

**"PROBLEMÁTICA DEL ABASTECIMIENTO DE AGUA POTABLE  
DE LA CIUDAD DE MONTERREY"  
(TRINKWASSERVERSORGUNGSPROBLEME DER STADT MONTERREY)  
(DRINKABLE WATER SUPPLY PROBLEM IN MONTERREY CITY)**

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### **1.- BACKGROUND**

This Study is derived from the project " Limits of the Drinkable Water Supply in the North-east of Mexico, SIREYES/95-053 ", which involves a thesis for a Bachelor degree in the area of Geology, Structural Geology and Hydrogeology.

Based on the current request for drinkable water from Monterrey, Nuevo Leon and the metropolitan area, the search for new underground sources of water supply have begun in different regions of the Nuevo Leon State (De León, *et al.*, 1998; De León and Schetelig, 1996).

One of these zones is in the Linares-Montemorelos region, in the frontage of the Sierra Madre Oriental (SMO), which is considered to be a zone of underground water discharge of the aquifers found in the SMO. Due to this reason, the study was developed based on the aquifers in this region, with a maximum depth of 120 m, which are: An aquifer of pores constituted by alluvial material and another aquifer of joints of tectonic origin. There are not any previous works related to the Hydrogeology in this region, therefore this is the first hydrogeological regional map.

### **2.- SUBJECT**

The main purpose of this work is the elaboration of a piezometric regional map scale 1:50,000.

Based on the piezometric characteristics, feasible zones of water exploitation were defined to satisfy the request. In addition to this, the interpretation of the direction of underground water flow necessary for the study of contaminated aquifers was also carried out.

### **3.- METHODOLOGY**

The basic methodology for the elaboration of the piezometric map is the following:

The main map was edited based on information provided by INEGI from the maps with code G14C47, G14C48, G14C57 and G14C58. A squared pattern was spread every 3 km<sup>2</sup> over the total area of 918 km<sup>2</sup>. This was done to establish a proportion of 2 or 3 hydraulic utilizations (wells or chain pumps) per square. Next, the field work was designed for the analysis of the wells to be

registered, in order to mainly obtain the type of utilization, geographical coordinates, static or dynamical level and the height. The field work was developed from January to December of 1998 and a total of 121 hydraulic utilizations were registered.

Due to the extension of the area and the duration of the census (11 months), the records of wells and chain pumps qualified in 5 zones. In each one of these zones records of utilizations can be found for shorter periods of time.

The obtained field data took form on an insole applying the hydrologic triangle method (Custodio & Llamas, 1996; Werner, 1996), later the piezometric lines of underground water were interpreted and added to the main map.

In addition a compilation of aquifer proofs was obtained from previous works and all these data was positioned in the map in order to locate ground water discharge for different zones of the area (SARH, 1982; SARH, 1984).

#### **4.- RESULTS**

Two types of aquifers were located in the area of study and based on their lithology were classified thus: aquifer of gravels and aquifer of joints. A regional piezometric map was elaborated in agreement to the dimensions of the area and the census of hydraulic utilizations This was done with equidistant lines every 5 m, sufficiently to observe the behavior of the underground water.

It is highly important to know that the study was developed in one of the most intense periods of drought registered in the last 10 years (January - December, 1998). This is why the piezometric levels were registered very low.

The water flow in the area is restricted by the major cracking directions in relation to the relief of the area. The topography of the area presents a moderate decrease with direction towards the Gulf of Mexico, it is the same direction of the main joint system of rocks. The predominant flow of water is North-east, though in some places it flows eastward.

#### **5.- DISCUSSION**

With the hydrogeological map results and the proofs support, three zones of feasibility for underground water exploitation were defined:

1. Based on the structural geology, a zone is located at the frontage of the Sierra Madre Oriental, specifically at the entry of the Río Hualahuises canyon, looking for a "bc" joint system that is perpendicular to a predominant "ac" joint system; these are distensive cracks with an opening of up to 0.5 m and are filled up of calcite.
2. The second proposed place is based on the influence of superficial currents to the aquifer, looking for zones of meanders where the water of a river infiltrates and influences for the overcharge of the aquifer. This is the case of the Río Potosí-Cabezones, near of El Sotolar mess, where extensive meanders exist and river recharge feeds the gravel and joint aquifers.
3. The third zone could be identified due to registered discharges in the aquifer proofs. It is North-east of Linares city in the surrounding areas of the messes Rio Verde, El Refugio, La Escondida

and El Alamillo, which are also found near Cerro Prieto dam. Discharges of 68.4 l/s until 70.6 l/s in the well named Guadalupe 1 have been registered.

Besides social positive impacts like the water contribution for the current request from Monterrey city and the metropolitan area, this hydrogeological map can be used to establish flow directions of contaminated water, caused by pollution agents in the study area, such as waste dumps, residual water discharges, possible leaks of chemical substances coming from industrial companies and spillages of hydrocarbons.

## **6.- CONCLUSIONS**

A total of 121 hydraulic utilizations among wells and chain pumps were registered.

The field development took place in a period of extreme drought, being this the main cause for the lowest piezometric level of the aquifers in the last years. Due to this situation, reliable results have been obtained during normal climatological periods.

The direction of underground water flow is Northeast - East, which is influenced by the main joint system "ac" and the morphologic slope of the area.

Based on the structural characteristics, Piezometric level and aquifer proofs, three feasible zones of underground water exploitation were defined:

1. In the front of the Sierra Madre Oriental, in the surroundings of the Rio Hualahuises canyon.
2. In the central part of the area, at the margin of the Rio Potosí-Cabezones one, to the North of the messes El Sotolar and Dos Compadres.
3. To the North of Linares city, in and around the messes Rio Verde and El Refugio.

This study can be considered to be a base for the projection of contaminated aquifers.

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# PIEZOMETRIC MAP OF THE STUDY AREA

