CONTENTS

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
General Status

Strict and Meticulous Water Quality Management

Supply Water without Interruption

Sustainable Management and Overseas Business

Efforts to Improve Citizen Service and Awareness
Organizations and Personnel
Office Of Waterworks Seoul Metropolitan Government

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

**Personnel**
- (1,874 people)
- Headquarters (223), water supply offices (1,084), water purification centers (441), Waterworks Research Institute (93), waterworks equipment management center (33)

**Headquarters**
- Management & 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)

**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)
As of December 31, 2018

Liabilities
157.5 billion KRW

Total assets
5.2491 trillion KRW

Budget
Revenue
835 billion KRW

Government subsidies 0 KRW

2019 revenues and expenditures
Production and Water Supply Facilities
Office Of Waterworks Seoul Metropolitan Government

- 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
  - Length of water pipes: 13,571km
  - Water reservoirs: 100 locations (2.42 million tons)
  - Booster stations: 212 places
  - Hydrants: 2,205,000 shatts
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

Production of clean, mineral-rich Arisu

- Preemptive water quality management from a water source to a faucet
- Optimal management of faucet disinfection condition
- Maintaining the ISO22000

Supply Water Without interruption

- 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

Strengthening Capacity for Sustainable growth

- 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

Improve Social and Psychological Awareness Of Arisu

- 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

Improve Citizen Service

- Arisu quality checking system
- Provide information of home water quality and supply path
- Water rate notification service
I. General Status
II. Strict and Meticulous Water Quality Management
III. Supply Water without Interruption
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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 + 111 self-monitoring standards, Total 171 items water quality inspection
- Water quality inspection on faucets at 450 different locations through Arisu quality checking system
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 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
Seoul Water-Now System
Office Of Waterworks Seoul Metropolitan Government

- 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

Mapo-gu Arisu water quality residual chlorine 0.28 mg/L (criteria 0.1–4.0) Healthy and tasty Arisu
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 water

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

Past
Chlorine injection limited to center
- Local chlorine odor complaints
- Long-distance residual chlorine targets not met

Now
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

Office Of Waterworks Seoul Metropolitan Government

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)

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

Effective management of harmful elements in production and manufacturing process

Strengthening hygiene management for all visitors
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)

Built before 1983
Rust often generates

Replacement of corrosion resistance pipes

Galvanized steel pipes
Gray cast iron pipes
Stainless steel 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 m³ (40,000 m³ of new construction, 26,000 m³ of expansion)
- Reservoir status: total 100 locations, 2.42 million tons, 2018.12.31
- Business period: 2015 – 2030
- Total business expenses: 108.2 billion KRW

Water supply by natural flow type
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**
Ⅰ General Status
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World’s best revenue water rate management

Office Of Waterworks Seoul Metropolitan Government

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

39.9% increase from 1989 to 2018

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.

**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.
Environmental Friendly Energy, Recycling Facilities

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

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

- Korea Seoul: 0.49
- U.K. London: 2.17
- Denmark Copenhagen: 2.77
- U.S. New York: 3.13

Tap water fees (USD/m³)
Applied exchange rate: 1066.30 KRW / USD

City of Seoul froze the cost after an increase in March 2012

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

- **Completed water facility improvement project for regions in Vietnam**
  - Huế, 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
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.)
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
  - 223 people from 34 countries participated in 18 events held from 2012 to 2018
General Status

Strict and Meticulous Water Quality Management

Supply Water without Interruption

Sustainable Management and Overseas Business

Efforts to Improve Citizen Service and Awareness
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)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Social welfare facilities and beneficiary of basic livelihood security aid</th>
<th>Single house</th>
<th>Multi-household house</th>
<th>Apartment houses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement construction</td>
<td>Entire construction cost</td>
<td>1,500,000 KRW max</td>
<td>2,500,000 KRW max</td>
<td>1,200,000 KRW max</td>
</tr>
<tr>
<td>: within 80% Restoration construction : within 80%</td>
<td></td>
<td></td>
<td></td>
<td>(400,000 KRW common water pipes)</td>
</tr>
</tbody>
</table>
Pursuit of direct-connection water supply system for high-rise apartments
Office Of Waterworks Seoul Metropolitan Government

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)
Arisu Quality Checking System
Office Of Waterworks Seoul Metropolitan Government

Water quality testing service provided for water faucets in every household

<table>
<thead>
<tr>
<th>Testing items</th>
<th>Residual chlorine, Turbidity, pH, iron, copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>300,000 households each year (220,000 households from 2019)</td>
</tr>
<tr>
<td>Methods</td>
<td>Immediate inspection at faucet</td>
</tr>
</tbody>
</table>

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 (1,290 schools, 20,400 units 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
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
- 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