Climate-Resilient City, Bucheon

Region	**Asia and the Pacific**
Award Scheme	**Guangzhou Award**
Sustainable Development Goals	**Goal 11 - Make cities and human settlements inclusive, safe, resilient and sustainable**

Summary

The sewer tunnel construction to prevent urban flood inundation and the ecological river restoration are core projects to create resilient urban system against climate change. Having established private and public governance system in cooperation with the Ministry of Environment (MoE), the Korea Environment Corporation (K-eco) and private organizations, Bucheon City set its water vision as “sustainable water management in which people and nature can enjoy together.”

Background and Objective

After going through disasters resulting in 5,633 flood victims and property damages exceeding KRW 7.9 billion caused by heavy rain in 2010 and 2011, Bucheon City constructed a large-scale sewage storage tunnel (10m underground, 1.1km in length, and 4.3m in diameter) for the first time in Korea. As the sewer tunnel is equipped with rainwater storage function, it will guarantee to manage the heavy rain of 91mm per hour without flooding. It showed its sustainability when heavy precipitation fell about 70 mm per hour in 2017, creating economic effect of KRW 138.2 billion. As a result of restoration of the covered river (1in length) which roads run and under which sewage flows, a green space where ecology, culture and history are well-mixed in harmony was created for 870,000 citizens. This project has become a driving force of Bucheon City’s 100-ri (40) Waterfront Road project. Bucheon Dulle-gil-trail was connected to the waterfront road to make Bucheon City a city of healing where citizens can enjoy the Blue (water) + White (wind) + Green (green space) + Gold (soil) walking. The treated waste water generated from the sewage treatment plant began to be reused as the river maintenance water and the water quality class was developed from grade 6 to grade 2. The reason why Bucheon City has changed from a city where people want to leave to a city where people want to live in is because of the increasing eco-friendly green spaces with green forests where clean water flows between buildings in downtown.

BACKGROUND INFORMATION Bucheon City was selected as a pilot city in 2011 for the “Urban River Ecology Restoration Project” and in 2012 for the “Urban Flooding Prevention Project.” As indicated in the Paris Agreement in 2015 and UN’s Sustainable Development Goals in 2016, the projects are the ones which cities are the core parts of the climate change. Bucheon City established the “Bucheon City Safety Village Support Ordinance” for the first time in Republic of Korea to promote disaster prevention and life safety. ORIGINS Bucheon City is a satellite city of Seoul, capital city of Republic of Korea. With the influx of 260,000 people into Bucheon due to the new town development in the 1990s, Bucheon City grew into the second densely populated city after Seoul. The rivers were covered with asphalt to be used as roads and, as a result, the rivers turned into drying streams and water pollution got serious. Due to the urbanization and covered rivers, Bucheon City became a city with the highest impermeable ratio in Republic of Korea. It made a city to get flooded with water every year by its overflowing sewage. Bucheon City went through disasters resulting in 5,633 flood victims and property damages exceeding KRW 7.9 billion caused by heavy rain in 2010 and 2011. The key goal of this project is to create a sustainable “Water Cycle System” that can be realized in a city resilient to climate change, a city where waterways breathe, and a city where neighbors communicate with eachother. The Ministry of Environment has revised its guidelines in 2011 to raisethe design frequency from 10 years to over 30 years. The Ministry has also revised the “Sewerage Act” in 2012 in order to give financial support to the local governments for the “Urban River Ecology Restoration Project” and the “Urban Flooding Prevention Project.” Introduction of advanced technologies, reuse of sewage treatment water, rainwater storage and use, recycling of clean water along the whole basins by creating ecological rivers in downtown, and coexistence of people and nature are the core of the projects (2011~2017). Bucheon City signed on a MOU with the Ministryof Environment (MoE) and the Korea Environment Corporation (K-eco) to promotethe projects. Bucheon City took the role of supervision, MoE of budget support and K-eco of technical and administrative supports. A project consultative group was organized with the local residents, civic groups, City Council members, experts and public officials. As a result of having discussions, sharing worries, and solving problems, Bucheon City became a safe green space where ecology, culture and history are mixed well in harmony for 870,000 Bucheon citizens. 60~70% of the project cost (a total of KRW 86.2 billion) was borne by MoE and 30~40% was borne by Bucheon City. 5,000 citizens donated floor stones and tiles. River purification activities are performed by a system in which 251 citizens from 11 civic groups are voluntarily participating.

Outcomes and Impacts

This project goes with the new urban management paradigm in the 21 century that nature and people coexist. As there was no flood damage even with the rainfall of 70 mm/hr in 2017, it was analyzed that the economic effect reached KRW 138.2 billion. The water quality was improved from 58.8 mg/L to 2.2 mg/L as BOD (Biological Oxygen Demand) analysis, and 47mg/L to 4.5 mg/L as COD (Chemical Oxygen Demand) analysis. 19 species of birds and fishes, 31 kinds of insects and crustaceans, 37,945 trees in 18 species, and 113,720 herbaceous flowers in 20 species inhabit in the area. The temperature in the summer was reduced by around 3?, and the value of real estate increased by 15~27%. The “Bucheon 100-ri (40km) Waterfront Road Project (2015~2018)” is under promotion and it will be a new representative brand of Korea as a leisure and rest space for citizens. Various indicators are adopted to assess the success of the project. It measures the water quality by section andmonitors water ecology twice a month. It posts the water quality results, temperature changes, and plant and animal changes on the website. According to the waterways and urban temperature distribution, the temperature of the areas within around 100m of range from the waterways is lower than the overal ltemperature of the whole city. To facilitate the implementation, iIt developed optimal cost and effectiveness method using the dual drainage system simulation technique. The sewer tunnel was constructed using the TBM (Shield Tunnel Boring Machine) technology so that the 1km long tunnel could be made 10m below ground without blasting to solve the transportation problems and to secure the safety of workers and citizens. Real-time operation & management system (RTC) analyzes the weather forecastand the measured data to predict the flood information. The river was restoredas a natural ecological river in which sand is deposited naturally. By usingthe treated waste water, clean water in Grade 2 in water quality standard couldbe used. Beacuse of this project, Bucheon City was selected as an excellent city in the category of the ecological river restoration (Ministry of Environment), an excellent institution in the category of beautiful small river (Ministry of Public Safety and Security), and a city with Gyeongin Hot Item (Gyeongin Ilbo) in 2017. It has been introduced as a rest place for citizens, a space forecological environment experience, and a space for exhibition and cultural activities through various events and broadcasting of SBS and OBS, and has become a landmark of Bucheon City as it brought a big revolution in the urbanparadigm in Republic of Korea.

Innovative Initiative

The project is an evolutionary business case. In order to avoid the simple restoration-oriented maintenance works after flooding damages, Bucheon City introduced the tunnel-typed sewer pipe (D=4.3m, L=1.066km, Storage Capacity=15,473 tons) with water storage and automatic control functions. TMB (Shield Tunnel Boring Machine) technology was adopted for the first time in Republic of Korea and the sewer tunnel of Bucheon City constructed by using the technology was the first case in Republic of Korea. The ecological river restoration project has developed the experience and know-how of the “Urban Streamlet Project” implemented in 2000 by reusing the treated waste water. It is an ecological river, rather than an artificial one, that has been restored to its original river bed 31 years ago by removing the concrete structure from the river. The treated sewage water in Grade 2 in the water quality standard is used as the maintenance water flow. Based on the experience and know-how of the “Urban Streamlet Project” implemented in 2000, Bucheon City referred to the overseas cases of US, Japan and France as well as the domestic ones. It reached a conclusion that creating the waterfront spaces utilizing the existing resources would be the project that could increase the value of Bucheon City. It revised the project guidelines and the Sewerage Act in order to prepare for the foundation for policy making and financial support to cope with climate change. By setting up the concept through storytelling, it created an amenity space where history and culture coexist, exceeding the simple level of restoration. Furthermore, it is implementing a project titled “Bucheon 100-ri (40km) Waterfront Road Project (2015~2018)” connecting 5 rivers by themes to create a “Bucheon city where citizens like to walk along the waterways.” The innovation of this project can be applied to various policies and administrative promotion such as establishment of environmental polity to cope with climate change, use of amenities in the urban areas, balanced city development, introduction of accidents/disaster prevention system, and realization of green city for improvement of water circulation system. The typical examples of conflict were transportation problem solving and urban flood prevention measures. Bucheon City held 35 times of brief sessions for 1,300 residents for 6 years. It placed the project department in the field, organized consultative groups with residents, and established private-public governance system. In order to solve the transportation problem at which residents got most angry, it secured detour roads during the construction period, newly installed parking lots with 77 spaces, raised the design frequency from 20 years to 80 years to improve thedimensional stability.

Conclusion

First, change to the sustainable urban paradigm. It refers to the transition of a city from development-oriented and car-centered city to a people-centered city where nature and people coexist, being a new urban management paradigm in the 21stcentury. Second, recovery of the ecological environment. As citizens’ interests in life quality have been increasing in recent years, the eco-friendly urban design has been globally continued. In addition to the restoration of ecosystem that allows clear water to flow, Bucheon City has been transformed into an eco-friendly city well blended with nature. Third, the balanced regional development. As Bucheon City has been changed to a city safe from the urban flood inundation and with high growth potential, the surrounding aged areas are actively developed. Bucheon became not only a city of balanced urban development but also a competitive city. Fourth, the birth of space of ecology, culture and history. Various spaces of history including “Pillars of the Years” were created. It became a space of leisure and rest

for citizens with festivals and international events. Cultural streets with cafés and cultural handicraft workshop have been created. The promotion process of the restoration project can be found on the promotion hall, on the Internet and via books. Domestic and overseas PR activities have been carried out through various cultural events and many media reports. RELEVANCE TO SUSTAINABLE DEVELOPMENT GOALS Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable Target 5: Reduce deaths and number of people affected by disasters with particular focus on the poor and people in vulnerable situations Target 7: Universal access to safe, inclusive and accessible green and public spaces, in particular of women, children older persons and persons with disabilities Target 9: Improving resource efficiency, mitigation and adaptation to climate change, resilience to disasters and implement holistic disaster risk management Goal 13: Take urgent action to combat climate change and its impacts