RAINWATER MANAGEMENT IN KOREA: PUBLIC INVOLVEMENT AND POLICY DEVELOPMENT

MOOYOUNG HAN* [1], JUSUK PARK[2]

1) Professor, School of Civil, Urban and Geosystems Engineering, Seoul National University, 56-1 Shinrimdong, Kwanakgu, Seoul, Korea (Tel: +82 2 880 8915, Fax: +82 2 889 0032, email: myhan@snu.ac.kr)

2) Professor, Department of Env. Eng., Seoul National University of Technology, 172 Gongneundong, Seoul, Korea (Tel: +82 2 970 6626, Fax: +82 2 971 5776, email: juspark@snut.ac.kr)

Introduction

Rain has been utmost importance in Korean life, because Korea's economy has been based on agriculture. Rain has also influenced other aspects of culture: such as architecture, language, and art. The importance of rainwater is shown from the old Korean history. When Dankun Wanggum established the first nation in Korea on BC 2333, he invited three masters who have power and authority to control rain, wind and cloud, respectively.

Therefore it is natural that Korea has a long history of rainwater management to cope with the annual drought and flooding. The Chuck-U-Ki (Figure 1), the first rainfall gauge in the world, was invented as early as AD 1441 by King Sejong, the Great. This instrument was developed about 200 years earlier than a similar type of rainfall gauge invented in Europe. Since then, a network to report the rainfall of all the local government to the central government has been established [1],[2],[3]. Through this network, Korea has the longest rainfall record in the world. Although some data are destroyed, some 150 years of rainfall record are still remaining.

Despite this history, Koreans seem to have forgotten the importance of rainwater. Only in some remote areas, such as islands, is rainwater used as the sole source of water. However, recently, there has been an increasing interest within government, academic circles and non-governmental organizations to promote the utilization of rainwater in Korea. Some progress is being made or is planned in terms of regulation, engineering and scientific aspects. Many projects are under design or construction stage to demonstrate that rainwater harvesting can be used as a solution to mitigate flooding, water shortage and to make ecological environment.

In this paper, a new "Areal Approach" is introduced to overcome Korean water problems inherent in the traditional "Linear Approach". The movement and involvement of public to promote the rainwater harvesting in Korea are presented together with some of the demo projects. Some efforts and progress to include the new "Areal management" concept in the regulation sector to pursue a multipurpose benefit of rainwater system into society are presented. Finally, the vision that forms the basis of vital energy for all the progress and strategy of Korea are presented.

Figure 1. The world's first rain gauge. It was developed in 1442 by King Sejong the Great and used since that time. It was distributed to local governments under the direct supervision of the King. Rainfall data thus measured were gathered through a nationwide network and records were kept for more than 500 years after its development.

A new management approach: From linear to areal

The traditional approach to cope with urban flooding has been "Linear"; that is all the rainwater that has fallen over a wide area is conveyed to and managed by sewers or rivers that are consisted of a line. When the carrying capacity is found to be insufficient, then the possible countermeasures are considered only to the line; i.e., to upsize the sewer or to widen the rivers or to increase the pumping capacity. Due to the recent rainfall characteristic, which becomes heavier and unpredictable, the water conveying system in the whole city might be limiting and therefore, should be upgraded. However, this costs lots of money and time and sometimes there is hardly any room to construct new facilities on or under the roads of a congested city. According to the hydraulic analysis of a circular sewer pipe, flow capacity decreases dramatically after a small addition of water especially when it is near the peak. Therefore, rainwater tank storage at near this critical flow can sufficiently reduce the danger of urban flooding in a local level.

The new "Areal" approach is to manage rainwater that has fallen in a watershed, that is to store and manage the rainwater in the whole area. By storing rainwater in small but many tanks, the peak runoff is reduced and time to the peak flow is retarded. After the rainfall, the relatively clean water that is stored in the tanks can be used for non-drinking purpose resulting in water conservation.

Another advantage of building many scattered rainwater tanks may contribute to the fire fighting. In Korea, mountain fires are frequent especially during early spring time, because of dry weather. When the mountain is on fire, it is very hard to control because sometimes it is not accessable. Especially in a recent mountain fire on the spring of 2005, a 1000 year old temple has been burnt down. An areal approach to deal with both water and fire problem with a set of multipurpose tanks is suggested and a demonstration project is under design.

Public involvement of rainwater harvesting promotion

Since the inauguration of KRCSA (Korean rainwater catchment systems association) on 2001, many successful demonstration projects were made. Based on the technical and operational data and proper PR in mass media, citizens and the people in the regulatory agency are becoming more and more convinced of the possibility of rainwater harvesting and its potential to solve the major water problems in Korea. Several examples of the demonstration projects are presented as follows.

Galmoe middle school

A rainwater harvesting system was installed at Galmoe Middle school in Uiwang city on October 2002 (Figure 2) . This project was launched to educate students the importance of rainwater by constructing rainwater utilization facilities. The rainwater utilization system is composed of ① a collection area (1,713 m^2), ② two treatment facilities including a storage tank which consists of corrugated steel (120 m^3) and soakaway, ③ two water-supply facilities including two submerged pump, ④ a monitoring system, and ⑤ a small pond for landscape. The rainwater collected from the roof of the building are used for cleaning, gardening, emergency, and pond water(pond water and emergency). Throughout this experience, lots of people became aware of rainwater harvesting, which was another challenge to disseminate rainwater utilization systems in Korea. The main target was to teach students.

Figure 2 . Rainwater Utilization System in Galmoe Middle School, Uiwang City, Korea

Rainwater Museum

The rainwater museum opened on December 2003 at Galmoe Middle School. It consists of four classrooms at the second and third floor, the total area is 300 m^2. The importance of RWH are educated through exhibition, poster display, regular meetings. Also, it is used as a place for information exchange about rainwater and water cycle and water conservation. International exchange program are made in cooperation with sister rainwater museum in other countries. Some of interesting events such as rainwater gathering contest, postcard drawing contest etc attracted many students and parents.

Dormitory at Seoul National University

A newly constructed dormitory in SNU adapted a rainwater system (Figure 3). A rainwater system and water reuse system are parrallelly installed. A 200 m^3 concrete rainwater tank is installed and the rainwater are used for toilet flush and landscape to one of the buildings. The public acceptance and performance of two systems (rainwater and water reuse system) are being monitored and compared. Since its operation from April 2004, 15% of supplied tap water is saved. Technical data about the water usage, rainwater quality, special aspects in the design, monitoring and maintenance are being studied and published. Some research to investigate the target pollutant in the rainwater tanks and the treatment method is made. The water level is monitored and its realtime data is available on the internet. All newly constructed buildings in Seoul National University are advised to install rainwater harvesting system. It was proved that the quantity of rainwater was enough to supply the toilet water without the operation of greywater system.

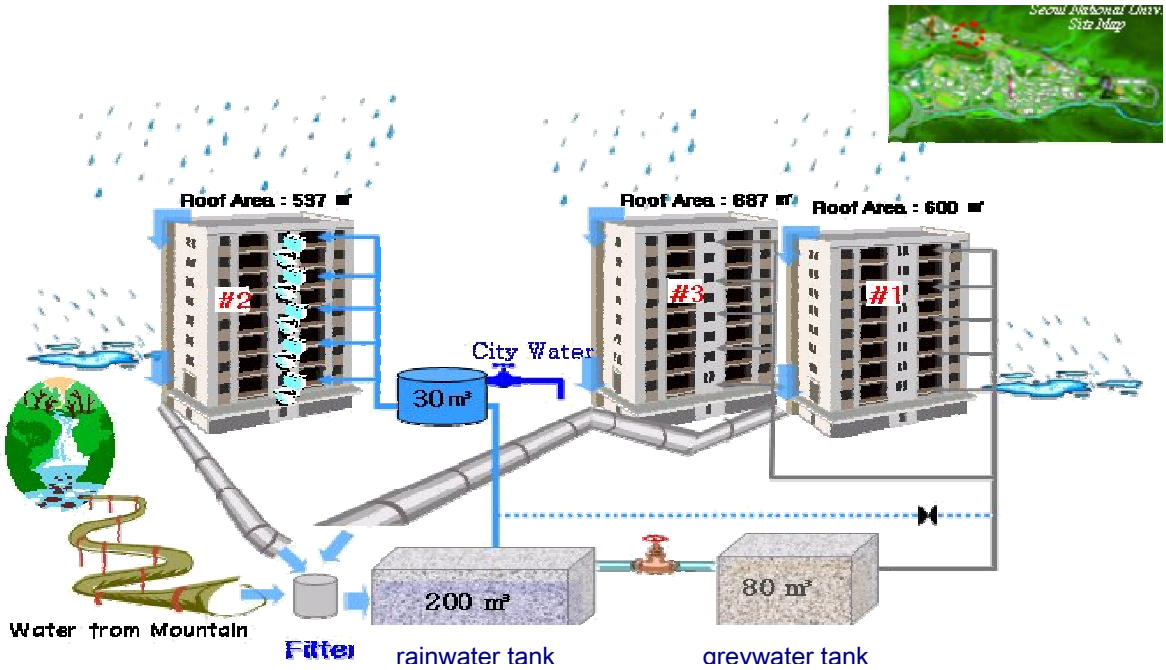

Figure 3 Rainwater Utilization System in SNU dormitory, Seoul, Korea

Rainwater tank in an army base

A HDPE tank with the capacity of 30 m^3 is constructed in an Army base (Nodo Unit) in Gangwon Province (Figure 4). Water is collected from both office buildings and storage buildings nearby. Because most army units are located in a remote area (e.g. in the mountains), sometimes the water supply from the city may be limited. In such a case, rainwater is a very good option as a water supply. Soldiers in the Nodo unit use rainwater for washing, laundry, irrigation and cleaning. In case of hostilities, self-sufficiency of an army unit's water supply is very important.

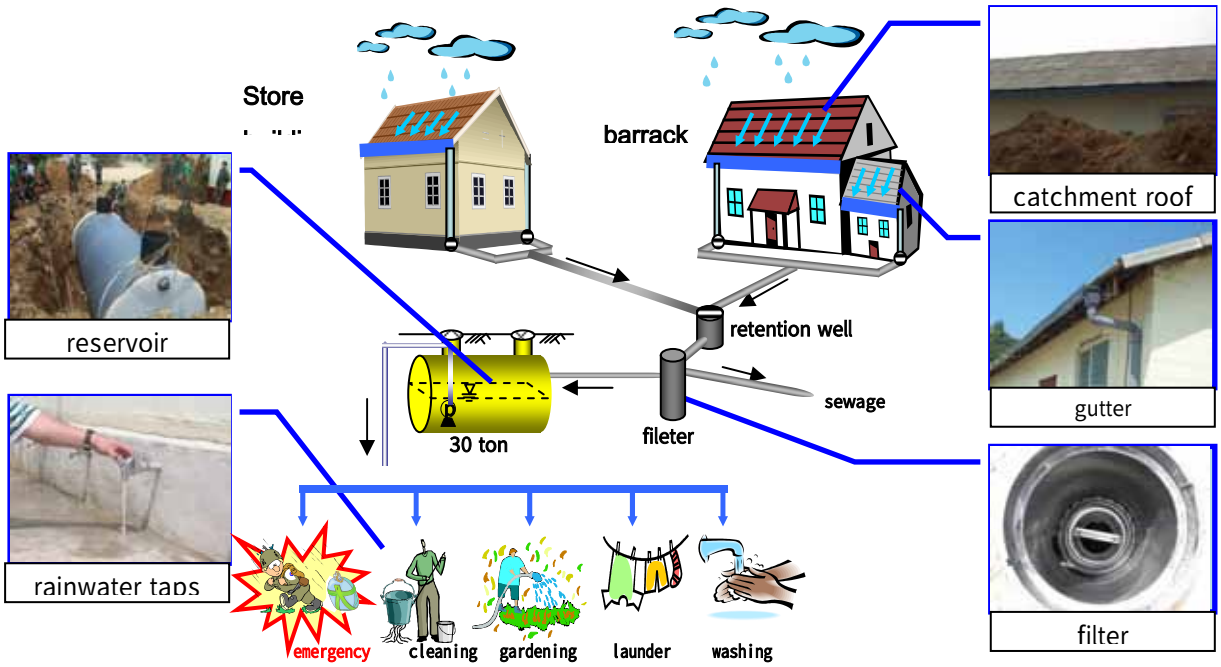

Figure 4 Rainwater Utilization System at an army base (Nodo Unit) , Korea

Star City Project

One specific rainwater system was designed at a newly constructed building site (Figure 5) at the Star City Project in Kwangjin-Gu, Seoul. A 3000 m^3 rainwater tank was installed and divided into three sections, 1000 m^3 each. The first tank collects rainwater from the unpaved surface, but should be kept empty most of the time, except when there is rain. The second 1000 m^3 tank collects rainwater from the roof, and collected rainwater is used for toilet flushing and landscaping. The third 1000 m^3 tank is filled with fresh water and should be ready to be used for supply during emergencies such as fire fighting or accidents. The first tank is for flood control (for others), second is for water saving (for self) and the third is for emergency (for all of us). This basic design concept stems from the Korean philosophy of allowing everybody to benefit.

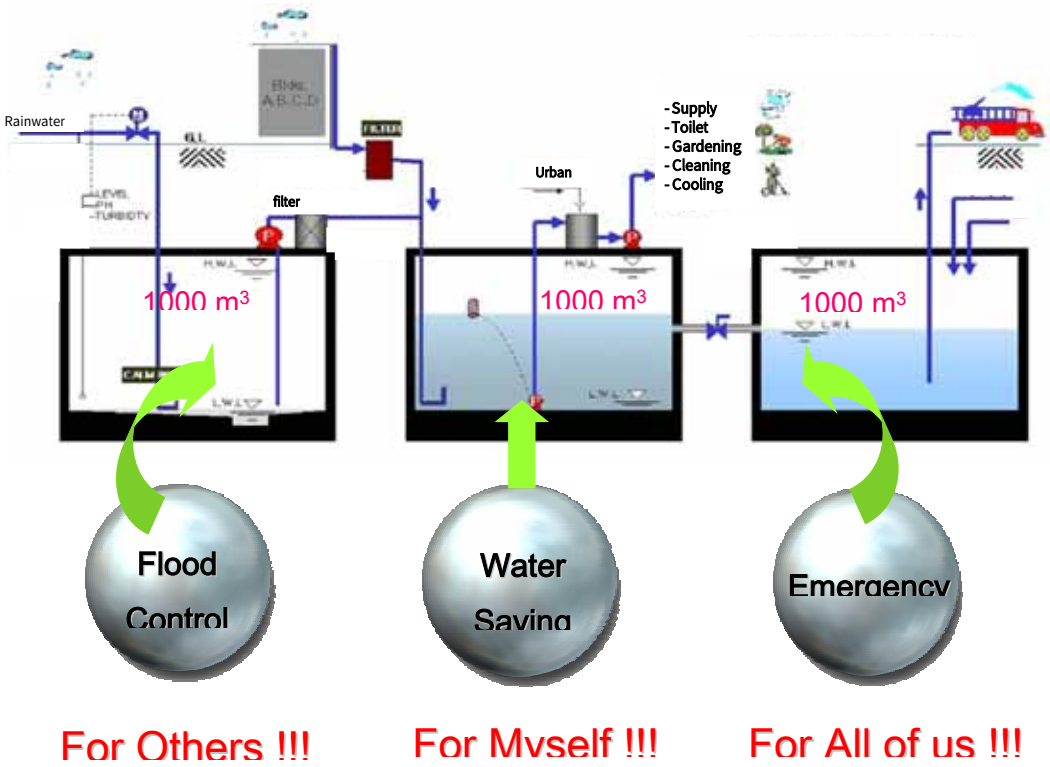

Figure 5. An example of rainwater tank design in Korea. An ideal design of rainwater management at an apartment building complex in Kwangjin-Gu, Seoul, Korea. The rainwater tank is divided into three sections with different purposes, one each for the prevention of flooding, drought relief and emergency use.

International Workshops on Rainwater Harvesting [4], [5], [6], [7]

Four International Rainwater Harvesting Workshops were held since 2002 by inviting rainwater harvesting experts. The case studies of Korea and the world are presented and discussed. The third workshop was held at Seoul with the subtheme of "Rainwater Harvesting, for others, for me and for all of us". The fourth workshop was held at Seoul with the subtheme of "The improvement of safety and well-being of the society by Rainwater Harvesting". All of the workshops were well attended and drew much attention of many public and news media.

Policy development

Water Law

According to the "Water Law", some sports facilities with roof area more than 2500 m^2 should install the rainwater harvesting facilities. And some financial support for the owner of the building is made possible. Four world cup stadiums in Korea have equipped with rainwater system under this law.

Incentives for Rainwater Harvesting

The Kyoungki province recently passed a law that each city can make regulation to reduce the water rate when the rainwater harvesting is utilized. As a result, Eiwang City, Paju City

and Anyang City made a regulation to reduce the water rate up to 65 % of to a building owner who installed and used rainwater.

A new guideline of Seoul Metropolitan Government for rainwater management

On Dec, 2004, Seoul City announced a new regulation to enforce the installation of rainwater harvesting system. The main purpose is to mitigate the urban water flooding and the secondary purpose is to conserve water. By doing this, it is expected to ensure the safety of a city and improve the well-being of citizens. It also asks the voluntary cooperation of the citizens to fill and empty the rainwater tank acoording to the direction of disaster prevention agency.

The special feature of the new regulation is to provide a network so that water levels of all the water tanks can be monitored at a central disaster prevention agency. Depending on the amount of expected rainfall, the central disaster prevention may issue an order to the building owners to empty the rainwater tank fully or partially. In order to do this, some incentive program is planned for those follow the direction and some punishment to those who do not obey. After the storm event, the stored water can be used for fire fighting purpose and/or miscellaneous purpose such as toilet flushing and gardening.

The buildings which must install the rainwater tanks are:

- All public building: Newly built buildings must install the rainwater tanks and existing buildings are recommended to build one as much as possible.
- New public facilities (such as park, parking lot, schools) should install rainwater tanks and existing facilities should install as much as possible.
- Private Buildings: New buildings which are subject to get permission (Floor area larger than 3000 m^2) are recommended to install rainwater tanks.
- For a large development plan such as new town projects, they should include the rainwater management system as a first priority.

Some necessary guidelines for the design, installation and maintenance of the rainwater system are included. Considering the leadership of Seoul city in Korea and the urgent need to mitigate the natural disaster, most cities in Korea are expected to follow the case of Seoul City in a very near future.

Special Law for Rainwater Management under preparation

A speacial law is drafted for the proper management of rainwater with multiple purpose of disaster prevention, flooding protection, drought prevention, environmental, energy saving and mountain fire protection. It is now under preparation by NEMA (National Disaster Management Agency) together with KRCSA and it is targeted to submit to the National Assembly on September 2005.

Conclusions

RWH has traditionally been used in different parts of the world since the beginning of human history, without any difficulty. Recently, people began to think of this forgotten wisdom as a first option to solve the world water problem such as drought and flooding. Through the recent rainwater harvesting campaign from the public sector, Korean people have now become aware of the importance of rainwater. Several successful demonstration projects convinced the regulators and citizens to promote more. A draft of regulation is inder preparation which will lead to build areal rainwater management systemfor the mutipurpose of flooding, drought, environmental and disaster concerns.

References

1. Han M.Y. (2004). Rainwater Harvesting: A new paradigm to meet MDG and Sustainability. In: Rainwater Harvesting Workshop Proceedings, IWA Rainwater Harvesting Task Force, Marakech, Morrocco. pp. 1-8.

2. Han M.Y. and Park J.S. (2005). Rainwater Harvesting: A new paradigm for water mahagement in Korea", proceedings of JSCE, Committee on advanced Water Treatmnet and System.

3. http://rainwater.snu.ac.kr/cuk

4. Proceedings of the 1st International Rainwater Harvetsing Workshop, Seoul, Korea, 2002.

5. Proceedings of the 2nd International Rainwater Harvetsing Workshop, Jeju, Korea, 2002.

6. Proceedings of the 3rd International Rainwater Harvetsing Workshop, Seoul, Korea, 2003.

7. Proceedings of the 4th International Rainwater Harvetsing Workshop, Seoul, Korea, 2004.