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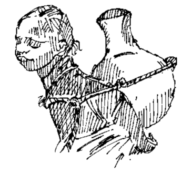
INTEGRATED DEVELOPMENT FOR WATER SUPPLY AND SANITATION



Groundwater development in Maharashtra State, India

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MAHARASHTRA IS ONE of the most developed, progressive and industrialised States of India, being 3rd in population as well as area. It is also one of the leading States in the country with reference to groundwater based irrigation development and water supply. The overall stage of groundwater development in Maharashtra is above 30 per cent despite being a predominantly hard rock area with difficult hydrometereological conditions.

Out of a total area of 308,000 km^2, 65 per cent is under cultivation, 23 per cent of the cultivated area is under irrigation of which more than 50 per cent is based on groundwater, utilising dugwells and borewells.

Groundwater development has flourished in Maharashtra because of a strong State groundwater organisation, the Groundwater Surveys and Development Agency (GSDA). Established in 1971 it now draws on the skills of 2500 staff including Geohydrologists, Engineers, Technicians and Administrators.

GSDA has the responsibility for study of groundwater availability – both for minor irrigation and water supply, exploitation using latest technigues to improve yield and sustainability and also acts in an advisory capacity in difficult groundwater areas. Since establishment the Agency has successfully drilled 178,290 borewells and installed 160,000 handpumps in 25,000 villages and 20,000 habitations, surveyed 20,000 villages under a systematic geohydrological survey scheme, provided guidance to nationalised banks for financing dugwell development and launched innovative watershed development techniques in micro watersheds for water supply source strengthening utilising unconventional measures for augmentation of groundwater sources and hydrofracturing techniques, for example.

GSDA is also closely co-ordinating with UNICEF, World Bank and DFID in water supply and sanitation projects as well as building its capacity through the introduction of improved modelling techniques using a computer based Hydrological Information System as a part of the World Bank funded National Hydrology Project.

Planned groundwater development in the State is important because of growing demand for water for agricultural, industrial and domestic use. (Table-1) Unfortunately, this is not uniform because of the variations in physiography, climate and geological conditions across the State.

The State is located between north latitudes 16^{0}04’00" and 22^{0}01’00" and east longitudes 72^{0}06’00" and 80^{0}09’00”. The geographical area is about 300,000 Sq. Km., which is divided into 31 districts and 303 talukas (sub-districts).

Geology and hydrogeology

The State is divided into 5 groundwater provinces based on the prevailing hydrogeological conditions. The rock types and their distribution are given in Table 2. It will be seen that major part of the State (82 percent) is occupied by Deccan Trap Basalts. Hence, the hydrogeology of the Deccan Traps is practically the hydrogeology of the State.

Source development

The drilling of borewells for rural water supply has progressively accelerated over the last 25 years. The borewells have diameter of 150 mm and depth of 60 to 100 m. The

Table 1. Water requirement in million cubic metres

Use	*1991 requirement (MCM)*	*% split*	*2030 projection (MCM)*	*% split*
Domestic Urban	1962	10.7	4236	13.8
Domestic Rural	971		1943	
Irrigation	23000*	83.8	35000*	78.4
Industrial	1513	5.5	3461	7.8

Notes

1) All figures except (*) obtained from the 2nd Water and Irrigation Commission.
2) (*) Net irrigated area which was 2.6 M.ha. in 1991 is projected to be more than 5 M.Ha. i.e. 30 per cent of net sown area by 2030 and considering 70 cm, average water requirement per annum for irrigated crops, the total irrigation water requirement would be more than 35000 m.cu.m.
3) Maximum 30 per cent irrigation potential is achievable in Maharashtra according to the First Irrigation Commission (Barvee) Report.

Table 1. Groundwater provinces of Maharashtra State (India)

Groundwater Province	*Rock Type*	*Area* (km^2)	*Districts covered*
Archaeon and Dharwar Metamorphics	Granites, Metamorphic	32,264	Bhandara, Chandrapur, parts of Sidhudurg, Nagpur, Gadchiroli.
Consolidated Sedimentary	Limestone, Shale, Sandstones	6,214	Parts of Nagpur, Chandrapur and Gadchiroli.
Gondwana Sedimentary	Sandstomes	4,800	Parts of Chandrapur, Yavatmal and Amravati.
Deccan Trap Basalt	Basalts	249,784	Greater Mumbai, Mumbai Suburb, Thane, Raigad, Ratnagiri, Sindhudurg, Dhule, Nandurbar, Nashik, Jalgaon, Beed, Aurangabad, Jalna, Ahmednagar, Pune, Usmanabad, Latur, Satara, Sangli, Solapur, Kolhapur, Parbhani, Nanded, Buldana, Akola, Washim, Amravati, Yavatmal, Wadha and Nagpur.
Unconsolidated Alluvials	Alluvium	14,618	Parts of Akola, Amravati, Budana, Dhule and river deposits of other districts.

Groundwater Surveys and Development Agency has so far drilled 232,788 borewells, out of which 178,290 borewells are successful (borewell yielding 500 litres per hour of water is considered successful), 159,913 borewells have been fitted with handpumps, while 12,585 borewells have been fitted with power pumps (borewells yielding 3000 litres of water per hour are considered suitable for installation of a power pump).

Drilling of borewells for irrigation is also becoming popular in recent years because of the ease with which they can be drilled, attractive financial incentives and the depth to which they can penetrate compared to open dugwells. However, presence of a large number of irrigation borewells in certain areas is leading to the problem of interference. This is now being addressed by enactment of the Ground Water Act, 1993.

Recharge of groundwater

In order to enhance the recharge to groundwater, the Government of Maharashtra has undertaken a massive programme of water conservation. The programme includes conventional measures for recharge and in addition, GSDA has developed some unconventional methods and is a pioneer organization in the country in implementing these water harvesting techniques under its Research and Development programme. Some of these projects have been funded by the World Bank, DFID and UNICEF who are appreciative of this unique strength of the State Groundwater organisation. Key techniques include Bore Blasting, Jacket Well and Fracture Seal Cementation.

Problems faced

Maharashtra faces the following problems in groundwater development :

- A substantial increase in groundwater abstraction due to increase in number of wells and motorised pumps (lifting devices) leading to failure of both irrigation and community water supply wells as the aquifers in hard rocks have limited quantity of stored water, accentuated by low and variable rainfall. (Tables 1,2 and Plate 1).
- Irrigation and drinking water wells are in competition for the same limited resource and increasing over-abstraction has led to removal of the utilisable proportion before the onset of summer and progressive depletion of the water table. Leakage from shallow aquifers to the deeper ones and increased abstraction from the deeper aquifers is also affecting the stability of water tables.
- Overexploitation in certain areas due to the above reasons has led to hazardous effects on availability of ground water for drinking water purpose causing acute drought conditions for rural habitants who have to be supplied water with tankers. Such areas are either having long term decline in water table due to discharge exceeding long term annual recharge or local problems due to higher well density affecting capacity of aquifer to transmit water to drinking water wells in excess of the local abstraction rate. In addition, a short term decline in water table due to drought conditions in certain years may only be recouped by the aquifer through future excess rainfall.
- Unsustainability of sources, quality and pollution problems have arisen due to the above.

Reforms necessary

The following reforms are felt necessary to rationalise groundwater development:

- From the problems it is evident that there is a need for a shift from development to management in an integrated manner (both surface and groundwater for both irrigation and drinking water) alongwith community involvement to understand competitive and multiple uses and regulate demands.
- Environmental issues of sustainability, over exploitation, declining water quality and pollution should become an integral part of the groundwater assessment, evaluation and planning methodology leading to effective monitoring and implementation of remedial measures.
- Equitable and acceptable legal enforcement of provisions of the Ground Water Act with community participation in implementation locally by extensive training orientation programmes and IEC activities is needed.

- There is a need for reorienting government ground water institutions to provide strong linkages with each other, enhanced role in water resources policy making, enhanced capacity for basic research more so in hard rock aquifers and development of valid, comprehensive, interactive, user friendly hydrological data base.
- There is an urgent need to reorient incentive and investments for changing cropping pattern to low water intensity crops increase use of efficient irrigation technology, conjunctive management and recharge, reliable power supply and metering all connections to improve service along with use of non-conventional energy source for groundwater pumping, away from new wells to water conservation, recharge and improving data availability and networking for exchange.

Prospects

Many reforms enumerated above are being brought about under the World Bank sponsored National Hydrology Project which is currently under implementation in Maharashtra. It will help improve the organizational arrangement, technical capabilities and physical facilities available for monitoring all aspects of the hydrological cycle by developing a comprehensive data base for the purpose as well as bringing in institutional reforms in a time bound action oriented manner. The HDUG (Hydrology Data Users Group) has also been formed under the project to facilitate easie access to data users and standardise formatting of reports thereby linking the supply and demand sides of groundwater. Further efforts at community development through UNICEF support have also been attempted by distributing and displaying four posters in the local language covering hand pumps, over exploitation and dug well site survey and blasting. A booklet on drilling, installation and maintenance of hand pumps has also been distributed at village level. A CD-ROM on similar lines is also being prepared. A water conservation manual is under preparation which will contain success stories in elimination of supply during scarcity by water tankers to create awareness among both official and non-official decision makers.

Lectures, modelling and exhibits and field demonstrations at village, district and State level are being arranged for officials and non-officials to involve the community in the work of the Department. UNICEF help has also been forthcoming for water conservation projects in one District on a pilot basis and the results are encouraging, particularly for elimination of tankers and changes in cropping pattern. A phase II for the project for evaluation and community involvement is under way. UNICEF is also considering a GIS based computer package development for water resources planning in Ahmednagar by the Department, as a pilot project for drinking water planning in a complex hydrogeological mix and analysis with enormous data and multiple maps. GSDA has already developed a GIS for one Taluka of 1143 sq.km. (Ramtek, Nagpur) with the help of the State Remote Sensing Agency and another such project for a watershed in Barshi Taluka of Solapur district is in progress.

The GIS approach is proving to be a useful tool for watershed development and development of sustainable drinking water sources. Apart from the unconventional recharge techniques for drinking water sources in the micro-watershed, the department has also carried out more than 6000 hydrofracturings with good success and about 50 induced recharge projects in over-exploited areas. Major research projects under the Hydrology Project include a project for recharge in Pune and Jalgaon and one on conjunctive use in Ozar, Nasik district which relies on community assistance. A desalination project in the saline alluvial tract of Purna valley is also in the third year of implementation and results are encouraging. There is a need to replicate the above efforts on a larger scale to cover all the problem areas of the State.

Conclusion

It can be appreciated that the demands for groundwater in Maharashtra are increasing (Table 1) and rising drinking water allocations would lead to competition with irrigation and industrial supplies. Sustainable development, containing over exploitation and water quality problems are challenges which can be met by reforms in the strategy and approach to groundwater issues. The Hydrology Project provides a unique opportunity for institutional reform and improvement of the hardware infrastructure to meet the challenges of the future. Coupled with community involvement and help from international agencies, it is imperative that the environmental impact of the lowering of the ground water tables in the State is tackled head on using the unique strengths of the department, the modern technology of GIS and comprehensive computer networked data bases. For we owe it to the future generation, to act in time with all the commitment at our command, to pass on the legacy of a balanced and undegraded environment.

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