

Urban Environment of Seoul

Written by: Ki-Yeong Yu, Researcher, the Seoul Institute
Description of General Polity: Environment

Background of Establishment of Environmental Policy

Overview of the Environmental Policy

The space where human life, animals and plants are living consists of atmosphere, water and soil. Environmental policy refers to the comprehensive measures including all laws, systems, organizations, financial resources and governance to control the discharge of pollutants, to purify the polluted parts and to monitor the status in order to prevent the media from being contaminated.

The environmental policy areas of Seoul can be classified into Environmental Pollution Control, Water Supply, Sewage System, Waste Management and Parks & Landscape. You can find the start point of environmental policies by area by taking a look at the changes of administrative organizations of Seoul and environment-related laws and regulations.

Water supply projects began in the Japanese colonial era and the relevant organization existed in 1945 when Korea was liberated from colonial rule. The waste management system was set up in 1950, when the Korean War was started, to take care of the sanitary issues. The administrative organization for sewage system management was established in 1961, and the operation of public sewage treatment facilities got started in 1976. The civil construction department of Seoul City began the works for parks & landscape in 1963, and an exclusive organization was made in 1973. The management organization for atmosphere pollution, water pollution and emission source control was established in 1968, the last among the 5 environmental policy areas.

According to the thorough amendment and enactment of the related laws and regulations in the early 1990s, the environmental policy area came to have the current classifications of water quality, atmosphere, waste materials, soil, underground water, noise & vibration, toxic substance management, parks & landscape, water supply, sewage system, etc. In the 2000s, the area was subdivided further into energy, response to climate change, bad smell, asbestos, etc.

<Table 1> Changes in Seoul Environmental Management Policy Areas

Classification	Sectors of the Environmental Management Policy
The 2000s and the present	Water Supply, Waste Management, Sewage System, Parks & Landscape, Atmosphere, Water Quality, Soil, Underground Water, Noise & Vibration, Harmful Chemical Substance, Environmental Dispute Conciliation, Environmental Effects Evaluation, Bad Smell, Asbestos, Energy, Response to Climate Change
The 1990s	Water Supply, Waste Management, Sewage System, Parks & Landscape, Atmosphere, Water Quality, Soil, Underground Water, Noise & Vibration, Harmful Chemical Substance, Environmental Dispute Conciliation, Environmental Effects Evaluation
The 1980s	Water Supply, Waste Management, Sewage System, Parks & Landscape, Atmosphere, Water Quality
The 1970s	Water Supply, Waste Management, Sewage System, Parks & Landscape, Atmosphere, Water Quality
The 1960s	Water Supply, Waste Management, Sewage System, Parks & Landscape, Atmosphere, Water Quality
The 1950s	Water Supply, Waste Management
The 1940s	Water Supply

Environmental Management Policies and Their Background

When Korea was liberated from Japanese colonial rule in 1945, there was no Korean government and Korea was in serious financial difficulties. In spite of this poor situation, drinking water was supplied to the people continuously through the water supply plant constructed during the colonial era. In the situation of the outbreak of the Korean War in 1950, the waste management as a public cleaning project began in order to restore the destroyed city and to improve sanitary conditions.

Korea in the early 1960s was in a politically chaotic situation due to the fraudulent presidential election on March 5th in 1960, the April revolution on April 19th in 1960, and other political issues. The chaotic state was finished with the military coup on May 16th in 1961. The 5-year economic plan of the government started in 1962 to overcome deep-rooted poverty. The light industry led the growth of the Korean economy in the 1960s and the steel and heavy chemical industries did the same in the 1970s. The Gyeongbu (Seoul to Busan) express way which was completed in 1970 took the lead in development of the distribution industry in Korea. The rural population flocked to the cities in order to find better jobs. The construction of new urban districts in Yeouido and Yeongdong in the late 1960s took place to solve the problem of housing shortage, signaling the start of urbanization of Seoul. However, there emerged a dark shadow of environmental pollution from behind such industrial development and urbanization. That was the reason why the sewage system projects and pollutant discharge management to control atmosphere and water quality were started in the 1960s.

With the rapid development of scientific technologies in the 1970s, the mass production of cars and consumer electronics began and plastic started to replace the heavy, weak and corruptible materials such as paper, wood, glass, metal, etc. Oil consumption rapidly increased as petroleum was used as materials in cars and other products. But the first oil crisis in 1973 and the second one in 1978 served as important events to increase momentum to think about energy efficiency and alternative energies. In the 1980s, Korea introduced district heating system for the efficient use of energy. The development of the plastic industry not only contributed to the improvement of living convenience and the cost reduction of product manufacturing, but also mass-produced wastes as a side effect. At that time, Nanjido turned into a mountain 100m in height after just 15 years since that place was used as a waste landfill. As the garbage quality got worse, the wastes, which used to be used as fill materials for the land development areas in the 1970s, were degraded into troublesome garbage.

The endeavor for economic growth that started in the 1960s came to fruition in the 1980s and 1990s. Cars, color TV, refrigerators, washing machines, air conditioners, etc. became necessities for each home. While hosting the 1986 Asian Games and the 1988 Seoul Olympics, the global positioning of Korea had risen and the people developed higher self-esteem. As the interest in and expectation of life quality and the environment were increasing, the environmental management area was further subdivided into atmosphere, water quality, waste, parks & landscape, ecology, drinking water, underground water, soil, noise & vibration and harmful chemical substances.

On the other hand, high expectations regarding life quality and the environment became factors to oppose the construction of various social welfare facilities as well as sewage treatment facilities, waste landfills, waste incinerators, nuclear waste treatment facilities, nuclear power plants, power-transmission towers, etc., making it difficult to secure social infrastructures. The IMF financial crisis in 1997 forced the country into economic depression and really hurt the people's pride. With the hope for the new millennium in 2000 and successful hosting of the World Cup games in 2001, the Korean economy was revitalized and the environmental management was able to maintain the stance of the 1990s.

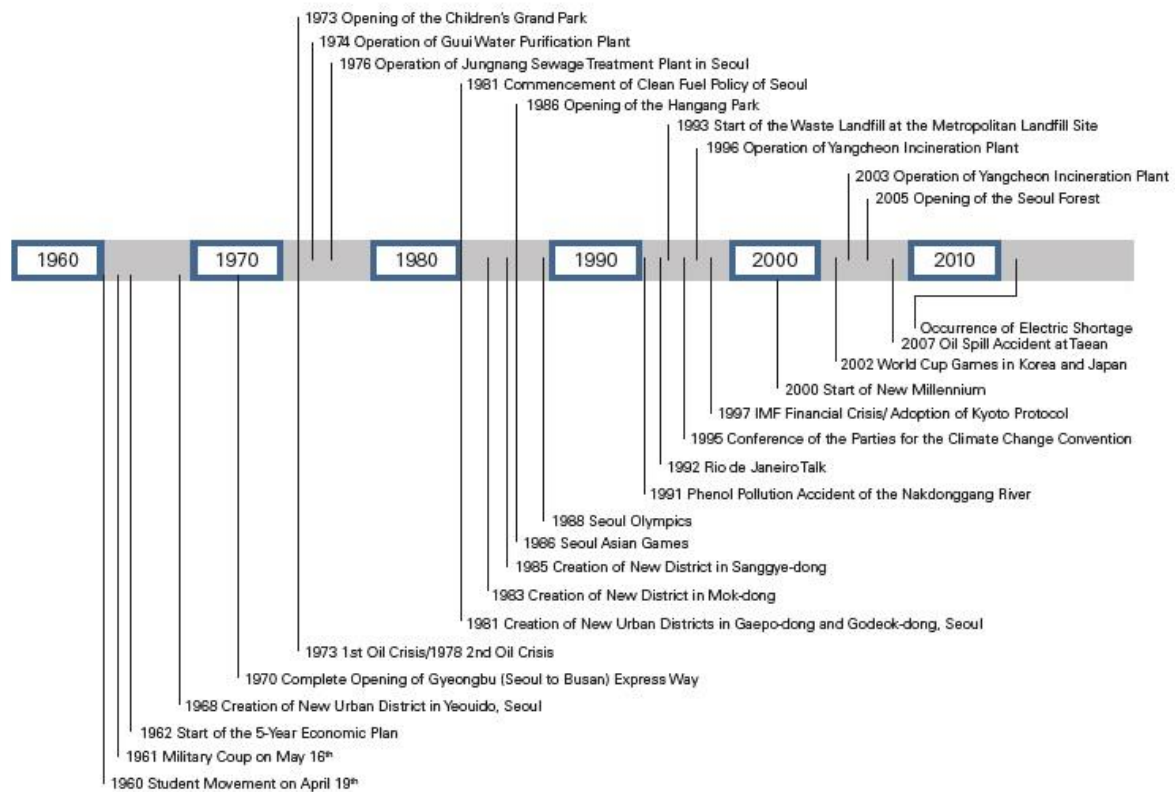
One of the key features of environmental management in the 2000s was the addition of energy and response to climate change to the existing environmental area. Since the 1990s, the earth has experienced abnormal climate phenomena such as frequent typhoons, heavy rain, heavy snow, heat waves, tropical nights, droughts, melting polar ice, etc. There was a variety of opinions about what was the main reason. Some insisted the environmental pollutants that human beings emitted caused global warming and others stated that those were natural phenomena of climate. But everyone agreed on the fact that the abnormal phenomena occurred frequently. To solve the problems, the related countries established a joint international response system through the Rio de Janeiro Talk¹ in 1992, the United Nations Climate Change Conference in 1995² and adoption of Kyoto Protocol in 1997³. Such

¹ It is the summit talk held in Rio de Janeiro, Brazil where 175 country summits participated in June 1992 to discuss the global environment and preservation issues. During the talk, the "Rio Declaration on Environment and Development" and the "Agenda 21" were adopted, 3 agreements of "Climate Change Convention", "Convention on Biological Diversity" and "Forest Protocol" were made as the concrete measures and "UN Commission on Sustainable Development" was established in UN in order to fulfill the agreements. State officials from 114 countries and over 7,900 private environmental groups participated in the talk.

² It was held to discuss concrete implementation methods including regulations on greenhouse gases, financial support, technology transfers,

activities are represented by energy, energy rationalization, alternative energy, response to climate change, green growth, etc. in the Korean environmental management and classified into the areas of energy and response to climate change in the environmental policy of Seoul.

<Figure 1> Main Environmental Management Projects of Seoul and the Social Background



consideration of the countries in special situations, etc. to prevent global warming by controlling the emission of greenhouse gases such as carbon dioxide, methane, CFC, etc. which had been contained in the Climate Change Convention adopted by the UNCED with the representatives from the countries at Rio de Janeiro in 1992. The first Conference of the Parties was held in Berlin, Germany in 1995 and the Berlin Mandate was adopted that declared the protocol on the greenhouse gas reduction targets after 2000 will be adopted in the third Conference of the Parties to be held in 1997.

³ The Kyoto Protocol that was adopted in the third Conference of the Parties for the Climate Change Convention in Kyoto, Japan in 1997 and became effective on February 16th, 2005 was the concrete implementation plan for the Climate Change Convention in order to regulate and prevent the global warming. Its formal name is the Kyoto Protocol to the United Nations Framework Convention on Climate Change. The emission of 6 kinds of greenhouse gases including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), fluorocarbon (PFC), hydrofluorocarbon (HFC) and fluorinated sulfur (SF₆) will be reduced. The non-tariff barriers would be applied for the countries that do not reduce the emission of such greenhouse gases. For the flexible implementation of greenhouse gas reduction of the countries directly involved in the Convention on Climate Change, emission trading, joint implementation and clean development mechanisms were introduced.

Development of Environmental Policy

Legal System

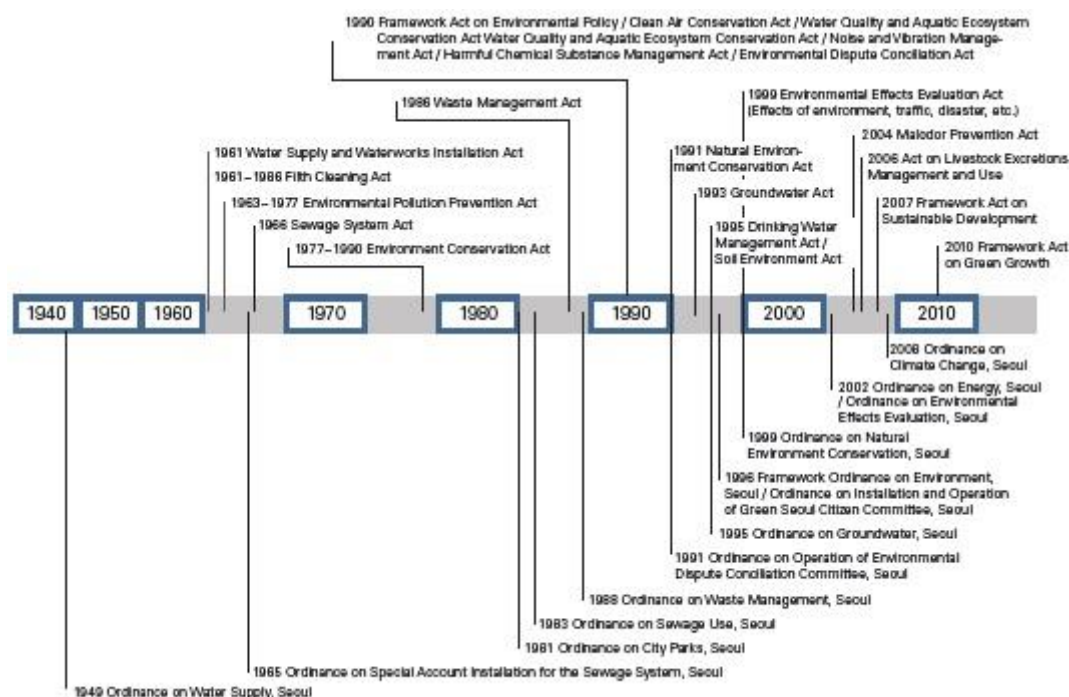
We can see the structure of administrative organizations of Seoul and the development process of environmental policy areas of Seoul through the national laws and ordinances of Seoul.

The first ordinance of Seoul in the environment area was the ordinance on water supply enacted in 1949. The first law of the Korean government in the environment area was the Water Supply and Waterworks Installation Act enforced in 1961, 12 years after the ordinance of Seoul. In the case of sewage system, Seoul enacted an ordinance on special account installation for the sewage system in 1965, one year ahead of the governmental law. Since then, however, the central government enacts laws and regulations and Seoul establishes the ordinances to determine detailed things necessary for such enactment. When Korea was liberated from Japanese colonial rule in 1945 and went through the Korean War beginning in 1950, the national system had not yet set up. Therefore, cities took the initiatives in implementing the projects necessary for basic living necessities of citizens including drinking water supply, public cleaning and sewage system. Since the 1960s when the national system was structured, the central government has led the selection of issues and agendas in the environment area and established relevant systems.

We can see the development process of environmental policy by area through the revision history of relevant laws and regulations. The first environmental policy of Seoul was on the water supply (the Water Supply and Waterworks Installation Act in 1949) and garbage cleaning followed (the Filth Cleaning Act in 1961). Policies on the emission of pollutants causing atmosphere and water contamination appeared during the 5-year economic development plan in the mid-1960s (the Environmental Pollution Prevention Act in 1963) followed by the area of collection and purification of sewage and waste water (the Sewage System Act in 1966). In the 1970s, the Environmental Pollution Prevention Act was revised to become the Environment Conservation Act, the environmental policy area being expanded, technical measures being introduced and various regulations being enacted. During the 1970s and the 1980s, the amount of waste increased rapidly as a result of economic growth, appearance of plastic products and increase in income. In that period, the laws and regulations related to waste management, divided into the Filth Cleaning Act and the Environment Conservation Act, were integrated into the Waste Management Act (enacted in 1986).

In the 1990s, the environmental management was subdivided by the environmental media, the environmental effects evaluation system was introduced to estimate and minimize the effects of large-scaled development projects on the environment and the government started to mediate possible disputes. The overall area of environmental management was specialized and expanded dramatically. In the early 1990s, basic laws such as the Framework Act on Environmental Policy (enacted in 1990), the Natural Environment Conservation Act (enacted in 1991), etc. were legislated to set the management directions in the main environmental areas and the individual management laws for water quality, atmosphere, waste materials, aquatic ecosystems, noise & vibration, harmful chemical substance, underground water, drinking water, soil, bad smell, etc. in order. The Environmental Dispute Conciliation Act was enacted in 1990 in order to mediate the disputes occurring among the nation, people and enterprises over environmental damages. The Environmental Effects Evaluation Act was legislated in 1999 in order to break the existing environmental management methods that used to control and monitor environmental pollution which occurred within the regulation level. According to the act, the effects on the environment shall be evaluated in the stage of project preparation in the case of government projects and private sector projects over a certain scale to reduce the negative influences by taking measures like project modification, establishment of prevention plans, etc. which implementation shall be evaluated after completion of such projects.

In the 2000s, energy and response to climate change has emerged as the agenda in the environmental management area. The main tasks were to develop the technologies to reduce the emission of greenhouse gases including carbon and methane gas, to develop the technologies to increase energy efficiency, to produce energy in new ways and to set conditions for developing such technologies. The central government enacted the Framework Act on Sustainable Development in 2007 and the Framework Act on Green Growth in 2010, and Seoul established the Ordinance on Energy in 2002 and the Ordinance on Climate Change in 2008.

<Figure 2> Development Process of Environment Related Laws and Regulations

Administrative Organization

The environmental administrative organization of Seoul has been steadily expanded in keeping pace with the increased administrative demands, subspecialized and extended environmental areas, and so on. In 1945, when Korea was liberated from Japanese colonial rule, Seoul had just one department for water supply as the environmental administrative organization. In the 1950s, Seoul came to have 2 departments by adding the waste management work. There were 5 departments in 1961 when the sewage system area was added, 8 departments in 1968 when the environment preservation area was added and 14 departments in 1973 when the parks & landscape projects and the sewage system projects began in the environmental policy areas. The number of departments taking care of environmental policies was reduced to 7 in the 1980s, but was expanded again to 16 in 1996 as the environmental management system was subspecialized and the related regulations and systems were improved in the early 1990s. The areas were expanded to cover energy, response to climate change, eco-friendly transportation, etc. in the 2000s, bringing the total number of departments in Seoul to 20 in 2012.

The total number of public officials in Seoul was 40,267 as of 2012, consisting of 10,118 in the Seoul city government and 30,149 in the 25 autonomous districts. Of them, the total number of public officials working in the environmental policy area was 5,914, which consisted of 241 in the climate environment division, 604 in the blue city bureau, 365 in the city safety office, 2,036 in the water supply project division and 2,668 in the autonomous districts, making up 15% of the whole manpower of the Seoul City.

<Table 2> Changes of Environmental Administrative Organization of Seoul

Year	Organization (Dept.)	Environmental Pollution Control	Waste Management	Sewage System	Water Supply	Parks & Landscape
1945	1				Water Supply Dept.	
1950	2		Sanitation Dept.		Water Supply Dept.	
1961	5		Same as above	Sewage Dept.	Biz. Service Dept. Facility Dept. Water Supply Dept.	

Year	Organization (Dept.)	Environmental Pollution Control	Waste Management	Sewage System	Water Supply	Parks & Landscape
1963	7		Same as above	Same as above	Biz. Service Dept. Cashier Dept. Accounting Dept. Water Source Dept. Water Supply Dept.	
1968	8	Health Dept.	Same as above	Same as above	Biz. Service Dept. Accounting Dept. Water Source Dept. Water Supply Dept. Facility Dept.	
1969	9	Health Dept. 1	Same as above	Same as above	Biz. Service Dept. Accounting Dept. Water Source Dept. Water Supply Dept. Facility Dept. Electric Generation Dept.	
1973	14	Environment Dept.	Cleaning Dept. 1 Cleaning Dept. 2	Administrative Dept. Facility Dept.	Same as above	Landscape Dept. Green Belt Dept. Park Dept.
1979	12	Environment Dept. 1 Environment Dept. 2	Cleaning Dept.	Sewage Dept.	Biz. Service Dept. Accounting Dept. Water Resource Facility Dept. Water Supply Dept. Electric Generation Dept.	Same as above
1981	7	Environment Dept.	Cleaning Dept.	Same as above	Biz. Service Dept. Water Supply Dept. Water Source and Electric Generation Dept.	Parks & Landscape Dept.
1983	9	Same as above	Same as above	Administrative Dept. Processing Dept.	Same as above	Park Dept. Green Belt Dept.
1989	12	Same as above	Same as above	Same as above	General Affairs Div. Facility Div. Management Div. Production Div. Water Supply Div.	Park Dept. Landscape Dept. Green Belt Dept.
1992	15	Same as above	General Affairs Div. Project Div. Planning Div. Facility Div.	Same as above	Same as above	Same as above
1993	14	Environment Dept.	Same as above	Same as above	Same as above	Park Dept. Green Belt Dept.
1996	16	Planning Dept. Atmosphere Dept. Water Quality Dept.	Management Dept. Recycling Dept. Facility Dept.	Same as above	Same as above	Park Dept. Green Belt Dept. Planning Dept.
1998	15	Same as above	Management Dept. Facility Dept.	Sewage Dept. Flood Control Dept.	Same as above	Same as above
2003	16	Environment Dept. Atmosphere Dept. Water Quality Dept.	Cleaning Dept.	Same as above	General Affairs Div. Management Div. Facility Div. Production Div. Water Supply Div. Tab Water Div.	Park Dept. Landscape Dept. Democracy Park Seoul Forest

Year	Organization (Dept.)	Environmental Pollution Control	Waste Management	Sewage System	Water Supply	Parks & Landscape
2007	20	Environment Dept. Water Quality Dept. Energy Dept. Project Dept. Management Dept. Transportation Dept.	Resource Recycling Dept. Clean City Dept.	Same as above	Same as above	Same as above
2008	18	Energy Dept. Low Pollution Dept. Transportation Dept. Environment Dept. Water Management Dept. River Dept.	Environment Dept. Resource Recycling Dept. Clean City Dept.	Planning Dept. Facility Dept.	Management Div. Production Div. Water Supply Div. Facility Div.	Planning Dept. Park Dept. Landscape Dept. Natural Ecology Dept.
2009	18	Environment Dept. Climate Dept. Atmosphere Dept. Environmental Cooperation Dept. Water Management Dept. River Dept.	Same as above	Same as above	Same as above	Same as above
2010	18	Environment Dept. Climate Dept. Atmosphere Dept. Transportation Dept. Water Management Dept. River Dept.	Resource Recycling Dept. Living Environment Dept.	Same as above	Same as above	Same as above
2012	20	Environment Dept. Energy Dept. Climate Dept. Transportation Dept. Water Management Dept. River Dept.	Same as above	Same as above	Management Div. Billing Div. Production Div. Water Supply Div. Facility Div.	Planning Dept. Park Dept. Landscape Dept. Natural Ecology Dept. Disaster Prevention Dept.

Governance

Until the 1980s, Seoul City had planned and implemented the environmental policies in the aspect of administration. Beginning in the 1990s, however, there appeared lots of difficult projects that could not be solved just with the administrative power. For example, agreement with the citizens was required to build unpleasant facilities such as waste incinerators, expert knowledge was necessary for the projects of new and renewable energy, automotive fuel, etc. in the energy area, and cooperation with citizens and enterprises was required in the area of energy, tap water, reduction of wastes, and purchase of eco-friendly products. Also, international cooperation projects increased as climate change related issues could not be solved just with the efforts of a city or a country.

The representative internal cooperation projects of Seoul are the Green Seoul Citizen Committee and the Seoul Action 21. For the international cooperation projects, Seoul joined ICLEI and C40.

Green Seoul Citizen Committee

The Green Seoul Citizens Committee was inaugurated on November 22nd, 1995 to reflect on the development-oriented policies and to address the environmental concerns in Seoul through the spontaneous participation of the citizens as the local autonomy era began, emphasizing the life quality of citizens.

The committee, an organization established based on the Framework Ordinance on Environment, implemented autonomous and independent activities through civil participation. It took the type of governance in which various entities in the public area (Seoul City), market area (enterprises) and spontaneous area (civil society) work together. It performed the functions as a policy advisory group and a subject of practical implementation of policies while

sharing the vision on the sustainable future of Seoul and making the social systems together.

The key roles of the committee are to evaluate and advise on the issues on integration and adjustment of preservation and development in the aspect of sustainable civic administration, to evaluate and advise on the sustainability of the policies, plans and systems proposed by the mayor, to fulfill the “Seoul Agenda 21” and its implementation state, to suggest directions and give advice to facilitate the autonomous district agenda 21, to develop the citizens’ coalition model and attract voluntary participation from the citizens and the enterprises to address climate change, to carry on the activities to improve environment through cooperation of the citizens and the enterprises, to give advice for the establishment and adjustment of comprehensive environmental education plan and to support the development of training materials for education programs, and so on. In addition, the committee participates in the environment conservation program to attract cooperation of the citizens and enterprises and performs the activities to facilitate the eco-friendly consumer culture of the citizens.

The committee’s main projects are evaluation on the sustainability of Seoul’s policies, monitoring of implementation state of Seoul Action 21, support to the public contest for selection of citizens participation methods, organization and operation of citizens coalition for the Seoul Agenda 21, organization and operation of the green start of autonomous districts, etc.

Seoul Action 21

The “Seoul Agenda 21” refers to the local agenda 21 made by Seoul. In 1992, the Rio de Janeiro Environment Conference recommended each local government to make up its own agenda 21 as an action plan for environment conservation in local units to facilitate the global environment preservation. The Seoul City included the local agenda 21 of Seoul made with the citizens in the “3 Year Administrative Operation Plan (1996~1998) which was planned to be declared and submitted to the United Nations. The “Green Seoul Citizen Committee of Seoul City” launched on November 22nd, 1995 was the basis of creating the local agenda 21 of Seoul. The “Preparatory Committee for Seoul Agenda 21” was organized with 12 participants consisting of civic group members, experts and officials of Seoul City and the committee discussed facilitating system, operating methods, writing schedules, etc. of the “Seoul Agenda 21” through 18 meetings and public hearings. The draft of “Seoul Agenda 21” was prepared in 1997 and confirmed through opinion collection procedures like workshops, public hearings, etc. The “Seoul Agenda 21” was announced on June 5th, 1997 to celebrate the 25th World Environment Day. Its revised version was announced in March 2000.

In order to achieve the activity objectives in the 8 areas of the “Seoul Agenda 21” including vision, issues, basic principles, activity targets, indicators, status and problems, improvement goals and action plans, and to contribute to the changes of situations and the sustainable development of Seoul, it was required that the vision and activity targets of the “Seoul Agenda 21” should be closely connected to the administration of Seoul. In this connection, Seoul City converted the “Seoul Agenda 21” to the “Seoul Action 21” to express its practice clearly and to approach the citizens more intimately.

The Seoul Action 21 was an important plan corresponding to the era of governance in the aspect that it was an action plan for the sustainable development of Seoul established through the participation of various persons concerned. The Seoul Action 21 suggested things that would preserve the environment and increase the life quality of Seoul citizens and what would later become the things that future generations enjoy during their lives.

There were 7 areas, 34 activity targets and 580 action plans in the “Seoul Action 21.” In order to make the action plans to be settled in the civic life, Seoul City has hosted public contests for the practice of the Seoul Agenda 21 for non-profit private organizations.

<Table 3> Activity Targets of the Seoul Action 21

No.	Area	Vision	Activity Targets
1	Environment Management	Clean Water, Blue Sky, Pleasant Seoul	1-① Expand the space for plants by securing more areas with rainwater permeating soil. 1-② Improve water quality of rivers and make water always flow in the rivers. 1-③ Conduct campaigns for water conservation. 1-④ Reduce fine dust generated by the vehicle emission gas. 1-⑤ Reduce the indoor air pollution. 1-⑥ Make Seoul clean.
2	City Planning	Seoul as a Pleasant Ecological City Built by the Citizens' Participation	2-① Make Seoul an ecologically oriented city. 2-② Increase the number of parks within 5 min. on foot distance from any place. 2-③ Activate town gardening of the citizens by allocating 1% of citizen autonomy budget. 2-④ Develop beautiful city evaluation index and apply them to city management.
3	Consumption	Sustainable Consumption, Seoul as a Safe Place for Living	3-① Reduce waste. 3-② Reduce food wastes. 3-③ Purchase eco-friendly products and services positively. 3-④ Make sustainable consumption a way of life.
4	Transportation	Pedestrian-friendly Street, Seoul with the Beloved Public Transportation	4-① Use public transportation actively. 4-② Enhance the level of traffic culture. 4-③ Supply green transportation and facilitate use of them. 4-④ Reduce traffic accidents. 4-⑤ Improve the pedestrian environment.
5	Industry Economy	Prosperous Seoul in Cooperation of the Citizens and the Enterprises	5-① Increase the number of ecofriendly industry clusters. 5-② Reduce the amount of CO2 emission to prevent climate change. 5-③ Decrease the unemployment rate. 5-④ Make Seoul a good city even for foreigners in doing business.
6	Health	Lively and Health Seoul with the Sound Lifestyle	6-① Reduce the smoking rate. 6-② Maintain healthy weight. 6-③ Have sound drinking culture. 6-④ Relieve stress. 6-⑤ Manage mass feeding to keep it safe and sanitary.
7	Social Equity	Seoul without Barriers and with the Spirit to Share the Joy	7-① Make Seoul a city where people can live in safety and happiness during their old age. 7-② Make Seoul a city where wheelchairs can access everywhere. 7-③ Make Seoul a city where anyone can live in a pleasant house in comfortable way. 7-④ Make Seoul a city that ensures equality between men and women. 7-⑤ Help people to enjoy culture and arts in order to give energy to their lives. 7-⑥ Make Seoul a city that is filled with the sound of children's laughing.

ICLEI Activities

In May 1999, Seoul City became a full member of International Council for Local Environment Initiatives (ICLEI – Local Governments for Sustainability), which had been founded in 1990 aiming to build up the environmentally autonomous capacity of local governments. In the “ICLEI World Congress” held in Belo Horizonte, Brazil in June 2012, Won-soon Park, the Seoul Mayor, was elected as the chairman of World Mayors Council on Climate Change (WMCCC), which is a gathering of leaders of the major cities around the world. He has contributed a lot in developing and implementing useful and substantive policies and alternatives to improve the competence to respond to climate change. In October of the same year, the opening ceremony of East Asian Headquarters of ICLEI and seminars were held. The local governments from 6 countries including Korea, China, Japan, Taiwan, Mongolia and North Korea shared their opinions and discussed how to response jointly to environmental issues at the events. Also, the joint conference of WMCCC and World Executive Committee of ICLEI was held to discuss the future activity scope, membership system, articles of association, etc. of WMCCC and to agree on the “Declaration of the Seoul Local Government on Energy and Climate” which had been designed to facilitate the substantive policies and set the clear goals in responding to climate change. In addition, Seoul participated in the “Local Action Project for the Biological Diversity”, an international cooperation project of ICLEI, to submit its assessment report on the biological diversity of Seoul, established action plans to increase the biodiversity and facilitated such plans actively for the related programs.

C40 Activities

C40 Climate Leadership Group is a voluntary consultative body organized by the world’s largest cities in order to recognize the seriousness of climate change and to respond to it. The body was proposed by Ken Livingstone, an ex-Mayor of London in 2005 and launched in London to face the reality that the cities taking up just 2% of the global area emitted more than 80% of the greenhouse gases, which are the main cause of global warming, and to take measures against such reality. Seoul joined the body in July 2006 shortly after the tenure of the 4th mayor elected by popular vote began. Seoul participated in the 2nd General Meeting in New York in May 2007 to sign on an MOU to host the 3rd C40 Summit in Seoul⁴, joined the C40 Steering Committee in April 2008, hosted the 3rd C40 Summit in Seoul in May 2009, participated in the Carbon Disclosure Project in February 2011, participated in the C40 Steering Committee in New York in April 2011, introduced eco-friendly transportation policy of Seoul in the 4th C40 Summit in Sao Paulo in May 2011, participated in the C40 Steering Committee in London in October 2011, accepted the position of chairman of the Asian region for the Carbon Disclosure Project and participated in the C40 Steering Committee in Rio de Janeiro in June 2012.

⁴ It was held at Seoul Silla Hotel from May 18th – 21st 2005. 1,037 people from 72 cities and 4 international organizations participated in the summit. Seoul Declaration was adopted as an official resolution of the C40 Climate Leadership Group.

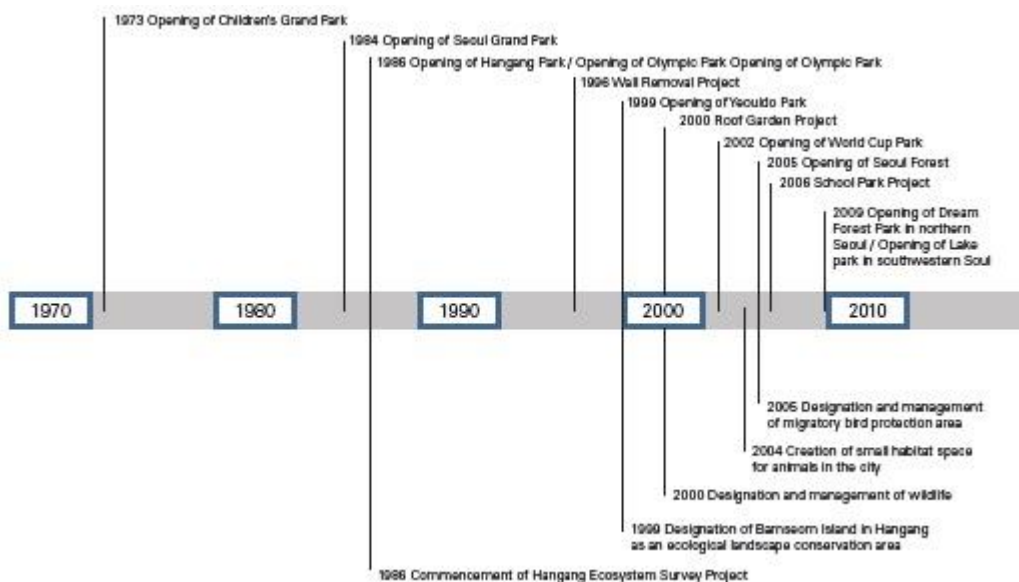
Important Policies and the Contents

Parks & Landscape

Main Projects in Parks & Landscape Area by Period

The parks & landscape area is largely divided into healthy green, ecological preservation and creation of parks. In the parks & landscape area of Seoul, most of the projects were the creation and expansion of parks in the beginning stage, and still lots of energy are invested in such projects. The representative ones are Children's Grand Park completed in 1973, Seoul Grand Park in 1984, Hangang (Han River) Park in 1986, Yeouido Park in 1999, World Cup Park in 2002, Seoul Forest in 2005 and Dream Forest Park in northern Seoul in 2009. The wall removal project in 1996, the roof garden project in 2000 and the school park project in 2006 were facilitated to create small parks in the surrounding areas. The activities to ensure a healthy ecosystem began with the survey of the Hangang ecosystem in 1987, but the actual projects got started in the late 1990s. Some examples of projects are designation of Island Bamseom in Hangang as an ecological landscape conservation area in 1999, designation and management of protected wild animals by Seoul in 2000, creation of small habitat space for animals in the city in 2004 and designation and management of migratory bird protection area in 2005.

<Figure 3> Main Projects in Parks & Landscape Area by Period



Designation of Ecological Landscape Conservation Area

Seoul city, with abundant biodiversity designates and manages the areas which have ecological importance and special value for conservation in order to protect them systematically from being artificially contaminated and damaged. Seoul has designated 17 places of 4,807,327m² in total as ecological landscape conservation areas; 1 area (Bamseom Island in Hangang) in 1999, 1 area (Dunchon-dong) in 2000, 4 areas (Tancheon, Bangi-dong, Amsa-dong and Jingwan-dong) in 2002, 2 areas (Godeok-dong and Wonteo Vally of Mt. Cheonggyesan) in 2004, 1 area (Heoninneung) in 2005, 3 areas (Mt. Namsan, Samyukdae of Mt. Bulamsan and Backyard of Changdeokgung Palace) in 2006, 2 areas (Mt. Bongsan and Mt. Inwangsan) in 2007 and 3 areas (Downstream of Seongnaecheon, Mt. Gwanaksan and Baeksasil Valley) in 2009. In the places designated as ecological landscape conservation areas, it is strictly prohibited to capture, harvest, transplant, damage or kill wild animals and plants, to install explosives, traps, snares, nets, trap pits, etc. or spray or inject toxic chemicals, agricultural pesticides, etc. with the purposes of capturing or killing wild animals and plants, to change the structure of rivers, lakes, ponds, etc. and bring increase or decrease of water level and water quantity, and to commit collection of soil and stones, water reclamation and making fires. In the case of violating any of the prohibited acts, a penalty of less than KRW 2 million is charged.

<Figure 4> Bamseom Island in Hangang That Was Designated as an Ecological Landscape Conservation Area for the First Time



View of Bamseom Island



Migratory Birds in Bamseom Island

Designation and Management of Protected Wildlife

Seoul designates the species with high scientific and ecological value for conservation among the wildlife that are gradually disappearing in Seoul as protected wildlife. The protected wildlife are designated based on the recommendation made through the Hangang ecosystem survey, forest ecosystem survey, etc. conducted by Seoul City, and the recommendations of environmental organizations and professional agencies. The designation process goes through citizen consultation and expert advice via Internet. As a result, 35 species of wildlife including swallows, toads, roe deer, etc. were designated and announced for the first time on November 15th, 2000. On October 25th, 2007, 14 species of wild animals and plants including squirrels, onychodactylus fisheri were added to the protected wildlife.

<Table 4> Designation Status of Protected Wildlife

Kind (Species)		Designated in Nov. 2000 (35 Species)	Designated in Oct. 2007 (14 Species)
Mammalia	5	Roe Deer, Badger, Hedgehog, Weasel	Squirrels
Birds	11	Great Spotted Woodpecker, Yellow-rumped Flycatcher, Kingfisher, Swallow, Oriole, Chickadee	Dendrocopos Kizuki, Dendrocopos Leucotos, Grey-Faced Woodpecker, Reed Warbler, Black Capped Kingfisher
Amphibians, Reptiles	7	Toads, Salamanders, Dybowski's Frog, Red-bellied Frog, Lined Grass Lizard, Small Stringy Snake	Onychodactylus Fisheri
Fishes	4	Yellow Puffer, Microphysogobio Jeoni, Roughskin Sculpin, Repomucenus Olidus	
Insects	12	Dorcus Titanus Castanicolor, Luehdorfia Puziloi, Pseudothermis Zonata, Large Dragonfly, Migratory Locust, Mole Cricket, Rhoenanthus (Potamanthindus) Coreanus, Dalla Torre	Rhyothemis Fuliginosa, Papilio Maackii, Muljarus Japonicus, Cybister Brevis
Plants	10	Acanthopanax Seoulensis Nakai, Epimedium Koreanum NAKAI, Drosera Rotundifolia L., Cyripedium Macranthum Sw., Forsythia Saxatilis Nakai, Patrinia Saniculaefolia, Buckler Fern	Pear-leaf Selliquea Fern, Bladderwort, Glechoma Grandis Kuprian

Creation and Expansion of Parks

Everyone wants to live in pleasant environments with clean air, clean water, warm sunlight and green spaces. The metropolitan city of Seoul with over 10 million people is getting bigger and larger, and the life quality of citizens is not enhanced significantly. More than 76% of the parks & landscape of Seoul is forest area which is concentrated in the outskirts of Seoul. Thus the space that can be used for citizens' leisure and relaxation during their daily life is not enough, and in particular, the amount of green space in the downtown area is seriously insufficient.

In order to address the lack of green and park spaces, Seoul constructed Children's Grand Park in 1973, Seoul Grand Park in 1984, Hangang Park in 1986, Yeouido Park in 1999, World Cup Park in 2002, Seoul Forest in 2005, Dream Forest Park in northern Seoul in 2009, and so on. At the same time, Seoul made efforts to create small parks in the neighboring areas and working spaces through the wall removal project in 1996, the roof garden project in 2000 and the school park project in 2006. As a result, Seoul came to have city parks totaling 170km² of area, which is 28% of the whole area of Seoul. According to the classification by type, urban nature parks make up 38.56% of the whole park area, natural parks 23.21%, neighborhood parks 25.45%, children's parks 1.29% and cemetery parks 1.40%.

<Figure 5> Examples of Representative Neighborhood Parks in Seoul



Children's Grand Park (Completed in 1973)



Hangang Park (Completed in 1986)



World Cup Park (Completed in 2002)

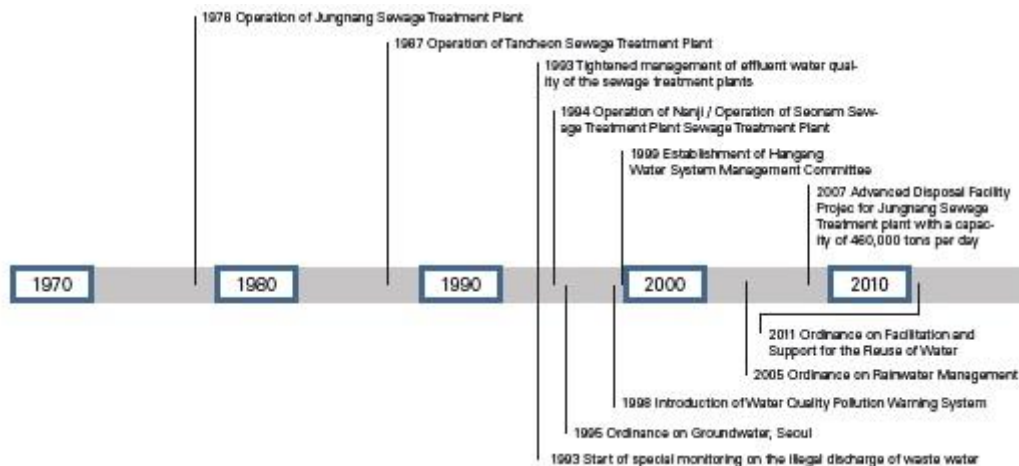


Seoul Forest (Completed in 2005)

Water Management

Main Projects for Water Management by Period

Seoul's water management area is divided into public sewage treatment, water quality monitoring for Hangang and its branches, underground water management, rainwater management and waste water discharging source management. The public sewage treatment was started in 1978 when the Jungnang sewage treatment plant began its operation. Tanchon sewage treatment plant was constructed in 1987, Nanji sewage treatment plant and Seonam sewage treatment plant in 1994. The performance of sewage treatment plants has been gradually improved to discharge the treated sewage water with less than BOD 20 mg/L since 1993. As the management of effluent water quality was tightened since 2000, the BOD level of a part of treated sewage water of the Jungnang sewage treatment plant is maintained to be less than 10 mg/L. The water quality monitoring for the Hangang and its tributaries began in the early 1980s. At that time, however, the monitoring was done through occasional survey methods. The water quality monitoring by measuring the specific places and items on a regular basis began in the 1990s. Underground water management began in the 1990s. In the 2000s, the rainwater management (an ordinance enacted in 2005) and the water utilization promotion project (an ordinance enacted in 2011) began. The waste water discharging source management was started when the Environmental Pollution Prevention Act was legislated in 1963 and gradually strengthened as the Environment Conservation Act and the Water Quality Conservation Act were enacted respectively in 1997 and 1990. Because of the increasing unauthorized, illegal and expeditious discharges of waste water during nights, holidays and the rainy season, monitoring of the waste water discharging facilities is carried on frequently.

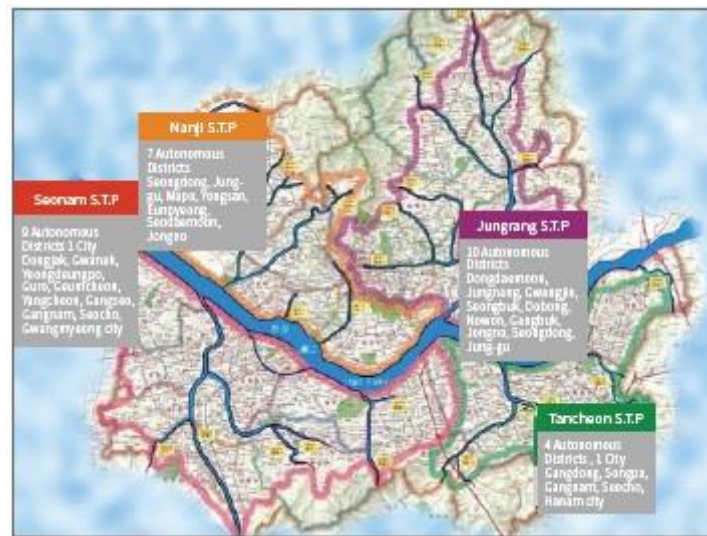
<Figure 6> Main Projects for Water Management by Period

Sewage Treatment

As the contamination of public waters caused by sewage emerged as a social problem, Seoul constructed the Cheonggyecheon (stream) sewage treatment plant that could dispose of 150,000 tons of sewage per day in 1976 for the first time in Korea. It built the Jungnang sewage treatment plant with 210,000 tons of disposal capacity in 1979 and continued to construct the Seonam, Nanji and Tancheon (stream) sewage treatment plants. In order to secure the financial resources used for the sewage treatment projects, Seoul started imposing a sewage fee in 1984 on the basis of polluters pay principle.

Seoul started enlargement constructions of the 4 sewage treatment plants in 1992 to cope with the sewage amount increase according to the changes of overall city conditions. With the project to enlarge the sewage disposal capacity by 2.7 million tons per day completed in 1998, the total facility capacity reached 5.81 million tons per day. As the regulations on the standard of effluent water from the sewage treatment plants have been steadily tightened, Seoul also has facilitated the projects to upgrade the existing facilities to meet such trends. However, the construction of new advanced disposal plants required enormous expenses. So, Seoul selected a way that gives priority to the improvement of the existing facilities to increase their capacity first, and then adds new advanced disposal plants later if their capacity is insufficient. According to the scheme, Seoul completed a phase 1 project to introduce the advanced disposal facilities to the Jungnang sewage treatment plant with a capacity of 460,000 tons per day in 2007, and conducted constructions for the Tancheon, Seonam and Nanji sewage treatment plants to compensate their existing facilities.

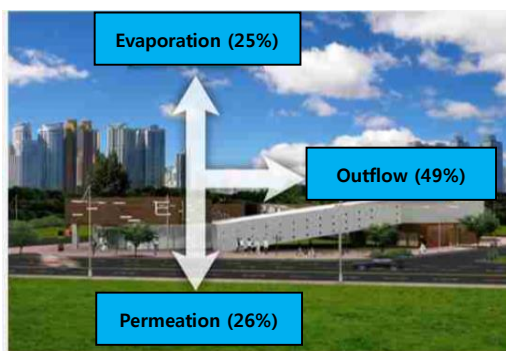
The whole length of sewage pipes, that lead the sewage from the discharging sources to the sewage treatment plants, reached 10,487km as of the end of December 2012. The sewage pipes in Seoul used to be constructed and expanded focusing on rainwater treatment since Seoul became the capital city 600 years ago until the modern era. The sewage leaked into the outside to contaminate underground water, soil and rivers due to the broken pipes, defective joints, etc. In the meantime, large amounts of underground water flowed into the sewage pipes so that the sewage treatment plants came to process relatively clean water, lowering the efficiency of the facilities. To cope with such situations, Seoul started in 1992 to install certain kinds of endoscopy cameras (CCTV) inside the sewage pipes for detailed investigation based on which Seoul facilitated the repair and maintenance of the sewage pipes.

<Figure 7> Main Waterways and the Public Sewage Treatment Plants of Seoul

Rainwater Management

Since 1962, when urban development began in earnest in Seoul, the rainwater started to flow into the rivers at the same time as the impervious areas where rainwater could not permeate into the underground broadened. Thus the areas along rivers and streams and the low-lying ground suffered from flood damages habitually in the case of localized torrential downpours. The bottoms and sides of the rivers paved with concrete could make the downstream of rainwater rapid to prevent floods, but it lowered the level of underground water and depleted the fresh spring water. Accordingly, it became difficult to secure water resources during the dry season, frequently resulting in the state of urban heat island caused by the dry rivers and streams.

To cope with this situation, Seoul started rainwater management projects in the 2000s. First, systems were prepared through enacting the ordinance on water management in 2005, the ordinance on facilitation and support for the reuse of water in 2011 and establishment of basic plan for water management in 2013, and the projects to collect and use rainwater have been facilitated. As of 2012, there are 141 places for rainfall storage and permeation facilities including Mt. Mangwusan rainfall storage, Gangil district rainfall storage, etc. totaling a capacity of 339,662m³. There are 490 places of rainwater recycling facilities including the new office building of Seoul City Hall, Dongdaemun Design Plaza, Gangnam Segokrienpark, etc. totaling a capacity of 107,671m³. Seoul supported the installation expenses for 125 rainwater recycling facilities (capacity: 2,020m³). Seoul has also recommended the installation of rainwater permeation and recycling facilities for the projects controlled under the environmental effects evaluation. In the case of large scale housing land development projects, it is mandatory to install rainwater management facilities.

<Figure 8> Rainwater Moving Route of Seoul and an Example of Rainwater Management Project

Rainwater Moving Route of Seoul (2010)



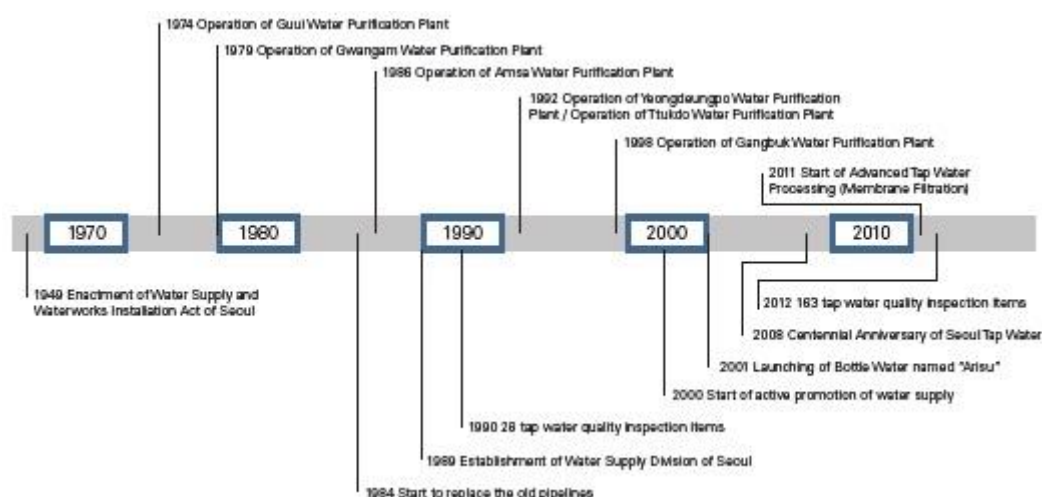
Rainwater Recycling Facility in a Park

Water Supply

Main Projects of Water Supply by Period

The water supply area can be largely divided into tap water production, maintenance of distribution pipelines, tap water quality management, etc. The water supply system was introduced to Seoul in 1908 in the late Joseon Dynasty by an American technician named Henry Collbran, and Seoul celebrated the centenary of the operation of the water supply system in 2008. In 1949, the Water Supply and Waterworks Installation Act of Seoul was legislated. Since the construction of Guui water purification plant in 1974, 6 plants including Gwangam, Amsa, Yeongdeungpo, Ttukdo and Gangbuk have been built and operated. Seoul introduced the membrane filtration process for better water taste in 2011. The projects of water distribution pipeline maintenance were started in 1984, replacing 13,122km of the total deteriorated pipelines 13,668km in length until 2012. Thanks to the replacement of the old pipelines, the water flow rate of Seoul tap water had been remarkably increased from 72% in 2000 to 94.5% in 2012. The quality management of tap water is conducted by quality management of water supply sources, expansion of inspection items, indoor tap water quality check, etc. In particular, the number of tap water inspection items has been continuously increasing from 28 in 1990 to 163 in 2012.

<Figure 9> Main Projects of Water Supply by Period



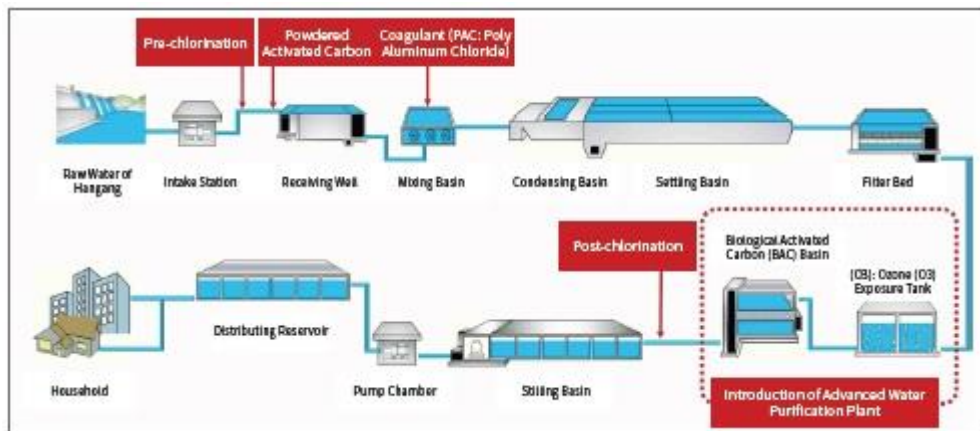
Production of Tap Water

The first water supply system was the water purification plant constructed at Ttukdo reservoir which was completed on September 1st, 1908 by the two Americans named Collbran and Bostwick under the permission of Emperor Gojong on the water supply system project. At that time, the production capacity was 12,500 tons per day and the water supply population was 125,000. Three purification plants (Ttukdo, Noryangjin and Guui whose total capacity was 150,000m³ per day) were operated in 1946 and 5 (Ttukdo, Noryangjin, Guui, Bogwangdong and Yeongdeungpo whose total capacity was 2.17 million m³ per day) in 1977. In 2004, Seoul closed the deteriorated and low competitive water purification plants including Guui 1 & 2, Noryangjin, Sinwol, Seonyu and Bogwangdong. Currently, 6 plants including Gwangam, Amsa, Guui, Ttukdo, Yeongdeungpo and Gangbuk are in operation.

As of 2012, the water purification and production capacity is 4.35 million m³ per day, and the water supply population is 10.44 million, recording 100% supply rate.

Prior to 1992, there was no reserve in capacity for water supply plants, causing difficulties in water supply operation. However, sufficient purification facilities were ensured in 1998 and stable water supply has been possible without places with no running water since then. In 2012, the amount of tap water used in Seoul reached 1.20 billion tons, which means 3,216,000 tons per day on average.

<Figure 10> Tap Water Production and Feeding Process of Seoul



Maintenance of Feeding Pipes

The total length of distribution water pipe installed in Seoul is 13,801km. Seoul replaced 13,122km of the total deteriorated pipelines 13,668km in length by 2012, and it was going to replace all the pipelines except the old ones in the redevelopment project areas (43km). The effects of the water distribution pipeline maintenance can be checked by the water flow rate. The water flow rate means the ratio of the amount generating revenue of the total amount produced in the purification plants. Therefore, high water flow rate means the reduction of the amount of leaked tap water. The water flow rate was increased remarkably from 72% in 2000 to 94.5% in 2012. As the water flow rate was increased, the budget for the raw water, chemicals, powers, etc. was reduced enough to contribute to the improvement of water supply management. In 2012, the water flow rate was increased by 1.0% and it realized the reduction of KRW 6.842 billion (based on the sales unit price).

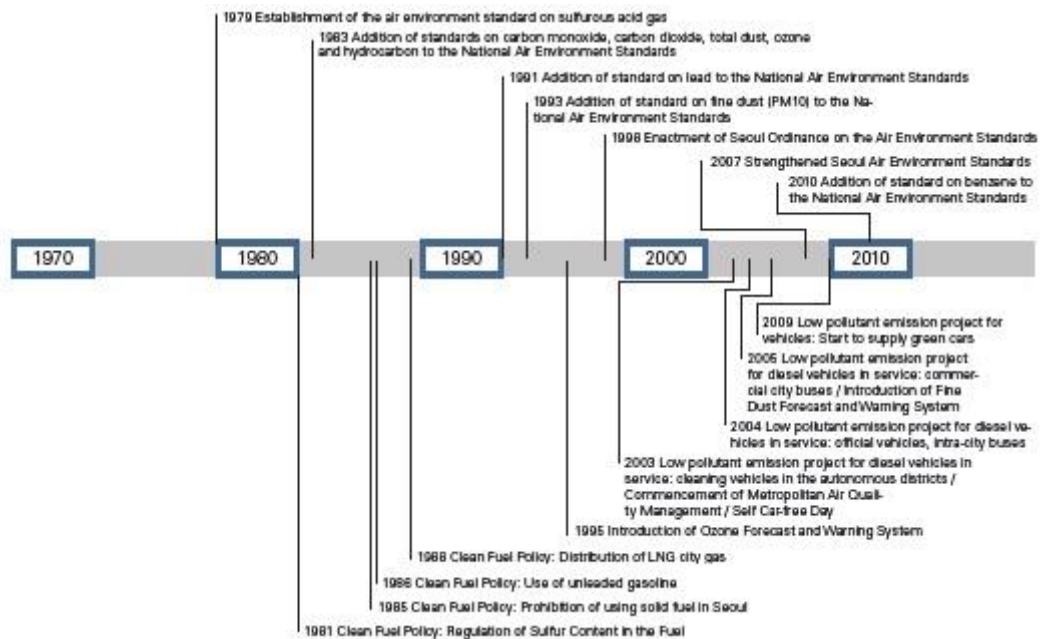
Air Quality Management

Main Projects of Air Quality Management by Period

Air quality management area is largely divided into environment standard establishment, fuel control, low pollutant emission vehicle projects, transportation demand management, establishment of air quality management basis, etc. Seoul has started to establish the air environment standards from 1979 first on sulfurous acid gas, followed by the standards on carbon monoxide, nitrogen dioxide, total dust, ozone, hydrocarbons, lead and fine dusts in consecutive order. The standard on benzene was added in 2010. Seoul City has applied its own air environment standards since 1998. Seoul began its fuel control with the regulation of the sulfur content in 1981, followed by the regulations and policies on prohibition of solid fuels and use of unleaded gasoline. Seoul started distribution of LNG city gas in 1998. In order to suppress the emission of pollutants from cars, Seoul started the low-emission vehicle projects for the diesel vehicles in service in cooperation with metropolitan areas in 2003 and began to supply the green cars such as electric automobiles in 2008. To restrain the demands on vehicle uses, Seoul introduced Self Car-free Day system in 2003.

For the systematic implementation of air quality management, Seoul is running the air quality measuring posts. Seoul introduced ozone warning system in 1995 and fine dust forecast and warning system in 2005 to help citizens prepare for such situations.

<Figure 11> Main Projects of Air quality by Period



Low Pollutant Emission of Vehicles

The low pollutant emission projects of Seoul consist of the low pollutant emission project for the operating diesel vehicles, the green car supply project and the expansion of natural gas stations. Seoul began the low pollutant emission project for operating diesel vehicles in 2003 by replacing the 135 diesel engines of the 2.5-ton official garbage trucks with LPG engines as a pilot project. In 2004, it conducted more pilot projects such as attachment of emission reduction devices to around 880 official vehicles and intra-city buses. With the low pollutant emission projects having been conducted for the city buses and the commercial vehicles in earnest from 2005, Seoul had applied its policies for 248,779 units of vehicles in total by the end of 2012; attachment of DPF for 82,115, engine modification to LPG for 67,834, attachment of DOC for 53,054 and early scrapping for 45,776 vehicles. Seoul had interest in supply of electric automobiles as a fundamental solution for air pollution. Since 2009, Seoul has facilitated the supply of green cars and established the infrastructure of gas stations to be used as a testbed for electric vehicles. Seoul also has implemented proof projects with the 'electric two-wheeled vehicle' as a start, followed by low speed electric vehicles, modified electric vehicles, high speed electric vehicles, electric buses, hydrogen fuel cell vehicles, on-line electric vehicles, etc. It established recharging stations in public facilities such as city hall, autonomous district offices, parks, etc. In particular, Seoul developed a "Smart Recharging System" that allows the payment for charging to meet the requirements of the electric vehicle users.

Self Car-free Day

The self car-free day campaign is a kind of civil movement that the citizens decide autonomously a car-free day during the week from Monday to Friday and do not drive their cars on that day. It was started with the name of "Self Car-free Day" in July 2003. The targets of the self car-free day were to restrain the operation of non-business cars with less than 10 seats and encourage people to use public transportation instead, to make the air of Seoul clean and pleasant and to improve the air quality to the level of advanced countries. The paper sticker attachment method was introduced first in July 2003 and the electronic tagging method was adopted in January 2006, which replaced the existing paper sticker method in July 2007, realizing a unified operation. As of 2012, 1,080,793 vehicles are participating in the self car-free day campaign.

<Figure 12> Self Car-free Day



The self car-free day campaign is a civil movement that citizens decide autonomously a car-free day during the week from Monday to Friday and do not drive their cars on that day.

It is strongly recommended to join the self car-free day campaign and use public transportation in order to save energy in the long era of high oil prices, to ease heavy congestion and to make air clean and pleasant.

Air Quality Forecast and Warning System

The ozone warning system was introduced in July 1995 to minimize the impact of ozone on human health and living environment, to raise the citizens' concerns for air pollution and to enhance the level of environmental awareness by issuing warnings promptly to the citizens when the ozone (O₃) concentration is measured to be higher than a certain standard. The ozone warnings are issued for 5 areas including downtown, northwest region, northeast region, southwest region and southeast region of Seoul in consideration of the moving route of air pollutant. In the case that the ozone concentration measured in a measuring station exceeds the standard level, ozone warning, alert and alarm are issued according to the set standards by the region where the relevant measuring station is located.

<Table 5> Ozone Warning Issuance Criteria and Items Required for the Citizens

Stage	Issuance Criteria	Items Required for the Citizens
Warning	In the case that ozone concentration in air in the morning is more than 0.12ppm	• Abstain from outdoor exercise. • The elderly, children and patients abstain from outdoor activities. • Refrain from unnecessary driving of cars and use public transportation.
Alert	In the case that ozone concentration in air in the morning is more than 0.3ppm	• The elderly, children and patients abstain from outdoor activities. • Abstain from outdoor learning in kindergartens and schools. • Vehicles are advised to pass around the region where the alert is issued.
Alarm	In the case that ozone concentration in air in the morning is more than 0.5ppm	• The elderly, children and patients should not do outdoor activities. • Kindergartens and schools are advised to close. • Vehicles are advised not to enter the region where the alarm is issued.

There are three categories of fine dust forecasts, warning, alert and alarm in the fine dust forecast and warning system. As the air pollution level got higher and the citizens' interest in fine dust got increased due to the rapid growth of vehicles, Seoul introduced the fine dust forecast and warning system for the first time in Korea on February 1st, 2005 in order to minimize the damages to the citizens' health and to contribute to pollution reduction. The fine dust forecast is created by estimating the dust concentration of tomorrow and announced to the citizens for their reference in outdoor activities. The forecast categories are Good (0~30 $\mu\text{g}/\text{m}^3$), Normal (31~80 $\mu\text{g}/\text{m}^3$), Possible Influence on the Sensitive Persons (81~121 $\mu\text{g}/\text{m}^3$), Bad (121~200 $\mu\text{g}/\text{m}^3$), Very Bad (201~300 $\mu\text{g}/\text{m}^3$) and Dangerous (300 $\mu\text{g}/\text{m}^3$ ~). The forecast is disseminated using the forecast computer systems after referring to the weather forecast of Korea Meteorological Administration and its accuracy. Also, a detailed forecast is made by time (morning, day time, evening and midnight) in cases that the average concentration for 2 hours is estimated to be higher than the level of "Possible Influence on the Sensitive Persons." When the fine dust concentration is higher than certain levels, a warning or alarm is issued to recommend and facilitate people to refrain from going out and doing outdoor classes, to close schools, to abstain from driving, to stop construction generating dusts and to wash the roads using water.

<Table 6> Criteria on Issuance and Release of the Fine Dust Warning and Alarm

Classification	Issued When	Released When
Warning	Fine dust concentration more than $200\mu\text{g}/\text{m}^3$ per hour on average continued over 2 hours	Fine dust concentration is less than $100\mu\text{g}/\text{m}^3$ per hour on average
Alarm	Fine dust concentration more than $300\mu\text{g}/\text{m}^3$ per hour on average continued over 2 hours	Fine dust concentration is less than $200\mu\text{g}/\text{m}^3$ per hour on average

Waste Management

Main Projects of Waste Management by Period

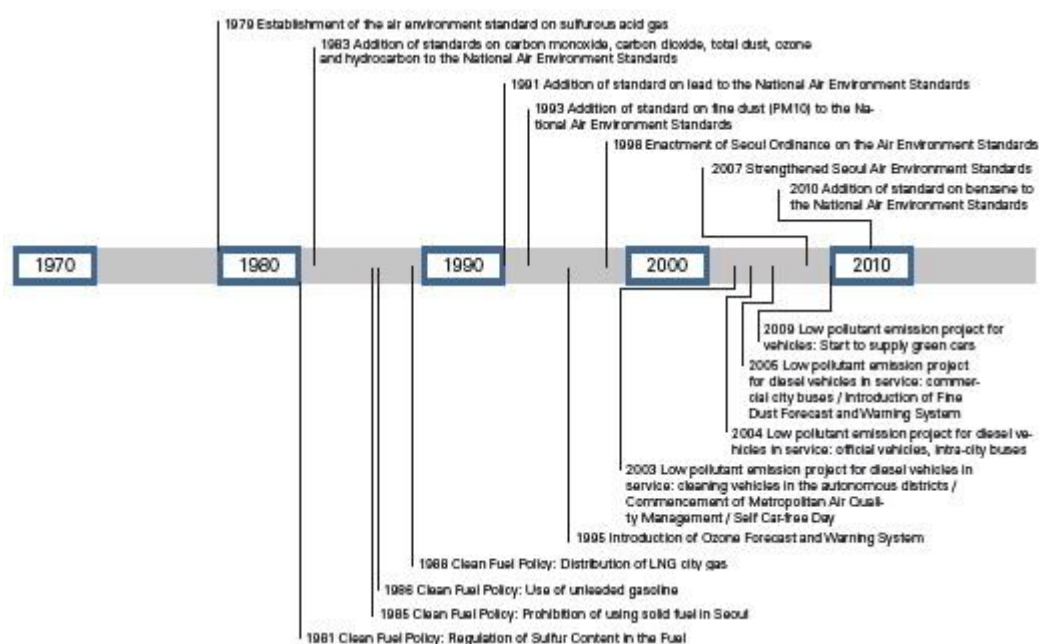
The waste management area of Seoul is largely divided into the construction of treatment facilities, separate collection of recyclables and food waste, introduction of volume-rate waste disposal system (pay-as-you-throw) and promotion of reuse.

The first waste treatment facility in Seoul was the Nanji Landfill which was used from 1978 to 1993. Since 1993, wastes have been treated at the metropolitan landfill site which was constructed jointly by the central government and the Seoul Metropolitan Government in the city of Incheon. The first waste incineration facility with high-tech features was the Yangcheon incinerator constructed in 1996. Since then, Nowon facility in 1997, Gangnam facility in 2001 and Mapo facility in 2005 were constructed respectively. Aside from the Mapo facility, which was built to dispose of household waste from Mapo-gu, Jung-gu and Yongsan-gu, the other 3 facilities started to process household waste generated from the neighboring autonomous districts from 2007 and the Mapo facility also expanded its coverage to the other areas in addition to the existing districts.

The collection of recyclables in Seoul began in 1990 in apartment complexes and then was extended to single-family homes and business sites. The purity of the recyclables was not high because a lot of garbage was mixed in. To cope with this situation, Seoul introduced the volume-rate waste disposal system. The garbage fee was charged depending on the amount of waste produced, and the collection of recyclables was performed for free. The volume-rate waste disposal system contributed a lot to the settlement of separate collection of recyclables. But another problem has occurred. The garbage from which the recyclables were separated was filled with enough perishable food waste to cause filthy water and bad smell, and it was difficult to find the source of demand on the recyclables increased in a short time. Because the landfill of food waste was prohibited beginning in 2005, food waste began to be collected separately. The expanded producer responsibility system, introduced in 2003 helped find and secure the source of demand on the recyclables.

In addition, Seoul opened the sharing marketplace from 2003 to support the exchange of second-hand goods. Seoul also began a waste metal resource recycling project in 2009 to collect metals, plastic, etc. by disassembling small home appliances such as mobile phones, electric fans, telephones, etc.

<Figure 13> Main Projects of Waste Management by Period



Construction and Joint Use of Incineration Facilities

In 1991, Seoul established a plant to construct 16,500-ton capacity incineration facilities in 11 places in Seoul. In 1992, a project was commenced to construct 4 incineration facilities over 13 years; in Yangcheon in 1996, Nowon in 1997, Gangnam in 2001 and Mapo in 2006. The total processing capacity of the 4 facilities were 2,850 tons per day.

However, the utilization level of the facilities was so low that the operation rate of Yangcheon facility was 33%, Nowon facility 19%, Gangnam facility 24% and Mapo facility 59% as of the daily operating capacity in 2005. Seoul began area broadening projects from 2001 to use those facilities with the neighboring autonomous districts. Yangcheon, Nowon and Gangnam facilities, which had been planned to treat the waste of their own districts, began to receive waste from the neighboring autonomous districts and the Mapo facility, which had been planned to treat the waste of Mapo-gu, Jung-gu and Yongsan-gu, began to receive the waste from more autonomous districts according to the area broadening projects implemented.

The key issue was to get the consent of the resident support and consultative groups of the 4 regions that had incineration facilities. In case of Gangnam facility, Seoul had around 160 meetings with the resident groups until reaching an agreement on the joint use of the facility on May 7th, 2007. It took 9 years in the case of Yangcheon facility to reach an agreement on the joint use of the facility. After having around 150 meetings with the resident groups, the joint use of the 4 facilities was agreed on May 10th, 2010.

The achievement of the joint use was great. First, the number of autonomous districts using the 4 incineration facilities was greatly increased. In spite of the completion of Gangnam and Mapo facilities, the number of autonomous districts using the facilities was just 6, but the use of incineration facilities was expanded to 20 autonomous districts with the agreement of joint use of Yangcheon facility in 2010. As Dongdaemun-gu joined the joint use in 2012, along with Gwanak-gu in 2013, the number of autonomous districts using the 4 facilities was 22 as of 2014. With the joint use of the incineration facilities available, the operation rate was improved from 19~59% (33% of all facilities) in 2006 to 77~92% (85% of all facilities) in 2012.

<Table 7> Construction Overview of Seoul Incineration Facilities

Classification	Yangcheon	Nowon	Gangnam	Mapo
Facility Capacity	400 tons/day (2 incinerators)	800 tons/day (2 incinerators)	900 tons/day (3 incinerators)	750 tons/day (3 incinerators)

Classification	Yangcheon	Nowon	Gangnam	Mapo
Construction Period	Dec. 1992 ~ Feb. 1996	Dec. 1992 ~ Jan. 1997	Dec. 1994 ~ Dec. 2001	Dec. 2001 ~ May 2005
Land Space	14,627m ²	46,307m ²	63,813m ²	58,435m ²
Construction Cost	KRW 32. 1 Bil.	KRW 74.3 Bil.	KRW 115.5 Bil.	KRW 171.2 Bil.
Type of Incinerator	Stoker Type	Stoker Type	Stoker Type	Stoker Type + Rotary Kiln
Air Purification Facility	• Wash Tower • Semidry Reaction Tower • Bag Filter • SCR Catalyst Tower	• Electric Precipitator • Wet Wash Tower • Bag Filter • SCR Catalyst Tower	• Wash Tower • Semidry Reaction Tower • Bag Filter • SCR Catalyst Tower	• Semidry Reaction Tower • Bag Filter • SCR Catalyst Tower • Police Filter
Subsidiary Facilities	• Swimming Pool • Fitness Center • Reading Room • Auditorium	• Swimming Pool • Fitness Center • Cultural Lecture Room • Reading Room	• Swimming Pool • Fitness Center • Cultural Lecture Room • Reading Room	• Sauna • Fitness Center • Driving Range • Reading Room

Separate Collection of Recyclables

The waste emitted by residents is divided into household waste and recyclables. Clothing or other items may be added depending on the region. The recyclables are divided into paper packs, glass bottles, metal cans (cans made of steel, aluminum and others) and synthetic resins (plastic, PET bottles and Styrofoam) on which there are the separate disposal marks according to government guidelines. The Seoul Metropolitan Government added used clothing and beddings as recyclables and started collecting them autonomously from March 1999.

The recyclables should be discarded using transparent vinyl bags and put in front of the door of each household for collection at the specified date and time designated by the autonomous districts. The collected amount by the autonomous districts makes up 10~15% of the entire amount of recyclables in Seoul. 85~90% are reported to be collected by private companies. The discarding locations are in front of the door, in vehicles and at designated points. In the case of Seoul, the apartment complexes use designated points and most of the other households use the places in front of doors.

The collected recyclables are then transported to sorting facilities and divided into paper, plastic, glass, metal and debris. The recyclables are sold and the debris is treated in the incineration facilities or buried in landfill. 14 sorting facilities are operated by the autonomous districts of Seoul, and the others are consigned to private companies. The expanded producer responsibility introduced in 2003 has greatly contributed to securing demand for low value items such as plastic containers, etc. The producers should collect some of their packaging materials from the distributed products and the amount of obligatory processing is increasing each year.

Scrap Metal Recycling Project

Seoul started the scrap metal reuse project from June 11th, 2009 for the first time in Korea. With this as a momentum, the Ministry of Environment and the Ministry of Trade, Industry and Energy along with other ministries established and announced policies on scrap metal recycling while Seoul had been leading the industry. To implement the scrap metal recycling, Seoul revised the Ordinance on Waste Management in June 2009 to remove the disposal fee for used small home appliances. It also supplied 6,165 collection boxes exclusively to collect used small home appliances in community centers and apartment complexes. In the case of detached houses, it was permitted to put used small home appliances in front of doors on the day designated for recycling.

Seoul had treated 8,820 tons of waste home appliances and 1.41 million units of used mobile phones from 2009 to December 2012. The collected materials were sold to earn KRW 6,968 million, of which KRW 758 million was

donated to the Community Chest of Korea and the Seoul Scholarship Foundation. Seoul established the SR Center to process used home appliances and mobile phones, and offered stable jobs to 53 socially disadvantaged people such as the disabled, homeless people, etc. Seoul collects used home appliances and mobile phones through joint campaigns with the autonomous districts and the SR Center disassembles them primarily by materials and sells them to metal resources collection companies. In the case of used mobile phones, the rare metals and so on are collected through melting process after detaching batteries.

<Table 8> Overview of Seoul SR Center

Classification	Description
Location	(Within car service center) 73-36 Songjeong-dong, Seongdong-gu, Seoul
Building Area	1 st Ground Floor, 810m ² (general steel frame structure)
Purpose of Building	Workspaces, Warehouses, Offices, Meeting Rooms, Lounges, Shower Rooms, etc.
Processing Capacity	3,600 tons of the used home appliances /year 700,000 units of used mobile phones /year
Recruited Manpower	53 people in total (low-income 19, disabled 6, single parents 3, homeless 7, the elderly 6, Ordinary people 12) ※ Authorized as a social enterprise by the Ministry of Labor in December 2011

Outcomes of Policy Implementation

Parks & Landscape

Parks & landscape policies of Seoul are implemented in two axes; ecological conservation and expansion of parks & landscape. Having concentrated on expanding the park areas, Seoul created Hangang Park, World Cup Park, Seoul Forest and Dream Forest Park in northern Seoul, etc., resulting in an increase of park area. The park area was increased by around 12% from 152km² in 1995 to 170km² in 2011. The share of park area in Seoul was increased by around 4% from 24.2% in 1995 to 28.1% in 2011.

<Table 9> Park & Landscape Management Results of Seoul

Classification	1995	2002	2005	2009	2011
Seoul Area (km ²)	627	605	605	605	605
Parks Area (km ²)	152	158	164	169	170
Parks Area (%)	24.2	26.1	27.1	27.9	28.1

Water Quality

Waterways in Seoul consist of the Hangang (River) and the several tributaries flowing into the Hangang. Therefore, the water quality of Hangang going through Seoul depends on the water quality of Hangang river water before it reaches Seoul, the water quality of the tributaries flowing into the Hangang and the water quality of effluent water from the 4 sewage treatment plants. Since the 1990s, the central government has exerted their efforts to improve the water quality of Hangang and its tributaries in cooperation with the autonomous districts along the Hangang and the non-governmental water quality monitoring organizations. However, it was not easy to improve the water quality as shown in the water quality of Jamsil whose BOD was 2.0 mg/L in 1995 and 1.9 mg/L in 2008. Thanks to the stepwise results of the advanced sewage treatment plants projects which began in 2007, however, the water quality has been improved dramatically so that the BOD of Jamsil area, the upper region of Hangang, became 1.1 mg/L, the BOD of Noryangjin area became 2.8 mg/L and the BOD of Gayang area, the lower region of Hangang, became 2.7 mg/L in 2011.

<Table 10> Biological Oxygen Demand (BOD) of Hangang (mg/L)

Classification	1995	2002	2005	2008	2011
Jamsil	2.0	1.8	1.4	1.9	1.1
Noryangjin	3.8	3.3	3.1	4.0	2.8
Gayang	4.4	3.4	2.9	3.6	2.7

Tap Water Production Capacity

The main concern of Seoul regarding the water supply projects in the 1990s had been how to ensure sufficient production facilities to supply water for living water, commercial water, industrial water and public water (fire-fighting water, etc.). In the 2000s, the main objectives were to reduce the leakage amount, increase the water flow rate (supplied amount/produced amount x 100) and to produce high quality tap water. As a result, the water flow rate which had been merely 61.9% in 1995 was greatly improved to 93.5% in 2011. As the water flow rate was enhanced, the total production in 2011 could be reduced to reach 66% of the production amount of 1995. In order to increase the water quality, the number of water quality inspection items, which had been 53 in 1995, was increased approximately twice in 2011 to 155.

<Table 11> Tap Water Management Status of Seoul

Classification	1995	2002	2005	2008	2011
Production Amount (Mil. Ton)	1,810	1,379	1,278	1,211	1,187
Water Flow Rate (%)	61.9	79.2	88.0	91.7	93.5
No. of Water Quality Inspection Items	53	105	145	145	155

Status of Air Quality

To suppress the pollutant emission to improve the air quality of Seoul, Seoul has implemented various policies such as prohibition of solid fuels, improvement of fuel quality, low pollutant emission of diesel vehicles, self car-free day, etc. However, the remarkable achievement was the fine dust (PM₁₀) control. The fine dust concentration, which was 68 $\mu\text{g}/\text{m}^3$ in 1997, was reduced to 41 $\mu\text{g}/\text{m}^3$ in 2012. In the case of nitrogen dioxide, etc., however, the improvement was slower. The concentrations of ultra fine dust (PM_{2.5}), nitrogen dioxide, etc. are likely to emerge as new goals in air quality management.

<Table 12> Air Quality Status of Seoul

Classification	1997	2001	2005	2009	2012
Fine Dust ($\mu\text{g}/\text{m}^3$)	68	72	58	54	41
Sulphur Dioxide (ppm)	0.011	0.005	0.005	0.005	0.005
Nitrogen Dioxide (ppm)	0.032	0.037	0.034	0.035	0.030

Waste Management

The core areas of waste management in Seoul were the construction of incineration facilities and the expansion of recycling. The main projects were the construction of 4 incineration plants and establishing the joint use of them with the neighboring autonomous districts, implementation of separate collection of the recyclables by implementing the volume-rate waste disposal system, and separate collection and recycling of food waste. As a result, the recycling rate, which had been 33.5% in 1997, was significantly improved to 65% in 2012, and the incineration rate, which had been 4.6% in 1997, was also improved to 27% in 2012 (The burning heat was taken back as energy). On the contrary, the frequency of landfill use was dramatically decreased from 61.9% in 1997 to 8% in 2012.

<Table 13> Household Waste Management Results of Seoul

Classification	1997	2001	2005	2009	2012
Recycling (%)	33.5	47.5	64.3	67.0	65.0
Incineration +Energy Recycling (%)	4.6	6.9	10.2	18.8	27.0
Landfill (%)	61.9	45.7	25.5	14.2	8.0

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