# Rainwater harvesting and disaster management

# From life line to life points: Japanese rainwater harvesting response to natural disasters

### The case of Kobe city

Japan's city of Kobe, which depends on a pipeline from the distant Lake Biwa for most of its water, was severely affected when the earthquake destroyed the city water supply line in 1995. During the approximately one month it took to repair the pipeline, Kobe's municipal functions were ground to a halt. To ameliorate this problem, 100 tanks each having a capacity of 200 liters, were delivered daily by the People for Rainwater ( PR ) to secure emergency water for drinking, cooking and washing to the four districts of the City. They proved to be very effective as life points. Even after recovery of the city water supply, many Kobe residents connected tanks to the down pipes of their houses for roof water harvesting.

To avoid a repeat of this disaster, Kobe residents are aware that a transition is needed from the "life line" to the "life point" approach. This would involve construction of numerous small scale and decentralized water sources as "life points" within the city, drawing on rainwater, groundwater and other sources. This approach would enable cities to face natural disasters like earthquakes and droughts.

### The case of Sumida City

In Kokugikan area located at Ryogoku within Sumida city, an enormous Kanto earthquake occurred on the 1st of September, 1923. Forty thousand residents of Sumida City were burned to death. The water supply systems were also heavily damaged. In response, a rainwater harvesting project was started in Kokugikan. Innovative rainwater projects were undertaken for flood control, water shortage mitigation and disaster prevention 23 years ago. In 1982, the City directed the Japanese Sumo Association to stock rainwater for mitigating urban flooding, and to use stocked rainwater for city water conservation and emergency water supply. This was done through harvesting rainwater falling on the roof (8400 $m^2$) into a basement tank with a capacity of 1000 tons, this tank functions as a life point. The water is currently used for flushing toilets, cooling towers, and irrigating plants. At the community level, a unique rainwater utilization facility, "Rojison" has been set up by local residents. In this system, 72 rainwater facilities have been combined with a capacity of 10,000 tons. Rainwater mini dams are gradually spreading throughout the Sumida City. Todate, 50 local governments have a guideline for rainwater utilization, while the other 36 have a subsidy system for installing rainwater tanks. Rainwater utilization systems for flood control, water shortage mitigation and disaster prevention, have been introduced in 3400 buildings at private and public levels in Japan.

# An innovative solution to prevent urban flooding in Korea

**Information Technology based management of multiple rainwater tanks**

Seoul Metropolitan Government (SMG) is a 600 year old city with a population of 12 million. Studies of rainfall trends over the last five to thirty years depict a recent increase in amounts. Rainfall is concentrated in the summer months with higher intensities.

The traditional approach for coping with urban flooding has been “Linear”. This means that all the rainwater that has fallen over a wide area is conveyed to and managed by sewers or rivers consisting of a line. When the carrying capacity is insufficient, possible countermeasures are considered only to the line; denoting the upsizing of the sewer, widening of the rivers or increasing the pumping capacity. Due to heavier and unpredictable rainfall, the water conveyance system in the whole city is limited, thus requiring upgrading. However, this costs a lot of money and time.

A new “Areal” approach of managing rainwater that has fallen in a watershed, has been formulated. By storing rainwater in small but numerous tanks, peak runoff is reduced while the time to peak flow is retarded. After the rainfall, the relatively clean water stored in the tanks is used for non-drinking purposes resulting in water conservation.

SMG recently designed special mandates to cope with this flooding problem based on the areal approach. This requires a rainwater harvesting system for newly constructed buildings larger than 5000 m2 and existing official buildings larger than 3000 m2. The size of the rainwater tank depends on the land and floor area in order to monitor the water levels in tanks larger than 50 m3. The water level of each tank is monitored at a disaster prevention center through the internet. The public can have access to the information at any time and place. Such information can be transferred to the mobile phone, local station and central station of the people who control the system. The building owner is instructed to empty the tanks depending on the weather forecast. The size of the pump system should be adjusted to be able to empty the whole tank in five hours to the existing sewer or infiltration system. Financial incentives or punishments are given to the building owner who does or does not obey the rule.

There many advantages of this system include cooperation because people become aware of the reason of flooding, people's voluntary participation and cooperation is expected. The capacity of sewer pipes can be fully utilized even without increasing its size. After the flooding, clean rainwater is stored and can be used for non-drinking purposes such as toilet flushing and irrigation.

In order to cope with the urban flooding caused by climate change, it is necessary to shift the rainwater management paradigm, from the traditional "Linear" approach to the new "Areal" approach. Monitoring and management of multiple rainwater tanks in a whole city area coupled with modern IT has been found to be a very powerful solution to mitigate the damage caused by urban flooding.