

Study on Water Resources Protection in Ecological City Construction^{*}

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Abstract: “Ecological City” is an important concept put forward in the research of “Man and Biosphere Program” sponsored by UNESCO (United Nations Educational Scientific and Cultural Organization). Ecological City meeting the ecological laws should be a urban ecosystem with reasonable structure, function efficiently and the coordination of relations. For the urban construction of increasing tension in terms of water resources, to construct water-saving ecological city is the only way in the context of the intensive use of water resources, ecological and environmental cycle and sustainable economic and social development. Based on reference to a large number of research results at home and abroad, this paper focus on Ecological City Construction approach under the constraints of the water resources. This paper based on ecological city theory combined with the practice of Ecological City Construction in China, described the importance of water resources protection to the Ecological City Construction, and put forward my own proposals in view of water resources status and new trends in water pollution in Ecological City Construction in China.

Key words: Ecological City; Urban water resources; Water resources protection; Sustainable development

“Ecological City” are essentially different compared with the common sense of the modern cities. “Ecology” in the Ecological City is an integrated, holistic concept, contains social, economic, natural compound rather than a simple biological meaning, it has been set far beyond the purely about the past, becomes a carrier of natural, economic, cultural, political. In the process of Ecological City Construction, water has an important significance [1]. Recently, the Planning Department chief of Development and Reform Commission LI Shouxin said, the Contradiction between urban spatial distribution and the carrying capacity of resources and environmental in China is more and more prominent now. Currently there are nearly 400 cities in 655 that are short of water, of which about 200 cities are in serious water shortages. The official statement on this issue means that water scarcity will affect the process of the ecological city construction.

1 Construction of Ecological City

1.1 Basic Principles for Ecological City Construction

First of all, we maintain that the sustainable development combine with the practice of regional development, and abide principles of people-oriented principle and harmonious development, adhering to the coordination of economic, social and ecological benefits, and the improvement of the living environment and ecological

environment construction. Secondly, ecological and environmental protection and development should be equally emphasized. While in broad cooperation, the government market regulation, social participation and investment diversification must be combined. Construction of Ecological City should be supported by science and education, keep the innovation, seek truth from facts, highlighting local characteristics. Finally, according to local conditions, we make out our overall planning, break the key part through, advancing step by step. In order to construct Ecological City, we must adhere to the organic unity of the forward-looking and feasible, while strengthening the management, enact the rule of law for the protection of the water.

1.2 The Main Content of Ecological City Construction

The main content of Ecological City Construction are as follows: Ecological Industrial Construction. To design of industrial systems and industrial systems and environment logistics and energy flow according to meeting the requirements of sustainable development, and apply the theory of circular in economy industrial system, Ecological Agriculture Construction. It realize high quality and efficient and sustainable development in agricultural in accordance with the agriculture ecosystem of species coexistence, material cycle energy use of ecological principles many times, according to local conditions of modern science and technology combined with traditional agricultural techniques, thus both ecological and economic systems achieve a virtuous circle and economic, ecological and social benefits in a unified.

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Ecological Forestry Projects are mainly ecological public welfare forest construction project, the implementation of Grain for Green Project, the natural landscape engineering, ecological forestry and forestry industry base construction projects. Ecological Water Projects is to comply with the harmony between man and nature, persist in balanced, treating the symptoms and reduce expenditure equal emphasis on both flood and drought water resources development and utilization of principles to speed up construction of water conservancy facilities. In addition, There are also Clean Energy Projects Construction, it is development of alternative fuels, improve energy structure, clean energy in the proportion of energy efficiency.

1.3 The Practice of Ecological City Construction

In the 1980s, with the implementation of the strategy of sustainable development, China began research and construction of ecological city. In December 1984, Ecological Society of China held "The First National Urban Ecology Science Symposium" and established the "China Urban Ecology Ecological Society of Professional Committee" in Shanghai. Yichun City of Jiangxi Province proposed development goals of construction of ecological city in 1986, and begin ecological city pilot projects in early 1988. This is the first step in construction of ecological city in China. In 1995, State Environmental Protection Administration initiated the construction of ecological demonstration zones. Construction of ecological city in China achieved substantive results in 2006. Examination, publicity and validation by the State Environmental Protection Administration, Zhangjiagang City, Changshu city, Kunshan city, Jiangyin City in Jiangsu Province named for the National Ecological City, Shanghai Minhang District, was named national ecological zone, and Anji County in Zhejiang Province, is the National Ecological County. The current practice of ecological city construction in China continue to deepen and will make new progress.

2 Analyze on Impact of Protection of Water Resources on Ecological City Construction

With the rapid economic development and the acceleration of urbanization, water resources become the important factors which increasingly affect the current urban economic development and social progress. Water is the essence of life on Earth and the source of human civilization. Water is important natural resources a human survival and development and also an important constraint of ecological environment. As one of the most important material and resources in the entire biosphere, it maintains the growth and balance of all natural plants and animals. Especially in urban areas, all of their economic and social activities are greatly dependent on access to water quantity and quality. Therefore, to realize sustainable development and utilization of water re-

sources, and realize protection of economic and social sustainable development, has become an important part of urban construction.

2.1 The Present Situation of Water Resources in the City

The total quantity of the water resources in China is not little, but the water resources of every person is very poor, which is 1/4 of the level of the world (the water resources of every person in China is about 2700 cubic meter, which is the 88th in the world)[2]. In accordance with the water resources of every person, Canada is 48 times of China, Brazil is 16 times of China, Indonesia is 9 times of China, Russia is 7 times of China, America is 5 times of China, and the water resources of every person in China is below that of Japan, Mexico, France, Australia and so on. After the establishment of China, lots of work has been done in the area of water exploitation and the realignment of river and controlling water disasters, and greater achievements have been made. In the area of urban water supply, the water system has been built up in more than 300 cities in China up to now. The supply of tap water is 40 million tones every day, and the supply of tap water is more than 100 billion cubic meters every year. the supply of their own tap water in industrial and mining establishments and public institution in the city is more than 60 million tons, and the supply of tap water is 17 billion cubic meters every day. 28 percent of more than 7400 towns have established water equipments, and the supply of tap water is about eight million tons every day, and the supply of tap water is 2900 billion cubic metres every year. The imbalance between supply and demand of the water resources is influenced by the physical factors, such as water quantity, quality, the distribution of law and development conditions, but is also influenced by the supervision of socio-economic factors, such as the demand of water resources in every department[3].

2.2 The Features of City Water Resources

City is the focus of the relationship between people and place, and is the most intensive centre of production and consumption in the development of social economy. The features of city are as follows: population is dense, and economy is developing, and natural resources are shortage, and ecology environment is fragility, and town water is highly centralized, and pollutant emission is centralize, which deteriorate water resources in cities. What's more, the quantity of water resources in cities is little, and exploitability is low, and is mainly supported by extra-regional or areas outside. The consumption of water of city residents living and industrial and commercial is up, and the reliability of stage of water is high. Hence, we must protect the providing of the water resources of urban areas from a wider range of areas. to sum up, the features of city water resources for the spe-

cial position and function are: intensive, that is, the need for water resources is great and intensive; continue and stable, that is, the need for water and water quality is stable in all seasons; limited, that is, the quantity of water resources is limited, and the exploitation and utilize of water resources is limited; regeneration, that is, the usage of water resources is not one-off, and is of many applications, and can be recycled; fragility, which can be reflected in two areas: in the one area, there are many t pollution sources, and the area is very large, and the intensity is grate, so the water resources are easily polluted; in the other area, the water resources are easily destroyed, especially the groundwater. When the produced quantity is more than recharge quantity, quantity and quality of water resources will loss its balance, and will give rise to a series of geological and environmental problems [4].

2.3 The Shortage of Water Resources and the Forecast of the Need in the Future

There are two status in the shortage of water resources: the one is the shortage of un homogeneous area, the other one is the shortage of homogeneous area. Generally, we can solve the shortage of area by adjustment of water and the structure of space. The shortage of water resources is closely related to the space and range. To sum up, there are three problems in the urban water: the shortage of water resources, the pollution of water resources, and the supply of urban water. Because of the rapidly development of urbanization, and the expansion of city size, and the increasing of urban population, and the rapidly development of industry, and the sharply increasing of urban water requirement, the shortage of water resources is becoming the problem in the world [5]. With the constantly expanding of city scale ,and the accelerating of urbanization process, the shortage of water resources are severity, the amount of groundwater mining is increasing, which lead to the overlift of groundwater, and lead to land subsidence, the constant expansion of drawdown curve, and so on.

The growth of population and fast urbanization lead to serious the shortage of water resources. More than the 50 percent of over 600 cities in our country are short of water, the water deficit is 100 billion cubic meter every day. According to the estimate of the united nations, up to 2030, more than 1/3 people in the world are facing up to the shortage of water resources. The contradictions of the supply and the need for water are becoming increasingly prominent, become the one of the strategic problem in the world. The problem of the balance between water resources supply and actual demand become the focus of concern in the present. These years, relevant studies research it from different angles. on the whole, the analysis of water system supply and need balance face up to the social economy, and to adopt mining as the main means to the need for water in social economy[6]. Because of

ignorance of eco-environmental water demand, the development and utilization of water resources is absurd, especially Social and economic water occupy the ecological environment water, which affect the benign run of city complex ecosystem.

2.4 The Importance of Water Resources for Ecological City Construction

Water is the world's most precious resource, meanwhile, is the most important and irreplaceable resource as for life on the earth and human existence and development. Because of the growth of population and socio-economic development, water consumption increased rapidly, the shortage of water resources has become a serious problem worldwide. Water shortage has become an important factor constraining urban development. The urban is the place that the population is the densest, the economy develops the most rapidly and the demand for water is largest [7]. With the accelerated urbanization process, urban water requirements increase rapidly, the problem of water shortage in the city becomes more prominent. It is estimated that urban water shortage resulted in about the loss of 100 billion RMB in an average annual. With the reform and opening, the eastern's economy developed rapidly in our country and the demands for water raise rapidly, so that water shortages have existed in some areas which located in humid climate and was not large rivers flowing through the eastern city. For instance, the water shortage of Jinan, Dalian, Tianjin and so on has been very serious. In the water shortage, people tend to approach with drilling of underground water to meet current needs. However, only part of the groundwater is involved in the annual cycle of the renewable water resources, this part of the renewable water resources is that groundwater resources can be exploited. There are also a number of non-participation in the annual cycle of non-renewable water resources that form in a long historical, even geological period, it is the same as mineral resources, if we exploit a little, the number of ones become less, therefore, we must be extremely Cautious. Or else, if it is only mined and not recharged, groundwater level declines continuously, such as Beijing, Shanghai, Xi'an and many other cities have formed the phenomenon of the groundwater cone of depression and the ground subsidence and ground fissures due to excessive exploitation of groundwater[8].

3 Proposals on Water Resources Protection on Ecological City Construction

3.1 Increasing the Awareness of Saving Water and Full Implementation of Water Conservation

For a long time, traditional values "Water is unlimited", "Water is inexhaustible" deeply rooted in people's minds, water-saving consciousness is scarcity, water resources were seriously wasted and polluted. Urban water authorities should strengthen publicity and educa-

tion so that people abandon the erroneous concept, establish a correct ecological consciousness that “water resources are finite and irreplaceable”, indispensable strategic resources for human survival and development. Thus the reasonable development of water, water conservation, water resource protection become conscious action in the everyday life, meanwhile water resources could exert their maximum effectiveness [9].

The important channel which solves the shortage of urban water resources is comprehensive water conservation. We should establish the focus on water-saving agriculture, water-saving industry, water-saving society as sustainable development of urban water resources, with the growth of urbanization and urban water quota raise, people's daily lives will be increasingly raise water consumption, meanwhile the volume of urban sewage will increase. At Present, There are very few cities achieving the standard of zero emission. In order to protect water quality, increase water resources, it is necessary to control the sewage and pollution and implement wastewater reuse. Pollution control should be as an important measure as for “open source” and protection of water resources.

3.2 An Important Measure for Ecological City Construction is to Promote Urban Recycling

Taihu Lake Basin which is one of the most developed areas in the aspect of economic and urban development was one of the most abundant water resources in China, however, with the continuous development of economy and society, pollution control measures is lagging behind, in the past 20 years, water pollution of the whole river basin grow quickly, water environment deteriorate seriously, there has happened the embarrassing situation that more than 3000 million people in more than 2,300 square kilometers of the lake face water problems.

In the word the important strategy to solve the shortage of water is the urban sewage water recycling. It has a long history that the urban sewage water recycling was used for agricultural irrigation, industrial production, urban landscape, urban green, miscellaneous life, groundwater recharge and additional surface water such as research and engineering applications, not only to protect the water environment, but also ease the water demand and the contradiction between water supply, promoting water quality and quantity of recycling achieved significant environmental, economic and social benefits. Urban recycling has significant benefits, the shortage of water resources in dry areas, especially cities, industry and population are concentrated in the areas of socio-economic development of water resources has become a serious constraint. Recycling of urban waste water can solve the pollution problems, meanwhile, sewage can be used effectively to alleviate the water shortage

tension, which is achieved through the measures, and results in obvious economic and social benefits.

3.3 Strengthen the Unified Management of Water Resources, Improve the Scientific Management

To strengthen the unified management of water resources is needed in the construction of eco-city. Currently, the work of water resources development and utilization is also in the multi-sectoral decentralized management. The management and system of surface water, groundwater and sewage are all separate. This created a serious problem that certain departments are too autonomous and poorly managed. All the water resources make up a complete system. Only unified management and proper exploration can play its potential. It is an urgent need to form a authority of the unified management of water resources to formulate and implement city water distribution and protection scheme in the long term. At present, the mainly problems in urban water resources development and utilization in China are following: blind exploitation of water resources. Hydrology law is ignored in some cities, and the underground water was wanton exploited; quoted neighborhood water resources without scientific proof which result in the lack of water neighborhood. Besides, groundwater was overdraft in coastal cities, causing sea water intrusion and salt water diffusion. In addition, the overexploitation of the inland groundwater causing the large depressions and ground subsidence. All these problems bring about serious damage to the environment. The damage is not only bad for the sustainable use of urban water resources, but also seriously affect the city's economic development.

3.4 Improve water administration system, managing water by laws

Perfecting the supervised system of the water resources according to the law. China is on the way that the country is ruled by the law. It is inevitable to administrate water resources according to law to the development of the water conservancy. The way to manage both the quantity of water and the quality of water; the way to union the surface water and the underground, and the way to form rapid water issues and countermeasures systems to achieve optimal allocation of water resources and establish the sustainable use of water resources and sustainable development of the economy of Shiyang City are what we must face[10].

Therefore, we should improve the region's water administration system, enforce "Water Law", "Water Pollution Prevention Law", "Water Act" and other laws and regulations of water resources properly, and ensure the sustainable use of urban water resources and sustainable socio-economic development. The management of water resources should be changed from ownership and management to the scientific management. Using the

monitoring network of the city's integrated hydrological system monitor and evaluate the quality and the quantity of the water all year round. We should registrate the water well permit certification work, and seriously implement the water quality of intake and return evaluation system. Knowing the water demand and the trend of the society; finishing the water supply planning of the urban which is short of water and completing the industry water balance testing. With the help of water resources information and flood control information, the unified management of the water resources will be standardize, systematic and scientific.

4 Conclusions

Many scholars believe that the compound ecosystem should be run well in a ecological city. As the subsystem of water, the definition has two requirements [11]. One is the need of water resources to ensure the sound operation of the system itself which plays a vital function in biological ecological protection, landscape entertainment, consumptive and purification of pollution and other ecological services; the other is to supply the water for the other subsystems to ensure the healthy development of these subsystems. Whether for the aquatic ecosystem or socio-economic system itself, water is the most basic requirement and the prerequisite for the healthy operation of eco-city. Therefore, as an important decision support tool, eco-city water supply and demand analysis should be involved into the ecological water demand, emphasizing the protection of the quality of water resources and unifying water quantity, water quality, water resources utilization and protection into the analysis to meet the requirements of the water quantity and quality of the complex ecosystem.

Sustainable use of urban water resources is a serious issue and must be settled in a harmonious society. It is necessary to meet the needs of contemporary people, as well as not threat the needs of future generations. We should be rational to the development and the utilization of water resources. It is necessary to full implement the project of water conservation to realize the protection, saving and anti-pollution simultaneously. It is our responsibility to protect water sources and the environment. We should insist the principal of unified planning, scientific

exploration, comprehensive utilization and strict management of urban water resources. Multiple measures should be taken to strengthen the protection of city water such as multi-source water, sub-quality water supply, water conservation and wastewater treatment. It is a pressing issue to protect water resources in the construction of the eco-city and attract more and more attentions now. We hope that relevant departments pay more attention on the sewage treatment, urban planning and environmental protection, and invest money in the research of new technology, to bring more green and fresh for people's lives.

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