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Future water supply management adaptation measures – case study of Ljubljana field aquifer

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The main drinking water supply problems are related to the significant change of groundwater quantity and quality observed in the last decades as an effect of land use practices and very likely also climate change. The latter may affect the ability of drinking water suppliers to provide enough water of sufficient quality to the consumers. These topics were studied in the frame of SEE project CC-WaterS (Climate Change and Impact on Water Supply) with the main goal to develop a water supply management system regarding optimisation of water extraction and land use restrictions under climate change scenarios for water suppliers, since existing management practices are mostly inadequate to reduce impacts of CC on water supply reliability.

The main goal was a designation of appropriate measures and risk assessment to adapt water supply to changing climate and land use activities considering socio-economic aspects. This was accomplished by using 'Fuzzy Decimaker', which is a tool for selecting and ranking risk reduction measures or management actions for local waterworks or water authorities under the pressure of climate change.

Firstly, management options were selected and ranked. For public water supply of Ljubljana, the capital of Slovenia, several management options were selected. For improvement of water supply and preservation of water resource quantities there is a need for engineering interventions, such as reducing water losses on pipelines. For improving drinking water safety and preserving water resource quality farmers are not allowed to use fertilisers in the first safeguarding zone and they get compensations for income reduction because of lower farming production. Compensations for farming restrictions in the second safeguarding zone were applied as additional management option. On the other hand, drinking water treatment is another management option to be considered. Trends in groundwater level are decreasing, above all recharge areas of waterworks; therefore there is a threat of reduction of water resource availability. For this following management options were proposed: artificial recharge with infiltration wells, setting up new and additional waterworks (one with river bank filtration, one with exploitation of local porous aquifer and one with deep groundwater exploitation from dolomite aquifer).

Management actions can be evaluated according to several criteria, such as water supply risk reduction for the various users (drinking, agricultural, industrial and ecological), realization of the actions (cost, flexibility and leg time). Ranking criteria are characterized by different units (e.g. units of water supply (quantity) risk may involve number of unsupplied people, monetary terms, agricultural area or habitat loss). Decision making process is followed by defining relative weights, balancing factors and best and worst values for the indicators; calculating base risk and risk elements for each management option and sensitivity analysis. The result of this decision making process is evaluation of preferred management option(s) according to the ranking results.