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ASSESSMENT OF EFFICIENCIES OF GEOINFORMATION TECHNOLOGIES IN THE FIELD OF WATER MANAGEMENT – PROFESSIONAL PROBLEMS IN THE FIELD OF CREATION FLOOD PLANS

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ABSTRACT

The following article is dealing with the issue of use and integration of Geoinformation technologies in the process of creating flood plans. Their efficient use in the field of addressing issues brings sophisticated ways, which are closely linked to the current information technologies. Floods' plans are for the water management the organizational and technical document of flood protection. The government authorities and the all of the stakeholders should develop effective instruments for crisis management in the water management. Substantive aspect of the evaluation process is necessary to focus precisely on the primary spatial information in terms of its method of collection, processing, storage and access to them. The current purpose of the processing can be realized only in compliance with current requirements on the management of spatial data of this significance. Assess the effectiveness of using geoinformation technologies can be evaluated by the design of conceptual data model for flood plans.

Keywords: Spatial data, flood plan, effectivity, geoinformatics, water management

INTRODUCTION

The issue of flood events is still a topical field of social happenings not only in terms of the Slovak Republic, but in neighboring of EU States. We are constantly looking for procedure and streamline processes in order to promote an effective system of preventive measures to prevent flooding and to deal with other natural disasters. Constantly is updated and supplemented the priorities at the level of local and territorial Governments to create economic instruments of the State to deal with the consequences of extreme events [1]. The concept of the water policy of the Slovak republic reflects all the essential documents, from which the water policy is based. A select group of the stated objectives of the concept consists of prevention and mitigation of floods and support the implementation tools. They are taken into account the principles of cost recovery for services including the costs related to environmental protection - economic analysis. The above issue of return on investment is dealing collective of authors [2]. Legislative support in the area of prevention and mitigation of floods offers approved

program of flood issues in SR (updated for the period 2008 - 2015), supplemented by a system of measures to protect the territory of the Slovak republic before the flood at national level (Proposal of management plans for river basins) [3]. One of the support instruments of this program is the "Flood Warning and forecasting system of the Slovak Republic" (referred to as POVAPSYS). Its aim is to reduce the negative consequences of the floods, with an emphasis on improving the quality of the outputs of hydrometeorology service. Conceptually consists of 12 basic tasks (the concept of the water policy of the Slovak republic by 2015). The legislation in force in the area of flood protection is valid based on the European legislation (2007/60/EC on the assessment and management of flood risks), transformed into the form of the flood protection Act (No. 7/2011 Coll). The risk of the emergence of new flood events and the repetition of the occurrence of flood scenarios from past is increasing. It is compounded by inadequate management of water construction works, in terms of the redistribution of water in the country and urban structure settlement of the territory (construction of new settlements in passive zones of inundation area). With that is also related the protection of objects on water courses (water power plans) [4]. The issue of prevention and the prevention of crisis situations need to be explicitly addressed at the level of cities and towns. One of the fundamental areas, which the Association of towns and communities of Slovakia is considered necessary in the field of the prevention and protection of the territory of the flood is making flood plans. In terms of communication platform, it is necessary to focus attention on the transfer of knowledge from European neighbors. The need for a consolidated knowledge and expertise in the issue of making flood plans are based on the existing legislation (legal regulation No. 261/2010 Coll.). The above implementation Decree lays down the specific details about the content of the plan and the procedure for their approval of the flood. Professional part of creation of flood plans is in its content essentially passed for the local and territorial authorities, in the form of generally binding regulations and resolutions at the level of cities and towns.

BASIC OUTLINES OF SOLVED ISSUES

The company has available in the solution to the issue of flood events of great potential options for reducing their consequences. One of the primary options is a conceptual solution for the integration of information technology in the field of water policy. Tracking and understanding of flood events are becoming an increasingly important precisely because of the protection of human lives and property. In the context of the implementation the content of the page presented the issue of the integration of information technologies it is necessary to ensure the coordination and the effective use of spatial information in accordance with current standards (INSPIRE, NSDI, NGII). The content aspect of this process will focus on just the primary spatial information in terms of its method of obtaining, processing, storage and access to it. It is valid, that information technologies are through spatial information infrastructures have become an instrument for coordinated solutions to the issues (the data model of the geographical database design). At present, the administrators of major watercourses in cooperation

with many other water management stakeholders are processed for areas with the premise of the significant impact of the flood the floodwater documentation. It is based on the creation of flood plans, flood risk management plans (flood hazard maps and flood risk maps). It is these plans which are contributing to the reduction of the likelihood of repeated flooding of the territory. The issue of making flood risk management is dedicated to quite a large group of professional publications [5], [6]. The starting point is publishing studies on the creation of flood hazard maps and risk on the part of Slovak and foreign authors. It is possible to illustrate the range of potential flood hazard through endangered territory during extreme floods, the threat of household and housing stock, and other important objects of infrastructure in built-up parts of cities and towns [7]. For high-quality strategic planning at the level of competent bodies in the field of creation and processing flood plans is appropriate to use the geographical information systems (next as GIS), for which are spatial data about the country the foundation of all documentation. Flood maps and river basin management plans are not the only bearer of the amount of spatial information and descriptive information with the graphic interpretation, central base, which brings together a number of geographical, hydrological, meteorological hydrodynamics and other data types. The present time is showing increased interest in the implementation of these systems in the field of flood situations in our solutions as well as abroad. GIS with lots of available analytical tools offered in the area, which is the issue of security and the creation of common data structures [8].

In the field of flood risk has its place also flood plan. Within the meaning of the legislation in terms of organisational - technical document [9]. Its realization in digital form is an important tool of creation and updating of the flood prevention plans of cities and towns [10]. Semantic aspect of flood management plans is based on the idea of an early awareness of the evolution of flood events. From the important point of view can be flood plan classified into the following parts: a substantive plan to flood the structure, organization, graphics, annexes. Each plan shall contain information on flood risk, which have a unique geographical position and therefore have a direct link to GIS [11].

PROPOSAL OF DATA MODEL

The model of flood plan is designed for the automation of process in the water practice. It Presents part of processing documentation of graphical information of flood events. Its structure is based on data models, to allow for the presentation of metadata entity, their semantic terms and relations. A data model for flood plans will be theoretical proposal for the imposition and modification of spatial data with regard to the legislative provisions applicable to the issue. The aim of the solution is to determine the optimum design solution to ensure the proper management of spatial data in the field of flood management plans. The subject of the implementation of the main methodological starting points is the partial watershed of the Poprad River (Fig.1).

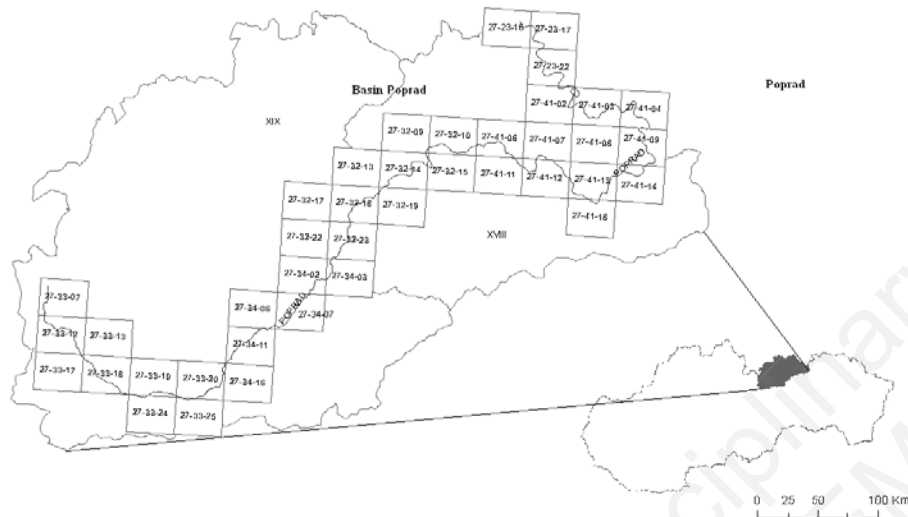


Fig. 1 The geographical location of the territory

The data model will be designed with a view to the fulfillment of the main requirements for flood plans, resulting from the implementation of their graphics section. The basic unit is the object. The interaction of all the objects that are the subject of processing a flood plan is the basis for the proposal for a data model. When compiling the functional model was taken into account the structure of the input data for the area. Data inputs are divided into two basic categories:

- Compulsorily observing standard data formats and types (minimum standard).
- Optionally tracking standard types and data formats.

From the level of mandatory reporting of the standard types and formats of data according to the legislative regulation, the graphical part of the flood plan consists of three main areas:

- A. Situations.
- B. Longitudinal profiles of watercourse and transverse profile of flood protection lines.
- C. Consumption curves.

The law prescribed data documents for the management of flood risk management plans are defined under § 4 of Decree No. 419/2010 the following structures, which will be constituted an additional meaning: maps, surveying the field, hydrological data, data hydrotechnické data, calibration data.

Surveying data necessary for processing graphical part of flood protection plans are provided as a result of geodetic and cartographic activities subject to legal regulations Act no. 215/1995 Coll. Binding requirement is a design and display data in geodetic coordinate system S - JTSK and in the altitude Bpv system. Detailed measurements were performed in a standard manner GNSS technology using three frequency receivers

using (monumented in the original and most plain terrain, GNSS receiver remained in the position during the whole measurement) [12] a RTK method. In case the sky is shielding, for the collection of geodetic data used UMS of points determined by the RTK method. For creating flood plans is the optimal way use to GNSS technology, which has options for the process of collecting spatial information [13].

METHODOLOGY FOR COMPILING DESIGN

Methodologies of the processing uses techniques, analytical tools, and documentation with the aim promote and facilitate the process of designing the data model specified for the field of solving issue. It was determined the fundamental conditions which the proposed solution in the form of a data model has to meet. These requirements were formulated into the form of the following points: conceptual database design, logical database design, physical database design. Prerequisite for the functionality of the data model is mainly design and in the final phase the creation such a repository for managing spatial data, which would adaptable linked more data with GIS enviroment. Through the conceptual model it is useful to write a general subject of interest. It is a useful tool for the definition of concepts and links between them. This reality will enable to pay more attention to entities and their mutual linkages that are actually required for the functioning of the entire system of creation the conceptual level of data model. The proposal conceptual form of data model through a detailed examination of the level of investigations reality of flood plan presents figure. 2.

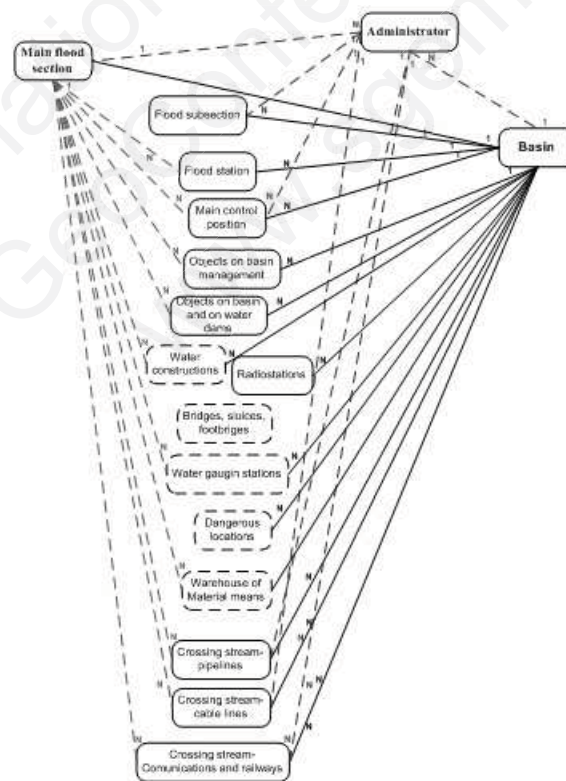


Fig. 2 The entity - relationship diagram of proposal

Logical proposal pretty much presents a conceptual proposal. The basis for the successful proposal of the logical data model is clearly defined entities of conceptual part assign the characteristic specification (class attributes of objects - entities). In this stage occurred to clarifying conceptual model. Each attribute of variable was associated variable name based on the conceptual proposal. Each of variable could acquire only certain types of values with a specified range of characters for the description. Description of the basic characteristics of selected variables are reported in Table.1.

Tab. 1 Sample of review of content for graphic part of the flood plan

<i>The attribute name</i>	<i>Type of field</i>	<i>Range of characters (size)</i>	<i>Description (note)</i>
Number of subject	String	50	code of flood section
River basin management	String	250	code of flood section

On the implementation level solutions of physical model was chosen system, in which was created databases. The physical model is the ultimate representation of the object model. It contains a complete list of classes with their real name and attributes with complement of their data types. Selected the system was adapted GIS technology that offers a wide variety of functions. The whole processing at the physical level describes the following scheme of model geodatabase (Fig. 3) [14].

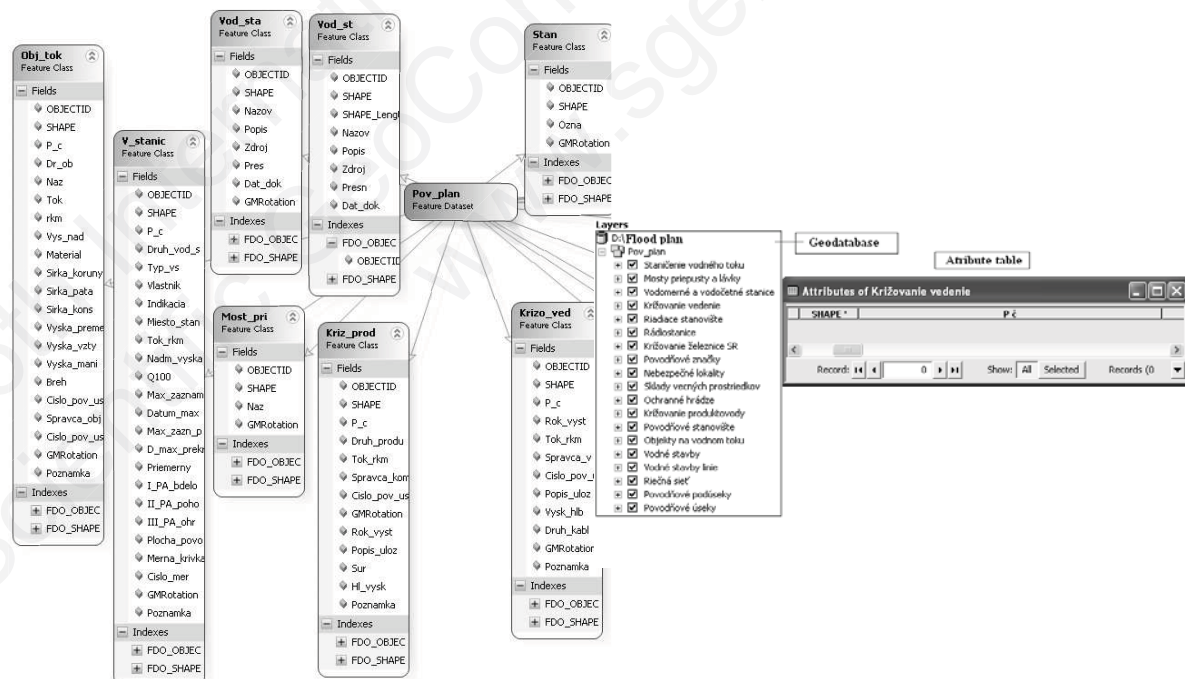


Fig. 3 Sample of database model

CONCLUSION

The field of water management among other things is focusing its activities on the collection of spatial information, with a view to further processing. Requirements are directed on the completeness and perfection of processing spatial data and are going towards the use of geo-information technologies. Processing issue was supported by the creation, proposal and implementation of data model based on geographical database in field of the flood plan. Aim of this paper was to implement the concept of processing of spatial information database into a data model for a documentation process and automatization the processing of graphical part of the flood plan. Presented information in fully confirms the importance of geo - information technologies in the field of water management. Contribution attempts to explain creation flood plans with the use of current trends in processing spatial information. Streamlining the creation of flood plans is reflecting on the local governments in the process of ensuring the protection of the country from flood events. GIS systems are solutions for the field of flood issues with importance role. It is confirming foreign studies, that are using GIS systems as a solutions the problems of flood events and actively apply them.

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