Exploring the "Self-flowing" Rural Living Water Model in Suzhong Water Network Area of China

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Abstract
The relationship between the "canal-frame-row-squat" water network system built by Zhang Jian in the Suzhong area of China 100 years ago is inseparable. However, the modern lifestyle and the construction of transportation facilities have caused structural damage, resulting in a sustained negative impact on the ecological environment. In recent years, governments have adopted measures such as increasing pumps to control them. However, such measures require higher costs and shorter live water hours, thus covering only rivers within the urban area, but have not been for more extensive villages. Efficient and ecological way of living water. The problem of water network problems in China's Central Jiangsu region is that the water is not smooth and the water speed is too slow. The author found three main reasons: First, the new road blocked the connection between the "row" and the "squat", resulting in multiple "end-waterways"; Secondly, the number of river channel nodes per unit length is too large, and the water flow is insufficient, so the river water flows slowly and is not oriented; finally, because the sediment in the river channel is freshly cleaned, the river bed is narrowed or even filled and disappeared. Based on its core problem, this study proposes a replicable "self-flowing" rural living water model consisting of "mutual" type living water units, and verified it through the case of Pingan Village, Haimen City, Jiangsu Province, China. Finally, the model is simulated by water flow using MIKE21 software to verify and optimize the model.

Keywords: Suzhong Self-flowing Water Model

Background

Many of China's coastal and coastal cities are located in plain water network areas with low terrain and poor drainage conditions. The Suzhong Plain area is a typical case. Its water network is a typical tidal river network, which follows a strict "canal-frame-row-squat"order. The water network model is a valuable asset left by Zhang Wei's "Save the Country" 100 years ago. Under the basic framework of the Suzhong rural system, its life and production are inseparable from water. However, along with the gradual changes in rural life and production patterns, rural water environment governance has become a thorny issue that has to be faced at the moment. The study found that the water network is unreasonable and the water pollution is the crux of the water environment in the region. The fine trenches are intertwined with the living space of the residents, but almost all the trenches have become the end of the river, and the water flows in and out in the same direction, thus forming stagnant water at the end. In addition, domestic sewage is directly discharged into the river, the sewage is not purified, and agricultural pollution is infiltrated into the soil, which also causes pollution of water bodies.

In response to this ecological problem, the local government has taken certain measures to improve, such as the implementation of the "river system" policy, the regular water pollution control of the river, etc., but due to the large human and financial resources, it is only possible to the main river channel. Water quality is governed, and water quality in trenches and waterways that are more closely related to residents' lives cannot be purified. In addition to the large amount of water pollution caused by the river network itself, another important aspect is that the current measures are all external pollution cleaning methods, and as part of the ecosystem, the river network Its own ecological stability attributes have not been stimulated. Therefore, the author hopes that in this study, the river network can be based on its own characteristics, through a series of measures to enable it to achieve self-circulation and self-purification in the current human environment, so as to the entire Suzhong water network. Play a role in improving quality.

Case Study

Ruibei Village is located in the northeast of Desheng Town, Haimen City. It borders Tongzhou Dizhen Town in the north and is merged by five communities: Ping An, Tiandong, Dingxi, Dingxing and Ruibei. The area under the jurisdiction of the village is 6 square kilometers, and the village has 51 village groups. 1,620 households with a total population of 4,050. The village has an area of 4,247 mu of cultivated land and 210 mu of water. The roads in the village are 3 vertical and 3 horizontal, 10 east and west, 1 third-class river, 7 fourth-grade rivers, 58 gullies and 16 bridges. Among them, Ping An Community (Fig. 1) is located in the middle of Ruibei Village. It is the center of the village. Its water network is criss-crossed and is a typical form of water network in the Suzhong Plain. Since Zhang Wei led the implementation of the "Tong-hai-ken-mu" project, the Ping An community has always existed as an important gathering point for residents. The residents here maintain an intimate and harmonious relationship with the water system, but due to the construction of roads and the development of industry and agriculture, Ping An Village The water environment was destroyed and the waterway structure changed. Therefore, as a typical Suzhong water network, Pingan Village has typical water environment

problems. This study will focus on the reform of the area, and conduct in-depth research on its water environment issues and propose improvement measures to form a self-flowing new water network.

Fig. 1 Ping An Community

Through in-depth research and field investigation, the author summarizes the problems in the region as three aspects: the water is not smooth, the pollution source has not been treated, and the self-recovery needs to be improved. At the beginning of the high tide, the flow of the river flows from south to north. At this time, the flow of water flowing into the river and the gully is indefinite. In 1985, the main road was built, and the main channel was cut off, making the internal gully become the broken river. At this time, the gully has a fixed flow. Direction, the direction of the river is uncertain. Secondly, the sewage in the base mainly comes from domestic sewage and agricultural sewage, and domestic sewage is directly discharged into the ditch by household. Finally, after the main road in the village is cut off from the gully, the silt in the end gully gradually accumulates. In addition, the rainstorm will make the river bank mud in the middle of the river. The government uses the method of dredging mud to fill the river channel, resulting in a gradual reduction of the river channel area. We have further analyzed the status quo problem and found that the relationship between life and water network space has changed under the changing times, including the transformation of production methods, living space and cultural entertainment. With the development of society, the residents of Pingan Village have changed from paddy sanitation to leaving their hometowns to work in cities. Therefore, the labor force has gradually moved away from agriculture. At this time, the economic value of the water network that people used to live on has gradually decreased. At the same time, the living space was basically concentrated in farmland and river courses, and with the development of transportation, public life and activities were concentrated on both sides of the road, and the internal farmland was relatively private. In addition, the water network has spawned a variety of cultural and entertainment methods, but due to the development of information and water network pollution, the village entertainment has turned to indoor development. Secondly, after many interviews with the author, it was found that the local residents of Pingan Village missed the clean and amiable rivers in the old days and expressed their

willingness to participate in the remediation plan for the river water regeneration.

Living water strategy

This study starts from the source of local water pollution and takes "living water" as the main target. Based on the respect of the original three-level water system, the site is fully utilized to make full use of the characteristics of water flow lines and flow velocity, and proposes the "water network regeneration" combined with point and line. "Planning and coupling with the public space of the villagers to reshape the scene of "water and water pro" in the water town.

Based on the original pattern of the water network, this study proposed a "mutual" type living water unit. Relying on the existing water network, the scale of the living water unit is controlled by the kinetic calculation in the module of 400*400m (Fig. 2). The directional flow of water in the unit solves the problem of the current stagnant water. The division of the unit changed the original channel structure, and the trenches in the middle became a higher level of river channel, while the whole unit formed the last level of the river. This mode can be applied to the impact plains throughout the Suzhong to improve the existing water-free problem, thereby improving the self-purification capacity of the overall ecological environment. During the high tide, the river flows from south to north. Due to the difference in water potential energy, the water flow in the living water unit enters from the river, flows through the farmland and residential areas, and flows to the secondary trench to flow northward. At the time of low tide, the water body of the river exits from the north to the south, and the direction of the water flow is opposite to the direction of the high tide. Therefore, the water purification filter between the secondary trench and the living water unit plays a role.
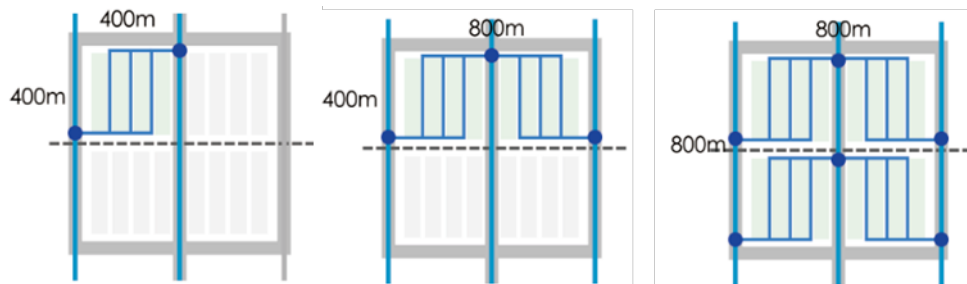

Fig. 2   "Mutual" type living water unit

Simulation

The river network is the main channel for river pollutants. The home of the River Grid Bureau is related to the migration and enrichment of river pollutants. From the perspective of pollutant transport, this study proposes four river grid bureau indices, through which these indices are Reflects the river's ability to discharge pollutants and self-purification. The number of nodes in the main river channel is $P=N/S$, that is, the length of the main channel divided by the number of rivers exchanged with the river, and the river tortuosity index $Q=S1/S2$, that is, the length of the channel divided by the line from the start point to the end of the river. The angle of the river channel is $\varphi=\arcsin[\alpha/10]$, α is the length of the vertical line from the intersection of the river channel to the main channel, the length of the sewage flow is $M=Ma+\sum Mi-1$, and M

is the height of the river basin where the sewage outlet is located. The level river crossing is at a distance from the estuary of the higher level river.

In this study, the MIKE11 software was used to simulate the hydrodynamics of the new water network. The annual average water velocity was used as the current water velocity of the river. The bottom of the river was calculated as the flat land, and the river width was averaged. The simulation results show that the current water velocity of the gully-grade river channel is about 0m/s (Fig. 3), which means that the current gully and the river water in the river channel are in the state of stagnant water. The water velocity of the gully-grade river channel of the modified "mutual" water network is 0.25m/s—0.35m/s (Fig. 4), and the water velocity is improved obviously.
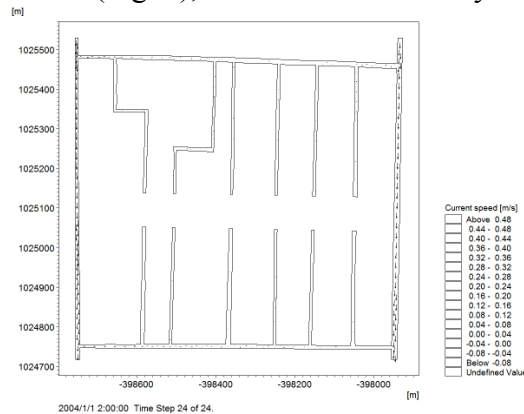
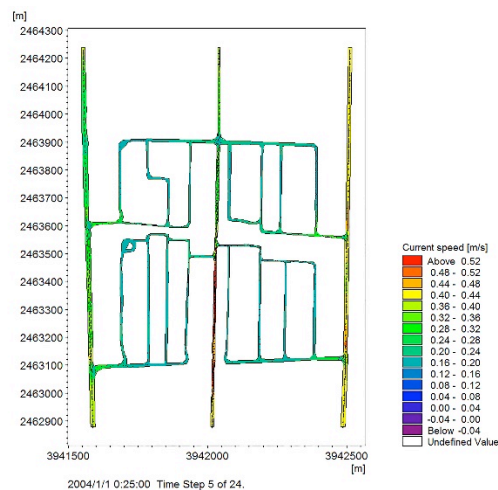Fig. 3 the current water velocity

Fig. 4 the modified "mutual" water network's velocity

Conclusion

This study verified by software simulation that the "mutual" water network can effectively improve the self-purification capacity of the water network in the Suzhong Plain. In addition, the government, residents, tourists and investors will build a family farm with demonstration functions and expand Its social impact and social benefits, and finally hope to use this as a pilot, using its modular, reproducible characteristics, to expand into the rural areas of the Soviet Union, to form a rural area of water and surplus, and water and neighbors.

For the time being, most of the water quality in the Suzhong Plain has been polluted.

In a few areas, the river water is black and smelly, and the self-cleaning function of the river has been basically lost. Through the implementation of self-flowing water network improvement measures, combined with the actual situation of water ecology in Suzhong, a new comprehensive water environment management to protect "water ecology", improve "water quality", enrich "water landscape" and develop "water economy" Road, so that water resources can play the greatest economic, social and environmental benefits. The specific requirements are to achieve four adherences, namely: adhere to the combination of water environment management and water pollution prevention and control - improve "water quality", adhere to the combination of water environment management and sustainable development of water resources - protect "water ecology" and adhere to water environment management Combine with regional culture - enrich the "water culture", adhere to the combination of water environment governance and economic development - develop "water economy". Pay attention to the combination of water environment management and economic development mode, structural transformation and upgrading, and eliminate a number of high-pollution, high-energy, low-output enterprises through the guidance and reversal mechanism, and foster the development of low-energy, low-pollution, high-value-added green industries. Vigorously develop the tertiary industry, through the improvement of water ecology, beautification of water landscape, and promotion of water culture, so that various water environment elements can be organically combined with landscaping, leisure tourism, etc. In the near future, a "water clear, shore green, scenery beautiful" - Suzhong will definitely arrive.

Acknowledgements

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