Advances in Hydraulic Engineering (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/hyde.2023.030101
ISSN 2616-2431 Vol. 3 Num. 1

The Brief Analysis on Operation Management of Large and Medium-sized Reservoirs

Yang Li[1,2], Xiaojing Zeng[1], Xiao Kong[3], Lianhai Cao[1,*]

[1]*College of Surveying and Geo-informatics, North China University of Water Resources and Electric Power, Zhengzhou, China*
[2]*Construction Management and Quality Safety Center, Ministry of Water Resources, Beijing, China*
[3]*Shandong Yellow River Material Reserve Center, Jinan, China*
[*]*Corresponding author*

Keywords: Reservoir, Operation management, Uncover problems during Inspections, Management model

Abstract: Reservoir safety management is a very important engineering link in the infrastructure construction of water conservancy projects in China, which plays an important role in ensuring the economic development of China. However, at this stage, the Ministry of Water Resources found that there are various potential safety problems in the management of provincial, municipal and county level reservoir management units through inspection. In this paper, three typical reservoirs are selected as the research object, and the potential safety problems are classified and analyzed. It will provide a strong guarantee for the subsequent strengthening of the safety management of large and medium-sized reservoirs and continuously promoting the standardization of the management of large and medium-sized reservoirs.

1. Introduction

After the founding of the People's Republic of China, Chinese water conservancy flood control engineering system has made great progress [1]. A large number of large and medium-sized reservoirs have been put into operation, becoming the backbone of water conservancy flood control projects, giving full play to the efficacy of flood control and disaster reduction, and ensuring the safety of people's lives and property [2,3]. There are many large and medium-sized reservoir management units, and their management ability is uneven, which causes some hidden dangers to the safe operation of the reservoir [4, 5].

This time, three typical reservoirs in a province were selected as the research object, and the management problems of reservoir management units at the provincial, municipal and county levels were reflected through the inspection, from which the management loopholes faced by large and medium-sized reservoirs in the province were summarized, and suggestions were put forward for the next step to promote the standardization of the management of large and medium-sized reservoirs in the province [6-8].

2. Uncover Problems during Inspections

This time, three representative reservoirs are selected as research objects, which are directly administered by the provincial water administration department, directly administered by a municipal government and directly administered by a county water conservancy bureau. The corresponding levels are large (I) reservoir, large (II) reservoir and medium reservoir. Hereinafter refer to the three reservoirs by provincial, municipal and county management respectively.

A total of 56 problems of all kinds were found in the inspection of the three reservoirs, which were divided into two types of problems, namely violation behavior and quality defects, and three levels of problems, namely serious problems, heavier problems and general problems. Through the analysis of the problems found from multiple angles, the deficiencies in the operation and management of the three reservoirs were studied. The number of problems found in the three reservoirs is shown in the table below. (Figure 1)

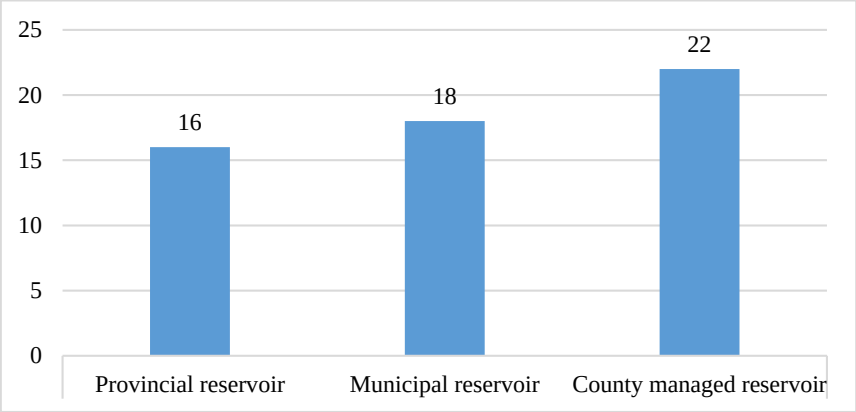

Figure 1: Comparison of the number of problems found in three reservoirs.

From the inspection found the number of problems, the number of problems in provincial management reservoir is less.

2.1 Qualitative Analysis by Problem

Among the 56 problems, 16 were serious problems, accounting for 28.6%; there were 32 heavier problems, accounting for 57.1%; there were 8 general problems, accounting for 28.6%. (Figure.2)

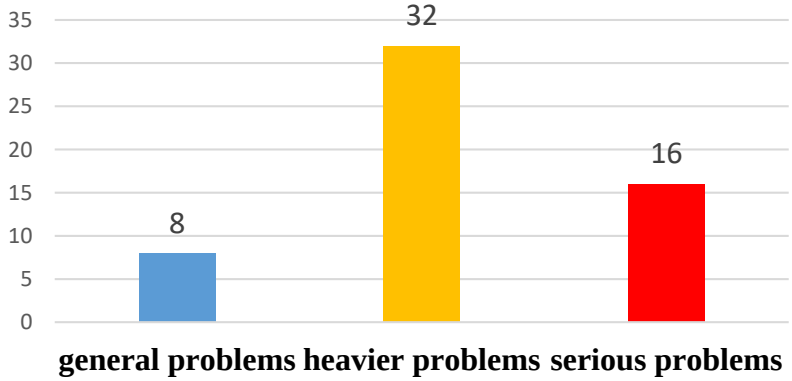

Figure 2: Comparison of the proportion of serious problems, heavier problems and general problems.

According to the qualitative classification of problems, the heavier problems found in the three reservoirs are relatively high, and then the three reservoirs were analyzed separately according to the

qualitative analysis. (Figure 3)

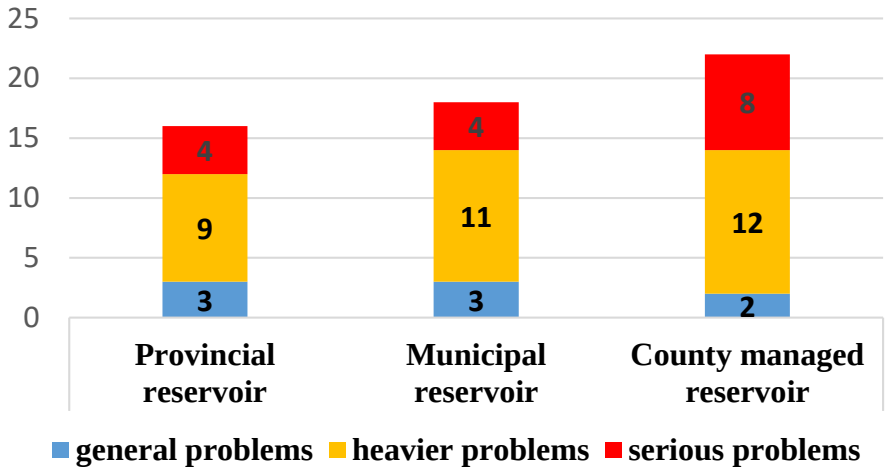

Figure 3: Comparison of data on serious, heavier and general problems in provincial, municipal and county managed reservoirs.

On the whole and individually, the commonality of the three reservoirs is that serious and heavier problems account for a large number. From the point of view of management units, serious and heavier problems of provincial, municipal and county reservoirs increased successively, and the management level of reservoirs in the province gradually decreased to the grass-roots level.

2.2 Analyze by Problem Type

Among the 56 problems, 32 were violations, accounting for 57.1%; there were 24 engineering defects, accounting for 42.9%. (Figure 4)

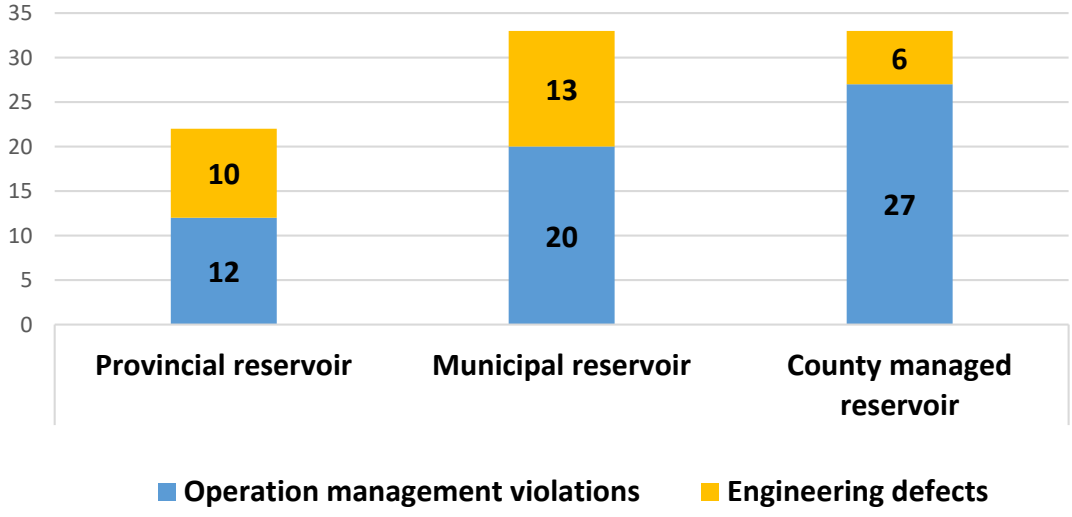

Figure 4: Proportion of violations and engineering defects among 88 existing problems.

From the perspective of problem types, the number of violations was obviously greater than the number of engineering defects, and the number of violations of provincial management, municipal management and county management reservoirs increased successively, accounting for an increasing proportion, reflecting that the reservoir management ability of the province was gradually declining to the grass-roots level.

2.2.1. Violation Analysis

The violation problem is divided into different types based on the content of the problem. (Figure 5)

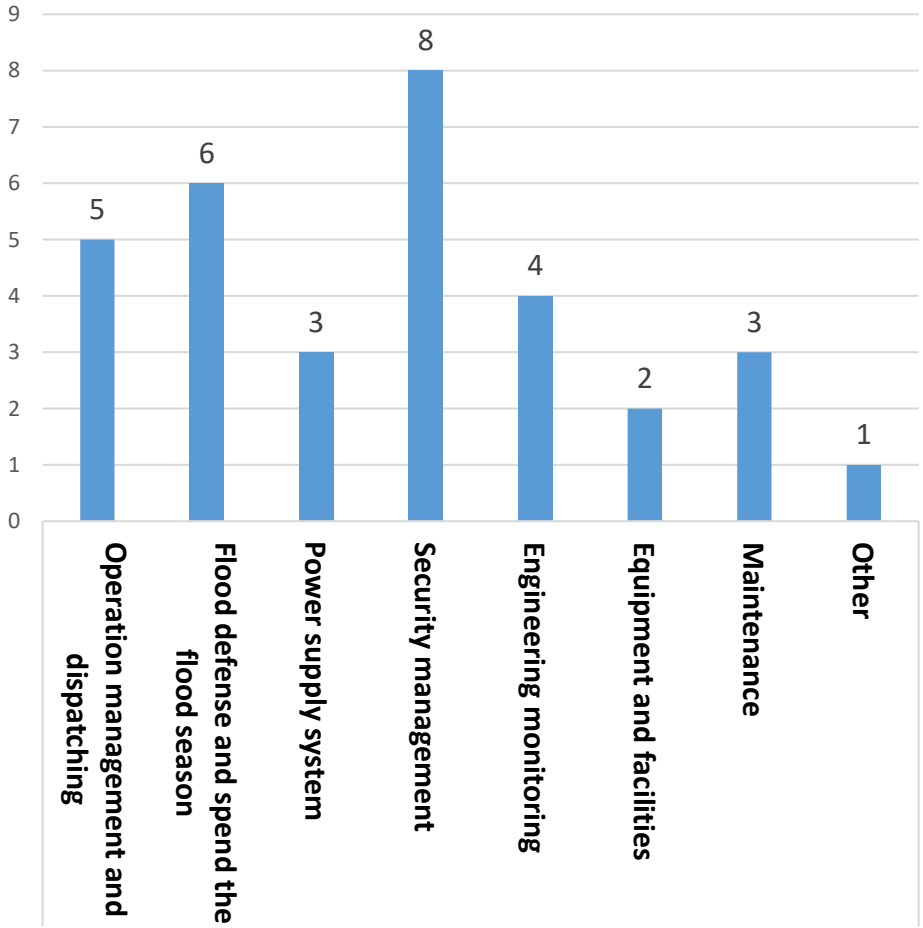

Figure 5: Proportion of different types of violations

From Figure 5, security management problems are more prominent.

2.2.2. Engineering Defect Analysis

According to the problem content, the engineering defect problem is divided into different types. (Figure 6)

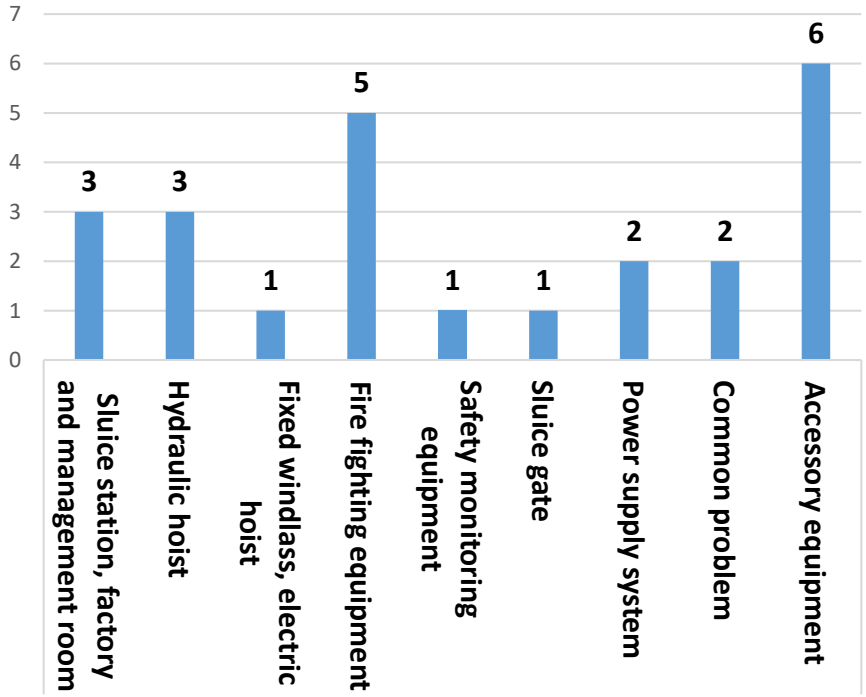

Figure 6: Classification of specific problem types in engineering defect problem

As can be seen in the chart above, fire and accessory equipment found the most problems.

To sum up, through analysis from different perspectives, basic judgments can be made:

(1) The management level and ability of the province, the city and the county had been lowered layer by layer.

(2) The standard management of the province's water management unit needed to be strengthened.

(3) Safety management is the weak point of reservoir management at three levels in this province.

3. Hidden Danger of Three Reservoirs Management Mode

3.1 Provincial Reservoir

The operation and maintenance of the provincial reservoir are entrusted to the company, and the management unit cannot grasp the operation management and dispatching, and the supervision is insufficient. During the inspection, the operation and maintenance unit has 8 shift personnel off duty, and the management personnel do not grasp the password of the dispatching system and monitoring system, so they cannot perform the scheduling operation. Moreover, if the personnel on duty arrive after notifying the operation and maintenance unit, they only grasp the password of the dispatching system and do not grasp the password of the monitoring system, they cannot perform the monitoring and inspection duties. This management mode has hidden risks of operation scheduling security, management units should pay great attention to it [9].

3.2 Municipal Reservoir

The municipal Reservoir Management Bureau is set up in urban area, and the dispatching center is set up in the flood control watch room on the site of the dam. The two places are one hour's drive away. The watch room has 3 people on duty 24 hours a day, and the change is once a week. Three personnel on duty are responsible for receiving transfer orders, opening calculation, gate control,

routine inspection and other work. The Administration has not formulated an annual maintenance plan. Due to the remote location, the on-duty personnel will conduct preliminary treatment after finding out the problem through inspection. If the problem exceeds the capacity, the Administration will entrust a third party to centrally handle it.

Although this management mode saves money, it has hidden safety risks. There is no professional maintenance personnel on site. In case of an emergency, the personnel on duty does not have the ability to deal with it, which will have a significant impact on the operation of the reservoir.

3.3 County Pipe Reservoir

The power station of the county reservoir has been sold to private companies. The on-site inspection found that the equipment of the power plant was aging, the management personnel did not have professional knowledge, and the management was chaotic. Such as: in the power control room private use of old electric furnace wire electric furnace, high voltage distribution room without fire detection device, equipped with fire extinguishers expired, no light and other problems.

There are hidden dangers of safety risks in power plant management. Although the power station has been resold, the county water resources Bureau still has the responsibility of supervision. The non-standard management of the power station will lead to the accident, which will affect the normal operation of the reservoir and cause a bad impact.

4. Cause Analysis

4.1 Weak Safety Awareness

The three reservoirs have been operating for many years without any safety accidents, and the management personnel have little awareness of safety precautions. Especially in the aspects of fire safety and safety protection, they ignored some common problems and did not rectify them in time to meet the requirements of refined management. The idea of rebuilding light management still exists [10].

4.2 Loose Thinking

The provincial reservoir has won many honors since it was put into operation. The staff are proud and complacent. Most of the management work is entrusted to a third party, resulting in lax thinking and insufficient technical ability of the management personnel, laying hidden dangers for the safe operation of the project.

4.3. The Professional Competence of the Management is Inadequate

There are few professional management personnel of the reservoir in the municipal reservoir, the existing management personnel have low education, not high professional quality, not familiar with the operation rules and regulations, daily management is all based on experience, the new technology, new requirements cannot be timely grasp and update. In particular, the lack of professional knowledge on safety monitoring and fire safety leads to the lack of timely discovery of reservoir safety hazards, which affects the safe operation.

4.4. Routine Inspection Management is not in Place

Routine inspection management is not in place. Municipal reservoir management units do not pay attention to the inspection work, daily inspection is a formality, did not find and eliminate hidden

dangers in a timely manner, so as to prevent problems gradually.

4.5. Construction and Operation Standards are not updated

The construction of the county reservoir began in the 1980s and was put into operation in the 1990s. The construction and operation standards adopted by the county reservoir were lower than the current standards. The management personnel have been managing and operating in accordance with the original standards for a long time, resulting in the old operation equipment and facilities, and the failure to update the operation technical standards in time, which laid many hidden dangers for the operation and management of the reservoir.

5. Summary

The normal and safe operation of large and medium-sized reservoirs is of great significance to social development. Therefore, the staff of relevant water institutions should fully understand the potential safety problems and reasons existing in the operation of large and medium-sized reservoirs. Only by constantly improving and strengthening the norms of safe operation and management of reservoirs can we effectively reduce the occurrence of safety accidents, give full play to the actual effectiveness of reservoirs, and provide a strong guarantee for the orderly development of China's economy and society [11].

References

[1] Haifei Guo. Analysis of ecological slope protection construction in water conservancy and flood control project. Agricultural Science-Technology and Information. 2021, (10): 113-114.
[2] Ye Guoping, Lu Zhangsheng. Analysis and counter measures of problems found in safety operation supervision of Shantang reservoir. Low Carbon World, 2020, 10 (05), 116-118.
[3] Jinsheng Jia. A Technical Review of Hydro-Project Development in China. Engineering. 2016, 3(2):302-312.
[4] Mingjian Chen. Analysis on classification of underground reservoirs. Sichuan Cement. 2019 (05): 355+346.
[5] Qingyuan Zhu, Guohua Fang. Evaluation index system for positive operation of water conservancy projects. Water Science and Engineering. 2009, 4(2): 110-117.
[6] Jiaxin Pan. Analysis on safety management and construction of medium and small reservoirs. Low Carbon World, 2020, 10 (05): 116+118.
[7] Yangxin Shi, Discussion on key points of safety management and construction of medium and small reservoirs. Low Carbon World, 2021, 11 (12): 111-112.
[8] Miao Chen, Yuanchao Wu. Discussion on standardized management of reservoir water conservancy project. New Technology & New Products of China. 2018 (13): 74-75.
[9] Liu Yan. Safety monitoring and accident prediction during reservoir operation period. Heilongjiang Hydraulic Science and Technology. 2022, 50 (07): 197-199+207.
[10] Tan Jiexiong, Li Xing, Wang Mixue, Yang Guang. Discussion on safety management of reservoirs in the new age. China Water Resources. 2021, (18): 36-38.
[11] Yunshu Yu, Common Problems and Countermeasures in Operation and Management of Medium sized Reservoirs. Sichuan Cement. 2018, (06): 188.