

INTERNATIONAL CONFERENCE ON GROUNDWATER IN ETHIOPIA

" SOME ASPECTS THAT INFLUENCE COST IN GROUNDWATER DEVELOPMENT"

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1. Background

During the last millennium, great advances have been made in space exploration and various fields of science. With the aid of artificial satellites it is now possible to forecast the weather, Very recently scientists were trying to determine whether there has ever been water on Mars. Here on our planet drilling off shore in water to a depth of about 3 km is now possible. With the aid of super computers and new sounding techniques in oil exploration, the probability of striking oil fields has increased by a factor of ten.

It is, however, not yet possible to control climate, and mankind still depends on rain and snow fall as the main sources of water. There is a glimmer of hope, however, that sometime by the year 2015 the weather might be controlled. Before that, much remains to be done in environmental protection and the Kyoto declaration has also to be implemented. Such advances in science and technology characterize activities in the industrialized countries, but the general benefit of all these progress is undoubtedly for all mankind.

The accumulated knowledge in various fields is used as a tool to put natural resources like groundwater for the benefit of man. With population growth, the once assumed inexhaustible natural resource now requires a careful utilization. The same is true for surface and groundwater resources, which seem to abound but is not so.

2. Available Water Resource

Although the world's resource of water in various forms is in the order of $1.37 \times 10^{12} \text{ m}^3$, only 2.8 % is available as fresh water, out of which 2.2% is surface water and the remaining 0.6% is groundwater. From the 2.2% of fresh water, only 0.05% is found in lakes and reservoirs, and the large portion of 2.15 % is found trapped in glaciers and icebergs. The comparison of surface and groundwater volumes reveals that groundwater is about 30 times the volume of fresh water in lakes and reservoirs, and about 3000 times the volume of streams at any one time. With respect to volume of water utilized, it is known that about 20% of the water used in the world comes from groundwater source, and 80% of it is used for irrigation. It is for this reason that groundwater is considered to be the largest source of fresh water. One should not lose sight, however, of the future possibilities for obtaining fresh water from glaciers and icebergs.

In Ethiopia, the estimated amount of yearly groundwater recharge is about $28,000 \text{ Mm}^3$ and annual production is in the order of 18 Mm^3 . It is understood that this quantity will change as more and more data is collected. Groundwater is mainly used in Ethiopia for domestic and industrial water supply.

3. Factors Which Influence Development Of Water Resources

3.1 Lack of Awareness

In Ethiopia the role of science in our everyday activities, and the consciousness of the general public of the utilization of natural resources to satisfy everyday needs with due regard to environmental balance is far from satisfactory. On the one hand we are apt to realize that there is a serious pressures on the natural forests and grazing lands; on the other hand efforts to utilize water resources in areas even where it abound is not significant.

It is simple to cut trees and use them, but it takes a bit of thinking to divert a stream for farm irrigation. For the latter case a bit of orientation is required from one who has done it already. Strictly speaking however, the whole question of establishing a self sustaining community becomes a question of setting national goals and mobilizing the entire population for the purpose.

Such a move will create a favorable climate for easy exchange of opinions to solve pressing issues on regional or community levels. No external expertise or finance will be required to device a procedure to put the waters of Awassa or Lake Tana for simple irrigation practice. What is required is to bring the possibility to the attention of the general public or to decision makers.

A regular forum for discussion on various issues should be envisaged to be part of our normal activities. It is appropriate to establish various types of associations or discussion groups to shake and awake all passive attitudes. Development and all social and political issues requires the active participation of the entire population. This, however, requires the examination of our social or traditional norms.

3.2 Traditional Outlook and Practice

There is also plenty of room to improve traditional outlook and practices. The farming implements and the farming methods which we are using have been with us for centuries, and the ideas which emerged three hundred years ago during the industrial revolution have not yet taken root in our country! This is manifested in our farming practice and methods of cattle raising, which are not still influenced by the new ideas of long. Seeds are not yet planted in rows and cattle is not yet managed in enclosures - ideas which emerged during the industrial revolution . Such practices have led low yield in farming.

The random movement of cattle from one area to another has contributed to the degradation of the rural landscape. Consequently stock watering both from groundwater and surface water requires careful planning. Widely scattered boreholes will result in stressful travel to and fro to water points, with a tendency to linger around within reasonable reach of water points, even though grazing possibilities are lacking. This will create adverse effect on the environment. Accordingly borehole location for cattle should be conceived to minimize unnecessary cattle concentration, which will further damage the already strained environment.

Accordingly borehole location for cattle should be conceived to minimize unnecessary cattle concentration which will further damage the already strained environment. Is it not worthy then, to examine for the sake of environmental protection the traditional outlook of regarding the sheer number of cattle as a sign of wealth? Should we not resort to numbers which can be supported by the water and grazing capacities of the area? What if enclosure system of cattle management is introduced and grazing grounds are put to usage for a specific period and then left free for regeneration? What will be the effect of strategical placement of engineered stock ponds at various parts of the country?

It is not paradoxical to note that such steps to control domestic animal population and proper stock water provision will lead to the regeneration of the environment in general and the water resources in particular. In such a case the cost of borehole and stock pond should be seriously seen in the light of the non quantifiable cost for maintaining a sustainable environment and ecosystem.

In the present millennium, mankind is expected to attain further remarkable achievements in science and technology, however, capital shortage coupled with relatively high implementation costs of projects are expected to be major constraints in countries like Ethiopia. The situation needs full discussion as it could influence development of groundwater resource.

3.3 Shortage of Capital And High Construction Cost

The present artificial hiking of construction cost as compared to the Ethiopian living standard and the low cost of labor in the country is an area of concern. So long as the accepted norm for cost recovery is from tariff to be collected from urban water consumers, full attention should be given to construction costs of water supply projects. In order to get a wider perspective, it is worth having a brief look into the investment practice in the water sector within the country.

It is known that an average of 50million Birr per year was allocated for drinking water supply during the last three decades. Comparing this sum with the required amount of 500 million Birr per year, reveals the great shortage of finance in the water supply sector. The seriousness of the situation is also manifested in the schemes that are known to have failed due to absence of fund either for maintenance or expansion.

As construction cost has a great impact on scheme sustainability, the procedures for tendering, tender selection and evaluation should be given due attention. In general, there should be a provision for examining unit prices with the aim of negotiation to come to acceptable prices with due regard for overhead and profit margins. A clear set of procedures for tendering will help in lowering construction costs.

But this solves only one part of the problem as our greatest constraint is capital shortage for development activity. The country has been struggling to survive by one sort of aid or another and it is now dragged into the third millennium, where the stage is set for globalization / free trade.

Already the strain is felt in our modest edible oil cottage like industries. Complaint has been voiced that they can't compete with the imported oils that are sold at lower cost. The case could be further clarified in the failures that were met to supply bottled water to the American soldiers during the first Gulf war. An Ethiopian water bottling company participated in the tender and lost, because price offers by suppliers from the industrialized countries were far too low and more reliable for the supply. It is thus practically impossible to compete in the international market and create capital accumulation. Partial solution to the capital constraint should thus be solved by our traditional sources of international aid. The remaining part could be solved by giving more attention to projects, which are within our financing possibilities as outlined below.

3.4 Absence of Detailed Hydrogeological Maps

Since many decades, ground water is being used for domestic water supply, irrigation and industrial water supply in many parts of the world. As a result procedures and methods for exploration and identification of ground water resources are very elaborate. In many of the developed countries, the ground water resource is mapped and quantified and there is regular monitoring of physical and chemical properties as a safe guard from pollution. Aquifer yield characteristics are also known well in advance and are recorded to serve as information base for any development under taking.

In Ethiopia ,by contrast, there is no detailed hydrogeological information which covers the country. A general hydrogeological map, however, is available. Such being the case, every ground water development is undertaken case by case, and standard procedures of topographic geological and hydrogeological investigations are undertaken as required. There is no doubt that ,in absence of detailed hydro-geological map, the piecemeal approach that is in practice, precludes in depth study due the usual time limitations for completion of specific projects. This is a major constraint and it usually characterized by failures of hit and miss identification of appropriate borehole sites.

3.5 Failure to Identify Projects Which Fulfill the Country's Needs

With regards to irrigated agriculture, the prevailing opinion that irrigation is expensive and that the countries fate lies in rain fed agriculture needs correction. Statements to that effect have been expressed through the national television media on various occasions. Such ideas are probably due opinions obtained from big projects, which have been identified by various consultants and which are not found feasible in the present stage of development of the country. This situation brings the need for identifying of projects which respond to the country's immediate needs.

The Blue Nile Basin study that was made by assistance from United States Government could serve as an example. Within the forty years that the study has been completed, only three projects have been realized. Most of the projects are big and it is not easy to get finance for their implementation. Given the country's pressing needs for food security and water supply smaller schemes which could be implemented by local finance should have also been identified. It is, however, true that big schemes could bring significant change in the economical development of a country. It is equally true that because big projects require long periods of detail investigation, study and design and long periods to acquire

finance. As a result they lose importance because they don't address to the practical and immediate needs.

In the Ethiopian context, however, where short and medium-term solutions are required to curb the ever increasing social and economic pressures. It is worth noting that the former National Water Resources Commission has made a useful inventory for locations for small dams to that effect. Due to lack of follow up, however, none of these schemes have been realized. Attention for further investigation and study of these potential sites should be given due emphasis as they can be implemented without any foreign technical or financial assistance.

3.6 Inappropriate Choice of Water Source

The current practice in Ethiopia is to use groundwater for urban and rural water supply. Surface water is excluded as a first choice, because it entails a higher investment cost in comparison to groundwater. This general situation, however, should be verified by study for each specific case. The possibility of combined usage of surface water and groundwater should not also be precluded. A case that comes to mind in this respect is in the high fluoride areas of Wonji and Metehara.

Boreholes in Wonji sugar plantation area are known to have high fluoride contents. As a result the Wonji borehole water has been a subject for a sad poetic expression by one of the employees of the sugar factory. It is sad to note that people of migrated to the area, in search of earning their livelihood are forced to face unnecessary problems. Their children have lost their teeth, and the parents have been handicapped by skeletal deformation, which has affected their health. In this particular case, a combined development of the groundwater, with the option of blending it with water from Awash River could have prevented the tragedy.

In addition to the factors, which influence the development of groundwater, there are also known sanitary requirements, which could influence sustainability and an unnecessary cost due to remedial measures in case of pollution due to careless operation. The main preventive measures are summarized below.

4. The Groundwater Option for Irrigation

With regards to using groundwater to irrigated agriculture, careful consideration is required. In practice ground water is used in areas where the volume is sufficient and where it could supplement canal irrigation. Full groundwater supply applies in cases where canal supply is closed or in cases where there are pockets of irrigable land which are strictly feasible from ground water supply.

In general, it is known from the Indian experience that surface water irrigation is cheaper than groundwater irrigation. In cases where the water table rises, however, groundwater can be considered in conjunction to surface water irrigation. In such a case the utilization of groundwater has the additional purpose of lowering the water table. Experience in Israel and U.S.A. shows that blending of groundwater with surface water could be used to raise crops which could stand saline water. In the Indian practice it is known that tracts of

irrigable land are cultivated from water diverted from rivers. These schemes do not require any storage as groundwater aquifers are used for the supply of deficits.

Another fact from the Indian practice is that conjunctive use is applied to areas which are already under surface irrigation, and it precludes the indiscriminate use of tube wells for irrigation. Here the basic concept of irrigated agriculture should not be lost, as it is a means to supplement soil moisture to enable the economical production of crops two or three times per year. It is a prerequisite that crops produced by irrigated agriculture should fetch higher selling price. That was the guiding idea when the first diversion project was realized in the year 1847 in Utah, U.S.A.

Accordingly in the Ethiopian scene, the most feasible projects for irrigated agriculture should be handled from federal level. Such a strategy should be applied in order to make the best use of our strained financial reserve for the most promising projects on a national level. The use of groundwater for irrigation should, however, be justified by comparison with surface water irrigation.

5. Sanitary Requirements

In addition to the factors, which influence the development of groundwater, there are also known sanitary requirements, which could influence sustainability and an unnecessary cost due to remedial measures in case of pollution due to careless operation. The main preventive measures are summarized below.

There are signs which indicate that industrial and domestic effluents are endangering ground water and surface water sources. The danger is more apparent as most of the urban centers are not provided with appropriate waste and liquid waste disposal systems. It is thus required that both shallow well and boreholes should have proper sanitary protection to prevent contamination during the service period.

Habits of building simple perimeter fences around spring and borehole sites to preclude any human or animal access to discourage any type of pollution should be developed.

In areas like the Arba Minch springs, where a large water shade area is involved and where the town is built on top of a high ground which drops into a cliff below which the springs emerge, appropriate precaution should be taken. Such areas should be reserved as parks or buffer zones with restricted activities which would help to enhance a green environmental setting for the town. A similar protection mechanism should be devised to protect both shallow well and borehole well fields. Before long the country might require to enact the proper management/protection of groundwater resource.

6. Concluding Remarks

As learnt from some studies, in the water supply sector, the current level of water supply coverage In addition to the factors, which influence the development of groundwater, there are also known sanitary requirements, which could influence sustainability and an unnecessary cost due to remedial measures in case of pollution due to careless operation. The main preventive measures are summarized below.

is about 14%, and the required investment to raise the coverage level to 40% is about 11.9 billion Birr. Given the low level of water supply activities, an enormous amount of effort is required in the coming years, the following actions should be taken.

- i. Solving financial constraints for investing in water supply projects.
- ii. Improving the information base for sighting and drilling for groundwater
- iii. Creating a favorable atmosphere for local professionals or skilled technicians, who would like to enter in the business but lack of incentive or support.
- iv. Encouragement of drilling contractors and equipment suppliers

With this background, the need for sufficient government allocation of budget for the sector and substantial foreign assistance from various sources is apparent.

In general, for all development activities, high priority should be given to projects that can be financed locally. It is evident that such a move could serve to accelerate the provision of water supply facilities that will bring the socio economic development of the country on the basis of self reliance.

In the final deliberations of this seminar, however, emphasis should be given to voice Ethiopia's deplorable situation and need for committed long-term financial assistance from all possible sources.

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