

SOME SUGGESTIONS TO DEVELOP THE GROUNDWATER MANAGEMENT IN SRI LANKA

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ABSTRACT

The author has published a few research papers since 1979 to date. The objective of this paper is to combine all conclusions and recommendations together. Research based on groundwater evaluation, changes of the chemical quality of groundwater, attitude of rural people, maximum drilling depth, actual hand force to be applied, maximum pumping period and minimum recovery period, the affect to the environment due to long term extraction and the different management systems in Sri Lanka are discussed here.

INTRODUCTION

Water is perhaps the most basic resource. It is an extremely scarce and hence a most valuable resource in many parts of the world. Because of this the period from 1981 to 1990 was declared as the International Decade for Water Supply and Sanitation. Generally in Sri Lanka the people living in major cities and urban areas get water from the delivery pipes under the government drinking water supply schemes. People living in other areas use water in open dug wells, irrigation channels, reservoirs, tanks, lakes, natural springs, rivers, streams, or by collecting rain water. This had been a practice before the introduction of the deep well concept to Sri Lanka in 1978.

After commenced the deep well concept in Sri Lanka, a number of foreign organizations have started to tap deep groundwater resources in the fractured crystalline rocks. The hydrogeological investigations under different projects in different administrative districts were carried out for domestic water supply for the rural areas as well as for the close by towns and urban areas to satisfy the water deficit problem.

The deep wells have been categorized into hand pump borehole wells and production borehole wells. Hand pumps were installed for the low yielding wells and electric pumps were installed for production wells for distributing of water through delivery pipes after pumping to a storage tank. Before use the water each well is subjected to evaluate the quantity and quality of water of source.

OBJECTIVE

The author carried out a number of surveys, research and investigations in different areas on groundwater resources and published many research papers after introducing the deepwell concept to this country since 1978 to date. The objective of this paper is highlight the conclusions and recommendations mentioned in his papers.

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METHODS OF SURVEY

At the beginning, the scientific investigations for groundwater resources in hard rock terrains were initiated by a state enterprise. The aim of these studies was to yield economic quantities of groundwater. Then the demand for tube wells increased drastically and as a result of this, several government, semi government, private institutions and foreign firms were authorized to carry out investigations in Sri Lanka. The author visited different localities to observe the ongoing groundwater programs which have been managed by different institutions in various administrative districts in Sri Lanka. The author collected more data specially from the Kandy District Water Supply and Sanitation Project and carried out more research in various themes which are given below.

(a) Groundwater Evaluation

A groundwater evaluation for the Andella Oya basin in Ampara district was carried out using the available data of precipitation, evapotranspiration and runoff. The net recharge from the precipitation was found from these data but the result is not the actual groundwater storage in the basin.

(b) Chemical Quality of Groundwater

The water quality variation of different low yielding wells (hand pump wells) and high yielding wells (production wells or piped water schemes) were found. Analysis were done for the samples obtained before pumping, with continuous time intervals while pumping and after the completion of pump test. The changes of the variations of all elements while pumping were found.

(c) Attitude of People

Some villagers are thinking that water in open dug wells are more pure than the closed wells such as hand pump wells. To find the truth of this traditional thinking of people water samples were collected from open dug wells, closed dug wells and closed hand pumped wells and analyzed chemically.

(d) Maximum drilling depth

The reports of borehole wells and the location maps were collected to study the subsurface fracture systems of crystalline hard rocks in three electorate of Kandy district. This study was based on the borehole reports of production wells only. The major information taken from the borehole reports were mean sea level at drilling point, subsurface rock types, penetration rates, of rock drilling, groundwater discharge levels and the variation of the changes of flushing yields while pumping. From all of these data only the flushing yields of various depths were considered to understand the subsurface fracture

patterns. The number of fractures at every five meters compared with the flushing yields and then used these data for statistical analysis.

(e) Impact to the environment

A survey was carried out around Ampitiya, Kandy to investigate the land subsidence and the other environmental impacts due to groundwater extraction from hard rocky areas. The hydrogeological setting, groundwater pumping, water level declines etc. was found.

(f) Maximum hand pump force

Some hand pumps which are used to lift groundwater from low yielding wells are not easy to operate. Even for an adult needs a very high force to get groundwater. There may be several factors to be considered before the installation of all the parts of pump. A survey was carried to determine the suitable conditions for pump installation and easy operation conditions. The relationship among the theoretical force, dynamic water level and the pump installation depth for a particular hand pump (INDIA MARK II) were found.

(g) Groundwater management and research

There are many problems associated with the groundwater development programs or tube wells construction program in Sri Lanka. Problems in data collection, problems arising during the field work, technical problems while drilling, well design and construction etc. and nontechnical problems. Groundwater investigations in Sri Lanka are conducted by several organizations either governmental or nongovernmental or foreign organizations. All institutions face number of problems though they have their own development program. The author found that all of these institutions are not under one administration.

DISCUSSION

(a) The general factors affecting to the groundwater circulation are climate, geology and water bearing properties of rocks, geomorphology, drainage and sea water levels. Occurrence of groundwater in an area varies with the climatic condition such as rainfall, temperature, humidity and evapotranspiration. Groundwater recharge take from streams, natural reservoirs and lakes, and swamps in addition to the seepage from the surface by direct precipitation. The artificial surface water supply schemes such as reservoir for hydropower and water supply, irrigation channels, agricultural fields etc. contribute to change the general groundwater level. Seepage from these water bodies may take place into the basins. Therefore the groundwater circulation and storage is different in different basins. This shows that the exploitation of groundwater quantity depend on the net groundwater recharge and storage in the basin.

There are more irrigation water tanks and canals which supply the surface water for paddy cultivations in the ANDELLA OYA water basin. Water may recharge into the ground from these schemes also. The source of these surface water bodies may not be only from this basin and may be from other basins. Therefore the total groundwater recharge is not only from the precipitation. This implies a groundwater balance study should be carried out for each water basin in the country. This gives the total recharge, discharge and storage in each basin. The amount to be extracted can be calculated after this evaluation. This is very important for future development programs.

(b) In most hand pumped wells all the elements tested were within the permissible limits or less than the WHO safe limit standards and therefore no harm to the human health. But a few wells contained more iron and fluorides. For these a iron and fluoride removal plants should be introduced among the people.

Chemical analysis of production wells indicated that the continuous pumping of bedrock groundwater also may create adverse effects to the human health if there is no procedure to monitor the their quality frequently. Some elements may increase and some may decrease while continuous pumping for piped water supply scheme. Therefore it is necessary to establish a well planned sampling program to determine if any trend occur in the future. For example, if groundwater is becoming acidified, plans must be developed to deal with the health and treatment implications.

The deep wells should be constructed carefully along the coastal regions because water from fractured rocks may be mixed with saline water.

(c) The results indicated that the water quality of closed wells and hand pump wells are much better than the open dug wells. It proved that the traditional thinking of the people on the effect of sun light is wrong and it is not a factor for change the quality of water. Therefore the people must educated to use the hand pump wells.

(d) From the analysis , it was found that the drilling beyond 70 meters below the surface level would not be beneficial and might be an unnecessary expenditure except very few locations. The well sites should be selected only in the valley or basins or along lineaments.

(e) The ground surface surrounding the production well has gone down about one meter due to the extraction of groundwater.. Some cracks and holes were able to seen along the road crossing the area. Some houses close to the pumping wells also affected by this land subsidence and cracks have been developed on the walls and foundations. The paddy field are drying out and no water at all in some dug wells after commenced this project.

The total groundwater withdrawal amount has increased for the second year than the first year after commenced the distribution without any reason. This may be due to the increase of demand for drinking water. But the withdrawal per day should be constant because a minimum recovery period is needed for the aquifer before start the next day pumping. If

the pumping period is not maintaining the damage to the surrounding environment will be very high in the future. This is very important factor to be considered to save the aquifer.

Another investigation was carried out at Pathadumbara production well sites. The pumping tests data used to find the storage, recovery and the maximum pumping yield of aquifer and then recommended a minimum of 8 hours period per day for recovery. Decreasing of this recommended period will be harmful to the aquifer as well as to the surrounding environment. And also recommended the maximum pumping rate per day.

(f) This survey indicated that the hand force sometimes not enough to operate the well. Some hand pumps are not from the same manufacturer. In a village not only the adults but also small children are coming to collect water from the wells. If a child cannot operate a hand pump, or his force is not enough to operate the handle of the pump, then the objective of this project may not be successful. for a particular pump the maximum dynamic water level and the maximum pump installation depth from the ground surface must be found for easy operation.

(g) Groundwater is a renewable resource. It would last for ever with good management and proper development system. Investigations for groundwater in Sri Lanka are very easy because of the limited land area which is surrounded by the sea with no geographical boundaries with other countries. Good management and skilled planning are needed to maintain the amount of consumption below the lower limit of recharge.

Existing programs are conducted by different government organization under different ministries, private local organizations, foreign organizations with the permission of the government or as non-governmental organizations. The aim of all the organizations is to provide safe groundwater for the people. Most of these programs are funded by foreign organizations such as NORAD, WORLD BANK, ADB, UNICEF etc. Though they are giving funds for the development of groundwater the targets, objectives and managements are not similar. Due to this different administration all of these investigations are only for short term solutions. There are no long term solutions for the next generations under this situations. To avoid this problem an institute must be responsible for the data collections, investigations and research and those should be the main objectives the institution. All other construction should be carried out under the instruction and supervision of that institute. It create one administration for groundwater extraction for the people living in the country for a longer period.

CONCLUSION

To develop the various sections of groundwater programs, all groundwater projects must be under single management. Therefore it is necessary to establish a GROUNDWATER RESEARCH INSTITUTE in Sri Lanka. Successful groundwater programs in the future will involve a team of experts including social and political scientists and economists under a single managements. The technical and nontechnical research teams will find the answers for the real problems.

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