

PROTECTION STRATEGIES FOR GROUNDWATER MANAGEMENT IN KARST PLAIN AQUIFERS

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ABSTRACT.

The geology of northwest Yucatan consists in its upper hundreds of meters of almost pure carbonate rocks and evaporites, forming a mature karstic system. The dissolution process of the rocks leaves little, if any, residue, so there is a thin to non-existent soil cover. There are no surface water bodies in northwest Yucatan. Due to the karstic terrain, rainfall infiltrates rapidly to the water table. The freshwater in the aquifer consists of a thin freshwater lens that floats above denser saltwater. The saltwater underlying this aquifer has a dual origin, by sea saltwater intrusion and dissolution of evaporites. Groundwater flow is from inland to the coast, with a clear influence of the Ring of Cenotes (sinkholes), which intercepts the regional groundwater flow and resulting in a concentrated discharge at the two interception points with the coast. Merida, with population greater than 600,000, is the largest city in south-eastern Mexico. It is the most important economic centre in the region. The city originally obtained all of its water supply from municipal and private wells located within the urban limits. Presently 65% of the urban supply is obtained from Three wellfields outside of the urban limits. The population in Merida, is growing rapidly as the city grows, it is incorporating the surrounding towns. Presently, 119 million cubic meters per year (Mm^3/yr) are extracted from the aquifer to be used as a source of drinking. The potential contaminant activities in this region can be divided into four main groups: 1) industrial activities, 2) on-site sanitation, 3) agricultural activities and 4) hog farms. The first, and second groups are clearly associated with urban areas, whereas the third and fourth groups are present in rural areas. Combining the result from the analysis of geological, geochemical, hydrogeological and socioeconomic data, plus contamination risk and the drinking water demand, we proposed an hydrogeological reserve (HRZ), limited to the south by the RC, to the west by the shore line, to the north by the road between Sisal and Uman, and to the east by the highway between Uman and Kopoma. It covers an area of 900 Km^2 . However, for the establishment of the groundwater reserve in this area. The strategies applied for the protection of groundwater in karstic systems include the zoning of the land use, the assessment and management of the pollution risk, development of a code of practice, and the establishment of a monitoring system. The more applicable approach for the zoning of the land use, is based on the establishment of protection zones which surround the sources of drinking water and expands towards the whole aquifer area. Before a detailed ground water management scheme can be implemented for the HRZ in Merida, two types of actions are needed. These may be divided into short and intermediate term actions and both include legal and hydrogeologic actions, in order to develop the code of practice for the Merida, Yucatan karstic aquifer. The proposed scheme for a general procedure for the development of a code of practice for the managing of karst aquifers include: 1) review of the existing legal framework in the region, 2) analysis of the hydrogeological conditions of the aquifer, 3) identification of the current problems related to ground water, 4) analysis of future demands of ground water, 5) identification and organization of the stakeholders involved in the management of the resource, 6) establish the hierarchy of the necessary actions in short and long term.