

Future: Water supply and drainage system

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The water supply and drainage system is very crucial for fulfilling the basic needs of human life. It is also one of the most important life supporting systems for urban populations.

The traditional water supply system can be classified in different ways. Functionally, it is classified into two systems, i. e. , water supply system and water drainage system, which work separately and single-functionally. Locationally, it is also classified into two systems, i. e. , indoor system (applied as a building facility) and outdoor system (working as a building infrastructure). A typical water supply system usually consists of a water intake facility, a water plant, a network of pipes for water supply, fire hydrants and other affiliated facilities, booster pumps, water supply pipelines in the building and some terminal facilities as a faucet. The typical water drainage system has two different processes depending on whether the rainwater is drained with the sewage or not, and both contain building sanitation facilities, rainwater and sewage collection pipes, collecting wells, drainage pipes/canal, valve and other subsidiary facilities, wastewater treatment plants, drainage pumping station etc.

Traditional water supply systems only targeted to meet the requirement of city development, residential and industrial purposes. Wherever the city expands, the network of the water distribution system follows it and whenever, the sky scrapers are built, the secondary water supply system is also designed at any cost. Recently, the quality of the surface water sources is deteriorating, and many researchers are still engaged in research activities to develop inexpensive, environment friendly, healthy and risk free measures to meet the water quality standards. The traditional system never takes the user's need of water quality into consideration, but it keeps sticking to the "National Hygienic Standard for Drinking Water (GB5479—2006)". It is not difficult to learn from the title that we share the same standard between systems we used for daily life and drinking water. Hence, we can say that at present this water supply system is neither scientific nor sustainable.

Traditional water drainage systems carried the sewage and rainwater as waste materials, aiming at draining them away as soon as possible. Many researchers believe that the water pollution problem can be resolved as long as we thoroughly separate the sewage and rainwater before they enter the drainage systems. In fact, the development of cities has changed the original nature of the land use and meanwhile brings numerous environmental problems from various pollution sources such as impermeable surface covering of roads and rooftops, reduction in groundwater recharge and evapo-transpiration. Similarly, under heavy rainfall intensity conditions, the time of runoff formation has been shortened and the peak of runoff has been increased. Therefore, the water drainage systems cannot adapt themselves to the change and thus we face frequent water-logging problem in urban areas. Meanwhile, intensive habitation, commercial and industrial activities largely increase the total amount of sewage, wastewater and aggravate runoff pollution. As a result, water cycle and environmental quality are entirely different from the pre-development conditions. Due to the increase of total amount of pollutants and over intensive of the urban agglomeration, even we have taken measures such as effective control measures at various pollutant sources and treatment facilities to improve the water quality to meet the standards, we are still facing huge challenge from the discharge wastewater from sewage and municipal wastewater treatment plants and runoff from other sources to surrounding rivers and lakes. Hence, by the current system, we cannot provide the guarantee of the water safety to the cities. Equally, the water drainage system today is neither scientific nor sustainable.

In the future systems, water supply and water drainage will be considered together where the city itself will be concerned as a watershed, meanwhile fresh water (surface water and ground water), sewage and rainwater will be used as beneficial usable resources.

These resources can be used as not only for living and manufacturing requirements, but also for restoring the former water cycle and ecological-balance as much as possible. Taking into account the total amount of fresh water resources and comprehensively considering the amount of previous, current and future utilization, we have to optimize the design of urban development scale, population and production layout and industrial development activities. One of the most important evaluation standards for modern society will be that how reasonable we have been on controlling the utilization of fresh water resources. We need to control the over utilization and over exploitation of water resources and save them for our future generations. Therefore, we can separate drinking water from the water used for other purposes by introducing the specialized drinking water network and make efficient use of fresh water resources. Specialized drinking water network can easily provide a guarantee to the safety of water for future generations. Non-potable water (grey water) can be utilized for many other purposes such as irrigation in urban gardens and in toilets for flush through specially installed recycled water pipelines in the buildings. Whereas, the wastewater (black water) from sanitation facilities can be reused as spray on the ground, in urban water landscapes and in industrial cooling systems through special underground pipelines of recycled water after being collected and treated with advanced technologies. Then, in the rainwater system we can focus on catchment management, collection and storage of rainwater and in-situ reuse of runoff by effective treatment measures such as bio-retention cells, constructed wetlands and bio-filtration etc. and combine them with urban landscaping and biodiversity for reuse of storm-water. By these means, we can probably prolong the formation time, lower the peak discharge, recharge the groundwater and reduce the load on water supply and drainage network. By applying these measures for better use of water, we will be able to save it, use it and drain it properly. We can also slow down the water cycle and destruction of urban ecological balance destruction. Use of impermeable surfaces is also very useful for managing the urban microclimate and control the heat island effect.

Reuse of municipal wastewater and rainwater can considerably improve the utilization factor of the water resources. It also reduces the total amount of drainage and pollution load in urban environments. Consequently, it is not necessary to pay much emphasis on the separation of the sewage system and the rainwater system because partial discharge of sewage after advanced treatment as well as rainwater discharge under extreme conditions will not affect the quality of surface water. The main function of sewage and rainwater systems will be catchment and reutilization, and there will be hardly a border between the two systems. Cities will no longer totally depend on the upstream fresh water resources, and being a consumer of water resources, cities can turn to be water producers. The future urban water system will be served as the source of specialized drinking water, reused wastewater, recycled rainwater and guaranteed water resources. Whereas, the water cycle in future systems will be more close to the pre-developed systems, while safety of water quality will be ensured. Hence, we can say that these future systems will be strongly resistant and less harmful systems as well as more scientific and sustainable.

These changes would not happen naturally and requires continuous innovations and practices from management to technical personnel of water science and engineers from various engineering fields as well as the support from the local governments and people. The development in water supply and drainage system is a time-consuming process, but inevitable for vital use of water resources because it directly affects the environment, socio-economic developmental activities and people's livelihood. There will be no future for us without the thorough revolution of innovative ideas and wise utilization of water resources.