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MECHANICAL RESOURCES AVAILABLE AT MIDDLE TISZA DISTRICT WATER DIRECTORATE FOR EXTERNAL FLOOD PROTECTION AND OUTSOURCING

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Abstract

After 1998, the flood waves of the Tisza, Zagyva and Hármas-Körös rivers reached record levels in the area of operation of MTDWD requiring significant mechanical resources from the Water Directorate and participating external organizations in order to perform the protection tasks. In this article, the author describes the volume of mechanical resources used in the management of the MTDWD and the volume of those provided by external organizations during the flood control of the Tisza River in 2000, 2006 and 2010. It proves that in the event of flood defenses exceeding the order level, the Directorate's own machinery resources are not sufficient, and that therefore, external machinery capacities are indispensable to meet future requirements.

Keywords*: flood protection, mechanical resource, defense intervention, damage prevention, external forces.*

1. Introduction

The water directorates responsible for flood protection have undergone major organizational changes since the 1990s. The construction and execution departments of the organization have been dissolved or reorganized. As a result, the mechanical capacity of the Directorate has been significantly reduced and currently no longer has the technical capacity and quantity of equipment to fully carry out water damage prevention activities. In order to provide the shortfall in mechanical resources, it is essential to involve external organizations that have the necessary technical means. (For example: disaster management, the military, law enforcement agencies, construction companies, entrepreneurs, service providers, etc.)

The reality of the topic is evidenced by the fact that during the flood protection of the last decades, significant external machinery resources had to be involved in all cases because the directorates concerned did not have sufficient technical machinery and tools for defense requirements.

The possibility of higher floods than the previous flood waves of the Tisza **[1]** ehas to be taken into account, and preparations must be made to prevent them and to intervene in order to protect the population.

Publications dealing with the state of flood control in Hungary are often published in the Hungarian literature, however, they do not investigate the state of the mechanical resources of the water sector, and do not investigate and explore the possibility of compensating for the lack of mechanical and technical equipment.

In this article, I present the mechanical resources used in flood protection work during the floods in the MTDWD area in 2000, 2006 and 2010, and examine and show, in terms of designed flood level (hereinafter: DFL) and highest water level (hereinafter: HWL), what kind of machine resource needs to be considered. The purpose of writing this article is to prove, and at the same time point out, that during the recent flood defenses and in the case of projected future flood waves, the internal water resources of the Water Directorate will not be sufficient for defense work. It has been necessary so far, and without further improvement, it must be taken into account that the shortage can and must be solved

by using the mechanical and technical equipment of external organizations.

During the preparation phase, it is essential to assess the resource needs and, if necessary, secure them in advance by concluding pre-contractual and cooperation agreements. In order to provide the necessary resources, it is essential that a 'Resource Management Plan' be prepared and updated on an annual basis, and that it should include the machines available from external forces as well as availability of contact points. When the defense work begins, neither the time nor the personnel capacity will be available to assess and arrange the necessary machine availability.

2. Mechanical resource requirements for flood control tasks in the area of MTDWD

In addition, to human resources, a large range of equipment including cars, motor vehicles, trucks, special transport vehicles, watercraft and other necessary equipment are used in the course of flood protection work. In particular, moving the material needed for defense and transporting a large number of manual workers to the intervention sites is a major logistical challenge. An aggravating circumstance is that the locations of the flood events detected and the sites of interventions are spatially different. In the case of MTDWD, the total length of the designated primary flood protection line is 707.114 km. Following the technical qualification of the flood phenomena detected by the monitoring service (e.g.: sand boil, leakage, contour seepage, slope shifting, etc.), the Head of Defense will decide how and when to intervene. If immediate intervention is required, the mobilization of manual workers and the delivery of protective materials to the site must be started.

As of January 1st, 2020, the Water Directorate's own fleet of equipment available for the execution of defense work is as follows:

– vehicles and trucks with off-road capability (less than 3.5 t);
– 67 agricultural tractors;
– 5 construction machines;
– 31 watercraft (ship, boat, raft).

By 28th February of each year, the Water Directorate shall produce a preparation plan for each of its protection areas in its area of operation. The Preparation Plan shall include the intervention tasks at predetermined flood levels and their human, mechanical and protective material requirements.

Table 1 shows the number of flood protection machines needed for three different flood levels according to the 2019 Preparation Plan **[2]**.

The highlighted peak flood levels on the Szolnok water level are: "old" DFL: 974 cm, HWL: 1041 cm and DFL: 1085 cm. These water levels have been designated because they can be considered as a planning level for preparedness and at the same time decisive for flood protection. The water level of the “old” DFL reflects the value before, the 74/2014. (XII. 23.) decree by the Ministry of the Interior on the significant flood levels of rivers **[3]** has been passed. Estimation of the water level of the “new” DFL with a probability of 1 % was based on the statistical analysis of long term time series, calculated with 1 % probability of discharge for which long-term time series, including data from recent floods, were provided.

Table 1. *Mechanical resources required for flood control in the MTDWD area, depending on the level of the peak flood wave.*

Machine types [no.]	„old” DFL	HWL	„new” DFL
Construction vehicles	232	330	1114
Car crane	5	22	57
Truck	1426	2071	6630
Agricultural tractor	163	217	137
Watercraft	21	24	27
Other vehicles	6	6	7

The amount of machinery required in **Table 1** shows that the Water Directorate has sufficient capacity for its own fleet of machines only for watercraft. The 86 vehicles and trucks available are not even sufficient enough to carry out the management tasks in case of a 3-stage flood wave since the number of defense commanding staff (above 100 persons) must be provided with vehicles.

The flood alertness grades are the following with reference to the measured water levels on the water level gauge of Szolnok (actual zero point: 78,78 meter above Baltic sea level): I. grade: 650 cm; II. grade 750 cm; III. grade: 800 cm.

Table 1 shows that road vehicles (trucks) make up most of the machinery needed for flood control (approx. 77-83%), and are therefore prerequisite for successful flood control.

Given the machinery requirements in the Preparation Plan and the Water Directorate's own machinery, it can be stated that in order to carry out the defense tasks, it is necessary to involve external resources, since its own capacity is insufficient.

3. Mechanical resources used in the Tisza flood defense in 2000, 2006 and 2010

In this chapter, I present the quantitative data of daily and aggregated machines from flood control reports [4] in tabular form, and examine the proportion of mechanical resources provided by external forces and MTDWD's own capability during flood control in 2000, 2006, 2010. The External Force Mechanical Quantity Data refers to the external organizations' machinery that is pre-contracted and co-operated with the Directorate.

Based on the data shown in Table 2, it can be stated that during the flood control in 2000 the largest mechanical resource (27963) was mobilized and the greatest capacity (93%) was the mechanical capacity of the external forces. Among the three flood waves, the year 2000 peaked at 1041 cm in Szolnok (2006: 1013 cm, 2010: 954 cm).

Table 2. *Summarized data of the mechanical resources used during flood control in 2000, 2006 and 2010 for the duration of the flood in the area of MTDWD.*

Machines	2000.	2006.	2010.
MTDWD [No.]	2022 (7%)	2684 (15%)	2310 (18%)
External forces [No.]	25941 (93%)	14837 (85%)	10790 (82%)
Total [No.]	27963	17521	13100

The daily maximum data in Table 3. also shows the significant proportion of machines provided by external forces.

Table 3. *Maximum daily data on mechanical resources used during flood defense in 2000, 2006 and 2010 in the area of MTDWD.*

Machines	2000.	2006.	2010.
MTDWD [No.]	05.01. 59	04.28. 78	06.03. 56
External forces [No.]	04.18. 1181	04.09. 601	06.11. 602
Total [No.]	04.18. 1233	04.09. 654	06.11. 650

In each case, the execution of the defense works on the designated main flood protection lines will be organized and managed by the territorially competent water directorate. It utilizes and provides the required excess capacity in a planned manner and applies for transfer within the sector through the National Technical Management Body. Involvement of associated organizations (e.g.: the military, law enforcement agencies) can be requested through the County Defense Committees.

Figure 1 illustrates the number of machines provided by external organizations used during the defense which has reached the maximum number of machines (approx. 1200) in 2000.

The sharp increase in the number of machines used in the defense has been in direct proportion to the rise in the flood wave, because the sharp rise in the water level has caused the surveillance service to detect a large number of adverse flood events, which have been remedied. Therefore, more transportation vehicles were needed to bring security materials and physical labor to the scene.

4. Conclusions

It can be stated that MTDWD is not able to carry out flood defense works in the case of higher degree floods with its own available mechanical capacity.

In the event of a severe flood surge, a significant amount of external mechanical resources will be required in the water sector in order to successfully defend against the floods and ensure flood safety for the population.

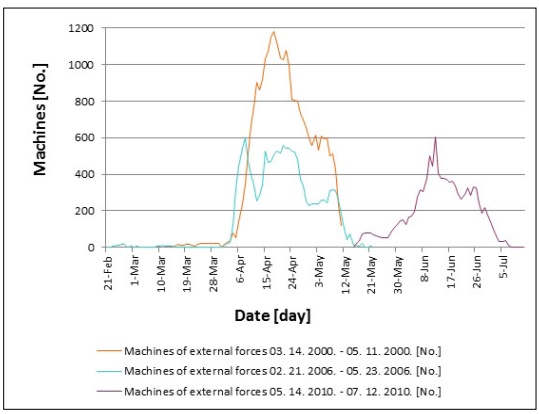

Figure 1. *Daily quantitative data for the external forces used in flood control in the years of 2000, 2006 and 2010.*

In addition to managing and carrying out defense work, MTDWD also carries out its basic "peaceful" administrative, operational, technical supervision, etc. tasks, which also involve vehicle demand, and therefore cannot fully involve the Directorate's vehicle fleet in carrying out defense tasks.

In the case of the three flood waves examined, the proportion of mechanical resources of the Water Directorate and external forces varies according to the highest water level. In case of the Tisza peaking at over 1000 cm, measured on the staff gauge of the Szolnok, 80-95% of the mechanical resource is external. This also means that the success of flood defense work depends to a large extent on the resources provided by external forces. If the required machinery and technical equipment is not available in sufficient numbers or in time, it will impair the effectiveness and efficiency of the flood defense work.

In order to avoid the above situations, I propose that in the future the machine requirements included in the Resource Management Plan shall be planned according to the HWL level, and the external organizations (forces) that can provide these technical tools should be named in it.

I also recommend that Resource Management Plan, as well as the underlying preliminary contract and cooperation agreements, should be updated on an annual basis.

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