Rainwater Utilization in China—History and Current Issues

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A Google search on rainwater utilization in Beijing mostly yields articles about the rainwater collection and purification systems that were built into Olympic venues the Bird's Nest and the Water Cube. Indeed, such facilities demonstrated China's increasing realization of its water scarcity issues and its recognition of a huge and largely unused resource: rainwater. However, what has been largely unseen in the English media is the development of the overall picture of rainwater utilization in China. What is the current state of the art? What has the history of the practice of rainwater utilization in China been up to now and what is its potential for the future?

Not only is China a water scarce country, water scarcity may be a significant factor in limiting the country's development in the future. According to a 2009 report, of China's 669 cities, 400 do not have enough water to meet distribution demands. In Beijing, the amount of water availablity per capita is less than 300 cubic meters, which is about one-thirtieth of the global amount. In many areas, especially in northern China (including Beijing), groundwater is overextracted in order to meet water demands, causing permanent ground subsidence damages. In order to reroute more abundant resources from the south to northern China, other large scale water diversion projects have been planned, but not without controversy . There have also been more and more demand-side campaigns to encourage residents, developers and industry to reduce water usage. In the eyes of some researchers and policy-makers however, one very obvious source of water has not been utilized to its full capacity: rainwater.

Raining outside the Olympic venue the "Water Cube", which is designed to collect enough water annually to supply 100 Beijing residents

According to rough calculations, if Beijing municipality covers an area of 770 hectares and the annual rainfall is 630 mm, then the amount of rainwater the city receives each year is about 485 million cubic meters of water. If Tianjin covers an area of 640 hectares, and its annual rainfall is 600 mm, then it receives 276 million cubic meters of water each year. Similar calculations yield that Jinan, Shandong Province would receive about 80 million cubic meters of rainwater annually. If a significant portion of this largely unused resource could be collected, we can see that its impact on water scarcity in northern Chinese cities could be a very important resource.

There are two types of utilization methods for rainwater. One is to actively create sites where permeable facilities replace impermeable pavements (for examples, large parking lots or public squares), so that rainwater can slowly infiltrate into the underlying aquifers, recharging the water levels. The other kind is what we think of as active rainwater harvesting. These facilities may be located on rooftops or built into buildings. The water is collected and stored and or treated for landscaping, waterscaping, toilet flushing, or industrial cooling or rinsing usages. To a certain extent, both active and passive rainwater harvesting techniques have been implemented in China.

Rainwater utilization first began to be explored as a resource possibility in the 1980's. At that time, certain local governments began to notice their water scarcity problems and installed rainwater collection systems on buildings. However, because at that time such facilities did not have the necessary accompanying treatment or reuse systems, their effect was not practical. In the 1990's, the Beijing Water Conservancy Office (Now the Beijing Municipal Water Conservancy Bureau) headed up two rainwater research projects—"Research on Beijing Municipality Urban Rainwater Utilization Technologies and Rainwater Infiltration Expansion" and "Beijing Municipality Urban Buildings' Increased Water Collection Measures Research". These two research projects reflected the two branches of rainwater utilization and the results of the research helped propel advances in the efficiency lacking in previous attempts at rainwater utilization. The research included not only technological research, but economic, urban planning and policy analysis. By 1998, with funding from the Beijing Municipal Government, over 20 rainwater utilization projects were completed.

In the year 2000, The Beijing Water Conservancy Bureau launched a joint project with Essen University (Germany) to build 6 demonstrative projects under the title "Urban Rain Flood Control and Utilization". The projects were carried out in several distinct representative areas, converting paved areas into more porous surfaces (for groundwater infiltration) and installing catchment facilities to collect water (for car washing, toilet flushing and landscape use). The results of the project indicated that although the rainwater could be successfully reused for other purposes, when the economic factors of installing active facilities (as opposed to the passive infiltration facilities) were taken into accout, the outcomes were not very practical. Because Beijing receives little rainfall for about half of the year, the active facilities laid unused for too much time for such a plan

to be considered for widespread use. Also in the year 2000, for the first time, the Beijing Municipal government passed a law stipulating that in residential communities, water for fountains and waterscapes must be supplied with either reclaimed water or with rainwater to decrease the strain on the potable water supply.

Waterscapes in residential areas in Beijing are required by law to utilize reclaimed water or rainwater instead of tap.

In 2001, China's State Council passed a document called "The Beginning of the 21st Century Capital Water Resources Sustainable Utilization Plan" (21世纪初期首都水资源可持续利用规划), which states that in Beijing, rain water utilization should be an important measure to reduce the severity of water scarcity problems in the city. In 2003, The Beijing Municipality Planning Bureau and the Beijing Water Authority jointly passed an interim provision that all new construction, renovation, or expansion projects must go through rainwater engineering facilities design and construction. In 2004, the Standing Committee of the Beijing People's Congress passed a law encouraging individuals and work units to utilize rain harvesting, infiltration, storage, and utilization strategies. In 2005, the fine for residential communities utilizing tap water for landscaping or waterscaping purposes was raised over 10 fold, showing the municipal government's commitment to reclaimed wastewater and rainwater usage. Also in 2005, the Chinese Architectural Design Research Institute (中国建筑设计研究院) made a number of standardizations to rainwater utilization techniques.

Most recently, for the 2008 Olympics, the Water Cube and the Bird's Nest were all equipped with the most modern rain harvesting and treatment technologies. The Bird's Nest rain harvesting area is 22 hectares, and it is able to collect 67,000 cubic meters of water annually and treat 2000 cubic meters of water daily. The Water Cube has a rooftop rain harvesting system that collects 10,500 cubic meters of water annually and it can treat enough water to support 100 Beijing residents' water usage for one year.

An article published in Chinese in 2009 purports 5 major reasons that China still lags behind developed countries in its extent of rainwater utilization. Firstly, the technology lags behind developed countries. Secondly, rainwater utilization facilities are not adopted on a large scale. Thirdly, relatively little legislation exists for the appropriate treatment of rainwater (for example, urban runoff may enter the same channels as municipal wastewater and be treated as such in the urban water cycle). Fourthly, there is little standardization of rainwater harvesting or infiltration techniques. Lastly, the "level of industrialization" around issues of rainwater usage is low.

"Level of industrialization" refers to the development of corporations that work in services and technologies relating to rainwater utilization. Such corporations include those that provide collection and treatment services for rainwater, those that are able to market and sell filtered or treated rainwater effluent, corporations that provide technology support, maintenance and repair services, and corporations that actually sell equipment and technology for rainwater utilization designs.

However, the future looks bright for increased rates of rainwater usage in China. In an article by the Worldwatch Institute, experts have already seen trends in rainwater utilization systems design by real estate developers in Beijing, probably in response to recent legislature that requires residential areas to used reclaimed water or rainwater for waterscapes. Currently, many rainwater consulting projects are done by academic institutions such as universities, institutes or national academies. In the future as legislations become more defined and implemented on a national scale, there will probably be more room for development for private environmental consulting agencies who wish to enter the market.

The information in this article is a summary of information gathered from the following sources:

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