

GLOBAL BEST TAP WATER


Arisu

Office of Waterworks Seoul Metropolitan Government





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- 
- A tall, clear glass filled with blue water, sitting on a reflective surface. Inside the glass, a vibrant green island with a city skyline, including a prominent skyscraper, is visible. Bubbles are rising from the bottom of the glass. The background features a blue sky with white clouds and a body of water with ripples at the bottom.
- I General Status
  - II Strict and Meticulous Water Quality Management
  - III Supply Water without Interruption
  - IV Sustainable Management and Overseas Business
  - V Efforts to Improve Citizen Service and Awareness



I General Status

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## Organization

Personnel  
(1,874 people)

- 1 headquarters(5 bureaus, 1 division), 8 water supply offices, 7 centers(6 water purification centers, 1 waterworks equipment management center), 1 research institute
- Headquarters(223), water supply offices(1,084), water purification centers(441), Waterworks Research Institute(93), waterworks equipment management center(33)

Office  
of Waterworks  
Seoul  
Metropolitan  
Government

## Headquarters

## Offices

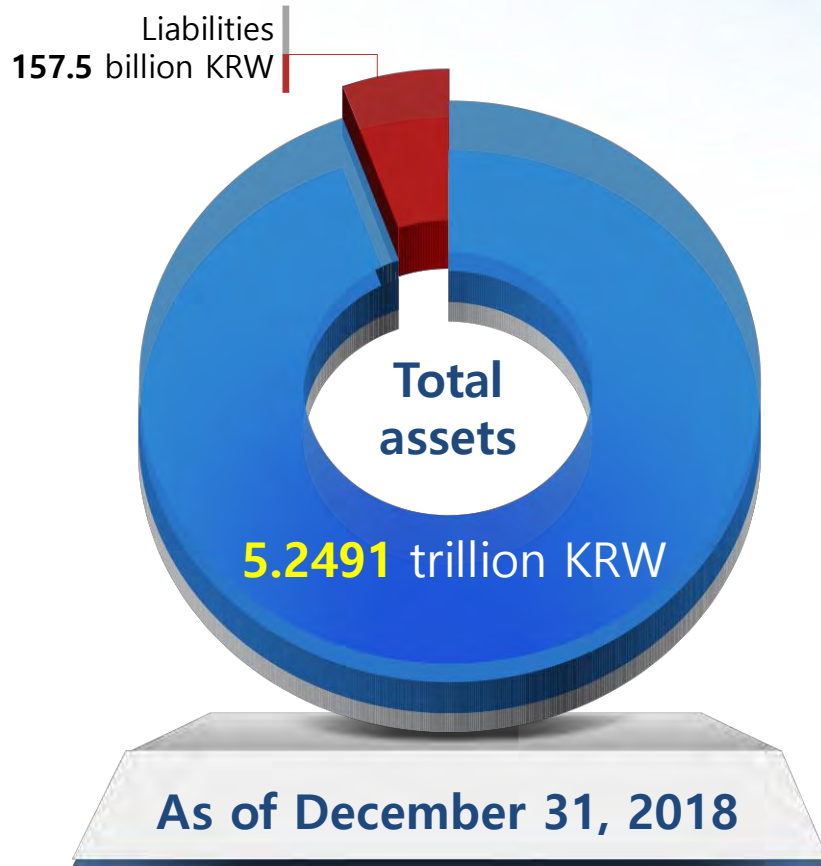
Waterworks  
Research  
InstituteManagement &  
Administration Bureau(6 departments)Revenue Management Bureau  
(4 departments)Production Bureau  
(4 departments)Water Supply Bureau  
(4 departments)Water Facility Safety Bureau  
(4 departments)Safety Management Division  
(1 division)

Water supply office(8)

Arisu water purification center(6)

Waterworks equipment  
management centerWater Quality Analysis Bureau  
(5 departments)Waterworks Research Bureau  
(4 departments)Future Strategy Research Center  
(2 departments)





# Production and Water Supply Facilities

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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:  
3,200,000 tons/day



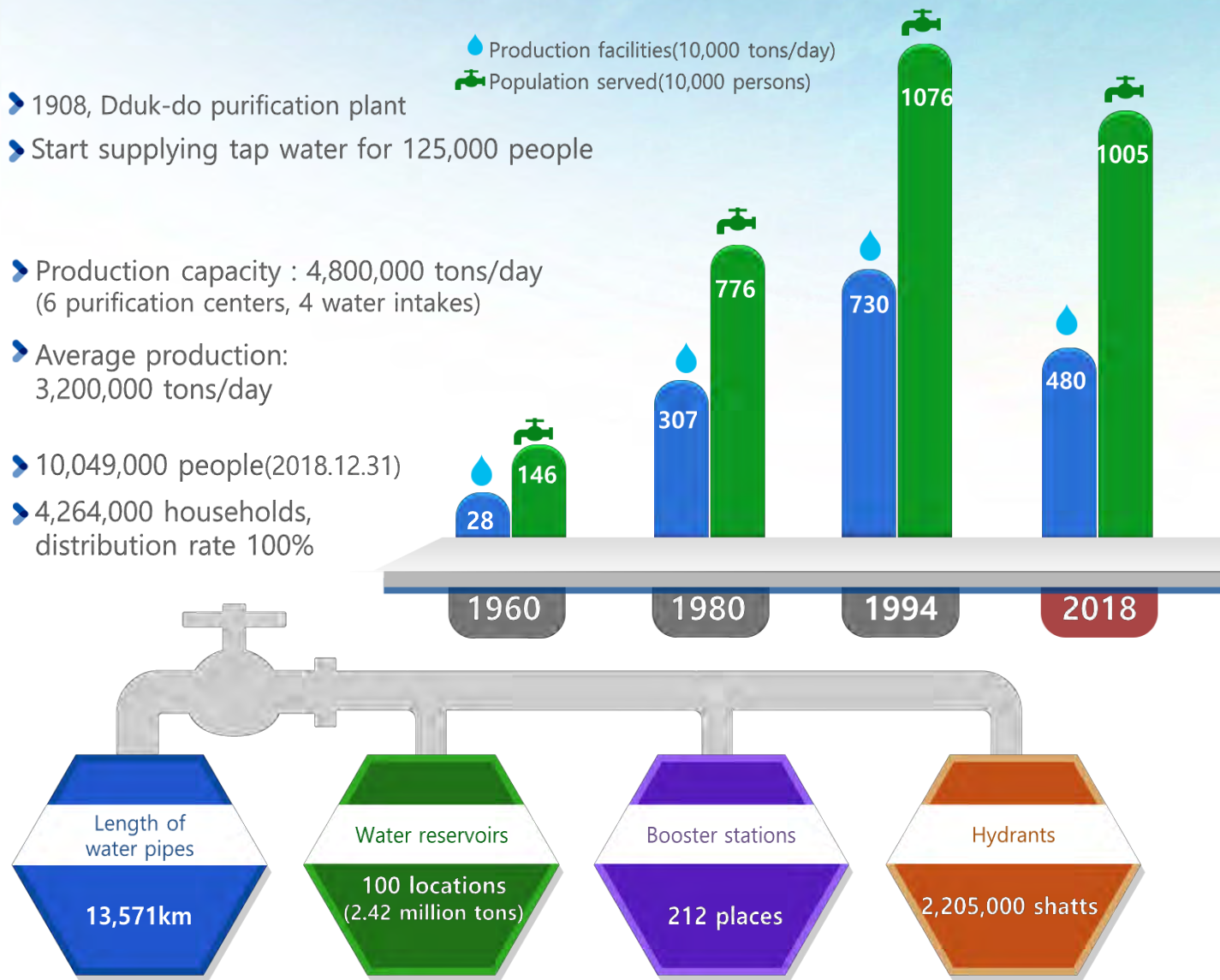
Population  
served

- 10,049,000 people(2018.12.31)
- 4,264,000 households,  
distribution rate 100%



Water supply  
facilities

Production facilities(10,000 tons/day)  
Population served(10,000 persons)







## Seoul's tap water Arisu that **citizens trust and drink**







I General Status

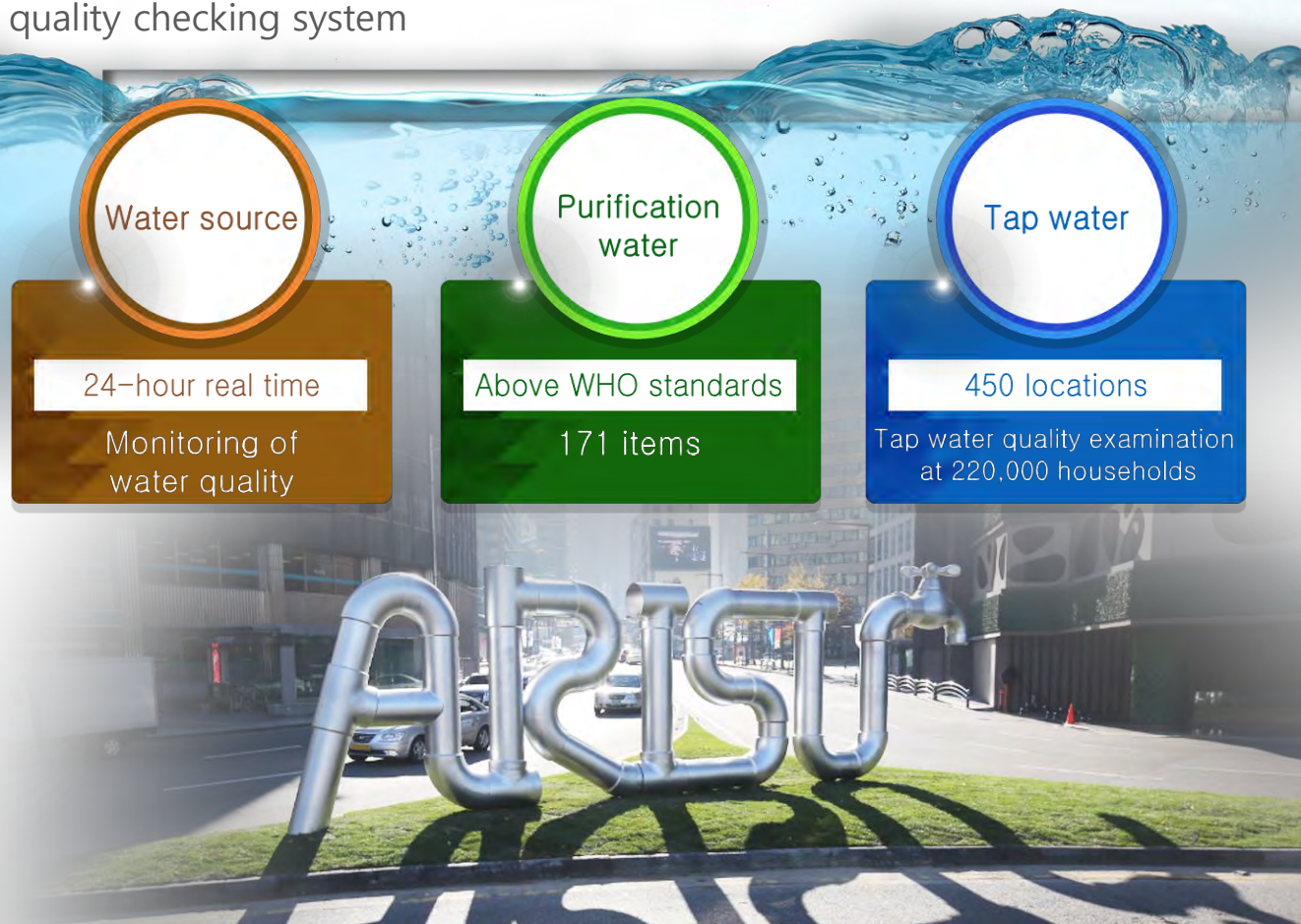
II Strict and Meticulous Water Quality Management

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- 33 branch water quality inspection, Automatic monitoring of source water quality, Biological warning system
- 60 water quality standards + 111 self-monitoring standards, Total 171 items water quality inspection
- Water quality inspection on faucets at 450 different location through Arisu quality checking system





# 24-Hour monitoring of water source

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Use the surface water of the Han River as source water

Installation of automated water quality measuring equipment at water intake plants to detect the presence of algae and phenols 24 hours a day

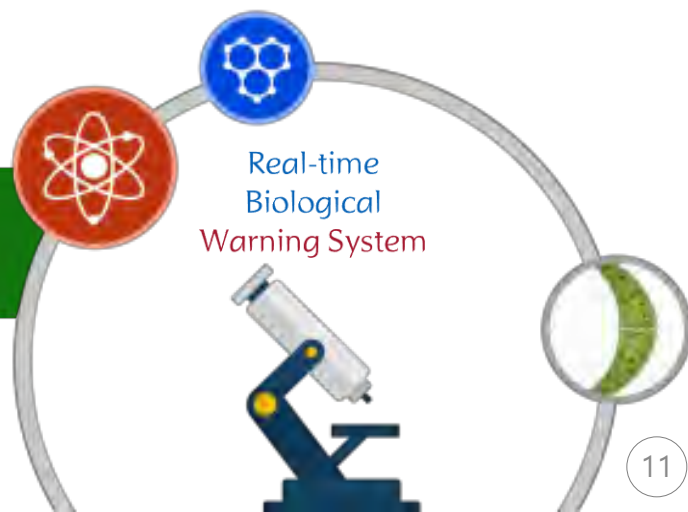
Reinforcement of monitoring of new microbial elements and secure safe source water

Operation of Biological-Warning System using the Food Chain Index

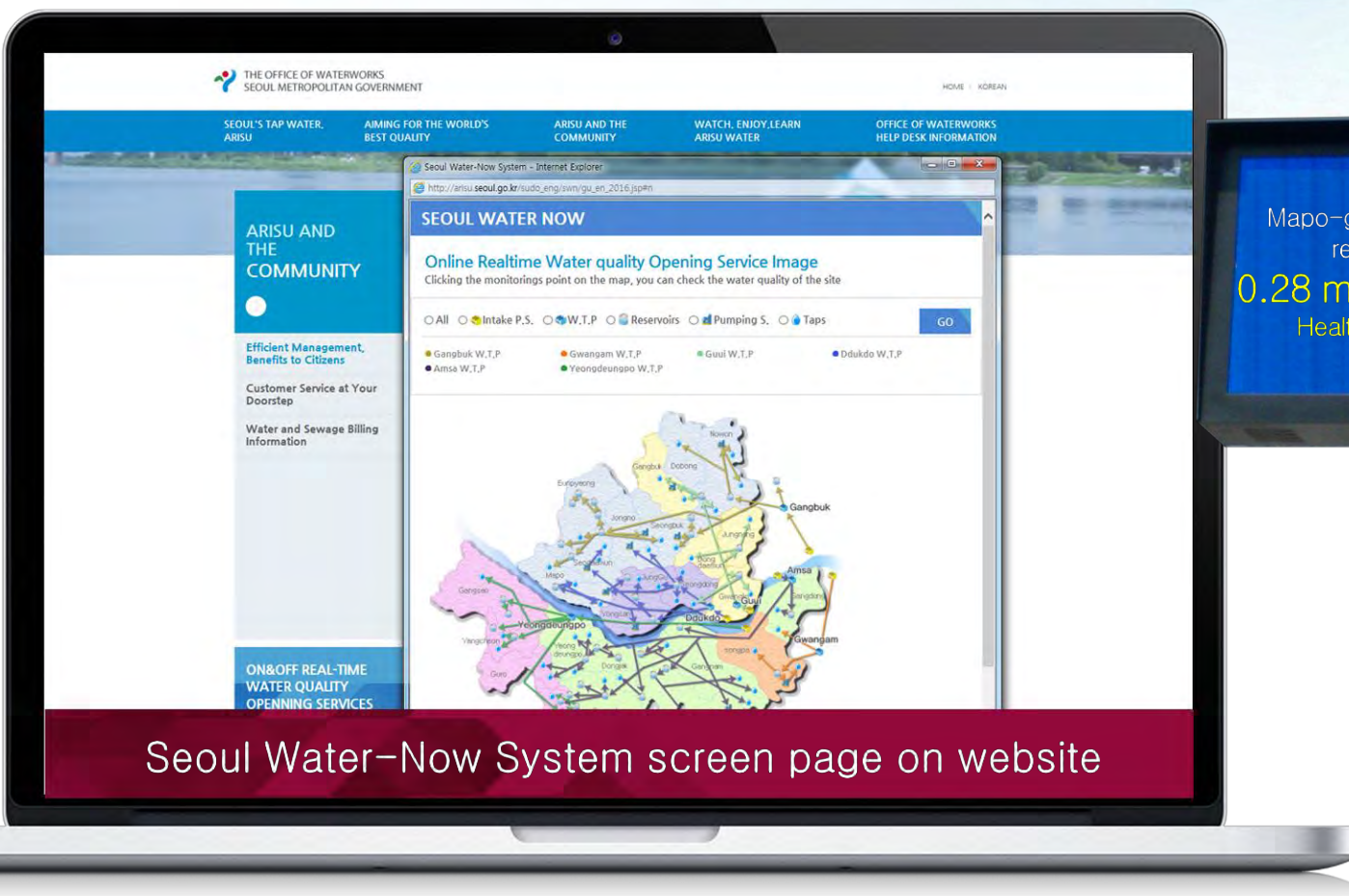
Microorganisms, algae, fish



Real-time inspection of influx of toxic materials



- Publication real-time water quality from Source water to faucet **208 spots**
- Water quality information available on Seoul City atmospheric environment electronic bulletin board **12 locations**



Seoul Water-Now System screen page on website



# Advanced Water Purification System

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## Process

- Ozone and Granular Activated Carbon particle treatments added to process

➔ Production of healthy and tasty tap water

## Installation and Operator

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



Water intake



Coagulation/  
Sedimentation



Filtering



Advanced  
water purification



Active carbon on  
adhesion



Ozone oxidation



Faucet

## Effect Advanced water treatment



### 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 material

- Total of 12 Management Items Artificial radioactive elements(5), natural radioactive element(6), radiation(1)
- Provision of radioactive element removal plan during water purification & creation of response manual

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





Residual chlorine equalization across the entire area

the amount of residual chlorine in water at the faucet



Past

Now

Chlorine injection limited to center

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

Decentralized injections in water purification center and reservoir

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

### Construction of Chlorine Disperse Injection System

- 15 reservoirs (Nakseongdae, Daebang and others)



# Maintaining ISO22000 International Certification

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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)

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

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

Strengthening hygiene management for all visitors

**Effective management of  
harmful elements in  
production and  
manufacturing process**





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

Business scope • 13,571km(13,396km repaired, 98.7% completed)

Business period • 1984~present

Total business expenses • 3,512.3 billion KRW(invested cost from 1984 to 2018: 3,338.4 billion KRW)

Galvanized  
steel pipes

Stainless  
steel pipes

Built before 1983  
Rust often generates

Replacement of corrosion  
resistance pipes

Gray cast  
iron pipes

Ductile cast  
iron pipes



**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 m<sup>3</sup>  
(40,000 m<sup>3</sup> of new construction(7), 26,000 m<sup>3</sup> of expansion(4))

Reservoirs status

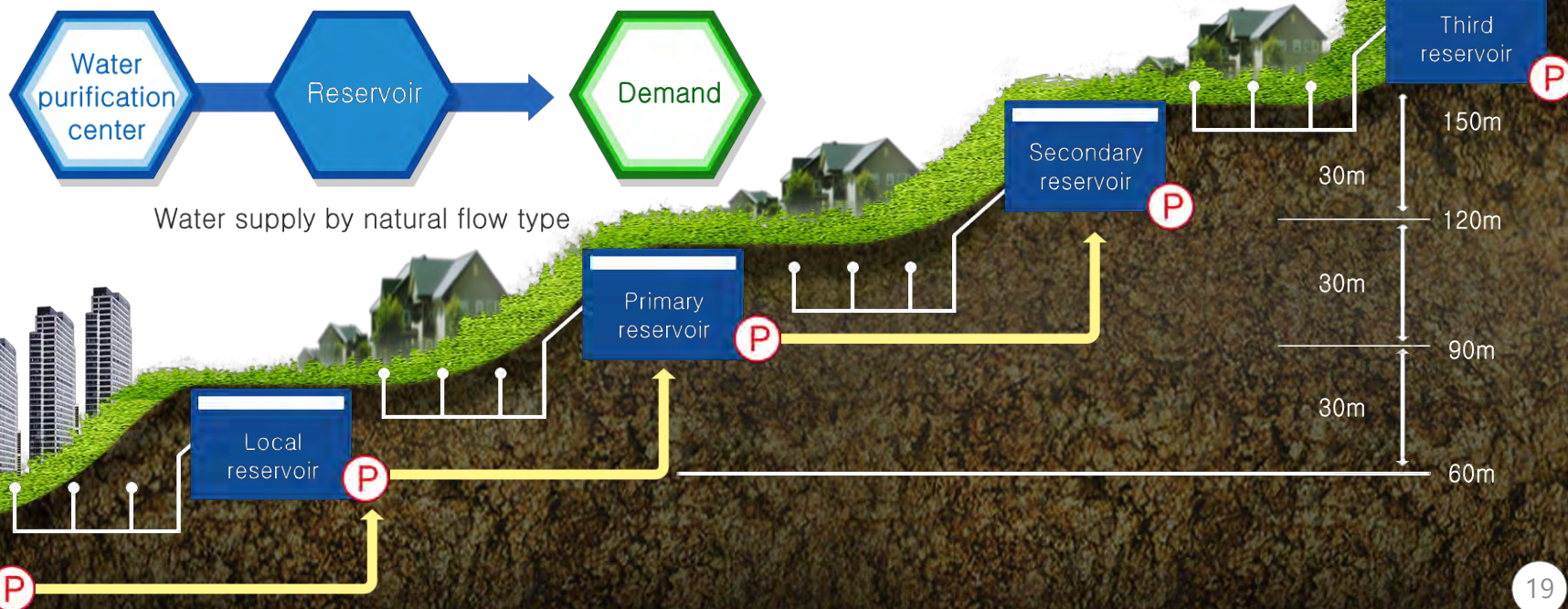
- total 100 locations, 2.42million tons, 2018.12.31

Business period

- 2015 – 2030

Total business expenses

- 108.2 billion KRW



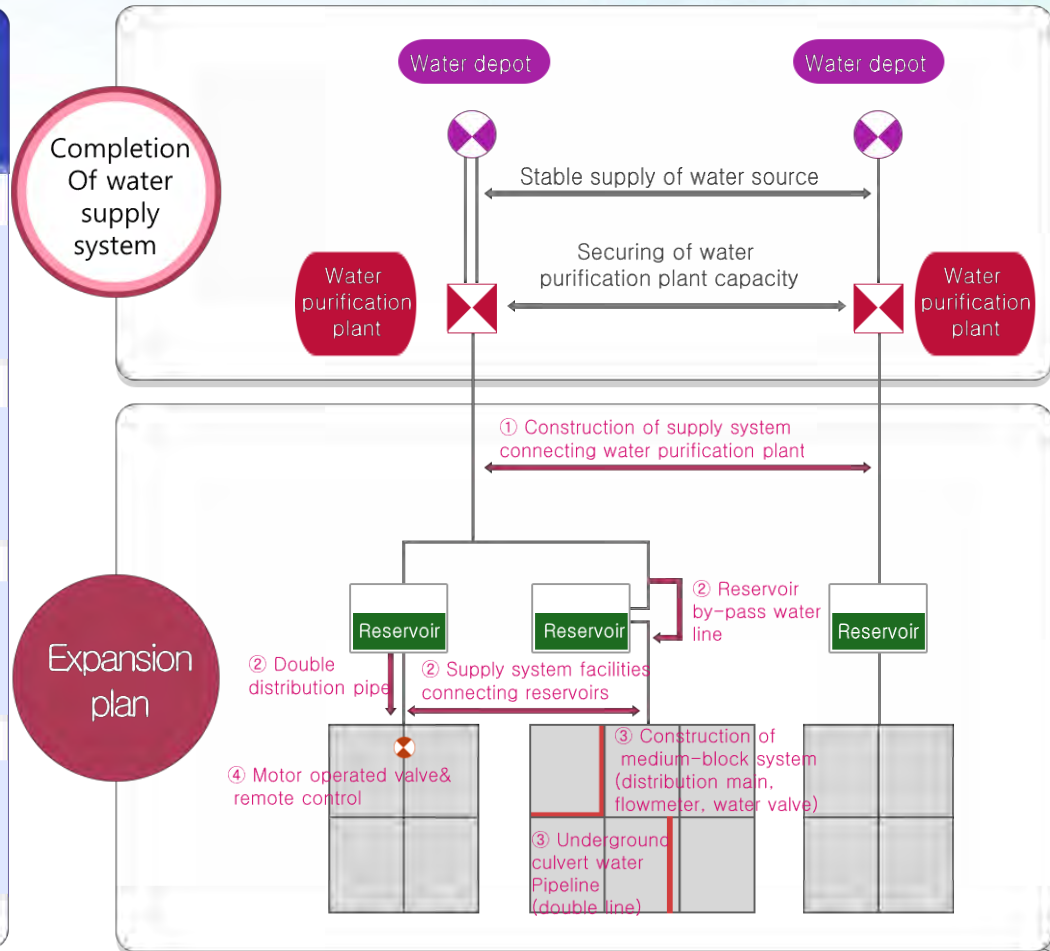
# 03 Build an uninterrupted water supply system

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## 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





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

### Project objective

- Establish Construction of water pipeline (9,647km / more than 80mm diameter)

### Progress report

- Completed 72.6% (7,003km) as of December 2018

### Project period

- 2005 – 2022(Cost: 87.8 billion KRW)

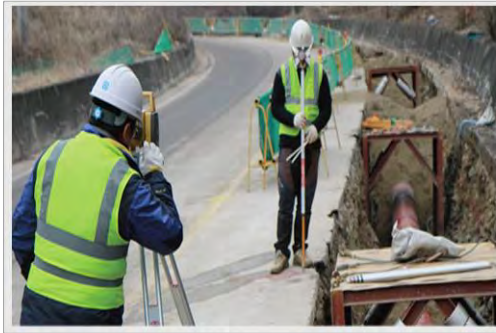
### Project detail

- 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

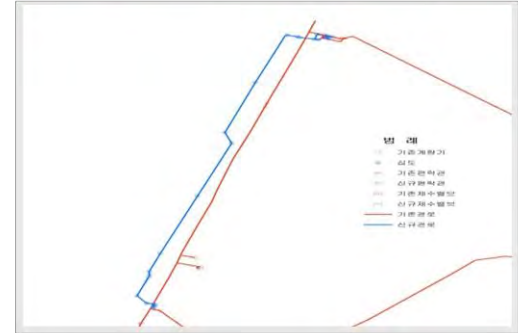
### Tap water facilities research and inspection



### Precise(Coordinate) measurement



### Modification/editing of database





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## Replacement of old facilities

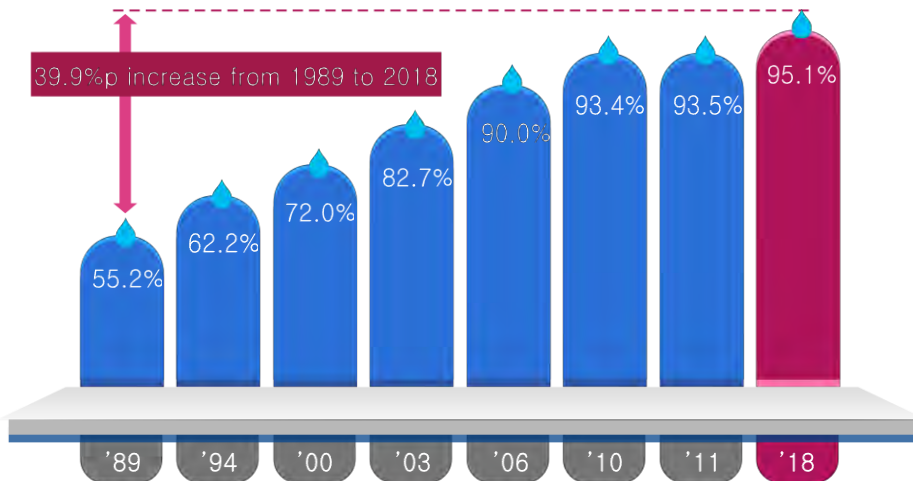
- Systematic management of waterworks facilities  
Removal of disused pipes, Preemptive leak detection

Revenue  
water rate  
**95.1%**  
(2018)

Scientific management  
of water supply quantity

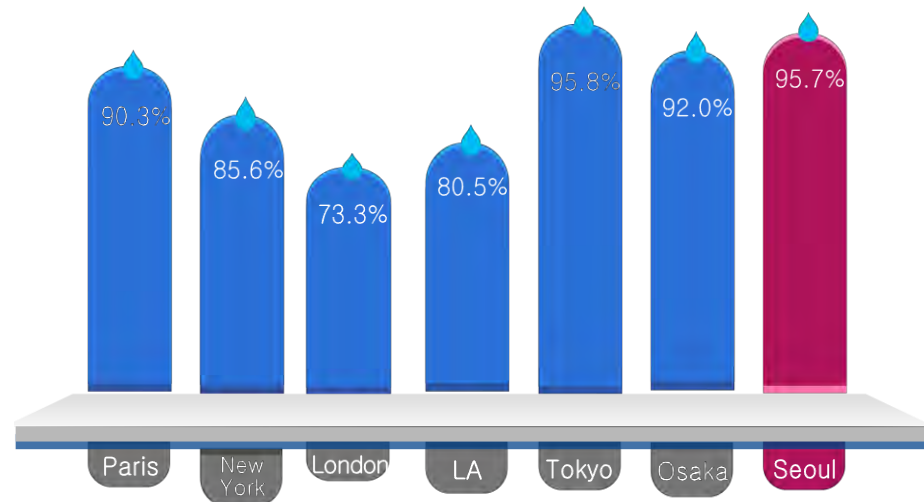
- Water intake and flow meter management,  
booster area management, flow management  
block by block

### Producing savings 500 million tons per year



Trend in revenue water rate changes

### World's Second highest revenue water rate



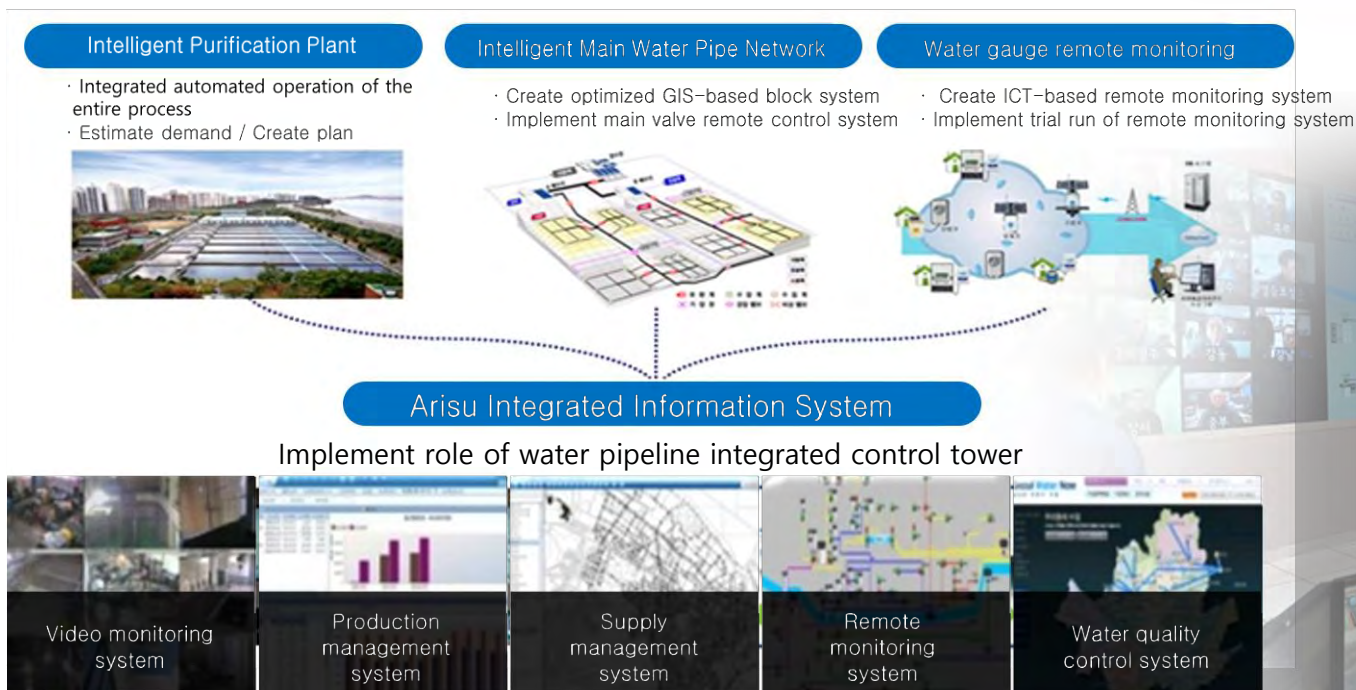
Comparison to major cities in developed countries(2017)

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 with state-of-the-art IT technology in order to enhance management efficiency of water resources, supply and drainage





## Production of renewable energy

Solar  
power

Geothermal

Small  
hydro

- Produced 18,448 mwh/year,  
reduced manufacturing cost of 640 million  
KRW (2018)



## 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

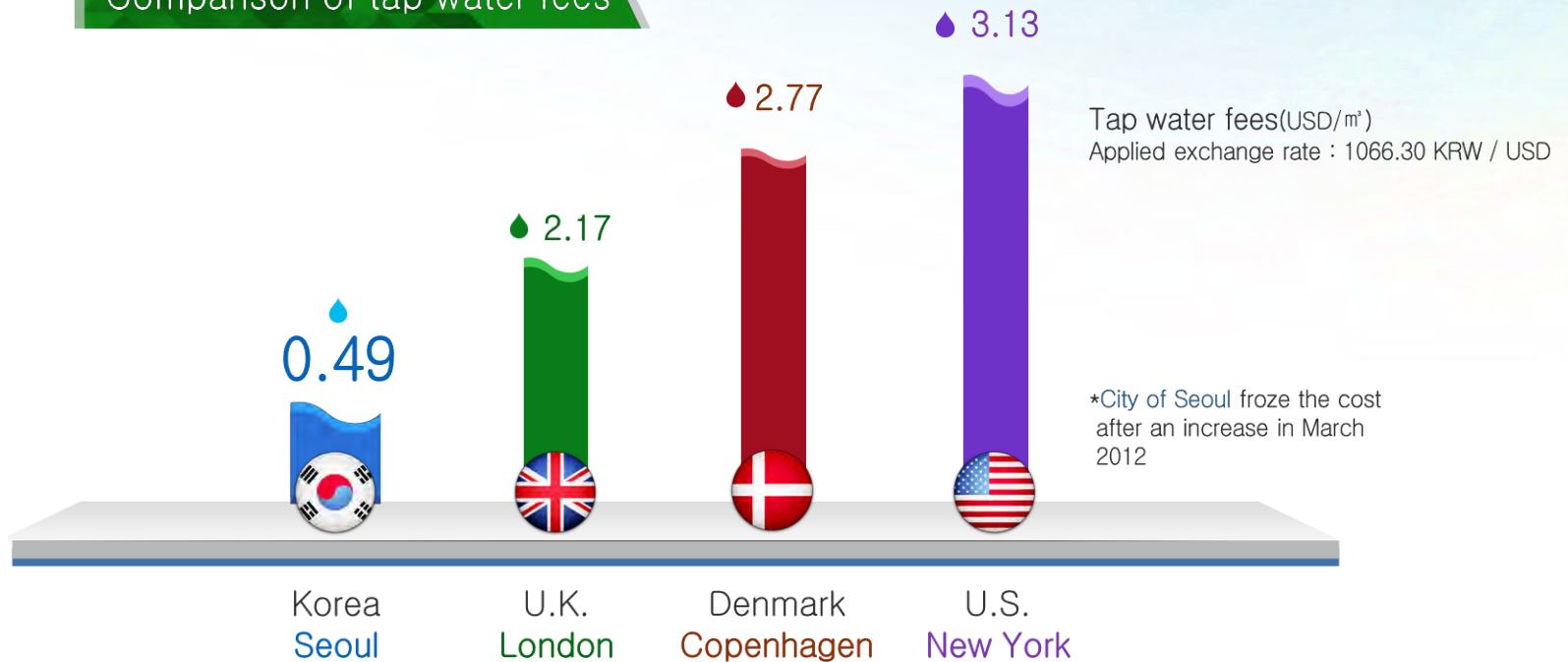


Small hydro



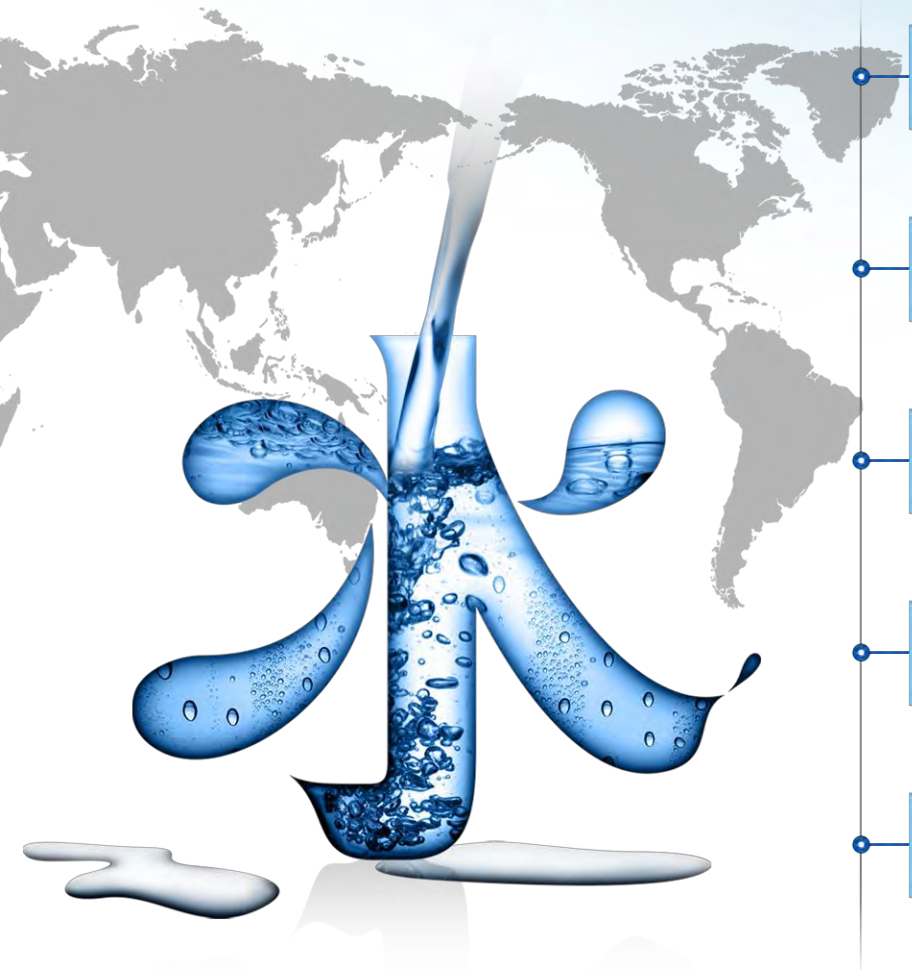
## Minimizing fees through sensible management

### 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)





## 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 target capital cities(2~3 times per year)

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

## Operate private-government council for overseas advancement of waterworks

- ▶ Operation of subcommittee for consulting, design, construction, water quality, and equipment

## 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.)





# Supporting policy for the International Waterworks Project

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## 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  
**223 people from 34 countries participated in 18 events held from 2012 to 2018**





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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

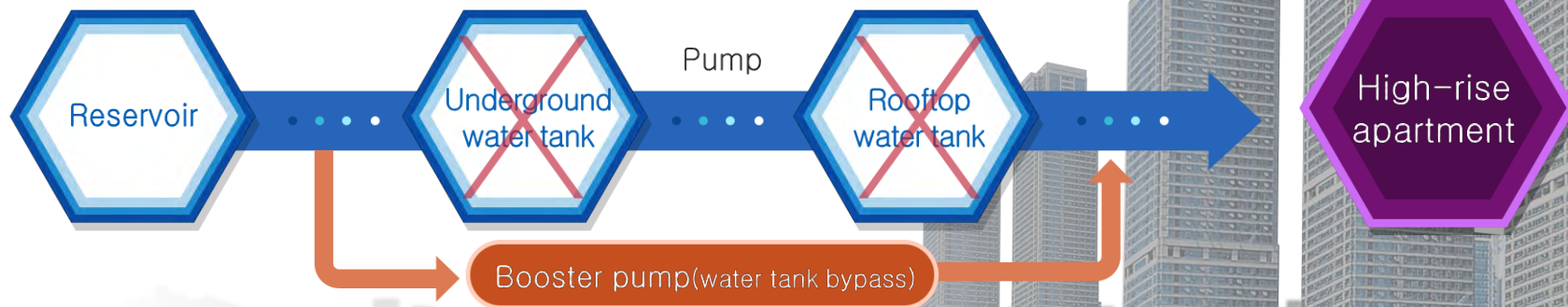
- 389,000 households, 147 billion KRW(69%)  
(Supporting up to 80% of the cost within the upper limit for each housing type)



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

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 : 443 complexes completed from 2014 to 2018
- Assigned conditions for direct-connection water supply after agreeing on water supply of new apartments with construction permission(178 complexes completed)





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 (220,000 households from 2019)
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 pipe and tank performed free of charge



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(1,290School 20,400units completed)
- Installing Arisu drinking fountain in Park, Circumference, National and Public kindergarten

Expense • 86.6 billion KRW

Maintenance • Outsourcing



Elementary School



Kindergarten





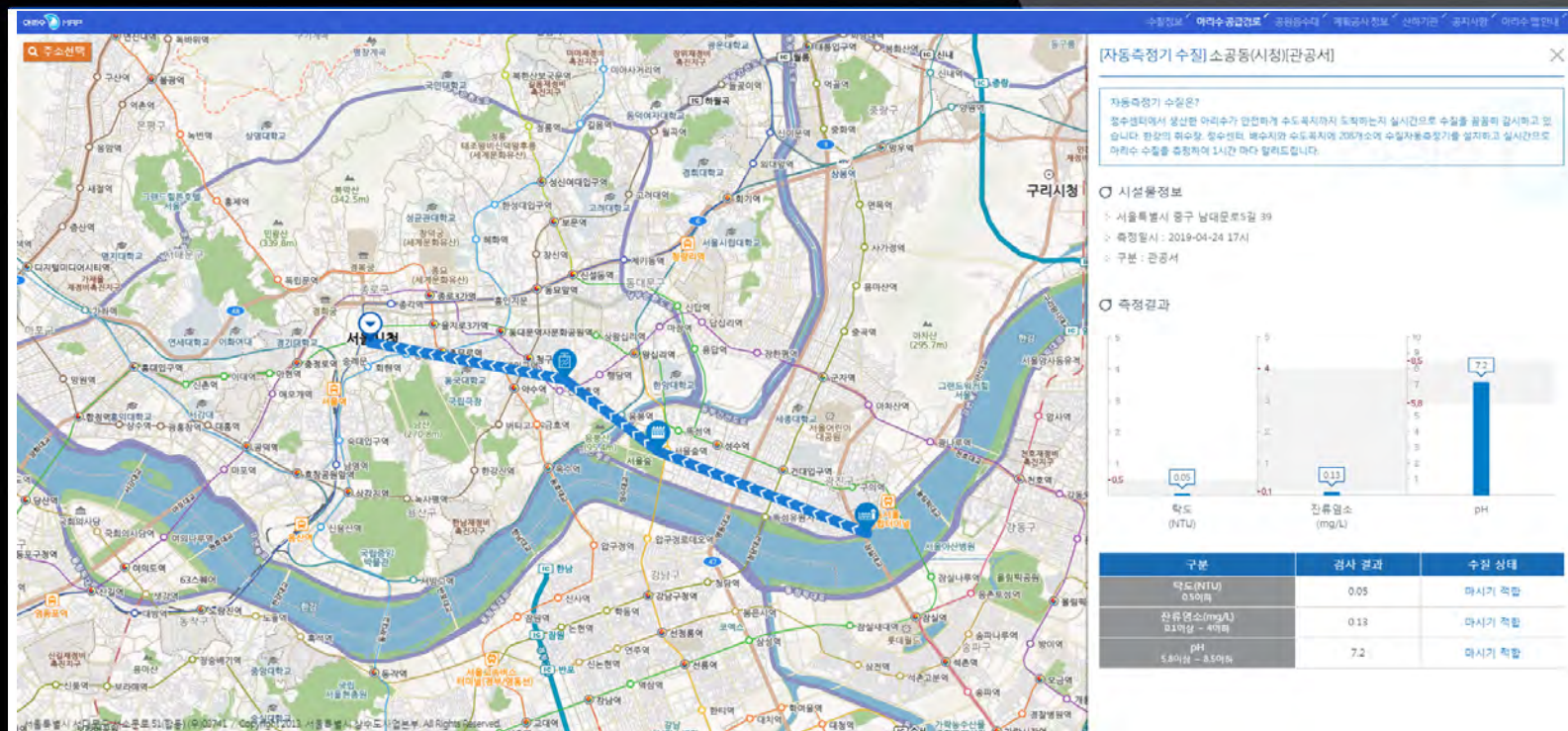
# Confirmation service of our home supply path

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

### Policy Information

- Tight monitoring system by Installing an automatic water quality meter
- Map-based verification of household Arisu supply route & water quality per route



# [Thank you]

Office of Waterworks  
Seoul Metropolitan Government

Healthy and tasty

Globally expanding

# Arisu

