(6 goals and 15 tasks)

Effective management of harmful elements in production and manufacturing process

Establishing a safe tap water production system
(2 manual and 17 procedures)

Strengthening hygiene management for all visitors

01 Repairing of old water pipes

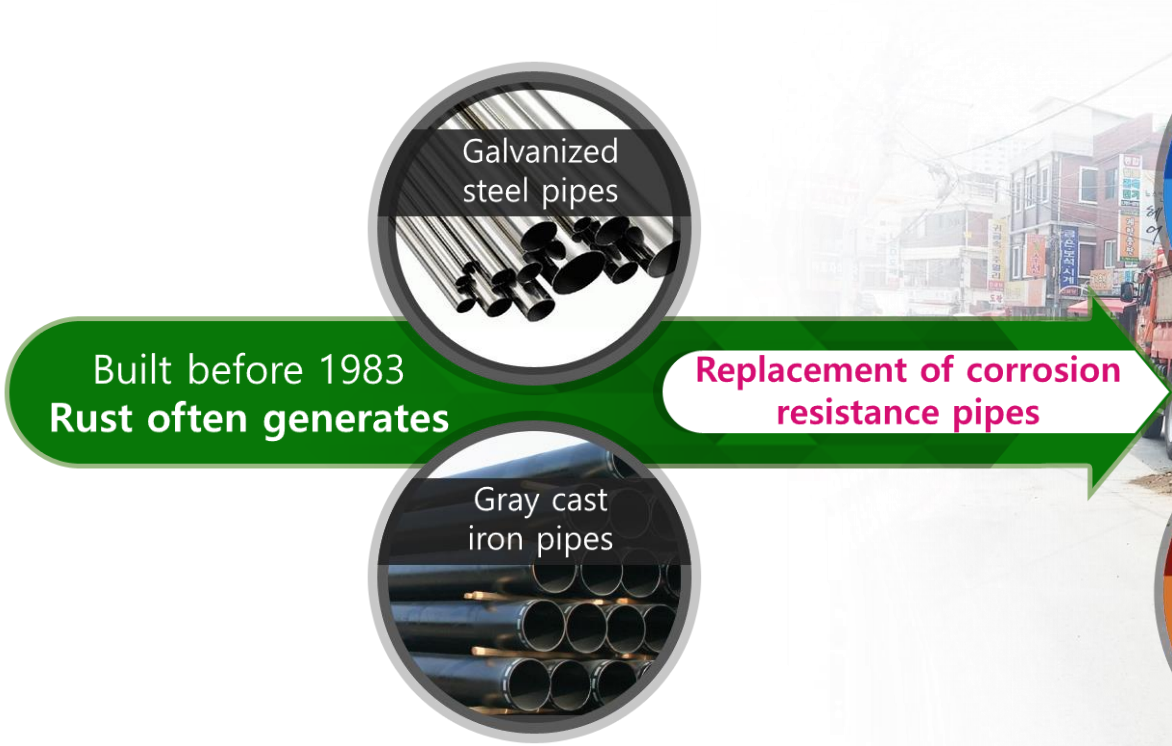
Office Of Waterworks Seoul Metropolitan Government

Repairing weak, old water pipes to create an environment to supply safe, clean tap water

Business scope 13,587km(13,366km repaired, 98.4% completed)

Business period 1984~present

Total business expenses 3,499.7 billion KRW(invested cost from 1984 to 2017: 3,230.5 billion KRW)



02 Expanding reservoir for establishment of a stable water supply system

Office Of Waterworks Seoul Metropolitan Government

Newly construct or expand reservoir to establish a stable water supply system without a shutoff even during waterworks construction, leakage accidents, etc.

Newly construct or expand reservoirs 11 locations, capacity of 66,000㎥
(35,000㎥ of new construction, 31,400㎥ of expansion)

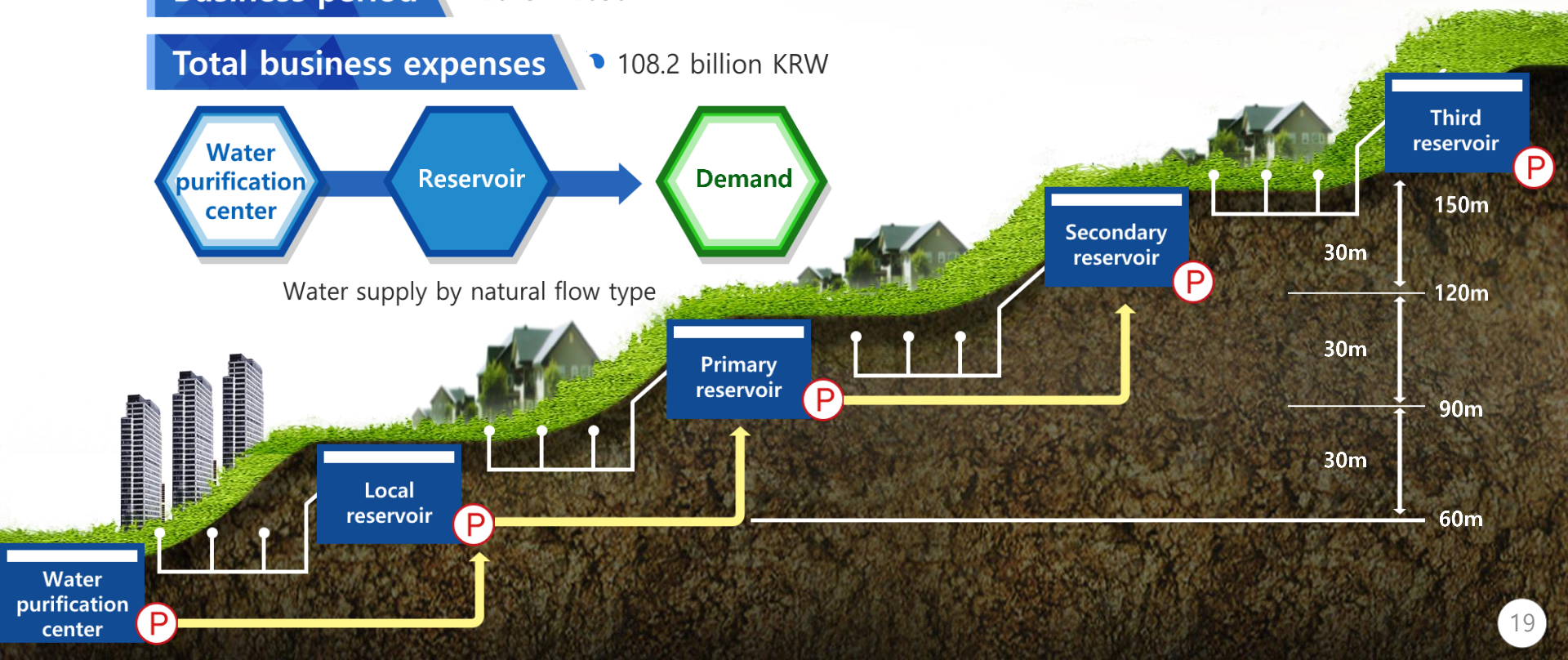
Reservoirs status total 101 locations, 2.42million tons, 2016.12.31

Business period 2015 – 2030

Total business expenses 108.2 billion KRW

Water purification center → Reservoir → Demand

Water supply by natural flow type



03 Build an uninterrupted water supply system

Office Of Waterworks Seoul Metropolitan Government

Arisu

Build a systems that can supply tap water under any circumstances(2018~2030)

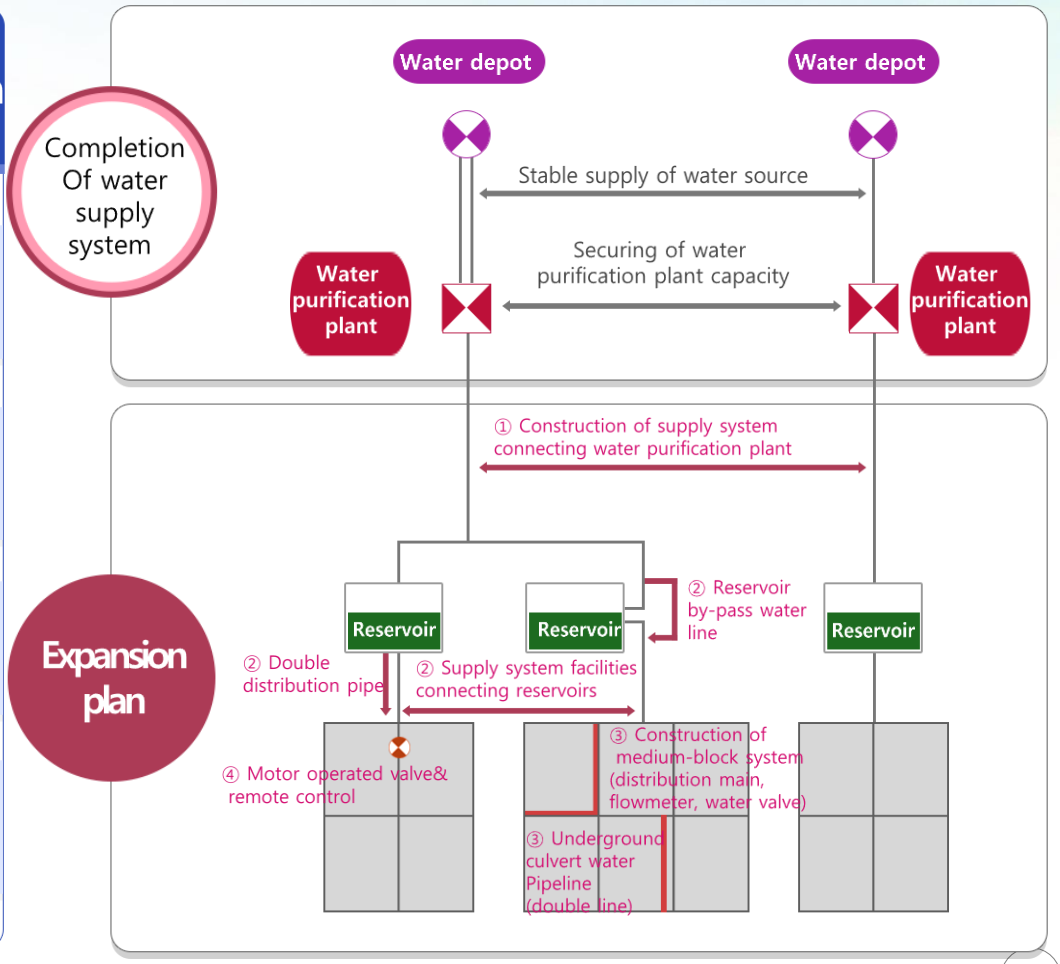
Fundamental measures against Large-scale water supply interruption Caused by leakage

01 Establishment of supply system **between Arisu water purification centers**

02 Stable supply of tap water through **Double line of main water line**

03 Establishment of efficient **block system**

04 The main valve of the water supply pipe Was electronicized for **remote control**



04 Improving Accuracy of the Waterworks Geographic Information system(GIS) Database

Office Of Waterworks Seoul Metropolitan Government

Arisu

Close examination of facilities' location, depth and data and construction of tap water GIS database

Project objective
- Establish Construction of water pipeline (10,468km / more than 80mm diameter)

Progress report
- Completed 62% (6,654km) as of 2018

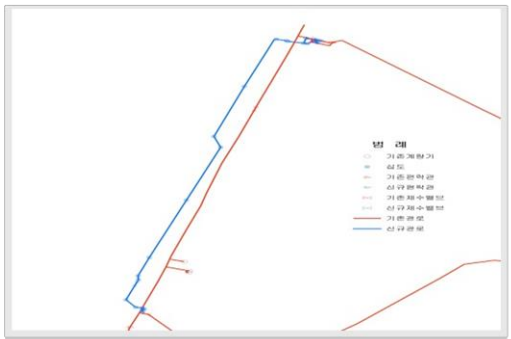
Project period
- 2005 – 2022(Cost: 87.8 billion KRW)

Project detail
- Close examination of facilities' location and specifications
- Measurement of coordinates using state-of-the-art equipment such as Global Navigation Satellite System(GNSS) & editing of database

Tap water facilities research and inspection

Precise(Coordinate) measurement

Modification/editing of database



01 World's best revenue water rate management

Office Of Waterworks Seoul Metropolitan Government

Arisu

Replacement of old facilities

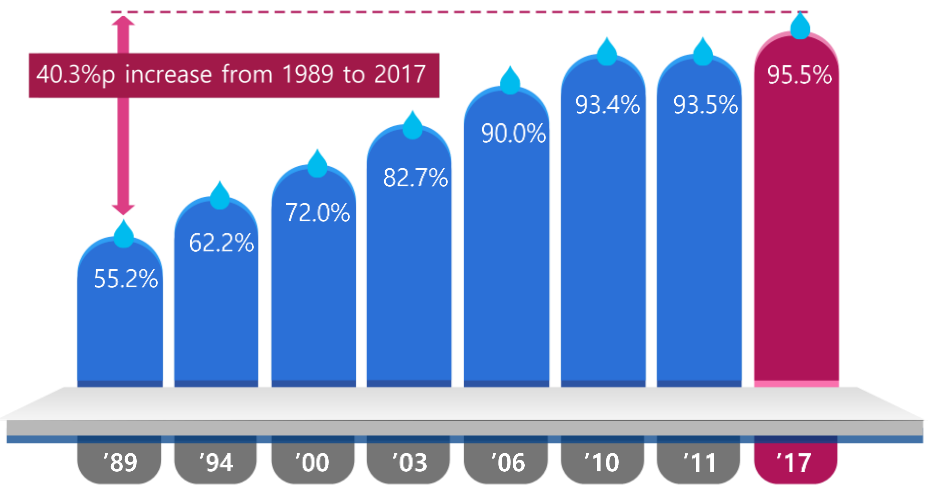
- Systematic management of waterworks facilities
  Removal of disused pipes, Preemptive leak detection

Revenue water rate **95.5%** (2017)

Scientific management of water supply quantity

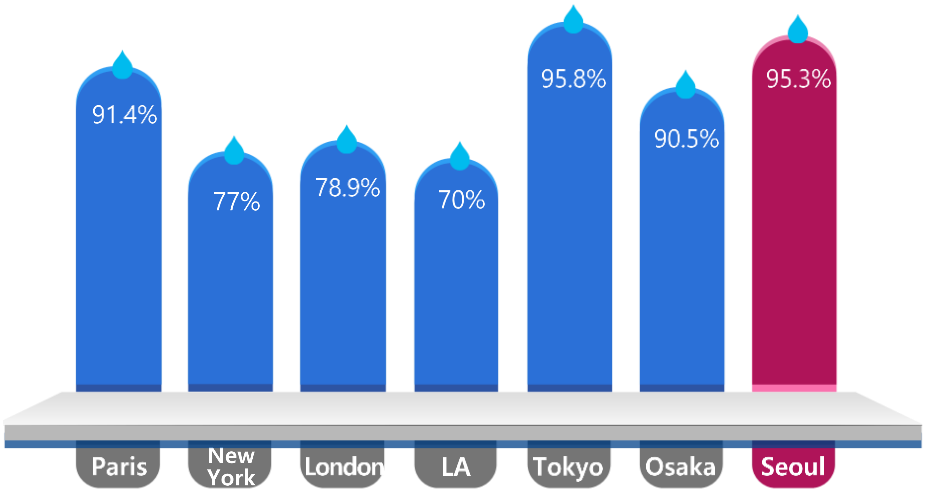
- Water intake and flow meter management, booster area management, flow management block by block

Producing savings 500 million tons per year



Trend in revenue water rate changes

World's Second highest revenue water rate



Comparison to major cities in developed countries

Arisu Integrated Information Systerm

Office Of Waterworks Seoul Metropolitan Government

Information on the supply and distribution of tap water is collected in real time via the Smart Water Grid and holistically managed in order to improve management efficiency and ensure a prompt response in the event of an emergency

Smart Water Greed

What is the Smart Water Grid?

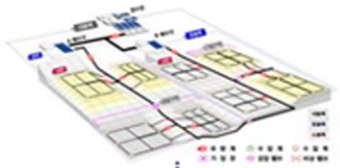
A next generation water control system combined withstate-of-the-art IT technology in order to enhance management efficiency of water resources, supply and drainage

Intelligent Purification Plant

· Integrated automated operation of the entire process
· Estimate demand / Create plan

Intelligent Main Water Pipe Network

· Create optimized GIS-based block system
· Implement main valve remote control system

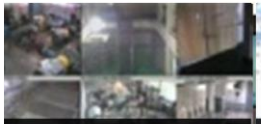


Water gauge remote monitoring

· Create ICT-based remote monitoring system
· Implement trial run of remote monitoring system

Arisu Integrated Information System

Implement role of water pipeline integrated control tower



Video monitoring system

Production management system

Supply management system

Remote monitoring system

Water quality control system

03 Environmental Friendly Energy, Recycling Facilities

Office Of Waterworks Seoul Metropolitan Government

Production of renewable energy

Solar power | Geothermal | Small hydro

- Produced 19,000 mwh/year, reduced manufacturing cost of 580 million KRW (2017)

Environmentally friendly usage of sludge originating from water purification process

- Construction using prototype water-permeable soil concrete and water-permeable blocks at 3 water purification centers to reduce the waste processing cost

Sludge Sediment deposits from the water purification process

Reduction of the **cost of generating** tap water, **reduction of waste management fees, improvement of productivity**

Solar power

Geothermal

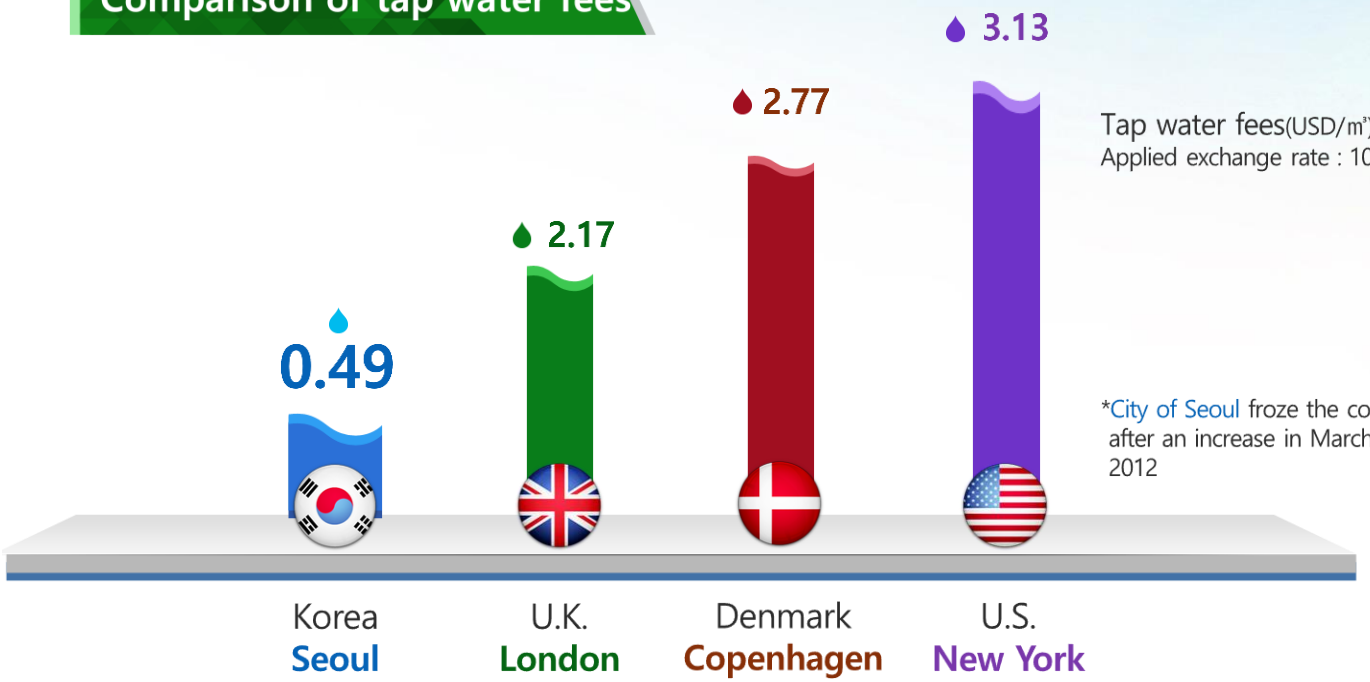
Small hydro

Lowest Water Fees in the World

Office Of Waterworks Seoul Metropolitan Government

Minimizing fees through sensible management

Comparison of tap water fees



Water usage costs in Seoul are 5.7 and 6.4 times lower than Copenhagen and New York respectively(as of January 2018)

05 Pursuit of international expansion of waterworks project

Office Of Waterworks Seoul Metropolitan Government

Participated in infrastructure development consulting project of PMB Island, Brunei

- Dispatch supervising personnel, 2016.04 – 2020.04

Pursuit of waterworks system improvement project in Chanchamayo city, Peru

- San Ramon, La merced, Pichanaki(2012 ~ 2018, 2.5billion KRW)

Completed water facility improvement project for regions in Vietnam

- Huê, Vietnam, 2016.01 – 2016.02

Conduct training for representatives from targe capital cities(2~3 times per year)

- Dispatch professional personnel(Ninh Binh and Hai Duong, Vietnam)

Operate private-government council (2 general meetings, 5 subcommittees, 3 executive meetin

- Arisu Internationalization Forum(2 general meetings)

World Water 10 for cooperation with foreign Advanced cities

- Preparing for the 2019 founding Meeting

06 International Waterworks Project

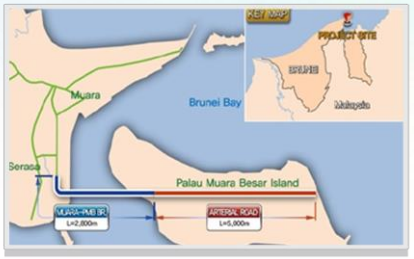
Office Of Waterworks Seoul Metropolitan Government

ODA for the International Waterworks Project

- ODA for improving the intake & water treatment facilities and water supply system in Chanchamayo city, Peru from 2013 to 2018

Bidding as a Private and Public Consortium for the International Waterworks Project

- Contracted an infrastructure consulting service of PMB Island, Brunei (2016. 4.~ 2020. 4.)

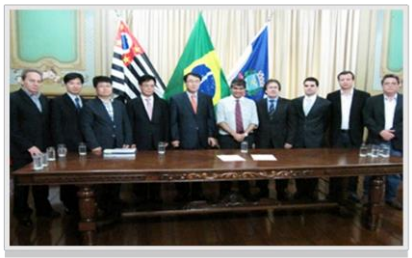


07 Supporting policy for the International Waterworks Project

Office Of Waterworks Seoul Metropolitan Government

MOU for Promoting the Cooperation Projects of Waterworks with Foreign Cities

- **11** cities and institution in **Brazil, Thailand, Papua New Guinea and others**



Training Camp for Foreign Waterworks High Officials

- Instructed 40 high level officials each year from ASEAN and Latin America
  181 people from 31 countries participated in 15 events held from 2012 to 2017

01 Supporting replacement of old indoor water pipes

Office Of Waterworks Seoul Metropolitan Government

Since old indoor pipes become a reason for deteriorated water quality, replacement construction cost is supported to prevent the release of rust and improve the water quality

Implementation performance

- 565,000 households , 255 billion KRW (2007 - 2022)

Details

- 349,000 households, 130 billion KRW
  (Supporting up to 80% of the cost within the upper limit for each housing type)




Classification	Social welfare facilities and beneficiary of basic livelihood security aid	Single house	Multi-household house	Apartment houses
Replacement construction : within 80% Restoration construction : within 80%	Entire construction cost	1,500,000 KRW max	2,500,000 KRW max	1,200,000 KRW max (400,000 KRW common water pipes)

02 Pursuit of direct-connection water supply system for high-rise apartments

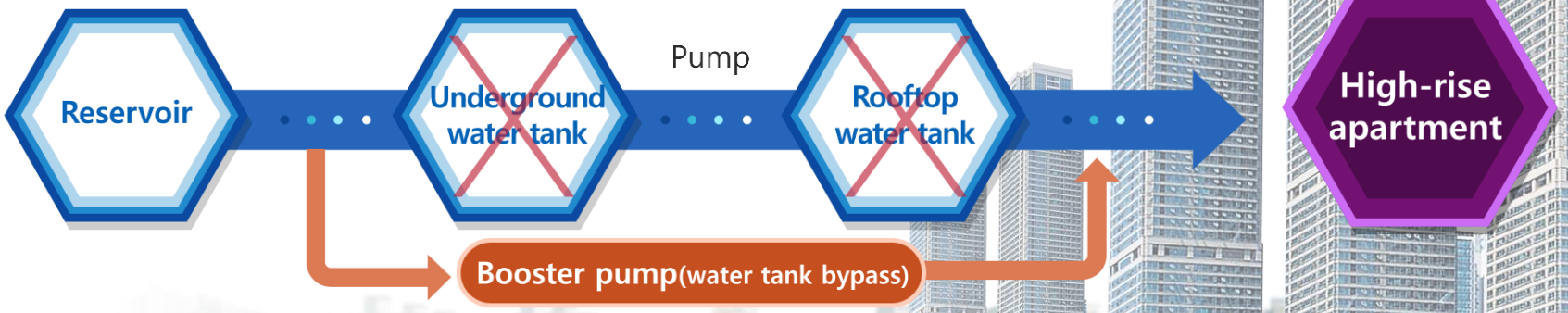
Office Of Waterworks Seoul Metropolitan Government

Arisu

Improved from water tank supply method to pressurized direct-connection water supply method, supplying clean Arisu to faucets to improve the drinking rate

- Existing apartments **converting to direct-connection water supply method**
  - For : 1,325 complexes(39% of 3,359 apartment complexes that have 6 floors or more)
  - Results : 310 complexes completed from 2014 to 1st half of 2017

- **Assigned conditions for direct-connection water supply after agreeing on water supply** of new apartments **with construction permission(122 complexes completed)**



03 Arisu Quality Checking System

Office Of Waterworks Seoul Metropolitan Government

Water quality testing service provided for water faucets in every household

Testing items	Residual chlorine, Turbidity, pH, iron, copper
Objective	300,000 households each year
Methods	Immediate inspection at faucet

When inadequate, an additional seven items are thoroughly checked and an improvement plan is formulated

Testing items	Typical germs, Total E. coli groups, E. coli, Ammoniacal nitrogen, Chlorine ion, Zinc, Manganese

Diagnosis of general condition of in-house water pipes and tank performed free of charge

04 Installing Arisu drinking fountain

Office Of Waterworks Seoul Metropolitan Government

Creating an environment where drinking water can be enjoyed by Installing Arisu drinking fountain at places where there are many citizens, Such as schools, kindergartens

Policy Information

- Elementary School and Middle School 1,353(1,287School 20,285units completed)
- Installing Arisu drinking fountain in Park, Circumference, National and Public kindergarten

Expense

- 86.6 billion KRW

Maintenance

- Outsourcing

Elementary School

Kindergarten

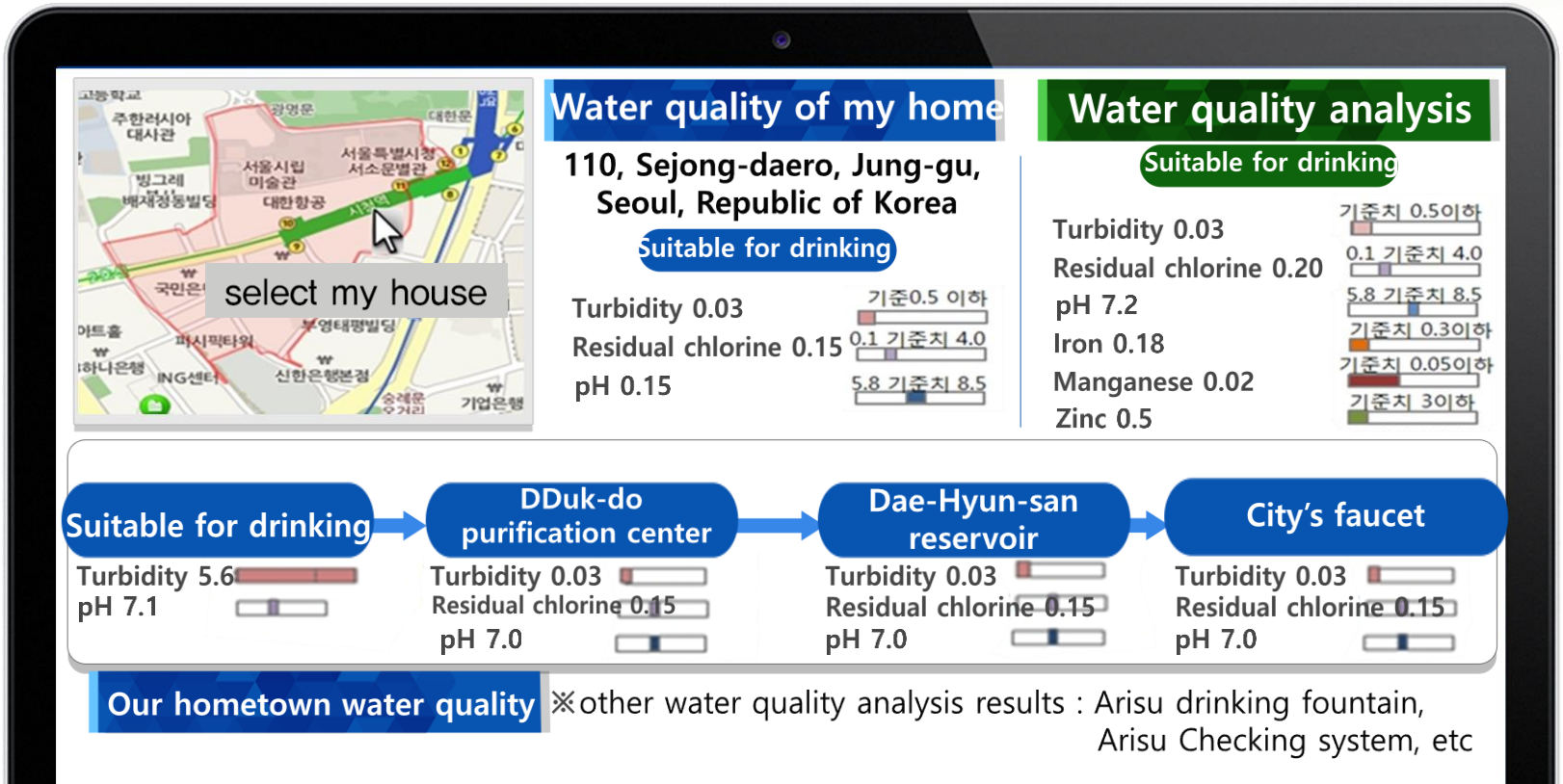
05 Confirmation service of our home supply path

Office Of Waterworks Seoul Metropolitan Government

Information of home water quality, Secure tap water through real-time confirmation

Policy Information

- Tight monitoring system by Installing an automatic water quality meter
- Disclosure of tap water quality('18.December) : If you enter an address on the web, you can check water quality along the supply
- Expense : '18, 732 million KRW



※other water quality analysis results : Arisu drinking fountain, Arisu Checking system, etc

[Thank you]

Office of Waterworks
Seoul Metropolitan Government

Healthy and tasty
Globally expanding
Arisu