Improvement of water measuring equipment and urban waterlogging drainage during flood control period

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Abstract: Since July 2020, an ocean of river flood water level warning lines in the middle and lower reaches of the Yangtze River have a critical period of flood controlling. Flooding’s condition is concerned with people’s interests and safety. This paper considers how to accurately forecast the water level and fasten the construction of urban water logging and drainage during floods. Imagine a tempered gauge with thin bottom steel and solar energy gauge used both rain and drought to predict the flood level and water volume more accurately, and do well in flood prevention in advance. At the same time, the attention of urban water logging will be further combined with the displacement and rate of the reservoir in the system to reduce loss during urban flooding period.

1. Introduction
China's total water resources are abundant, decreasing from southeast to northwest. The regional differences in water resources are large. There are plenty of concerning problems: the per capita water resources are scarce, the water resources are seriously polluted, the water volume distribution is incompatible with the economic development status, and the water supply scheduling system has uneven supply and demand in terms of space and time. Recently, rivers in many provinces in the south have become urgent, and the safety of the middle and lower reaches of the Yangtze River has been threatened.

The process of runoff generation and confluence has changed due to the shaky human being’s activities. With the construction of urbanization, a large number of buildings and roads have been built, which lead to increase the area of the impermeable layer, reduce the amount of infiltration and evaporation, increase runoff, at the same time flood peak flow is becoming stronger. [1] The recent flooding of all hydrological stations has been emergent, and over-alarm lines have occurred in 433 rivers across the whole country. The problems caused by soil erosion, submerged losses, and property security threats have affected the Chinese people.

Rivers and lakes are the most important surface water resources, regional water condition assessment indicators, and water ecological construction content, which are related to social public interests, people's safety, and international relations. River and lake safety plays an important role in the process of urban development and urban-rural construction.

2. Suggestions for improvement of water measurement device
After positively learning relevant experience from the concept of hydrology and systematic comprehensive calculation method originated in some foreign regions, our country has developed into a hydrological forecasting system that conforms to our national conditions. Multi-factors such as water quantity prediction, water quality pollution and treatment work well together. The method of
measuring the water level of the existing hydrological station is to read the rainfall scale on the rain bottle using manual or electronic means, and obtain the rainfall depth within the specified time period through actual measurement. Flood discharge and accumulation are pretty much important in different hydrological years. Accurate readings can provide a sufficiently accurate basis for prediction and improve the resilience of water measuring equipment of hydrological stations to respond to emergencies.

Under the current trend, it is of great practical significance to manage and predict water resources availability, research and develop flood prevention instruments, and how to accurately measure and reasonably predict rainfall. If the rain gauge in the current hydrological station can collect solar energy to generate clean energy when the solar radiation is strong, obtain clean energy and protect the ecological environment; flip the solar panel when it rains, so that the equipment is protected under the cover, and at the same time use the back panel to increase the rain Collect area to achieve the purpose of improving the amount and accuracy of rainwater collection under the premise of a certain amount of rainfall. The bottom of the rain gauge is equipped with a thin bottom tempered glass, which can be used for reading when a flash flood is coming. A series of process technologies such as chemical polishing are used to change the thick bottom glass of the conventional rain bottle to an ultra-thin structure similar to the bottom of the corresponding measuring cylinder. Tempered glass is used at the bottom of the bottle to enhance the resistance to strong rain and impact. In the event of heavy rain, the prestress on the surface of the tempered glass bears the load in advance. When the ring is broken by the impact force, visible small discrete particles are first formed to facilitate the staff to have enough reaction time of changing the rain bottle will not cause safety hazard to the operators when replacing the glass.

3. Research progress of urban waterlogging

Due to the threat of natural floods, the waterlogging problem in the urban closed system has become an essential factor affecting the safety of people’s lives and property. Comprehensive and timely monitoring and forecasting of urban waterlogging disasters can improve the overall accuracy of the disaster prevention and mitigation system and reduce financial losses. [2] In the current urban construction management and prediction of sudden natural disasters, hydrological models are mainly used to simulate the flooding and retreating processes of waterlogging and the severity of disasters. By searching for the keyword "urban waterlogging", it has been found that in recent years, attention and citations have been less than those in other areas of hydrology, while it is worthy of increasing attention and strengthening research and improvement. With the development of social economy and the establishment of a complete flood escape management system, the evaluation of urban waterlogging in the future should include the evaluation of the fragile carrying capacity of residential areas, industrial areas, commercial areas, communication systems, land, animals and plants.

4. Suggestions for improvement of the waterlogging system

When evaluating the risk of urban waterlogging disasters, we must first analyze the urban waterlogging disaster and climate characteristics, using statistical analysis methods such as climate tendency rate and polynomial curve fitting, and using conventional data processing software such as excel and spss to analyze urban waterlogging Analysis of disaster characteristics and climate characteristics. [3] Based on historical disaster data and many key factors influencing the occurrence of disasters, a scenario simulation method is used to establish future disaster scenario simulations for evaluating different waterlogging disaster intensity. Scenario simulation methods for assessing urban waterlogging disasters abroad are relatively mature and can be used to simulate climate change, such as regional precipitation and temperature [4]. It is worthy of learning during the critical period of flood control. Domestic studies have pointed out that: through the transformation of the existing reservoir structure, drainage holes with different apertures are provided at the bottom of the reservoir, so that the rainwater is collected into the reservoir first during rainfall, and then slowly discharged into the soil or underground pipe after rainfall. The network can extend the drainage time, reduce the peak runoff and
reduce the probability of underground pipe network blockage. [5] Zang Jinlong [6] et al. have proposed that superposition of waterlogging point data distribution maps and different regional thematic maps can obtain a wealth of information, including superposition with lake spatial distribution maps, lake area proportion maps, lake centroid movement maps, and comparison of data for many years.

In urban infrastructure, an ecological infiltration tank that can absorb, infiltrate, and store is constructed, which concentrated treatment at the end of the urban drainage system to improve the timely response to urban waterlogging and runoff control capabilities. The following figure shows the commonly used infiltration tank structure in municipal engineering. There are 8 layers of water blocking design from top to bottom, 1-natural ecological vegetation, 2-bark covering layer, 3-planting soil layer, 4-artificial filling layer, 5-Sand layer, 6-gravel layer, 7-perforation layer, 8-irrigation layer, and filter layer are 2mm in sequence. Under the same frequency of heavy rain and rainfall, with the increase of impervious rate, the flood volume and peak discharge gradually increase. While at the same impervious rate, as the frequency of heavy rain increases, the flood volume and peak discharge also increase. Set up multi-layer plant interception, the function is to delay the water accumulation rate, provide temporary space, and at the same time concentrate the water in a certain size area of the percolation tank, which is convenient for observation and excretion. At the same time, the purification effect of natural plants can temporarily store and remove sewage in order to use conveniently in the next stage.

![Figure 1 Schematic diagram of the filter layer of the ecological percolation tank](image)

Compared with the same level system, the urban system is more complex in structure and involves a wide range of fields, which is related to public interest, public security, life and property, and humanistic inheritance. When the flood reaches a dangerous level, because the initial water accumulation is slow, which is not obvious, when the height above the wheel is reached, the pressure difference between inside and outside changes drastically, hence the door cannot be opened to escape. The window breakage also has a lot of restrictions, which poses a serious safety hazard. Further standardize management and monitoring of the drainage aperture size and drainage fluency of the storage tanks in the urban system, accumulate more rainwater in the dry season and remove a large amount of excess water during the rainy season. In the process of flooding caused by deeper and wider floods, it can be combined with the sponge city system of surface soil absorption, seepage, stagnation and drainage. The construction of a sponge city is not to overthrow and reconstruct the original drainage pipe network system, but to maximize the role of the urban environment itself on the basis of the original drainage, it is a "burden reduction" for the traditional drainage system, which has a positive effect on the construction and development of the city, and can effectively control urban waterlogging disasters and reduce the occurrence of waterlogging disasters’ frequency. [7] The frequent occurrence of extreme climate events has a more serious impact on mountain cities, often
facing with the two problems of urban waterlogging and mountain floods at the same time. [8] The full-time management department coordinates all aspects for efficient management, such as strengthens urban waterlogging awareness, improves infrastructure management and monitoring, and actively promotes the establishment of a rainwater management system, promotes the research and development of new technologies and new concepts, and establishes local urban areas. The index system for evaluating the degree of urban waterlogging and its specific calculation and analysis methods composed of instantaneous waterlogging indicators, comprehensive indicators of local waterlogging, and standard values of regional overall waterlogging indicators [9][10]. In this way, we can form a long-term system safely and timely to a certain extent at the aim of effective drainage system.

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