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Analysis and Design of Digital Water Conservancy Information System in Water Conservancy Project

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ABSTRACT. Water conservancy project is closely related to people's life. Under the background of digitalization and informatization, it is the current trend of water conservancy project construction to establish digital water conservancy information system by combining water conservancy project and digitalization, and it is also the inevitable requirement to give full play to digital water conservancy information system to promote the development of water conservancy industry. This paper analyzes and constructs the digital water conservancy information system in the water conservancy project, hoping to provide help for the relevant departments.

KEYWORDS: Digital water conservancy, Information system, Water conservancy project

1. Introduction

Since ancient times, there has been a legend of Dayu harnessing water in China. The splendid civilization and history of mankind cannot be separated from the role of water conservancy projects. With the continuous accumulation of people's experience in the construction and management of water conservancy projects, water conservancy projects have also experienced the process of retaining water by artificial force, opening channels and drainage, to the stage of using automation construction and management, including modern civil mechanical design, mechanization, model introduction and computer-aided design. At present, water conservancy project builders and managers are also actively promoting the application of computers, the Internet of things in the project to make full use of water resources. In order to optimize the allocation of water resources, one of the major measures is to make good use of the digital water conservancy system and realize the modern management of water conservancy.

2. The Concept of Digital Water Conservancy Information System

Digital water conservancy information system means to collect basic data through modern information technology, such as computer, photogrammetry, remote sensing, geographic information system and global positioning system, and to form an integrated digital platform by means of ultrashort wave, microwave, satellite, optical cable and other convenient transmission methods. In this platform, a powerful system software is running. By establishing a digital model to simulate and analyze the problems in water conservancy project management, reliable decision support is provided for water conservancy management, thus ensuring scientific and predictable water conservancy decision-making. In other words, digital water conservancy brings "water conservancy project" into the computer. By simulating, analyzing and studying the water conservancy phenomenon in the natural state, a set of internal models is found out, which is fully applied to the development, management and governance of water conservancy to improve the efficiency of comprehensive water conservancy management.

3. The Current Situation of Digital Water Conservancy Information System

With the progress of science and technology, many local governments have established the basic digital water conservancy information system, and made some achievements, promoting the modernization of water conservancy projects. But on the whole, the application and development speed of digital water conservancy information system is relatively slow, the software and hardware facilities are not very developed, and there are many problems in the practice process. First of all, the understanding of informatization is not enough to keep up with the changes of external environment, there is no sense of urgency, and there is no unified command system and corresponding construction mechanism. The application and development of digital water conservancy information system has not formed a unified plan, nor has it set a clear development goal, and lacks integrity and order. Secondly, the information investment in

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water conservancy project is insufficient. Since the information infrastructure of our country is yet fully developed, there are obvious deficiencies in the development of information sources, the means of collecting and transmitting information are generally backward, and there is a lack of water information network covering the whole region. Especially in the important fields related to national economy and people's livelihood, such as water resource management, flood control and drought relief, water quality monitoring, soil and water conservation, there is no unified application system in a large range. Thirdly, the development of public information platform is relatively slow, and the interconnection of digital water conservancy and large-scale information integration have not yet taken shape. In addition, the overall planning and management of the city is not suitable for the needs of informatization, and the comprehensive quality of informatization personnel is not high, which makes the construction of "digital water conservancy" in many areas and cities remain in the initial stage, or the function is not fully developed.

4. Establishing Digital Water Conservancy Information System in Water Conservancy Project

Many cities in our country are still facing serious water use problems, such as flood threat, drought, lack of water resources and so on. The digital water conservancy information system connects the water conservancy industry and information technology, uses advanced technology to provide sustainable development strategy for the city, and promotes sustainable development of water resources. In addition, the digital water conservancy information system in water conservancy project involves many aspects and technologies.

4.1 Flood Control and Disaster Reduction Information System

Flood control and disaster reduction is an important goal of digital water conservancy information system. Through the comprehensive use of digital water conservancy information system, it can automatically collect, transmit, process and store all kinds of flood control information, realize the timely transmission of information, accurate flood forecast, visual flood control management, optimize the command, and realize the modern flood control.

4.1.1 Rainfall Forecast

The key basis of flood control decision-making is to accurately predict rainfall duration. By using telemetry, remote sensing and satellite technology in digital water conservancy, hydrological information that could not be provided in the past can be provided for the forecast of meteorology and hydrology, so as to greatly improve the accuracy of rainfall forecast and extend the predicted rainfall duration.

4.1.2 Flood Forecast

At present, three flood forecasting methods are mainly adopted in China, they are rainfall runoff correlation method, peak flow measurements and flood forecasting model prediction. In theory, these forecasting methods are easy to achieve, but they all have a same problem, that is, it is difficult to understand and grasp the rules of watershed runoff. Using digital water conservancy, this problem can be solved. Taking a Chinese city Cangzhou as an example, the rivers in the upper reaches of Cangzhou and the local heavy rainfall are easy to cause rainstorm and flood, while Cangzhou belongs to the arid and semi-arid area, which has complex underlying surface conditions. In recent years, the underlying surface conditions of Cangzhou have been constantly changing, so it is very important to understand the underlying surface parts in the basin and understand the new changes at any time. Through the digital water conservancy information system, we can use the satellite to obtain high-quality images, cooperate with other bottle bodies, and realize the three-dimensional management of the underlying surface data.

4.2 Water Dispatching System

Due to the emergence of environmental pollution, the supply and demand of water resources has become a major focus of urban development. In order to distribute water resources scientifically and reasonably, modern information system needs to be used to realize modern dispatching.

4.2.1 Runoff Forecast in Dry Season

An important basis of water allocation is runoff forecast in dry season. In the past, cities seldom considered the runoff forecast in dry season. European and American countries first began to organize and develop "river forecast system", which has a great effect by providing urban decision makers with medium and long-term water regime probability prediction based on month and season, and applying the results to water resource management. After this,

China has also begun to actively learn from international experience, and regards runoff in low flow period as an important point in the construction of digital water conservancy informatization.

4.2.2 Helpful to Establish Regional Ecological Simulation System

The estuarine area is generally located in the downstream of the river, and its ecosystem is relatively primitive. An important prerequisite for the sustainable development and maintenance of the ecosystem in reservoir and estuarine areas is that there is enough freshwater supply, and the biodiversity of these ecosystems also depends on freshwater supply. Through the platform of digital water conservancy information system, the ecosystem in this area can be digitized. The platform can be used to analyze the reproduction rate of the main organisms, calculate the metabolism of the group organisms, and calculate the fresh water supply to maintain the ecosystem according to these ecological indicators, so as to keep the minimum flow and minimum flow in different seasons and different periods of time runoff.

In order to respect the objective reality, in the process of building the system, the large-scale system can be divided into subsystems, and then further divided into sub-subsystems. Each sub-subsystem is regarded as a unit with similar type (such as river reach and irrigation area), which is called “box”; then, according to the actual data, the water quantity, water quality and ecosystem models of each box are established respectively, and the coupling calculation is carried out; according to the model integration method, the subsystem models are coupled and integrated into a large-scale system model, so that the final hydrology of the whole system--ecological coupling system model can be obtained.

The establishment of the ecological simulation system will actively help ecologists and hydrologists to better understand the data and problems of water cycle and ecosystem changes, so as to consider and manage the water quantity and water quality, and organically combine the changes of water quantity and water quality with the ecological environment protection, so as to realize the goal of “sustainable utilization of resources and protection of integrity of ascending system”.

4.3 Helpful to Improve the Level of Water Environmental Governance and Monitoring

Remote sensing technology and GIS technology are applied to interpret and process the photo information transmitted by satellite, and a dynamic monitoring system for soil and water conservation is established in each region. The water quality station network needs to be established, and the data needs to be collected to establish the pollution source database. By simulating the water quantity and quality problems, and taking the GIS system as the query interactive platform, a system that can detect and manage the dynamic of water environment can be built. It is necessary to inspect and monitor the water quality of the main stream section and the main tributaries in real time, and establish a monitoring database. By using the diffusion and movement model of pollutants in rivers, the diffusion and movement of pollutants in rivers can be analyzed, and the situation and change of water quality can be predicted, especially for the urban residents’ drinking water.

The monitoring system is controlled by computer automatically. Its working system consists of information collection system, information transmission system, information management system and information service system. The information collection system completes the information collection and arrangement of automatic detection system, and transmits all kinds of information to the water and soil monitoring center through the communication system and computer network, so as to ensure that the decision-making department can understand the water and soil situation in time, and issue the water and soil bulletin in time, so as to provide scientific basis for water quality control and water environment management.

Water quality monitoring provides the basis for the assessment of pollution load red line in “three red lines”, which can win valuable time for dealing with water pollution emergencies, and provide reliable information support for relevant departments to make decisions on water environment management.

4.4 Value in Soil and Water Loss Monitoring and Prevention

The digital water conservancy information system should take monitoring and controlling soil erosion as its content. Through the promotion and application of 3S technology in the system platform, the advantages of GPS in accurate positioning will be brought into play. RS will be able to summarize the situation of soil erosion in time, so the situation and extent of soil erosion in a certain area can be knew. At the same time, GIS can also be used to evaluate the economic, social and ecological benefits caused by soil erosion control.

4.5 Value in Water Conservancy Project Management

Through digital water conservancy information system , the operation status of important water conservancy projects can be mastered in real time. In fact, the digital water conservancy information system can be used to realize the automatic management of water conservancy projects from planning, design, construction to final operation and maintenance. Planning information management system can be established to promote the rolling planning and management. CAD and other design software can be applied to improve the drawing efficiency of the design scheme. In addition, project management software can be used to control the progress of the project, so as to save the cost of the project.

5. Conclusion

Digital water conservancy information system is a system engineering which is built by making full use of modern information system under the premise of scientific and technological progress. It needs to carry out unified planning and layout with the new ideas of water control in the new era, comprehensively consider the order and priority, and pay attention to the actual effect, so as to complete the construction of digital water conservancy. The information technology in water conservancy project needs to be improved, and the informatization of “digital water conservancy” needs to be used to promote the development of water conservancy industry.

The improvement of water environment and water quality is one of the important supports related to the quality of life of residents and the sustainable development of economy. The quality of water environment needs to be based on the recent and long-term historical changes of the river basin to formulate a long-term governance plan. The use of digital water conservancy information system can timely provide relevant departments with relevant current and historical data, make effective governance decisions, prevent and control pollution from the root, control water use, fundamentally restore the self-circulation ability and ecological function of the basin, and further improve the ecological environment.

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