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Four Major River Restoration Project of Republic of KOREA

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Summary

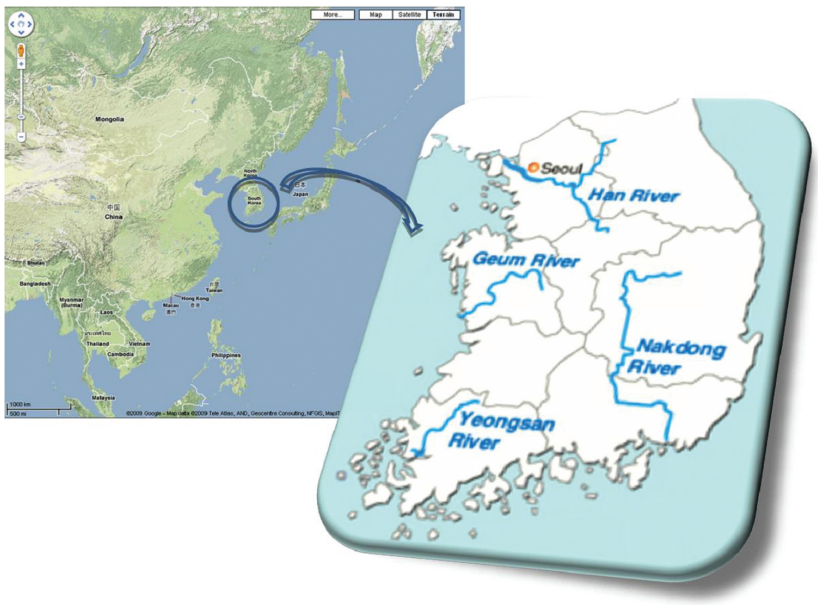
One of the greatest environmental threats to the entire world is water shortage, water quality degradation, and ecological disturbance. Last year, Republic of Korea proclaimed a national vision, 'Low Carbon Green Growth', and the 'Four Major River Restoration project' has been initiated as an important implementation tool of the green new deal. The 'Four Major River Restoration Project' is prepared to achieve the following five core tasks: 1) securing water supply, 2) flood control, 3) water quality improvement and ecosystem restoration, 4) development of spaces for cultural and leisure activities, and 5) regional development around four major rivers. Specifically, river water quality in 83~86% of four rivers will be enhanced to 'Grade II (BOD ≦ 3 mg/L)' by 2012.

The 34-polluted watersheds are selected, and investments will be made to 5 core areas among the selected riparian areas. In addition, the Four Major River Restoration Project is expected to stimulate local economy.

I. Background

The World is now facing serious environmental and economic issues. The financial crisis has led to global economic stagnation and unemployment caused by the recession which may cause serious social and economic problems. On the other hand, rapid climate change, which is already in progress, represents one of the greatest environmental threats, including water shortage, water quality degradation, and ecological disturbance, to the entire world. In order to overcome these challenges, a new and comprehensive policy and implementation plan should be implemented. In the last year, the Republic of Korea proclaimed a national vision, 'Low Carbon Green Growth'. The vision pursues economic and social developments in consideration of environmental value. Under the vision, a 'Green New Deal (GND)' strategy was devised with 5-year action plan. GND pursues sustainable economic growth by developing low-carbon and eco-friendly industries. To be more specific, the GND project includes job

Figure1. The Four Major Rivers in KOREA.



creation policies as well as green development strategies involving low-carbon, eco-friendliness, and saving resources, etc.

As an important part of the GND project, the 'Four Major River Restoration project' has been initiated. The four major rivers (Han, Nakdong, Geum and Youngsan Rivers) have been an important driving force of both agriculture and industries in Korea. Repeated damages caused by floods and droughts may likely occur more frequently because of climate change. About 15.7 million people, 33.2% of Korean population, live in the neighborhood of the four major rivers. Five metropolitan cities (Seoul, Busan, Daegu, Gwangju, and Daejon) as well as 24 small-to-medium size cities are located near the four major rivers. If a severe flood occurs at the four major river basins by the extreme rainfall event, such as Typhoon Morakot in Taiwan, the human injuries and the property damages will be beyond conception.

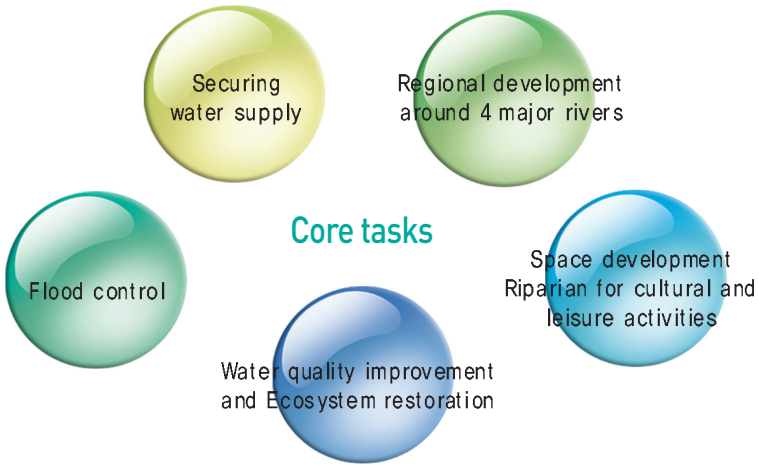
As such, fundamental measures to address these issues are necessary. Although the impact of flood damage is increasing, previous investments for prevention measures are very likely insufficient. It is expected that Korea will be short of 800 million m^3 of water by 2011. On the other hand, the river water quality is worsening during dry period of the year in spite of the investment on the environmental infrastructures. The 'Four Major River Restoration project' has been planned to mitigate the impacts of climate change on rivers as well as to improve the river environment. The master plan of the project was completed on July, 2009 through series of public hearings and expert group meetings.

In this article, the five core plans presented at the master plan will be first highlighted and then water quality enhancement plans will be mainly introduced in details.

Ⅱ. Outline of the Project

The 'Four Major River Restoration Project' is prepared to achieve of following five core tasks: 1) securing water supply, 2) flood control, 3) water quality improvement and ecosystem restoration, 4) development of spaces for cultural and leisure activities, and 5) regional development around four major rivers (Figure 2).

Figure2. Five Core Tasks of the Four Major River Restoration Project.



1. Securing water supply

In Korea, it is anticipated that 800 million m^3 of water will be deficient by 2011 and 1.0 billion m^3 will be insufficient by 2016. To secure 1.3 billion m^3 of additional water supply, diversion weirs, dams and reservoirs for irrigation will be constructed for drinking water, in-stream flow, irrigation and so forth.

Sixteen dammed pools will be built in four rivers and provide 800 million m^3 of water. Multipurpose small-to-medium-sized dams will be constructed, too. On the Nakdong River, Songriwon Dam and Bohyoun Dam will be built, and Andong Dam and Imha Dam will be connected to store additional 250 million m^3 of water. In total, 96 reservoirs for irrigation will be extended, and they will sustain 250 million m^3 of water.

2. Flood control

Climate change may very likely cause intense precipitation at local and/or regional level in the future. To prevent potential flood damages, 200-year frequency flood control will be implemented, and flood control storage will be enhanced by 920 million m^3, and 570 million m^3 of river sediment will be dredged. Then, the water flow capacity will be enhanced and peak water levels which occur during floods can be lowered by 0.4 to 3.9 m.

As described earlier, two-flood retention facilities, three-riparian detention and storage areas, and three dams will be constructed, and 96 reservoirs for irrigation will be

extended. In addition, 620km of outworn river banks will be reinforced. To discharge the flood water at estuaries, more estuary dikes will be constructed along the Nakdong and Youngsan Rivers. When completed, flood water levels will decrease by 0.9~3.9m and 0.4~1.5m in the Nakdong and Youngsan Rivers, respectively.

3. Water quality improvement and ecosystem restoration

In light of the above mentioned plans, water quality is expected to improve, and ecosystem restoration will be carried out. More specifically, river water quality in 83~86% of the four rivers will be advanced to Grade II(BOD < 3.0 mg/L) by 2012. Furthermore, the 34 polluted watersheds are selected, and investments will be made to 5 core areas among the selected riparian areas. The distribution percentage of the sewage system will be extended to greater than 91% until 2012. Farmland on river flood plains are a major non-point source of nutrients and pesticides. Furthermore, small rivers directly connected to the four major rivers will also be improved.

4. Development of riparian space for cultural and leisure activities

To promote leisure, tourism, and culture, multipurpose areas will be created for citizens around the four rivers. In total, 1,743 km of bike paths will be constructed according to the master plan. In addition, waterfront areas will be utilized as sports facilities, leisure areas, riverside tracking paths, etc. To promote regional development, various sub-projects are included in the master plan. Ministry of Culture, Sports and Tourism (MCST) will restore cultural and historic sites and utilize them as tourists attractions. Ministry of Food, Agriculture, Forestry and Fisheries (MIFAFF) will improve rural areas and construct agricultural complexes. In addition, region-specific development projects which were proposed by local governments are also included in the master plan.

5. Regional development around the four major rivers

The 'Four Major River Restoration Project' reflects the characteristics of each river. For the Han River, flood control policies of the South Han River will be implemented and leisure tourism will be emphasized. To prevent flood damages and water shortages, dredging and dam construction will proceed. For the Geum River, the restoration of cultural and historic sites, as well as ecosystem recovery will be carried out for regional development. The water quality of the Youngsan River will be improved and flood control policies will be implemented.

Ⅲ. Environmental Enhancement Plans in the Four Major River Project

1. Improvement of river water quality

According to the master plan, 83~86% of river water's quality will be improved to 'Grade II' (biochemical oxygen demand (BOD) ≦ 3 mg/L) by 2012. In addition, Ministry of Environment will make significant efforts and investments on mitigating chemical oxygen demand (COD), total phosphorus (TP), and non-point source pollutants.

1) Focused management on the important basins

Original long-term plan for improving 86% of river water's quality to 'Grade II' by 2015 has been shortened to be accomplished by 2012 and the endeavor will be focused on TP management. The 34 watersheds at the four major rivers are selected as important basins and further classified to highest priority-, core- and focused-management basins. There are 5 highest priority management basins whose COD, TP, and BOD level is high. The 11 core management watersheds are located at the upstream of drinking water source. Other 18 watersheds are designated as focused management basin.

2) Establishment of river water quality criteria on COD and TP

After reviewing the current river water quality data, the possibility of achievement and criteria of foreign countries, the river water quality criteria on COD and TP will be revised.

Current river water quality criteria are divided to 7 grades and the criteria for COD and TP will be 2-11 mg/L and 0.02-0.5 mg/L, respectively.

3) Enforcement of wastewater discharge criteria

The wastewater discharge criteria will be improved and segmented to Region I, II, III after 2012. Region I will be the areas where drinking water sources locate. Region II will be the 34 watersheds, and Region III will be other four major river watersheds. Because the conventional biological treatment process cannot meet the enhanced TP maximum permissible concentration, chemical treatment and filtration process will be established in wastewater treatment plants (WWTPs).

4) Enhancement of environmental infrastructures at the important basins

The Government will enhance and/or

construct 740 WWTPs including 390 advanced wastewater treatment facilities. About 9,800 km of sewage network will be repaired; 40 industrial WWTPs and 140 advanced treatment processes will be constructed. In addition to that, 30 public treatment facilities will be prepared and improved for livestock manure.

5) Enforcement of Total Maximum Pollution Load on TP

Now, total maximum pollution load (TMPL) is enforced only to BOD. However, TP will be incorporated in TMPL. Among four major rivers, 3 rivers are ready to enforce TMPL of TP, and another river, Han River, is under revision.

6) Non-point source management

At the upper river basin, the runoff from the farm fields at mountains significantly impacts dam and river water quality. 'Zero muddy water' project will be carried out from 2009 to 2011. At agricultural areas, puddles, green lands and wetlands will be created to control the non-point source. At urban areas, 24 detention ponds will be constructed at the 34 watersheds by 2012, and the combined sewage overflow will be detained and treated prior to discharge. The infiltration and storage system of rain water will be constructed at 61 sites.

7) Restoration of eco-river

The eco-river restoration is composed of 3 projects-urban stream restoration, local stream restoration and revitalization of streamlets. Twenty streams in urban will be restored to provide waterfront space for the citizen. About 223-local streams will be converted to ecologically abundant spaces. About 500 streamlets will be restored in accordance with the local characteristics.

8) Creation of Riparian Eco-belts

The riparian buffer areas prevent the direct influx of non-point source pollutants into the river water. The Government will purchase riparian land and create 8.1 million m^2, mainly at the upstream area. After the Four Major River Restoration Project, the restored river can be used for the education of water conservation, wet land, bird observation and river ecology.

2. Securing clean and safe drinking water

To secure the drinking water quality, the management of industrial wastewater will be reinforced. The priority pollutant list of wastewater will be extended. Maximum permissible concentration will be established to

the currently unregulated contaminants such as 1,4-dioxane. The prevention and surveillance of water pollution accident will be strengthened.

About 104 of chemical treatment facilities including detention ponds will be constructed at industrial complexes to prepare for the unexpected discharge of polluted water. Since 2010, water quality Tele-Metering Systems (TMS) will be extended to about 600 sites including WWTP and major factories. Automatic water quality measurement network will be expanded to 81 sites by 2012. Direct water-intake system from river will be examined to transform indirect water-intake such as river bank filtration, river-bed filtration, groundwater dam etc.

3. Management of the environmental impacts of the project

Because the construction and maintenance works will be carried out at rivers, water pollution and damages on aquatic ecosystem are serious concerns. The Government, especially Ministry Pollution Control Center' to effectively respond to the water pollution accidents.

Seven warehouses with four Water Pollution Control Centers(WPCCs) will be stationed around the construction areas. On-time monitoring system is also established.

As mention above, TMS will be installed at 600 sites to observe the quality of water stream discharged from factories. The automatic water quality measurement networks will be installed at 53 sites throughout the major rivers and tributaries.

When the project begins, surveillance by eight aircrafts will be carried out too. Once the water pollution accident occurs, emergency response from WPCCs will initiate the emergency response action and cooperate with local governments, military and firehouse authorities.

2) Pollution accident prevention manual

MOE published 'Pollution Accident Prevention Manual'. The manual prescribes the prevention measures and emergency actions that environmental agency professionals,