

Analysis of the Importance of Hydrogeological Geological Survey for Geological Disaster Prevention and Control

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Abstract: Hydrogeological geological survey, as an important part of geological disaster prevention and control work, is increasingly highlighted in its importance. It is not only a necessary means to explore underground hydrogeological conditions but also a key to revealing the causes of geological disasters. Through in-depth research and analysis, we can accurately grasp the details of the geological environment, thereby formulating more scientifically effective prevention and control measures. At the same time, hydrogeological geological survey also provides important basis for the prediction and early warning of geological disasters, helping us to make full preparations before disasters occur, minimize disaster losses, and protect the safety of people's lives and property.

Keywords: hydrogeological geological survey; geological disaster prevention and control; importance analysis

Introduction

Geological disasters occur frequently, posing a serious threat to the safety of people's lives and property. The work of geological disaster prevention and control is urgent. Hydrogeological geological survey, as an important part of prevention and control work, is self-evidently important. Through in-depth surveying, we can grasp detailed information about the geological environment, reveal the causes and mechanisms of geological disasters, and provide scientific basis for prediction and early warning. Moreover, hydrogeological geological survey also helps in formulating targeted prevention and control measures to reduce disaster losses. Therefore,

strengthening hydrogeological geological survey work is of great significance for geological disaster prevention and control.

1. Overview of Hydrogeological Geological Survey

Hydrogeological geological survey is a crucial component in the fields of geology and environmental science, focusing primarily on the interaction between groundwater, surface water, and the rock and soil formations. Through in-depth study of these interactions, vital information regarding groundwater movement patterns, storage conditions, and water quality can be obtained, thereby providing a scientific basis for water resource development, environmental protection, and



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geological disaster prevention and control. The core tasks of hydrogeological geological survey include determining the distribution, reserves, and quality of groundwater resources, revealing groundwater movement patterns, and assessing the feasibility and environmental impacts of groundwater resource development and utilization. During the survey process, a variety of methods and techniques need to be comprehensively utilized, including drilling, geophysical exploration, testing and analysis, remote sensing, etc., to obtain comprehensive and accurate hydrogeological data. In hydrogeological geological survey, drilling is a commonly used technique. Through drilling, samples of underground rock and soil formations can be directly obtained to understand their physical properties, chemical compositions, and structural characteristics. Additionally, drilling can also reveal the occurrence state and movement patterns of groundwater, providing direct basis for evaluating groundwater resources. Geophysical exploration techniques also play an important role in hydrogeological geological survey. By using geophysical exploration techniques, we can non-invasively detect the structure and properties of underground rock and soil formations, as well as the distribution and movement status of groundwater. This information is of great significance for assessing the potential of groundwater resources and predicting geological disaster risks. Furthermore, testing and analysis are indispensable components of hydrogeological geological survey. Through chemical analysis, isotope analysis, etc., of groundwater samples, we can understand the chemical composition, age, and source of groundwater, thereby evaluating its water quality status and development value. With the continuous advancement of technology, the application of remote sensing technology in hydrogeological geological survey is becoming increasingly widespread. Remote sensing technology can rapidly acquire surface information over large areas, including terrain, vegetation coverage, water body distribution, etc., providing important auxiliary data for hydrogeological geological survey.

2. The Role of Hydrogeological Geological Survey in Geological Disaster Prevention and Control

2.1 Risk Assessment and Prediction

The primary role of hydrogeological geological survey

in geological disaster prevention and control is to conduct risk assessment and prediction. Geological disasters often occur with complex changes in underground hydrological conditions, including fluctuations in groundwater levels, deterioration of water quality, and alterations in flow velocity. Through thorough hydrogeological geological surveying, critical information can be obtained, enabling accurate assessment of geological disaster risks. Risk assessment involves not only judging the likelihood of geological disaster occurrence but also predicting the scale of disasters and potential impact areas. This information is crucial for planning disaster prevention and control efforts. The results of hydrogeological geological surveying can provide scientific decision-making basis for relevant authorities, helping them identify priority areas and tasks for disaster prevention and control. Additionally, hydrogeological geological surveying aids in predicting the development trends of geological disasters. By monitoring dynamic changes in underground hydrological conditions, abnormal geological phenomena can be detected timely, predicting the possible occurrence time and location of geological disasters. This predictive capability assists in taking preventive measures in advance, reducing the likelihood and losses of disasters.

2.2 Construction of Disaster Early Warning Systems

In geological disaster prevention and control, hydrogeological geological survey plays a pivotal role in the construction of disaster early warning systems. Geological disaster early warning systems are indispensable tools for preventing and responding to geological disasters in modern society. The effective operation of early warning systems relies on key data and information provided by hydrogeological geological surveying. Hydrogeological geological survey work can reveal in-depth information about the occurrence state, movement patterns of groundwater, and its interaction with rock and soil formations. These detailed pieces of information not only help accurately assess the risk level of geological disasters but also provide valuable scientific basis for the construction of early warning systems. Supported by this information, early warning systems can monitor changes in underground hydrological conditions in real-time, predict the possibility of disasters, and issue timely warning signals. Hydrogeological geological surveying

also plays an important role in continuously improving the functionality and performance of early warning systems. With the continuous advancement of surveying technology, more accurate and comprehensive underground hydrological information can be obtained, further enhancing the predictive capabilities of early warning systems. Additionally, through continuous optimization of surveying methods, the reliability and stability of early warning systems can be improved to ensure their effective operation during critical moments. Hydrogeological geological surveying plays an indispensable role in the construction of geological disaster early warning systems, providing valuable geological information, supporting the construction and improvement of early warning systems, and ensuring the solid guarantee of geological disaster prevention and control efforts.

2.3 Formulation of Prevention and Control Measures

Another important role of hydrogeological geological survey in geological disaster prevention and control is the formulation of prevention and control measures. Geological disasters often exhibit suddenness and unpredictability, making it particularly important to develop scientific and effective prevention and control measures. Hydrogeological geological surveying serves as a crucial basis for formulating these measures. Through hydrogeological geological surveying, we can gain in-depth understanding of the characteristics of the geological environment and the mechanisms of disaster occurrence. This information helps accurately determine the types and scales of geological disasters, providing a basis for formulating targeted prevention and control measures. For example, in areas prone to landslides, by investigating the distribution and movement patterns of groundwater, we can assess the likelihood of landslides and the location of slip surfaces, thus formulating corresponding reinforcement and drainage measures. Hydrogeological geological surveying also provides important parameters and basis for the design and construction of prevention and control engineering projects. For instance, in the construction of retaining walls or drainage ditches, understanding the occurrence state and permeability of groundwater is necessary to ensure the safety and effectiveness of the engineering projects. Through hydrogeological geological surveying, critical information can be obtained to provide a scientific

basis for the design and construction of prevention and control engineering projects. The continuous innovation and development of hydrogeological geological surveying also provide new methods and means for geological disaster prevention and control. With the continuous advancement of technology, new surveying techniques and methods emerge, providing more accurate and efficient surveying results.

3. The Importance of Hydrogeological Geological Survey in Geological Disaster Prevention and Control

3.1 Providing Scientific Basis for Geological Disaster Prediction and Early Warning

Hydrogeological geological survey plays a crucial role in geological disaster prevention and control as it forms the cornerstone for predicting and warning of geological disasters and is key to formulating effective prevention and control strategies. Geological disasters such as landslides, debris flows, and ground collapses are often closely related to changes in underground hydrological conditions. Factors such as fluctuations in groundwater levels and changes in water pressure can serve as triggers for geological disasters. Therefore, it is vital to thoroughly understand the occurrence state, movement patterns of groundwater, and its interaction with rock and soil formations for effective disaster prevention and control. Through a series of field surveys, tests, and analyses, hydrogeological geological surveying can provide detailed information about underground hydrological conditions. This information includes not only basic facts such as the distribution, reserves, and water quality of groundwater but also deeper insights into groundwater movement patterns, recharge-discharge conditions, and interactions with rock and soil formations. Based on this critical information, accurate assessments of the risk levels of geological disasters can be made. By comparing changes in underground hydrological conditions in different regions and time periods, we can identify patterns and trends in geological disaster occurrences, thus predicting the possible timing and locations of geological disasters. This predictive capability is crucial for geological disaster prevention and control efforts as it helps in taking preventive measures in advance to reduce disaster losses. When designing prevention and control engineering projects, the

influence of underground hydrological conditions must be fully considered to ensure the safety and stability of the engineering structures.

3.2 Revealing the Causes and Development Mechanisms of Geological Disasters

Undoubtedly, hydrogeological geological surveying is an indispensable component of geological disaster prevention and control efforts, particularly in revealing the causes and development mechanisms of geological disasters. Geological disasters often involve complex and varied geological environmental factors, with changes in underground hydrological conditions often serving as critical triggers. In-depth hydrogeological geological surveying, akin to a sharp sword in the hands of geologists, can penetrate layers of fog to reveal the subtle interactions between groundwater and rock and soil formations. These relationships resemble a complex geological script, with every detail affecting the causes and development of geological disasters. Taking landslides as an example, their occurrence is not random but rather the result of multiple factors. Among these, factors such as fluctuations in groundwater levels and changes in water pressure act as "hidden hands" behind the scenes, subtly influencing the stability of landslide bodies. Through hydrogeological geological surveying, we can accurately grasp the occurrence state and flow patterns of groundwater, capturing the actions of these "hidden hands." Furthermore, through this information, we can understand crucial details such as the moisture content and stress state within landslide bodies. These details serve as "vital signs" of landslide bodies, with their changes directly reflecting the stability of landslide bodies. By understanding the patterns of change in these "vital signs," we can more accurately reveal the causes and mechanisms of landslide disasters, providing a scientific basis for formulating targeted prevention and control measures.

3.3 Guiding the Design of Geological Disaster Prevention and Control Engineering

Geological disaster prevention and control engineering, as a crucial barrier to maintaining social stability and people's safety, requires every step in its design and implementation process to be particularly critical. In this series of processes, hydrogeological geological surveying undoubtedly plays a crucial role. It is not merely a simple surveying process but

rather an important basis for scientifically guiding the design of geological disaster prevention and control engineering. At the beginning of prevention and control engineering design, we must have a clear and comprehensive understanding of the causes, development processes, and impact ranges of geological disasters. Hydrogeological geological surveying is the crucial means by which we obtain this key information. Through thorough surveying, we can understand detailed geological information such as stratigraphic structure, lithological characteristics, and groundwater distribution. This information not only helps us reveal the causes and mechanisms of geological disasters but also provides a scientific basis for formulating prevention and control plans. More importantly, hydrogeological geological surveying can provide important parameters and bases for the design of prevention and control engineering projects. When designing prevention and control engineering projects such as retaining walls or drainage ditches, we need to fully consider the occurrence state and permeability of groundwater. This is because changes in groundwater directly affect the stability and drainage effects of these engineering structures. Through hydrogeological geological surveying, we can understand information such as groundwater movement patterns and recharge-discharge conditions, ensuring that the design of prevention and control engineering projects is more scientific, rational, and meets practical needs.

3.4 Enhancing Monitoring and Model Prediction Capabilities

With the rapid development of technology, the application of hydrogeological geological surveying technology in geological disaster prevention and control is becoming increasingly widespread, bringing revolutionary changes to the prediction, early warning, and prevention and control of geological disasters. Modern hydrogeological geological surveying technology, aided by advanced instruments and efficient surveying methods, significantly improves the accuracy and efficiency of obtaining geological information. High-resolution geophysical exploration technology, unmanned aerial vehicle remote sensing technology, underground water dynamic monitoring systems, etc., allow us to gain deeper insights into the occurrence state, movement patterns of groundwater, and its interaction with rock and soil formations. These

detailed geological information provide a solid data foundation for revealing the causes and mechanisms of geological disasters and formulating prevention and control plans. More importantly, modern hydrogeological geological surveying technology provides us with more monitoring methods and model prediction techniques. By monitoring changes in underground hydrological conditions in real-time, we can promptly capture abnormal geological phenomena such as sudden fluctuations in groundwater levels or rapid changes in water pressure. These abnormal phenomena are often precursors to geological disasters; therefore, timely detection and analysis are essential for predicting and warning of geological disasters.

Conclusion

With the rapid advancement of technology, hydrogeological geological surveying techniques are evolving at an unprecedented pace, continuously improving in accuracy and efficiency. The application of new surveying methods and technologies enables us to comprehensively grasp underground hydrological information and accurately analyze trends in geological environments. This not only enhances the accuracy

of geological disaster prediction but also helps us formulate more scientifically effective prevention and control measures, significantly reducing the losses caused by geological disasters and further strengthening the defense line for the safety of people's lives and property. Therefore, strengthening hydrogeological geological surveying work is of paramount importance and is the key to enhancing the capability of geological disaster prevention and control.

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