A Ground Water Reconnaissance in the Pine Forest Region - Haiti

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A GROUND-WATER RECONNAISSANCE IN THE PINE FOREST REGION, HAITI

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INTRODUCTION

The Pine Forest region is located in southeastern Haiti. The SHADA Forest Division headquarters near the eastern end of the region is about 98 kilometers by road from Port-au-Prince.

In early February 1949 the writers made a brief geologic study of the region to determine the feasibility of drilling wells to obtain water for domestic, stock and small-scale industrial use. Existing water supplies are very scanty and undependable. There are no wells in the region, and springs are notably scarce and widely separated. Water supplies are now obtained principally from rain-water catchments or from roof-tops. These supplies frequently fail during prolonged dry periods and water must be hauled from great distances.

TOPOGRAPHY AND DRAINAGE

The Pine Forest region lies in a band several kilometers wide along the crest of the Massif de la Selle. The region is located between the Dominican border on the east and the Montagne de la Selle on the west. The elevations in the region range from about 1,500 meters to 2,690 meters above sea level. The topography is very rugged and is characterized by broad sloping uplands dissected by deep ravines. From the crest of the Massif de la Selle these ravines drain northward to the Cul-de-Sac and Enriquille depression and southward to the Caribbean Sea.

Underground drainage is characteristic of the region. Limestones are the prevailing rocks and these are in part quite soluble. By the action of circulating ground water extensive systems of solution passages

have been formed in the limestones. Where the passages reach the surface sinkholes or "mares" are commonly developed. The Savane Zombie and the depression of Petite Source near the SHADA Forest Division headquarters are typical large-scale examples of such features.

GEOLOGY

Upper Eocene limestones underlie the entire Pine Forest region as well as adjoining regions. The two principal facies of the rock in the Pine Forest region are massive gray limestone of chalky texture and thin-bedded dense white limestone. In most outcrops the bedding is obscure and the rock is commonly sheeted by closely spaced vertical joints or is broken into small blocks by irregular fractures. Owing to the tropical climate and prevailing high rainfall the limestones are in most places deeply weathered near the surface. Reddish lateritic soils in places 4 to 5 meters thick are commonly developed in the region.

Evidently the upper Eocene limestones have great thickness. In deep ravines there is an exposed thickness of 500 meters or more and the base of the limestone series was nowhere observed in the region.

In the Massif de la Selle of southeastern Haiti the upper Eocene limestones are arched in a great compound anticline or geanticline whose axis trends somewhat north of west. Superimposed on this structure are minor folds and faults. The Pine Forest region lies approximately along the structural crest of the geanticline.

GROUND WATER

The ultimate source of ground water that occurs in the upper Eocene limestones is rainfall. In the Pine Forest region the annual precipitation is of the order of 1,500 to 2,000 millimeters. A large part of the rain

that falls runs off on the surface in ravines, but a considerable part moves down into the limestones. As previously described extensive systems of underground passages exist in the limestones. The percolating water circulates downward through these passages until it reaches the zone of saturation whose upper limit is the water table. Once in the zone of saturation ground water moves along the slope of the water table and discharges naturally at the surface in springs.

The position, shape and depth of the water table in the Pine Forest region can only be estimated in general terms based on geologic inference. It is probable that the position of water table is determined largely by the drainage levels of the major ravines. The geologic structure of the limestone probably plays an important part in controlling the shape of the water table as well as in the movement of water in the zone of saturation. The Pine Forest region lying as it does on the structural and topographic crest of the Massif de la Selle is probably high above the regional zone of saturation and the water table.

There are no major springs in the Pine Forest region but large perennial springs to the south and north suggest the position at which the water table lies beneath the region. Source Royer near Thiotte rises on the south flank of the Massif de la Selle at an elevation of about 870 meters above sea level or 510 meters below the SHADA Forest Division headquarters. The spring issues from fractured white limestone in the bottom of a deep ravine. The flow was estimated at 25 liters per second, on February 5 and the temperature of the water is 19 degrees Centigrade. Springs of comparable character occur on the north flank of

the Massif de la Selle near Fond Verrettes. These springs are at an elevation of approximately 830 meters above sea level or ~~530~~ 550 meters below the Division headquarters. Both groups of springs appear to be outcrops of the regional water table. It is inferred from the geologic structure and the hydrology that the regional water table slopes up toward the crest of the Massif de la Selle from Source Royer and from the springs of Fond Verrettes. At the SHADA Forest Division headquarters the regional water table may be of the order of 450 meters below the surface.

Two small springs, Source d'Haiti and Source St-Louis, were observed near the Division headquarters. Both springs appear to be fed by small local bodies of "perched" ground water which lie high above the principal or regional zone of saturation. Source St-Louis is essentially a wet-weather spring which goes dry in the dry seasons. Evidently Source d'Haiti is fed by a somewhat larger area of groundwater catchment because its flow though small persists throughout the dry seasons. Source d'Haiti rises near the head of a ravine on the north slope of Morne Guimby about 1 1/2 kilometers airline north-northwest from the Division headquarters. The flow on February 4 was estimated at .06 liter per second or about 1 gallon a minute. The temperature of the water is 14 degrees Centigrade. The water issues from fine limestone rubble mixed with red clay in a spring basin about 3 meters in diameter. Source St-Louis is located about 500 meters north-northwest of Source d'Haiti and at considerably lower elevation. The flow of the spring was a mere dribble - perhaps one-half pint a minute - when observed. The water issues from a small joint in limestone in a

small but deep ravine.

CONCLUSIONS

Possibilities for Drilling Wells

All geologic and hydrologic evidence observed points to the conclusion that the main or principal zone of saturation lies at considerable depth beneath the Pine Forest region. It is estimated that a well of the order of 500 to 650 meters deep would be required to tap this water in the vicinity of the SHADA Forest Division headquarters. Moreover, it is unlikely that the water would be under artesian pressure and hence a pumping lift of the order of 500 meters might be required to bring water to the surface. However, it is believed that an ample and permanent supply would be obtained in a well tapping water in the regional zone of saturation.

Some possibility also exists that one or more bodies of "perched" ground water may be present beneath the vicinity of the Division headquarters at shallower depth than that of the regional zone of saturation. However, the supplies of such ground-water bodies may be temporary or so meager in quantity as to be insufficient for the requirement. In the event that drilling is attempted in the vicinity of the SHADA Forest Division headquarters it is suggested that the well be located in the Petite Source depression.

Spring Development

Source d'Haiti is apparently the only spring in the Pine Forest region that is susceptible of development for beneficial purposes. The flow of the spring could probably be considerably increased by cleaning

the spring basin of existing track and logs and by constructing a small collecting box over the spring heads.

By means of a pipe line estimated 2 to 2-1/2 kilometers long it would be possible to bring the flow of the spring by gravity to a point on the main highway at Barrasa. Such a pipe line would have to follow the north face of Morne Guimby more or less along the contour. It is estimated that about 1,200 to 1,500 gallons a day could be delivered to Barrasa in this manner, and if desired a reservoir could be constructed at this point for carry-over storage.

It is also possible that low saddles may exist near the end of Morne Guimby over which water from the spring might be pumped at reasonable cost to a point nearer to the SHADA Division Headquarters than Barrasa. To explore this possibility would at least be worth a small engineering study by transit and stadia.

Rain-Water Catchments

It was observed in passing that some of the rain-water catchments near the SHADA Forest Division headquarters are constructed on slopes of 30 degrees or more. If the rain falls vertically in the Pine Forest region, the slopes of these catchments are too steep and the total area impermeablized is not effectively utilized. Assuming that the rain falls vertically, the most effective utilization of an impermeablized surface is level. However, in order to deliver water from a catchment surface readily to a storage reservoir an optimum inclination of about 5 degrees would seem desirable.

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