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THE POTENTIAL OF LOCAL INITIATIVES ON EXAMPLE OF FLOOD WARNING SYSTEM IN SOUTH-EAST POLAND

Next to traditional range of infrastructure protecting against flooding: embankments, polders and reservoirs, there are some specific activities aimed at obtaining peculiar effects, which enable residents of areas being at risk of flooding, to avoid casualties and losses – they are called local systems of warning against flood (LSWAF).

1. Introduction

Due to the terrain, its geological structure, characteristics of vegetation and the specificities of the implemented infrastructure, certain areas are particularly susceptible to the occurrence of specific events. Podkarpackie voivodeship is exposed to floods and their associated landslides. This paper was formed as a result of observations made by the author at the occasions of the last few floods which damaged areas of Podkarpacie. The consequences for environment depending on actions taken by the authorities were also taken into consideration.

Areas of the South-East Poland which were selected to the introspection usually differ from each other in terms of topography, geological structure and resources.

The local authorities have also different opinions on actions that should be taken in area of crisis management.

For simplification the author decided to use administrative division of voivodeship and assigned the concerned areas to counties and municipalities.

The analysis of the official reports and news from the period of flooding in 2010 shows that in subject of flood security most of information was focused on embankments. Officials and journalists were focusing mostly on status of flood banks and levels of water.

Author attempted to present an interesting trend, which can be noted among certain counties of the Podkarpackie voivodeship – organizing local

systems of warning against flood (LSWAF) based on data available after flooding in 2010.

Embankments are important elements of infrastructure of flood passive security. Parallel to passive protection there are some active forms of anti-flood protection. Observations of floods during last 10 years in South-Eastern Poland showed that a lot of support for the inhabitants living on flood-prone areas were provided by local systems of warning against flood.

The idea of such system was first suggested in year 2001 in Tarnów-county, Małopolskie voivodeship. The list of expectations which computer system should meet and its basic functions were prepared in the first place after a series of meetings and discussions with representatives of departments of crisis management and members of authorities. In 2002 Tarnów-county authority had opened an invitation to tender such systems, which was won by RWD company Prospect Sp. z o.o. In summer 2002 system was installed in Tarnów on Biała river, and it has been operating till today.

Experts maintain, that getting the information about water coming half an hour before flooding enables to save human life and the same information 2 hours before enables to salvage some of the most value subjects. This shows, especially in mountains and near to them, where rate of events change in the initial stage of floods is particularly quick, and how important is the time of warning. It was appreciated for residents of Jasło-county, Ropczyce-Sędziszów-county, Dębica-county, and Mielec-county during disaster in 2010 in Podkarpackie voivodeship. The systems of warning against flood were installed on the bridges over most important rivers stations in the given regions.

The benefits of such systems have quickly been recognised also by other local authorities in the region. Subsequently, similar initiatives were taken by Przeworsk-county, Brzozów-county, Sanok-county and the city of Rzeszów.

An essential component of such system is component responsible for notifying stakeholders of impending threat. In described system it is done in several ways. On one hand, it is realized by sending SMS-messages about threat. They are sent to people whose mobile numbers were signed up to the database organized for such occasions by the crisis management appropriate for the given area. Additionally, everyone can find information about the situation on the website where current movements of floods are being shown.

2. What is easy and what is difficult in LSWAF building?

Table. 1 The SWOT analysis of flood monitoring

I. <u>Strengths</u>
1) The construction of the LSWAF perfectly meets the Action 4.2 infrastructure of the flood and the rational management of water resources in Axis 4: PROTECTION OF ENVIRONMENTAL LEGISLATION and the PREVENTION of Regional Operational Programme for Podkarpackie voivodeships for the years 2007-2013.
2) Design perfectly fits into the statutory programs of WFOŚiGW (Provincial Fund for

Environmental Protection and Water Management in Warsaw).

- 3) Simple and understandable idea of the project.
- 4) The architecture of the system allows to customize it to needs and upgrade, if changes occur.
- 5) Price depend on the scope of the project.
- 6) Structure of costs easy to understand.
- 7) Potentially short time system construction.
- 8) Monitoring system for the slowly flowing rivers for mounting measuring elements uses structures of existing bridges, which significantly reduces their cost.
- 9) Possibility of rapid substitution of damaged probes on others.
- 10) The control panel of system placed in a base station in Emergency Management Centre of county.
- 11) Usage SMS's enables quick data transmission to base station and next, at the same time, to persons and institutions placed in database which are responsible for functioning crisis management appropriate to the area.
- 12) The CCM of voivodeship has fully and current access to the data contained in the database administration system (the application allows to preview the current levels of present, past and future projections for the designated).
- 13) The use of the Internet infrastructure – current access for interested inhabitants to information on the systems website.
- 14) Short time of information flow between the participants in the process of crisis management at various levels administrations in Podkarpackie voivodeship.
- 15) Ability to prepare system to current emergency activities and direct management of security, based on data available in systems next to the area of crisis.
- 16) Possibility advance warning of threat to residents and companies on endangered areas.
- 17) System lets better organize activities of warning and protection against flooding in areas, where flooding is result of dynamic changes of streams, which every day do not present threat.
- 18) System enables current estimation of changes caused by rainfall in area of local watercourses and streams.
- 19) Ability to simulate the evolution of situation based on digital maps of GIS (Geographic Information System), historical information's about flooding and maps of flood plains areas.
- 20) In long time, LSWAF allows to develop areas of potential flooding associated with each of rivers on protected area.

II. Weaknesses

- 1) Necessity of installing sensors over monitored rivers directly before the expected threat.
- 2) Need for current oversight for IT and measuring infrastructure.
- 3) Difference of status of objects for mounting individual stations monitoring - possible some costs associated with the improvement of some objects.
- 4) Ability to reduce network bandwidth of mobile telephony in periods of holidays and a failure as a result of increased number of connections and as an effect of destroying by people and atmospheric conditions (thunderbolts).
- 5) Need to increase density of network of monitoring stations for improving efficiency of LSWAF.
- 6) Risk associated with the availability of the Internet: infrastructure failures, attacks by hackers, errors of services, etc.
- 7) Preparation and training of employees to work with system in municipalities and counties.
- 8) Risk of inappropriate choice place for mounting infrastructure of monitoring.
- 9) Sensitivity to destroying by people.
- 10) The largest field of project and major of costs would be paid by local authorities with comparatively small incomes (for example area Bieszczady and other submountain areas)

11) Necessity to build, from beginning, systems for monitoring streams and rivers in areas of mountains.
III. Opportunities <ol style="list-style-type: none"> 1) Several alternative ways of financing. 2) Activation most interested residents and local entities to preventive action. 3) Reduction of risks for public infrastructure. 4) Modernization of equipment cooperating with the system. 5) Streamlining the procedures of response and cooperation on crisis management. 6) Management on basis of accurate and actual data. 7) Increasing activity of inhabitants of protected areas to protect themselves. 8) Better conditions of insurance policy.
IV. Threats <ol style="list-style-type: none"> 1) Need to focus around project other authorities – opportunity for conflicts of interests. 2) Complex system of financing and changes of ownership of material elements of the project. 3) Potential problems with making decision by individual councils of municipalities and counties. 4) Possible conflicts between partners in area of incurred costs and acquired tangible components of a project. 5) Possibility of not meeting expectations of inhabitants of areas monitored. 6) Need for continuing care about design elements after it starts . 7) unknown costs of current maintenance for elements not subject to warranty. 8) Possibility of withdrawal of some partners of project during preparation.

Some of the issues that have been assigned to the block THREATS are also repeated within the block of WEAKNESSES. Easiness of understanding depends on the properties of the environment in which the LSWAF are installed, and the issues will change with the changes of the environment.

3. Model of the local system warning against flooding

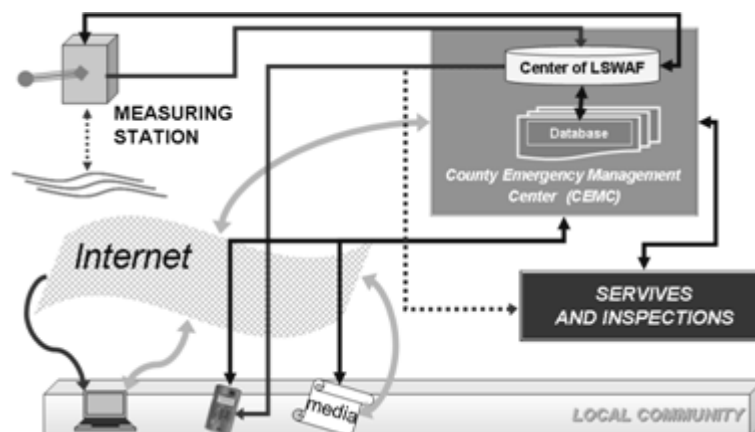


Figure 1. Idea of local system warning against flood (LSWAF)

Idea of local system warning against flooding for the first time was successfully implemented in Podkarpackie voivodeship in 2007 in Jasło-county, Dębica-county, Ropczyce-Sędziszów-county and Mielec-county.

Authorities signed a relevant agreement and the basin of Wisłoka river began to be monitored; in face of impending collapse of weather on previously prepared positions on bridges over the Wisłoka river and its tributaries, mounted ultrasonic probes to measure distance between probe and mirror of water under the bridge.

LSWAF action is intended to alert as soon as possible about the threat and to provide data for the institutions responsible for the rescue operation. System sends alerts to control panel and to operator of crisis management and then to all concerned. Database of people and institutions, which should be warned about threat as first, was prepared by CCMC.

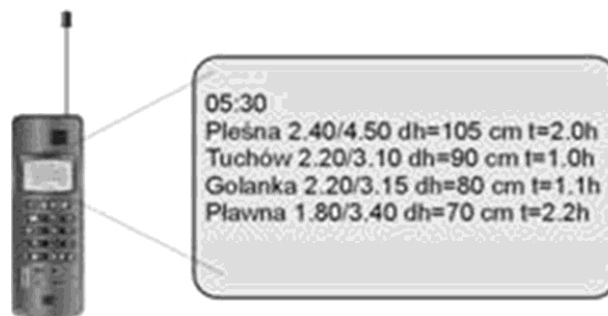


Figure 2. The example of SMS message

Due to the fact that such system provides services to many local authorities, primarily of municipals and counties, the most reasonable way for taking such initiatives are agreements between local authorities. This is evident in initiatives of Podkarpackie voivodeship.

4. Balance expectations and effects

Estimated costs of LSWAF depend on number of measurement stations, range of functionality of a system and complexity of its structure. Among systems installed in Podkarpackie voivodeship the largest market share of the products has a RWD Prospect Sp. z o.o.

In year 2011 sample costs construction LSWAF were as follows:

- PLN 310 000 in the county of Przeworsk - included Grant Regional Fund for Environmental Protection (WFOŚiGW) amounting to PLN 186 000 accounted for 60% of total cost of task. Remaining 40% covered the county and the municipalities participating in the project,

- PLN 166 000 in the county of Brzozów – co-financed in parts by: WFOŚiGW – PLN 91 000, county – PLN 21 000 the rest gave six municipalities participating in project,
- PLN 164 000 in Rzeszów – city gave 30% of costs, and the rest financed WFOŚiGW.

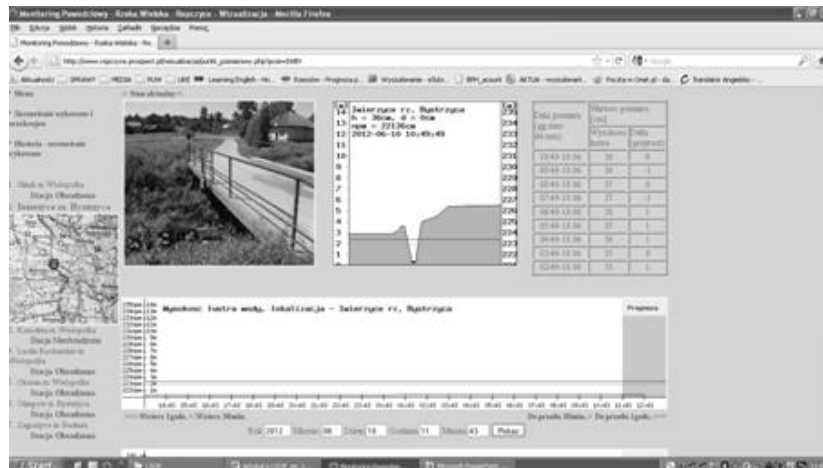


Figure 3. The website of one of LSWAF measuring stations in Ropczyce-Sędziszów-county

Annual sample costs of maintenance of the system (as example the LSWAF of district of Mielec) is about PLN 12 000 per year. For comparison, estimated losses in Podkarpackie region caused by the flood in 2010 were accounted for PLN 1,3 billion.

In addition to the financial dimension, the fact of activation of communities on areas monitored by the LSWAF is also crucial. It is extremely important that inhabitants of the threatened areas participate actively in receiving the information about threats on the basis of which they could take the proper actions. Then, people living in areas at risk of flooding warned by the system are preparing their families, houses, mobility, food, money and documents, in order to protect themselves from water. Very important at those moments is also neighbourly help. Safety and efficiency of all activities before, during and after flooding depend on accumulated knowledge and experience. To use the information which generates LSWAF properly the residents of threatened areas should be educated to be able to take right actions. A good example of this type of operation is a small instruction in case of the event of floods, which was developed and delivered by Emergency Management Centre of district of Mielec.

5. What is to be done?

Next step should be a creation of a new generation of devices reacting on volume and dynamics of precipitation. This functionality would give people inhabiting area near the mountain brooks and streams an additional time to take preventive actions. It is extremely important since their houses are located in places where the flooding begins its destruction, e.g. in valleys of mountains. Often it is not possible to use existing facilities, because they simply do not have a place where they can be installed.

Since in Poland a lot of houses are being built on flood plains flood warning systems become a necessity. Taking into consideration specific topography of these areas their anti-flood protection is difficult and expensive.

Excellent examples of this are residential areas of Wrocław Kozanów, or closer to, residential areas 'Gądky' in Jasło or areas near to Strug river in the vicinity of Rzeszów.

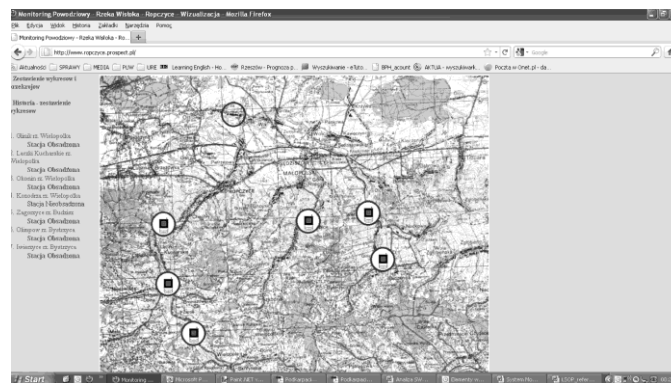


Figure 4. The website with view of map of the area monitored by LSWAF of Ropczyce-Sędziszów-county

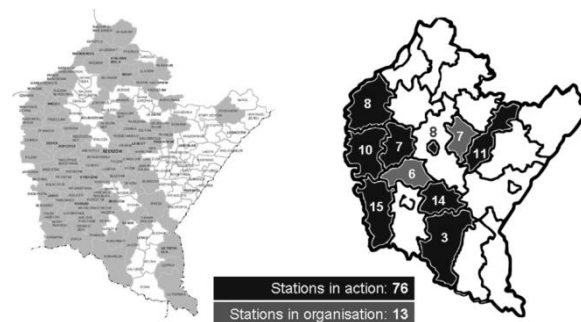


Figure 5. Correlation of counties flooded in the disaster of 2010 year with the areas monitored of the SFWS in Podkarpackie voivodeship

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THE POTENTIAL OF LOCAL INITIATIVES ON EXAMPLE OF FLOOD WARNING SYSTEM IN SOUTH-EAST POLAND

S u m m a r y

Next to the traditional anti-flood protection infrastructure like embankments, polders and storage reservoirs there are some innovative procedures and systems – like warning against flooding system in South-Eastern Poland (LSOP). Thanks to them local communities living in the areas threatened by flooding can avoid losses.