The Four Major Rivers Restoration Project

Yoon Jung Cha, Myung-Pil Shim, and Seung Kyum Kim, Office of National River Restoration

Type of tool: water planning
Issue: watersheds
Location: South Korea, Asia

Challenges

The project is designed to address the significant environmental challenges faced by the Han, Nakdong, Geum and Yeongsan rivers in Korea. Repeated flooding and droughts have caused human casualties, ecosystem loss and habitat degradation, property damage and forced displacement of riverine residents. Extreme weather events that lead to flooding and droughts are expected to worsen in frequency and intensity due to climate change impacts. In the case of the Yeongsan River, toxic contamination from domestic and industrial waste disposal has resulted in water quality levels unfit even for agriculture and industrial use. These environmental challenges have dramatic economic consequences.

In Korea, cases of torrential rainfall over 100 mm in a day have increased by 1.7 times during the last 10 years. In 2002, Typhoon Rusa brought record-breaking rainfall of 870 mm a day in Korea. Moreover, torrential rainfall is expected to increase by 2.7 times and droughts are expected to become 3.4 times more frequent in the near future.

The annual average precipitation of Korea is 40% greater than the world average. However, the amount of water available per capita in a year is only about 12% greater, because two-thirds of the annual rainfall occurs during the rainy season from June to September, and almost no rain occurs in the dry season. As a result, disasters caused by repeated floods and droughts used to be commonplace. In addition, the river reaches in Korea are relatively short and channel slopes are steep. Therefore, flooding occurs quickly, peak flood discharges are great, and flow variations are comparatively large.

Objectives

The goal of the Four Major Rivers Restoration Project of South Korea is to restore the Han, Nakdong, Geum and Yeongsan Rivers and to provide water security, flood control and ecosystem vitality. The project will prevent natural disasters such as floods and droughts, protect the environment and promote historical and cultural tourism. The project will result in the creation of many new jobs, furthering economic growth and broadening the horizon of Korea's green growth initiative.

The Four Major River Restoration Project consists of three sets of projects: (1) Main projects – the Han, Nakdong, Geum and Yeongsan rivers revitalisation projects; (2) projects on the 14 tributaries of the four major rivers; and (3) refurbishment for other smaller-sized streams. The project has five key objectives: (1) securing abundant water resources against water scarcity; (2) implementing comprehensive flood control; (3) improving water quality and restoring ecosystems; (4) creation of multipurpose spaces for local residents; and 5) regional development centred on rivers.

This project was first announced as part of the "Green New Deal" policy launched in January 2009. It was later included in Korea's five-year national plan released in July 2009. The Four Major Rivers Restoration Project systematically approaches its objectives of restoring the rivers. As a comprehensive public project, the programme includes a variety of plans submitted by several ministries, but coordinated by the Office of National River Restoration under the Ministry of Land, Transport and Maritime Affairs.

Drivers of change and project initiation

The Four Major Rivers Restoration Project is a comprehensive, pan-governmental project, representing the planning commitment of several Korean governmental ministries to work together to restore the Han, Nakdong, Geum and Yeongsan rivers.

The roles of each Ministry in subsequent projects are as follows:

- The Ministry of Land, Transport and Maritime Affairs: Restoration of the four rivers and local tributaries
- The Ministry of Culture, Sports and Tourism: The “Rivers of Culture” project
- The Ministry of Knowledge Economy & Korea Communications Commission: Production of new and renewable energy and information technologies
- The Ministry for Food, Agriculture, Forestry and Fisheries: The “City of Beautiful Scenery” project, known in Korean as “Geum-Su-Gang-Chon,” and maintenance of forests in the upstream watersheds of the four rivers
- The Ministry of Public Administration and Security: Restoration of small branch streams flowing into the four rivers.

At the level of planning and even during project implementation, the government set expert advisory groups from seven different fields: senior committee meeting, policy advisory meeting, water resources, water quality, ecology and environment, landscape, culture and tourism, and local development. The advisory groups consist of professors, specialists, academics, and local

representatives. In addition to the operation of the expert advisory group, the government gathers NGOs such as religious groups, environment groups, local citizens associations, etc. on a regular basis to discuss and gauge opinions.

From these participatory processes, twelve cities and provinces submitted 836 recommendations worth 98.3 trillion KRW. 213 river-related cases worth 6.9 trillion KRW that were coherent with the master plan were incorporated into the Four Major Rivers Restoration Project at the beginning. Examples are dredging sediments, fortifying existing levees, and restoring ecological rivers.

The government has taken the following steps toward implementation:

1) Dec. 2008. The Project was commenced at the Presidential Committee on Regional Development as part of the "Green New Deal Project." A master plan was drafted by the Korea Institute of Construction Technology and the Korea Culture and Tourism Institute. The first projects were launched: December 2008 in Andong and Naju, February 2009 in Chungju, and March 2009 in Busan.

2) Feb. 2009. The Ministry of Land, Transport and Maritime Affairs established a joint task force comprised of several ministries to supervise the restoration as a comprehensive pan-governmental project. The Project has since developed as follows:

    - In April 2009, the task force, which had operated at the directorate level, became the Office of National River Restoration at the ministerial level to improve relations and communications among the participating ministries.

    - The Association for Government Support at the Office of the Prime Minister began operations, along with the Local Government Association of the Four Rivers, which collects input from local communities.

3) April 2009. A joint briefing was convened with three committees and the four participating ministries and government agencies.

4) May 2009. A series of regional conferences and forums were held with public officials, experts and distinguished guests.

5) June 2009. The Master Plan for the Four Major Rivers Restoration Project was published.

6) Dec. 2009. Ground-breaking ceremonies were held.

The approach: how the Four Major Rivers Restoration Project addresses the challenges

The Four Major Rivers Restoration Project comprises the following activities to achieve its five objectives:

- *Water storage.* The project will aim to secure sufficient water quantities by building waterways and 16 weirs. These 16 weirs are expected to secure 800 million cubic metres of water. The project will increase peak water levels of 96 agricultural reservoirs so as to secure 250 million cubic metres of water. Additionally, the construction of three small and medium size multipurpose dams is expected to yield another 250 million cubic metres of water. These infrastructures will enable the storage of water needed during the dry season. By dredging riverbeds, the flood water level will decrease, and the water flow capacity will increase significantly. This will significantly reduce annual floods and the damage they cause.

- *Flood control.* Flood control measures involve an expansion of the water gates of tributaries, allowing a quick water level decline and fast draining of flood. In addition, two flood-control areas and three underflow areas of riversides will together expand the flood control capacity up to 920 million cubic metres of water.

- *Water quality and ecological restoration.* By 2012, the water quality of the mainstream will be improved to an average of level two (Biochemical Oxygen Demand less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. Moreover, the ministry is trying to restore ecological rivers, create wetlands, and relocate farmlands in the rivers to rehabilitate the river ecosystem.

- *Creation of multipurpose spaces for local residents.* To create the riverfront as a multipurpose area for improving lifestyle, leisure, tourism, cultural activities, and green growth, bicycle lanes (1,728km) will be developed, hands-on tour programmes will be promoted, and walkways and sports facilities will be expanded.

- *River-oriented community development.* The project will also contribute to regional development through various plans that utilise the infrastructure planned in the project and the scenery. The examples are ‘our major rivers that flow with culture’ of the Ministry of Culture, Sports, and Tourism, and ‘Creating a vivid land of beautiful scenery’ of the Ministry for Food, Agriculture, Forestry, and Fisheries.

The implementation of the project follows three phases. In phase 1, approximately KRW 16.9 trillion will be spent on the 'main project' dredging operations, and building dams and reservoirs on the four major rivers. Most of the main projects are planned to be completed by 2011; projects for dams and reservoirs for irrigation will be completed by 2012. In phase 2, another KRW 5.3 trillion will be invested on improving water flow and sewage systems of tributaries. Projects for the development of Sumjin River and other tributaries to the four rivers would be completed by 2012. Phase 3 includes restoring local and small rivers, and developing cultural and tourism attractions around the four major rivers. The Ministry of Culture, Sports and Tourism is involved in this phase.

The Office of National River Restoration under the Ministry of Land, Transport, and Maritime Affairs is the lead agency for the project. In the implementation of the project, the office will operate in cooperation with the Ministry of Culture, Sports and Tourism, the Ministry for Food, Agriculture, Forestry and Fisheries, the Ministry of Environment and the Ministry of Land, Transport and Maritime Affairs.

Assessing the environmental impact of the project

The Korean Government conducted an environmental impact assessment (EIA) of the Four Major River Restoration Project in order to assess the potential effects of the project and to devise response measures. The results of the EIA were announced on November 6, 2009.

The Environmental Impact Statement (EIS) was prepared by the Regional Construction Management Administration after collecting opinions from various stakeholders. The EIS includes the anticipated and assessed environmental impacts. The draft was shared with the local residents, environmental organisations, and relevant experts to gather diverse opinions for 20 days. The EIS was then submitted to the Regional Basic Environmental Offices, under the authority of the Ministry of Environment. To verify feasibilities of the EIS, Korea Environment Institute (KEI) and the Environmental Assessment Team comprised of independent experts were entrusted for review of the EIS. The final EIS agreement was set after the opinions of KEI were considered. The final EIS, agreed by the Regional Basic Environmental Offices and the Regional Construction Management Administration, covers four categories (ecosystem, natural environment, water quality, and others).

On ecosystems, the assessment identified around 68 legally designated protected species and natural treasures that may be affected by the Four Major River Restoration Project. The assessment concluded that direct impacts would be minimal if mitigation measures are implemented. Measures planned include an adjustment and reduction of the intensity of the

construction work during the winter time when migratory birds arrive. Small size habitats such as small rivers corridors and food places will be created to provide sanctuaries and places for laying eggs. In addition, green belts will be constructed to provide additional habitats for animals to live in a natural environment.

With regard to the natural environment, the assessment mainly addressed potential risks to wetlands that surround the four rivers. It was found that out of 100 wetland sites located in the project area, 54 wetlands may be directly or indirectly affected by the project. These 100 wetlands cover 12.5 per cent of the total area which will be affected by the project. Considering the ecological functions of the wetlands, the Korean Ministry of Environment decided to conserve wetlands that have high ecosystem value. Parts of the wetland areas that are likely to be affected are compensated for through the construction of man-made wetlands. As a result, after the four major rivers projects, a total of 84 alternative or new wetlands are expected to be created and ecological and environmental functions of the rivers are expected to be improved. In addition, lower river ways will be created with mild slopes of 1.5 ratio so as to lead to a natural creation of wetland areas after the completion of the projects.

Regarding water quality, Korea's National Institute of Environmental Research, which was entrusted with an assessment of water quality, concluded that water quality will generally be improved as a result of the project. It has been estimated that pollution from mud that may occur during the construction phase will not lead to weighted density (by standard of dry season) of more than 10 mg/litre. In the case that floating matters exceed 15 mg/litre, it is planned that the construction period and intensity will be adjusted and that additional pollution reduction facilities will be installed. As 570 million of cubic metres of dredged materials will result from the dredging of the rivers, there is a plan to create a sedimentation basin and a diversion waterway will be installed at the storage yards of the dredged material in order to prevent secondary water pollution. The Korean government is considering options for a differentiated use of the dredged material according to the grain size and the level of contamination.

The Korean Ministry of Environment has the responsibility to ensure follow-up and implementation of the conclusions of the IEA. In that process, the existing Environment Evaluation Board will be transformed into a Post-management Investigation Commission after a re-composition of its membership. The future Post-management Investigation Commission will be entrusted with monthly investigation, monitoring and inspection of the implementation of measures to mitigate identified environmental effects.

Main implementation barriers that were overcome

Political opposition was a major challenge faced by this project. The opposing political party utilised environmental groups and NGOs to voice opposition to the project. Continuous communication, education and public relations were the main tools used to overcome the barriers. More than often, opponents had wrong information about the project; providing the correct information with project briefing and data helped to gain understanding and acceptance. Establishing a project advisory group with regional citizens, professionals, and academics has provided a means to gather the views of stakeholders.

A dispute started to arise when environmental societies asserted that the rare wild plant 'Danyang aster helophyllus' only found around the Southern Han River was threatened with extinction because of project constructions. The ecoactivists have called for the closure of the project. The wild plant is classified as the 'Endangered Species Plant 2nd Grade', being the biennial plants of Asteraceae Class. However, the Office of National River Restoration officially announced on 2 May 2010 that there was no founded danger of extinction even for 'the Danyang aster helophyllus' (Danyang Ssukbujaengi) due to implementation of the project.

The Gangcheon Isle, Gangcheon-myeon, Yeoju-gun, Gyeonggi-do (province) is located inside of the construction area of 'the 6 Sector' of the Project. There is a plan to create a 'Nature Ecological Experience Park' with protected wild species including 'the Danyang aster helophyllus'. The government also announced an official plan for their preservation in all the habitats except the area that will be inevitably damaged in the creation of an artificial stream. This indicates that both government and constructors have environmental values, recognising the importance of protecting endangered species like 'the Danyang aster helophyllus'. The government and constructors designated the habitat bed as 'reservation area' so that with visible boundaries, damage from construction activities is minimised. Presently 'the Danyang aster helophyllus' is waiting mass proliferation due to the successful research for proliferation by the authorised institutes of 'Hwanghak Mount Arboretum', 'Pyeonggang Botanical Garden', 'the Botanical Garden of Shingu University', 'Danyang Technical Center of Agriculture', and a private farm in Danyang county (all the spots have the permissions from the Ministry of Environment under the Clause 14 of the Endangered Species Act). Provided that soil condition meets the standards level, this plant can grow well.

At the end of 2010, Buyeo County conducted a survey with approximately 12,000 residents to gather their views on the appropriateness of the project. The survey revealed that 70% voted in favour of the project. Also 70% answered that they were aware of the project, suggesting that those who knew about the project voted in favour of it. It seemed that the remaining 30% did not have appropriate information on the project.

Effective contribution expected or already delivered to green growth

The project seeks to achieve, by 2012, a 90 percent increase in water quality (BOD less than 3ppm) by expanding sewage treatment facilities and establishing green algae reduction facilities. In terms of adaptation strategies to climate change and sea level rise, federal and local governments are bound to maintain an adequate level of salinity concentration to protect drinking water supply and other water usages. In order to monitor water quality, Korea's Ministry of Environment is expanding the existing Tele-Monitoring System (TMS) to 586 sewerage and waste water treatment facilities by the end of 2009. This includes 323 sewerage facilities, 58 waste water treatment facilities, and 205 operating sites.

On ecosystem restoration, an Eco-river Restoration Program (ERP) initiated in 2008 is being implemented in the context of the Four Major River Restoration Project. One of the ultimate goals of the program is to restore indigenous and endangered aquatic species and maintain the quality of water and ecosystems. The other national program to restore freshwater ecosystems is to develop an aquatic ecosystem-monitoring network. Since 2007, preliminary field surveys have been conducted at more than 540 locations. More than 929 km of national streams will be restored as part of the Four Major River Restoration Project. A follow-up project will be planned by 2010 to restore more than 10,000 km of local streams. More than 35 riparian wetlands will also be reconstructed. Riparian areas will be afforested or reforested, and will also be used for biomass production.

Finally, the project seeks to support regional economic development. This is pursued through the creation of multipurpose spaces for cultural and touristic activities near rivers which are expected to contribute to job creation and local economic revitalisation. Overall, it is expected that the project will create 340,000 jobs and generate an estimated KRW 40 trillion of economic benefits.

- 340 thousand (340,000) jobs created by the project is calculated from the project as a whole including major projects by several ministries (MLTM, ME, MA, Etc). The number includes direct and indirect employment inducement effect. In addition, Korean government is expecting that there will be more new jobs created in leisure, tourism, cultural industries, etc by this project.

- The number is calculated based on the Construction Employment Induction Factor from the Bank of Korea (2006) which provides the most objective data.

- The Ministry of Land, Transport and Maritime Affairs, initially in the presentation of the master plan, estimated job creation in the whole industrial field to be 340,000 (Ministry of

Land, Transport and Maritime Affairs: 231,142 / Ministry of Environment: 67,236 / Ministry of Agriculture: 40,098) with application of 'the coefficient of employment induction' (17.3 per 1000 million people) of 'Korea Bank'.

Evaluation of benefits already delivered

A typhoon in June proved the Four Rivers 'flood-proof'. It was predicted that this year's summer would have more frequent torrential rainfall with a larger amount of rain than average. As the first 'attack', the Typhoon Meari in June and the subsequent rainy season were enough to make those involved with the project tense and nervous. Paradoxically, this torrential rainfall became a good opportunity to demonstrate the effect of the project. From June 22 to 27, it rained a total national average of 207.7 mm. This is equivalent to 20 billion ton reaching 17% of annual rainfall. Despite the concerns about safety on the sites of the Four Rivers, damage turned out to be meagre. Particularly, the northern area of Gyeongbuk Province, Daejeon and some areas of Chungcheong region had no considerable damages. This is due to the effect of lowered flood level achieved from dredging.

The sites have already experienced lowered flood levels from dredging 420 million m^3 soils. According to a survey of Ministry of Land, overall water levels have been lowered: 2.55 m in Yeoju (the Han River), 3.5 m near Sangju (the Nakdong), 0.84 m in a vicinity of the Buyeo Weir, and 1.12 m near the Seungchon Weir of the Yeongsan River. The construction of weirs will be completed by late June or July, so the condition of flood prevention can be said to be improved. As for devastating flood damage, the safety level has been dramatically elevated. Before the typhoon and rainy season came, the sites were fully prepared. Cofferdams and construction roads were taken away. Meanwhile, riverbed maintenance structures (structures for preventing erosion of the riverbed) were completed to be installed. Waterfront parks under construction were accelerated in its final touch. By late June, dredged soils piled up on the terrace land of the river were moved outside of the riverside area in order to prevent them from crumbling and also to secure more space for water flow.

There have been significant economic benefits derived from the project due to job creation. According to the Ministry of Labour (at an employment policy inquiry commission, Press Center, Seoul, 30 June), an analysis shows employment effects to be equivalent to KRW 7.37 trillion from 2009 to 2010 for 2 years, creating job opportunities for 88,400 workers. Those were fewer amounts (11,852 – 11.8%) than the 10,252 released from the master plan of the Ministry of Land. However, since the Four Major Rivers Restoration Project consists of complex processes including civil engineering, construction, landscape architecture and more

technologies, the employment induction effect in other fields might compensate the gap. In addition, the Korean government is expecting that there will be more new jobs created in leisure, tourism, cultural industries, and so on, by this project.

We have been making the participation of local construction companies mandatory, and advising the clean allocation of constructions for the local subcontractors. This will ultimately provide support to local economies.

The Korean Government has identified several policy tools to maximise local development potential through the river restoration initiative. The Master Plan mandates that local companies should account for at least 40% of all joint ventures (with the exception of turn-key projects, which require 20% participation of local companies). Currently, 187 of 338 companies (55%) are implicated in the project. Specific lots have been consigned to the local government; as of March 2011, local governments are coordinating nearly a quarter of the lots associated with the project.

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