

Institutional Framework for Regulating Use of Ground Water in India

Final Report

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Ministry of Water Resources
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**Submitted by
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Preface

The Research and Development (R&D) Division of the Ministry of Water Resources, Government of India sanctioned this study which commenced from December, 2005 with two years duration. The study required collection of information from both secondary and primary sources. The field surveys in 6 states namely, Andhra Pradesh, Delhi, Gujarat, Punjab, Tamil Nadu and West Bengal were organized. The Institute received full cooperation in this respect from respective state governments as well as Regional Directors of CGWB.

Quarterly as well as annual progress reports were sent regularly to Member Secretary, Indian National Committee on Hydrology (INCOH), Roorkee under copies to the Director (R&D), Ministry of Water Resources and the Central Ground Water Board. These agencies were kept fully informed of developments related to the study.

The report of the study was more or less ready by the end of the November, 2007. However, certain critical information needed for the study could be received only by the later part of February, 2008. Thereafter, draft the report was submitted on 7th March, 2008, after taking into account the above information. Comments from 3 anonymous experts from INCOH were received on 18th August, 2008. All the 3 experts not only approved the report but also commended it highly, calling it scholarly, highly useful and comprehensive. They also made a few suggestions, of which, the feasible ones pertaining to the study taken into account while finalizing the report, 5 copies of which are being submitted now.

The Institute received full cooperation from Shri R.C. Jain, the then Superintending Hydrogeologist, and now Regional Director, Central Ground Water Board who was CGWB Coordinator for this study. The Institute is thankful to him for his guidance in selection of states and introducing us to state governments. Our thanks are also due to Dr. Ramakar Jha, who was Member Secretary, Indian National Committee on Hydrology during the period of the study and Shri S. Masood Hussain, Director (R&D), Ministry of Water Resources for the cooperation and guidance provided by them. We thank the 3 anonymous experts for their comments and suggestions.

We would also like to thank, the Chief Secretaries, Secretaries, Water Resources, and Heads of Ground Water Departments in all the six states for sparing time for discussion, providing data/information and necessary help to the study at the grass root levels in their respective states. We thank NABARD for its cooperation in supplying the needed information.

My colleagues and staff in the Institute for Resource Management and Economic Development deserve special thanks for providing the needed cooperation. In particular, I would like to thank Shri D. Routray, Director of the Institute and Co-Principal Investigator, Dr. Mohammed Aslam, Dr. Arbind Kumar and Shri Mangal Giri, Research Associates, Shri Muneesh Kumar, Junior Research Fellow and a large number of Field Investigators particularly Shri Bastooram and Shri Sudhir Raut. I am thankful to Shri S.C. Kocheta, the then Accounts Officer and Shri Minnatullah present Accounts Officer for taking care of all matters related to accounts. Finally I thank Shri Mehar Singh Bisht and Shri M. Ramabadaran for typing of several versions of the report.

(Kamta Prasad)
Principal Investigator

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Executive Summary

Introductory

1. Ground water has played a very important role in providing drinking water and irrigation in the country thereby helping in food security and poverty alleviation among poor. (Para 1.1)
2. The distribution of ground water resources as well as the stage of ground water development have been uneven across different parts of the country. (Para 1.2)
3. Ground water development has been on an accelerated pace ever since the country entered stage of green revolution. This has resulted in a substantial increase in well density. (Para 1.3)
4. Pumping technology facilitated by subsidized free power along with changes in cropping pattern have been mainly responsible for the rapid expansion in over-exploitation of ground water resources in India. (Para 1.3)
5. Growth in ground water exploitation led to steep fall in water table in several parts of the country. As a result, ground water is becoming unsustainable with several adverse effects. (Para 1.3)
6. Though confined to particular districts and blocks, ground water exploitation has serious implications at the national level also since a substantial portion of the value of irrigated agricultural output in India depends on ground water irrigation in over-exploited and critical areas. Para 1.3)
7. In view of limited potential for supply side measures in critical and over-exploited areas, the need is to develop appropriate regulatory measures for moderating demand. (Para 1.3)
8. The challenge of sound governance of ground water resources underscores the need to review the legal and institutional framework for regulating ground water utilization in India. (Para 1.4)
9. The basic objectives of this study were
 - (i) To examine the adequacy of the existing institutional framework in regulating utilization of ground water in respect of “over-exploited”, “critical” and semi-critical” areas.
 - (ii) To evaluate the level of awareness of the prevailing legal and institutional setup amongst the grass root level users as well as local level implementing agencies.
 - (iii) To evaluate the efficacy of the ground water regulation system in providing access to ground water on equitable basis to the weaker section of the society.
 - (iv) To examine the scope for self regulation through community based organizations like Panchayati Raj Institutions (PRI) or water users associations or other local level organizations in management of ground water utilization, at the local level.

- (v) To evaluate the institutional arrangement for regulating exploitation of ground water mainly for sale of water.
 - (vi) To examine the reliability of the system for collection and dissemination of data on availability of ground water and changes therein at the micro level i.e. village and town (Para 2.1)
10. The in-depth study was conducted in 6 states and from each state one district (2 districts in case of Delhi) was selected. From each district, 2 blocks (1 block in case of Delhi) and from each block 3 villages and a small town were selected. From each sample village, 10 ground water user households and from each town, 15 ground water user households (subject to availability) were selected (Para 2.2)
 11. Information for the study was collected from both secondary as well as primary sources with greater reliance on primary sources through field surveys at the grass root level (Para 2.4)
 12. The states selected for the study were Andhra Pradesh, Delhi, Gujarat, Punjab, Tamil Nadu & West Bengal (Para 2.4)
 13. Field surveys covered 7 districts, 12 towns, 36 villages, 540 households (Para 2.4)
 14. Four sets of structured questionnaires after being pre-tested under practical field conditions were administered one each at state, district, village/ town and households level (Para 2.5)
 15. The field work started towards the end of June, 2006 and ended by February, 2007. (Para 2.6)
 16. Meetings were also held with senior level officers at the state level to discuss policy matters in the light of observed effectiveness or non-effectiveness of the existing regulatory system. For this purpose state specific supplementary questionnaires were also formulated (Para 2.7)
 17. Meetings of the study team with Central agencies were also held (Para 2.8)

Legal and Institutional Aspects

18. Ground water is usually treated as a state subject as the Constitution of India does not empower Central Government to directly deal with its management (Para 3.1)
19. Unlike several countries, India does not have any separate and exclusive water law dealing with various water resources and covering all aspects (Para 3.2)
20. As per the provisions of the Easement Act 1882 and the Transfer of Property Act, 1882, the land owner is supposed to have a right to ground water beneath his land as it is considered as an easement of land (Para 3.2)
21. The Easement Act does not permit land owners ownership of ground water if it is passing through in a defined channel (Para 3.3)

22. As much of ground water is a dynamic resource which flows through defined channels, owners of land can not claim absolute ownership over water under their land (Para 3.3)
23. The introduction of high powered technology of extracting ground water, strikes at the very root of ground water as a property right available to every property owner. (Para 3.3)
24. Property owners should be allowed to use ground water to a reasonable extent keeping in view the needs of their neighbours or in proportion to the amount of land owned by each person (Para 3.3)
25. The Govt. of India prepared a model bill for regulation of ground water in 1970 and circulated it to all states for implementation. The bill was revised in 1992, 1996 and 2005. (3.6)
26. The main thrust of all the versions of model bill had been constitution of a state ground water authority which would identify the critical areas and would notify them for regulation. (3.6)
27. Very few states have taken action on the model bill. (3.6)
28. Model bill is not expected to be a panacea for the problem of over-exploitation of ground water resources. (3.6)
29. Central Ground Water Authority was set up on 14 January, 1997 under the Environment (Protection) Act 1986, as a major institution for regulating use of ground water. (3.7)
30. The Authority has been given wide powers including power to impose penalty on any person, company, Government Department etc. (3.7)
31. To achieve its mandate, the Authority has divided its functions into 4 sub-heads namely regulation of ground water, conservation of ground water, protection of ground water and mass awareness. (3.7)
32. The view that ground water is under public and not in private domain is gaining ground in India. Government should come out with a declaration in its favour and enact a suitable law as advocated by legal bodies/experts. (3.8)
33. The regulatory authorities at both central and state levels should be strengthened. (3.8)
34. Overlap in the functions between central and state authorities should be avoided. (3.8)
35. There are several institutions at the national level dealing with management of ground water. These include National Water Resources Council, National Water Board, Ministry of Water Resources and Central Ground Water Board. The Central Ground Water Authority constituted in 1997 is the most important national agency for regulating ground water in India. (4.1)

36. At the state level, ground water is managed by the state Irrigation or Water Resources Department, and Minor Irrigation Department or Corporation. The state Public Health Engineering Department has also some role with regard to managing drinking water supply. (4.2)
37. Some states have several agencies involved in ground water management. But coordination between them is quite weak. (4.2)
38. At local level (villages and towns), regulatory functions are performed by Government office at the block level, Panchayat and Municipality. (4.3)
39. The institutions providing credit and power also have some indirect role in management of ground water. (4.4)
40. The legal and institutional framework for regulating ground water was grossly inadequate to tackle the trend towards over-exploitation of ground water in the country. (4.5)
41. The ineffectiveness of ground water legislation has been noted by Planning Commission also. (4.5)
42. The most important reason for ineffectiveness of legal measures lies in absence of any provisions for restricting the quantum of water extracted through existing ground water structures. (4.6)
43. The authorities must give powers to regulatory bodies to restrict excessive withdrawal of ground water by existing users. (4.6)
44. The composition of the ground water authorities, at both central and state level needs to be changed and these authorities should be provided with adequate staff and funds to discharge their functions in an efficient manner. (4.6)
45. The CGWA should evolve a strategy for launching massive awareness generation programme on continued basis in all the affected parts of the country. (4.6)
46. No punitive action has been taken by central or state ground water authorities even though the numbers of over-exploited, critical and semi-critical units are increasing. (4.6)
47. The regulatory machinery at all levels from centre to state to district and below is entirely bureaucratic. Public is nowhere in the picture, even at the grass root levels. (4.6)
48. The extent of awareness among officials of legal provisions related to regulation of ground water was found to be far from adequate. (4.6)
49. Lack of political will to impose any restriction on extraction of ground water has been a major factor in ineffectiveness of regulatory measures. (4.6)

Data and Information System

50. Ground water regulation would require information on ground water at the micro-level at frequent intervals. The states, however, have inadequate set up to handle this task in a satisfactory manner. They should increase the number of ground water monitoring centres to cover every panchayat and to install mechanical devices for the purpose. (5.2)
51. The introduction of piezometers has led to a marked improvement in the quality of ground water data. Maintenance of these piezometers has, however, been a great problem. As a result, many piezometers do not function. (5.2)
52. The ground water data in West Bengal is not published. Absence of transparency makes it difficult to assess its reliability. (5.2)
53. There should be good collaboration between Universities, State Research organizations and state ground water departments for bringing out improvement in ground water data. (5.3)
54. The possibility of using remote sensing for monitoring ground water tables may be explored by CGWB. (5.3)
55. The local data obtained through observation wells may be shared with local people so as to help in cross checking with the information collected manually. (5.3)

Ground Water Scenario at the Micro Level

56. A majority (almost three fourths) of villages and towns depended upon private (mostly own) sources of water. (6.1)
57. Ground water was the pre-dominant source of drinking water in all sample villages/towns. (6.1)
58. All the sample households were getting water from tubewells or hand pumps. (6.1)
59. Tubewells constitute 81% of the ground water structures. (6.1)
60. Agricultural sector is the most important user of ground water followed by domestic use which, however, is far behind. (6.2)
61. About 79% of rural households have installed their own tubewells for irrigation purpose. A higher proportion of them, about 84% relied on ground water for irrigation. (6.2)
62. Farmhouses located on the outskirts of cities or big towns depended on tubewell for irrigation. (6.2)
63. Ninety percent of the tubewells were running on electricity whereas only 10 % were diesel operated. (6.3)

64. About 90% of the tubewells were owned by private persons and only 10% by panchayats. (6.3)
65. Eighty eight percent of the tubewells owned by Panchayats and 77% of the tubewells owned by private persons were in working condition. (6.3)
66. The level of awareness among people about fall in the ground water table was quite high. (6.4)
67. A majority of households (75%) in both urban and rural areas were aware of the adverse consequences of fall in ground water level. (6.4)
68. Only 33% of households were aware of the existing laws/rules/procedures to regulate the use of ground water. (6.5)
69. One third of the respondents reported that they followed existing laws and regulations pertaining to ground water management and use. (6.5)
70. Suggestions given by sample households to overcome problems of ground water management were supply augmentation measures only. Demand management measures were conspicuous by their absence. (6.7)
71. The introduction of submersible pumps goes against the interest of small and marginal farmers. (6.8)
72. Data for 11 major states show that 37% of large farmers owned different types of wells, whereas only 6% of marginal farmers owned such wells. (6.8)
73. About 54% of households covered under the study felt that there was equity in the use of ground water. (6.8)
74. Suggestions made by households for more equitable distribution of ground water included access of poor to ground water sources, increasing number of public stand posts, adequate representation of poor in water users associations and separate tubewells for weaker sections. (6.8)

Regulation through Indirect Measures

75. Cultivation of water intensive crops should be discouraged in areas suffering from scarcity of ground water. (7.1)
76. Appropriate extension and policy initiatives are needed to induce farmers to adopt less water intensive cropping pattern. Participatory approach could be one such method. (7.1)
77. Water intensive industries should not be allowed in water scarce areas. (7.2)
78. Mismanagement of water resulting in inefficiency and wastage had been a major reason for scarcity of ground water. (7.3)

79. The states had not adopted policies or provided incentives for promoting efficiency in use of ground water and discouraging wastage. (7.3)
80. There are several ways through which better management of water can be brought about. Their adoption would reduce the demand for water. (7.3)
81. A major improvement in water saving through better management would take place by use of micro-irrigation techniques like drip and sprinkler irrigation. (7.3)
82. For the above purpose, subsidy may be provided to small and marginal farmers when opting for such devices. (7.3)
83. Availability of institutional credit has been a major factor in development of ground water irrigation in India. But its scope is somewhat limited now. (7.4)
84. The reason for the above is that a major proportion of ground water structures are either self financed by farmers or financed through sources other than the banks. (7.4)
85. Electricity has the potential to be a potent source of regulating use of ground water since 90% of the pumpsets in sample villages were found to be energized through electricity. (7.6)
86. There are several ways through which supply of electricity can be used to restrict extraction of ground water. Some of these are being attempted by state governments also. (7.6)
87. Metered power at an appropriate tariff will induce farmers to cultivate less water intensive crops and reduce over-extraction of water by them. (7.6)
88. Metering electricity can be made feasible by adopting a phased approach. (7.6)
89. Authorities may evolve a mechanism to regulate installation of tubewells/borewells through influencing the operations of drillers and suppliers. (7.7)
90. Recommendations for a slab system for water pricing may be considered. It can be made feasible through metering of electricity supply. (7.8)
91. A beginning can be made by concentrating on bulk users of water like big industries and urban complexes. (7.8)
92. Water charges paid by farmers for getting water for irrigation were higher from private sources. (7.9)
93. There was no systematic estimate of the magnitude of water trading at the national level. But about 5 percent of all farmers in our sample received water from fellow farmers of the adjacent plots. (7.9)
94. There is a need for regulatory measures to control the extraction and sale of ground water by large scale operators. (7.9)

95. Legal and institutional support as needed for regulation through indirect measures may be provided. This would imply changes in composition of regulatory authorities at both central and state levels. (7.10)

Regulation Through People's Participation

96. Panchayats have the potential to tackle problems associated with utilization of ground water resources at local levels. (8.1.1)
97. The Constitution of India lists minor irrigation, water management, drinking water as items to be handled by panchayats. Hence, it should be made mandatory to involve panchayats in water resources management. (8.1.2)
98. The Ministry of Rural Development has some schemes for involving Panchayats in management of drinking water supply in rural areas. (8.1.2)
99. The present study shows that Panchayats have limited roles in management of ground water. In most of the sample areas, their role was found to be casual or negligible. (8.1.4)
100. The functions performed by some panchayats included selection of sites for water works related to public tubewells, formation of users groups, collection of water charges and help in repair and maintenance of the water works, pipelines and motors etc. (8.1.5)
101. Suggestions given by households to involve panchayats/municipal bodies in ground water management included assigning some well defined role through legislation. In this respect, their role in creating awareness about water conservation and formation of water users associations will assume a great significance. (8.1.6)
102. In most of the sample villages, NGO's were not found to have any role in development and management of ground water. In some states, however, NGO's were reported to have performed some role in motivation and awareness generation. (8.2)
103. Water users associations were found in Chittoor district of Andhra Pradesh and Moga district of Punjab, both of which were under the Sector Reform. Project, in rural water supply of the Ministry of Rural Development, Government of India. Such associations were, however, non-existent in other sample districts. (8.3.1)
104. The number of water users associations in the sample villages was 50 in Chittoor district and 45 in Moga district. The functions performed by them included providing awareness education about efficient use of water, regulating the timing of water supply, resolution of conflicts among members etc. (8.3.1)
105. The need for involving Panchayati Raj Institutions in management of ground water resources has been emphasized by the National Commission for Integrated Water Resources Development as well as Expert Group on Ground Water Management and Ownership of the Planning Commission. (8.4)

106. Given the vastness of the problem related to over-exploitation of ground water, a command and control system will have little chance of success. Hence, there is no alternative but to involve local level institutions in the task of regulation. (8.5)
107. Several measures would be needed to make panchayats role in management of ground water effective. These would include (i) an awareness generation-cum-orientation training programmes for the technical officers of ground water departments, (ii) introduction of a system of rewards for panchayats doing good work in managing ground water in critical and over-exploited areas (on the pattern of Nirmal Gram Puraskar Yojana of Ministry of Rural Development, Government of India), (iii) vigorous programme of awareness generation in areas facing scarcity of ground water, (iv) providing technical guidance to panchayati raj functionaries, (v) collection and dissemination of data on ground water at the grass root levels by ground water department, (vi) formation of ground water users groups etc. (8.5)
108. The Model Bill, the state ground water laws and rules and procedures of the CGWA as well as the state panchayati raj legislation need to be amended suitably to give powers to panchayats to perform the regulatory function in the areas under their jurisdictions. This should be accompanied by putting in place an appropriate institutional framework. (8.5)

Summing Up

109. A multi-pronged approach is needed to deal with such a complex matter as declining ground water level. (9.3)
110. The institutional mechanism suggested is mainly for over-exploited and critical areas. For safe areas no regulations might be needed, while in the case of semi-critical areas, awareness generations campaigns would be enough. (9.3)
111. A set of action points are recommended. (9.3)

Chapter - I

Introduction

Any discussion on legal and institutional framework should take into account the context of the overall situation facing the ground water sector. Hence, it is useful to give background information related to ground water resources and their development. This is attempted in the present chapter. It is based on secondary sources of data obtained mostly from publications of the CGWB. The chapter also poses the problem of governance and draws attention to the need for the study.

1.1 Ground Water Scenario in India

The importance of water is too obvious to require much elaboration. Water is life. It is one of the most critical natural resources for the continuance of life on earth. It is a scarce, precious and replenishable natural resource which cannot be created. Its true value can be known only when it is not available. Its value can be gauged by the energy and time spent in traversing to fetch a pot of water. The sources of water are mainly surface and ground water. To some extent, these are interdependent as the use of one source affects the availability of the other. Utilisation of each source varies depending upon its availability.

The renewable water resources in the world as a whole have been estimated as 42,700 km³. The availability in Asia, South America, Europe and Australia is estimated 13,500, 12000, 2,900 and 2,400 km³ respectively. There has been a decrease in per capita availability of water due to population growth from 12,900 M³ in 1970 to 7,600 M³ in 1994. The reduction in Africa is 2.8 times, in Asia 2 times, in South America 1.7 times but in Europe it is only 16 percent. At the same time, there has been growth in per capita water use. As a result, water is becoming increasingly scarce. (Ground Water Management in India, CGWA, MoWR, GOI, 2000, p.1)

It has been estimated that India, Nepal, Bangladesh, Pakistan and China use over 300 billion m³ of ground water annually, which is mostly in agriculture. This constitutes nearly half of the world's total annual use. As can be seen from the table given below, India is the largest user of ground water. In the case of South Asia, the utilization of ground water is mainly in private and informal sectors specially the farmers with no or very limited regulation. Policy measures to regulate ground water overdraft, such as enacting and enforcing ground water laws, installing licensing and permitting systems, establishing clear tradeable property rights for water, pricing of ground water etc., have been advocated in South Asia and China. For example, the National Water policy of India highlights the ground water development issues of over-exploitation and the need for regulation. But no Asian country has yet been able to effectively deploy any of these measures despite continued deterioration in ground water level and quality. (K.D. Sharma, Groundwater Governance, 2007, p.277)

Table 1.1 : Extent of Ground Water Development in selected Countries

Country	Annual Ground Water Use (Billion m ³)	Number of Ground Water Structures (million)	Extraction/ Per Structure (m ³ /year)	Imputed Value of G.W. Used/ Year (billion \$)
India	150	19	7900	6
Pakistan	45	0.5	90,000	1.2
China	75	3.5	21,500	2.5
Iran	29	0.5	58,000	NA
Mexico	29	0.07	414,285	NA
USA	100	0.2	500,000	NA

Source: K.D Sharma, Groundwater Governance : The Indian Scenario op.cit., 2007, p.278

India has a highly seasonal pattern of rainfall, with 50 percent precipitation falling in just 15 days and over 90 percent of river flows occurring in just four months. The average annual precipitation in India in volumetric terms is 4000 BCM. Due to topographical and other constraints, it is estimated that only 690 BCM of surface water can be effectively utilized. The annual replenishable ground water resources in the country are estimated to be 432 BCM*. Thus, the total utilizable water resources of India has been estimated at 1122 km³. Total water use in the country was estimated by the National Commission on Integrated Water Resources Development (NCIWRD) of India at the level of 611 km³ in 2000 and projected to be 793 km³ by the year 2025 and 1104 km³ by the year 2050. These water demand projections are based on the population projections at the level of 1581 million by 2050. Irrigation constitutes the main use of water and presently accounts for 84 percent of the total water withdrawals. The share of withdrawal by the domestic and industrial sectors is only 59 m³ per person in India which is quite low, but it is expected to increase on account of increasing urbanization and industrialization.

In recent years, ground water has received preference over surface water as a source of irrigation as well as for use in domestic and industrial sector, due to features, like dependability of supply, widespread distribution, ease of availability in the proximity of place of use, natural availability in pure form etc. Moreover, due to inadequate dam storage capacities and poor maintenance of the public irrigation infrastructures, contribution of public surface irrigation has been declining. On the other hand role of ground water has been increasing. Presently about 65 percent of the irrigation and about 90 percent of the domestic and industrial water requirements are met through private ground water resources. However, this precious resource has often been wrongly regarded by the users as infinite and inexhaustible resource. Consequently, important aspects relating to ground water like its scientific management, conservation and augmentation tend to be neglected by the general public.

Out of the annual replenishable ground water resource of 432 Billion Cubic Metres (BCM). 399 BCM is available for utilization, leaving aside 33 BCM for natural discharge. The total ground water draft is 231 BCM of which 92 percent is for irrigation (213 BCM) and 8 percent is for domestic and industrial use (18BCM). The overall stage of ground water development is 58 percent.

* The resources were estimated as 432 BCM when ground water resources of the states of Mizoram and Sikkim and UT of Andaman & Nicobar were not assessed. After the resources of these three States/ UT are taken into account, the estimated figure becomes 434 billion cubic meter (BCM).

An assessment of the dynamic ground water resources of the country was completed in March 2004 by CGWB. Its region wise summary is given below.

Table 1.2 : Ground Water Availability for Irrigation in Future

Region	Net Annual GW available for future irrigation Development (in million ha.m/year)*
North	(-)12.7
North East	41.2
East	36.4
Central	48.4
West	18.4
South	30.3
Total	162.0

North: J&K, HP, Punjab, Haryana, Rajasthan, Delhi, Chandigarh

North East: Arunachal, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura

East: Bihar, Jharkhand, Orissa, West Bengal, Sikkim, A & N Island

Central: MP, Chhattisgarh, UP, Uttaranchal

West: Gujarat, Maharashtra, Goa, Dadra & Nagar Haveli

South: AP, Karnatka, Kerala, Tamil Nadu, Laksadweep, Pondichery)

*Figures in terms of million ha.m given in the original source have been converted to bcm to provide uniformity in different tables.

Source: John Kurien and Ashutosh Kumar Sinha, Groundwater Governance Issues in Irrigation Development- A Perspective, op.cit., 2007, p.398

This shows that as of March 2004, there are 162 bcm dynamic ground water resources available in the country for future irrigation development. These, however, are very unevenly distributed in the different regions. The Western and Northern regions have low ground water availability with assessment units categorized mostly as critical and over-exploited.

1.2 Varied Ground Water Scenario

India is a vast country with diversified geological, climatological and topographical set-up, resulting in divergent ground water situations. The prevalent rock formations, ranging in age from archaean to recent, which control occurrence and movement of ground water, are widely varied in composition and structure. At the same time, there are marked variations of land forms, from the rugged mountainous terrains of the Himalayas, Eastern and Western Ghats to the flat alluvial plains of the river valleys and coastal tracts, and the intermountain deserts of Rajasthan. The rainfall pattern, too, shows considerable region-wise variations. Based on the topography and rainfall control run-off and ground water recharge, one can expect variations in ground water situations in different parts of the country.

The high relief areas of the northern and north-eastern regions occupied by the Himalayan ranges, the hilly tracts of Rajasthan and peninsular regions with steep slope, provide considerable scope for high run-off and, therefore, little scope for rain water infiltration. Hence the ground water potential in these areas is limited to intermountain valleys. On the other hand, the large alluvial tract in the Indus-Ganga-Brahmaputra plains extending over a distance of 2000 kms. from Punjab in the west to Assam in the east, constitutes one of the largest and most potential ground water reservoir in the world. The aquifer systems in these areas are extensive, thick, hydrologically interconnected and moderate to high yielding.

The entire Peninsular India is more or less occupied by a variety of hard and fissured rock formations and consolidated sedimentaries (including carbonate rocks), with patches of semi consolidated sediments in narrow intracratonic basins. Such a topography has given rise to discontinuous aquifers, with limited to moderate yield potentials. The near surface weathered mantle forms the all important ground water reservoir, and the source for circulation of ground water through the underlying fracture systems. In the hard rock terrain, deep weathered pediments, low-lying valleys and abandoned river channels, generally contain adequate thickness of porous material, to sustain ground water development under favourable hydrometeorological conditions. Generally, the potential water saturated fracture systems occur down to 100 m depth, and in cases yield even upto 30 litres per second (Lps). The friable semi consolidated sandstones also form moderate yielding aquifers. Auto flowing zones in these formations are not uncommon.

The coastal and deltaic tracts in the country form a narrow linear strip around the peninsula. The eastern coastal and deltaic tract and the estuarine areas of Gujarat are receptacles of thick alluvial sediments. Highly productive aquifers occur in these tracts. But these are also exposed to salinity hazards. Hence, ground water withdrawals in such areas need to be regulated so as not to exceed annual recharge and not to disturb hydro-chemical balance leading to sea water ingress.

The quality of ground water in both hard rock and alluvial terrains is by and large fresh and suitable for drinking, agricultural, industrial and other uses. The specific conductance is generally less than 1000 us/cm at 25 °C. But there are a few areas where ground water is contaminated due to inherent properties of rock formations which hold water or through which the ground water passes. Poor quality of water has been due to fluoride and arsenic contamination, iron contamination and salinity (both inland and coastal) In coastal areas, estuarine tracts of Gujarat, Rann of kutch and arid tracts of Rajasthan, the risk of mineralization of ground water is rather high. Moreover, salinity hazards are not uncommon.

Salinity in ground water is also found in arid and semi-arid areas of Punjab, Haryana, Uttar Pradesh, Rajasthan and Gujarat.

The uneven distribution of ground water resources across different parts of the country can be seen from the table 1.2 given earlier as well as table 1.3 and 1.4 given below. The variations are obvious whether we make inter-basin or inter-state comparisons, data for both of which are given below.

Table 1.3 : Basin-wise Ground Water Potential of the Country (bcm/year)*

S.No.	Name of Basin	Total Replenishable Ground Water Resources
1	Brahmani with Baitarni	4.05
2	Brahmaputra	26.55
3	Cambai Composite	7.19
4	Cauvery	12.3
5	Ganga	170.99
6	Godavari	40.65
7	Indus	26.49
8	Krishna	26.41
9	Kutch & Saurashtra Composite	11.23
10	Madras and South Tamil Nadu	18.22

S.No.	Name of Basin	Total Replenishable Ground Water Resources
11	Mahanadi	16.46
12	Meghna	8.52
13	Narmada	10.83
14	Northeast Composite	18.84
15	Pennar	4.93
16	Subarnrekha	1.82
17	Tapi	8.27
18	Western Ghat	17.69
	Total	431.44

*Figures in terms of cubic km/year given in the original source have been converted to bcm to provide uniformity in different tables.

Table 1.4 : State-wise Ground Water Resources (in bcm)

States/ Union Territories	Annual replenish- able Ground Water Resources	Net Annual Ground Water Availability	Annual Ground Water Draft	Projected Demand for Domestic and Industrial Uses upto 2025	Ground Water Availability for Future Irrigation	Stage of Ground Water Develop- ment (%)
States						
Andhra Pradesh	36.50	32.95	14.90	2.67	17.65	45
Arunachal Pradesh	2.56	2.30	0.0008	0.009	2.29	0.04
Assam	27.23	24.89	5.44	0.98	19.06	22
Bihar	29.19	27.42	10.77	2.14	15.89	39
Chhattisgarh	14.93	13.68	2.80	0.70	10.67	20
Delhi	0.30	0.28	0.48	0.57	0.00	170
Goa	0.28	0.27	0.07	0.04	0.18	27
Gujarat	15.81	15.02	11.49	1.48	3.05	76
Haryana	9.31	8.63	9.45	0.60	-1.07	109
Himachal Pradesh	0.43	0.39	0.12	0.04	0.25	30
Jammu & Kashmir	2.70	2.43	0.33	0.42	1.92	14
Jharkhand	5.58	5.25	1.09	0.56	3.99	21
Karnataka	15.93	15.30	10.71	1.41	6.48	70
Kerala	6.84	6.23	2.92	1.40	3.07	47
Madhya Pradesh	37.19	35.33	17.12	1.74	17.51	48
Maharashtra	32.96	31.21	15.09	1.52	16.10	48
Manipur	0.38	0.34	0.002	0.02	0.31	0.65
Meghalaya	1.15	1.04	0.002	0.10	0.94	0.18
Mizoram	0.04	0.04	0.0004	0.0008	0.04	0.90
Nagaland	0.36	0.32	0.009	0.03	0.30	3
Orissa	23.09	21.01	3.85	1.22	16.78	18
Punjab	23.78	21.44	31.16	1.00	-9.89	145
Rajasthan	11.56	10.38	12.99	2.72	-3.94	125
Sikkim	0.08	0.08	0.01	0.02	0.05	16
Tamil Nadu	23.07	20.76	17.65	0.91	3.08	85
Tripura	2.19	1.97	0.17	0.20	1.69	9
Uttar Pradesh	76.35	70.18	48.78	5.30	19.52	70
Uttaranchal	2.27	2.10	1.39	0.08	0.68	66
West Bengal	30.36	27.46	11.65	1.24	15.32	42
Total States	432.42	398.70	230.44	29.12	161.92	58

States/ Union Territories	Annual replenish- able Ground Water Resources	Net Annual Ground Water Availability	Annual Ground Water Draft	Projected Demand for Domestic and Industrial Uses upto 2025	Ground Water Availability for Future Irrigation	Stage of Ground Water Develop- ment (%)
Union Territories						
Andaman & Nicobar	0.330	0.320	0.010	0.008	0.303	4.000
Chandigarh	0.023	0.020	0.000	0.000	0.020	0.000
Dadara & Nagar Haveli	0.063	0.060	0.009	0.008	0.051	14.000
Daman & Diu	0.009	0.008	0.009	0.003	-0.002	107.000
Lakshdweep	0.012	0.004	0.002	-	-	63.000
Pondicherry	0.160	0.144	0.151	0.031		105.000
Total UTs	0.597	0.556	0.181	0.050	0.365	33
Grand Total	433.02	399.25	230.62	29.17	162.29	58

Source : Annexure I of Dynamic Ground Water Resource of India (March 2004) brought out by CGWB in 2006

There is a large variation in the country also with respect to development of ground water. As can be seen from the last column of table 1.5, the stage of ground water development in March 2004 varied from 0.04 percent in Arunachal Pradesh, 0.18 in Meghalaya and 0.65 in Manipur to 170 percent in Delhi, 145 percent in Punjab and 125 percent in Rajasthan while the average for the country was 58 percent.

1.3 Phenomenal Expansion of Ground Water Structures and its Impacts

Ground water development has been proceeding at an accelerated pace ever since the country entered the phase of Green Revolution under which high yielding and high water demanding crops were introduced in agriculture. Irrigation using tubewells and borewells started on a large scale from the eighties of the last century. Water intensive crops like sugarcane, rice and coconut started replacing earlier crops like maize, cotton and groundnut in many parts of the country. As at present, more than 85 percent of the rural and 50 percent of the urban drinking and industrial water supplies and 55 percent of the irrigated agriculture water requirements are met from ground water. This expansion of ground water has been a factor in changing cropping pattern and in raising agricultural production and productivity. It has also helped in sustaining subsistence cropping for millions of small and marginal farmers. It has, therefore, played an important role in poverty reduction.

Ground water has become the preferred source for the various uses because of its advantages like the ubiquitous availability, good quality and above all the control that the user can exercise on its use. These factors along with invention and popularization of mechanical pumping technologies in the mid twentieth century, the availability of subsidized (or even free) electric power and diesel, have led to a phenomenal increase in the growth of ground water abstraction structures during the past four decades as can be seen from the figures of growth in the number of dugwells, shallow tubewells (T/W) and public tubewells and pumpsets from 1951 onwards given in tables 1.5 and 1.6 (which are somewhat overlapping). As a result, at present in India, there are about 19 million ground water structures and 7900-m³/year water is extracted per structure.

Table 1.5 : Growth of Ground Water Abstraction Structures ('000) and Irrigation Potential

Year	Dug-wells	Private Tubewells	Public Tubewells	Total	Pumpsets		Commulative Irrig. Pot. created from Ground Water
					Electric	Diesel	
March 1951	3860	3	2.4	3865.4	21	66	6.5
March 1980	7786	2132	33.3	9951.3	3965	2650	22.00
March 1985	8742	3359	46.2	12147.2	5709	3550	27.82
March 1990	9407	4754	63.6	14224.6	8358	4365	35.62
March 1992	10120	5379	67.6	15566.6	9391	4585	38.89
March 1997	10501	6743	90.9	17334.9	-	-	45.73

Source: Ground Water Management in India, CGWA, Workshop on Past Achievements and Future Strategies, MoWR, Government of India, p.2

Table 1.6 : Growth of Wells and Pump Sets (all figures in '000s)

Year	Total Dug Wells	Total STW & DTW	Total E&D Pumps	Total Area Irrigated by		Percentage of Dug Wells that are Energised
				Dugwells	Tubewells	
1950-51	3860	5.4	87	6661.4	23.6	2.1
1960-61	4540	30.9	430	7155	135	8.8
1968-69	6100	374.7	1810	7714	3087	23.5
1973-74	6700	1160	4180	7679	5604	45.1
1977-78	7435	1770	5650	7943	7641	52.2
1979-80	7786	2165.3	6615	8557	9307	57.2
1984-85	8742	3405.2	9259	8828	11566	67
1989-90	9487	4817.4	12781	9837	14049	83.9
1994-95	11198	6517.4	16203	11803	17894	86.5

Source : Minor Irrigation Census, Government of India as quoted in Ground Water Management in India by M. Dinesh Kumar, P. 45, STW-Shallow Tubewells; DTW-Deep Tubewells

Over the past two to three decades, the major expansion in irrigation capacity has taken place in the private ground water irrigation because of which ground water has become the life line for agriculture during this period. As per the latest 3rd Minor Irrigation Census (as of 2000-01) the number of minor irrigation structures existing in the country are as below.

Table 1.7 : Minor Irrigation Structures in India

(in thousands nos.)

Region	Ground Water				Surface Water*		
	Dugwell	Shallow Well	Deep Tubewell	Sub Total	Lift	Flow	Sub Total
North	1,197.6	1,570.8	92.1	2,860.5	5.6	25.7	31.3
North East	10.3	80	0.9	91.2	3.2	47.4	50.6
East	876.5	1,300	15.9	2,192.4	157	148.6	305.6
Central	1,606.9	3,943.2	77.6	5,627.7	228.8	140	368.8
West	2,599.8	112.6	171.6	2,883.8	104.1	90.3	194.4
South	3,335.7	1,349	172	4,856.7	108.1	189.9	298
Total	9,626.8	8,355.6	529.9	18,512.3	606.8	641.9	1,248.7

*Irrigation tanks included here

North: J&K, HP, Punjab, Haryana, Rajasthan, Delhi, Chandigarh; **North East:** Arunachal, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura; **East:** Bihar, Jharkhand, Orissa, West Bengal, Sikkim, A&N Island; **Central:** MP, Chhattisgarh, UP, Uttaranchal, **West:** Gujarat, Maharashtra, Goa, Dadra & Nagar Haveli; **South:** AP, Karnatka, Kerala, TamilNadu, Lakhadweep, Pondichery)

Source: John Kurien and Ashutosh Kumar Sinha, Groundwater Governance, 2007, p.396

It may be recalled here that ground water irrigation structures fall almost entirely in the minor irrigation category. Thus, we see that there are more than 18.5 million ground water structures as of 2000-01. The number would have increased further by now.

Some states have witnessed very fast growth of ground water. The following table gives an idea of the fast growth of the ground water sector in Andhra Pradesh.

Table 1.8 : Development of Ground Water in Andhra Pradesh

Year	Dug Wells in lakhs	Bore Wells in lakhs	Area Irrigation under Ground Water in lakh ha.
1971-72	6.90	1.13	8.03
1980-81	9.33	1.90	11.24
1990-91	13.67	3.94	17.61
2000-01	11.55	15.33	26.92
2004-05	8.78	16.01	24.79

Source : Director, Economics and Statistics, Government of Andhra Pradesh as quoted in a note of state ground water department.

Type of ground water extraction structures has changed from dug wells to deeper borewells. Well density has increased from 5 wells per sq. km. in 1995 to 20 wells per sq. km. now. (Source : Ground Water Department, Andhra Pradesh Government)

A similar picture emerges in the case of Punjab and Haryana as can be seen from table 1.9 given below.

Table 1.9 : Number of Tubewells in Punjab and Haryana (Lakhs)

	1970-71		2003-2004	
	Diesel	Electrical	Diesel	Electrical
Punjab	1.01	0.91	2.88	8.56
Haryana	0.17	0.86	2.43	3.64

Source : Kaledhonkar, M.J. and others, Groundwater Governance, 2007, p.95

Data provided by the report on 3rd Census of Minor Irrigation Schemes (2005) has revealed that in many states the irrigation potential created by the reference year of 2000-01 has exceeded the ground water potential of those states. Data are given below.

Table 1.10 : States with High Irrigation Potential Created through Ground Water

(thousand ha.)

State	Ultimate Irrigation Potential through Ground Water	Irrigation Potential reportedly already created through Ground Water
Gujarat	2756	4364
Haryana	1462	2424
Maharashtra	3652	4568
Punjab	2917	6287
Rajasthan	1778	5840
Tamil Nadu	2832	2961

Source : Report on 3rd Census of Minor Irrigation Schemes, Ministry of Water Resources, 2005 as quoted on page 6 of the Report of Expert Group on "Ground Water Management and Ownership Planning Commission, September, 2007.

Note : Ultimate potential assessment has been made based on the dynamic ground water zone recharged by mainly rain water. Rain water harvesting by artificial means supplements the recharge already taking place and helps in partly recouping declining water levels. Thus, some of the lost irrigation potential due to decline in ground water can be retrieved.

Based on GEC 97 methodology, CGWB has given a picture of all the assessment units in the country as of March 2004. This is described in the following table 1.11.

Table 1.11 : State-wise Categorization of Blocks/Mandals/Talukas in India

States/Union Territories	Total No. of Assessed Units	No. of Safe	No. of Semi-Critical	No. of Critical	No. of Over-exploited
States					
Andhra Pradesh	1231	760	175	77	219
Arunachal Pradesh	13	13	0	0	0
Assam	23	23	0	0	0
Bihar	515	515	0	0	0
Chhattisgarh	146	138	8	0	0
Delhi	9	2	0	0	7
Goa	11	11	0	0	0
Gujarat	223	97	69	12	31
Haryana	113	42	5	11	55
Himachal Pradesh	5	5	0	0	0
Jammu & Kashmir	8	8	0	0	0
Jharkhand	208	208	0	0	0
Karnataka	175	93	14	3	65
Kerala	151	101	30	15	5
Madhya Pradesh	312	264	19	5	24
Maharashtra	318	287	23	1	7
Manipur	7	7	0	0	0
Meghalaya	7	7	0	0	0
Mizoram	22	22	0	0	0
Nagaland	7	7	0	0	0
Orissa	314	308	0	0	0
Punjab	137	25	4	5	103
Rajasthan	237	32	14	50	140
Sikkim	1	1	0	0	0
Tamil Nadu	385	145	57	33	142
Tripura	38	38	0	0	0
Uttar Pradesh	803	665	88	13	37
Uttaranchal	17	12	3	0	2
West Bengal	269	231	37	1	0
Total States	5705	4067	546	226	837
Union Territories					
Andaman & Nicobar	1	1	0	0	0
Chandigarh	1	1	0	0	0
Dadara & Nagar Haveli	1	1	0	0	0
Daman & Diu	2	0	1	0	1
Lakshdweep	9	6	3	0	0
Pondicherry	4	2	0	0	1
Total UTs	18	11	4	0	2
Grand Total	5723	4078	550	226	839

Source : Annexure III of Dynamic Ground Water Resource of India (March 2004) brought out by CGWB in 2006

Note : Assessment units vary from state to state. It is block in Bihar, Chhattisgarh, Haryana, Jharkhand, Kerala, Madhya Pradesh, Manipur, Mizoram, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttaranchal, West Bengal; **Mandals** (command/non-command) in Andhra Pradesh; **Talukas** in Goa, Gujarat, Karnataka, Maharashtra; **Districts** in Arunachal Pradesh, Assam, Delhi, Meghalaya, Nagaland; **Districts** (Valley) in Himachal Pradesh, Jammu & Kashmir; **State** in Sikkim; **Island** in Lakshdweep; **UT** in Andaman & Nicobar, Chandigarh, Dadra & Nagar Haveli, Daman & Diu, Pondicherry

Pumping technology facilitated by subsidized or free power along with changes in cropping pattern have been mainly responsible for the rapid expansion in over-exploitation of ground water resources in India. Over the last three decades, more than 148 lakh pumpsets have been energized in the country and out of the above 85.65 lakh pumpsets have been energized under REC financed schemes till March 2006. At the same time cropping pattern has been changing in favour of water intensive crops as these are found to be more remunerative by the farmers as for example the large scale cultivation of paddy in Punjab and Haryana. This, in turn, has been prompted by agricultural price policies as well as agricultural trade policies being followed in recent years.

Adverse Effects

Growth in ground water exploitation, however, has led to a steep fall in water table in several parts of the country. Use of ground water is becoming unsustainable day by day. This has resulted in drying up of open dug wells and depletion of all important shallow aquifers in those areas with adverse impacts on water quality, health, livelihood and environment. It results in reduced supply of ground water for irrigation. Ground water flow to rivers also decreases. Water quality is deteriorating not only due to arsenic, fluoride or naturally inherent causes but also due to seepage of agricultural and industrial wastes and chemicals. The fall in ground water level and deterioration in quality give rise to drinking water shortages. Cost of pumping of ground water in terms of both finance and electricity – use, increases. Costs are also incurred on replacement or modification of pumps. Due to fall in water level to depths greater than 40 meters in summer, people find it difficult to obtain water from hand pumps. It is the poorer segments of the society who suffer more due to decline in ground water level. They are forced to purchase water from better off segments. **The falling water table is a matter of special concern since it tends to reduce the accessibility of the resource to small and marginal farmers due to increase in costs of extractions.** Larger farmers also suffer on account of rising financial liability for deepening wells and purchasing new equipments and for rising cost of operation along with reduced yield. The manufacturers of drilling rigs, borehole pumps etc., of course, derive much gain in the process. **It is, therefore, obvious that “business as usual” or “no-intervention” scenario has undesirable social impacts as described earlier.**

The stage of ground water development increased from 37.2 per cent in 1998 to 58 per cent in 2004 and the over-exploited blocks increased to 839 in 2004. **(Report of the CGWB, 2006).** The increase in the numbers of ‘unsafe’ (semi-critical, critical and over-exploited) blocks over the last 14 years (1992-2005) is indicated in the table below.

Table 1.12 : Increase in Non-Safe Areas

Block Categorization within the 'unsafe' Category	Jan 1992	April 1998	August 2005
Over-Exploited	-	-	839
Critical	309	416	226
Sub Total	309	416	1,065
Semi-Critical	16	448	550
Total	325	448	1,615

Source : John Kurien and Ashutosh Kumar Sinah, Groundwater Governance, 2007, p.398.

Out of the 5723 assessment units, 839 are categorized as over-exploited and 226 are critical while 550 are semi-critical. These account for 29 percent of total ground water draft. The following tables throw further light on the extent of over-exploitation in several states.

Table 1.13 : Extent of Over-exploitation

States	Percentage of Non-safe assessment units to total units	Percentage of Over-exploited Units to total units
Andhra Pradesh	38	18
Delhi (all over exploited)	78	78
Gujarat	57	14
Haryana	63	49
Karnataka	47	37
Punjab (75 % over-exploited)	82	75
Rajasthan	86	59
Tamil Nadu	62	37

The situation is really alarming in Delhi, Punjab and Rajasthan where over-exploited areas constituted more than half of total ground water utilized.

It is a matter of special concern that the over-exploitation of ground water has become an acute problem in several agriculturally important states e.g. Punjab, Haryana, Gujarat, Maharashtra, Rajasthan, Uttar Pradesh and Tamil Nadu. There has been a sharp deterioration in the reserves of ground water in Punjab and Haryana as can be seen from the following table.

Table 1.14 : Temporal Changes in Status of Dark and Over-Exploited Blocks

State	1984-85	1992-93	1997-98	2003-04
Haryana	31	51	41	67
Punjab	64	770	83	112
India	253	383	445	673

Source: M.J. Kaledhonkar et.al, Groundwater Governance, 2007, p.97

There has been a continuous rise in the number of over-exploited, dark and saline category talukas in Gujarat State also. As per the estimation committee report, in 1986, five talukas were in over-exploited, one in dark and two in saline category, while as per year 2002 estimation, 30 talukas were in over-exploited, 12 in dark and 14 in saline category. (V.M. Yagnik et.al, Groundwater Governance, 2007, p.227)

Kerala in the deep south, exhibits a similar trend. Here, all the blocks were in safe category till 1992. But by 2004, 5 blocks were categorized as over-exploited, 15 as critical and 30 as semi-critical (P.N. Ajithkumar and A.S. Sudheer, Groundwater Governance, 2007, p.364)

It can, of course, be said that ground water exploitation in India is not a major problem at an aggregate level since India uses only about 58 percent of the annual utilizable potential of ground water as per 2004 data. But there are a few states and a few districts in those states where ground water overexploitation has already become quite serious as per data already provided. Moreover, **though confined to particular districts and blocks, ground water overexploitation has serious implications at the national level since as much as 70-80 percent of the value of irrigated agricultural output in India depends on ground water irrigation. Thus a large proportion of India's agricultural production as well as GDP is tied to the availability of ground water.** Moreover, the states or districts that suffer from overexploitation of ground water constitute agriculturally important states and districts of the country with a heavy dependence on ground water.

The situation is getting worse from day to day. Authorities have not been able to evolve appropriate measures to manage the emerging pressures. Mostly supply side measures focusing on increasing the availability of ground water are adopted. One such measure often advocated and adopted is of artificial recharge through rain water harvesting and watershed development. Steps taken to increase ground water recharge through watershed development and artificial recharge have not given the expected results. According to some surveys, water scarcity continued to prevail in drought years even in successful watersheds. These measures may reduce the problem at specific locations and are therefore welcome but they cannot solve it altogether at the national level because of their limited potential. Hence, the need is to develop adequate demand side or non-structural measures for moderating demand so as to bring about an equilibrium between demand and supply. However, management of demand has been quite weak in India due to factors like institutional inadequacy, general apathy and lack of political will.

Ground water is becoming an increasingly scarce resource because of its unabated and indiscriminate over-exploitation. The situation is fast deteriorating. **How to check the fast depleting ground water reserves has now become a major challenge in India at the moment. The existing economic, technical, social and regulatory methods have almost failed to tackle the problem.** If attempts are not made now to protect the future degradation of water table, the situation will be more critical in near future which would have serious implications for the welfare of future generation since ground water has become the primary source of irrigation, domestic and industrial use in India. **There is an urgent need to change the focus from development to sustainable management of this resource. What is needed is sound governance. How to bring it about is the real challenge.**

1.4 Need for the Study

The challenge of sound governance of ground water resources underscores the need for a review of the legal and institutional framework for regulating and managing ground water utilization under varying physical and socio-economic conditions. Information on this aspect was found to be inadequate about five years ago when the need for a study of this aspect was mooted. There was lack of systematic all India study on the subject. It was not known whether and to what extent, the grassroots level implementing personnel like the Patwaris, Junior Engineers, Taluka Development Officers etc. were aware of the provisions of the prevailing legal and institutional set up for regulating use of ground water. It was not known whether there was political will at the state level to enforce regulations of ground

water exploitation in the larger social interest. Very little information was available on the extent to which Panchayati Raj Institutions or other institutions or associations at the local level were and could be involved in ground water utilization. Were NGOs playing any part in this? Did the government have any effective administrative machinery at the grass-roots level to enforce its directives under the prevailing legal system? Moreover, the legal and institutional back up for ground water was assessed to be quite weak because of which indiscriminate exploitation of ground water resulting in continuous increase in “non-safe” areas was taking place. A thorough all India study was needed before suggesting appropriate measures for strengthening the legal and institutional framework for ground water. It was in this context that this study was proposed about 5 years ago in early 2003. It could, however, fructify after three years and could start from December 2005.

Chapter - II

Objectives and Methodology

2.1 Objectives

The basic objectives of this study were

- (i) To examine the adequacy of the prevailing institutional framework in regulating utilization of ground water in respect of “over-exploited”, “critical” and “semi-critical” areas.
- (ii) To evaluate the level of awareness of the prevailing legal and institutional setup amongst the grass root level users as well as local level implementing agencies.
- (iii) To evaluate the efficacy of the ground water regulation system in providing access to ground water on equitable basis to the weaker sections of the society.
- (iv) To examine the scope for self regulation through community based organizations like Panchayati Raj Institutions (PRI) or water users associations or other local level organizations in management of ground water at the local level.
- (v) To evaluate the institutional arrangement for regulating exploitation of ground water mainly for sale of water.
- (vi) To examine the reliability of the system for collection and dissemination of data on availability of ground water and changes therein at the micro level i.e. village and town.

2.2 Scope of the Study

The study was conducted in 6 states and from each state one district was selected. From each district, 2 blocks were selected and from each block 3 villages and one small town were selected following the criteria given below. From each sample village 10 households and from each town 15 households were contacted for eliciting information.

2.3 Methodology

This is an all-India study. Hence, such information as was available in published sources with respect to the objectives mentioned above was collected from different sources. But the information required for most of the objectives mentioned above were either not available in published or unpublished forms or not easily accessible. Little information was available on whether the legal provisions were being implemented in true letter and spirit. Information was also not available on the extent of involvement of Panchayati Raj Institutions and on the access to ground water by the vulnerable section of the society. Similarly, very limited information was available on ground water scenario at the micro level. Hence, a need was felt to collect the required information from primary sources through field surveys at the grass root level so as to supplement the information collected from secondary sources. This required interaction with officials involved in ground water management at various levels and procurement of responses through canvassing of questionnaires amongst grass root level users and functionaries.

Thus the methodology followed for the present study was a combination of data collected from both secondary and primary sources. For the purpose of collecting information from secondary sources, the study team visited several libraries, government departments and took stock of materials published/compiled by expert groups, eminent water technologists etc. The government sources included inter-alia, the libraries of the Ministry of Water Resources, Central Water Commission, Central Ground Water Board, Ministry of Environment &

Forests, Ministry of Law, Planning Commission etc. in Delhi and concerned offices in the states, covered in the study. The collection of information from secondary sources also included Acts more particularly the Easement Act of 1882. Environment (protection) Act, 1986, water (prevention) and control of pollution Act 1974 as well as the recently enacted laws for regulation and development of ground water in a few states, the administrative orders, rules, regulations and judicial pronouncements on the subject. A close watch was put on new publications brought out on the subject till the end of the study by going through the list of publications released by reputed publishers at periodic intervals and collecting relevant material from them. Thus most of the materials available from secondary sources including the very recently brought out report on ground water by an expert group of the Planning Commission have been consulted.

2.4 Selection of Study Areas

Selection of States

Data and information available from secondary sources are usually classified state wise. It was, however, not possible to conduct the field surveys in all the states due to constraint of funds as well as time nor was it necessary. It was thought appropriate classifying states into suitable agro-climatic/hydrological zones and selecting a representative state from each zone. Based on the above principle, six states were selected.

This being an all-India study, the areas selected for collecting data and information through primary sources were expected to reflect diversity of hydrological, geographical, socio-economic, legal and administrative setup that characterize India. There are rocky strata and alluvial plains, areas having abundant and scanty rainfalls, areas categorized as prosperous and poor etc. In addition, there are state specific institutional differences. A few states like Andhra Pradesh, West Bengal, Kerala, Goa, Lakshadweep, Pondicherry and Chandigarh have enacted and implemented legislation for control and development of ground water resources while in Maharashtra and Tamil Nadu the bill has been passed but not enforced. States like Bihar, Assam, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Mizoram, Orissa, Rajasthan, Uttar Pradesh, Daman & Diu, NCT of Delhi, Jharkhand, Meghalaya, Dadra & Nagar Haveli, Madhya Pradesh, Uttarakhand, and Andaman & Nicobar Island have initiated action for preparing legislation. Punjab, despite being a ground water scarce state, did not feel the necessity to enact legislation in this regard. It may be mentioned here that “Punjab Ground Water (Control & Regulation) Act, 1998” was prepared on the basis of the Model Bill and was submitted to the Punjab State Water Resources Committee (WRC). However the committee observed that the draft was too harsh for users. The committee also opined that Punjab being irrigation dominated state largely depending upon ground water, adoption of Model Bill was not in the larger interest of its farmers.

It was proposed to select initially one state from each of the six zones of the country namely East, North East, West, North and South and Central. While selecting the states, due care was taken to ensure that at least one state which had enacted and implemented the new ground water legislation as mentioned above was included in the sample. While selecting the states, consultations were held with CGWB and their views were given serious consideration. As a result the basis for selection of states was modified somewhat. Since the focus of the study was on regulation of ground water, the CGWB felt that the areas selected should be such where issues relating to the management of ground water posed problems in view of continuous depletion in the level of ground water against corresponding replenishment. The enactment of legislation was one response to this challenge. Hence, there was need to have a fair representation of states where new legislation on ground water had been enacted so as to examine the experience of its implementation, constraints and problems. The members of the

study team agreed with the view point of CGWB. Following the above guidelines and examining relevant data for all the states, CGWB indicated a list of 6 states of which 3 had enacted legislation to regulate the use of ground water.

Since North Eastern states representing Assam, Meghalaya, Manipur, Tripura, Mizoram, Sikkim, Arunachal Pradesh and Nagaland had no problem of over draft of ground water, it was decided not to select any state from this category. From the Northern zone representing states of Delhi, Punjab, Haryana, Himachal Pradesh, Jammu & Kashmir and Chandigarh, two states i.e. Punjab and Delhi facing acute ground water scarcity were selected. In these states ground water overdraft was above 75 percent which was much higher than figures for other states of the northern zone namely 59 percent for Haryana, 12 percent for Uttarakhand, 5 percent for Uttar Pradesh, and zero percent for Himachal Pradesh and Jammu & Kashmir. Similarly, from among states where the new legislation had been enacted Andhra Pradesh and Tamil Nadu under Southern zone were selected. Although Tamil Nadu and Karnataka from Southern zone had equal weightage of 37 percent of areas declared as overexploited, Tamil Nadu was selected because of having a legislation in place. In Gujarat, legislation was proposed, but enactment was pending. From the eastern zone, the state of West Bengal was selected as it had passed a legislation which was implemented in 2007. Moreover this was the only state in the eastern zone which had some problem areas where the ground water situation was semi-critical. Hence, both the states representing western and eastern zone of the country respectively were included in the study. The above procedure resulted in selection of two states namely Andhra Pradesh and Tamil Nadu from the Southern Zone and also two states of Punjab and Delhi from the Northern zone instead of one from each zone and none from the North East and Central zones. The project reviewing authorities were kept informed of this through the quarterly progress reports. The zone wise details of states selected and extent of overdraft of ground water in each state is given below.

Utilization of Ground Water in the Sample States

Name of Zone	Name of State	% of Over Draft
North	Delhi	78
	Punjab	75
South	Andhra Pradesh	18
	Tamil Nadu	37
West	Gujarat	14
East	West Bengal	14 (Semi-critical)

Selected states classified by Area of Vulnerability

State	No. of Observation Units			
	Safe	Semi-critical	Critical	Over-exploited
Delhi (No. of Districts)	2	-	-	7
Punjab (Block)	25	4	5	103
Andhra Pradesh (Mandal)	760	175	77	219
Tamil Nadu (Mandal)	153	57	33	142
Gujarat (Taluka)	111	69	12	31
West Bengal (Block)	231	37	1	-

Selection of Districts

For selection of districts, the data supplied by CGWB classifying areas into various vulnerable categories such as semi critical, critical, over-exploited etc. was used. The units of observations as specified by CGWB was different in different states. While it was mandal in Andhra Pradesh, in states like Gujarat, Goa, Karnataka and Maharashtra, it was taluka. But in a majority of states/UTs, the unit of observation was block.

Each selected state (except for West Bengal) had a number of districts classified as over exploited of which one district was selected for the study. The selection of a district out of a number of over-exploited districts was done based on probability sampling. For this, districts were arranged in ascending order based on the number of units facing overdraft and the sample of a district was drawn at random. In Delhi, however, 2 severely affected districts notified initially for registration of ground water structures were selected in view of the fact that in the districts selected, there was only one block each representing a cluster of villages while the study proposal required to spread the sample households in two blocks for better coverage. Hence, two districts i.e. South and South West in Delhi were selected. In Gujarat, however, the selection of a district was purposive since the idea was to take some representative sample from coastal areas prone to frequent earthquakes in order to find out the response of the beneficiaries to the changing water quality due to hydrological disorder. State wise distribution of districts classified by proportion of over exploited areas is given below. In West Bengal, there was only one critical block in Murshidabad district but no over-exploited block in any of the districts. But, there were 3 districts having more than 5 blocks declared as semi-critical of which, one was selected for the study.

Name of State	Name of District	No. of Over-exploited Blocks/Taluka/Mandal	% of Over-exploited Block/Mandal/Taluka to Total
Delhi	South (District)	Entire area	100
	South West (District)	Entire area	100
Andhra Pradesh	Kadapa	17	30
	Chittoor	18	29
	Mehboobnagar	13	18
Tamil Nadu	Dindigul	10	71
	Coimbatore	11	58
	Vellore	13	80
	Salem	14	70
	Villupuram	14	64
Punjab	Moga	5	100
	Jalandhar	10	100
	Ludhiana	10	91
	Sangrur	12	100
	Amritsar	16	100
Gujarat	Patan	3	43
	Kachchh	3	30
	Gandhinagar	4	100
	Banaskanta	6	50
	Mahesana	8	80
West Bengal (Semi-critical)	Nadia	6	35
	Burdwan	6	30
	Murshidabad	15	58

Selection of Blocks

In order to have larger spread, it was decided to select 2 severely affected blocks from each district. For this, the study team of IRMED had to visit the sample districts and with the help of district level officials incharge of ground water resources, over exploited blocks/mandals/talukas in respective districts were listed and a sample of 2 blocks was drawn at random applying the probability sampling criteria. In West Bengal, the same was done for semi-critical blocks only. The blocks thus selected were as follows.

Name of State	Name of District	Name of Block/ Mandal/Taluka
Delhi	South District	Mehroli
	South West District	Najafgarh
Punjab	Moga	Moga-II
		Nihalsingwala
Andhra Pradesh	Chittoor	Tirupati (R)
		Gangavaram
Tamil Nadu	Dindigul	Vedasandur
		Vadamadurai
Gujarat	Kachchh	Mandvi
		Anjar
West Bengal	Burdwan	Purbasthali-II
		Memari-II

Selection of Villages/Towns

For selection of villages/towns, the information/feedback given by the district level officials of the ground water resources department was mainly used. This information was also cross checked with the officials of the concerned blocks wherever felt necessary. A list of villages in each selected block facing acute water shortage was prepared and from this list, 3 villages and a small town were selected at random. The purpose of selecting a town was to find out the behavioural changes if any, in respect of water use practices in urban areas compared to rural habitation.

Selection of Households

In the selected villages, the ground water user households were listed under a format prepared by IRMED and from this list, 10 households were selected at random. Similar method was followed for selection of 15 households in each town.

Number of Schedules Canvassed

State	State Level	District Level	Town Level	Village Level	HHS Level
Andhra Pradesh	1	1	2	6	90
Delhi	1	2	2	6	90
Gujarat	1	1	2	6	90
Punjab	1	1	2	6	90
Tamil Nadu	1	1	2	6	90
West Bengal	1	1	2	6	90
All States	6	7	12	36	540

2.5 Instruments of Observation

Four sets of structured questionnaires, which were pre-tested under practical field conditions, were administered one each at state, district, village/town and household levels. In the state and district level questionnaires, information pertaining to ground water development and management was collected from state and district level officials while in the village/town and household level questionnaires information about views/opinions of the end users of ground water on regulatory aspects, water use practices, role of customary practices in the management of ground water, was sought. The field work of above study was taken up in different states between June 2006 to February 2007. The list of villages/towns thus selected from different states and districts is given below.

Name of State	Name of District	Name of Block	Name of Village/Town
Delhi	South District	Mehroli	Joanpur
			Godaipur
			Mandi
			Sai-dula Jab (T)
	South West District	Najafgarh	Ujwa
			Jarodakalan
			Pindwalakalan
			Najafgarh (T)
Punjab	Moga	Moga-II	Gajjanwala
			Chatian khurd
			Dhulkke
			Ghalkalan (T)
		Nihalsingwala	Lohara
			Bilaspur
			Takhtupura
			Nihalsingwala (T)
Andhra Pradesh	Chittoor	Tirupati (R)	Padipeta
			Brahmanpattu
			Mundalpudi
			L.B. Nagar (MR Palli) (T)
		Gargavaram	Keelapatla
			Melumai
			Gangavaram
			Palamaner (T)
Tamil Nadu	Dindigul	Vadamadurai	Padiyur
			Ayyalur
			Thennampatti
			Vadamadurai (T)
		Vadasandur	Nallamanarkottai
			Srirampuram
			Kalavarpatty
			Vedasandur (T)
Gujarat	Kuchchh	Anjar	Ratnal
			Sapeda
			Nagalpurmot
			Anjar (T)
		Mandvi	Maska
			Bagh
			Gundiiali
			Mandvi (T)

Name of State	Name of District	Name of Block	Name of Village/Town
West Bengal	Burdwan	Memari-II	Satgachi
			Harakali
			Shridharpur
			Burdwan (T)
		Purbastnali-II	Palashberia-Totbana
			Pathangram
			Nakadaha
			Sultanpur (T)

Note : In Memari-II and Purbasthali-II blocks of Burdwan district, there was no urban area. Hence, ward 3 of Sultanpur town was taken as representative urban area for Purbasthali Block-II. Similarly, ward no. 30 of Burdwan town was taken as representative urban area for Memari block-II.

2.6 Period of Field Work

The field work in Delhi started towards the end of June, 2006 and completed in July, 2006. The field work of Punjab initiated in July was completed in middle of August after which West Bengal was taken up for field survey. The field work in this state was over in the month of September, 2006. In the same month (September) field work in Gujarat state was taken up. This was completed in October 2006. The field work in Andhra Pradesh was started in the month of November and was completed in December 2006. Tamil Nadu was the last state where field work was started and completed in February, 2007.

2.7 Supplementary Questionnaires and Holding of Discussion with State Level officials

Analysis of replies to questionnaires received from different states indicated some anomalies and inconsistencies which required collection of additional information. There was also a need to get the feedback of the very senior state officials on several policy aspects as well as on the tentative recommendations that were emerging. Some of the state governments had not sent required information and published material including copies of relevant Acts, Rules, Notification etc. These had to be collected.

The above underlined the need for formulating state specific supplementary questionnaires and discussions on policy matters with very senior government functionaries. For this purpose, the Principal Investigator (PI) made a series of visits to the states of Punjab, Tamil Nadu, West Bengal, Gujarat, Andhra Pradesh, Delhi and held number of meetings with the senior level officers of the state to discuss policy matters in the light of effectiveness or non-effectiveness of the existing regulatory system etc. In these states he met state Chief Secretaries and the Secretaries of the Water Resources Department, Panchayati Raj, Planning etc. and had elaborate discussion on issues related to groundwater governance and inadequacies in the existing regulatory system. Such meetings were very useful in respect of working out modalities for ground water management.

During his visit to Punjab in May 2007 accompanied by Research Associate (RA), the Principal Investigator met the following officials at Chandigarh

1. Shri Ramesh Inder Singh, Chief Secretary, Government of Punjab, Chandigarh,
2. Shri L.R. Lakhnpal, Ex-Chief Secretary, Government of Punjab, Chandigarh,
3. Shri K.S. Taksi, Director, Water Resources & Environment Department, Government of Punjab, Chandigarh,
4. Shri Satish Chandra, Secretary, Planning and Panchayati Raj, Government of Punjab, Chandigarh,
5. Shri Sushil Gupta, Regional Director, Central Ground Water Board, Chandigarh,

6. Shri Kavarjit Singh, Department of Agriculture, Government of Punjab, Chandigarh,
7. Shri Jatinder Pal Singh, Executive Engineer, Water Resource Investigation Division, Government of Punjab, Chandigarh.

After meeting the state level officials at Chandigarh on 14th May, 2007, the RA visited the sample district of Moga to have discussion with district level key functionaries regarding groundwater governance in the district. He met Deputy Commissioner, District Water Supply and Sanitation Officer, Agriculture Officer, Panchayat Officer, Municipal Councilor, Supervisor, Water Supply Department of Municipality of Moga, Block Development Officer of Moga-II block, and a number of Sarpanches, Panches and farmers of village Rajjiwada, Ogarh.

In West Bengal on 21st May 2007, the PI met

1. Shri A.K. Deb, Chief Secretary, Government of West Bengal, Kolkata,
2. Shri K.John Koshi, Secretary, Water Investigation Department, Government of West Bengal, Kolkata,
3. Shri B.N. Roy, Secretary, Panchayati Raj Department, Government of West Bengal, Kolkata,
4. Shri P.K. Roy Chowdhury, Director, Water Investigation Department, Government of West Bengal, Kolkata, and had a wide ranging discussion about issues involved in ground water management.

During the field visit of PI on 12th September, 2007 to Andhra Pradesh, he met

1. Shri J. Harinarayan, Chief Secretary, Government of Andhra Pradesh, Hyderabad
2. Shri Sutirtha Bhattacharya, Secretary, Irrigation and CAD Department, Hyderabad,
3. Dr. A.K. Jain, Special Secretary, Irrigation and CAD Department, Hyderabad,
4. Mr. R. Madhav Rao, Joint Commissioner, Rural Development, Hyderabad,
5. Md. Imtiaz, Director, Andhra Pradesh Ground Water Department, Hyderabad,
6. Shri S.A. Raoof Hashmi, Joint Director, Andhra Pradesh Ground Water Department
7. Shri D. Doraswami Naidu, Deputy Director, Andhra Pradesh Ground Water Department
8. Shri M.I. Hussain, Deputy Director, APGWD, Hyderabad
9. Shri B.K. Kishen, Deputy Director, APGWD, Hyderabad
10. Shri B.M. Murali Krishna Rao, Deputy Director, APGWD, Hyderabad
11. Shri G. Sudarshan, Scientist 'D', CGWB, Hyderabad
12. Shri A.D. Rao, Scientist 'D', CGWB, Hyderabad

During his visit to Gandhinagar in Gujarat on 3rd October, 2007, the PI met and discussed various issues related to Ground Water Development and Management in the state with the following officials.

1. Smt. C.S. Manjula Subramaniam, Chief Secretary, Government of Gujarat, Ahmedabad,
2. Shri S.S. Rathod, Secretary, Water Resources Department, Government of Gujarat, Ahmedabad,
3. Shri V.S. Bramhabhat, Managing Director, Gujarat Ground Water Resource Development Corporation, Ahmedabad,
4. Shri A.D. Gohil, Supdt. Engineer, Ground Water Department, Government of Gujarat, Ahmedabad,
5. Shri J.P. Raval, Research Officer, Water Resource Department, Ahmedabad,
6. Shri H.P. Shroff, Geologist-II, Ground Water Department, Ahmedabad,
7. Shri H.R.K. Mehta, Geologist-II, Ground Water Department, Ahmedabad,

8. Shri A.K. Jain, Hydrologist, Central Ground Water Board, Ahmedabad,
9. Shri Ashok Kumar, Scientist, Central Ground Water Board, Ahmedabad.

The Research Associate visited Ahmedabad and Kachchh district of Gujarat between 5 - 10 September, 2007. He met the following officials and had wide ranging discussion on issues related to ground water management in the district.

1. Shri R.K. Varshani, Collector, Bhuj
2. Shri Prafull Hansa, DDO, Bhuj
3. Shri S.D. Lambachia, AD, Agriculture, Bhuj
4. Shri M.L. Shukla, Tehsildar, Mandvi
5. Shri R.L. Meena, Social Forestry, Bhuj
6. Shri M.D. Patel, Supdt. Engineer, Bhuj
7. Shri I.K. Chabra, MD, WASMO, Bhuj
8. Shri Kotilingham, Geophysist, GWRDC, Bhuj
9. Shri S.V. Bhatt, Supdt. Engineering-Irrigation Department, Anjar and
10. Officials of local NGO, Vivekanand Research and Training Institute (VRTI)

While in Tamil Nadu, the Principle Investigator met and interacted with the following officers at Chennai on 26 February, 2007

1. Shri P. Mahalingham, Chief Engineer, PWD, WR, Chennai
2. Shri K. Nagarajan, Superintending Engineer (Hydrology), WRO/PWD, State Ground and Surface Water Resources Data Centre, Chennai
3. Several officers of the State Ground and Surface Water Resources Data Centre, Chennai
4. Regional Director, CGWB, Chennai

He also had meetings with the concerned officers in the Dindigul Anna district on 27 February, 2007. These included

1. Shri P. Ulaganathan, Deputy Director, Ground Water Circle, PWD, Madurai,
2. District Development Officer, Dindigul,
3. Shri Selvirajan, Asst. Director, Geology and In-charge of District Ground Water Circle,
4. Shri T. Veerappan, Secretary, Primary Agricultural Rural Development Bank, Vedasundar,
5. Chairman, Taluka, Panchayat Samiti, Vedasundar, Dindigul District.

The Principal Investigator also had a meeting with Chief Executive Officer and other senior staff of Dhan Foundation, Madurai, on 27 February 2007.

The Principal Investigator had a meeting with Shri Ramesh Narayanaswamy, Chief Secretary, Government of NCT of Delhi on 2 November, 2007 wherein policy issues related to ground water in NCT of Delhi were discussed.

2.8 Interaction with Central Agencies

As required under the study information and views from central agencies concerned with this subject was also obtained. National Bank for Agriculture and Rural Development (NABARD) with its head office in Mumbai has been playing an important role in providing refinance to banks for providing loan for installation of tubewells/borewalls. Hence, a questionnaire was developed for NABARD. As the reply was delayed despite several reminders, the Principal Investigator visited NABARD head quarter in Mumbai on 4th October, 2007 and had a long discussion with the following officials.

1. Dr. K.R. Rao, CGM, Technical Services Division (TSD)
2. Shri S.C. Kaushik, CGM, ICD, NABARD, Mumbai
3. Shri D. Elangovan, GM, TSD, NABARD, Mumbai
4. Shri K.C. Panda, DGM, ICD, NABARD, Mumbai
5. Shri Ashutosh Kumar Sinha, Manager, TSD, NABARD
6. Shri Sai Harangkhol, AGM, TSD, NABARD, Mumbai

Thereafter the reply to the questionnaire sent earlier was also received from NABARD. Several meetings were held with officers of CGWB and more particularly with Shri R.C. Jain, the then Superintending Hydrogeologist and now Regional Director, CGWB and Shri G.C. Saha in charge of Delhi state.

An interactive meeting was held in May 2007 with the Scientists of CGWA. Thereafter, a questionnaire specifically designed for CGWA was sent to it the reply of which came quite late.

2.9 Feedback through Power Point Presentations

The Principal Investigator made power point presentation during 4th R&D Session of INCOH held at BHU, Varanasi, between 24-25 August, 2006 in respect of methodology for selection of sample. On 16th August, he made a more comprehensive presentation involving methodology, findings and tentative suggestions in a meeting arranged by the Member Secretary, Central Ground Water Board (CGWB) in his chamber at New Delhi. The feedbacks from these meetings were analysed and included in the report wherever relevant.

2.10 Data Processing and Analysis

Data and information obtained through the household schedules were processed and analysed through computer for which a software package was developed. Data and information obtained from state, district and village/town schedules were processed manually. For the above purpose, all the filled in schedules of all the four schedules were thoroughly checked and inconsistencies and error, if any, were taken care of. Revisits to fields in some cases were also made

Chapter - III

Constitutional and Legal Provisions for Ground Water Governance

The basic objective of the study is to examine the legal and institutional framework related to ground water sector in India. This obviously requires a clear understanding of the legal system. The legal framework, however, works on the foundation of the Constitution. Hence, an analysis of the constitutional provisions having a bearing on management of ground water becomes necessary. The present chapter is designed to deal with these aspects.

3.1 Constitutional Framework

The Constitution of India lays down the legislative, functional and financial jurisdictions of the Union, State and local governments on different subjects including 'water'. Under Constitutional provisions, the allocation of responsibilities between the states and the centre falls in three categories. First, the Union List (List I), second, the State List (List II) and the third, the Concurrent list (III). In the Constitution of India, water as a whole is included in Schedule VII in Entry 17 of list II, i.e., State List which states "*Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power subject to the provisions of Entry 56 of List I*". Thus, this entry is subject to the provision of Entry 56 of List I i.e., Union List. Entry 56 of List I (Union List), reads as follows: "*Regulation and development of inter-state rivers and river valleys to the extent to which such regulation and development under the control of the Union, is declared by Parliament by law to be expedient in the public interest*".

It can be seen from the above that ground water is not mentioned in any of the lists in the VII schedule of the Constitution of India. This could be because framers of the Constitution did not envisage a situation like that of today when ground water in a particular area would become so scarce as to pose a threat to environment, life and livelihood of the people of the concerned area as it has become now in several parts of the country.

Though not mentioned separately in any of the three lists, ground water can, however, be understood to be a part of the generic category of "water supplies" as well as "irrigation". While surface water comprising mainly of river water is subject to Entry 56 of List I, the same is not true of ground water. Thus ground water can be viewed as wholly under the jurisdiction of states as per provisions of the Indian Constitution. **But most of ground water flows through defined channels which cut across state boundaries. In that case, ground water can be interpreted in terms of inter-state management in which case purview of the Centre becomes quite important.** Notwithstanding these Constitutional niceties, in actual practice, the view that ground water is a state subject is almost universally subscribed to by most of the administrators at all levels, centre, state and local.

Though the Concurrent List (List III) does not have any entry related to water, but it does have an entry on "Economic and Social Planning". As water is a significant input in agricultural and industrial development, and since water is used for social planning, the development of water in a sense may be considered to be under the purview of this Entry. But such an interpretation would be too far fetched to be accepted since "economic and social planning" is so vast an area that it would cover almost everything. There is, however, another way through which water becomes a subject of concern by the Union. Water is a very important part-of environment which comes under Union domain by virtue of being a

residual item as per Indian Constitution. In fact the Central Ground Water Authority has been established under the Environment (Protection) Act 1986.

The 1992 (73rd and 74th) amendments to the Constitution regarding Panchayats and Municipalities introduced the following entries in the schedules listing the subject-areas in which the State governments and legislatures may devolve functions to such bodies, so as to make them evolve as local self-governing institutions:

In the Eighth Schedule (Part IX) dealing with Panchayats, the subjects, “Minor irrigation, Water management and Watershed development”, “drinking water” and “ maintenance of community assets” are listed.

In the Twelfth Schedule (Part IX) dealing with municipalities, the subjects “water supply of domestic, industrial and commercial purposes” is listed. Here it may be noted that ground water comes under minor irrigation, drinking water and water supply.

Functional responsibilities are, thus, visualised for local governments in respect of several aspects of ground water use.

3.2 Legal Position

Unlike several countries, India does not have any separate and exclusive water law dealing with all water resources and covering all aspects. Instead the water related legal provisions are dispersed across various irrigation acts, central and state laws, orders/decrees of the courts, customary laws and various penal and criminal procedure codes. As a result, understanding of the exact legal position with respect to ground water becomes rather cumbersome.

Moreover, **India does not have any explicit legal framework specifying water rights.** The Supreme Court of India has, however, reinterpreted Article 21 of the Constitution of India to include the right to water as a fundamental right to life. The Easement Act of 1882 made all rivers and lakes the absolute right of the state. But as per the provisions of the Easement Act 1882 as usually understood and the Transfer of the Property Act of 1882, a land owner is supposed to have a right to ground water beneath his land as it is considered as an easement of the land. So, the land owners own the ground water on their lands. **Ground water was considered an easement connected to land: he/she who owns the land: owns the ground water beneath the land.** Ownership of ground water, therefore, accrues to the owner of the land above. Ownership of ground water is transferred along with the transfer of ownership of land. **Thus, ground water is viewed as an appendage to land.** This absolute ownership concept has allowed unlimited withdrawals of ground water beneath the land by the owners. There is no limitation on how much ground water a particular land owner may draw. As a result, a person is free to draw water more than his/her personal requirement and sell the same in the market. Moreover, the landless have no right on ground water. Similarly the tribals who have no ownership right over land have no right on ground water.

The legal aspects governing ground water resources have continued to remain the same despite substantial changes in ground water scenario that have taken place since then. Rapid expansion in the exploitation of ground water resources in India for irrigation and other uses has led to an over-exploitation of ground water in several parts of the country. As a result, the above law is no longer in harmony with resource sustainability and economic requirement.

It may, however, be mentioned that the Directive Principles of State Policy [Article 39 (b)] of the Indian Constitution has made it incumbent on the state to ensure that the ownership and control of the material resources of the community are so distributed as to subserve the common good in the best possible manner.

Moreover as already pointed out, since the Constitution does not have an entry relating to 'Environment', using the residual powers, the Union has enacted laws on environment and control of pollution, which have effects on water use, including ground water and its exploitation. Moreover, a correct understanding of the Easement Act 1882 implies that it does not give unlimited power to the land owner to exploit ground water regardless of the adverse effects on other users. We examine this aspect in the following section.

3.3 The Indian Easement Act 1882

An easement is a right which the owner or occupier of certain land possesses as such for the beneficial enjoyment of that land, to do and continue to do something or to prevent and continue to prevent something being done, in or upon, or in respect of, certain other land not his own.

In the first and second clauses of this section, the expression "land" includes also things permanently attached to the earth, the expression "beneficial enjoyment" includes also possible convenience, remote advantage, and even a mere amenity, and the expression "to do something" includes removal and appropriation by the dominant owner, for the beneficial enjoyment of the dominant heritage, of any part of the soil of the servient heritage, or anything growing or subsisting thereon.

Section 7(g) the Indian Easement Act, 1882 which came into force in July 1982, states that

- (a) "The right of every owner of land to collect and dispose within his own limits of all water under the land which does not pass in a defined channel and all water on its surface which does not pass in a defined channel". This clause explicitly relates to ground water and is the basis for prevailing thinking that land owners have absolute rights over water underneath their land. The provision has been based on the common English law under which ground water is viewed as an easement connected to land.
- (b) The Act also contains several provisions regarding natural streams which include underground streams also as per explanation provided in the Act which states that "a natural stream is a stream whether permanent or intermittent, tide or tideless, on the surface of land or underground, which flows by the operation of nature only and in a natural and known course".
- (c) The right of every owner of land that the water of every natural stream which passes by, through or over his land in a defined natural channel shall be allowed by other persons to flow within such owners limits without interruption and without material alteration in quantity, direction, force or temperature, the right of every owner of land abutting on a natural lake or pond into or out of which a natural stream flows, that the water of such lake or pond shall be allowed by other persons to remain within such owner's limits without material alteration in quantity or temperature. (Sec. 7h)
- (d) The right of every owner of upper land that water naturally rising in, or falling on such land, and not passing in defined channels, shall be allowed by the owner of adjacent lower land to run naturally thereto. (Sec. 7i)

The burden of these clauses (Section 7h and i) is to draw attention to interdependent nature of water flows.

A close reading of the relevant portion of clause 7 of the Act may, however, give a new insight. The Act says: *“The right of every owner of land to collect and dispose within his own limits of all water under the land which does not pass in a defined channel and all water on its surface which does not pass in a defined channel”*. The crucial words of **“defined channel”** have been totally forgotten by our political executives, engineers and administrators. The Easement Act does not permit land owners ownership of ground water if it is passing in a defined channel. **As much of ground water is a dynamic resource which flows through defined channels, owners of land can not claim absolute ownership over water under their land.** A proper implementation of this Act would require authorities to provide information whether ground water in an area is passing through a defined channel. This is not done presumably because most parts of ground water pass through defined channels with the result that the more one person withdraws ground water from his/her land, the less ground water becomes available to the person owning the neighbouring land.

The introduction of high powered technology of extracting ground water strikes at the very root of ground water as a property right available to every property owner. A few land owners who install powerful borewells/tubewells in the beginning and thereby succeed in withdrawing higher proportion of water may leave little water for other land holders who join the race later on. The newcomers, therefore, would have little or no rights to water in actual practice. The restrictions imposed on new structures by the state under the dispensation of new ground water law tend to reinforce this trend and give it a legal backing. This phenomenon is described as the **Appropriation Rule** which results in gross inequity and denial of rights to water for the late comers, who usually happen to be the have-nots. What is needed is either **Reasonable Use Rule** which allows a property owner to use water under his/her land as long as the use is reasonable in comparison to the water needs of his/her neighbours or a **Correlative Rights Rule** which apportions ground water resources of an area on the basis of the amount of land owned by each person.

In this connection, one may cite the case of the Kerala Act dealing with ground water. This Act appears to uphold the principle of reasonable use of ground water by all concerned. This is reflected in the provisions in the Act which allow the Authority to include conditions or restrictions on ground water use. The conditions are prescribed on the basis of an examination of the following factors:

1. Purpose for which water is used
2. Existing users of the locality
3. Availability of ground water
4. Quality of ground water
5. Well spacing and well density in the area and the possibility of well interface
6. Rate of recharge
7. Chances for ground water pollution
8. Long term water level trend

(J.P. Kukillaya and A. Rajan, Groundwater Governance, 2007, p.216)

3.4 The Water (Prevention and Control of Pollution) Act 1974

Water (Prevention and Control of Pollution) Act, 1974 was passed by the Parliament in 1974 for prevention of pollution of water due to discharge of liquid effluents from industries. Subsequently, another Act namely Water (Prevention and Control of Pollution) Cess Act 1977 was enacted for enabling the effective implementation of the earlier Act. All the states adopted the Act by 1990 and State Pollution Control Boards of the respective, states were inter alia set up under the Act. Central and state Pollution Control Boards adopted the

environmental norms for water discharge from different types of sources. This Act contains specific provision for prohibiting the use of stream or well for disposal of polluting matter, prescribing restrictions on new outlets and new discharges, laying down rules regarding existing discharge of sewerage or trade effluents, emergency measures in case of pollution of stream or well and power of the Board to make application to courts for restraining apprehended pollution of water in streams or wells. The said Act also incorporates provisions for creating Central and State Pollution Control Boards and prescribing powers and functions of these Boards to take various steps and measures for regulating the prohibition, prevention and control of water pollution. Some states have also enacted separate water pollution Acts, e.g. Orissa River Pollution Prevention Act, 1953 and Maharashtra Prevention of Water Pollution Act, 1969.

The Water (Prevention and Control of Pollution) Act, 1974, as amended in 1978, makes even the companies and the Heads of the Government Departments punishable under the said Act, if the offences under that Act are found to have been committed by a company¹ or a Government Department,² as the case may be.

Under the Water (Prevention and Control of Pollution) Act 1974 as amended in 1978, if the State Government, after consultation with, or on the recommendation of the State Boards, is of the opinion that the provisions of this Act need not apply to the entire State, it may, by notification in the Official Gazette restrict the application of this Act to such area or areas as may be declared therein the water-pollution-prevention and control area or areas and thereupon the provisions of this Act shall apply only to such area or areas.³

3.5 The Environment (Protection) Act (EPA), 1986

Environmental (Protection) Act (EPA), 1986 was passed by the Union Parliament in 1986 and was notified by the Union Ministry of Environment and Forests. This Act covers different areas of “environment” including water as well as items interrelated to water.

In exercise of the powers conferred by sub-section (1) and (3) of section 3 of the Environment (Protection) Act, 1986 the Central Government has constituted an authority known as “Water Quality Assessment Authority”. It consists of members drawn from the concerned ministries like Ministry of Environment and Forests and Ministry of Water Resources.

The Authority exercises the following powers and functions:-

1. To exercise power under section 5 of the said Act for issuing directions and for taking measures with respect to matters referred to in clauses (ix), (xi), (xii) and (xiii) of sub-section (2) of section 3 of the Act.
2. To direct the agencies (government/local bodies/non-governmental) for the following.
 - (a) To standardize methods for water quality monitoring and to ensure quality of data generation for utilization thereof.
 - (b) To take measures so as to ensure proper treatment of waste water with a view to restoring the water quality of the river/water bodies to meet the designated best uses.
 - (c) To take up research and development activities in the area of water quality management.

¹ Section 47.

² Section 48.

³ The Water (Prevention and Control of Pollution) Act, 1974, Section 19(1).

- (d) To promote recycling/re-use of treated sewage/ trade effluent for irrigation in development of agriculture.
 - (e) To draw action plans for quality improvement in water bodies, and monitor and review areas, implementation of the schemes launched/to be launched to that effect.
 - (f) To draw schemes for imposition of restriction in water abstraction and discharge of treated sewage/trade effluent on land, rivers and other water bodies with a view to mitigating crises of water quality.
 - (g) To maintain minimum discharge for sustenance of aquatic forms in riverine system.
 - (h) To promote rain water harvesting,
 - (i) To utilize self-assimilation capacities at the critical river stretches to minimize cost of effluent treatment.
 - (j) To provide information to pollution control authorities to facilitate allocation of waste load.
 - (k) To review the status of quality of national water resources (both surface water and ground water) and identify “Hot Spots” for taking necessary actions for improvement in water quality.
 - (l) To interact with authorities/committees constituted or to be constituted under the provisions of the said act for matters relating to management of water resources.
 - (m) To constitute/set up State Level Water Quality Review Committees (WQRC) to coordinate the work to be assigned to such committees, and.
 - (n) To deal with any environmental issue concerning surface and ground water quality which may be referred to it by the Central Government or the State Government relating to the respective areas, for maintenance and/on restoration of quality to sustain designated best-use.
3. The Authority shall exercise the powers under section 19 of the said Act.
 4. The Authority may appoint domain experts for facilitating the work assigned to it.
 5. The Ministry of Water Resource shall create a cell to assist the authority to carryout the assigned functions.
 6. The Authority shall furnish report about its activity once in three months to the Ministry of Environment and Forests.

The Central Ground Water Authority, constituted under Environment (Protection) Act of 1986 has been a major institution created for regulating over-exploitation of ground water. In view of its importance, its salient features and activities would be discussed in a separate section in this chapter as well as in other chapters also. For the protection of coastal environment in India, including ground water resources, a Coastal Regulation Zone Notification (CRZ), 1991 has been issued. National Coastal Zone Management Authority and State Coastal Management Authorities constituted under Environment Protection Act (1986) are other legal bodies for overall protection of coastal environment including ground water.

3.6 The Model Bill

The need for restricting excessive exploitation of ground water was realized by the Centre as early as about 40 years ago. But the Centre could not do much since regulation of ground water was supposed to be a state subject. What it did was to prepare a model bill for the purpose and circulated the same to the state governments for enactment and implementation. The Draft Model Bill was circulated to all States/UTs by Government of India, Ministry of Agriculture (which was the concerned ministry at that time) as early as in 1970. The bill envisaged empowering the state governments to acquire powers to restrict installation of new

ground water structures like borewells, tubewells and even dug wells by private individuals or groups for purpose other than drinking water. The Bill was revised thrice, once in 1992, second in 1996 and then in 2005 by the Ministry of Water Resources (MoWR) (which became the concerned ministry later on)

The salient features of the 1970 model bill were as under:

- (a) The State Governments were to acquire powers to restrict the construction of ground water abstraction structures (including wells, borewells, tubewells etc.) by individuals or communities for all uses except that of drinking water in any area declared as notified area based on report from Ground Water Authority of State in public interest.
- (b) For discharging the various functions to be acquired by the Government under the legislation, a Ground Water Authority was to be constituted by each state. The Authority was to consist of a Chairman, representative of the concerned State Government Departments and knowledgeable persons in the field of ground water appointed by the State Government. The authority was to be provided with support of technical persons and other staff considered necessary for enforcing the legislation.
- (c) Application for sinking wells for purposes other than domestic use were to be considered by the Ground Water Authority keeping in view the purpose for which water was to be used, the existence of other competitive users, the availability of ground water and any other relevant factor.
- (d) Persons/organizations desirous of taking up the business of sinking of wells/tubewells were required to register with the Ground Water Authority. The Authority was also to be vested with the power to cancel any permits, registrations or licenses issued by them.
- (e) Finally, the Authority was to be provided with complete legal support to enforce the various provisions of the legislation. It was also provided that the orders issued by the Authority would fall outside the purview of the Civil Court. The Civil Courts were to be barred from granting injunctions on any decision taken by the Authority.

But the states failed to rise up to the occasion. They ignored the Centre's advice completely. Thereafter, the issue remained more or less dormant for 20 years after which the Central Government revived the bill and made some revisions. The revised bill was circulated to states for adoption with modification if any in the year 1992.

The following provisions were included in the revised version of the Model Bill (1992):

- (a) Extension of the bill to cover all uses including drinking and domestic use, and
- (b) Exemption of small and marginal farmers from obtaining prior permission of the proposed Ground Water Authority for the construction of ground water abstraction structures, provided these were for their personal use (not commercial).

The states, however, continued to adopt a non-responsive attitude. Meanwhile, the Model bill was further revised and circulated again to states for implementation in 1996. The main revision made was with respect to the earlier provision related to small and marginal farmers. That provision was replaced by the following.

“The person or persons will not have to obtain permit if the well is proposed to be fitted with a hand operated manual pump or water is proposed to be withdrawn by manual devices”. Further, the latest Bill warranted that all wells sunk even in the non-notified areas with certain exceptions would require registration. Certain changes were also made in the penalties to be imposed. Another significant change was that the provision of bar of jurisdiction by civil courts made in the earlier draft bills did not find a place in this bill.

Yet another revision was made in the “Model Bill to Regulate and Control the Development of Ground Water” by adding Chapter III-“Rain Water Harvesting for Ground Water Recharge” for identifying the areas for recharge by the Authority, encouraging roof top rain water harvesting and promotion of mass awareness and training for the same. It was circulated in January, 2005 to states.

The main thrust of all versions of the Draft Model Bill sent by government of India, however, remained the same i.e. constitution of State Ground Water Authority (SGWA) which would identify the critical areas that are over-exploited (where exploitation is much more than natural recharge to ground water and depletion is quite high) and would notify such areas as “Notified Areas”. Owners of ground water structures in such areas would be required to get themselves registered with such Authority. For installation of any tubewells in such Notified Areas, a permit would be required from such Authority and penalties can also be imposed for failure to comply with provisions of the Act.

Thus, Government of India has been requesting States/UTs since 1970 to implement Model Bill by enacting ground water legislation. It was also printed out by the Central Government, that before attempting any such enactment, common people as well as farmers should be fully educated about the need of judicious regulation of ground water. However, as in June, 2005, out of 30 States and 5 UTs of the country, only 7 had enacted and implemented the legislation and three had passed the Bill but did not notified the same. The reasons for non-implementation of the proposed legislation could be several. But the most important one seems to be lack of political will, Political parties have been reluctant to impose restrictions on use of ground water due to fear of losing support of the electorate. Salient features of the enactments passed or proposed by states in our sample are provided in Appendix 3A.

It would, of course, be unrealistic to expect that the implementation of the Model Bill in its present form would take care of the problem of over exploitation of ground water. It can not do so because it has no provision for restricting the extent of ground water extracted by the existing users. It would have some minor advantages only. For examples, implementation of the bill would help in improving the information base with respect to ground water. By registration of structures it may be possible to collect and maintain basic data of all existing wells/tubewells viz. location, depth, design, discharge, command area, canal irrigation at village level. Data of various aquifer characteristics under different hydrogeological conditions, density and quality of ground water may also become available. The legislation may be easier to implement in urban areas to protect drinking water source and water supply to industrial units. But it would be extremely difficult to implement it for agriculture use which consumes bulk of ground water. The number of farmers owning tubewells is too large to be regulated by a central agency specially when these farmers have political backing because of their voting power. No coercive policy is expected to succeed when the number is quite large. The legislation may lead to widespread corruption and intimidation in some cases. Further the constitution of the authorities comprising mainly of representatives of concerned departments is such that these become a technical wing of the state government. There is little scope for participation of local population. Thus the Model Bill, in its present form is not expected to be a panacea for the problem of over exploitation of ground water resources. **It is surprising and speaks poorly of the relevant wings of Government of India that the later versions of the model bill did not take any notice of the 1992 (73rd and 74th) amendments to the Constitution regarding giving powers to Panchayats and Municipalities in management of local resources of which ground water is a good example. Thus an excellent opportunity was lost.**

Notwithstanding what has been stated above, the Model Bill represents a milestone in approach of the government. It places ground water in problem areas under public domain. It advocates the view that government has the right to regulate the extraction of ground water. Ground water, therefore, should not be regarded as private property like land.

3.7 Central Ground Water Authority

Central Ground Water Authority was set up on 14th January, 1997 by the Ministry of Environment and Forests, Government of India in pursuance of an order of the Hon'ble Supreme Court of India dated 10th December, 1996 on a PIL. Authority has been established under sub-section (3) of Section 3 of the Environment (Protection) Act, 1986. The authority is headed by a Chairman, has eight members and a member secretary.

The Authority has been empowered to exercise the powers and perform the following functions :-

- (i) Exercise powers under Section 5 of the Environment (Protection) Act, 1986. The Authority can issue directions in writing to any person, officer or any Authority and such persons, officer or Authority shall be bound to comply with such directions. For example – The Authority has power to direct the closure, prohibition or regulation of any industry or process and also the stoppage or regulation of the supply of electricity or water or any other service.
- (ii) To resort to the penal provisions contained in Section 15 to 21 of the Environment (Protection) Act, 1986. In Sections from 15 to 21 of the Act, it has been summarized that penalty should be levied in avoidance of the rules, orders and directions of the Act. Also if this offence is done by companies or Government Departments, every person, who at the time the offence was committed, was responsible and also the company or Govt. Department should be punished accordingly. Also the Central Govt. may ask from time to time, to the concerned officer, State Government or the authority to furnish the required information, report etc. All the members, officers and employees of such authority working under this Act shall be deemed to be public servants.
- (iii) To regulate indiscriminate boring and withdrawal of ground water in the country and to issue necessary directions with a view to preserve and protect the ground water.

Areas of Activities of CGWA

To achieve the mandate, the Authority has divided its functions into following mentioned four sub-heads. These are detailed as follows.

- (a) Regulation of ground water.
 - (i) Extraction of ground water development
 - (ii) Construction of wells
 - (iii) Registration of ground water abstraction structures
 - (iv) Performance of business of drilling wells
 - (v) Sale of ground water
- (b) Conservation of ground Water
Conservation and artificial recharge of ground water including roof-top run-off harvesting storm water recharge and by other means etc.
- (c) Protection of ground water
 - (i) Protection of ground water quality deterioration from disposal of urban and industrial wastes.

- (ii) Management of ground water in coastal aquifers.
 - (iii) Clearance of solid & liquid waste disposals sites.
 - (iv) Clearance for setting up of ground water based industries.
- (d) Mass Awareness – Promotion of education & Mass Awareness Programmes.
- Declaration of any area as “Notified Area” has to be preceded by a mass awareness programme aimed at educating the people of the necessity and objectives of notification of the area. Detailed literature, in local language, should be published on ground water conditions. Mass contact functions should be organized involving the administration, political persons, schools and the users in the affected area.

Operational Modalities

The Authority has taken a decision that instead of adopting a policy strategy, it should adopt a pro-active approach and sensitise persons and users at the different levels with regard to need for judicious use and scientific management of ground water. The Authority has, therefore, decided to adopt the following plan of action.

1. Organise mass awareness programmes involving the users and NGOs to explain the objectives of the notification of any area. The effort shall involve:
 - (i) Preparation and issue of literature in local languages,
 - (ii) Establish one to one contact by involving voluntary agencies, and
 - (iii) Education through schools, etc.
 2. Issue of messages through news, media for seeking cooperation of the people in the effort.
 3. Organise activities like registration of wells, grant of permission for the replacement of the existing or the construction of new wells, organizing roof-top rain water harvesting without causing any inconvenience to the people.
 4. Issue insertions through electronic display boards,
 5. Production of films, etc.
 6. Issue of notices to offenders giving them sufficient time to explain their position and take corrective actions.
 7. Personal hearing before imposition of penalties.
- To regulate indiscriminate boring and withdrawal of ground water in the country and to issue necessary regulatory directions with a view to preserve and protect the ground water.

The approach, policies and operations of CGWA have been modeled on the pattern of the Model Bill. Hence, these have the same advantages and disadvantages as those of the Model Bill. Its impact, therefore, is doubtful. Further discussion on the effectiveness of CGWA will take place in Chapter IV.

3.8 Conclusions and Suggestions

The age old understanding that a land owner has absolute right over ground water beneath his/her land and that government has no right to interfere has started changing. The Easement Act which provided the basis for the traditional approach allows considerable scope for regulation of ground water use by the government. The Model Bill on ground water regulation, the subsequent enactments by some of the state governments on the lines of the Model Bill signifies a marked departure from the traditional viewpoint of non-interference by government in management of ground water resources. What is even more significant is that the Supreme Court of India in its landmark judgement asking for the creation of Central Ground Water Authority has given its seal of approval to the view that **ground water is under public domain** and also that the central government has a primary responsibility in

managing it. There is, therefore, no legal inadequacies. The problem lies with the failure of the administrative machinery at the centre and in the states to seize upon the opportunity provided by the Supreme Court judgement and adopt necessary measures to stop the over exploitation of ground water in several parts of the country. For this to happen, several steps are needed. Government should come out with a clear cut declaration that ground water rights are held by the community rather than the individual. If needed, a suitable law may be passed in case appropriate legal bodies, experts indicate the need for the same. The government should also generate mass awareness among all sections of society to propagate the above view point. It should also bring about far reaching changes in the powers, composition and functioning of the Central Ground Water Authority as well as state level ground water authorities. These changes would be discussed in the subsequent chapter.

The model bill was circulated in 1970. Since then, it was revised as per details given earlier. But the main features of the bill have remained the same. However, as we know, from January 1997 the Central Ground Water Authority has been constituted as a statutory body under Environment (Protection) Act, 1986. The modus operandi of this measure has been same as that under the model bill. A question, therefore, arises as to how far it is expedient to have two legal bodies performing the same functions in the same manner. This matter was discussed with the state governments and their view was that the above arrangement of having two bodies one under Central law and another under state law amounts to duplication, which should be avoided. Most states felt that the states are better equipped to perform the regulatory functions in view of the presence of the state's administrative machinery at the grass root level. Here it may also be noted that the Punjab Government had sought a clarification from Ministry of Water Resources on the issue of overlapping of functions between the two authorities. The Central Ground Water Authority is reported to have obtained opinion of the Department of Legal Affairs, Ministry of Law, which opined that "though the states are competent to make their own laws and constitute state authorities, the provision of Environment (Protection) Act, 1986 would override the State Enactment under Article 253". (Kuldeep Singh Takshi, Groundwater Governance, 2007, p. 246).

The above view point is acceptable in a legal sense, but it does not take care of operational aspects at the micro-level. The district collector or block level officials or farmers will be confused if they have to submit to two types of authorities for the same purpose. It is, therefore, suggested that this matter may be examined in the meeting of the Centre and states and only one law should be made applicable. There is perhaps no need for state laws after the creation of CGWA provided GGWA links up closely with the state administrative machinery to make itself effective. Alternatively, if all the concerned states make their own laws then there is no need for a central legal authority directly looking after different parts of a state. A review is urgently called for

The existing legal framework suffers from a major defect in that it puts no restriction on withdrawal of ground water by existing users. This will be discussed in detail in the next chapter.

It would be useful to have a glimpse of international experience in regulation. A brief outline of the international experience is provided in Appendix 3B attached to this chapter.

Ground Water Acts of Some States

During recent years and in response to repeated circulation of the model bill on ground water by the Central Government, a few state governments have enacted legislation for regulation of ground water in their states. Of the six states covered in our sample, three states of Andhra Pradesh, Tamil Nadu and West Bengal have enacted legislation while Punjab, Gujarat and Delhi have prepared draft of the legislation but not passed it. Gujarat, however, constituted a state level ground water authority in November, 2001 which has been functioning since then. Details about this are, therefore, provided here. While Andhra Pradesh and West Bengal have implemented the legislation, Tamil Nadu is yet to do so. The salient features of these Acts as well as proposed legislation are outlined in this chapter. We first take up Andhra Pradesh since it has the longest experience of implementing the Act. Because of this, provisions of the Act in Andhra Pradesh are described in greater detail.

Andhra Pradesh

Ground Water Protection measures under Andhra Pradesh Water, Land and Trees Act-2002 (APWALTA-2002)

Constitution of Andhra Pradesh Water, Land and Trees Authority

(1)	The Authority shall consist of		
	(a)	Minister, Panchayati Raj, Rural Development and Rural Water Supply or any other Minister, nominated by the Chief Minister	Ex-officio Chairperson
	(b)	Three members of the State Legislative Assembly, nominated by the Government out of which one shall be from the main opposition political party.	Ex-Officio Member
	(c)	Chief Secretary to the Government	Vice-Chairperson
	(d)	Secretary to the Government in charge of Agriculture	Ex-Officio Member
	(e)	Secretary to the Government in charge of Irrigation and Command Area Development	Ex-Officio Member
	(f)	Secretary to the Government in charge of Municipal Administration	Ex-Officio Member
	(g)	Secretary to the Government in charge of Rural Water Supply	Ex-Officio Member
	(h)	Secretary to the Government in charge of Panchayati Raj	Ex-Officio Member
	(i)	Secretary to the Government in charge of Environment, Forests, Science and Technology Department	Ex-Officio Member
	(j)	Vice Chancellor, Acharya N.G. Ranga Agricultural University	Ex-Officio Member
	(k)	Three Professors of whom one each from the faculties of Life Sciences, Earth sciences and Engineering and Technology from the Universities in the State nominated by the Government for a two year term by rotation.	Members
	(l)	Three experts in the field of water and soil conservation and economics nominated by the Government	Members
	(m)	Such other non-official persons not exceeding five in number who, in the opinion of the Government are interested in the conservation of natural resources of whom one each shall be from the Scheduled Tribes, Scheduled Castes and Women respectively.	Members

	(n)	Secretary to the Government in charge of Rural Development	Ex-Officio Member Secretary
2.	The term of office of the nominated members except those nominated under clause (k) of sub-section (2) shall be such as may be prescribed.		
3.	The members shall be entitled to such allowances as may be prescribed for attending the meetings of the authority or performing duties entrusted by the authority.		
Meetings of the Authority	4.(1) The Authority shall meet at least once in three months at such place and time as the Chairman may decide. (2) The quorum to constitute a meeting of the authority shall be one third of the total number of members. (3) Save as otherwise expressly provided by or under this Act, the procedure for the conduct of business at the meetings of the Authority shall be such as may be prescribed.		

Registration of Wells

1. All ground water resources in the State shall be regulated by the Authority, subject to any general or special directions issued in this behalf by the Government.
2. On and from the date of commencement of this Act, the owners of all the wells including those which are not fitted with power driven pumps and water bodies in the State shall register their wells/water bodies with the Authority in such manner as may be prescribed.

Prohibition of Water Pumping in certain Areas

1. The Designated Officer, with the approval of the Authority, may prohibit water pumping by individuals, groups of individuals or private organizations in any particular area, if in his view such water pumping in such area is likely to cause damage to the level of ground water or cause deterioration or damage to natural resources or environment for a period of not more than six months which after review may be extended for a further period of not more than six months at a time.
2. Provided that no well shall be sunk in such areas as may be prescribed.
3. The Authority may issue directions to A.P. Transco not to raise and collect electricity bills during stoppage of pumping of water in pursuance of order issued under sub-section (2) thereof.

Permission for well sinking near drinking water source

1. Notwithstanding anything contained in any law for the time being in force and having regard to the interests of the general public to have the supply of requisite quantity of water for drinking purposes from the public drinking water source, no person subject to sub-section (2) shall sink any well in the vicinity of a public drinking water source within a distance of two hundred and fifty meters in areas other than the areas covered under section 9 and sub-section (1) of section 11 thereof:

Provided that sinking of any well for public drinking purpose and hand pump for public or private drinking water purpose shall be exempted under this section.

2. Any person, who intends to sink a well for purpose of irrigation or drinking or for any other purpose within a distance as specified under sub-section (1) of a public drinking water source, shall apply for permission to the Authority in such manner and on payment of such fee as may be prescribed.

Provided that in respect of sinking a well for the purpose of irrigation or drinking or for any other purpose and if such source is intended to be used with a power driven pump, the person shall also obtain prior permission of the A.P.TRANSOCO constituted under section 13 of the Andhra Pradesh Electricity Reform Act, 1998 in such manner as may be prescribed.

3. The Authority within forty five days of receipt of an application under sub-section (2), may, on the advice of the Technical Officer, for reasons to be recorded in writing, grant permission for the sinking of a well for irrigation or drinking water purpose, if it is satisfied that such sinking shall not adversely affect the public drinking water source or refuse to grant permission if such sinking affects such source adversely.
4. Every permission granted under sub-section (3) shall be subject to the condition that the authority may for the reasons to be recorded in writing, by order, prohibit, restrict or regulate from time to time the extraction of water from such well if in its opinion it is necessary to do so in the public interest and also such other conditions and restrictions as may be prescribed.

Over Exploited Areas

1. The Authority may on the advice of the technical expert, declare a particular ground water basin as over-exploited for a period of not more than six months which, after review, may be extended for a further period of not more than six months at a time.
2. For the purpose of sub-section (1), the technical officer shall take into consideration the quantum and pattern of rainfall, degree of extraction of ground water and any other relevant factor while advising the Authority.
3. On and from the date of such declaration under sub-section (1), no well shall be sunk in such areas except wells sunk for public drinking purposes or hand pump for public or private drinking water purpose.
4. The Authority may issue guidelines for improving the ground water by suitable measures in such over-exploited ground water basins as declared under sub-section (1) and such guidelines shall be followed by each individual or group of individuals or institution or organisation or government department or local body concerned as the case may be.
5. The Authority may review from time to time the ground water and results achieved after taking the measures under sub-section (4) and it may revoke the declaration of over-exploited basins as made under sub-section (1) and permit sinking of wells duly specifying the number of wells to be sunk, depth of the well, distance between two adjoining wells and other conditions as deemed fit after satisfying itself that such sinking shall not adversely affect the public drinking water source.

Protection of Public Drinking Water Sources

1. Notwithstanding anything contained in any law for the time being in force, the authority may, on the advice of the Technical Officer, that any existing well is found to be adversely affecting any public drinking water source, after giving the owner a reasonable opportunity of being heard by an order, prohibit the extraction of water for commercial, industrial, irrigation or any other purposes from such well for a period of not more than six months after which review may be extended for a further period of not more than six months at a time.

Provided that irrigation wells with standing crops shall be taken as last priority for such purpose.

2. Notwithstanding anything contained in any law for the time being in force and in any other provisions of this act, the Authority, on the advice of the Technical Officer that any existing well is found to be adversely affecting any public drinking water source and if such source cannot be adequately protected by action under sub-section (1) may after giving the owner of such well a reasonable opportunity of being heard, by an order require him to stop the extraction of water and close or seal off such well forthwith either temporarily or permanently.
3. Whenever it is necessary to make an inquiry of examination in connection with the protection of a public drinking water source or with the maintenance of a public water supply system, the Authority or any officer duly authorized by it in this behalf may after giving prior notice to the owner or occupier of any land:-
 - (a) enter upon such land as he may think necessary for the said purposes;
 - (b) undertake surveys or take water levels;
 - (c) conduct pumping tests and geophysical surveys;
 - (d) conduct well logging on the bore;
 - (e) install and maintain water levels recorded and water gauges on the wells; and
 - (f) do all such other things as may be necessary for pursuing such inquiry and examination.
4. Notwithstanding anything contained in sub-sections (1), (2) and (3), the Authority may on the advice of the Technical Officer in any urban area, issue an order:-
 - (a) Prohibiting extraction of water for sale from an over exploited water source or aquifer or residential areas or in the recharge zones of residential areas depleting the public or private water sources and affecting the supply of water for domestic usage;
 - (b) Prohibiting the drawl of the ground water within the premises of multi-storied building for sale of water outside the premises of such multi-storied building.
5. The Authority may, on the consideration of the availability of drinking water, command any existing well in order to ensure supply of drinking water to the local population. For this purpose the Authority may take over the well for such period as deemed necessary subject to such conditions as the Authority may prescribe.
6. The Authority may issue directions to the concerned including local bodies for preventing wastage of water from the public water supply system or public drinking water source.
7. The Authority may issue directions by general or specific order to A.P.TRANSOCO not to raise and collect electricity bills during stoppage of pumping of water in pursuance of order issued under this section.

Distance and Depth for Sinking of Wells

In order to curb unhealthy competition to tap water from deeper layers of ground water and to maintain ground water, the Authority may issue directions specifying the distance for sinking of wells from the existing wells and depth for such sinking and such other conditions in areas other than overexploited ground water basins as declared under sub-section (1) of section 11, areas declared under section 9 and near drinking water sources as specified under sub-section (1) of section 10.

Registration of Drilling Rigs

1. Every rig owner shall register his machinery with the Authority in such manner and on payment of such fee as may be prescribed.
2. Every rig owner or operator shall follow the instructions issued by the Authority from time to time.

Closure of Wells

1. Wherever it appears to the Authority that any well has been sunk or is being sunk or water has been extracted or is being extracted in contravention of any of the provisions of this Act, the Authority or any officer duly authorized by it in his behalf, may enter upon that land, remove obstruction, if any, close the pumping of the water, disconnect the power supply, seize any material or equipment used in connection with such extraction of water and take any such action, as may be required to stop such extraction and may by order require the owner or the person in possession of the well to close or seal off the well at his expenses and in such manner as the Authority may specify in such order and such owner or person shall comply with such order.
2. Where such owner or person fails to comply with any order made under sub-section (1), the Authority may after giving such owner or person due notice in that behalf enter upon the land and close or seal off the well and the cost incurred thereof shall be recoverable from such owner or person as arrears of land revenue.

Compensation for Closed Wells

Where an order of permanently closing down or sealing off the well, which is giving substantial yield and which is really useful for irrigating any land or for an industrial use, is made under sub-section (1) or sub-section (2) or sub-section (5) of section 12, the Authority may on making such enquiry and requiring the owner to produce such evidence as he may deem necessary, make an order for payment of compensation which shall not be less than the market value of the well including the other expenditure incurred like energisation thereon and structure thereon, the standing crop at the time of making such an order and with regard to the determination of compensation for the well situated in a land acquired shall apply the provisions of the Land Acquisition Act, 1894 in determining the market value of the well under this section:

Provided that, where an order under sub-section (1) or sub-section (2) or sub-section (5) of section 12, relates to temporarily closing down or sealing off a well, water from which is used for the irrigated crops standing at the time of making such an order, compensation for such crops shall be payable under this section :

Provided further that where by virtue of an order made under sub-section (1) or sub-section (2) or sub-section (5) of section 12, any well which is permanently closed or sealed off for any reason whatsoever, allowed to be opened for extracting water therefrom and any subsequent order made for permanently closing down or sealing off such well again shall not entitle the owner thereof, to claim compensation to such well:

Provided also that compensation shall not be paid in such cases of temporary or permanent closure of wells in pursuance of order passed under section 15.

Rain Water Harvesting Structures

1. To improve the ground water resources, by harvesting and recharge, the authority may issue guidelines for constructing appropriate rain water-harvesting structures in all residential, commercial and other premises and open spaces having an area of not less than 200 square meters in the manner prescribed within stipulated period failing which the authority may get such rain water harvesting structure constructed and recover the cost incurred along with a penalty as may be prescribed.
2. Notwithstanding anything contained in the relevant laws, the Municipal Corporation or Municipality or any other local Authority as the case may be, shall impose a condition for providing appropriate rain water harvesting structure and or roof top

- harvesting structures in the building plans in an area of not less than two hundred square meters, while according approval for construction and permanent water and electricity connection shall be extended only after compliance of the directions given in this regard.
3. The Authority may issue guidelines to Municipal Corporations or Municipalities or any other local authorities in the state for providing incentives for constructing roof top harvesting structure.

Re-use of Water

The Authority may formulate guidelines including suitable incentives for recycling and reuse of waste water by industrial, commercial users and local bodies and in the event of non-feasibility in the opinion of the authority to install suitable recycling and reuse system, the authority may levy appropriate charges:

Provided that the Technical Officer may suggest appropriate measures for this purpose, which shall be adopted by the industry, commercial unit and local bodies concerned.

Prohibition of Water Contamination

1. No ground water resources shall be contaminated in any manner by anybody including industrial, local bodies and aquaculture waste disposal.
2. Direct disposal of waste waters into the aquifers, is prohibited.

Rules

Short title, extent and commencement

1. These rules may be called the Andhra Pradesh Water, Land and Trees Rules, 2004.
2. They extend to the whole of Andhra Pradesh State
3. They shall come into force from the date of publication in Andhra Pradesh Gazette.

Definition

In these rules, unless the context otherwise requires :-

1. “Act” means the Andhra Pradesh Water, Land and Trees Act, 2002;
2. “Authority” means the Andhra Pradesh State Water, Land and Trees Authority constituted under section 3 of the Act;
3. “Member Secretary” means the member secretary of the Andhra Pradesh State Water, Land and Trees Authority;
4. The words and expressions used but not defined in these rules shall have the same meaning assigned to them in the Act.

Appointment of Administrator and the Staff in State, District, Divisional and Mandal Authorities

1. The Government may designate officers as Administrator who shall assist the Authority in discharging its duties.
2. The Authority may take on deputation such other officers or members of staff subordinate to the Administrator either on contract basis or from the surplus manpower cell.

The Member Secretary of the District Authority shall assist the District Authority in its work and the District Authority may take on contract basis or from the surplus manpower cell such other officers or the staff to assist the Member Secretary.

The Member Secretary of the Divisional authority shall assist the divisional authority in its work and the Divisional authority may take on contract basis or from the surplus manpower cell such other officers or the staff to assist the Member Secretary.

The Member Secretary of the Mandal Authority shall assist the Mandal authority in its work and the Mandal authority may take on contract basis or from the surplus manpower cell such other officers or the staff to assist the Member Secretary.

The Authority under the provisions of section 5 of the Act, may designate the officers from the departments such as Ground Water, Rural Development, Irrigation, Municipal Administration and Urban Development, Panchayati Raj, Forest or any other department or agency as deemed necessary to work as Designated or Technical Officers for the purpose of the Act by a separate order.

The power of designating the officers at District and Mandal level may be delegated by the State Authority.

Term of Office of the Nominated Members of the Authorities

The term of office of the nominated members of the Authority except those nominated under clause (k) of sub-section (2) of section 3 shall be three (3) years from the date of their appointment.

Resignation

1. A nominated member of the Authority may resign from his office by giving thirty (30) days notice to the Chairman.
2. The power to accept the resignation of a member shall vest with the Chairman who on accepting the resignation shall report to the Authority during its next meeting.
3. Whenever a nominated member of the Authority resigns or dies or is removed from the office or becomes incapable of acting, Government may, by notification in the officials gazette, appoint a person in the said vacancy.

Provided that a person so appointed in the said vacancy shall hold office only for the residue of the period.

Removal from the Authority

The Government may remove any non-official member from his office if he is of unsound mind, or convicted of a criminal offence involving moral turpitude, or fails to attend more than three successive meetings of the Authority without prior approval of the Chairman.

Allowances

1. The non-official members of the Authority shall be entitled to the traveling and daily allowances as admissible to Grade-I officers of the state for attending the meetings or any other work assigned by the Authority. They should produce a certificate that they have not claimed Travelling Allowance and Dearness Allowance for the same period elsewhere.
2. The Authority may designate an officer of the Authority as the controlling officer in respect of payment of allowances.

District Authority

1. The Government, may, by notification, in consultation with the State Authority, constitute the District Authority as follows:-

(a)	The District Collector	Ex-Officio Chairman
(b)	One Member of Parliament and two members of the Legislative Assembly as nominated by the Government. Out of two members of Legislative Assembly, one shall be preferably from the main opposition political party.	Ex-Officio Member
(c)	Three Mandal Parishad Presidents and two Zilla Parishad Territorial Constituency members to be nominated by the Ex-Officio Chairman of the District Authority.	Ex-Officio Member
(d)	Joint Director, Agriculture Department	Ex-Officio Member
(e)	Superintending Engineer, Irrigation Department	Ex-Officio Member
(f)	Superintending Engineer, Rural Water Supply Department	Ex-Officio Member
(g)	Deputy Director, Ground Water Department	Ex-Officio Member
(h)	Deputy Director, Mines and Geology Department	Ex-Officio Member
(i)	Deputy Conservator of Forests (Planning & Extension)	Ex-Officio Member
(j)	Project Officer/Integrated Tribal Development Agency/MADA/PTG	Ex-Officio Member
(k)	Regional Officer, Andhra Pradesh Pollution Control Board	Ex-Officio Member
(l)	District Panchayat Officer	Ex-Officio Member
(m)	An official from Hyderabad Metropolitan Water Supply and Sewerage Board, in respect of Rangareddy and Hyderabad Districts	Ex-Officio Member
(n)	Municipal Commissioner of Head Quarter Municipalities	Ex-Officio Member
(o)	Other Non Official persons not exceeding five, who in the opinion of the Ex-Officio Chairman of the District Authority are interested in the conservation of natural resources of which one shall belong to Scheduled Caste, one to Schedule Tribe and one shall be a woman	Ex-Officio Member
(p)	Director, Urban Forestry, Huda in respect of Hyderabad and Rangareddy districts	Ex-Officio Member
(q)	Project Director, Drought Prone Area Programme/ District Water Management Agency.	Ex-Officio Member Secretary

2. The term of the office of Non Official Members shall be three years from the date of appointment and they are entitled to the allowances as admissible to grade-I officers of the State
3. Resignation or removal of the members of the District Authority shall be governed in the same manner as prescribed under rules 5 and 6 of these rules.
4. The quorum to conduct a meeting of the District Authority shall be one third of the total number of the members.

Divisional Authority

1. The Government, may, by notification, constitute the Divisional Authority as follows:-

(a)	The R.D.O./Sub-Collector	Ex-Officio Chairman
(b)	Three Mandal Parishad Presidents and Two Zilla Parishad Territorial Constituency members to be nominated by the Ex-Officio Chairman of the District Authority	Ex-Officio Member
(c)	Deputy Director of Agriculture (having jurisdiction)	Ex-Officio Member
(d)	Executive Engineer, Irrigation (having jurisdiction)	Ex-Officio Member
(e)	Executive Engineer, Rural Water Supply (having jurisdiction)	Ex-Officio Convener

(f)	Geologist of Ground Water Department	Ex-Officio Member
(g)	An officer from Mines and Geology Department	Ex-Officio Member
(h)	Forest Range Officer (having jurisdiction)	Ex-Officio Member
(i)	An officer from APTRANSCO	Ex-Officio Member
(j)	Divisional level panchayat officer (having jurisdiction)	Ex-Officio Member
(k)	Commissioner municipality (having jurisdiction)	Ex-Officio Member

2. The quorum to conduct a meeting of the Divisional Authority shall be one third of the total number of the members.

Mandal Authority

1. The Government may, by notification, constitute the Mandal Authority as follows:-

(a)	Mandal Revenue Officer of the concerned Mandal	Ex-Officio Chairman
(b)	Mandal Development Officer	Ex-Officio Vice-Chairman
(c)	Sarpanch of the Mandal Headquarter Gram Panchayat	Ex-Officio Member
(d)	Two Mandal Parishad Territorial Constituency Members of the concerned mandal to be nominated by the Ex-Officio Chairman of the Mandal Authority with the approval of Ex-Officio Chairman of the District Authority	Ex-Officio Member
(e)	Assistant Executive Engineer, Irrigation Department	Ex-Officio Member
(f)	An Officer from Ground Water Department	Ex-Officio Member
(g)	Assistant Director, Agriculture Department	Ex-Officio Member
(h)	Assistant Project Director, Integrated Tribal Development Agency	Ex-Officio Member
(i)	Forest Section Officer (having jurisdiction)	Ex-Officio Member
(j)	Three non-official members, of whom, one shall be a woman, who in the opinion of the Ex-Officio Chairman of Mandal Authority are interested in conservation of natural resources or presidents of the Water Users Association or Vana Samrakhan Samithi or Watershed Association to be nominated with the approval of the Ex-Officio Chairman of the District Authority	Ex-Officio Member
(k)	An official from TRANSCO having jurisdiction	Ex-Officio Member
(l)	Assistant Executive Engineer, Rural Water Supply	Ex-Officio Member Secretary
(m)	Municipal Commissioner (if mandal head quarter happens to be municipality)	Ex-Officio Member

2. The term of the office of non official members shall be three years from the date of appointment.
3. The Mandal Authority shall conduct meetings atleast once in a month and perform such functions as delegated under section 6 and under section 3(6) of the Act, and also other functions as directed by the Government. The Mandal Authority may utilize the services of the Designated Officers and technical officers in discharging of its functions.
4. The quorum to conduct meeting of the Mandal Authority shall be one third of the total number of the members.

Meeting of the State, District, Divisional and Mandal Authorities

1. The time, date and place of the meeting of the State, District, Divisional and Mandal Authorities shall be fixed by the Member Secretary of the respective authorities with the approval of its Chairman.
2. The District Authority may conduct meetings and perform such functions as delegated under section 7 and under sub-section (6) of section 3 of the Act and also other functions as directed by the Government and will report to the State Authority Through Administrator. The District Authority may utilize the services of the Designated Officers and Technical Officers in discharging of its functions.
3. Seven clear days notice of an ordinary meeting and three clear days notice of a special meeting along with the agenda notes if any, shall be given by the Member Secretary to the members.
4. Any particular meeting may adjourn from day to day or to any particular day and no fresh notice shall be required for an adjourned meeting.
5. All decisions in a meeting shall be decided by a majority of votes of the members present. Voting shall be by raising of hands in favour of the proposal. In case of equality of votes, the presiding officer shall have a casting vote.
6. The Authority may co-opt any person as an observer for a particular meeting or period who shall have no voting rights.

Registration of Wells

Every owner of the well shall register the well as per sub-section (2) of section 8 of the Act by an application giving details as in Form-I appended to these rules. The Town Planning Department of Municipal Corporation, Municipalities, Hyderabad Water Supply and Sewerage Board, Village Secretaries of the Gram Panchayats shall facilitate registration of all existing wells in their jurisdiction. The details should be entered in a register as prescribed in Form I appended to these rules.

Permission for New Wells

1. Any person or institution desiring to dig a new well of any kind in their premises should obtain permission by submitting to the Authority having jurisdiction over the area, an application in Form 2 and 5 as the case may be appended to these rules together with a fee as fixed by the authority from time to time. Application duly filled in can also be given to concerned village secretary who shall pass it on to mandal authority within two days. The Authority shall process the application with the help of the Designated Officer. The Designated Officer after examining the application shall satisfy himself about the compliance of the various provisions of the Andhra Pradesh Water, Land and Trees Act, 2002 and give his recommendation to the Authority and the said Authority shall dispose off the application within fifteen days of receipt of the application. The Designated Officer while giving recommendation shall comply with the relevant provisions of the Act. Wherever necessary, the District Authority shall take the opinion of the Technical Officer of that area. Every order for permission shall be in Form 3 and 6 as the case may be appended to these rules:
2. The mandal authority on receipt of application for drilling new wells in form 2 and 5, as the case may be, will refer the matter simultaneously for feasibility certificate and for power supply to respective agencies in the mandal authority and obtain the required information and dispose of the application on the basis of the reports from Andhra Pradesh Transmission Corporation (APTRANSCO) and the Ground Water Department within 2 weeks. It is the responsibility of officials of APTRANSCO and Ground Water department to submit their reports to mandal authority in prescribed time. Single window approach is followed to help the people.

Provided that, before issuing the permission, the applicant has to pay prescribed amount through a D.D. towards insurance premium, in respect of agricultural wells.

The fee shall be paid through a demand draft drawn in favour of “The Andhra Pradesh Water, Land and Trees Authority Fund” payable at the head quarters of the respective Authority.

Conditions for Grant of Permission

1. The permission for grant of sinking of well under the Andhra Pradesh Water, Land and Trees Act, 2002 shall be subject to the following conditions, namely:-
2. That the sinking of the well should not violate any provisions of the Act.
3. that the Authority reserves its right to take such measures necessary for preservation and control of water including an order for closure of the well; and
4. That the persons sinking the well shall furnish necessary information as and when required by the Authority in such form as may be prescribed and bound by the orders of the Authority with regard to the drawing of water including imposition of condition of hours of drawing of water.

Taking Over of Well to Ensure Drinking Water

1. The Authority may by a general or special order shall authorize the Designated Officer to identify such wells as required to ensure supply of drinking water to local population and shall take over such wells.
2. On identification of the wells, the Designated Officer shall serve or cause to serve an order of requisition on the owner of the well specifying the period of such requisition, the Designated Officer for sufficient reasons may extend such period of requisition.
3. On requisition, the owner of the well shall not draw water for any purpose other than drinking for his own use.
4. If the well so requisitioned is the only source of irrigation and if the owner is solely dependent on agriculture for his livelihood, the owner shall be compensated for the loss of livelihood. The quantum of compensation shall be decided by the District Collector in consultation with the agriculture department based on the crops raised during the same period in the previous three years by the owner utilizing the water from the well.

Construction of Rain Water Harvesting Structures

The construction of the water harvesting structures in all existing and new residential, commercial, public and open areas shall be governed by the guidelines and schemes adopted by the respective urban and local bodies. They shall also be responsible for monitoring execution of the construction in accordance with the design and the scheme. The provisions of section 17 of the Act shall be followed by the Urban and Local bodies.

Registration of Rigs

Every rig owner or an operator operating or desiring to operate in the state of Andhra Pradesh shall register the rig with the Authority by paying the prescribed fee which shall be renewable for every two years. The application shall be made in Form 15 and the permission shall be given by the Authority in Form 16. The rig owners are required to display the Form 16 at all times upon the rig. Failure to register the rig shall be an offence and shall be dealt in accordance with rules.

Water Cess

The Authority may levy a cess on consumption of water and discharge of effluent by any industry, which is not covered under Schedule I of the Water Prevention and Control of Pollution Cess Act, 1977 and the amount of cess shall be as fixed by the Authority from time to time.

Andhra Pradesh Water, Land and Trees Authority Fund

1. Constitution of the Fund : All monies received by the Mandal, District or State Authority shall be credited to the respective Authority. The remittances to the Mandal, District or State Authority shall be made by way of cash or demand draft in a Government account to be operated jointly by Member Secretary and the Chairman of the Authority.
2. Control of the Fund : The Member Secretary of the District or State Authority shall operate the Fund after obtaining the approval of the Chairman.
3. Accounts and Audit:
 - (a) The District and State Authority shall maintain monthly accounts of receipts and expenditure.
 - (b) The Mandal and District Authority shall furnish an abstract of monthly receipts and expenditure to the State Authority in Form 12 appended to these rules.
 - (c) The State Authority shall furnish to the Government a consolidated statement of receipts and expenditure once for every year in Form 12.
4. Budget estimates
 - (a) The District Authority shall on or before the 30th day of September every year prepare annual budget estimate in respect of the ensuing financial year of the estimated income and expenditure and submit to the State Authority, in the format as prescribed in budget manual.
 - (b) The State Authority shall on or before 31st day of October every year prepare annual budget estimate in respect of the ensuing financial year of the estimated income and expenditure and submit to the Government for incorporating in the State budget in the format as prescribed in budget manual.

Tamil Nadu

Tamil Nadu has passed two Acts of which the first one namely the Chennai Metropolitan Area Ground Water (Regulation) Act 1987 was enacted in 1987 and was implemented thereafter. It was amended in November 2002. Its salient features are as below.

- (a) It is exclusively for Chennai city and 302 adjoining revenue villages in the Kancheepuram and Thiruvallur districts. The Act is implemented by Chennai Metropolitan Water Supply and Sewerage Board in Chennai City and by the Collectors of the respective districts for 302 villages.
- (b) Persons proposing to sink a well in the scheduled area will have to apply to the competent authority for permission which may be cancelled if the holder of the permit is found to be violating any of its provisions.
- (c) No person shall extract or use ground water in the scheduled area for any purpose other than domestic use; permit is to be obtained for the extraction of ground water for transport by any means.
- (d) The use of ground water for agriculture is, however, allowed but only from those wells, which were in existence before enforcement of this Act, New wells for agriculture are required to obtain the permit of the authority.

- (e) The competent authority has the powers to refuse permit for the extraction of ground water citing reasons.
- (f) Contravention of the Act by anybody whether individual or a company, would entail a fine of Rs.2000 on first instance. For second and subsequent offences, the fine is Rs.5000 or imprisonment for 6 months.
- (g) The competent authority has powers to break open and enter the property, seal the well and recover the cost of such action from the violator.
- (h) There are prescribed license fees for extraction of ground water for other than domestic purpose ranging from Rs.500 to Rs.5000 for different pump capacities.
- (i) The person aggrieved by an order made under the Act may appeal to such authority as the government may specify in this behalf.
- (j) It is also stipulated that all buildings should have rain water harvesting as prescribed. And water bodies to be used only for storing the water and not for any other purpose.

The second Act passed by Tamil Nadu is Ground Water Development and Management Act, 2003. This Act covers the areas in Tamil Nadu not covered by the Chennai Metropolitan Area Ground Water (Regulation) Act 1887. However, wells used for domestic purposes (extracting device upto 1 HP), wells sunk by state and central agencies for scientific purposes; and wells sunk by small and marginal farmers are exempted from the purview of the Act.

It provides for the constitution of Ground Water Authority which has been given powers to regulate further growth of ground water structures in the state. For this purpose, it can

- Notify areas for development, control and regulation of ground water.
- Monitor the ground water regime in the mining area and may direct the disposal of mined water suitably.
- Lay down or adopt standards for water quality depending on the kinds of water use.
- Alter or amend or cancel terms of certificate of registration, permit or licence.
- Enter upon any premises (including break open the door if the owner or the occupants refuse to comply with) inspect, take specimens and copies of relevant records, serve notice and seize and take possession of any equipments utilized for unauthorized sinking.
- This Act also provides for ground water management by identifying and notifying the suitable areas for conjunctive use of surface water and ground water. According to it, all wells sunk in the state on or after the date of commencement of this Act (including notified and non-notified areas) have to be registered with the authority.
- This Act also provides that electrical energy from Tamil Nadu Electricity Board will not be supplied for energizing the wells sunk in contravention of this Act.

This Act envisages certain restrictions in the notified areas as below.

- Every user of ground water has to obtain 'certificate of registration' from the Authority.
- Sinking of wells without permit from the Authority is prohibited.
- Transportation of ground water without permit is prohibited.
- Carrying on the business of sinking wells without license from the Authority is prohibited.

This Act, however, has not been implemented so far since the government has not constituted the Ground Water Authority which alone is the competent body to enforce the provisions of the Act.

West Bengal

West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005

“The West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005” was enacted with effect from 15th September, 2005. The rules under the said Act were finalized and came into force with effect from 1st August, 2006. This Act envisages: (i) protection of the ground water resource with due consideration to conservation and management, (ii) protection of the resource against quality degradation and (iii) ensuring social equity. The salient features of the Act are discussed below in brief.

This Act applies to the entire State of West Bengal. It has been made mandatory to obtain one time permit from the concerned Authority set up under this Act for sinking of tubewells/wells fitted with electrical/mechanical pumping device for any purpose i.e. for use in public health, irrigation and industrial sector by depositing prescribed fees. The Act does not, however, have any provision in respect of pricing of ground water. This Act also stipulates that all existing tubewells/wells sunk before the enactment shall be registered with the competent authority established under the Act. The registration will, however, be made free of cost.

Implementation Mechanism

1. Two tiers of Authority have been set up under the Act. There is a State Level Authority (SLA) under the administrative control of the Water Investigation and Development Department, Government of West Bengal for formulating policies regarding conservation and management of ground water resources. State Water Investigation Directorate (SWID) has been made the functional organ of the SLA; Director, SWID being the Chairman of the Authority while the Superintending Geologist, SWID will act as the Member Secretary. There are 16 other members in the SLA representing concerned departments of the State Government and Central Government.
2. Under the SLA, one Corporation Level Authority (CLA) having jurisdiction covering the area of Kolkata Municipal Corporation and 18 District Level Authorities (DLA) having jurisdictions over the respective districts have been setup for implementation of the Act.
3. Commissioner, Kolkata Municipal Corporation has been made the Chairman of the CLA of which the Superintending Geologist is the Member Secretary. In the CLA, there are four other official members from concerned departments of the State Government and Central Government and six non-official members appointed by the state government.
4. Geologist, SWID, in the respective district has been made the Member-Secretary of the concerned DLA and office of the Geologist, SWID in the district will act as the secretariat of the DLA, which will be headed by the concerned District Magistrate as Chairman. District level officers of nine concerned departments and two karmadhyakshas of Zila Parishad have been included as other members in the DLA.
5. As per the Act, the DLA and the CLA have been authorized to issue permit/certificate of registration in respect of wells having capacity not exceeding 50 m³/hr and 100 m³/hr respectively within a time bound period. For wells of higher capacity, granting of permit/certificate of registration is to be made only with the concurrence of the SLA.
6. As per the provision of the Act, an applicant can make an appeal to the appropriate authority on payment of prescribed fee against any action on decision of the SLA, or DLA, within a period of sixty days from the date on which such action was taken or

such decision was communicated to him. The appellate authority is to dispose off the appeal as expeditiously as possible after giving the appellant an opportunity of being heard. An officer not below the rank of the Joint Secretary, authorized by the Principal Secretary, Water Investigation and Development Department, Government West Bengal, shall act as Appellate Authority in case of all appeals made in connection with wells having discharge not exceeding 50 m³/hr. The Principal Secretary, Water Investigation and Development Department, Government of West Bengal himself will be the Appellate Authority for all other cases.

7. The Act also provides for imposing penal measure for failing to comply with any of the provisions of the Act or the rules made thereunder, in the matter of construction on use of any well. The penalty shall be in the form of fine up to rupees five thousand in case of first offence and upto rupees ten thousand, for the second and subsequent offence.
8. Implementation of the Act shall follow the policies formulated by the SLA on allocation of the ground water in line with the National Water Policy keeping in view the district wise sectoral demand, status of ground water development and hydro-geological condition to achieve the overall objective of management of ground water resources. The SLA shall monitor the progress of ground water development and accordingly formulate policies on conservation as well as augmentation of ground water resources by way of recharging, replenishing, recycling the resource in coordinated manner, minimizing use of ground water by adopting modern and traditional water harvesting practices and creating mass awareness and organizing people's participation in conservation and management of ground water resources.
9. As per ground water estimate carried out jointly by the State Water Investigation Directorate and the Central Ground Water Board following GEC' 97 Methodology (modified criteria) in 269 blocks of the state, 231 blocks were categorized as 'safe', 28 blocks are 'semi-critical' and 10 blocks as 'critical'. Such categorization is based on twin criteria of (i) stage of ground water availability expressed as percentage and (ii) long-term trend of ground water level. A subsequent review of categorization of the aforesaid 38 'critical' and 'semi-critical' blocks has placed 38 blocks under 'semi-critical' and one block under 'critical' category. 13 mountainous/sub-mountainous blocks of Darjeeling and Jalpaiguri districts having more than 20 percent scope and 59 blocks in the coastal tract having saline ground water environment, which are not considered to have favourable Ground Water regime for large scale ground water development for agricultural activities, have been excluded from this exercise. The aforesaid categorization of the blocks viz 'safe', 'semi-critical', and 'critical' will be the primary consideration for issue of permit for sinking new wells and certificate of registration for the existing wells in the initial phase of implementation of the Act.

It is important to note that although introduction of the Ground Water Act is an effective step towards management, control and regulation of ground water development, successful implementation of such a measure essentially depends on the involvement of the common people. The common people must be made aware of their role in protection of this vital resource. State Water Investigation Directorate contemplates to take up in association with the three-tier Panchayati Raj System in the state, various mass awareness programmes including group discussion, workshops, seminars, etc. to educate the people about different aspects of the Act, present status of both quality and quantity of ground water in their respective areas, the adverse effects of over-exploitation of ground water, health hazards arising out of use of contaminated water, etc. so as to arouse in them a spontaneous spirit of involvement in the process of judicious use of ground water.

Punjab

The Government of Punjab prepared the “Punjab Ground Water Control and Regulation Act, 1998 (Draft)” in line with the Model Bill circulated by Ministry of Water Resources (MoWR), Government of India. The Draft Act was approved by State Level Technical Advisory Committee (TAC) in its 4th meeting held on 19 March, 1998. The approved Draft Act was then circulated to all the members of Punjab State Water Resources Committee (WRC) for comment before putting up to State Water Resources Committee (WRC) for discussion. It was, however, observed that clarification was necessary on the issue of overlapping of functions between the Central Ground Water Authority (CGWA), under the Central enactment, and the proposed SGWA, under the State enactment, which was sought from MoWR, Government of India.

However, the Government of India kept on insisting for enacting the proposed Model Bill by the States. A Draft Bill on the subject matter, as prepared by TAC, was put up before the Punjab State Water Resources Committee (WRC) in its 2nd meeting held on 25 August, 2003 under the Chairmanship of Chief Secretary to Government of Punjab. *The Committee observed that the proposed legislation was harsh on the users. They desired that a system of incentives and disincentives on optimum use of ground water be considered instead of adopting bureaucratic authority as a solution of falling water table. An Expert Group was constituted by the WRC to consider all issues and aspects of ground water use and to prepare an Approach Paper in this regard. (Kuldip Singh Takshi, Groundwater Governance, 2007, p. 246.)*

Punjab Ground Water Control and Regulation Act – 2004 (Draft)

1. This Act is intended to establish a ‘Punjab State Ground Water Authority’ & to take other measures which may be necessary to manage and regulate the use of Ground Water resources in the State. The Act is meant to check continuous over-exploitation of ground water & deteriorating ground water quality by encouraging various measures for conservation of ground water resources and by ensuring their judicious use through various controls and systems of incentives/disincentives in the state.
2. It shall come into force with effect from the date of notification of the Act by the Government in the official gazette.

Establishment of Punjab State Ground Water Authority

1. The Punjab State Ground Water Authority shall consist of the following members:
 - (a) Chairman: Chairman of the Punjab State Ground Water Authority will be Chief Engineer, Water Resources & Irrigation Department, Punjab or State govt. officer of the rank of Head of department well conversant with water management to be appointed by the government.
 - (b) Members not exceeding six representatives of the State Government departments/organisations, which are concerned with studies, exploration, use, management and protection of ground water, to be appointed by the Government including one from Central Ground Water Board, Government of India. One member will act as Member Secretary.
 - (c) Representatives of stake holders (like farmers, local bodies etc.), or NGOs or the Persons, who in the opinion of the Government/Chairman have special knowledge or practical experience in matters relating to ground water can be nominated as special invitees by Government/Chairman.

2. The term of office and the manner of filling the vacancies and other conditions of service of the Chairman and other members shall be in such a manner as may be prescribed by the Government.

Powers to Notify Areas for Control and Regulation of Ground Water Resources

1. The Authority shall function under the overall control of the State Government.
2. If the Authority is of the opinion that it is necessary or expedient in the public interest to control and/or regulate the extraction or the use or both of ground water in any form, in any area, it will advise the Government to declare any such area to be a notified area for the purposes of the Act with effect from such date as may be specified therein. This declaration will be notified in the official gazette.

Provided that the date so specified in the notification shall not be earlier than three months from the date of publication of the said notification.

3. Every such notification shall, in addition to its publication in the official gazette, be published in not less than one daily Punjabi language newspaper having wide circulation in the state and all or any of the following modes may be followed in affecting such services, namely
 - (a) by affixing a copy of the notification at some conspicuous part of the offices of the village panchayats located in the said area;
 - (b) by proclaiming by beat of drum or by means of loudspeakers the contents of the notification in the said area;
 - (c) in such other manner as may be prescribed by Government.
4. If in the opinion of the Authority, the availability of the ground water has improved in a notified area, it may advise the State to de-notify such area and the State may do so according to the procedure similar to the one, prescribed above for notifying the area.

Grant of Permit to Extract and Use Ground Water in the Notified Area

1. Any user of ground water (as defined under section 2, sub-section vii) desiring to sink a new well in the notified area for any purpose either on personal or community basis, shall apply to the Authority for grant of a permit for this purpose (except for wells sunk by the authorized officials of the State or Central Governments for carrying out scientific investigations, exploration, development or management work for the survey and assessment of ground water resources or for providing water for drinking purpose) and shall not proceed with any activity connected with such sinking unless a permit has been granted by the Authority.

Provided that the person or persons will not have to obtain a permit if the well is proposed to be fitted with a hand operated manual pump or water is proposed to be withdrawn by manual devices.

2. Every application under sub-section (i) shall be made in prescribed form and shall contain such particulars as may be prescribed by the Authority.
3. On receipt of an application under sub-section (i), if the Authority is satisfied that it shall not be against public interest to do so, it may grant, subject to such conditions and restrictions as may be specified, a permit authorizing the extraction and use of water.

Provided that no person shall be refused a permit unless he has been given an opportunity of being heard.

4. The decision regarding the grant or refusal of the permit shall be intimated by the Authority to the applicant within a period of ninety days from the receipt of application.
5. In granting or refusing a permit under sub-section (iii) the Authority shall have regard to:
 - (a) the purpose or purposes for which water is used;
 - (b) the existence of other competitive users;
 - (c) the availability of water;
 - (d) spacing of ground water structures keeping in consideration the purpose for which water is to be used;
 - (e) quality of ground water with reference to use;
 - (f) long term ground water level behaviour; and
 - (g) any other factor relevant thereto.

Registration of Existing Users in Notified Areas

1. Every existing user of ground water in the notified area shall within a period of one hundred twenty days from the date of establishment of the Authority by the Government, will apply to the Authority for the grant of a certificate of registration recognizing its existing use in such prescribed form by depositing prescribed fee and in such a manner as may be prescribed by the Authority from time to time.

Provided that the Authority may entertain any such application after the expiry of the said period of one hundred twenty days, if it is satisfied that the user was prevented by sufficient cause from filing application in time.

2. On receipt of an application under sub-section (i) if the Authority is satisfied that it shall not be against the public interest to do so, it may grant, subject to such conditions and restrictions as may be specified, a certificate of registration authorizing the continued use of water.
3. The decision regarding the grant or refusal of the certificate of registration shall be intimated by the Authority to the applicant within a period of ninety days from the date of receipt of application.
4. In granting or refusing a certificate of registration under sub-section (iii), the Authority shall have regard to:
 - (a) the purpose or purposes for which water is to be used;
 - (b) the existence of other competitive users;
 - (c) the availability of water;
 - (d) quality of ground water with reference to use;
 - (e) spacing of ground water structures keeping in consideration the purpose for which water is to be used;
 - (f) long term ground water level behaviour; and
 - (g) any other factor relevant thereto.

Incentive/Disincentive in Notified Areas

To arrest over exploitation of ground water resources in the notified area, the government may enforce any scheme of incentive/disincentive to ensure judicious use of water and

additional ground water recharging in the notified areas. These schemes may include (but not restricted to the following):

1. Government may levy additional water rates for use of ground water resources in the notified areas.
2. Government may withdraw electricity subsidy on tubewells/other water extraction devices in the notified areas/or whole of the state.
3. Government may give some incentives for crop diversification or for other water saving methods.
4. Government may amend building by-laws to promote roof top rain water harvesting in the whole of the state or in the notified areas as may be considered necessary.

Validity of Permit

Permit shall be valid for a period of one year and after that it will have to be renewed on submission of fresh application to the Authority.

Powers of the Punjab State Ground Water Authority

1. The Authority or any person authorised by it in writing in its behalf shall have powers:
 - (a) to enter on any property (private or government owned) with the right to investigate and make any measurements concerning the land or the water extraction device located;
 - (b) to inspect the well which has been sunk or is being sunk;
 - (c) to take specimens of such soils or other materials or of water extracted from such wells;
 - (d) to direct by order in writing the persons sinking a well to keep and preserve in the prescribed manner specimens of soils or any material excavated there from such period not exceeding ninety days from the date of completion or abandonment of the works as may be specified by the Authority and thereupon such person shall comply with such directions;
 - (e) to inspect and to take copies of the relevant record or documents and ask any question necessary for obtaining any information such as diameter or depth of the well which is being or has been sunk; the level at which water is or was struck and subsequently restored/rested, the types of strata encountered in the sinking of the well and the quality of the water struck etc.;
 - (f) to direct the user of ground water to install water measuring devices on any water supply when necessary to properly administer the water or where there is a reason to believe that the user does not comply with the provisions contained in this Act;

Provided that where the user of ground water does not comply with the directions issued to him within a period of thirty days, the Authority may itself install such water measuring devices and recover the cost from the defaulter.

- (g) to seize any equipment/device utilized for illegal sinking and to destroy the work executed fully or partly after issuing a show cause notice;
- (h) to direct any user of ground water who does not comply with the provisions of this Act and rules framed thereunder to close down any water supply or destroy any hydraulic work found to be illegal according to the provisions of this Act and the rules framed thereunder;

Provided that where the user of ground water does not comply with the direction issued to him within a period of sixty days, the Authority may itself carryout the necessary work and recover the cost from the defaulter.

- (i) to enter and search with such assistance, if any.

Gujarat

On 19th November, 2001, the Government of Gujarat by an administrative order constituted **Gujarat State Ground Water Authority** under the administrative control of Narmada Water Resources & Water Supply Department to oversee management, development and regulation of ground water resources in the state. The **Gujarat State Ground Water Authority** consist of the following:

SR. No.	Designation of the Officer	Designation in GW Authority
1	Secretary (Water Resources), Narmada Water Resources & Water Supply Department, Gandhinagar	Chairman
2	Chief Engineer (Medium & Minor Irrigation) & Additional Secretary, Narmada Water Resources & Water Supply Department, Gandhinagar	Member
3	Chief Engineer (Panchayat) & Additional Secretary, Narmada Water Resources & Water Supply Department, Gandhinagar	Member
4	Member Secretary, Gujarat Water Supply & Sewerage Board, Gandhinagar	Member
5	Director of Agriculture, Gujarat State, Gandhinagar	Member
6	Financial Adviser (Saurashtra and Command Area Development), Narmada Water Resources & Water Supply Department, Gandhinagar	Member
7	Superintending Engineer, Ground Water Management Investigation Circle, Narmada Water Resources & Water Supply Department, Gandhinagar	Member
8	Superintending Engineer, Ground Water Management Mechanical Circle, Gujarat Water Resources Development Corporation Limited, Ahmedabad	Member
9	Superintending Engineer, Ground Water Management Circle, Gujarat Water Resources Development Corporation Limited, Mehsana	Member
10	Superintending Engineer, Ground Water Management Circle, Gujarat Water Resources Development Corporation Limited, Vadodara	Member
11	Managing Director, Gujarat Water Resources Development Corporation Limited, Gandhinagar	Member Secretary

The Headquarters of Gujarat State Ground Water Authority is located at STATE WATER DATA CENTER of Narmada Water Resources & Water Supply Department, SECTOR-8, Gandhinagar.

Delhi

The regulatory function in Delhi has been performed directly by Central Ground Water Authority. However, there is a proposal to have a state law on the pattern of the Model Bill. The Delhi Jal Board which is in charge of water supply in the capital has made a proposal, a copy of which was handed over to the study team.

In Delhi, no separate Ground Water Authority is proposed to be instituted. But the existing, Delhi Water Board Act, 1998 is proposed to be amended by inserting the words “regulation, control and development” after the words “water supply” and before the words “sewerage and sewage” excluding areas under New Delhi Municipal Council and Delhi Cantonment Board.

Under the Act, the Delhi Jal Board (DJB) will perform the function of regulation, control and development of ground water in Delhi, through the same board constituted in 1998.

Under the proposed amendment, the DJB is to be empowered to do the following

- notify areas for regulation and control of ground water;
- denotify areas where ground water availability position has improved because of control measures;
- give permission for extraction and use of ground water in notified areas;
- register existing users in notified areas;
- register users of new wells in non-notified areas;
- register drilling agencies;
- act or amend or vary terms of permit; and
- cancel permit or certificate of registration and various other functions as indicated in the Models Bill circulated by Government of India.

USA

Private ownership of ground water used to be in vogue in many countries including the USA. But due to ever increasing scarcity of ground water, a growing distinction is now being made between the concept of ownership and right to use. Ownership does not automatically convey the right to pollute or over-exploit ground water. There are two laws for the protection of ground water in United States namely The Clean Water Act (1972, 1987) which authorizes the US Environmental Protection Agency (EPA) to protect all water resources, and the Safe Drinking Water Act (1974, 1986), which sets minimum drinking water standards and establishes special protective statues for sole source aquifers. It is noteworthy that both of these impose restrictions because of environmental reasons. (R.C. Purohit et. al, Groundwater Governance, 2007, p.357-58)

Ground water is a state subject in USA. Hence, there are vaiations in regulations from state to state. Faced with the problem of ground water depletion, several states have been imposing restrictions on use of ground water thereby treating it as an item in public domain. For this, they receive support from laws related to environment. Examples from three states are given below.

In order to reduce areas irrigated with ground water, the State of Colorado decommissioned 1000 irrigation wells by force and Idaho purchased water rights from irrigators and closed 2000 wells where pumping from increased depths became so expensive that irrigators were more or less ready to have their operations bought out, of course, it cost millions of dollars of tax payers money to buy water rights back that the state gave away for free.

In California, 19 out of the 431 ground water basins are managed with some restrictions on pumping. In the rest 412, ground water management is passive involving federal grants to build infrastructure to import surface water and supply it to ground water users in lieu of pumping.

In Arizona, over exploitation and falling water levels are addressed by legislation that mandates balancing abstraction with recharge but it is not clear that targets will be met. On the whole, the institutional and regulatory action to improve water governance may not have solved the problem to the desired extent.

Oman

Being an arid country, Oman is faced with ground water scarcity. This has forced it to adopt regulatory measures to control demand for ground water. The measures include obligatory registration of all wells, introduction of well permits, prohibition of wells at less than 3.5 km from the mother well of a 'falaj', filling up of illegally constructed wells, confiscation of drilling contractor's equipment involved in illegal drilling, a national well inventory, well-

* A major part of the information presented in this appendix has been derived from Report of the Experts Group on Ground Water Management and Ownership, Planning Commission, September, 2007, pp. 37-39. Referencs from other sources are indicated at the respective places.

metering, well-field protection zoning, water treatment, leakage control, improving irrigation techniques and public awareness campaigns for water conservation. It has also adopted supply side measures like large recharge dams (both for flood control and ground water recharge). Treated waste-water is also reused in lieu of ground water pumping in the Muscat area for watering municipal parks, gardens and roadsides. Public water supply in this capital area depends mainly on desalinated sea water. The combination of these measures has proved to be helpful in controlling over exploitation of ground water.

Spain

Like many parts of the world, Spain too had private property rights over ground water resources. However, it passed the Water Act in 1985 which changed the rules of the game. Ground water was taken from the private to the public domain. River Basin Management Agencies were given a role in managing ground water including power to grant permits for ground water use that started after 1985. It also gave authority to the river basin agencies to declare an aquifer as over exploited, and thereafter, to formulate an aquifer management plan for recovery of that aquifer. Such a plan can include reduction in volume of withdrawals or rejection of new applications for wells. In addition, all users of aquifers were required to organize themselves into ground water user associations in order to encourage user participation. By 2006 some 16 aquifers have been declared totally or partly over exploited, while such user associations have been formed in only in five and implemented in only two aquifer areas. Further amendments to that Act were made in 1999 and 2001 which emphasized the role of the ground water users in aquifer management.

But the success achieved has been quite limited. For one, even after more than 15 years, recording of ground water rights still remain incomplete, and less than a quarter of all ground water structures have been registered. Thus, Spain, with 0.5 million wells is still grappling with the most basic issue of identifying and recording ground water users. Given Spain's long tradition of successful surface-water users' associations (some in Valencia are centuries old), the new water law has emphasized the formation of ground water users' associations particularly for management of over exploited aquifers. While thousands of small ground water users' associations have been formed, the majority of them are geared towards 'collective management of the irrigation network', and only a handful have a larger mandate of 'collective management of aquifers' and of these not all are success cases. Thus, even in Spain, which has relatively fewer wells, small aquifers and lesser direct dependence on ground water irrigation, but stronger farmers' lobbies than South Asia, the implementation of various clauses of ground water legislation has proved to be very difficult. Studies show that most Ground Water Users Associations in Spain are defunct and the water law widely bypassed.

Mexico

Mexico has reformed its water laws quite extensively since 1992. Water was declared as a national property by the law of the Nation's Waters of 1992 and it became mandatory for existing users to legitimize their rights through procuring water concessions. The National Water Commission was entrusted with the responsibility of registering water users associations, set up a regulatory structure to enforce and monitor the concessions granted and also to collect a volumetric fee from all users, except small scale irrigators. Aquifers Management Councils were promoted by the National Water Commissions as user organization aimed at managing ground water.

Response to the reforms so far has been mixed. The large industrial and commercial water users have been quick to apply for concession and pay for water fees. However, the real challenge has been one of registering water rights of the agricultural users, who withdraw at least 80 percent of total volumes withdrawn, and monitor their withdrawals. Among the agricultural users, the tube-well owners have responded to the law quite positively and have applied for water concessions. The major reason for such compliance has been the 'carrot' of subsidized electricity that has been promised to tube-well owners who regularize their connection through registration of the wells with the the National Water commission. This shows that farmers respond well to direct economic incentives. Monitoring of actual extraction has, however, proved to be more intractable.

Mexico, even with an ambitious water law is still grappling with the basic issues such as registering wells and issuing water permits. Recently, a move to withdraw unused portion of water quotas seems to have encouraged farmers to pump more ground water than they would otherwise have, lest they lose their quotas. This merely shows that passing of laws and executing administrative barriers is not likely to work unless social and economic realities are taken into consideration.

Other Countries

In some countries such as Indonesia, Australia and Peru, ground water is considered as a public good, either through legal tradition or through the suppression of private ownership rights and the transfer of the resource to the public domain. (Jivesh A. Tambi, p.386). In Thailand, a ground water law was enacted in 1977 to bring ground water activities within designated ground water areas under government control. Implementation is mainly in areas where ground water resources are particularly critical and are threatened by over-exploitation and pollution. Directives issued under the provision of the Act includes, specifications for drilling and well construction, methods of water extraction and conservation, technical measures for pollution control, drinking water standards and technical principles for subsurface disposal of liquids. Penalties for violations include fines, imprisonment and confiscation of equipment. A policy has been adopted of not granting permission to construct new wells in areas where there is an adequate public water supply. Strict controls on ground water use are applied in critical zones. (R.C. Purohit et. al, p.358)

Lessons from International Experience

According to the Report of the Expert Group on Ground Water Management and Ownership, "Spain & Mexico reformed their water laws to make ground water a national property. However, their success in getting water rights of agricultural users registered has been insignificant. If Spain with 0.5 million wells and Mexico with 0.09 million wells find it difficult to enforce the new water law, the situation in India with 198 million wells can be imagined should we also declare ground water a government property. The US experience of buying out ground water rights and supplying surface water by trans-basin diversions has huge cost implications which we may not be able to afford. The strategy adopted by Oman of deftly combining demand side measures to control, protect and conserve water resources with supply side measures to augment the resources has the potential for successful replication in India". (Planning Commission, Report of the Expert Group on Ground Water Management and Ownership, 2007, p. 39).

It might, however, also be said that India has an elaborate administrative structure going down to block and even lower level with adequate availability of technical personnel also. Moreover, India has a constitutionally sanctioned and functional participatory mechanism at village, block and district level. India, therefore, has the potential to tackle the problem if a coordinated machinery involving both technocratic cum bureaucratic and participatory mechanisms is evolved. An attempt has been made in this report to provide a brief outline of such an institutional framework.

Chapter - IV

Existing Institutional Framework and its Effectiveness

Measures taken to regulate ground water through licenses, credit or electricity restrictions work ultimately through some institutions. Institutional framework, therefore, plays a key role in the operationalization of the legal or regulatory set up. Hence an outline of the institutional framework related to groundwater governance would be an useful background information. This is briefly described below.

4.1 National Level

National Water Resources Council formed in March 1983 by Government of India is the apex body for water resources in India. But it is not a statutory body. The Prime Minister is the Chairman, Union Minister for Water Resources is the Vice-Chairman and a few concerned Union Ministers and all the Chief Ministers of States are its Members. Secretary Ministry of Water Resources is the Secretary of the Council. The functions of the Council are to (1) lay down the national water policy and review it from time to time, (2) to advise on the modalities of resolving inter-state differences related to water, (3) to consider and review major water development plans submitted to it, (4) to make such other recommendations as would foster expeditious and environmentally sound and economical development of water resources etc. The council is supposed to meet at least once in a year, but in actual practice it has held very few meetings. It is yet to establish itself as an effective body. Whether making it a statutory body will make it more effective is an open question.

National Water Board was constituted in September, 1990 by Government of India. Secretary of the Ministry Of Water Resources, Government of India is its chairman while secretaries of concerned Union Ministries and Chief Secretaries of States are its Members. Its functions are to review the programme of implementation of the National Water Policy and report to the National Water Resources Council and to take up several other specified matters related to development and management of water resources. The Board has held meetings at frequent intervals and has served as a useful forum for Centre-State discussions at the senior officers level. However, despite the overriding importance of ground water in india, issues related to ground water regulation and development have seldom been referred to this body.

The Ministry of Water Resources formerly (before September, 1985) designated as Ministry of Irrigation, is the nodal ministry in the Government of India for water resources. Its current mandate in the Allocation of Business is “development, conservation and management of water as a national resource; overall national perspective of water planning and coordination in relation to diverse uses of water”. The Ministry is responsible for laying down policies and programmes for development and regulation of country’s water resources including surface and ground water. This Ministry plays the role of co-ordination, synthesis and monitoring country-wide irrigation development and flood management. It plays a catalytic role in the above respects even though water is usually treated as state subject. The Ministry also helps the Planning Commission in the formulation, monitoring and review of Annual and Five Year Plans of the States in the water sector.

The functions with respect to ground water are carried out with the assistance provided by Central Ground Water Board having its office in Faridabad. The Union Ministry also has a

small ground water wing headed by a Commissioner rank officer who works under the Secretary of the Ministry. The following are among the functions assigned to this wing.

- Procurement of equipment/machinery including release of foreign exchange.
- Budget (Plan & Non-Plan of the Central Ground Water Board).
- Bilateral projects to be taken up by the Board.
- Formulation of new Plan proposals.
- Parliament Questions on Central Ground Water Board/Authority (excluding service matters).
- Finalization/ implementation of the Programme of the Board.
- Monitoring various Reports received from the Board on drilling/survey activities.

The Ministry of Rural Development looks after drinking water in rural areas while the **Ministry of Urban Development** looks after the same in urban areas. **The Ministry of Environment and Forests** looks after environmental aspects of management and development of water resources. **The Ministry of Agriculture** plays an important role in irrigation management, and allied issues directly or indirectly connected with development, utilisation and preservation of water-resources. This Ministry has full responsibility for micro irrigation comprising of drip and sprinkler irrigation.

The Central Ground Water Board which was set up in 1954 and restructured in 1972 is an apex body at the national level responsible for investigation, exploration, assessment and rendering technical advice for development and management of ground water resources in India.

The Central Ground Water Board's mandate is to develop and disseminate technologies and monitor and implement policies for the scientific and sustainable development and management of country's ground water resources including their exploration, assessment, conservation, augmentation, protection from pollution and distribution based on principles of economic and ecological efficiency and equity. The Board carries out the following activities:-

- Systematic hydrogeological surveys.
- District Ground Water Management Studies.
- Ground Water exploration aided by drilling.
- Monitoring of national hydrograph observation wells.
- Water Supply investigations.
- Periodic assessment of ground water resources.
- Publication of maps and reports.
- Scientific source findings for drought affected states under the National Drinking Water Mission.
- Construction of deposit wells.
- Hydro-Chemical and geophysical studies.
- Hydrogeological and hydrometeorological studies.
- Remote sensing studies.
- Pollution studies.
- Mathematical modelling studies.
- Data storage and retrieval.
- Water balance studies.
- Artificial recharge studies.
- Studies on conjunctive use of ground water and surface water.
- Training activities related to ground water.
- Reviewing regulation of ground water development

- Rain water harvesting and artificial recharge of ground water

The office of the Board is located in Faridabad in Haryana (near Delhi) with a small office in Central Delhi. But it has regional offices in different parts of the country which look after specific states and UTs. The regional offices coordinate with the concerned state governments, develop and maintain data observation centres within the concerned states, collect ground water data from these centres and keep the central office informed of significant developments within the area of their jurisdiction. They also assist the Central Ground Water Authority by supplying data on over exploited areas etc.

The Central Ground Water Authority

In 1997, a new organisation, namely Central Ground Water Authority was constituted under sub-section (3) of the Environment (Protection) Act, 1986 vide notification no. S.O. 38 (E) dated 14th January, 1997 and subsequent amendments, for the purpose of regulation and control of ground water development and management in the country. The Authority has been given necessary powers for issuing directions and resorting to penal provisions. The Authority is supposed to play a key role in regulation and control of development of ground water in over exploited areas to protect the quantitative as well as qualitative aspects of ground water availability.

The Central Ground Water Authority was constituted by the Government of India in response to the order of the Supreme Court. The first notification issued in this respect on 14th January, 1997 resulted in the constitution of the authority with Chairman and Members of the Central Ground Water Board. This gave a wrong signal that the Central Ground Water Authority was an appendage of the Central Ground Water Board. The misunderstanding once created has persisted ever since then. The above was for one year only. Later on by notification dated 13th January, 1998 the term of the Authority was extended for four more years. Thereafter, by notification issued on 5th January, 1999, the Regional Director, or a similar rank officer in Central Ground Water Board was appointed Member Secretary. In a subsequent notification on 6th November, 2000 the Authority was reconstituted with the following as Members :-

1.	Chairman, Central Ground Water Board	Chairman
2.	Member, Central Ground Water Board	Member
3.	Member, Central Ground Water Board	Member
4.	Member, Central Ground Water Board	Member
5.	Member, Central Ground Water Board	Member
6.	Joint Secretary (Admn.), Ministry of Water Resources	Member
7.	Joint Secretary & Financial Adviser, Ministry of Water Resources	Member
8.	Joint Secretary, Ministry of Environment & Forests	Member
9.	Chief Engineer, Irrigation Management Organisation (Water, Planning and Projects), Central Water Commission	Member
10.	Director/General Manager (Exploration) Oil and Natural Gas Corporation Ltd.	Member

Member Secretary of the CGWB functions as Member Secretary of CGWA. As a result of the dominance of CGWB members and non-interest by other members, **the CGWA continues to be regarded as an appendage of CGWB.** The Authority was also given powers to invite from time to time the following as special invitees as and when required.

1. Joint Secretary (Soil and Water Conservation), Department of Agriculture and Co-operation.
2. Joint Secretary (Water Supply), Ministry of Urban Development.

3. Joint Secretary (Department of Drinking Water Supply), Ministry of Rural Development.
4. Director, National Institute of Hydrology, Roorkee.
5. Director, National Geo-physical Research Institute, Hyderabad.

Other Institutions

For the protection of Coastal Environment in India, including ground water resources, a Coastal Regulation Zone Notification (CRZ), 1991 has been issued. National Coastal Zone Management Authority and State Coastal Management Authorities, constituted under Environment Protection Act (1986) are other legal institutions for overall protection of coastal environment including ground water.

4.2 State Level Institutions

Water being a State subject, the State Governments have primary responsibility for use and control of this resource. The administrative control and responsibility for development of water including ground water rests with the concerned State Departments and Corporations. Major and medium irrigation is handled by the irrigation/water resources departments. Department of Irrigation (Water Resources) is responsible for the enforcement and implementation of the irrigation Acts within the respective States and exercises administrative control over all irrigation projects including major irrigation, minor irrigation and irrigation through ground water resources such as tubewells etc. It also prepares plans and schemes for irrigation and flood control. In some states, minor irrigation works, however, are looked after by Agriculture or other departments. Minor irrigation is looked after partly by water resources departments, minor irrigation corporations, Zilla Parishads/Panchayats and by the other departments such as agriculture. Urban water supply is generally the responsibility of urban development and panchayats take care of rural water supply. Government tubewells are constructed and managed by the irrigation/water resources department or by tubewell corporations set up for the purpose. The concerned state department has its offices at district and in some states even at still lower levels like sub-division, taluka, block or mandal.

In some states departments other than the water resources department are also involved in management of ground water. For example in Andhra Pradesh 4 Govt. agencies are involved in supplying ground water for different purposes namely rural water supply, ground water department, irrigation department and A.P. State Industrial Development Corporation. Revenue Department is also involved for registration of existing ground water structures. However, only ground water department is concerned with exploration, controlling and regulating development of ground water. Similarly, in Punjab, 4 Departments of state government are involved in ground water namely Agriculture, Punjab State Water Supply & Sanitation, Irrigation & Punjab State Tubewell Corporation. However, only Irrigation & Agriculture Departments are involved in exploration & control and regulation of ground water development. In West Bengal the departments involved are Water Resources Development Department, Public Health Engineering Department, and Zila Parishad working under Panchayati Raj Department. In Gujarat, two agencies are involved viz Narmada Water Resources Water Supply and Kalpsar Department and Gujarat Water Supply and Sewerage Board. Of these, the first one is the major one. However, in Tamilnadu and Delhi only one department was involved in ground water administration in these states.

In states having several agencies involved in ground water management, there is sometimes a coordination committee between these agencies at the state level as in Andhra Pradesh and Punjab. But coordination is usually quite weak. While in Andhra Pradesh, the meetings of the coordination committees were held at quarterly intervals, in Punjab and West Bengal, there

was no specified schedule for such meetings. In Gujarat, there was no system of coordination between the two agencies. In most states, there was no coordination at the district or lower levels. It may, however, be mentioned that in the states which have established Ground Water Authorities whether through an Act or through administrative order as in the case of Gujarat, some coordination takes place in an indirect manner since representatives of the concerned departments are members of the Authorities in their respective states. However, in the case of Andhra Pradesh coordination committee functions even at the district and mandal levels and their meetings are held at quarterly intervals.

Thus a multiplicity of agencies deal with ground water with degree of coordination among them varying from state to state. But, in general, the ground water department/directorate/division/corporation of the state government has a major role to perform.

The government was perceived by households to be the major agency for formulating laws/rules pertaining to the regulation of ground water use. This was reported from Andhra Pradesh, Delhi and West Bengal while in states like, Gujarat, Punjab and Tamilnadu, Panchayats were also perceived to frame rules for groundwater governance. In Punjab & Tamil Nadu Municipalities also formulated rules in this regard. In 56 percent cases, the government formulated laws/rules to regulate the use of ground water.

Table 4.1 : Agency involved in Formulation of Laws/Rules/Procedures to Regulate Use of Ground Water as reported by Households

(No. of HHs reporting)

Agencies	Andhra Pradesh		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal		All India		Total
	U	R	U	R	U	R	U	R	U	R	U	R	U	R	
Government	7	12	20	38	0	0	0	0	0	0	8	15	35	65	100
Panchayat	0	7		0	0	9	0	9	0	20	0	5	0	50	50
Local Resident	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Customary Practices	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal Corp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipality	5	0	0	0	1	0	8	0	10	0	4	0	28	0	28

Source : Household Schedule

4.3 Local Level Institutions

The block level administration along with Panchayats are perceived to play some role in regulation of ground water use as can be seen from responses in the villages and towns tabulated below. Water supply department has also a role in regulation of drinking water supply.

Table 4.2 : Officials Empowered to Regulate Use of Ground Water

(No. of villages/towns reporting)

Agency	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Panchayat	8	-	6	6	8	6
Block	-	-	-	-	-	-
Water Supply Department	-	8	2	2	-	2

Source : Village Schedule

Tables 4.3 and 4.4 provide information on officials empowered to check unauthorized installations at village/town level. A majority of villages/towns (34 out of 48) mentioned that there were no officials to check unauthorized installations. However, 14 village level respondents have mentioned the names of the officials empowered to check unauthorized installations. These included Panchayat Secretary, Municipality, CGWA (in the case of Delhi) and PHED.

Table 4.3 : Officials Empowered to Check Unauthorized Installation

Response	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Yes	5	5	-	1	-	3
No	3	3	8	7	8	5

Source : Village Schedule

Table 4.4 : Name of the Official Empowered to Check Unauthorized Installation

Response	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Name of officials	Panchayat Secretary	CGWA (DJB)	-	Municipality	-	PHED Municipality Panchayat

Source : Village Schedule

Grievance Redressal Mechanism at Grass Root Level

The Ground Water Act of West Bengal provides for setting up of a grievance redressal machinery at the level of the district and down below for resolution of conflicts among stakeholders of ground water. However, the district is yet to take a step in that direction. But in sample villages/towns, the local authorities have resorted to such a system. This was reported by all the 90 households (urban and rural) from West Bengal contacted during the field survey. Reverse is the case in Andhra Pradesh where the state Act does not seem to have made a provision for conflict redressal but the district authorities have aptly adopted such a measure. The grievance redressal mechanism is reported to be monitored by the mandal revenue officers as well as rural water supply department and the system is also effectively working. In this state, all the households (urban and rural) surveyed reported that such a system of grievance redressal mechanism is in place in their areas. But, in other states, excluding West Bengal no such system exists as reported by state level ground water authorities of the concerned states. Chittoor in Andhra Pradesh is the only district in the sample which has made such an arrangement. But, local level authorities in all the states, except in the state of Tamil Nadu, seem to have made some adhoc arrangements for grievance redressal as can be seen from table 4.5 based on responses from households. About 63 percent of respondent households have acknowledged the existence of a grievance redressal system at local level. The remaining 37 percent households who reported not having access to such a system, felt the need to have one in place to get local problems sorted out at their end. The distribution of households reporting such a mechanism in place is given in table 4.5.

Table 4.5 : Grievance Redressal Mechanism*(No. of HHs reporting)*

Response	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	Total
Yes	90	37	60	62	1	90	340 (63%)
No	-	53	30	28	89	-	200 (37%)
Very effective	-	1	11	17	-	10	39 (11%)
Effective	64	28	49	45	-	64	250 (74%)
Not so much	26	8	-	-	1	16	51 (15%)

Source : Household Schedule

4.4 Credit and Power Distribution Institutions

Regulation of ground water extraction or expansion is also exercised through institutional credit and supply of power. The instrument of credit becomes operative if farmers apply for a loan from a bank or other financial institutions for meeting the cost of installation of tubewells/borewells. The National Bank for Agriculture and Rural Development (NABARD) which provides guidelines as well as refinance to banks and other financial institutions on credit for rural areas occupies an important place in this respect. NABARD with its headquarter in Mumbai has a separate department which looks after this aspect. The functioning of this institution is being discussed separately in this report (See Chapter VII).

Availability of electricity is another key instrument which influences the installation and operation of ground water structures. This is a much more potent instrument than credit since it affects even those structures which are not dependent on credit. The cheap or free availability of power has been a major factor in the phenomenal growth of tubewells/borewells in India. Electricity in each state is provided by State Electricity Boards which are State Public Sector Undertakings and are, therefore, subject to respective state policies. Besides, there is a national agency namely Rural Electrification Corporation (REC), a central Public Sector undertaking which has also played a very important role in terms of financing to State Electricity Boards for several schemes in operation. Electricity as an instrument of regulation of ground water is being discussed separately in this report.

4.5 Ineffectiveness of Legal and Institutional Framework

The legal and institutional framework as outlined in earlier sections of this chapter has proved to be grossly inadequate to tackle the trend towards over-exploitation of ground water in the country. The Central Ground Water Authority came into existence in January, 1997. More than ten years are over but there has been no reversal of the trend towards increase in number of over-exploited, critical and semi-critical areas. Far from that, their number has been increasing. Based on 1984 methodology, there were 7063 assessment units in 1995 of which 3 percent were categorized as dark and 4 percent over-exploited. But in 2004 out of the 5723 assessment units, 15 percent were categorized as over-exploited, 4 percent as critical and 10 percent as semi-critical by CGWB based on the latest 1997 methodology. “Even though the 2004 estimates are not strictly comparable with the 1995 estimates, they clearly indicate a deterioration, as the differences between the two estimates are too large to be explained by the minor differences in the classification methodology used in the two estimates. The percentage of over-exploited blocks, has increased from 4 percent to 15 percent, making over exploitation of ground water a matter of concern.” (Planning Commission, Report of the Expert Committee, 2007, p.8)

The enactment of ground water legislation by some of the states has also produced little impact in the respective states as can be seen from the information given in table below. In

response to our question, Gujarat, no doubt, stated that water level had increased but during discussions of the Principal Investigator with state officials, it turned out that there were other factors like increased rainfall that had taken place in Gujarat in recent years as well as effect of the Narmada water reaching Gujarat.

Table 4.6 : Number of Blocks declared for Notification and their Impact on Water Level

State	No. of Blocks	Impact
Andhra Pradesh	-	-
Delhi	2	Decreased
Gujarat	57	Increased
Punjab	93	Decreased
Tamil Nadu	-	-
West Bengal	02	Remained the same

Source : State Schedule

The institutional mechanism has been considered inadequate by the state governments themselves as can be seen from their replies to a specific question in this connection mentioned in table below.

Table 4.7 : Adequacy of Existing Institutional Framework to Regulate Ground Water Management in Vulnerable Areas?

Yes	No	No response
-	Andhra Pradesh, Delhi, Gujarat, Punjab, Tamil Nadu	West Bengal

Source: State Schedule

A similar picture emerges through a review of information obtained through village/town schedules as can be seen from the tables given below. Very few states have reported existence of a system to check illegal motorized domestic connection (Table 4.8). All the motorized domestic connections have been in place without permission (Table 4.9). It could be that many of the tubewells might have been installed earlier to the imposition of ban on development of new sources. But it would be difficult to say that no such tubewell were constructed since 1998 when CGWA came into being. Table 4.10 to 4.14 more or less support the above findings.

Table 4.8 : System to Check Illegal Motorized Domestic Connection

Response	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Yes	-	2	-	4	-	1	7
No	8	6	8	4	7	1	34

Source : Village Schedule

Table 4.9 : Status of Permission for Domestic Motorized Connection

States	Total No. of Domestic Motorized Connection	No. of Motorized Connection taken Permission
Andhra Pradesh	224	Nil
Delhi	50	Nil
Gujarat	90	Nil
Punjab	1125	Nil
Tamil Nadu	259	Nil
West Bengal	314	Nil

Source : Village/Town Schedule

Table 4.10 : Necessity to take Permission for Abstraction of Ground Water in Notified Areas

Responses	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Yes	7	5	-	-	-	-
No	-	2	-	8	8	-

Source : Village/Town Schedule

Table 4.11 : Status of Registration of Tubewells in the Villages

Responses	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Yes	6	1	-	-	-	1
No	1	7	7	8	8	7

Source : Village/Town Schedule

Table 4.12 : Reasons for not Registering Tubewells

Reasons	State					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Lack of awareness & negligence	6	2	-	-	2	-
No such rules	1	1	8	8	2	1
Rule not implemented	1	1	-	-	4	-
No need to Register	-	-	-	-	-	6

Source : Village/Town Schedule

Table 4.13 : System to Check Unauthorized Sinking of Wells/Tubewells

Responses	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Yes	4	3	-	-	-	3
No	4	5	8	8	8	5

Source : Village/Town Schedule

The above situation gets confirmed through replies to household schedule by farmers.

Table 4.14 : Awareness and Readiness of People for Registration of Ground Water Structure

Response	People Aware of and Ready for Registration of Ground Water Structure
Yes	88
No	140

Source : Household Schedule

The situation with respect to registration of tubewells/borewells turns out to be quite bleak. Only 228 out of 540 respondents replied to this question of which only 88 mentioned that they have got their water structure registered whereas 140 or a majority did not come forward for registration. It may also be inferred that those who did not come forward for registration did not respond to this question. In other words, 452 respondents out of 540 or 84 percent did not come forward for registration. Analysing the data further it appears that all the 88 respondents who responded were from Andhra Pradesh. Here 29 out of 30 urban respondents or all respondents mentioned that they came forward for registration of their ground water structures. No respondent from the other 5 states came forward for registration. This finding makes it clear that **the existing legal and institutional measures are not at all effective.** It may, however, be said that Andhra Pradesh is the only state where legislation has been enforced for the past 3 years whereas in West Bengal the legislation came into force from August 2007 so that its impact is yet to be felt. In Delhi, Punjab & Gujarat, the legislation is not enacted so far. In Tamil Nadu even though the Act was passed in the year 2003, it had not been enforced yet. However, CGWA under the Environment (Protection) Act has been in operation since 1997. It is more than 10 years now that the act came into force. This is a long time for any impact to be felt. **The absence of any impact clearly shows that the operations of Central Ground Water Authority (CGWA) are not at all effective at grass root level.**

The above finding is confirmed further in response to another question namely whether respondents had got their system registered. Only 228 respondents replied to this question. Of these, only 45 got their system registered whereas the remaining did not register their system. All the 45 respondents who had registered their system were from A.P. and none from any other state. Of the 45 respondents from Andhra Pradesh, 44 were from rural areas 1 from urban area. In other words, the registration system has been less effective in urban areas since only 1 out of 30 respondents responded even though they were aware of the system of registration and they knew people come forward for registration. This indicates that the law is not very effective even in Andhra Pradesh, specially in urban areas despite the fact that registration was to be done through Panchayats whose office is located nearby and it takes only one day for registration and the procedure for application for registration was described quite simple as stated by the respondents. The following table gives the data.

Table 4.15 : Registration of Ground Water System in Andhra Pradesh.*

Response	People aware of and Ready for Registration of Ground Water Structure	Respondents Water Supply System Registered	Agency that does Registration		Any Application Form for Registration	Any Fee for Registration (Rs.10)	No. of Days took for Registration (One)
			Panchayat	Others			
Yes	88	45	45	Nil	47	40	45
No	1	31	-		41	6	-

* This information is not available for other states.

Source : Household Schedule

The inadequacies of the regulatory methods become specially glaring with respect to over exploitation of ground water by industries as can be inferred from a few examples for the period since 1997 during which CGWA has been functioning. One can cite the well known cases of excessive withdrawal of ground water by coco-cola plant in Plachimada village of Palakkad district of Kerala after 1998-99, by Pepsi plant in Kanjihoda village of the same district in Kerala after 2003, by a coca-cola plant in Kaladera village near Jaipur in Rajasthan since 1999, and by a coca-cola factory in Kudus village in Thane district of Maharashtra since 2000. During the course of this study, it was found that Kandla Port Trust was sinking new tubewells in notified areas namely Ratnal village in Anjar block of Kachch district of Gujarat even though a state level Ground Water Authority has been functioning since September 2001. Since this was aggravating the ground water situation in the area, the Study Team wanted to know the measures that the state Authority was taking in this respect. The reply of the Gujarat state was that it was rather difficult to regulate sinking of such wells since legal powers were yet to be delegated to GGWA. The Gujarat government gave a similar reply when its attention was drawn to another case i.e. of A.V. Joshi Company withdrawing excessive ground water from village Nagalpur Moti in Anjar Block of Kachch district of Gujarat through its 10 bore wells in the village.

The inadequacies of the prevailing legal and institutional framework in regulating ground water has been acknowledged recently by the government agencies also. The Mid-Term Appraisal (MTA) of the Tenth Five Year Plan carried out by the Planning Commission had expressed concern about this aspect and had suggested setting up an Expert Group to review issues related to ground water management and ownership. The National Development Council (NDC) in its 51st meeting held on 27th and 28th June, 2005, while broadly agreeing with the viewpoints of the MTA, observed as under:

“In the water sector the MTA has expressed concern about the rapid decline of ground water levels in some parts of the country. It has been noted that **ground water legislation, where enacted, has not been found effective** and has suggested setting up of an Expert Group comprising officials, NGOs, academicians and experts to review the whole issue of ground water management and ownership and suggest line of action for implementation in the Eleventh Plan”. (Kuldip Singh Takshi, 2007, p.242).

As may be noted, such a committee under the chairmanship of Dr.Kirit Parikh, Member, Planning Commission was constituted on 21st October, 2005. It submitted its report in August, 2007 which was published in September, 2007. **The Expert Group also found that the regulatory measures of both Centre and the States were largely ineffective.** It has, therefore, given suggestions for making the regulatory measures effective, not through the existing control and command system, but through users groups, community participation and panchayats.

4.6 Reasons for Ineffectiveness

The lacuna in of the prevailing measures indicate that **something is fundamentally wrong with respect to the present approach to regulation of ground water resources.** The major flaws in the system are discussed below.

1. The most important deficiency relates to interpreting regulations in the narrow sense of controlling permits for drilling new ground water structures like borewells/tubewells only and not the existing ones. This is so whether it is the regulation of Central Ground Water Authority or that of the State Ground Water

Authority working under the respective state Acts which, in turn, are based on the Model Bill circulated by the Centre. The same is true of indirect measures like credit or electricity restrictions. The focus is entirely on stopping installation of new ground water structures. **There are no provisions for restricting the quantum of water extracted from the existing ground water structures.** As a result, the owners of such structures are free to extract any amount of water they wish to extract. Thus tubewell owners/operators who have been responsible for over-exploitation of ground water are completely left free, whereas restrictions are placed on the newcomers. The problem of over-exploitation in the over-exploited area would persist so long as this deficiency is not removed. **The above measure is not only unsustainable but is also inequitous.** It favours those who are already enjoying benefits from ground water as against those who have been deprived of these benefits so far. It is also known that the better off farmers in the rural areas were usually ahead of others in taking advantage of this technology because they had requisite capital or borrowing capacity from banks, whereas the small and marginal farmers as well as landless labourers usually lag behind. If this is so, then the equity implications of the present legal system becomes even more serious. Authorities must, therefore, give the maximum attention to this aspect and give powers to regulatory bodies **to put a ban on unreasonable or excessive withdrawal of ground water by existing users and also work out a satisfactory institutional framework for enforcing this provision.**

2. While the ground water regulation laws have been enacted and authorities have been created, administrative implications of the regulatory system have not been either understood or properly followed. As a result, appropriate actions have not been taken to ensure proper implementation of the legal framework created. The institutions which for years have been oriented towards development of ground water like the Central Ground Water Board and the state ground water departments and their personnel who have been trained mainly for exploring and developing ground water resources have suddenly been entrusted with the additional responsibility of doing the opposite namely controlling expansion of ground water structures. A similar pattern has been followed at the district levels where the officers of the state ground water department or division have been saddled with this responsibility as an additional charge. The organizational frame of CGWB has been designed to take care of supply side management mainly. Its technical and management staff have the expertise needed for supply side management namely “hydrogeological controls which determine the yield and behaviour of ground water levels under abstraction stress, the interaction of surface and ground water in respect of river base flow and changes in flow and recharge rates due to their exploitation” (Saleem Romani, Groundwater Governance, 2007, p.5). But an entirely different type of expertise is needed for demand side management which is the need of the hour. As has been pointed out by an ex-chairman of CGWB, demand side management requires expertise for dealing with socio-economic aspects related to the “managing the users of water and land”. This would require knowledge of regulatory and participatory aspects, awareness generation modalities, water rights and economic incentives etc. The present organizational framework, both at the centre and in the states which have created SGWA, is grossly inadequate with respect to demand side management. Personnel appointed for their expertise with respect to supply side management have been entrusted with the responsibility of demand side management also. This is far from the professional approach. It is, therefore, suggested that **an entirely different organizational framework** having members from economics, sociology and legal background apart from the hydrological one and headed by a judicial expert **may be set up at both centre and state levels.** If panchayats have to play a part at the local

level, then a senior representative of the Panchayati Raj Ministry/Department should be a member of the authorities at national and state level. Similarly, given the role of electricity and credit in regulation, it would be appropriate to associate senior representatives of NABARD and Ministry of Power in the regulatory bodies at both centre and state.

Adequate funds as well as manpower having dedicated responsibility and proper accountability exclusively for regulation and control are not provided. The authorities have been able to notify only 43 areas whereas number of over-exploited areas is 839 and that of critical areas is 226 as per March, 2004 data provided by CGWB. This indicates that it is not in a position to cope up with the work. In the 22nd meeting held recently, the Authority decided to take up 747 new over-exploited areas, but how much time it will take one does not know. Moreover considerable number of applications have been lying un-disposed in the secretariat of CGWA as mentioned in Minutes of the 23rd meeting of the CGWA held on 28th August, 2007. Similar situation exists at the state level. For example, in Gujarat it was observed during October 2007 that out of the 187 applications received for installation of new tubewells, only 4 were disposed off while the remaining 183 were pending for decision.

Further the CGWA has no legal personnel, nor does it have agricultural or socio-economic experts. It is reported in the Minutes of a meeting of CGWA that the need for a legal personnel in Secretariat of CGWA was felt by its Member Secretary. But it was decided to take the help of the services of legal personnel of the Ministry of Environment & Forests despite the fact that the representative of this department was not even attending the meetings of the Authority of which he/she is a member. The works as a result got neglected. **Many members of the Central Authority** from departments other than CGWB like Joint Secretary, Ministry of Environment & Forests and Financial Adviser, Ministry of Water Resources **do not show interest even to attend the meetings** which take place at the interval of several months sometimes after as long a period as 10 months. For example, there was a gap of about 10 months between 20th and 21st meeting and another gap of 10 months between 21st & 22nd meeting as can be seen from the information given below.

Meetings of CGWA

Meetings	Date
23 rd meeting	28/8/2007
22 nd meeting	13/3/2007
21 st meeting	24/5/2006
20 th meeting	26/7/2005

As a result, the Central Ground Water Authority essentially becomes the Central Ground Water Board and the State Ground Water Authorities become the State Ground Water Departments or Directorates as the case may be. Similarly, at the district level, it is essentially the ground water departments.

Regulating ground water management through demand driven measures is a very difficult task in a country like India where focus so far has always been on the supply side measures. It is entirely a new approach which can succeed only if the administrative hierarchy at all levels especially local levels, panchayati raj institutions

and the farmers in particular are convinced about its need and are aware of the modalities of the same. **Massive awareness programme is, therefore, required for the successful implementation of the new regulation.** The CGWA has rightly selected awareness as one of the components of the activities to be undertaken by it. But the scale of operation of this programme has been too meager to have any impact on the situation. For example, during the period August 1998 to October, 1999 massive awareness programme consisted of holding one day meeting at 13 places in the country (CGWB 2000 p. 34) whereas the problem lies in around 839 blocks/talukas etc. This is like a proverbial drop in the ocean. CGWA must have a strategy for launching massive programme on a continuous basis so as to cover at least 500 places in a year so that the programme gets repeated in a particular area in order to have an impact on the mind-set of the public as well as local administration.

The task before the CGWA is a gigantic one in view of the fact that there are as many as 839 over-exploited and 226 critical units. As against this, **the financial allocations** made by the Government for carrying out the task **is a very small** as can be seen below.

Year	Allocation	Expenditure (Rs./Crore)
2001-02	0.90	0.56
2002-03	2.20	1.64
2003-04	1.91	1.62
2004-05	1.36	1.22
2005-06	1.39	1.38

What is also surprising is that **even the meagre amounts could not be spent during the years 2001-02 to 2004-05.** The expenditure reached at a level of Rs.1.64 croree in 2002-03 but started declining thereafter. The decline would be more precipitate if account is taken of rise in prices. Can this body be effective under such situations?

3. It is worth noting that **no punitive action** (including imposition of fine) **has been taken anywhere** even though the number of over-exploited, critical and semi-critical units are increasing. The laws that have been enacted are, therefore, toothless. They give a false impression of regulation and control.
4. **The regulatory machinery at all levels**, from centre to state to district and below **is entirely bureaucratic.** Public is nowhere in the picture not even at the village panchayat, municipality or block levels. One wonders how it is possible to enforce control through a bureaucratic system when millions of farmers who are spread over throughout the length and breadth of the country are involved and when control implies affecting such vital aspects of their life as their livelihood, earning power, food security, which every farmer would like to protect. In such a situation either there will be little control or the control may degenerate into widespread corruption. In the absence of public cooperation, the last date for adoption of roof top rain water harvesting in National Capital Territory of Delhi has been getting extended from year i.e. June 2006 to June 2007 to June 2008 etc. It is surprising how the authorities while devising a control mechanism completely forgot to take into account the existence of local self-government institutions like the panchayats and municipalities, even though the new legal measures came into being much after 73rd and 74th amendments of the constitution through which an attempt was made to strengthen the local self-government institutions.

5. **The extent of awareness among officials of legal provisions relating to regulation of ground water resources was perceived to be far from adequate.** The interaction of the Study Team with officials in different states revealed several misconceptions. Many officers were not even aware of the Easement Act and some of those who were aware had not read it. They had a vague understanding that every land owner has full ownership rights over the ground water in his/her plot of land and that the state had limited right to intervene in the matter. But no one was aware of the exact wordings of the relevant clause of the Easement Act which states quite clearly that no land owner has absolute right over the ground water if the ground water is passing in a defined channel. But utilizable ground water is a dynamic resource which flows into defined channels such that if one person makes excessive withdrawal then the supply available to the neighbours would become less. Under these situations which are the normal situations, the absolute ownership position no longer holds good. Ground water, therefore, becomes an item in the public domain. But this awareness is completely missing at all levels whether Centre, State, District or below. Most officers also lacked understanding of the Environmental Protection Act 1986. Many state officials dealing with water resources in every state were harping on the point that ground water is a state subject and, therefore, Centre has no right to interfere in the matter even if excessive withdrawal of ground water starts posing a threat to environment and ecology. They were not aware that Centre has been given power for this purpose under Environmental Protection Act, 1986. In one state very senior officers responsible for policy making were not aware of the existence of Central Ground Water Authority and the functions performed by this agency, even though one district collector in that state had already been contacted by the Central Ground Water Authority for notification. The concerned state had enacted its own ground water laws. Hence the state level authorities were under the impression that licensing, notifications etc. come under the exclusive jurisdiction of the state ground water authority as constituted by the state government. Since officials at the state level keep on changing because of transfers, it would be advisable if **the central circulars regarding Central Ground Water Authority are sent to the state governments at periodic intervals and this item be discussed whenever meetings of state Ministers or state Secretaries dealing with ground water take place.** As regards awareness of local officials like Executive Engineer, B.D.O., TDO, MRO, Patwari etc. the same position as stated earlier for senior officials was more or less found to hold good. In other words, they also think that the government had no control over the utilization of ground water since it is a private property. In view of this background they appeared hesitant in taking any punitive action in this respect. The above point out to **the need for orientation training of officers** (at all levels from centre to state to district and below) associated with ground water regulation.
6. Another root cause that limits effectiveness lies in **total lack of political will** in this respect. Barring a few exceptional cases, political and administrative leaderships in most states have been reluctant to impose any restrictions for management of ground water. The Model Bill has been in circulation ever since 1970 i.e. for the last 37 years. But there have been very few takers. The state of Punjab for example, has been avoiding passing the ground water Act since 2002 when a draft legislation had been prepared and discussed within the Government. Punjab incidentally is a state which is under tremendous pressure with regard to exploitation of ground water resources. Tamilnadu which passed Act in the year 2004 has not implemented it so far. Implementation has not started because Government on some pretext or the other has not constituted the State Ground Water Authority which alone has powers to implement the Act. In Rajasthan also, a ground water regulation bill was prepared in

1996. But after some discussion, it was shelved. Rajasthan, therefore, has no law even though it is one of the worst states in India in terms of ground water over-exploitation (268). States do not care to respond to the directions issued by CGWA. For example, a direction was issued on 8 August 2006 to the Chief Secretaries/Administrators in 12 states and 2 UTs for adopting artificial recharge to ground water/promoting rain water harvesting in the 839 over-exploited blocks and 226 critical blocks. But only 3 states and one UT could send the action taken report by the end of one year i.e. August 2007. **Far from controlling over-exploitation of ground water, many of the states are encouraging this by providing subsidy on electricity for use in extraction of ground water in areas which include over exploited and critical.** Some state governments go to the extreme by providing free power for tubewells/borewells in such areas. These are suicidal measures which indicate lack of political will and short-sighted approach by the state governments. The lack of political will might be due to the following.

- (a) The number of users of ground water structures runs into millions because of which governments find it difficult to regulate the use of ground water.
- (b) Imposing restrictions on further expansion might amount to denying water to those who want to develop.
- (c) Regulation might go against the well established view based on a misinterpretation of the so called Easement Act of 1882 that owners of land have secure and unfettered right over water beneath their land.
- (d) Ground water depletion often starts with meeting the needs of drinking water during periods of droughts when ground water becomes the last resort for drinking water supplies for both human and livestock population. As a result, the determination to enforce regulatory provision tend to weaken. However, once in place, the ground water structures continue to be used even when the drought is over.

4.7 Conclusions

The broad conclusion that emerges from the above is that the present institutional set up is totally inadequate to take care of the increasing incidence of over exploitation of ground water in the country. **A complete revamp is needed.** This should involve substantial changes in composition of the Authority, nature and size of supporting staff, content of the programme, role of stakeholders etc. The Authority should be headed by a judicial person and should have a multidisciplinary team covering socio-economic, agriculture and hydrology. Chairman, CGWB should be ex-officio member. It should also have senior representatives from concerned government departments like Water, Power, Environment and Forests, ICAR as well as NABARD. It should have a full time Member Secretary. Other members as well as chairperson could be on a part time basis. It should have an adequate office staff with the requisite budget for its activities including vigorous awareness generation campaign.

Chapter - V

Data and Information System

Any effective system of regulation and control of ground water extraction would require a strong base of data and information along with an adequate monitoring mechanism. There would be need for adopting standards or norms with respect to which performance of specific areas may be assessed. The Central Ground Water Board has been active in this area. The norms or standards developed by it with respect to different degrees of exploitation of ground water are briefly explained below. There would also be need for a good and reliable system of collection of ground water data at frequent intervals so as to provide information on changes in hydrological variables. What is needed, therefore, is a well developed and reliable hydrological information system comprising of both physical and human resources for collecting, processing, storing and disseminating the relevant information. Further, the centres for data collection should be adequate so as to provide information for relevant administrative or implementing units like panchayats or blocks, when needed. Aspects like these are examined in this Chapter. It may, however, be noted that the focus of analysis in this report is mainly with respect institutional aspects and not technical aspects of data collection.

5.1 Ground Water – How it is Assessed

As already indicated, precise estimation of ground water resource is a prerequisite for planning its development as well as regulating its use. A complexity of factors: hydrogeological, hydrological and climatological, control the occurrence and movement of ground water. The precise assessment of recharge and discharge is not easy and reliable, as techniques are currently not available for their direct measurement. As such, the methods used for ground water resource estimation are indirect. Being a dynamic and replenishable resource, ground water is generally estimated on the basis of the component of annual recharge, which could be subject to development by means of suitable ground water structures.

For quantification of ground water resources, proper understanding of the behaviour and characteristics of the water bearing rock formation known as aquifer is essential. An aquifer has two main functions – (i) to transit water (conduit function) and (ii) to store it (storage function). The ground water resources in unconfined aquifers are usually classified as static and dynamic. The static resources are defined as the amount of ground water available in the permeable portion of the aquifer below the zone of water level fluctuation while the dynamic resources are defined as the amount of ground water available in the zone of water level fluctuation. The replenishable ground water resource is essentially a dynamic resource which is replenished annually or periodically by precipitation, irrigation return flow, canal seepage, tank seepage, influent seepage, etc.

The methodologies adopted for computing ground water resources are generally based on the hydrological budget techniques. The hydrologic equation for ground water regime is a specialized form of water balance equation that requires quantification of the items of inflow to and outflow from a ground water reservoir, as well as of changes in storage therein. A few of these are directly measurable, some may be determined by differences between measured volumes or rates of flow of surface water and some require indirect methods of estimation. These items are elaborated as below

- I. Items of supply to ground water reservoir
 - Precipitation infiltration to the water table.
 - Natural recharge from stream, lakes and ponds.
 - Ground water inflow into the area under consideration.
 - Recharge from irrigation, reservoirs and schemes especially designed for artificial recharge.
- II. Items of disposal from ground water reservoir
 - Evaporation from capillary fringe in areas of shallow water table, and transpiration by phreatophytes and other plants/vegetation.
 - Natural discharge by seepage and spring flow to streams, lakes and ponds.
 - Ground water outflow.

The first attempt to estimate the ground water resources on scientific basis was made in 1979. A High Level Committee known as Ground Water Over Exploitation Committee was constituted by the then Agriculture Refinance and Development Corporation (ARDC). The committee was headed by the Chairman, CGWB and included as its members representatives from the state ground water organizations and financial institutions. This Committee recommended definite norms for ground water resources computations. Based on these norms, the state governments and the Central Ground Water Board computed the gross ground water recharge as 460 bcm and the net recharge as 320 bcm. This committee had, however, recommended that the methodology be revised with subsequent availability of data to make it more scientific.

Relying on the experience gathered during the implementation of ARDC III and IV projects, and based on the knowledge of the behaviour of ground water regime in the highly developed blocks, and on detailed analysis in the Central Ground Water Board, it was later decided that the guidelines of the Over Exploitation Committee should be modified as under

- The correction factor for normalization of rainfall in the water table fluctuation approach be modified to make it conceptually more correct.
- For all the states, where Central Ground Water Board carried out the ground water resource evaluation by water table fluctuation approach, the concept of 100 percent utilization of recharge as available in November had been adopted as a realistic approach for ground water resource evaluation. It was felt that the water table fluctuation from pre-monsoon to November accounts for the irrecoverable losses, which were not to be again accounted for. The November water level represents a stabilized post-monsoon ground water situation.

Subsequently, the necessity was felt for constitution of a committee to go into various aspects of the problems of the ground water development faced during the implementation of ARDC III & IV credit projects, and make suitable recommendations. Accordingly in 1982, the Government of India constituted a Ground Water Estimation Committee under the Chairmanship of Chairman, Central Ground Water Board. This committee examined in depth a large volume of hydrogeological and related data generated by the Central Ground Water Board through nation-wide surveys, exploration and 12 water balance projects, completed till then, and area oriented studies, carried out by the state ground water organizations. The Ground Water Estimation Committee came up with a revised methodology for assessment of ground water potential and evolved new norms in 1984. This is known briefly as GEC' 84 methodology.

In the light of voluminous data generated due to a number of studies, which led to revision of parameters for ground water resource estimation and the difficulties experienced while computing ground water resources based on the 1984 methodology, the Government of India constituted a committee in 1995 for reviewing the then existing methodology of ground water estimation and to look into all related issues. This committee known as ground water Estimation Committee which was constituted under the Chairmanship of Chairman CGWB, submitted its report on the revised ground water estimation methodology in 1997.

The norms of Ground Water Estimation Committee 1997 known as GEC' 97 methodology are currently followed by the Central Ground Water Board and state ground water departments to assess the extent of utilization of ground water resources. In most of the states, the unit for assessment of ground water resources are the administrative units like block/taluka/mandal. But in the states of Andhra Pradesh, Karnataka and Maharashtra, watershed has been taken as an unit.

Central Ground Water Board regularly monitors ground water levels through a network of 14379 National Hydrograph Monitoring Stations located all over the country. The water level is measured four times in a year i.e. in the months of January, May, August and November.

It has been pointed out by a commentator that notwithstanding the above mentioned arrangements, there is yet no concrete estimate of the extent of depletion. The earlier practice of categorizing the areas as “dark”, “grey” and “white” and the current practice of categorizing as “over-exploited”, “critical”, “semi-critical” indicates only the broad degree of depletion. These categories are essentially based on the proportion of annual recharge being withdrawn. For example, with respect to the earlier classification, blocks with a utilization rate of over 85 percent were termed “dark”, those between 65 and 85 percent were termed “grey” and others as “white”. Under the current criteria for categorization of assessment units or areas, units having more than 100 percent stage of ground water development are denoted as “over-exploited”, those between 90 percent to 100 percent are denoted as “critical”, those between 70 percent to 90 percent stage of ground water development are denoted as “semi-critical” and those having less than 70 percent are denoted as safe. Stage of ground water development is defined as percentage of annual ground water draft to net annual ground water availability. (Net annual ground water availability is defined as annual replenishable ground water resource minus natural discharge during non-monsoon season.)

5.2 Collection of Data

Ground water regulation would require regular inspection at the micro level (namely villages & towns) to know the extent of utilization of ground water at frequent intervals. However, as the replies to our question on this aspect from the states indicated, the states are inadequately equipped to handle this task in a satisfactory manner. Table 5.1 based on the responses of the states is given below. No state government except Delhi has said ‘yes’ to the question regarding availability of regular inspection to know the extent of utilization of ground water.

Table 5.1 : Availability of Regular Inspection to know the Extent of Utilization of Ground Water

Response	States
Yes	Delhi
No	Andhra Pradesh, Gujarat, Punjab, Tamil Nadu, West Bengal

Source : State Schedule

An attempt was also made to find out the sources from which the state governments get information about new installations. The responses are provided in table 5.2. As can be seen, there are no standard practices. In some states, there is no source at all of getting such information.

Table 5.2 : Sources of getting Information about New Installations

Based on no. of wells & draft	Andhra Pradesh
Through complaints	Delhi
From Gujarat water authority based on application	Gujarat
Through Agriculture Department	Punjab
At present no mechanism to get information on new installation	Tamil Nadu
There is no provision in the Act	West Bengal

Source : State Schedule

Collection of data on ground water level is undertaken both by the Central Ground Water Board and state level agencies. For this purpose, they have a number of observation wells in different parts of the country. Earlier, the collection of data was manual as reported by the grass root level functionaries of the respective departments. Such a system was not considered very reliable as it was subject to human error including carelessness of the person reporting at the grass-root level. A major attempt was, therefore, made to improve the system under the externally aided Hydrology Project-I which was introduced since 1996 in several states of the country. For this, mechanical equipment known as Piezometer was used most of which were also fitted with automatic water level recorders (AWLR). As a result, the quality of data collected at the source improved substantially. But the number of piezometers have been limited. Hence, the manual system for other areas has also continued. Since agencies and practices vary from states to states, an attempt would be made to provide brief information for a few states covered in this study namely Andhra Pradesh, Gujarat, Punjab, and West Bengal.

Andhra Pradesh

Information on Andhra Pradesh infrastructure for data collection is given in the table below. Andhra Pradesh has 1017 piezometers of which 904 are fitted with AWLR. The district wise distribution of piezometers with AWLR is also provided in another table below. The number of such piezometers varies from 24 in West Godavari and 25 in Nalgonda districts to 69 in Anantpur and 58 in Chittoor districts. Water scarce drought prone districts facing the threat of over exploitation have greater number of piezometers than districts which are better endowed with water resources.

Table 5.3 : Ground Water Monitoring Centres in Andhra Pradesh

	SGWD	CGWB
General Network of Observation Wells	2986	
Piezometers under Hydrology Project	1017	
Piezometers with AWLR's	904	
RWS observation BORE Wells one in each		
Grampanchayat area for data dissemination at village level		21000
Specific study observation wells		
- For watershed evaluation	985	
- For NEERU-MEERU impact studies	1821	
- For aquaculture impact studies and fractured aquifer studies under INDO-FRENCH project	85	

Frequency of monitoring		
AWLRs	6 th hourly monthly	
All other piezometers & RWS bore wells	6 times in a year	
General & special study observation wells		

Source : Andhra Pradesh Government, Ground Water Department

Table 5.4 : District wise Distribution of Piezometer based Monitoring Stations in Andhra Pradesh

District	No. of (Piezometer based) Monitoring Stations	District	No. of (Piezometer based) Monitoring Stations
Srikakulam	37	Anantapur	69
Vizianagaram	32	Kurnool	54
Visakhapatnam	40	Mahabubnagar	56
East Godavari	44	Rangareddy	42
West Godavari	24	Medak	31
Krishna	37	Nizamabad	28
Guntur	46	Adilabad	28
Prakasam	56	Karimnagar	45
Nellore	30	Warangal	45
Chittoor	58	Khammam	31
Kadapa	46	Nalgonda	25
TOTAL		904	

Source : Andhra Pradesh Government, Ground Water Department

Gujarat

In Gujarat, collection and dissemination of ground water data is the responsibility of the Ground Water Resource Development Corporation (GWRDC) of the state. It has more than 4000 observation wells/tubewells/piezometers in different parts of the state for providing ground water data which are obtained twice in a year i.e. May-June (before monsoon) and October – November (after monsoon). In reply to our queries, GWRDC claimed that a system has been established for verification of data at various levels such as sub-division/division and circle. Data are validated by comparing them with earlier and surrounding area data. Data validation softwares are also available with GWRDC. As Gujarat state was covered under the Hydrology Project from 1998, it has also installed piezometers with AWLR for collection of data on ground water level. There are 5 to 6 piezometers in every taluka covering an area of 500 to 600 sq. km. In addition, there are about 5 observation wells of the traditional type in every taluka. Thus, there is an average of 10 observation points in a taluka which usually consists of 100 villages. In other words, **only 10 percent of villages are covered by observation wells**. Data is not published but is available on price. In addition, regional office of the Central Ground Water Board has its own infrastructure for monitoring of ground water level. CGWB has 991 observation points in the state with an average of 3 to 4 observation wells in every taluka. It too has a mix of piezometers and traditional wells. Monitoring is done 4 times in a year namely last week of May, last week of August, first week of November and first week of January. CGWB data is not published but is supplied to state agencies.

There is no doubt that the introduction of piezometers for monitoring of ground water level has led to a marked improvement in the quality of ground water data. But the Hydrology project under which the piezometers were introduced did not cover the whole country. And even in the states where piezometers were introduced, their number was limited so that the traditional observation wells existed side by side. Moreover, it was observed during field

investigations by the study team that **a greater proportion of piezometers (sometimes about 70% to 80%) do not work on automatic basis** because the automatic recorders do not function for various reasons. Hence, reading is done manually. Maintenance of these piezometers has been a great problem. Local vendors for repair work are usually not available. Satisfactory mechanism for regular maintenance through, for example, annual maintenance contract (AMC) with competent firms has not been evolved. Many of these equipments do not function due to software and/or battery problem. Those which were working were working with external batteries. Sometimes the original batteries did not function due to the so called “gel problem” or humidity factor. But in course of time, gel alternative has been found. It may also be mentioned that all the 666 piezometers obtained in Gujarat under the Hydrology Project were supplied by an Australian company which closed down its business. As such no help could be received from the original supplier.

Discussions with ground water staff indicated that officers are busy handling a variety of works whereas data collection and monitoring is a specialized job. Hence, at least in some cases they are not able to give as much time and attention to this work as they should do. The problem becomes compounded when a large number of posts are not filled up as, for example, in Gujarat because of which the work load increases and incentive and motivation decreases.

Table 5.5 : District-wise Monitoring of Ground Water in Gujarat

District	Open well	Tubewell	Piezometers (HP)	Piezometers (NCCA)
Ahmedabad	45	27	42	57
Amreli	75	-	32	-
Anand	30	25	13	-
Banaskantha	71	83	63	45
Bharuch	35	3	19	27
Bhavnagar	81	-	39	14
Central Territory	12	-	-	-
Dohad	38	-	9	-
Gandhinagar	7	32	23	-
Jamnagar	90	-	38	-
Junagadh	99	-	38	-
Kachchh	79	15	32	16
Kheda	37	22	8	18
Mahesana	28	40	41	29
Narmada	29	2	10	-
Navsari	30	-	10	-
Panchmahals	65	-	13	1
Patan	15	41	33	-
Porbandar	27	-	11	-
Rajkot	139	-	41	5
Sabarkanta	121	12	34	-
Surat	80	-	21	-
Surendranagar	107	17	31	53
The Dangs	8	-	12	-
Vadodara	61	15	36	50
Valsad	52	-	17	-
Total	1461	334	666	315

Source : V.M. Vagnik et al, Groundwater Governance, 2007, p.228

HP-Hydrology Project, NCCA : Narmada Canal Command Area

Punjab

Organization: Ground water observation network of Punjab is currently monitored by four agencies, namely, Water Resources & Environment Directorate, Punjab Planning & Design Studies Directorate, (both under CE/WR), Ground Water Cell of Department of Agriculture (DoA), and Central Ground Water Board (CGWB). Each agency has its own administrative set-up. Amongst them the Water Resources & Environment Directorate (WRED) has been designated as the Nodal Agency for Hydrology Project Phase-II and to act as Database Administrator in respect of ground water by the State Government.

Ground Water Monitoring Network: WRED observes ground water level from a network comprising of 162 dug wells & 224 piezometers (fitted in 175 shallow and 49 deep wells). GW Cell of DoA observes ground water level from 456 open dug wells & 133 piezometers, CGWB observes from 236 open dug wells & 87 piezometers and the Planning and Design Studies Directorate observes from 199 dug wells & 20 piezometers mainly in the Kandi Area. There are about 1.125 million private shallow tube-wells owned by farmers and the number is increasing day by day resulting in over withdrawal and lowering of ground water level.

Laboratory Facilities: Eight Governmental and semi-Governmental institutions, including the WRED, have the water quality testing facilities. But most of the water testing is done as per their own needs and some of these are also providing testing services to farmers and industries. Punjab Pollution Control Board and Public Health Department at Patiala have laboratories of Level II+ and II respectively. Punjab Agricultural University at Ludhiana has also some advance instruments.

Data Processing Facilities: The ground water level records are available since 1970s. The water level recording is taken, processed and validated manually by the collecting agencies.

Additional details are as below.

- There are only 700 piezometer for getting data regarding ground water table depletion These are under the control of Water Resources and Environment Directorate.
- Water Resource and Environment Directorate is the major government agency involved in data collection. At the same time, Department of Agriculture of the state government is also involved in data collection and monitoring of water level. But their role is supplementary
- They send data to CGWB.
- Data is updated at 5 years interval.
- Agriculture department collects data only manually with the help of Asst. Engineers and Junior Engineer etc.
- Data obtained from both the sources are pooled together before publication.
- These agencies select different villages to collect water table data.
- In addition, CGWB has its own stations for collection of data.

West Bengal

The data is updated 4 times a year in the months of April, August, November & January. Water Investigation Directorate has a network of observation points. This is generally 6 to 8 in each block from which observations are recorded. The data is compiled at the departmental level, but it is not published. The Directorate does not publish it to avoid legal complications in case data is challenged by some parties. **Absence of transparency makes it rather difficult to assess its reliability.**

5.3 Conclusions

Discussion with ground water management related officers in states on reliability of ground water data revealed that while it is safe to rely on the data generated through piezometers, the same cannot be said for the data based on manual observations. But the coverage of piezometers is limited. While some of the random errors arising out of the manual system may tend to cancel out in the case of macro level data (state and centre), the same may not be possible at the micro level. The unreliability of data at the block level for detailed and authentic micro level analysis on ground water uses has been noticed by other experts also. For example, Amanjyoti Kar et al have noted this deficiency for Orissa. They suggest that “ground water resources assessment based upon such data, especially, for the coastal blocks with high utilization of ground water, may further be reviewed with further micro level census of M.I. structures”. (Amarjyoti kar et al, Groundwater Governance, 2007, p.327) They also suggest the need for “extensive integrated hydro-geological and geophysical surveys coupled with ground water drilling and exploration in the hard rock areas of Orissa and limited areas Groundwater Governance under crystalline formations in West Bengal. (Amarjyoti kar et al, Groundwater Governance, 2007, p.329)

With reference to data collection, N.C. Nayak et al have some serious observations against the prevailing criteria for demarcation in the context of situation in Orissa. (N.C. Nayal et. al. 370 and 375). These groundwater governance are given below, specially as these are relevant for some other states also.

- The blockwise ground water resources is commonly estimated through ground water fluctuation method. As there are some 1000 odd monitoring stations (dug wells) spread over an area of 1,55,707 sq. km of Orissa, the water level data is quite insufficient for blockwise ground water recharge calculation. Moreover the specific yield values recommended for different geological formations for rainfall recharge calculation vary over a specified range. Taking the lower or higher value may lead to underestimation or overestimation of the ground water resource, respectively. As an example, for the laterite and weathered zone, which form the main repository of ground water in the hard rock terrain of Orissa, the specific yield value is recommended between 0.02 and 0.03. Hence, it gives a variation of resource at the tune of 33 percent.
- The ground water draft is calculated on the basis of numbers of different ground water abstraction structures present in a block. The amount of ground water commonly withdrawn by different types of such structures is recommended in GEC-1997. But due to lack of proper well census data, a correct picture of ground water draft cannot be obtained. Thus, the stage of ground water development of a block gives only a first approximation of the ground water situation of that block.
- In most of the coastal blocks of Orissa, confined aquifers of variable thickness have been preferred over the phreatic aquifer for meeting water supply demands including irrigation due to the high reliability and yield potentials. However, the resource position computed on the basis of phreatic aquifer gives erroneous picture of the ground water condition. As for example in Basudevpur block of Bhadrakh district the top aquifers are saline upto 180 metres of depth up the eastern part and in the wester part, heavy ground water withdrawal for summer paddy crop has led to the decline of ground water to such an extent that the water level has gone down below mean sea level during summer seasons. But the ground water resource is estimated as marginally exploited with only 23.84 percent ground water draft.
- The lack of actual ground water extraction data of large industries/industrial belts and data on dewatering during mining activities has led to the under estimation of ground

water resource. Moreover, land degradation leading to the reduction of recharge is not taken into account.

- Over-exploitation of ground water and reduction of recharge to ground water is commonly observed in urban areas. But this is overshadowed in the resource estimation where a block is taken as a unit. A typical example is that of Puri town spread over an area of 16.84 sq. km. which is at present experiencing all the adverse impacts of over-exploitation like deep water level condition in sand dunes, drying up of the Temple wells, reduction of yield of tubewells and salt water upcoming. Though the ground water draft is around 106 percent, the buffering action of the vast area of Puri Sadar block has deeply undermined the real situation with the stage of ground water development safely poised at 12.90 percent.

Improvement requires that there should be a good collaboration between universities, other research organizations and state ground water departments. But some state government departments like that in West Bengal keep the data as secret. This attitude should change specially when the Right to Information Act points towards the need for transparency.

CGWB may also explore the possibility of using remote sensing for monitoring water tables and identifying suitable sites for recharge structures so as to generate reliable data at the village panchayat and block levels which would be needed for regulation in future.

There is no accurate data on quantum of ground water used for different uses specially irrigation which is the major use. In order to improve the matter, a suggestion has been given by some experts that the “bore wells/tubewells are to be fitted with pump sets of known HP and separate electric connection is to be provided. By noting the consumption of electricity, we can arrive at the quantity consumed by the user i.e., if a 3 HP pump is used, the approximate quantity of discharge for pump per hour is around 17,000 lph and for running the pump for one hour the current consumption can be noted. Such a calculation will give almost accurate usage of ground water and this should be appropriately charged”. (P.N. Ajithkumar and A.S. Sudheer, Groundwater Governance, 2007, p.366)

The possibility of introducing participatory approach in data collection at the micro level may be explored. Local people in general and users in particular have a good knowledge of ground water situation in their area. Hence the local data obtained through observation wells may be shared with local people who can provide a good cross-check on the veracity of manually collected data.

Chapter - VI

Ground Water Scenario at the Micro Level

Ground water regulations have to be made effective ultimately at the micro level i.e. villages, panchayats and towns. Hence, a knowledge of the ground water scenario at the micro level would be useful for a proper appreciation of the legal and institutional aspects involved in management of ground water in India. Information on this was obtained from primary sources through surveys conducted by the study team at household, village and town levels supplemented by information obtained at the district level. An analysis of this information is presented in this chapter. Similar information on other aspects like those related to Panchayati Raj Institutions or status regarding registration is given in other chapters.

6.1 Sources of Water

Water is provided both by government and private sources. A majority of villages and towns, almost three fourths, depend upon private (mostly own) sources while the remaining one fourth or 25 percent depend on government sources. But there are inter-state variations as can be seen from table 6.1. In Andhra Pradesh and Gujarat, government source covers larger number of villages/towns. But in other states, private sources, which mainly include own sources, are more important. These findings are consistent with a very large scale nation-wide recent survey covering 78990 households in 5110 villages in India conducted by the International Water Management Institute (IWMI). This survey showed that less than 20 percent of rural households were connected with any public or community water supply. The survey also showed that there was no uniformity across the country. (Gunarwardene, International Water Management Institute, Water Policy Briefing, No. 24, 2007).

Table 6.1 : Water Supply Agencies in Sample Villages/Towns

Response	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Government	6	-	6	-	-	1	13
Private	2	7	2	8	8	7	34
All	8	7	8	8	8	8	47

Source : Village/Town Schedule

Table 6.2 indicates that ground water is the predominant source of drinking water in all sample villages/towns of all states. Of the six sample states, Delhi is the only state which depends on surface water for drinking and domestic use and that too partially. The villages in Delhi depend mainly on ground water for drinking and domestic use as well as irrigation. All sample villages and towns in other states depend on ground water as a source of drinking water. Ground water, therefore, occupies a very important place in the water sector of the sample states.

Table 6.2 : Source of Water Supply in the Sample Villages/Towns

Type	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Surface	-	1	-	-	-	-	1
Ground water	8	6	7	8	4	8	41
Both	-	-	1	-	4	-	5
All	8	7	8	8	8	8	47

Source : Village/Town Schedule

Water from ground can be obtained through several types of structures. A few decades ago, dug wells used to be the main source of procuring ground water in rural areas. But this has changed substantially by now. None of the households in our sample villages and towns mentioned using dug well for extracting water (even though there was an explicit question on this) as can be seen from Table 6.3. All of them were utilizing either tubewell or handpump. In Andhra Pradesh, people depend exclusively on tubewells whereas in West Bengal people depend exclusively on hand pumps. This is understandable since ground water level is very high in West Bengal and low in Andhra Pradesh. Other states have a mixed picture. Delhi and Punjab are other states where hand pumps are important. Details are provided in table 6.3 below.

Table 6.3 : Instruments of Ground Water Extraction reported by Households

(No. of households reporting)

Instruments	States													
	Andhra Pradesh		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal		All	
	U	R	U	R	U	R	U	R	U	R	U	R	U	R
Handpump	-	-	11	-	-	-	15	-	-	1	12	46	38	47
Tubewell	17	7	-	2	-	-	10	36	-	3	-	-	27	48

Source : Household Schedule

The above scenario is more or less confirmed by the information obtained from the village/town schedule as shown in table 6.4. Tubewells and hand pumps emerge as the two sources of extracting ground water. **The main reliance is on tubewells which constitute 81 percent of the ground water structures. Since the discharge capacity of a tubewell is much more than that of a hand pump, the actual contribution of tubewells in supplying water would, of course, be higher than 81 percent.** Hand pumps are important in West Bengal. However, Delhi, Punjab and Tamil Nadu also have a sizeable proportion of hand pumps. Hand pumps are insignificant in Gujarat and Andhra Pradesh where most of water supply comes from tubewells. Further, as will be seen from table 6.14 given in a subsequent page in this chapter, among the tubewells, it is the electric tubewells which dominate the scene. Diesel operated tubewells are found mainly in Punjab. But here also, about 80 percent of tubewells are electrified.

Table 6.4 : Ground Water Abstraction Structures as reported by Villages/Towns

Type	States						Total	% of Total
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal		
(a) No. of tubewells	882	710	1060	4048	626	634	7960	81
(b) Hand operated	70	510	19	263	355	682	1899	19
(c) Total	952	1220	1079	4311	981	1316	9859	100

Source : Village/Town Schedule

Some villages and small towns in the sample get water through in-house tap connections which, in turn, draw water from ground or surface water as the case may be. Many households having in-house connections specially those which are better off, have installed booster pumps. Figures are given in table 6.5 below.

Table 6.5 : In-house Connections and Use of Booster Pumps

	States						Total
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Total No. of In-house connections	900	12280	4700	2731	1056	1260	22927
No. of connection fitted with booster pumps	124	3	90	405	258	-	880

Source : Village/Town Schedule

Delhi has the largest number of in-house connections because Delhi has an extensive piped water system maintained by Delhi Jal Board. Gujarat and Punjab have also sizeable number. Andhra Pradesh has the least number. Information on this aspect was obtained from household survey also. Data thus obtained are provided in table 6.6 below. The figures are similar to those given in table 6.5. Delhi has the maximum number of household connections followed by Gujarat and Punjab. Public stand posts were reported in Andhra Pradesh, Tamil Nadu and West Bengal only.

A majority (about 56 percent) of households in the survey areas used tap water through their in-house connections. Besides, the users of public stand post were about 25 percent. Taken together those constituted 81 percent of households in the sample. The major source of supply for both the categories was ground water, and the users were mainly from rural areas with high concentration in Delhi and Gujarat. About 5 percent households used more than one source for drinking and other household chores. The distribution of households by source of water for domestic purpose is given below.

Table 6.6 : Use of Tap Water as reported by Households

(No. of households reporting)

(No. of households reporting)

Types of Connection	States												All	
	Andhra Pradesh		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal			
	U	R	U	R	U	R	U	R	U	R	U	R	U	R
In house Connection	22	21	30	60	30	60	5	37	4	15	16	3	107	196
Public Stand post	8	33	-	-	-	-	-	-	26	41	10	16	44	90
Other Sources	-	6	-	12	15	-	25	23	-	4	4	41	44	86

Source : Household Schedule

It is known that households try to augment water supply by installing booster pumps. But information on booster pumps was hard to get since possession of such pumps is not considered desirable from the social as well as legal angles. Hence, very few households gave this information for fear of being penalized, as can be seen from the data given in table 6.7 below. Larger numbers are reported in the village schedule (see table 6.5), but that too may be an underestimate.

Table 6.7 : Use of Booster Pumps in the Domestic Supply Lines as reported by Households

Use of Booster Pumps	States												All	
	Andhra Pradesh		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal			
	U	R	U	R	U	R	U	R	U	R	U	R	U	R
Yes	14	1	-	-	-	-	-	5	-	-	1	1	15	7

Source : Household Schedule

6.2 Uses of Water

Water has several end uses, an important one being for domestic purpose although in quantitative term, its use is not very significant and accounts for only 8-10 percent of the total water use in the country. The sector where bulk of water is used is irrigation accounting for over 90 percent from both surface and ground water sources. The responses given by sample households in this context, are being analysed below.

Table 6.8 gives information on use of ground water for domestic, agriculture and industrial purposes in the sample villages and towns. Agricultural is the most dominant use followed by domestic use which, however, is way behind. Industrial use is very limited. It can, therefore, be inferred that if water has become very scarce in these villages and towns such that ground water situation has become over-exploited or critical, then it is largely due to agricultural use.

Table 6.8 : Proportion of Use of Ground Water for various Purposes*(% of use)*

Type of Use	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Domestic	8	10	9	13	15	12	11
Agriculture	92	89	91	87	80	88	87
Industrial	-	1	-	-	5	-	2

Source : Village/Town Schedule

Use of Own Tubewells for Irrigation

Tubewells are considered so important for irrigation by farmers that 79 percent of them i.e. more than three fourths have installed their own tubewells for irrigation purpose. Almost all households in rural areas of Andhra Pradesh, Punjab, Tamil Nadu and a majority of over 70 percent in Gujarat and Delhi used own tubewells for irrigating their crops. This proportion is however, only 33 in case of West Bengal. This is because of the abundant rain in West Bengal and easy availability of surface water. The details are provided in table 6.9.

Table 6.9 : Use of Tubewells for Irrigating Crops as reported by Households*(No. of HHs reporting)*

State	Urban	Rural	Total	% of Rural
Andhra Pradesh	0	59	59	98
Delhi	0	43	43	72
Gujarat	0	48	48	80
Punjab	0	59	59	98
Tamil Nadu	0	55	55	92
West Bengal	0	20	20	33
Total	0	284	284	79

Source : Household Schedule

Reliance on Ground Water for Irrigation

The role of tubewells in providing irrigation turned out to be even more than what was described earlier. Some farmers who did not have their own tubewell or had inadequate supply from their tubewell, got water from tubewells owned by others. A higher proportion of rural households, about 84 percent, therefore, reported that they relied on ground water for irrigation purpose of whom about 79 percent used water from their own tubewells while 5 percent depended upon other tubewell owners for getting their crops irrigated. In this respect, households in West Bengal were found lagging behind their counterparts in other states. The reason for this has been given in the earlier para. The distribution of households relying on irrigation through ground water in the sample states is given in table 6.10.

Table 6.10 : Reliance on Ground Water for Irrigation as reported by Households

(No. of HHs reporting)

State	Urban	Rural	Total	% of Rural
Andhra Pradesh	0	59	59	98
Delhi	0	54	54	90
Gujarat	0	50	50	83
Punjab	0	60	60	100
Tamil Nadu	0	59	59	98
West Bengal	0	22	22	37
Total	0	304	304	84

Source : Household Schedule

Farm House Irrigation

Modern farm houses are not commonly found in a majority of sample villages/towns as they crop up in the outskirts of cities or big towns only. As per report given in the village/town level schedules, only 10 villages/towns out of a sample of 48 had farm houses, a majority of which were from Andhra Pradesh and Delhi. The maximum number was in Delhi (see tables 6.11, 6.12 & 6.13). These farm houses depend on tubewells for irrigation. These are generally owned by rich urban elite and are often used for commercial purpose. The details of the emergence of farm houses are given below.

Table 6.11 : Farm Houses in the Sample States

Response	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Yes	4	5	-	-	1	-	-
No	4	3	8	8	7	8	-

Source : Village/Town Schedule

Table 6.12 : Number of Farm Houses in the Sample Villages/Towns

No. of Farm Houses	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Number	24	1361	-	-	3	-

Table 6.13 : Total No. of Tubewells in Farm Houses

No. of Tubewells	States					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Number	23	1221	-	-	6	-

Source : Village/Town Schedule

6.3 Types of Tubewells

Now a brief account on types of tubewells reported in the sample villages and towns is given. Tubewells belong to both the categories of electrified as well as diesel operated ones. But the latter category tubewells are hardly 10 percent of the total. These are mainly in Punjab. On the other hand, **tubewells running on electricity constitute over 90 percent of the total tubewells and are found in all the sample states.**

Table 6.14 : Electric and Diesel Operated Tubewells

Type	States						Total	% of Total
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal		
(a) No. of electrified Tubewell	882	710	1060	3288	608	634	7182	90
(b) Diesel operated Tubewell	-	-	-	760	18	-	778	10
(c) Total Tubewell	882	710	1060	4048	626	634	7960	100

Source : Village/Town Schedule

A problem with electrified tubewells is that their operation depends on the availability of electricity which is highly uncertain. In order to overcome this problem, standby generators are kept. But this is a costly proposition which every farmer can not afford. Information was, therefore, collected to find out the extent to which standby arrangements are available. Table 6.15 gives the data.

In a number of villages/towns in Andhra Pradesh, Punjab and Tamil Nadu, the respondents reported to have made standby arrangements for extraction of ground water from the available structures. But this type of arrangement was available in a minority of villages/towns only as can be seen from table 6.15.

Table 6.15 : Standby Arrangement in Case of Disruption in the Supply of Electricity as reported in the Village/Town Level Schedules.

(No. of village/towns reporting)

Responses	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	Total
Yes	6	-	-	7	4	1	18
No	2	7	8	1	4	7	29

Table 6.16 provides information on tubewells classified according to type of ownership viz. panchayats and private persons. It is observed that 90 percent of tubewells are owned by private persons and only 10 percent by panchayats. One can, therefore, safely say that tubewells are by and large under private ownership. Information was also obtained as to how many of the tubewells were in working condition during the survey period. **It is observed that 88 percent of the tubewells owned by panchayats and 77 percent of the tubewells owned by private persons were in working condition.** This may be regarded as satisfactory.

Table 6.16 : Ownership of Tubewells and their Working Conditions

Type of Ownership	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	Total	% of Total
(i) Tubewells owned by panchayats	104	46	45	16	578	196	985	10 of (v)
(ii) No. in working Condition	101	29	26	10	529	176	871	88 of (i)
(iii) No. owned by private persons	848	1174	1034	4295	403	1120	8874	90 of (v)
(iv) No. in working condition	800	614	1034	3645	327	436	6856	77 of (iii)
(v) Total No. of Tubewells	952	1220	1079	4311	981	1316	9859	100

Source : Villages/Towns Schedule

6.4 Awareness of Households about Fall in the Level of Ground Water

In most of the sample states, the level of awareness among people about fall in the ground water table was quite high. Such awareness was even 100 percent, in states such as Andhra Pradesh, Gujarat, Punjab and Tamil Nadu. This awareness was observed in both rural and urban areas. The response of households on awareness about fall in the level of ground water in sample states is given in table 6.17.

Table 6.17 : Awareness about Continuing Fall in the Level of Ground Water in the Areas as reported by Households

(No. of HHs aware)

State	Urban	Rural	Total
Andhra Pradesh	30	60	90
Delhi	29	54	83
Gujarat	30	60	90
Punjab	30	60	90
Tamil Nadu	30	60	90
West Bengal	26	45	71
All India	175	339	514
	97.22%	94.17%	95.19%

Source : Household Schedule

The above is confirmed by reply to questions in the village/town schedule. People in villages/towns surveyed were aware of the continuing fall in the level of the ground water due to over-exploitation. Details are in table 6.18.

Table 6.18 : Awareness about Continuing Fall in the Level of Ground Water in the Areas as reported in Villages/Towns

(No. of Villages/towns reporting)

Response	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Aware	8	8	8	8	8	8	48
Not aware	-	-	-	-	-	-	-

Source : Village/Town Schedule

An attempt was made to find out the source of the information on this aspect in the villages/towns. The responses are provided in table 6.19. It appears that self observations of tubewell owners based on yield of their borewells/tubewells has been the most important source followed by information received from government/panchayats.

Table 6.19 : Source of Information about Depletion in the Level of Ground Water
(No. of villages/towns reporting)

Source	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Newspaper/Electronic media	2	1	-	-	2		5
Self observation/ Yield of borewell/tubewell	6	4	6	8	-	-	24
Panchayat/ and Govt. Departments	-	3	2	-	2	7	14
Municipality	-	-	-	-	-	1	1

Source : Village/Town Schedule

Awareness of Households about Adverse effect on Ground Water Stock due to Over Exploitation

It deserves to be noted that **a majority of people (75%) in both rural and urban areas were found to be aware of the adverse consequences of fall in ground water level in water scarce areas.** This awareness was relatively higher (79%) in rural areas compared to urban areas. This is not surprising since people in rural areas are self dependent on water for crop activities being carried out by them as well as for drinking water whereas people in urban areas are usually dependent on water supplied by government agencies. This awareness was relatively lower in West Bengal because this state does not face much problem being a water abundant state. The state wise details are given in table 6.20.

Table 6.20 : Awareness about Adverse effect on Ground Water Stock due to Over Exploitation as reported by Households

(No. of HHs aware)

State	Urban	Rural	Total
Andhra Pradesh	12	58	70
Delhi	25	40	65
Gujarat	20	50	70
Punjab	25	56	81
Tamil Nadu	25	59	84
West Bengal	15	21	36
All India	122	284	406
Percentage	67.78	78.89	75.19

Source : Household Schedule

As can be seen from the above, households were aware of the deteriorating ground water situation and its adverse effects because they were the sufferers whenever the ground water level used to fall down. But they were engaged in a game of competitive withdrawal and so they were withdrawing water regardless of consequences.

6.5 Awareness regarding Laws and Rules among the Households

As regards households awareness of legal and regulatory mechanism, a mixed picture emerges as can be seen from the table 6.21 given below. The overall awareness about existing laws/rules/procedures to regulate the use of ground water was about 33 percent. The

level of awareness among households regarding laws/rules/procedures in vogue to regulate the use of ground water was relatively lower in rural areas (32 percent) compared to that in urban areas (35 percent). In Gujarat, however, the awareness among households about laws/rules was the least. The level of awareness was the highest in Delhi compared to other states as can be seen in table 6.21. Low level of awareness in this respect provides one more indication that the laws and rules framed so far by the government have not been effective.

Table 6.21 : Awareness of Laws/ Rules Procedures for Regulating Use of Ground Water in the Sample Areas as reported by Households

(No. of HHs aware)

State	Urban	Rural	Total	% of the Total
Andhra Pradesh	12	19	31	34.44
Delhi	20	38	58	64.44
Gujarat	1	9	10	11.11
Punjab	8	9	17	18.89
Tamil Nadu	10	20	30	33.33
West Bengal	12	20	32	35.56
All India	63	115	178	32.96

Source : Household Schedule

Types of Laws/Rules to Regulate Use of Ground Water

Among the households which were aware of existing laws/rules to regulate use of ground water, a majority (57%) reported that as per existing laws personal tubewells were to be installed only after permission from the concerned authorities. There were another 25 percent households which reported that booster pumps were not allowed in the domestic water supply line. The details of the replies received in this respect are given in table 6.22.

Table 6.22 : Types of Laws/Rules Procedures for Regulating Use of Ground Water in sample villages/towns as reported by Households

(No. of HHs reporting)

Types of laws/rules	Andhra Pradesh		Delhi		Gujarat		Punjab		T.N.		W.B.		All India		Total
	U	R	U	R	U	R	U	R	U	R	U	R	U	R	
Installation of personal tubewell after permission	6	4	20	38	0	2	0	0	4	7	5	15	35	66	101
Booster pump not allowed in mainline	5	9	0	0	1	5	8	9	5	10	6	5	25	38	63
Maintaining space of at least 200m. between the borewells	1	6	0	0	0	2	0	0	1	3	1	0	3	11	14
Total	12	19	20	38	1	9	8	9	10	20	12	20	63	115	178

Source : Household Schedule

Households' Adherence to Laws/Rules for Regulating Use of Ground Water

Among 178 respondents who reported about their awareness of the existence of laws/rules/procedures to regulate use of ground water in their areas, 170 respondents or about 96 percent reported that they used to follow the prevailing laws/procedures aimed at regulating the use of ground water. The proportion of such households was higher in Delhi as compared to other states. The distribution of households which used to follow laws/rules to regulate use of ground water in sample areas, is given in table 6.23.

Table 6.23 : Laws/Rules Procedures followed for Regulating Use of Ground Water as reported by Households

(No. of HHs reporting)

States	Urban	Rural	Total	% of the Total
Andhra Pradesh	11	12	23	25.56
Delhi	20	38	58	64.44
Gujarat	1	9	10	11.11
Punjab	8	9	17	18.89
Tamil Nadu	10	20	30	33.33
West Bengal	12	20	32	35.56
All India	62	108	170	31.48

Source : Household Schedule

The remaining 8 households or about 4 percent which were aware of but did not follow the existing laws/rules in respect of regulating use of ground water, were only from Andhra Pradesh (Table 6.24).

Table 6.24 : Reasons for not following the Laws/Rules/Procedures for Regulating Use of Ground Water as reported by Households

(No. of HHs reporting)

Responses	Andhra Pradesh		Delhi		Gujarat		Punjab		T N		W B		All India		
	U	R	U	R	U	R	U	R	U	R	U	R	U	R	Total
There is no check on new installations	1	7	0	0	0	0	0	0	0	0	0	0	1	7	8
Not aware of any such rules	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Others do not follow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1	7	0	0	0	0	0	0	0	0	0	0	1	7	8

Source : Household Schedule

Laws/Rules followed by Respondent's Neighbour to Regulate Use of Ground Water

Not only a third of the respondents were found following existing laws/rules pertaining to the regulation of ground water, but their neighbours also used to follow the prevailing laws/rules etc. for regulating use of ground water. The response to this effect was over 64 percent in Delhi and was highest compared to the other states. The distribution of households reporting about their neighbour's adherence to rules in various states is given in table 6.25.

Table 6.25 : Laws/Rules Procedures to Regulate Use of Ground Water followed by Neighbours as reported by Households

(No. of HHs reporting)

States	Urban	Rural	Total
Andhra Pradesh	12	10	22
Delhi	20	38	58
Gujarat	1	9	10
Punjab	8	9	17
Tamil Nadu	10	20	30
West Bengal	12	20	32
All India	63	106	169

Source : Household Schedule

Awareness about Regulatory steps to be taken to Overcome the Problem

514 households (95%) who were aware of fall in the level of ground water, suggested several measures to overcome the problem of continuing fall in the level of ground water. The responses to this effect were multiple. About 16 percent suggested a penalty for keeping taps open after use. This was followed by 15 percent which advocated for ban on new installations. 11 percent households were in favour of strengthening awareness campaign to meet the challenge. Also, a similar proportion of households thought dry farming as a best option to overcome the problem of ground water shortage. The distribution of households by suggestions to overcome the problem is given in table 6.26.

Table 6.26 : Regulatory steps to be taken to Overcome the Problem of Fall in Ground Water
Table as reported by Households

(No. of HHs reporting)

Regulatory Steps	Andhra Pradesh		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal		All India	
	U	R	U	R	U	R	U	R	U	R	U	R	U	R
Ban on new installations	0	0	12	17	3	10	6	8	4	9	2	1	27	45
Penalty for keeping taps open	0	0	10	16	2	20	9	13	1	2	1	9	23	60
Taps in public place should be free of leakage	0	0	0	0	6	6	0	0	1	0	0	0	7	6
Damaged pipelines be replaced	6	0	2	1	4	5	0	0	0	0	0	0	12	6
Check valves should be used	0	0	1	2	0	0	0	0	2	1	1	4	4	7
Ban on use of tullu pumps	0	0	4	17	2	0	1	11	0	0	0	0	7	28
Introduction of dry farming	0	3	0	0	0	0	5	7	8	27	0	5	13	42
Checking of unauthorized connections	0	0	0	1	0	0	3	6	2	1	0	0	5	8
Sharing of water by co-farmers	0	0	0	0	0	0	3	6	0	0	0	0	3	6
Fixed supply time	0	0	0	0	5	12	3	6	1	3	0	2	9	23
Awareness to users	2	0	0	0	4	7	0	3	4	1	17	21	27	32
Tanks/ponds should be excavated	20	44	0	0	0	0	0	0	2	4	4	1	26	49
Arresting sand quarrying in nearby rivers	0	4	0	0	0	0	0	0	0	1	0	0	0	5
Provision for rainwater harvesting	8	1	0	0	0	0	0	0	5	10	4	3	17	14
Cloud seedling should be done	0	3	0	0	0	0	0	0	0	0	0	1	0	4
Total	36	55	29	54	26	60	30	60	30	59	29	47	180	335

Multiple responses.

Source : Household Schedule

6.6 Awareness of Households about Problems in Ground Water Management

Households were asked to indicate the problems associated with ground water management in their areas. Their responses are tabulated in table 6.27. Problems mentioned by larger number of respondents included **no system to check water quality, water scarcity during summer season and leakage of water because of old pipe lines etc.**

Table 6.27 : Problems Posed by Respondents*(No. of HHs reporting)*

Problems Highlighted by Respondents	States						All India
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
old pipe lines result in wastage of water through leakage	2	14	12	20	18	2	68
Use of motor in main lines causes low pressure which in turn results in inadequate water to tail enders	2	12	-	11	1	-	26
People do not deposit water tariff regularly	-	-	10	17	-	-	27
No system to check water quality	1	14	33	12	-	18	78
Water intensive crops lead to high demand for water	-	-	12	20	1	4	37
Limited number of stand posts	3	7	1	-	5	17	33
Water scarcity during summer season	33	4	-	4	5	22	68
Others	26	37	22	5	54	24	168

Multiple responses

Source : Household Schedule

6.7 Suggestions given by Households to Overcome the Problems of Ground Water Management

Suggestions given by sample households are mentioned in table 6.28 below. These are supply augmentation measures like diversion of surface water, increase in number of borewells, increase in time of water supply, increase in number of stand posts etc. Demand management measures are conspicuous by their absence.

Table 6.28 : Suggestions given by Respondents*(No. of HHs reporting)*

Suggestions given by Respondents	States						All India
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Damaged pipelines/taps should be replaced to avoid leakage	1	15	12	27	5	3	63
Number of public stand posts should be increased	3	3	-	-	7	14	27
All households should be provided in-house connection	-	2	12	7	15	10	46
Time of water supply should be increased	4	9	34	12	19	6	84
Water should be diverted to local tanks from rivers/reservoirs	26	-	3	-	-	3	32
Adequate number of borewells should be drilled to meet the requirement	23	-	-	-	-	19	42
More check dams/ponds to restore water in nearby villages	-	-	-	-	28	-	28
Others	34	59	29	44	13	29	208

Source : Household Schedule. Multiple responses

6.8 Equity Aspects

Since water is needed for survival and growth, it is necessary to ensure that benefits are distributed in a fairly equitable manner such that everybody has access to it to fulfill the minimum needs of drinking, domestic use and also for production of crops for one's survival. In particular, it is desirable to ensure that the poor and the disadvantaged among the population have an easy access to it. What is the ground reality in this respect? An attempt was made to obtain information on this crucial aspect from both secondary as well as primary sources.

Water is a precious natural resource which is becoming increasingly scarce. This raises an apprehension that the weaker sections may be left behind in the race for obtaining a fair share of water as it happens quite often with other scarce resources. **Measures taken so far to regulate ground water withdrawals through licensing, credit or electricity restrictions for wells or through spacing norms have sought to regulate only the establishment of new ground water structures and not the quantum of water extracted from the existing ones. But such restrictions often hit the poor and small farmers.** For example, effect of spacing norms which put restrictions on installation of tubewells for some distance around an existing tubewell, is felt primarily by the late comers who are generally the small and marginal farmers. Similarly the benefit of huge power subsidy goes mainly to the better off farmers who generally take the lead in installation of tubewells. In addition, some of the rich and influential farmers try to overcome restrictions on electricity connections by using diesel sets wherever useful and those on credit by resorting to self financing and/or informal sources of credit. The adverse effect of the above on equity is too obvious to require any elaboration.

The introduction of submersible pumps to take care of falling water level goes against the interest of small and marginal farmers. A recent study by M.J. Kaladhonkar and his colleagues of Central Soil Salinity Research Institute, Karnal (Haryana) revealed that the cost of submersible pump would be around Rs.0.70 to Rs.1.50 lakh. Such a high investment is obviously beyond the reach of small and marginal farmers. They have, therefore, no choice but resort to deepen the existing pits to maintain suction lift within the optimum range. But they may face two problems on account of increasing number of submersible pumps. When a submersible pump would be operated on the near about plots, resulting in huge drawdown, then the cavity well may either function at a reduced discharge or might even fail to operate. Moreover, increased rate of lowering of the water table would require frequent deepening of the pits. Such an exercise of deepening is fraught with problems of litigation/compensations that may deter the farmers to go beyond a particular depth, such that after sometime it would turn into a non-functional unit. Small and marginal farmers would, therefore, suffer huge economic losses, as they would be unable to maintain even the current cropping intensity. The situation would lead to increased gap between richer and poorer farmers, which is inequitable. (Kaladhondar, M.J. et. Groundwater Governance, 2007, p.102)

Evidence from a comprehensive recent study by M. Dinesh Kumar also indicates that the development of ground water has been highly inequitable. The analysis of data obtained by him from eleven major Indian states shows that there is skewedness in ownership of all types of wells (dug wells, shallow tubewells and deep tubewells) towards medium and large farmers. A little more than 20 percent of large farmers own dug wells; 16.5 percent of them own shallow tubewells and 0.4 percent own deep tubewells. Hence, **a total of 37 percent of large farmers own wells.** But as regards marginal farmers, 2.5 percent own dug wells and 3.5 percent own shallow tubewells. Ownership of deep tubewells is close to nil in this category of farmers. Hence, **only 6 percent of marginal farmers own wells.** (M. Dinesh Kumar 61-62)

Status of Equity in Sample Areas

The sample households covered in the study were asked to give their opinion on equity in the availability of ground water at the aggregate level whether for domestic or for irrigation purpose. Their opinion was somewhat similar in urban and rural areas although there are no crop activities in urban areas. The distribution is given below.

Table 6.29 : Equity in the Use of Ground Water as perceived by Respondents

Response	States						All India
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Yes	62	15	20	15	90	90	292
No	28	75	70	75	-	-	248

Source : Household Schedule

It appears from the information collected at the field level that a total of 54 percent (292) respondents affirmed that equity existed in the use of ground water with respect to its availability for the disadvantaged group in their village/town. However, in the states of Tamil Nadu & West Bengal, all the respondents from both rural as well as urban areas reported 100 percent equity in the use of ground water followed by Andhra Pradesh where 62 respondents (69%), a mix of urban & rural, were of this view. It is worth noting that a higher percentage of respondents from Delhi, Gujarat & Punjab reported absence of equity. This matter deserves to be looked into by the authorities.

But the above perception of households is not shared by the village/town level functionaries according to whom there is greater equity in availability of ground water in the villages/towns as can be seen from the table below.

Table 6.30 : Accessibility of Socially and Economically Disadvantaged People to Ground Water Use in the Villages

(No. of Village/town reporting)

Response	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Yes	7	4	4	2	8	8	33
No	1	4	4	6	-	-	15

Source : Village/Town Schedule

The district level officials in-charge of ground water in the sample states also reported that there was equity in the use of ground water for drinking and domestic use specially as water structures for supplying water for domestic use were owned and operated mostly by the government agencies. But in respect of irrigation, since most water bodies were owned and operated by individuals, there was no equity in the distribution.

Sources of Availability of Ground Water for Domestic Use for the Disadvantaged Groups

248 or about 46 percent households who reported inequity in the availability of ground water reported various ways through which they were getting water for their domestic use. A majority of these households, about 48 percent, reportedly managed their water requirements from their neighbours free of cost while another 39 percent used to take water from tankers or

private tubewells. There were nearly 8 percent households which purchased water from market for their domestic chores. About 6 percent households had to depend on handpump water for this purpose. Distribution of households by arrangement of water for domestic use by disadvantaged group in different states is given in table 6.31.

Table 6.31 : Availability of Water for Domestic Use in case of Inequity in Use of Ground Water by Weaker Sections

(No. of HHs reporting)

Response	States						All India
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Take from neighbours	-	49	34	36	-	-	119
From tankers/private tubewells	20	15	25	36	-	-	96
Purchase from market	-	10	9	-	-	-	19
Take from handpumps	9	1	2	3	-	-	15

Source : Household Schedule

Opinion of Households on Equity in the Use of Ground Water

All the 248 households which reported absence of equity, opined that there should be equity in the use of ground water. In other words, these households were not satisfied with their situation. The distribution of responses is given below.

Table 6.32 : Need for Equity in Ground Water Management

(No. of HHs reporting)

Response	States						All India
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Yes	28	75	70	75	-	-	248
No	-	-	-	-	-	-	-

Source : Household Schedule

Steps to be taken to Ensure Equity in the Use of Ground Water

In order to have a more equitable distribution of ground water, the villagers have suggested for installation of new borewells. Villagers have also expressed their views in favour of adopting a norm of distribution of water based on number of persons in the family. Their responses are provided in the table below.

Table 6.33 : Measures Suggested to be taken to Ensure Equity in Ground Water Distribution

(No. of Village/town reporting)

Measures	States			All
	Delhi	Gujarat	Punjab	
New Bore wells may be constructed	1	1		2
Water should be distributed based on Number of persons in the family	3	3	3	9

Note : Some villages did not report.

Source : Village Schedule

The second suggestion is possible only when all the connections are metered and per capita availability of water is assessed and publicised on the bill itself so that the users are aware of their daily/monthly limit of withdrawal. Also there should be a penalty for excess withdrawal which may help the households to maintain their limit. But such a system of checking may

add to administrative inconveniences and expenses. The situation might improve when the users are educated about community management of the resource.

About 54 percent of the sample respondents provided suggestions regarding more equitable distribution of ground water among weaker sections of which 13 percent suggested that access to the government water supply source be made to the weaker sections while 10 percent households were in favour of increase in public standposts. 9 percent each suggested that there should be adequate representation of poor people in the WUAs and these associations should help all categories of people to get water for their domestic needs. A separate tubewell for weaker sections of the society was suggested by 7 percent of the sample households while 3 percent of the respondents stressed on female representation in WUAs. The distribution of households by suggestions on steps to be taken to ensure equity among the weaker section of the society is depicted below.

Table 6.34 : Steps Suggested to Ensure Equity in the Availability of Ground Water
(No. of HHs reporting)

Steps to be Taken	States						All India
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
By increasing No. of public stand points	-	30	15	10	-	3	58
Access to the Govt. sources of water supply by weaker sections	-	12	9	4	-	45	70
Adequate representation of poor in water users associations	-	6	15	19	-	6	46
Separate Water Users Associations	-	6	6	1	-	3	16
Separate tubewells for weaker sections	1	11	1	22	-	2	37
Female representation in WUAs	-	3	1	11	-	-	15
Association will help all categories of people to get water	-	6	20	8	-	13	47
Villages should share available water during scarce season	-	1	-	-	-	3	4

Source : Household Schedule

Equity Oriented Policy Measures

Very limited information was available from study team's interaction with state government functionaries about equity oriented policy measures. It appeared as if their attention so far had not been focused on this aspect. NABARD, however, drew attention to two types of policy measures aimed at promoting equity. One was charging lower interest rates of 9 percent in the North East as against 9.5 percent in other states thereby promoting inter-regional equity. The other was charging a lower margin of 5 percent on loans on tubewells etc. from small farmers as against 10 percent from medium and large farmers. Our comments on these measures would be given in Chapter-VII and hence need not be repeated here.

The study team also noticed that the Model Bill as revised in 1992 exempted small and marginal farmers from obtaining prior permission of the proposed Ground Water Authority for the construction of ground water abstraction structures, provided these were for their personal use and not for commercial purpose. This provision, however, was removed in the 1996 version of the Model Bill. In its place, a new provision was included according to which

“the person or persons will not have to obtain permit if the well is proposed to be fitted with a hand operated manual pump or water is proposed to be withdrawn by manual devices”. The manual devices are used mainly for drinking and domestic purposes and for kitchen gardens etc. A small farmer proposing to install even a small non-manual device i.e. a pumpset for his farm has to go through the same process as the large farmers.

The Tamil Nadu Ground Water Development and Management Act 2003 has, however, a provision according to which wells sunk by small and marginal farmers are exempted from the purview of the Act. But this Act, though passed in 2003 is yet to be implemented.

The development of ground water market in the rural areas of certain states seems to have promoted equity in utilization of ground water. In West Bengal and Orissa, for example, the marginal farmers get water for their fields by buying it from nearby better off farmers having tubewells. But they have to pay a price which at times may be quite high. During the survey, it was found that water rates charged by private operators were much higher than those charged by government tubewells. (See Section 7.7 of Chapter 7 for the details) It would be useful if the government through local panchayats can operate some tubewells to provide water to the small and marginal farmers.

During the year 1988-89, Ministry of Rural Development, Government of India introduced a Million Wells Scheme (MWS) as part of its poverty alleviation programme. The aim of this scheme was to provide open irrigation wells free of cost to small and marginal farmers below the poverty line and free bonded labourers. The target group of MWS initially comprised of poor, small and marginal farmers belonging to SCs/STs and freed bonded labourers. From 1993-94 onwards, however, MWS was extended to include poor, small and marginal farmers from non SC/ST categories as well. MWS was primarily intended to provide open wells, Borewells and tubewells were not to be taken up under the scheme. Each well constructed under MWS was to be located in the holding of the beneficiary and an entry to that effect was to be made in the revenue records. In addition, projects catering to groups of beneficiaries instead of individuals were also permitted to be undertaken under MWS. It was a centrally sponsored scheme. Funds under the scheme were shared between Centre and the states on 80:20 basis. This programme ran for more than a decade and thereafter it was merged into other poverty alleviation programmes from 1999 onwards. More than a million wells benefiting more than a million poor farmers were constructed under this scheme with an expenditure of over Rs.5,000 crores. This programme had helped in promoting equity in the utilization of ground water resources in the country. However, maintenance has been a problem because of which the benefits could not be sustained.

Chapter - VII

Regulation Through Indirect Measures

Implementation of regulations imposing controls on demand and utilization of water which affect almost everybody is not a pleasant exercise for the political and administrative leadership in any country. Hence, the authorities usually adopt a cautious approach while imposing any restriction which affects a vast majority of population. Since millions of farmers are involved in the case of regulation of extraction of ground water through tubewells/borewells, the authorities would naturally like to adopt a line of least resistance. They might, therefore, prefer technological options oriented towards expansion in supplies. They would also like to influence farmers and other ground water users behaviour through indirect measures before undertaking direct control through legal measures. Several indirect measures are available which can influence ground water scenario at the micro level through influencing demand for the same. One may mention cropping pattern, industrial mix, water management, regulation through supply of credit and electricity and pricing.

7.1 Cropping Pattern

There is a consensus among experts that the **introduction of inappropriate cropping pattern in water scarce areas has been the most important factor leading to over exploitation of ground water in India**. Notwithstanding scarcity of water in Punjab, Haryana, Delhi etc., water intensive crops like paddy including summer paddy have come to be cultivated in such areas since farmers find them to be more remunerative because of the socio-economic milieu in which they operate. For example, a study of the over-exploited blocks of Haryana made by M.J.Kaladhonkar and his colleagues at Central Soil Salinity Research Institute, Karnal showed that most of these blocks were located in districts having a predominantly rice-wheat cropping. Ground water table data for four districts of Haryana namely Kurukshetra, Kaithal, Karnal and Panipat with predominantly rice-wheat cropping (70.8, 85.1, 76.1 and 62.1% of net cultivated area under rice crop, respectively) for the period 1974-2004 revealed a steady decline in water table in all the four districts over the last 30 years. The fastest decline was in district Kurukshetra where water table declined at a rate of 37 cm per annum during this period. The situation was compounded by (i) taking two crops of rice (summer rice crop known as sathi crop in local parlance and the normal rice crop during the monsoon season), resulting in a cropping intensity of 300 percent and (ii) early sowing of rice in 2nd/3rd week of May instead of 3rd week of June or thereafter. It may be mentioned that at one time nearly 25 percent of the area under rice was put under the sathi crop in districts of Kurukshetra and Karnal. Similar situation or even worse was reported from Punjab. (Kaladhonkar, M.J. et al. Groundwater Governance, 2007, p.96).

Cultivation of water intensive crops should, therefore, be discouraged in areas suffering from scarcity of ground water. But how to do this is the real problem. **It is essentially a fight between economics and ecology** as was very ably pointed out by Chief Secretary of Punjab during his discussion on the issue with the Principal Investigator of this study. Farmers can be convinced to restrict ground water use only if they are assured of some alternatives which would give them at least the same level of income which they are used to. Farmers are aware of the ecological implications as was pointed out in Chapter VI of this report, but they are not ready to adopt remedial measures since they are not sure that they would be able to maintain their present level of income. A way out could be to demonstrate the feasibility of alternative options before farmers. For example, the study made by

Kaladhonkar and his colleagues indicated that a saving of 15 cm water in rice-wheat cropping could stabilize the water table at the current level. This is considered feasible by following appropriate water management strategies for rice-wheat cropping. “Some of the technologies are rainwater management in rice fields, irrigation after hair cracks appear in rice fields, timing of last irrigation to rice, popularization of basmati rice, transplanting of rice towards the third week of June, zero tillage, laser land leveling, diversification to other crops in a part of the area and direct sowing of rice”. Appropriate extension and policy initiatives might influence farmers to adopt one or more of these strategies. (Kaladhonkar, M.J. et. al., p.103)

The task of reorienting farmers is not easy. But it is not impossible also. Appropriate strategies and policy packages should be devised to persuade farmers to adopt a less water intensive cropping pattern in water scarce areas. **Participatory approach could be one such method.** As has been pointed out by Director Agriculture, a very senior officer of Haryana Government, on the basis of his experience in Haryana, participatory approach “can do wonders” for sustainable management of ground water”. Working with the existing grass-root institutions and capacity building of these institutions is bound to yield positive results.” (R.K.Khullar, Groundwater Governance, 2007, p.235). The accompanying box provides the details of this experiment.

Change in Cropping Pattern Through Awareness Generation and Participation

Farmers in five districts of Haryana took to cultivation of an early maturing but water guzzling variety of paddy during the late nineteen eighties. It was sown as a lucrative quickie crop between the wheat and paddy crops and soon became popular as Saathi in Haryana. It is transplanted in May when the evaporation losses are the highest. Consequently, it consumes 5500 litres of water for every kilogram of rice. Widespread cultivation of Sathi led to an alarming recession in the ground water table in Karnal, Kurukh, Kaithal, Yamunanagar and Fatehabad, the only districts having freshwater aquifers in Haryana.

A focused group discussion with some farmers at the Directorate of Agriculture, Haryana Government, in January 2006 revealed that they were well aware of the ill effects of this crop. It was they who were putting their motors still deeper every year. It was they who had to use increasingly larger doses of urea for the Basmati and wheat crops.

They knew that leaving the land fallow or cultivating leguminous crops like moong or dhaincha instead of Saathi would restore the soil fertility and reduce the requirement of fertilizers. They realized that non-flooding of field in May/June would definitely permit nature to kill the pests that later attached Basmati in July and consequently reduce their burden of pesticides. Yet no farmer was willing to give it up till he was sure that others would follow suit. Nobody was foolish enough to be left behind while his neighbours made a quick buck at the expense of the common aquifer. To their mind, the best way for the government was to ban it in view of the strong ill effect of the crop.

Thereafter, the Directorate of Agriculture decided to launch a massive awareness generation campaign that would enable farmers to generate a collective solution. Beginning from 9th February in Karnal, meetings of Saathi growing farmers and members of PRIs were organized in every district.

Those present would resolve to refrain from sowing Saathi, to educate others in their sphere of influence and to initiate such punitive action against violators that may be decided by the community collectively. It was also agreed that Directorate might obtain data from satellites to monitor cultivation. Effective use of mass media was made for taking the message to sub-district level. The project period was from February 2006 to May 2006.

Thousands of farmers refrained from sowing Saathi. A large majority of them went in for dhaincha, the green manure crop. Abandoning Saathi helped check further recession in ground water. Fertility of thousands of hectares was restored. An unprecedented quantity of 3000 quintals of dhaincha seed was distributed free of cost to the farmers. This resulted in cultivation of green manure in 25000 acres. Area under moong also increased substantially. Around one crore units of power were saved every day during the month of May/June. (R.K.Khullar, Groundwater Governance, 2007, p.235-36).

In order to popularize less water demanding crops like Maize, Soyabean, Oilseeds etc., there will be a need for price and marketing support for these commodities. The minimum support price policy should take into account the need to reduce coverage of water intensive crops like rice in water scarce areas. Funding and marketing support should also be provided accordingly. This would require a strong political will at the highest level. Guided by considerations of short run political expediencies, the Government of India, in consultation with the concerned states has been raising support price of rice and wheat higher than what is recommended by Commission on Agricultural Costs & Prices. **What is needed is a change in minimum support price policy providing scope for relatively higher prices for less water intensive crops and providing adequate marketing support for them.** Moreover, there is an overall need to impress upon the public as well as their leaders and administrators that **water deficit areas have to accept the reality of limited water resources** and make a conscious decision to use these available resources wisely and equitably as per constraints imposed by nature.

7.2 Industrial Mix

What applies to agriculture applies with greater force to industry. There are some industries like those producing soft drinks or bottled water which require huge quantities of water. If they draw water from underground, then their operation results in fast decline in level of ground water as can be seen from the examples of coca cola factory at Plachimeda village and Pepsi cola factory at Kanyehole village both in Palakkad district of Kerala. Another case is of coca cola factory near Jaipur in Rajasthan. Their operations amount to virtual export of water from water scarce areas.

One wonders why such industries are permitted to operate in water scarce areas. While it may be difficult to control the activities of thousands of farmers with respect to cropping pattern, it may not be that difficult to control one or two industrial units in a particular area. Putting a ban on establishment of water intensive industries, would help in maintaining water table not only directly but also indirectly as it would set an example to other users of water including farmers and would provide moral courage to government to control misuse of ground water by others.

All industrial undertakings must, therefore, be required to make an assessment of their projected water demand and **obtain the clearance from central or state ground water authority** as the case may be with provisions for heavy penalties in case of violation. These agencies, in turn, **must consult local panchayats or municipalities that would be affected by withdrawal of ground water by the concerned industrial units.** If they are already working in such areas then they should be asked to shift to areas which are considered safe with respect to availability of ground water.

7.3 Water Management

Most of the planners and administrators are aware of the fact that water management in India is far from the optimum. There are several studies and reports which have drawn attention to considerable wastage of water in both rural and urban areas. Water from surface irrigation is wasted especially in areas adopting flood irrigation. **Farmers have little incentive to use water efficiently because the irrigation rates are highly subsidized.** There are states where these rates have not been revised for several years. In urban areas, considerable water is lost because of leakages in main communication and service pipes and leaking valves. Investigations carried out in 13 cities including Delhi, Kolkata, Mumbai and Chennai revealed that **about 17 to 44 percent of total flow in the distribution system was lost due to leakages in the mains.** The coverage of households under piped water supply system can be increased or pressure on ground water can be reduced if the loss of water through leaking pipelines and valves is avoided. Further, improvement would take place through water saving fixtures in households. **Water is wasted in households because it is provided either free or at highly subsidised water rates.** As a result, water users have no incentive to use water as efficiently as possible. In the case of ground water, much water is wasted due to uncertainty of getting electricity supply and due to absence of any pricing system. If ground water users can increase their efficiency and save water then the same may be transferred to new users. It will also serve the objective of equity.

As a part of this study a question was asked to the states whether they had adopted policies or provided incentives for promoting efficiency in use of ground water and discouraging wastage. The answer was mostly negative as can be seen from table 7.1. Four out of 6 states admitted that they had no such policy or incentive, while one state did not respond. Details are given in table 7.1. Another question was asked whether states would give incentive to increase efficiency of water used by current users. This question was not responded to by 3 states while the other 3 states indicated the usefulness of providing incentive to increase efficiency of water used by current users (See Table 7.2).

Table 7.1 : Availability of Policies or Incentives for Promoting Efficiency in Use of Ground Water and Discouraging Waste

Responses	States,
Yes	Gujarat*
No	Andhra Pradesh, Punjab, Tamil Nadu & West Bengal
Non-response	Delhi

*Subsidy provided for installation of Micro Irrigation System.

Table 7.2 : Need for Incentives to Increase the Efficiency of Water Use by Current Users

Responses	States
Yes	Andhra Pradesh, Punjab & Tamil Nadu
No	-
Non-response	Delhi, Gujarat & West Bengal

Source : State Schedule

One can suggest several ways through which better management of water can be brought about. There could be better utilisation of surface water and integrated utilisation of ground water and surface water. The national water policy (2002) has also drawn attention to this aspect. According to it **“integrated and coordinated development of surface water and ground water resources and their conjunctive use should be envisaged right from the**

project planning stage and should form an integral part of the project implementation”. (National Water Policy, 2002, para 7.3) Measures would include restoration of traditional water bodies through desilting of old tanks, ponds, and canals, improvement in efficiency of canals through their lining, diversion of surplus surface water, if any, including inter-basin transfer of water (or inter-linking of rivers) etc. Here it may be mentioned that one of the objectives of the Sardar Sarovar project is to recharge the ground water reserves in North Gujarat and Kachchh using the Narmada Water (K.D. Sharma, Groundwater Governance, 2007, p.279). This would require an integrated approach to water resource management including both surface and ground water resources. Such an approach has been advocated by policy makers in our country for a long time but not practised in a substantial manner. Augmentation of ground water resources might be brought about by watershed development programmes and rain water harvesting, both of which now occupy a high place on the agenda of the governments. It is, however, widely recognized that the potential for diversion of surplus water as well as watershed development and rainwater harvesting is somewhat limited specially in the drought prone areas where the need is more. **Hence, in the ultimate analysis, policy makers have to think in terms of moderating demand for ground water.**

Dual water supply system may be introduced in urban areas. It consists of treated potable water in one system and untreated or partially treated water in the other system for non-drinking like gardening, washing etc. Vigorous efforts be made to increase the supply of surface water through construction of dams which has slackened during the past two decades. This may happen if problems of rehabilitation and resettlement (RR) of project oustees are taken care of. The new RR policy of the Government of India, if implemented properly, can be of much help in this respect. Reduction or control of water pollution by regulating industrial and urban wastes can be of great help. Enhancement of rain water harvesting would also be of some help in water scarce areas.

A major improvement in water saving through better management would take place by **use of micro irrigation techniques like drip and sprinkler irrigation**. Israel has already shown the way. In our own country benefits can be seen in parts where these techniques have already been started. Maharashtra in India has taken the lead. The comparative advantages of micro irrigation system as compared to traditional irrigation system can be seen from the table below.

Table 7.3 : Comparative Advantages of Micro Irrigation System

Performance Indicator	Conventional Irrigation Methods	Modern Irrigation Methods
Water saving	Waste lot of water. Losses occur due to percolation, runoff and evaporation	30-70 percent of water can be saved over conventional irrigation methods. Runoff and deep percolation losses are nil or negligible
Water use Efficiency	30-50, because losses are very high	80 -95 percent
Saving in labour	Labour engaged per irrigation is higher than drip	Labour required only for operation and periodic maintenance of the system
Reduced weed Intensity	Weed infestation is very high	Less wetting of soil, weed infestation is very less or almost nil
Use of saline Water	Concentration of salts increases and adversely affects the plant growth. Saline water can not be used for irrigation	Frequent irrigation keeps the salt concentration within root zone below harmful level

Performance Indicator	Conventional Irrigation Methods	Modern Irrigation Methods
Diseases and pest problems	High	Relatively less because of less atmospheric humidity
Suitability in different soil type	Deep percolation is more in light soil and with limited soil depths. Runoff loss is more in heavy soils	Suitable for all soil types as flow rate can be controlled
Water control	Inadequate	Very precise and easy
Efficiency of fertilizer use	Efficiency is low because of heavy losses due to leaching and runoff	Very high due to reduced loss of nutrients through leaching and runoff water
Soil erosion	Soil erosion is high because of large stream sizes used for irrigation	Partial wetting of soil surface and slow application rates eliminate any possibility of soil erosion
Increase in crop Yield	Non-uniformity in available moisture reducing the crop yield	Frequent watering eliminates moisture stress and yield can be increased upto 15-150 percent as compared to conventional methods of irrigation

Source : Sivanappan, R.K., 1994, Prospects of Micro Irrigation in India, Irrigation and Drainage Systems, Vol.8, pp.49-58.

Narayanamoorthy, A (1997) "Drip Irrigation – A Viable Option for Future Irrigation Development, Productivity, Vol.38, No.3, October – December.

A major problem in the introduction of micro irrigation is very high capital cost which is beyond the financial capacity of most of our farmers. This requires subsidy specially for small and marginal farmers. But such a subsidy is fully justified in the national interest. **A feasible scheme of subsidy on micro-irrigation for areas suffering from over-exploitation of ground water may be evolved.**

7.4 Regulation through Credit

The ground water development in India has taken place mainly in the informal sector by individuals or group of individuals from their own resources or from loans taken from banks etc. The financial assistance provided for ground water development through the erstwhile Agricultural Refinance and Development Corporation (ARDC) and now National Bank for Agriculture and Rural Development (NABARD) has been of immense help in accelerating development of ground water in India. It is, therefore, useful to review the trends in financing so as to determine the scope for using credit as an instrument for regulating utilization of ground water in future. NABARD is the apex institution in this respect. The Study Team, therefore, had an interaction with NABARD both through correspondence as well as face to face discussion. Besides, information on credit for tubewells was also obtained from households through the household schedule as well as a few bank branches at the micro level.

It seems appropriate at this stage to mention that NABARD (including its predecessor, ARDC) has played a leading role in initiating and participating in the several exercises made for ground water assessment in India ever since 1972. It has been a part of all the committees constituted for the purpose by Government of India. In 2006, it brought out a publication entitled "Review of Methodologies for Estimation of Ground Water Resources in India". NABARD is also a member of the R&D Advisory Committee of CGWB. Given the extent of its involvement with the ground water sector continuously for several decades and given its presence in all parts of India, **NABARD deserves to be included as a member of CGWB and CGWA.**

In order to promote sustainable development of ground water, NABARD has adopted a policy not to provide refinance in critical and over-exploited blocks. This facility is available only in safe and semi-critical blocks. Guided by the same objective, NABARD has prescribed spacing norms for different types of areas whereby minimum distance between two ground water extraction structures is indicated. These are based on the hydrogeological characteristics of the area. In order to promote efficiency in extraction of ground water, NABARD has been taking initiative in improving the quality of pump sets.

The details of Ground Level Credit (GLC) and NABARD Refinance (NBRA) disbursement under Minor Irrigation Sector (of which more than 90 percent is accounted from ground water) during the Ninth Plan and Tenth Plan for Commercial Banks (CBs). Cooperative Banks (Coop) and Regional Rural Banks (RRBs) are furnished below in Tables 7.4 and 7.5. It can be seen that NABARD's refinance facility is availed mainly by Cooperative banks and Regional Rural banks. Commercial banks' liquidity position seems to be quite comfortable because of which their dependence on NABARD for refinancing is very limited. **This aspect tends to reduce the effectiveness of terms and conditions determined by NABARD.** It is also estimated that **not more than 30 percent of private ground water structures** created come to banks for financing. In other words, a major portion of these structures are either self-financed by farmers or are financed through sources other than the banks. (John Kurien and Ashutosh Kumar Sinha, Groundwater Governance, 2007, p.397). **The scope for regulating ground water development through credit, therefore, remains limited.** The tables also shows that **the quantum of NABARD's refinance has been stagnating. It would show a declining trend if figures are worked out at constant prices.** Table 7.4 shows that NABARD's refinance has been static or even declining in Northern, Western and Southern regions which are afflicted with the problem of over-exploitation. On the other hand, refinancing has expanded substantially during the past five years in the Eastern region which is more or less a safe region from the point of view of ground water development. NABARD, therefore, seems to have been following an appropriate policy. But the coverage of its operations is limited due to reasons explained earlier.

Table 7.4 : Credit Flow to the Minor Irrigation Sector (In Rs. Crores)

Sr. No.	Years	NBRA (MI)			GLC (MI)		
		CBs	Coop+RRBs	Total	CBs	Coops+RRBs	Total
Ninth Five Year Plan							
1	1997-98	23	501	524	817	767	1584
2	1998-99	67	477	544	1055	801	1856
3	1999-00	70	548	618	1060	1072	2132
4	2000-01	96	530	626	709	1111	1820
5	2001-02	69	622	691	703	1142	1845
6	Total	325	2678	3003	4344	4893	9237
Tenth Five Year Plan							
7	2002-03	41	814	855	967	1008	1975
8	2003-04	7	644	651	1601	1129	2730
9	2004-05	137.54	541.5	679.04	3047	1167	4214
10	2005-06	180.17	360.73	540.9	905	7759	8664
11	2006-07	311.2	359.76	670.96	NA	NA	NA
	Total	676.91	2719.99	3396.90	6520	11063	17583

Source : NABARD's reply to Study Team's Questionnaire

Region wise and agency wise analysis of performance of NABARD refinance (NBRA) disbursement under MI purpose during 2000-2007 is furnished below.

Table 7.5 : Region wise Distribution of NABARD Refinance (In Rs. Lakhs)

Year	Agency	Northern	North Eastern	Eastern	Central	Western	Southern	Total
2000-01	CBs	723	9	315	351	3618	4609	9625
	Coops_RRBs	14284	4	339	12747	10756	14847	52977
2001-02	CBs	574	0	358	938	3277	1801	6948
	Coops_RRBs	12619	9	407	21606	15378	12140	62159
2002-03	CBs	20	0	281	212	2081	1521	4115
	Coops_RRBs	14491	19	2979	25285	26733	11873	81380
2003-04	CBs	0	0	19	0	348	376	743
	Coops_RRBs	15902	17	5191	23440	11757	8097	64404
2004-05	CBs	281	31	5448	1886	3965	2144	13755
	Coops_RRBs	14662	72	4815	19495	4543	10562	54149
2005-06	CBs	728	84	4372	2884	3713	6235	18016
	Coops_RRBs	9043	35	1790	11399	6146	7662	36075
2006-07	CBs	9696	25	2831	7708	3846	7014	31120
	Coops_RRBs	6666	21	3499	9914	6169	9707	35976

Source : NABARD's reply to Study Team's Questionnaire

Margin Requirements at Ultimate Borrower Level

This is as per the guidelines issued by RBI and NABARD.

As per instructions, for agriculture loans up to Rs. 50,000/- and agri-clinics/agri-business centre loan up to Rs. 5.00 lakhs, banks may not insist on any margin. For amounts in excess of Rs. 50,000/- or Rs. 5.00 lakhs, as the case may be, the margin requirements will be as under:-

Category of Farmers	Borrower's Contribution	
	Minor Irrigation	Diversified Investments
Small farmers (as per NABARD definition)	5%	5%
Medium Farmers	10%*	10%*
Other Farmers	10%** for Pumpset and 15%** for other purpose	15%**

*7% for 2 or more farmers in a group loan.

**10% for 2 or more farmers in a group loan.

1. Subsidy, if any, available to the borrower is to be reckoned towards his/her contribution.
2. Share capital held in the borrowing Co-operative Society to be taken into account while determining the down payment.

The corporate bodies, public trusts, etc., shall contribute a minimum of 25 percent of the investment cost as down payment.

According to NABARD rules, refinance can go upto 95 percent of bank loan for minor irrigation projects. Rate of interest is 9 percent for North East and 9.5 percent for other parts.

As can be seen from the above, NABARD tries to promote inter-regional equity by charging lower interest rate for the North East which is a very backward area with respect to economic development. But the difference of 0.5 percent is too low to have much impact. Moreover, this facility is not available to other economically backward states like Bihar, Orissa, Jharkhand, Chhattisgarh etc. NABARD also promotes inter personnel equity by charging a lower margin of 5 percent from small farmers as against 10 percent from medium and large farmers. These are some of the very few policy measures in India in favour of promoting equity in ground water development.

The banks can finance for new ground water extraction structures in the “safe” areas, without prior approval from NABARD and claim refinance under the Automatic Refinance Facility (ARF), as per the existing policy. However, for financing in the areas under “semi-critical” category, the banks will be required to formulate suitable scheme and obtain NABARD’s prior approval for availing refinance facility.

Credit at Grass Root Level

As a part of surveys undertaken for this study, an attempt was made to get information of loans taken by households in sample villages so as to assess the scope for credit as an instrument of control.

In all, only 35 households in the sample had taken loan for installation of tubewells from institutional sources and all of them were from rural areas. (This is in cofomity with the observation made earlier with respect to limited role of a bank credit.) A majority of these households (83%) were from Andhra Pradesh followed by 4 (11%) from Gujarat. One household each from Tamil Nadu and West Bengal also availed loan for installation of tubewells as given in table 7.6.

Table 7.6 : Loans taken from Institutional Sources for Installation of Ground Water Structures as reported by Households

(No. of HHs reporting)

States	Responses Urban	Responses Rural	Total
A.P.	0	29	29
Delhi	0	0	0
Gujarat	0	4	4
Punjab	0	0	0
Tamil Nadu	0	1	1
West Bengal	0	1	1
All India	0	35	35

Amount of Loan

The amount of loan taken from bank and other sources for installation of personal tubewells varied between states. In Gujarat the average amount of loan per tubewell was Rs.65,000 against Rs.12,000 in West Bengal. This is understable since water level is quite high in West Bengal so that a shallow tubewell which costs much less would suffice. But in Gujarat, the water levels are much lower necessitating higher costs of tubewells. The distribution of households by amount of loan taken for installation of tubewells in the selected states, is given in table 7.7.

Table 7.7 : Amount of Loan taken from Institutional Sources for Installation of Ground Water Structures as reported by Households

(No. of HHs reporting)

States	Amount of Loan in Rs.		Total	Average
	Urban	Rural		
A.P. (78)	0	1066000	1066000	36759
Delhi (-)	0	0	0	
Gujarat (19)	0	260000	260000	65000
Punjab (-)	0	0	0	
Tamil Nadu (2)	0	30000	30000	30000
West Bengal (1)	0	12000	12000	12000
All India (100)	0	1368000	1368000	39086

Name of the Financial Institutions from where Loan was taken

The commercial banks were major source of funding for installation of tubewells in the sample states. This was followed by 3 cases from industrial bank, 4 cases from land mortgage bank, 1 from, R.C. Corporation and one each from other sources such as PACS, sugar factory and 2 from private sources. The distribution of households which availed loans from different sources in the sample states, is given in table 7.8.

Table 7.8 : Name of the Bank from which Loan taken for Installation of Ground Water Structures as reported by Households

(No. of HHs reporting)

Name of the Bank	A.P.		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal		All India		Total
	U	R	U	R	U	R	U	R	U	R	U	R	U	R	
Andhra Bank	0	7	0	0	0	0	0	0	0	0	0	0	0	7	7
Canara Bank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indian Bank	0	4	0	0	0	0	0	0	0	0	0	0	0	4	4
Ind.Bank	0	3	0	0	0	0	0	0	0	0	0	0	0	3	3
L.M.Bank	0	4	0	0	0	0	0	0	0	0	0	0	0	4	4
P.N.B.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R.C.Corp.	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1
S.B.I.	0	3	0	0	0	0	0	0	0	0	0	0	0	3	3
Syndicate Bank	0	4	0	0	0	0	0	0	0	0	0	0	0	4	4
Other sources	0	3	0	0	0	0	0	0	0	0	0	1	0	4	4

It can be seen that non-availability of institutional credit, which is under control of NABARD may not have impact on all the farmers proposing to install a tubewell/borewell, if farmers can manage finance through their own sources or through informal sources like friends and relatives or through suppliers credit. But some farmers would certainly be affected though the number may not be large. The effect will be more if restrictions are also put on the credit provided by suppliers of equipments for extracting water.

7.5 Spacing Norms

Spacing norms with respect to minimum distance to be observed between two ground water structures have been prescribed for a long time. These are supposed to be observed while considering application for credit for ground water structures. Implementation of such norms has a restraining effect on new comers. But its impact can be avoided if the farmers use their own money or borrow from informal sources like friends or relatives or suppliers of

equipments. Information on spacing norms for Andhra Pradesh, Gujarat and Tamil Nadu are given below in table 7.9, 7.10 & 7.11 respectively.

Table 7.9 : Spacing Norms - Andhra Pradesh

Situation	Spacing to be Adopted in mtrs between Proposed and Existing Wells			
	Well Bores	Dug Wells	Filter Points Shallow TWs	Tubewells/Bore Wells
Non ayacut	260	160	260	300 to 500
Ayacut	160	100	160	200 to 300
Near perennial sources like river or tank within 200 m	160	100	160	200 to 300
Non perennial streams with in 100m	250	150	180	300 to 500
From the existing public drinking water sources	Not less than 250m as per clause 10 of APWALTA, 2002			

Table 7.10 : Spacing Norms - Gujarat

Structure	Geological Formation	Spacing
Dug well	Hard rock	110m to 150m
	Alluvial	240m
DCBW and STW		600m

Table 7.11 : Spacing Norms - Tamil Nadu

Structure	Spacing
Between two Dugwells with or without pumpset	150m
Between two shallow tubewells/Filter Points with pumpset	175m
Between Dugwell with pumpset and Shallow Tubewell/Filter Point	162.5m

7.6 Regulation through Electricity

As already pointed out in chapter 1, availability of cheap (or even free) electricity has been a major factor in expansion of ground water structures in India in recent years. **Electricity has also the potential to be a potent source of regulating use of ground water. In the states where field survey was conducted, about 90 percent pumpsets were found being energized through electricity for extraction of ground water primarily for agricultural purposes.** In Andhra Pradesh, Delhi and Gujarat, all the tubewells used for extraction of ground water were electrified. The details of distribution by states have already been given in table 6.14 of the last chapter and may be recapitulated.

The reasons for preponderance of electric pumps in water scarce or critical and over-exploited areas (which were mostly included in our sample) are obvious. Because of very low water table, diesel pumps are unsuitable since they usually extract water from a distance of 10 to 15 meters only. Drawing water from lower water tables requires centrifugal pumps or submersible pump sets which run on electricity. Moreover, electricity for tubewells/borewells is heavily subsidized and sometimes free also, thereby making it cheaper to run the pumps on electricity rather than diesel. Even where the price is not very low, supply is not metered and a flat tariff is charged depending on the horse power of the pump. **This makes the marginal cost of power zero and provides little incentive to economise on power or water.**

There are several ways in which the supply of electricity can be used to restrict extraction of ground water. Some of these are being attempted by state governments also. One way to do this would be to raise power costs (through electricity rates) in areas suffering from over-exploitation of ground water. Since the objective is regulation and not generation of profit, revenue generated might be returned to the farmers in the same area in the form of subsidies on water-saving technologies like drip irrigation and schemes for rainwater harvesting. Another way could be denial of electricity connection for new tubewells in over exploited areas or restrictions on availability of electricity to existing tubewells through metering. The Gujarat Electricity Board, for example, does not provide new electric connection for extraction of ground water in over-exploited, critical and saline areas without consent of GGWA (reply from state). A similar practice exists in West Bengal also. A third way could be one of cutting off power supply to the existing irrigation tubewells during the summer months of May-June in order to discourage cultivation of summer paddy which is a water guzzling crop.

In West Bengal, the state government decided in 1994 that West Bengal State Electricity Board (WBSEB) would give electric connection to the submersible pumps after getting clearance from the State Water Investigation Directorate (SWID) for the seven districts where considerable withdrawal of ground water was observed by the state level committee. These districts were: 1, Burdwan, 2. Hooghly, 3. Malda, 4. Medinipur, 5. Murshidabad, 6. Nadia and 7. North 24 Parganas. It was also decided that no connection would be given in the dark (only one in W.B.) and over-exploited blocks (nil in W.B.). However, new electric connections to submersible pumps can be given in the white and grey blocks (GEC-84). In such cases one has to apply for a new electric connection for submersible pump in the SWID prescribed format. The format has to be forwarded by the Pradhan of the Gram Panchayat (GP), where he/she will certify (i) the residential status of the applicant under the jurisdiction of his/her GP, (ii) possession of land by the farmer as per the deed and (iii) occurrence of no submersible pump within a distance of 600 m from the proposed site. In case of white blocks the permission can be given by the district authority of SWID. In case of semi-critical blocks the applications are required to be forwarded to the SWID headquarters at Kolkata. The decision of approval or denial is taken through a state committee meeting and the same is conveyed to the farmer. It is only after getting the permission that the farmer can apply to the WBSEB for electricity connection to the submersible pump. (Amlarijyoti Kar et. al., Groundwater Governance, 2007, p.325-26)

Gujarat has launched Jyoti Gram Service (JGS) under which separation of agriculture and domestic/commercial feeder in rural area is undertaken. Agriculture load is diverted to a district agriculture feeder supplying power for eight hours a day. Advantage of feeder separation is (i) improved servicing of agriculture load-power supply only when needed. This cuts down theft and losses to other sectors, (ii) Reduction of ground water exploitation – as power is available only for a certain period of time, farmers would optimize utilization of water pumped out, resulting in lower ground water exploitation and investment in demand-side water management measure (A.K., Lakhina, Groundwater Governance, 2007, p.430)

It is also known that erratic supply of electricity in rural areas has been one of the reasons for wastage of ground water. Since electric supply is not regular, farmers have the tendency to extract water whenever electricity is available even though they do not need water at that time. This is out of the fear that electricity may not be available at a time when they need water for their crops. Water is, no doubt, kept in storage tanks from where some water is lost by evaporation or seepage. It is also known that quite often electricity for irrigation in many

states is obtained during night when farmers would like to sleep. As a result, they just put on the tubewell motor and go to sleep while keeping the motor still on. As a result, excess of water is extracted which results in wastage. Providing assured supply of electricity for tubewell irrigation during fixed hours specially during day would help in avoiding this type of wastage of water. Such an approach would be more useful to both farmers as well as the society as a whole than the provision of free or subsidized electricity.

Metering

It is often suggested that metered power at an appropriate tariff will induce farmers to cultivate less water intensive crops and reduce over extraction of water by them. The Model Bill 1992 had in fact suggested for mandatory installation of water meters by all ground water owners. Further, there are reports that some states such as Rajasthan, Gujarat, Andhra Pradesh, Maharashtra, Karnataka have started metering of new pumpset connections (A.K. Lakhina, Groundwater Governance, 2007, p.430). Such a measure might result in restricting water markets. Well owners who sell water to their neighbours without wells who might be mainly small and marginal farmers would sell less or charge a higher price. This is reported to be observed in Gujarat where farmers with metered supply charge 30-60 percent more for water compared to farmers with flat tariff in the same district (Planning Commission, Report of the Expert Group on Ground Water Management and Ownership, 2007, p.45).

It may be said that metering would require a massive operation along with considerable financial cost which may take much time or may not be feasible. The maintenance and safeguarding of these meters would be major operational problems. **These problems, however, can be taken care of by adopting a phased approach.** In the first phase, only large operators like large farmers, commercial units, group housing apartments in urban areas, major office complexes, industries etc. should be covered. In the light of the experience gained for about five years, the second phase of metering may be launched covering middle level operators. Small users like small and marginal farmers, small offices in single small houses in the urban areas need not be covered at all under this policy. Objective standards for classifying users in these categories may be worked out by the technical experts. Thus the task is manageable. Further, **trained rural volunteers at nominal rates may be appointed to take readings so as to minimize the cost of operation.**

7.7 Regulation of Drillers and Suppliers

Drillers and suppliers of tubewells and borewells can play a role in regulation if they refuse to supply these equipments specially those higher than a certain HP. or stop supplying them on credit in critical and over-exploited areas. Since their number is much smaller than the number of tubewell owners, it would be comparatively easier to control them. It is, therefore, suggested that the authorities may evolve a mechanism to regulate the supply of tubewells/borewells **through influencing the operation of drillers and suppliers.**

7.8 Ground Water Pricing

Pricing of ground water may induce users to use water more efficiently and reduce wastage. The 12th National Symposium on Hydrology with focal theme “Groundwater Governance: Ownership of Ground Water and Its Pricing” held in Delhi in November 2007 under the auspices of Central Ground Water Board has also laid emphasis on rational ground water pricing policy. It went to the extent of recommending amendments in the Model Bill to take care of water pricing. It recommended a slab system for water pricing wherein the economically weaker section of the society and small farmers can be charged at a subsidized rate whereas the water price can be increased substantially for big users with increasing demand. The price should also vary with respect to quantum of water extracted and

consumed. “Higher the consumption, more should be the prices”. (Paras 19 and 21 of Recommendations). The study team agrees with these recommendations since those would contribute to equity and help in conserving water and reducing its wastage. But its implementation would require a system of volumetric tariff which, in turn, would need metering of water supply. This might be a costly proposition. But a way out could be through metering of electricity supply. For this purpose, as already pointed out in the previous section, it is possible to work out a feasible plan of action.

But pricing is supposed to be an unpopular measure which political parties are not willing to introduce at the moment. This was recognized by the above mentioned 12th National Symposium on Hydrology also. It mentioned that “it is difficult to prescribe the ‘pricing’ as one of the tool for better ground water management, because it is difficult to price or regulate a resource as the ownership rights are not clearly defined.” (Para 20 of Recommendations).

In our view the problem lies not in the vagueness of the ownership rights but in lack of political will since millions of farmers are involved. As has been argued in Chapter III, there is an emerging consensus that ground water in critical and over-exploited areas should be treated under public domain. The Model Bill and the Supreme Court 1996 judgment clearly point out towards this. **As far as the problem of political will is concerned, an attempt can be made to tackle it by adopting a phased approach.** In the first phase, one can concentrate on bulk users of water like big industries and urban complexes. There are factories, for example, soft drink and water bottling units, which earn substantial profit by extracting ground water. These can be asked to pay a price or pay tax like a ground water cess. Such a step is politically feasible also. No political party is expected to oppose any move to charge appropriate prices from them. In the second phase, appropriate prices can be charged for supply of ground water through public tubewells in urban areas. Successful operation of these pricing structures would help the authorities to make a case for gradual extension of pricing to other users.

The recommendation for **a slab system for water pricing** made by the 12th National Symposium on Hydrology in November 2007 may be operationalised as below.

Water pricing structure for large users like industries etc. should be aimed at recovering the full cost of supplying water which should take care of both capital and O&M costs. The operational cost should also include the cost of monitoring and regulation. Besides, such users should be charged some amount for the intrinsic cost of water, which is a precious national resource. Price for other users could be lower which should be fixed in the light of paying capacity of respective users. The poorest households may be charged a nominal rate only which should be lower than the opportunity cost of fetching water by them. Subsidy, if any, would be fully justified in their case. Thus a socially politically and economically feasible scheme of water pricing can be evolved and implemented.

7.9 Water Markets in India

Trading of ground water has no legal basis in India. Water markets that exist in India are, therefore, informal and are often limited to localized water trading between adjacent farmers. It is often a substitute to owning a well. This practice serves two useful purposes: promoting efficient use of ground water and providing water to poor farmers who are either unable to afford wells, or find it uneconomical to do so. They, however, have to pay charges which are higher if they purchase from private sources as can be seen from figures obtained from our sample area in West Bengal and given in table 7.12.

Table 7.12 : Irrigation Charges per Acre Burdwan District (West Bengal)

Village	Block	District	Rate/Acre (Rs.)	
			Private	Government
Harakali	Memari-2	Burdwan	500	300
Palasberia	Purbasthali-2	Burdwan	-	280
Pathangram	Purbasthali-2	Burdwan	400	270
Nakadaha	Purbasthali-2	Burdwan	500	280

Source : Village Schedule

While water markets are widespread in Gujarat, Uttar Pradesh, Tamil Nadu, Andhra Pradesh and West Bengal, they are most developed in Gujarat. There is, however, no systematic estimate of the magnitude of water trading at the national level. The findings of the household level survey conducted during this study provide some indication of the trade among adjacent farmers. As can be seen from table 6.10 of chapter VI, 84 percent of farmers relied on tubewell irrigation. But as per table 6.9 of the same chapter, only 79 percent of farmers used their own tubewells for irrigating crops. In other words, **about 5 percent of all the farmers in our sample received water from fellow farmers of the adjacent plots**. There are, of course, state wise variations from nil in Andhra Pradesh to 12 percent in Delhi. Such figures, however, can not be generalized in view of the very limited coverage of our sample.

Sometimes, there is sale of large quantities of water to distant places by big water lords who make much money out of this national resource. This is done purely out of commercial motive to earn quick profit during periods of water scarcity. In reply to our question, all the sample states expressed themselves against this practice. States, however, have been tolerant of the practice, since no law on this issue has been enacted in any of the states nor any administrative order issued possibly because of the fear of provoking opposition from the vested interests who are often persons with influence. **There is need for evolving appropriate regulatory measures to ensure that extraction and sale of ground water by large scale operators do not result in over-exploitation of ground water in India.**

7.10 Conclusion

Legal and institutional support as needed for the above mentioned measures may be provided. The above would imply that senior representatives of the agencies responsible for the above measures are closely associated with the regulatory authorities at both central and state levels. Thus the Central Ground Water Authority should also include senior representatives from Indian Council of Agricultural Research, NABARD and Ministry of Power. Similarly State Ground Water Authority should include senior representatives of State Electricity Board, Lead bank of the state and State Agriculture Department.

Chapter - VIII

Regulation Through Peoples Participation

Past experience indicates that the management of ground water through the prevailing bureaucratic channels has been far from efficient. Hence, there is a need for visualizing alternative institutional frameworks for its better management. In the above context, one often hears a suggestion that public participation in management of this resource is desirable to promote efficiency, equity as well as environmental sustainability. Community responsibility in management is expected to make people understand the importance of limiting use of water in over-exploited and critical areas. Peer group pressures can generate socially responsible behaviour as has been observed in self help groups. In the light of the above, this chapter deals with role of Panchayati Raj Institutions (PRIs)/Urban Local Bodies (ULBs), NGOs and Water Users Associations (WUAs) in management of ground water resources

8.1 Role of Panchayati Raj Institutions and Urban Local Bodies

Panchayats at the village, intermediate and district levels, being representative institutions of the people at local levels, are ideally suited to provide scope for public participation either directly or through concerned groups of people working under or associated with them. After the 73rd Constitutional amendment, the Panchayats are emerging as the institutions of self-governance at the local level in India. There are 2,34,676 gram panchayats, 6097 intermediate panchayats and 537 district panchayats in the country. It would, therefore, be useful if panchayats are given an opportunity to manage the utilisation of this resource at the local level.

8.1.1 Potential

Recent experience has also shown that panchayats have the potential to tackle problems associated with utilization of ground water resources at local level. A few examples, which have already attracted widespread media attention, are given below.

There is the well known case of Plachimada village in Perumetty panchayat in Chittor Taluka of Palakkad district of Kerala. The establishment of a coca-cola manufacturing unit in this village in 1998-99, after receiving proper sanction from the state government, resulted in sharp depletion of ground water and deterioration of its quality. As the water shortage intensified, the local people started an agitation. Thereafter, the village panchayat decided to cancel the company's license and forced closure of the plant. But this was annulled by an executive order. The matter went to Kerala High Court which gave an order against the panchayat on the ground that the Panchayat was not legally empowered to cancel the license. Thereafter an appeal was made to the Supreme Court where the case is pending.

A somewhat similar situation arose in Kanjihode village of Pudussery gram panchayat in the same Palakkad district of Kerala where a Pepsi plant was located resulting in excessive depletion of ground water table. In 2003, the panchayat cancelled the license of the company which appealed to the Kerala High Court. On April 10, 2007, the Kerala High Court quashed the Pudussery Gram Panchayat order on the ground that the panchayat had no legal power to cancel the license. This standpoint has been confirmed by the Supreme Court in February, 2008.

A third case is from Kaladera village panchayat near Jaipur in Rajasthan. Here also, a Coca-cola factory, which had been established in 1999, had an adverse effect on the ground water situation in the village. On March 5, 2005, a meeting of the Gram Sabha of the village Panchayat unanimously passed a resolution asking the company to close its operation in the village. This resolution was endorsed by a meeting of Jan Adalat (People's Court) held on 15 March 2005 in Kaladera village. This meeting was attended by Sarpanches, Panches and members of the Panchayat Samities and Zila Parishad from about a dozen villages. The villagers pointed out that water as a natural resource could not be monopolized by a multinational firm. They would not allow Coca-cola to deprive them of their right to use their own water.

A fourth case is from village Kudus in Wada Taluka of Thane district of Maharashtra state. Here also a Coca-cola factory was established which started production in February 2000. Agitations against the plant started from the very beginning. Farmers have been complaining that the much needed water for agriculture in the area was sold cheaply to the Coca-cola company. Local people had a very reasonable demand that the rates be enhanced from Rs. 0.17 a litre to Rs. 3 a litre and the money should come to Zilla Parishad for development of this backward region.

The fifth case is most unique. It is from Amritya village in Bhilwara district of Rajasthan. About 5 years ago i.e. in 2002, villagers decided to stop sinking of borewells by people to preserve and judiciously use the water resources at their disposal. The villagers barred the sinking of borewells even though there was no legal compulsion to do so. This decision of the villagers was enforced effectively. In 2004, a similar decision was taken in a nearby Lodpure village. As a result, no borewells can be found in a radius of 4 km. This is remarkable since the government agencies are finding it almost impossible to do so in several parts of the country despite legal backing.

Any sustainable mechanism for public participation in ground water management is not possible without giving adequate role to Panchayati Raj Institutions. At the same time, it is also obvious that the centrality of the panchayati raj institutions in management of ground water can not be established without removing the prevailing deficiencies in this respect.

8.1.2 Recent Developments

As already mentioned in Chapter III, after the 73rd amendment of the Indian Constitution, a new schedule number 11 (eleven) was added to the Constitution giving a list of items to be dealt with by the Panchayats. **Here, the subjects of minor irrigation, water management and watershed development, drinking water and maintenance of community assets are listed.** Functional responsibilities are thus visualized for Panchayats with regard to several aspects of water. Bulk of ground water which has become the most important source of irrigation comes under minor irrigation. In view of the above, it should have been mandatory to involve Panchayats in water resource management.

Drinking water has a crucial position in the socio-economic fabric of a nation. Provision of safe drinking water to people is, therefore, a basic responsibility of the government. The Ministry of Rural Development, which is the nodal ministry for this purpose in the Government of India, has come to realize the need to involve Panchayats in the management of rural drinking water supply for ensuring provision of safe drinking water in rural areas. It has already developed and implemented some schemes in this connection. Under the Rajiv Gandhi National Drinking Water Mission, a Sector Reform Projects (SRP) in rural water

supply was started in the year 2002 in 65 districts of the country on a pilot basis. Under the programme villagers were involved in sharing of capital cost and full cost of operation and maintenance of the drinking water structures created in their areas. However, the scheme did not achieve much success for want of motivation among stakeholders as also due to vastness of the projects in terms of coverage and cost involving the panchayat as a whole. Hence, a switch over to smaller projects involving single habitation was felt necessary as a result of which, the Government launched another scheme named “Swajaldhara”, under which the villagers were empowered to construct, operate and collect monthly repair and maintenance charges from each and every beneficiary for the facility created under community contribution. In the initial years, the response was lukewarm but in subsequent years, due to a good deal of motivation and publicity among villagers, it picked up very well. It is expected that in the years to come, the programme might spread to a considerable extent.

In recent years, three community oriented ground water schemes were launched on a pilot basis in Kerala. The first one, known as the Community Irrigation Scheme was introduced during 1992. It was mainly focused on ground water utilization for irrigation purposes. A filter point well was constructed for irrigating an area of five acres of land, a bore well for 10 – 15 acres of land and a tubewell for irrigating 25-40 acres of land. A minimum of seven families were required for registering as a society. The distribution line mainly of PVC pipes, was laid in such a way that each family got a tap on its plot, with a valve. At one time, one or two persons could irrigate their plot. The electrical and repair charges were to be borne by the society and were to be shared by the members of the society. The scheme, however, did not succeed since the income generation from agriculture was virtually nil or minimal. The second one known as the Kerala Samuthya Jalasechana Samithi, aimed at utilization of ground water for both drinking and irrigation purposes. It was a Netherlands aided Project which was almost similar to the Community Irrigation Scheme. The main difference was that there were community organizers for motivating the people and they guided the people to form the society. The project was implemented in Thrissur district. The operational and maintenance costs were borne by the members of the society. The scheme became sustainable. The third one known as Jalanidhi was a World Bank aided project. It aimed to provide drinking water to a group of people of an area and the source of water was ground water. The operational and maintenance costs were to be shared by the members of the group. The drinking water was thus priced. In Kerala, many panchayats had adopted the Jalanidhi scheme. (Ajith Kumar P.N. and A.S. Sudheer, Groundwater Governance, 2007, p.363)

During the last two years, most states/Union Territories are reported to be undertaking activity mapping or reviewing existing activity maps with a view to carrying forward the process of effective devolution of functions at panchayat levels. **This is, therefore, an appropriate time when the attention of the authorities can be drawn to include management of ground water in the list of items to be devolved at the Panchayat level.**

8.1.3 Present Position

The present study shows that panchayats have a limited role in management of ground water. This is not due to villagers incompetence to manage this resource since we have already cited cases how panchayats have handled their responsibility with competence and dedication. **This is partly due to lack of financial resources but mainly due to reluctance of the ground water irrigation department to hand over responsibilities to Panchayats and thereby deprive them of their constitutionally mandated legitimate functions.**

It is, however, important to know the measures which should be taken to enable Panchayats to assume the responsibility assigned to them in the Constitution. From where the funds

would come and how much? What type of capacity building training would be needed, who will provide that and who will meet the costs? What type of organizational restructuring would be needed at Panchayat level and at the Block and District level Panchayats for an efficient functioning? What limits be placed on powers of Panchayats so that large national interests are not jeopardized under the pressure of local interest?

8.1.4 Role of Panchayats/Urban Local Bodies (ULB) in the Study Area

Overall Status of the Role

Since one of the objectives of the study was to ascertain the role of PRIs/Municipal bodies in the management and control of ground water resources, it was felt necessary to take the views of the sample households, village heads, incharge of the ground water management at the district and state on this matter. Their views when analysed revealed that in the absence of any legislation, the role of panchayats/municipalities in management and control of ground water was neither effective nor uniform. It varied across the states and also within a state. In most of the sample units **their role was found to be casual or negligible**. This assessment was confirmed by discussion at the state level also.

The interaction with the households during the survey revealed that the involvement of PRIs and Municipal Bodies was limited mainly to supply of water for drinking and domestic use. In this respect, about two thirds of the respondents reported involvement of panchayats in some ways or the other. This role was prominent in the states of Andhra Pradesh, Gujarat, Punjab and West Bengal. However, in Delhi, these agencies had no role. In Tamil Nadu, although PRIs were effectively functioning they were not given any role to play in respect of groundwater governance nor had they taken any interest in that matter. **But in respect of irrigation, these decentralized institutions had no role. Irrigation management in all the sample states was being looked after exclusively by the state irrigation department.**

Table 8.1 provides information on responses of households on involvement of PRIs in ground water management with respect to drinking and domestic use. All the respondents in rural areas of Andhra Pradesh, Gujarat, Punjab and West Bengal felt that PRIs had a role whereas in urban areas in these states, only 62 percent felt so as per table below. Combining both rural and urban responses, we find that 352 out of 540 respondents i.e. 65 percent of sample households reported that PRIs/ULBs had some role in management of ground water for drinking and domestic use.

Table 8.1 : Perceived Role of PRIs/Municipal Bodies in respect of Ground Water Use for Domestic Purposes as reported by Households

States	Role Played		No Role	
	Urban	Rural	Urban	Rural
Andhra Pradesh	24	60	6	-
Delhi	-	-	30	60
Gujarat	30	60	-	-
Punjab	28	60	2	-
Tamil Nadu	-	-	30	60
West Bengal	30	60	-	-
All India	112	240	68	120

Source : Household Schedule

The role of PRIs/Municipalities in the ground water management was further probed at the village/town level. This was done while interacting with key informants in the village and spokespersons of the concerned Municipalities to ascertain the extent of their involvement in the water sector. The analysis of data on role of PRIs/Urban local bodies revealed more or less similar picture as reported by households in the sample villages. In this case, the response is about 60 percent compared to 65 percent as reported by households. However, in Delhi apart from municipalities being involved in upkeep and maintenance of water works particularly those used for domestic purposes, Resident Welfare Associations (RWA) consisting of a group of households in a few pockets were found involved in the process. The services being offered by these associations are voluntary in nature and lack legal backing. The association of panchayats with ground water management as reported by village heads was also found to be voluntary without any legal backup. The distribution of villages/town wards by responses of the concerned spokespersons about involvement of GPs/Municipalities in different states is given in the table 8.2 below.

Table 8.2 : Assessment of Role Played by PRIs/Municipalities in the Ground Water Management as reported by Key Persons of Concerned Agencies

(No. of village/towns reporting)

States	Areas	Responses		
		Yes	No	Total
Andhra Pradesh	Urban	1	1	2
	Rural	4	2	6
Delhi	Urban	2*	-	2
	Rural	-	6	6
Gujarat	Urban	2	-	2
	Rural	5	1	6
Punjab	Urban	2	-	2
	Rural	3	3	6
Tamil Nadu	Urban	2	-	2
	Rural	-	6	6
West Bengal	Urban	2	-	2
	Rural	6	-	6
All India	Urban	11 (92%)	1 (8%)	12 (100%)
	Rural	18 (50%)	18 (50%)	36 (100%)

*Resident Welfare Association (RWA)

The information collected in the household and village/town level schedules pertaining to the role of PRIs/Municipalities in the ground water management was cross checked with the information collected through district schedules so as to find out the extent of convergence in views from the two sources. The analysis of data obtained at the district level showed that in 3 out of 6 districts i.e. Chittoor (Andhra Pradesh), Kachchh (Gujarat), and Burdwan (West Bengal), the PRIs/Municipal bodies were associated with ground water management. The responses are given below in table 8.3.

Table 8.3 : Involvement of PRIs/Urban Local Bodies in the Ground Water Management as reported by District Level Officials in charge of Ground Water Management
(No. of district reporting)

District	Responses	
	Yes	No
Chittoor (Andhra Pradesh)	1	-
South and South West (Delhi)	-	2
Kachchh (Gujarat)	1	-
Moga (Punjab)	-	1
Dindigul (Tamil Nadu)	-	1
Burdwan (West Bengal)	1	-

The analysis of state level schedules showed a different picture except West Bengal when compared with the information collected at the districts and down below i.e. village/town and household levels. Since there is no legislation enacted by the states empowering panchayats and other local bodies to manage and control ground water regulation, the response of the state officials was in the negative. In West Bengal, however some efforts have been made to involve panchayats in awareness generation and other activities related to ground water development and management. The responses of the officials incharge of ground water management in the sample states is given below.

Table 8.4 : Involvement of PRIs/Municipal Bodies in Management and Regulation of Ground Water as reported by State Level Officials
(No. of states reporting)

States	Responses	
	Yes	No
Andhra Pradesh	-	1
Delhi	-	1
Gujarat	-	1
Punjab	-	1
Tamil Nadu	-	1
West Bengal	1	-

As per report received from state level schedule of West Bengal, PRIs/municipal authorities were involved in ground water management in a limited way. But in other states PRIs/municipalities had no role in the management and development of ground water.

8.1.5 Types of Role Played by PRIs/Municipal Bodies

The above mentioned 352 (65%) household respondents have reported on the types of roles performed by PRIs/ULBs. These included selection of sites for water works related to public tubewells, formation of user groups, collection of water charges and help in repair and maintenance of the water works, pipe lines, motors etc. The PRIs role in formation of users groups was reported only from households of Andhra Pradesh and Punjab. This was because the selected districts namely Chittoor in Andhra Pradesh and Moga in Punjab were covered under Sector Reform Projects (SRP) in rural water supply launched by the Ministry of Rural Development. Formation of users groups was a part of this scheme. A majority of households, about 37 percent reported that PRIs helped in repair and maintenance of the created assets. This was followed by 21 percent who reported that PRIs/Municipalities also helped in collection of water charges to a considerable extent. Still, there were 28 percent households who reported that the PRIs/Municipal bodies helped a lot in selection of sites for new water works. However, in Delhi and Tamil Nadu, the PRIs played no role in this

direction. It, however, deserves to be noted that very few respondents, only 22, felt that PRIs/ULBs played a part in formation of user groups. Various roles played by PRIs/Municipal bodies in respect of ground water management in sample states as reported by households are given in the table below:

Table 8.5 : Type of Role Played by PRIs/Municipalities in Groundwater Governance as reported by Households

(No. of hhs reporting)

Districts (States)	Roles played			
	Selection of Site for Water Works	Formation of Users Groups	Help in Collection of Water Charges	Help in Repair and Maintenance
Chittoor (Andhra Pradesh)	57	13	19	68
South & South West (Delhi)	-	-	-	-
Kachchh (Gujarat)	27	-	31	27
Moga (Punjab)	56	9	59	31
Dindigul (Tamil Nadu)	-	-	-	-
Burdwan (West Bengal)	10	-	3	76
All India	150	22	112	202

Note : Multiple Responses

Major role played by PRIs/Municipal bodies in respect of ground water management as reported by officials of 3 districts namely Chittoor, Kachchh and Bundwan was selection of site for installation of new tubewells followed by generating awareness about efficient use of ground water. Similarly collection of beneficiary share towards capital cost and monthly operation and maintenance charges was the other role played by the PRIs as reported by district authorities in Chittoor and **Moga districts. The distribution of responses obtained** through district schedules in respect of PRIs role in ground water management in the sample districts is given in the table below.

Table 8.6 : Involvement of PRIs/Urban Local Bodies in Various Activities pertaining to the Management of Water Resources as reported by District Officials

Districts	Involvement in		
	Selection of Site for Water Works	Awareness Generation	Collection of Beneficiary Share
Chittoor (Andhra Pradesh)	1	-	1
South & South West (Delhi)	-	-	-
Kachchh (Gujarat)	1	1	-
Moga (Punjab)	1	-	1
Anna Dindigul (Tamil Nadu)	-	-	-
Bundwan (West Bengal)	1	1	-

The role of PRIs/municipal bodies in the regulation and control of ground water resource as reported in West Bengal amounted to selection of site for installation of tubewells, awareness generation for efficient use of ground water and giving permission for installation of new tubewells.

Suggestions given by Households to involve PRIs/Municipal Bodies in the Ground Water Management

The remaining households, who reported non-involvement of PRIs/Municipalities in ground water management, gave suggestions with a view to involve them in the process of groundwater governance. The most frequently offered suggestion was that these institutions should be assigned some defined role through legislation. The other suggestion was that they also should be assigned the duty of creating awareness among water users with a view to conserve water in the best possible ways. Further suggestion was that panchayats should be empowered to call a meeting of the villagers and help in formation of water users associations which may go a long way in conservation of water for future. Table 8.7 gives the details.

Table 8.7 : Suggestions to involve PRIs/Urban Local Bodies in Ground Water Management
(No. of households reporting)

Suggestions	States						
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	All India
PRIs/Municipalities should be involved in creating awareness	6	8	-	2	29	-	45
PRIs/Municipalities should call a meeting of households to form water users associations	2	7	-	1	18	-	28
Legislation be enacted to empower PRIs/Municipalities to deal with ground water problem	4	18	-	2	48	-	72

Note : Multiple responses

8.2 Involvement of Non-Governmental Organizations (NGOs) in the Management of Ground Water Resources

The role of NGOs in respect of ground water management was found sporadic and peripheral. As reported in the village/town level schedules in one out of 6 villages in Andhra Pradesh, a NGO was involved in providing awareness services to the households whereas in the remaining areas, they had no role. In Delhi, Punjab, Tamil Nadu and West Bengal, however, no NGO was available for promotion and management of ground water. But in Gujarat, in all the 6 villages and 2 towns, NGOs played an appreciable role in respect of promotion of related activities like watershed management such as building of check dams etc. and drip irrigation system.

The information about involvement of NGOs in water sector as reported in village/town level schedules when compared with the reports given by the district authorities, mis-matches with those of Moga district in Punjab and Dindigul district in Tamil Nadu. In these districts, NGOs role in awareness generation is reported. This may be to a limited extent but in the sample villages, NGOs were not found to have any role in development and management of ground water. As indicated in the district schedule, the NGOs played a motivational role in Chittoor (Andhra Pradesh) and Kachchh (Gujarat) apart from raising awareness among users. The other role played by NGOs in Kachchh district of Gujarat included providing help and cooperation for formation of user groups and collection of community contribution under watershed development programme. But in South and South-West districts of Delhi and Burdwan district of West Bengal, NGOs had no role in groundwater governance. This was reported by the authorities of the respective districts and was in conformity with the

information furnished in the village/town level schedules. The report of the district level officials pertaining to the involvement of NGOs in water sector is given in the table below.

Table 8.8 : Type of Roles played by NGOs in Management of Ground Water in the selected Districts

Role played by NGOs	Name of Districts					
	Chittoor (Andhra Pradesh)	South & South-West (Delhi)	Kachchh (Gujarat)	Moga (Punjab)	Dindigul (Tamil Nadu)	Burdwan (West Bengal)
Motivation	Yes	-	Yes	-	-	-
Awareness about water use practices	yes	-	Yes	Yes	Yes	-
Help in formation of user groups	-	-	Yes	-	-	-
Collection of community contribution	-	-	yes	-	-	-

Source : District Schedule

The analysis of data presented in the state schedule about the role of NGOs in the ground water management revealed almost a similar picture when compared with the information collected in the district schedules. Here also, NGOs role was absent in Delhi and West Bengal whereas in the remaining states, the NGOs performed some role in motivation and awareness generation. The distribution of responses given in the state level schedules pertaining to the role of NGOs in ground water management is given below table 8.9.

Table 8.9 : Role of NGOs in Ground Water Management as reported by State Level Ground Water Authorities

(No. of States reporting)

Role played by NGOs	Name of State					
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal
Motivation	Yes	Yes	-	-	-	-
Awareness about water use practices	Yes	Yes	-	-	-	-
Help in formation of user groups	-	-	Yes	-	-	-
Collection of community contribution	-	-	Yes	-	-	-

Source : State Schedule

8.3 Role of Water Users Associations/Cooperatives/Societies

8.3.1 Functioning of Water Users Associations/Cooperatives/Societies in the Sample Areas

The survey team had limited number of responses about functioning water users associations/societies, mainly from rural areas of Andhra Pradesh and Punjab. This is because the sample district of Chittoor in Andhra Pradesh and Moga in Punjab were among the few districts in the country where the Sector Reform Project in Rural Water Supply of the Ministry of Rural Development, Government of India was in operation. Formation of water users association was a part of the scheme. In no other state such associations/bodies were reported during the field survey. The distribution of households by responses on availability of water users bodies in the sample states is given in table 8.10.

Table 8.10 : Availability of Water Users Associations/Societies/Cooperatives in the Study Areas as reported by the Households

(No. of HHs reporting)

State	Urban	Rural	Total
Andhra Pradesh	0	10	10
Delhi	0	0	0
Gujarat	0	0	0
Punjab	0	45	45
Tamil Nadu	0	0	0
West Bengal	0	0	0
All India	0	55	55

Source : Household Schedule

Response of the state government on this issue is given in table 8.11. below. West Bengal is the only state which indicated existence of ground water users societies. It may be noted that replies from Andhra Pradesh and Punjab states make no mention of water users associations that exist in Chittoor district of Andhra Pradesh and Moga district of Punjab. This is because these associations are linked to Public Health Engineering Department/Rural Development Department and not to Water Resources Department which prepared the reply to our questionnaire. In view of the strong feeling of departmentalism that prevails in the government, it is quite likely that the Water Resources Department may not be aware of what is happening on the ground in one or two districts, through other departments.

Table 8.11 : Existence of Registered Ground Water Users Associations/Societies in the Selected States

Yes	No	Non-responses
West Bengal	Delhi	Gujarat
	Andhra Pradesh	Punjab
	Tamil Nadu	

Source : State Schedule

Responses obtained the village/town schedule are given in table 8.12 below. These confirm the findings of the household survey. Both Chittoor and Moga belong to special category of districts. Hence one may conclude **that water users associations/societies/cooperatives associated with ground water are more or less non-existent in India.**

Table 8.12 : Water Users Associations in Sample Villages/Towns

(No. of Villages/Towns reporting)

Association	States						All
	Andhra Pradesh	Delhi	Gujarat	Punjab	Tamil Nadu	West Bengal	
Yes	1	-	-	8	-	-	9
No	7	8	8	-	8	8	39
No. of association	6	-	-	94	-	-	100

Source : Village/Town Schedule

The survey result provided account for 95 water users associations i.e. 50 (majority) from Andhra Pradesh and 45 from Punjab. These associations were found only in the rural areas of the selected districts i.e. Chittoor of Andhra Pradesh and Moga of Punjab which were covered

under Sector Reform Projects (SRP) in Rural Water Supply. The details of distribution in both the states are given in table 8.13.

Table 8.13 : Number of Water Users Associations/Societies/Cooperatives in the Study Areas as reported by Households

(No. of HHs reporting)

State	Urban	Rural	Total
Andhra Pradesh	0	50	50
Delhi	0	0	0
Gujarat	0	0	0
Punjab	0	45	45
Tamil Nadu	0	0	0
West Bengal	0	0	0
All India	0	95	95

Source : Household Schedule

8.3.2 Role of Water User Association/Cooperatives

The water user associations in Andhra Pradesh and Punjab played several roles in regulating use of ground water. Of these, the major role pertained to users education reported by 26 households in Punjab. This was followed by 17 who reported about regulating the timing of water supply. Resolution of conflicts among members and issuing of instructions to households not to keep their taps open after use, were among other roles played by these associations. The distribution of households specifying roles played by water users associations in their areas is given in table 8.14.

Table 8.14 : Role of the Water Users Associations/Societies/Cooperatives in Regulating Use of Ground Water in Sample Areas as reported by Households

(No. of HHs reporting)

Role	Andhra Pradesh		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal		Total All India	
	U	R	U	R	U	R	U	R	U	R	U	R	U	R
Regulate timing of supply of water	0	8	0	0	0	0	3	6	0	0	0	0	3	14
Urgent repair of damaged pipeline/water taps in public areas	0	1	0	0	0	0	2	4	0	0	0	0	2	5
Issue of instructions to households not to keep open their taps	0	0	0	0	0	0	11	12	0	0	0	0	11	12
Get purified drinking water through use of chemicals by panchayats	0	1	0	0	0	0	0	5	0	0	0	0	0	6
Resolution of conflicts among members	0	0	0	0	0	0	8	13	0	0	0	0	8	13
Provide awareness education about efficient use of water	0	0	0	0	0	0	6	20	0	0	0	0	6	20
Total	0	10	0	0	0	0	30	60	0	0	0	0	30	70

Multiple responses.

Source : Household Schedule

8.3.3 Effectiveness of the Role of Water Users Associations

The role of water users associations/cooperatives was reported to be effective by only 36 out of 60 rural respondents in Punjab and 2 out of 60 rural respondents in Andhra Pradesh i.e. 38

out of 120 respondents (or about 32%) of these two states. **Thus, their role was not considered effective.** The distribution of households by effectiveness of the role of water user association in Andhra Pradesh and Punjab is given in table 8.15.

Table 8.15 : Effectiveness of the Role of Water Users Associations/Societies/Cooperatives in Regulating the Use of Ground Water in the Study Areas as reported by Households
(No. of HHs reporting)

State	Urban	Rural	Total
Andhra Pradesh	0	2	2
Delhi	0	0	0
Gujarat	0	0	0
Punjab	0	36	36
Tamil Nadu	0	0	0
West Bengal	0	0	0
All India	0	38	38

Source : Household Schedule

8.3.4 Suggestions for making Water User Association's Role Effective

17 households (8 from Andhra Pradesh and 9 from Punjab) who reported the role of water user associations as ineffective, gave a few suggestions to make their role more effective. Among suggestions given by households, majority's view pertained to resolution of differences among members reported by 12 households (5 from A.P. and 7 from Punjab). Eight respondents also suggested for change of office-bearers every year. Six respondents each advocated need for bye-laws to govern the associations and removal of members from membership if found causing defects. The distribution of households who provided suggestion to this effect is given in table 8.16.

Table 8.16 : Suggestions for making Water Users Association's Role Effective as given by Households

Suggestions	A.P.		Delhi		Gujarat		Punjab		Tamil Nadu		West Bengal		All India	
	U	R	U	R	U	R	U	R	U	R	U	R	U	R
Resolution of differences among members	0	5	0	0	0	0	0	7	0	0	0	0	0	12
Members causing difficulties should be removed	0	2	0	0	0	0	0	4	0	0	0	0	0	6
Office bearers should be changed every year	0	0	0	0	0	0	0	8	0	0	0	0	0	8
There should be bye-laws of society/association	0	1	0	0	0	0	0	5	0	0	0	0	0	6

Multiple responses. Source : Household Schedule

8.4 Viewpoints of Expert Bodies

In an earlier chapter, we have brought out the difficulties inherent in the prevailing system of regulating ground water extraction and emphasized the need for involving panchayati raj institutions in management of ground water in rural areas. Since bulk of the ground water namely over 80 percent, is used for irrigation, which is mainly in the rural areas, any system which results in better management of ground water in rural areas would have a salutary effect on the overall ground water scenario in the country.

In this connection, the National Commission for Integrated Water Resources Development has recommended that “the best option in such cases would be to introduce participatory process in the ground water management in which the role of the state could be that of a facilitator or empowerer and the prescribing regulator and the role of the community organisation as an implementing regulatory agency of the scarce resource. Naturally, a question arises as to why not panchayats instead of community, take the role of regulating ground water management. The view is expressed by some that much of the Panchayat system is afflicted with competition for power among traditionally organized groups or political parties and left to itself may not evoke the necessary confidence of all concerned in the control of as scarce a resource as ground water. We believe that the panchayats should not be wholly left out and that satisfactory working relationships between the panchayats and community groups should be adopted in each state depending on local conditions”. (National Commission, 1999, p. 213).

Here it may also be mentioned that the Expert Group on Ground Water Management and Ownership appointed by the Planning Commission, in its report submitted in September 2007 have also emphasized the role that panchayats can play in regulating ground water use. It has, therefore, recommended that “the State Act must oblige the State Government to involve the panchayati raj institutions and facilitate the creation and effective functioning of water user groups” (Planning Commission, Report of the Expert Group on Ground Water Management and Ownership, 2007 p. 41). Here it may also be noted that “the Government of Maharashtra through a resolution dated 14th February 2002 has taken some step in this direction. The said resolution requires the Village Water Supply Committee to compile all the relevant information on the water resources and then require the Gram Sabha to prepare a draft plan for the use of available water in the village. The Gram Sabha is also given the discretion to invite the District/Taluk Level Officers of the Zila Parishad and Ground Water Survey and Development Agency (GSDA) if their guidance is necessary. Further the agency for the implementation of the action plan and the programme is to be decided by the Gram Sabha. This initiative is a departure from the typical ‘command and control’ model of the new State Acts regarding ground water. (Resolution No. RWS 1001/CR-330/WS-07, Water Supply and Sanitation Department, Government of Maharashtra)

During our discussions with higher officers in the sample states, we noticed divergent views in this respect. The general administrators like Chief Secretaries, Water Resources Secretary, Planning Secretary, Panchayati Raj Secretary etc. were in favour of handing over this responsibility to local level institutions like Panchayats. As the Panchayati Raj Secretary of a state pointed out, the Panchayati Raj department can take care of the responsibility provided it is asked to do so by the Water Resources Department. The Chief Secretary of another state also expressed similar views. But the officers belonging to ground water department were either opposed to it or had some reservations. They were of the view that it is they who should be the regulatory authority since they alone have the technical knowledge and expertise. At the same time, it is also noticed that the views of the senior level ground water professionals have started changing as can be seen from the recommendations of the 12th National Symposium on Hydrology held in New Delhi on 14 and 15 November, 2006 and organised jointly by CGWB and National Institute of Hydrology. According to Recommendation no. 16, “Model Bill 2006 needs to be modified through bottom up approach with community participation”. And, according to Recommendation no. 22. “People’s partnership participation is a pre-requisite for any ground water management activity. However, the long term effects of the activity needs to be assessed in scientific manner”.

8.5 Conclusions and Suggestions

Given the vastness of the problem, a command and control system will have little chance of success. Hence, there is no alternative but to hand over this task to local level institutions. But how to overcome the opposition of the ground water departments in the states? **This would require an awareness generation cum orientation training programmes for the technical officers of ground water departments, so as to broaden their horizon.**

It would be also necessary to involve municipalities and panchayati raj institutions/departments as members of the authorities constituted for the purpose at block, district, state and national levels. At the same time, there is the hard reality of which we became aware from the discussions we had with elected panchayati raj functionaries in some states like Tamil Nadu that panchayats themselves may not be interested in taking upon this responsibility. This is because the assumption of this responsibility implies denying the right to water in the village to somebody who may not be entitled for it. Panchayat functionaries would not like to incur the displeasure of such persons since this would affect the chances of developing their political mileage. In order to overcome this tendency, **it may be necessary to provide some incentives to panchayats to shoulder the responsibility of regulating use of ground water.** A system of reward and punishment or incentives and disincentives is necessary.

At this stage, attention may be drawn to Nirmal Gram Puraskar Yojana (NGP) of Department of Drinking Water Supply, Ministry of Rural Development, Government of India whereby panchayats are given prizes for keeping their villages neat and clean. However, in order to avoid any scope for favouritism by local officials, a decision to award prizes is made on the basis of recommendations of an independent research agency. The lure of the prize induces panchayats to make their village as clean as possible. As a result of this scheme of Ministry of Rural Development, over 5000 panchayati raj institutions have won this award during last 3 years for achieving the status of clean village/panchayat free from the age old practice of open defecation. Sanitation coverage has become close to 45 percent of the total population because of which state authorities are fully hopeful that the goal of achieving full sanitation coverage by 2012 would indeed be achieved (Foreword by Secretary, Department of Drinking Water Supply, Ministry of Rural Development to the publication entitled Solid and Liquid Waste Management in Rural Areas brought out by the Department along with UNICEF, 2007). A similar scheme may be instituted for ground water in critical and over-exploited areas. A Paani Puraskar of an adequate amount may be given to Panchayats where the ground water table has been improved by their efforts over the past five years. It is true that award of prize to panchayats for taking care of ground water resources would require funds but the benefit to the environment is expected to be much more than the cost of the prize money. Besides money would be utilized by panchayats for the benefit of the village community as a whole. In fact, a condition can be laid down that the prize money must be utilized for development of the village as a whole. On the other hand, the Panchayats not meeting targets should be penalized in terms of reduction of their normal grant. The extent of reduction would depend upon the extent of depletion of water resources below the prescribed norm.

The introduction of the scheme must be preceded as well as accompanied by a vigorous programme of awareness generation in the areas being adversely affected. The intensity of this programme should be in direct proportion to the intensity of the problem of ground water depletion, i.e. more in over exploited areas and less in critical and semi-critical areas. Such a programme should make the people aware of the need to conserve water and the technology

of doing so through water saving devices including changes in cropping pattern, cropping practices etc. Awareness building is, of course, implicit in community based ground water management.

The village panchayat would, of course, need technical guidance and supervision. The technical experts of the ground water department at the block level should keep a watch on the level of ground water and keep the panchayats fully informed of the status of ground water and changes therein at periodic intervals. They should indicate to the panchayats about the quantity of water that they can withdraw within a year. They should also inform panchayats whether they have withdrawn more or less than the desired quantity of water. In order to avoid favouritism by local officials, there should be a mechanism for verification by independent agencies as in the case of Nirmal Gram Puraskar Yojana.

The implementation of the above proposal would require close monitoring of the ground water reserves at frequent intervals at micro level. The extent of monitoring would vary according to the extent of the problem. Most intensive monitoring would be needed in over-exploited areas. Here, water level in every village need to be monitored. For this to succeed, water observation centres should be located near about every village or cluster of villages. In critical areas, monitoring at Panchayat level can suffice. Hence observation wells should be established accordingly. In semi-critical areas, monitoring at block level would be adequate. Since observation wells are already found at such levels, no extra investment for creation of infrastructure is needed. In the case of safe areas, the prevailing monitoring arrangements are considered adequate. Panchayats should also be associated in collection of data. For this purpose, panchayats may nominate some volunteers who should be trained by the technical staff.

Panchayats have to be given clear instructions to promote equity in water distribution as far as possible. They should be provided some guiding points in this respect and norms to be observed for sustainable use of ground water like no irrigation well should be deeper than a drinking water well or no drilling of water beyond a certain depth depending on ground water scenario in the respective areas.

Panchayats should also be asked to constitute ground water users groups for assisting them in management of ground water. After all, it is the users whose stakes are involved. They have knowledge of the status of ground water, its quality, problems arising if any, etc. Panchayats should delegate as much powers and functions as possible to such groups. These groups should be given a formal position in the panchayat structure. The organisation of such groups would be facilitated if the local area has already schemes like Swajaldhara, Watershed Development programme, Accelerated Rural Water Supply Programme etc. In order to be successful, there would be need for utmost transparency in the operations of both the user groups as well as Panchayats. State ground water department should provide technical support and information on water table to user groups.

The Model Bill, the state ground water laws, rules and procedures of CGWA as well as the state panchayat raj legislation need to be amended suitably to give powers to panchayats to perform the regulatory function in the areas under their jurisdiction. This should be accompanied by establishment of an appropriate institutional framework.

Chapter - IX

Summing Up

9.1 The Challenge

Ground water played a remarkably important role in India in meeting the national needs with respect to drinking water, food security and poverty alleviation. But its phenomenal expansion during last two to three decades has led to a steep fall in water table in several parts of India. This has created a really difficult situation for the country, since the areas which contribute to major part of national agricultural production and specially marketable surplus are under increasing ground water stress with withdrawals exceeding recharge. Given the limited potential of supply side measures in these over-exploited and critical areas, there is an urgent need for taking up demand side measures so as to regulate extraction of ground water in such areas. Such a need has been realized for a long time, more particularly since 1970 when a Model Bill for this purpose was circulated by Government of India to state governments. But there has been little impact. Opinion about the usefulness of the strategy proposed in the Model Bill has also remained divided. **How to evolve a satisfactory mechanism is the real challenge.** Several suggestions to deal with this challenge have been given in the earlier chapters. It is proposed to present a holistic view of them in this chapter.

9.2 Basic Approach and Thrust

Restricting demand for a commodity like water is, of course, a difficult task since controls, licensing and regulations may cause widespread resentment. Given the political and administrative compulsions of a democratic society like India, **it might be more prudent initially to make use of indirect methods of reducing demand for ground water.** Several such measures were discussed in Chapter-VII. These might be able to take care of or reduce the problem of over-exploited and critical areas to some extent. In case the problem persists despite adoption of these measures, then **there would be no alternative but to impose restrictions by the government on the extent of private use of ground water.** The government is fully competent to do so. As has been concluded in Chapter III, the scarcity of ground water has the effect of bringing it in public domain, a view upheld by the Supreme Court of India also. **Government should come out with a clear cut declaration that ground water rights are held by the community rather than individuals.**

But, as has been pointed out in the report of the Working Group on Legal, Institutional and Financial Aspects of the National Commission for Integrated Water Development, **“the fact that a subject is (or should be) under public domain does not mean that it should be controlled only by the state. The legislation can provide for collective self-regulation”.** (Ministry of Water Resources, Report of the Working Group, 1999, p. 15). Equitable and reasonable utilization of water can be brought about without state control if local bodies are empowered to regulate use of ground water in their areas. In this context, we have indicated how a system of incentives and disincentives can be designed to make panchayats in rural areas a good medium through which ground water can be regulated. A similar approach can be adopted in small towns. But in the case of bigger towns and cities, control by government would be necessary, since community participation and feeling is not found to be adequate in such areas.

9.3 Conclusion and Action Points

A multi-pronged approach is needed to deal with such a complex matter as declining ground water levels. The institutional mechanism proposed here is mainly for over-exploited and critical areas. For safe areas, no regulations might be needed, while in the case of semi-critical, areas awareness generation campaigns might be enough. Almost all aspects of the proposed setup have been indicated at appropriate places in the earlier chapters. We may now present a summary of the action points at one place so as to indicate the magnitude of the tasks involved. Points are mentioned as briefly as possible since the details have been provided in the earlier chapters.

- Given the vastness of the problem related to over-exploitation of ground water, a command and control system will have little chance of success. Hence, there is no alternative but to involve local level institutions in the task of regulation. The Constitution of India also lists minor irrigation, water management, drinking water as items to be handled by panchayats. Hence, it should be made mandatory to involve panchayats in water resources management.
- Several measures would be needed to make panchayats role in management of ground water effective. These would include (i) a massive awareness generation-cum-orientation training programmes for the technical officers of ground water departments, (ii) introduction of a system of rewards for panchayats doing good work in managing ground water in critical and over-exploited areas (on the pattern of Nirmal Gram Puraskar Yojana of Ministry of Rural Development, Government of India), (iii) vigorous programme of awareness generation and an orientation training for panchayats along with a Manual of operation in areas facing scarcity of ground water, and (iv) providing technical guidance to panchayati raj functionaries.
- The local bodies, in turn, should constitute user groups for assisting them in management of ground water. They should frame some easy to implement rules like no irrigation well will be deeper than a drinking water well, or no drilling of water beyond a certain depth depending on ground water scenario in the respective areas.
- The panchayats would be able to manage ground water in a better manner if they are provided requisite data with respect to availability of ground water at frequent intervals. Arrangement should be made for collection and dissemination of data on ground water at the grass root levels by ground water department. For this purpose, they should have at least one observation well in every panchayat area. A participatory approach can also be adopted for collection of data. Educated persons in the village should be trained to measure ground water levels (on payment of a token amount) which should be supervised by technical personnel of the ground water department.
- Apart from increasing the number of ground water monitoring centres to cover every panchayat, the state governments should also explore the possibility of using remote sensing for monitoring ground water tables.
- Collaboration between Universities, State Research organizations and state ground water departments is needed for bringing out improvement in ground water data. The local data obtained through observation wells may be shared with local people so as to help in cross checking with the information collected manually.

- The Model Bill, the state ground water laws and rules and procedures of the CGWA as well as the state panchayati raj legislation should be amended suitably to give powers to panchayats to perform the regulatory function in the areas under their jurisdictions. This should be accompanied by putting in place an appropriate institutional framework.
- The composition of central and state level regulatory authorities should be changed in the light of functions proposed to be performed by Panchayats, agricultural experts, credit institutions, electricity distribution companies etc. If panchayats are involved in the regulatory framework, then it would be useful to involve state and national level panchayati raj department as a member of the state and national level ground water authorities. Similarly, banks and NABARD as well as different state electricity boards and Ministry of Power at the centre should also be associated as members of the respective authorities. In view of the need to change cropping pattern, it would be advisable to include agricultural scientists and socio-economic experts as members of the central and state level ground water authorities. Similar steps at the district level may be initiated.
- Authorities at the Central and state level should preferably be headed by persons having judicial background. These authorities should have a full time Member Secretary. Other members could be on part time basis. Ground water department at national and state levels should be represented by their heads.
- The composition of the ground water regulatory authorities, at both central and state level needs to be revamped and strengthened with provision for adequate staff and funds to discharge their functions in an efficient manner. Functions, funds and functionaries should go together which is not the case at the moment.
- The existing overlap in the functions between these authorities should be avoided by suitable legislation.
- A suitable grievance redressal machinery should be available at the block/taluka level along with an appellate authority at the district level.
- Government should come out with a declaration that ground water is under public and not in private domain and enact a suitable law as advocated by legal bodies/experts.
- Property owners should be allowed to use ground water to a reasonable extent keeping in view the needs of their neighbours or in proportion to the amount of land owned by each person
- The regulatory bodies at all levels, centre, state district and down below should be given adequate power to restrict excessive withdrawal of ground water by existing users.
- Cultivation of water intensive crops should be discouraged in areas suffering from scarcity of ground water. Appropriate extension and policy initiatives are needed to induce farmers to adopt less water intensive cropping pattern. Participatory approach could be one such method.
- Water intensive industries like soft drink plants should not be allowed in water scarce areas.

- Adequate promotional efforts may be made for expanding micro-irrigation techniques like drip and sprinkler irrigation. For the above purpose, subsidy may be provided to small and marginal farmers when opting for such devices.
- Supply of electricity can be used as an instrument to restrict extraction of ground water. Metered power at an appropriate tariff may also be introduced for this purpose. Metering electricity can be made feasible by adopting a phased approach.
- A slab system for water pricing must be introduced. It can be made feasible through metering of electricity supply. A beginning can be made by concentrating on bulk users of water like big industries and urban complexes.
- Authorities may evolve a mechanism to regulate installation of tubewells/borewells through influencing the operators of drillers and suppliers.

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Institute For Resource Management And Economic Development**Institutional Framework for Regulating Use of Ground Water in India**

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New Delhi**

Household Level Schedule

Urban-1 & Rural-2 ☐

Serial No. ☐ ☐ ☐

1. Identification Particular

- 1.1 Name of Village/Town (Ward)
- 1.2 Name of Block
- 1.3 Name of District
- 1.4 Name of State
- 1.5 Name of Beneficiary
- 1.6 Father's Name

2. Source of Supply of Water for Domestic Use

- 2.1 Availability of water in the household for drinking purpose ☐
[Surface Water-1, Ground Water-2, Tap Water (in-house connection)-3,
Tap water (public stand post)-4, other-5 (Specify.....)]
- 2.2 If in-house connection is booster pump fitted? [Yes-1 & No-2] ☐

3. Ground Water Use for Domestic Purpose

- 3.1 In case of personal ground water system, is it ☐
Dug Well-1, Handpump-2, Tubewell-3 ☐
- 3.2 If Tubewell, did you take prior permission. ☐
[Yes-1 & No-2]
- 3.3 If Yes, from whom?

4. Ground Water for Irrigation

- 4.1 Do you have tubewell for irrigating your crops? [Yes-1 & No-2] ☐
- 4.2 Do you rely mainly on ground water for irrigation? [Yes-1 & No-2] ☐
- 4.3 If Yes, are you aware of its adverse effect on ground water stock? ☐
[Yes-1 & No-2]

- 4.4 Is there any farmers cooperative in your village? [Yes-1 & No-2] ☐
- 4.5 If Yes, are you aware that farmers cooperatives can help in reducing wastages of ground water? [Yes-1 & No-2] ☐
- 4.6 If Yes, are you a member of that? [Yes-1 & No-2] ☐
- 4.7 If Yes, do you favour such a move? [Yes-1 & No-2] ☐

5. Awareness

- 5.1 Are you aware of the continuing fall in the level of ground water in your area? [Yes-1 & No-2] ☐

- 5.2 If Yes, what regulatory steps can be taken to overcome the problem?

- 5.3 Are there any laws/rules procedure for regulating use of ground water in your area? [Yes-1 & No-2] ☐

- 5.4 If Yes, what are these?

- 5.5 Do you follow them? [Yes-1 & No-2] ☐

- 5.6 If No, why?

- 5.7 Do your neighbours or others in your village/ward follow them? [Yes-1 & No-2] ☐

- 5.8 Are these laws/rules laid down by Government-1, Panchayat-2, Local Residents etc-3, Customary Practices-4, Other-5(specify.....)? ☐

6. Water Use Practices

- 6.1 Is there any water users association/society/cooperative in your village? [Yes-1 & No-2] ☐

- 6.2 If Yes, how many such associations are there?

- 6.2.1 total number of members

- 6.3 Are you a member of any such body in your village? [Yes-1 & No-2] ☐

6.4 If Yes, how many members are there in this particular association?

6.5 Indicate the role of the association in regulating the use of ground water in your neighborhood?

6.6 Is this role effective? [Yes-1 & No-2]

6.7 If No, your suggestions for making it effective.

7. Registration of Ground Water System(only private tubewell)

7.1 Do people come forward for registration of ground water structure? [Yes-1 & No-2]

7.2 Is your water supply system registered? [Yes-1 & No-2]

7.3 If Yes, who does the registration?

7.4 Is there any application form for registration? (Yes-1 & No-2)

7.5 If Yes, how long it takes for registration? No. of days

7.6 Is there any fee for registration? (Yes-1 & No-2)

7.7 If Yes, how much is that? (Rs.)

7.8 Is it one time-1, monthly-2, annual-3?

7.9 Is the procedure for application for registration? (Simple-1, Time Consuming-2, Cumbersome -3)

8. Equity in Use of Ground Water

8.1 Is there equity in the use of ground water by socially and economically weaker section in the village? [Yes-1 & No-2]

8.2 If No, how these families manage ground water for domestic need, explain

8.3 If No to 8.1, do you feel that there should be equity in the use of ground water? [Yes-1 & No-2]

8.4 If Yes, how should it be ensured?

9. Grievance Redressal

9.1 Is there any grievance redressal machinery for sorting out problems between water users in respect of sharing of ground water? ☐
[Yes-1 & No-2]

9.2 If Yes, how effective is it? ☐
[Very Effective-1, Effective-2, Not so much-3, Not at all-4]

9.3 If No in 9.1, do you feel that there should be one such machinery? ☐
[Yes-1 & No-2]

10. Role of PRI/Municipal Body

10.1 Do panchayati raj institutions play any role in management of ground water? ☐
[Yes-1 & No-2]

10.2 If Yes, specify their role ☐
(Selection of site for water works-1, formation of user groups-2, help in collection of water charges-3, help in repair and maintenance-4)

10.4 What can be done to involve them ?

11. Problems and Suggestions

12. Institutional Financing of Ground Water System (Owners of Individual system)

12.1 Total cost of ground water structure Rs.

12.2 Loans taken from institutional sources for installation of ground water structure? (Yes-1 & No-2) ☐

12.3 If Yes (in 12.2), then

a. Amount of Loan Rs.

b. Name of the Bank

- 12.4 Was it mandatory to take permission from Local Ground Water Authority before applying for loan for creation of new ground water structure? (Yes-1 & No-2) ☐
- 12.5 Whether the above permission was actually taken? (Yes-1 & No-2) ☐
- 12.6 Whether the water structure has been registered with the concerned local ground water authority? (Yes-1 & No-2) ☐

Annexure-B

Institute For Resource Management And Economic Development

Institutional Framework for Regulating Use of Ground Water in India

Sponsored by Ministry of Water Resources, Government of India,
New Delhi

Village/Town (Ward) Level Schedule

Urban-1 & Rural-2

Serial No.

1. Identification Particular

1.1 Name of Village/Town

1.2 Name of Block

1.3 Name of District

1.4 Name of State

2. Demographic feature

Population (2001 Census)

(a) Male

Population	Households

(b) Female

(c) Scheduled Castes

(d) Scheduled Tribes

(e) Other Backward Castes

(f) General

3. Water System

3.1 Availability of Water System in the village provided by
(Government-1 & Government/Private-2)

3.2 Type of water system available in the village
(Surface-1, Ground Water-2, Both-3)

- (a) If ground water, its share in the total supply %
- (b) Total number of tubewells (including hand operated)
- (c) Number of tubewells motorized
- (i) No. of Tubewells Electrified
- (ii) No. of Tubewells diesel operated
- (d) Stand-by arrangement in case of power failure [Yes-1 & No-2]
- (e) Number of tubewells owned by panchayat/public health dept.
- (f) Number in Working Condition
- (g) Number of tubewells owned by private individuals
- (h) Number in Working Condition
- (i) Total No. of In-house Connections
- (j) No. of connections fitted with booster pumps
- (k) Share of ground water for domestic use %
- (l) Share of ground water for agriculture use %
- (m) Share of ground water for other uses %

4. Water Use Efficiency

- 4.1 Is there any water user associations/society in your village?
[Yes-1 & No-2]
- (a) If yes, number of such associations
- (b) (b) Does the association play any role in deciding
[Whether a new tubewell is required to be installed -1, The location of the new tubewell -2, The quantum of water extracted from the old tubewells -3, Giving suggestions for more effective regulation -4]

5. Regulation of ground water use.

- (a) Who regulates the use of ground water?
[Panchayat-1, Block-2, Water Supply Dept./Municipality-3, District Administration-4, None-5]
- (b) Is the regulatory mechanism effective? [Yes-1 & No-2]
- (c) If no, what can be done to improve its functionality?

- (d) Is any official empowered to check unauthorized installation/use of ground water? [Yes-1 & No-2] ☐
- (e) If yes, Name of the official
- (f) Is he facing any problem while reporting the matter to the concerned authorities [Yes-1 & No-2] ☐
- (g) If Yes, what problems he is facing?
- (h) Is there any system to check illegal domestic motorized connections (Yes-1 & No-2) ☐
- (i) If No, do you feel that there should be somebody to check this practice (Yes-1 & No-2) ☐
- (j) If Yes, who it should be?
- (k) Total no. of domestic motorized connections
- (l) Of these, how many have taken permission

6. Government Tubewells

- 6.1 In case of government tubewells, who decides about installation of new tubewells?
- 6.2 Who decides about extent of utilization of water from existing tubewells?
- 6.2 Is the availability of ground water taken into consideration? [Yes-1 & No-2] ☐

7. Awareness

- 7.1 Are you aware of steady depletion in the level of ground water? [Yes-1 & No-2] ☐
- 7.2 If yes in 7.1, what regulation steps can be taken to meet the threat? Give your suggestions

7.3 What is the source of information about fall in the level of ground water?

8. Notification details

8.1 Is your village/town notified for regulation of ground water? ☐
[Yes-1 & No-2]

8.2 If yes, year of notification

8.3 Which agency notified

8.4 How is people's attitude towards notification? ☐
[favourable-1, not favourable-2]

8.5 Is it necessary to obtain prior permission for creation of new ground water structure? [Yes-1 & No-2] ☐

8.6 If yes, from whom permission is obtained?

9. Equity Aspects

(a) Do you feel that socially and economically disadvantaged people get due access to ground water use in your village? [Yes-1 & No-2] ☐

(b) If no, what can be done to ensure their participation in ground water management?

10. Abstraction of Ground Water in Notified Areas

10.1 As per prevailing practices, in notified areas, is it necessary to take permission for installation of new ground water structure? ☐
[Yes-1 & No-2]

(a) If Yes, who gives the permission?

(b) Is any fee charged for that? [Yes-1 & No-2] ☐

(c) If yes, what is the amount? (Rs.)

(d) How much days it takes to obtain permission? Days

(e) Are officials incharge of granting permission cooperatives? ☐

[Yes-1 & No-2]

(f) If not cooperative, do you know whom to report [Yes-1 & No-2] ☐

(g) Have panchayat functionaries any role to play in the ground water management? [Yes-1 & No-2] ☐

(h) If Yes, what role they play?

(i) Are grassroot level functionaries such as users and local implementing agencies aware of prevailing legal and institutional frame work under ground water management? [Yes-1 & No-2] ☐

11. Registration Details (Private Tubewells)

11.1 Has registration of tubewells been done in your village/town? ☐
[Yes-1 & No-2]

11.2 If Yes, number of tubewells registered

11.3 If all the tubewells are not registered give reasons

11.4 Do people come forward for registration ☐
[Yes-1 & No-2]

11.5 If No, what are the reasons?

12. Role of NGO

12.1 What role NGOs play in ground water management (awareness generation-1, formation of user group-2, collection of user charges-3, conflict redressal-4, convening meeting of user group-5, repair & maintenance-6)?

13. Knowledge base

- 13.1 How do you come to know about depletion in the level of ground water in your village/town? (through system adopted by dept./panchayat-1, from block/panchayat officials-2, neighbouring villages-3, electronic media, other-4)?

--

- 13.2 Is there any system to check unauthorized sinking of well/tubewells? ☐
[Yes-1 & No-2]

- 13.3 If yes, what punitive action is taken against those violating the procedure?

--

14. Farm house details

- 14.1 Is there any farm house in your village/town ☐
[Yes-1 & No-2]

- 14.2 If yes, how many (No.)

--

- 14.3 Total No. of tubewells in these farm houses

--

- 14.4 Of which bore size (Diameter/inch)

Diameter/Inch	No.

- 14.5 Number of tubewells registered

--

15. Problems & Suggestions

--

16. Was it mandatory to take permission from local ground water authority before applying for loan for installation of new ground water structure? (Yes-1, No-2) ☐

Institute for Resource Management and Economic Development**Institutional Framework for Regulating Use of Ground Water in India**

**Sponsored by Ministry of Water Resources, Government of India, New
Delhi**

District Level Schedule

Serial No.

1. Identification

1.1 Name of District

1.2 Name of State

1.4 Number of blocks/Talukas/Mandals facing steady ground water depletion in terms of

(i) Over exploitation

(ii) Critical

(iii) Semi-Critical

1.5 (a) No. of departments involved in ground water administration in the district

(b) Name of department supplying ground water for domestic/agriculture and other use

(c) Name of department exploring, controlling and regulating the development of ground water

(d) Name of the department/official in charge of registration of existing ground water structure.

(e) If more than one agency, is there any coordination committee between these agencies. [Yes-1 & No-2]

(f) If yes, at what levels. [State-1, District-2, Block/town-3, Panchayat/Village-4]

(g) How frequently it meets. [monthly-1, quarterly-2, half yearly-3, annually-4, time not specified-5, no meeting-6]

- (h) Are villagers included in the committee in decision making? ☐
[Yes-1 & No-2]
- (i) If Yes, at what levels. [District-1, Block/town-2, Panchayat/Village-3] ☐
- (j) Who convenes the meeting of the coordination committee?
- (k) Who presides over the meeting?
- (l) Is it useful in respect of sorting out problems in the management of ground water? (Provide copy of the minutes of last three meetings) [Yes-1 & No-2] ☐

1.6 Notification Details

- (m) No. of blocks declared for notification
- (n) Year of notification
- (o) Was it publicized? [Yes-1 & No-2] ☐
- (p) What is the impact of notification on water level (increased-1, remained same-2, decreased-3)
- (p) If increased, has the areas been denotified. [Yes-1 & No-2] ☐
- (q) Through What method, you ensure increase/decrease in the level of ground water
- (r) Is there any system to obtain permission for further extraction of ground water from the existing structures in notified areas? [Yes-1 & No-2] ☐
- (s) If yes, what system? (Application-1, Verbal intimation-2, No procedure-3) ☐

1.7 Is legislation enacted in your state based on the model bill circulated by Government of India? [Yes-1 & No-2] ☐

- (a) If yes, year of enactment
- (b) Name of the Act (Obtain a copy of the Act)
- (c) As per Act, if authority is constituted, who heads it at
District Level
Block Level

1.8 Whether the said Act is implemented? [Yes-1 & No-2] ☐

(a) If Yes, year of implementation

(b) Did you face any problems/constraints while implementing?
[Yes-1 & No-2]

(c) If Yes, mention problems and constraints encountered

(e) What suggestions you give to overcome the constraints?

1.9 If no to 1.7 then what is the prevailing institutional mechanism for regulating use of ground water in your state? Please provide a detailed note on this.

i Since when?

ii Is it effective? [Yes-1 & No-2]

iii If No, what are the constraints?

iv What are the methods of assessing ground water depletion?

v Is there any system of checking unauthorized sinking of ground water structure? [Yes-1 & No-2]

vi If Yes, specify

- vii Is there any penalty for unauthorized sinking of ground water structure in notified areas? **[Yes-1 & No-2]** ☐
- viii If Yes, what penalty is imposed?
- ix How is this penalty collected/enforced?
- x Who is authorized to impose penalty?
- xi What action is taken on those who fail to pay the penalty?
- xii Does the penalty provide an adequate deterrent? **[Yes-1 & No-2]** ☐
- xiii If No, what are your suggestions?
- xiv Is there any mechanism for grievance redressal among stakeholders in respect of use of ground water? **[Yes-1 & No-2]** ☐
 (a) If Yes, who monitors this activity?
 (b) Is it satisfactory? **[Yes-1 & No-2]** ☐
 (c) If No, Give suggestions for improvement
- xv Does ground water regulation system in your district provide equity in respect of use of ground water by the weaker sections of the society? **[Yes-1 & No-2]** ☐
- xvi Is it adequate and satisfactory? **[Yes-1 & No-2]** ☐
 (a) Does the system meet every body's need? **[Yes-1 & No-2]** ☐
 (b) If No, what should be done to improve its functioning?

xvii If No to 'xvi'(a) do you favour community participation in ground water management? **[Yes-1 & No-2]** ☐

xviii If Yes, how? **[Share in cost of installation-1, Share in monthly operation & maintenance-2, Powers to be given to Panchayats-3, Who in panchayat would handle this work-4]** ☐☐☐☐

xix Are there any informal practices or customary rights at local level regulating the use of ground water? **[Yes-1 & No-2]** ☐

xx If Yes, Give details?

1.10 Role of panchayati raj institutions

i. Are panchayati raj institutions involved in ground water development in your district? **[Yes-1 & No-2]** ☐

ii. If yes, specify the process (tick mark)

a) Selection of site for installation of tubewells ☐

b) Awareness generation about efficient use of ground water ☐

c) Giving permission for new installations ☐

d) Supervising the abstraction of water from the existing tubewells? ☐

e) Collection of beneficiary's share of contribution ☐

f) Collection of beneficiary's share in the monthly O&M ☐

g) Grievance redressal among water users ☐

h) Others (specify) _____ ☐

1.11 Is existing institutional framework adequate to regulate ground water management in vulnerable areas? **[Yes-1 & No-2]** ☐

1.12 What role NGOs play in ground water management in your district? (tick mark)

a) Motivation ☐

b) Awareness training on water use practices ☐

c) Help formation of users association/society ☐

d) Collection of Community Contribution ☐

e) Dispute resolution ☐

f) Any other ☐

1.13 Data base management

- a) Who collects and maintains data pertaining to ground water management
- At the village level
 - At the panchayat level
 - At the block level
 - At the district level
- b) What is the reporting system at the village/town level?
[Weekly-1, Fortnightly-2, monthly-3, quarterly-4, half yearly-5, annually-6, no fixed system-7]
- c) How reliable is the system of data collection and management at village/town level
[very reliable-1, reliable-2, not reliable-3]
- d) How do you get information about new installation and about extent of extraction of water in a village or ward of a town?
- e) Is the information quick and reliable? **[Yes-1 & No-2]**
- f) Are any cross check applied? **[Yes-1 & No-2]**
- g) If yes, how frequently?
[Weekly-1, Fortnightly-2, monthly-3, half yearly-4, annually-5, no checks-6]
- h) Who applies cross check?
- i) Do you have a regular inspection system to know the extent of utilization of ground water in a village, cluster of villages, town, city, block and district?
[Yes-1 & No-2]
- j) If Yes, give the details

2. Water Use Practice

- 2.1 Are there any registered ground water users association/ society in your district?
[Yes-1 & No-2]

2.2 If Yes,

(i) Number of such associations

(ii) Total membership

(iii) Number Non-functional

(iv) Is there any farmer's cooperatives in your district?
[Yes-1 & No-2]

(v) If yes, their number

2.3 Do water users (under association/society) pay any monthly charges?
[Yes-1 & No-2]

a) If Yes, what amount (Rs./month)?

2.4 Is there any provision of subsidy on use of electricity by association/society for abstraction of ground water?
[Yes-1 & No-2]

(a) If Yes, what is the amount?

2.5 Who is the designated officer in charge of registration of ground water structure?

2.6 Is any fee charged for registration? **[Yes-1 & No-2]**

(a) If Yes, how much is the charge? (Rs.)

2.7 What are the procedures for registration?
[Through application-1, Verbal Request -2, Any other practice -3]

2.8 If through application, is the procedure
[Simple-1, Complicated-2]

2.9 Is the time stipulated for registration enough? **[Yes-1 & No-2]**

2.10 In case of notification and ban on installation of new tubewells when new users can not acquire access to water supply; how would new users take advantage of economic development opportunities through use of water? Explain.

(a) Is there any policy/law in this regard? **[Yes-1 & No-2]**

(b) If Yes, give details

- (c) If no, give suggestions how interest of new users can be taken into account.

- (d) Should the existing users be permitted to sell water to new users? **[Yes-1 & No-2]**

- (e) Or the right to use water from existing tubewells/wells will be extended to new users also. **[Yes-1 & No-2]**

- (f) The above implies that the current water users increase their efficiency and save water which in turn would result in transfer of rights to new users. **[Yes-1 & No-2]**

- (h) If Yes, what way

- (g) Would you suggest incentives to increase the efficiency of water use by current users? **[Yes-1 & No-2]**

3. Water Quality

- 3.1 Is there any arrangement for testing the water quality? **[Yes-1 & No-2]**

- (a) If yes, is it everywhere or only at a few locations?
[everywhere-1, few locations-2]

- (b) Which location?

- (c) If Yes, who undertakes the testing?

- 3.2 What mechanism is adopted to test the quality?

- 3.3 What is the regulatory mechanism for preventing deterioration in quality of ground water?

- 3.4 Is it adequate and satisfactory? **[Yes-1 & No-2]**

- 3.5 If No, give suggestions

4. Commercial use of ground water

4.1 What is the policy on bulk sale of ground water by major operators?

(a) Are there any restrictions on the quantity of water that can be extricated from a tubewell? **[Yes-1 & No-2]**

(b) Also is there any water structure used on sharing basis. **[Yes-1 & No-2]**

(c) If yes, number of such structures in respect of

(i) Domestic use

(ii) Agriculture

(iii) Other uses

4.2 Do the owners of these structure pay any amount at the time of registration for sale of ground water? **[Yes-1 & No-2]**

(a) If Yes, periodicity of payment.

[Monthly-1, Annually-2, One time-3]

4.3 How much per month (Rs.)

(a) For what quantity

4.4 Is the amount adequate for checking over exploitation? **[Yes-1 & No-2]**

(a) If No, give your suggestions

5. Ground Water Usages

<i>Usages</i>	<i>Quantity of Use (%)</i>
Drinking purpose	
Irrigation	
Other uses	
Sale	

6. (a) Are there policies or incentive for promoting efficiency in use of ground water and discouraging wastes? **[Yes-1 & No-2]**

(b) If yes, give the details

(c) If No, do you feel the need for such policies? **[Yes-1 & No-2]**

(d) If yes, give details

7. Was it mandatory to take permission from local ground water authority before applying for loan for installation of new ground water structures? (Yes-1, No-2)

Institute for Resource Management and Economic Development

Institutional Framework for Regulating Use of Ground Water in India

**Sponsored by Ministry of Water Resources, Government of India,
New Delhi**

State Level Schedule

Serial No.

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1. Identification

1.1 Name of State

--

1.2 Number of Districts

--

1.3 Number of districts facing steady ground water depletion in terms of
(i) Over Exploitation

--

(ii) Critical

--

(iii) Semi-critical

--

1.4 Number of blocks/Talukas/Mandals facing steady ground water depletion in
terms of

(i) Over exploitation

--

(ii) Critical

--

(iii) Semi-Critical

--

1.5 (a) No. of departments involved in ground water administration in
the state

--

(b) Name of department supplying ground water for
domestic/agriculture and other use

--

(c) Name of department exploring, controlling and
regulating the development of ground water

--

- (d) Name of the department/official in charge of registration of existing ground water structure.
- (e) It more than one agency, is there any coordination committee between these agencies? **[Yes-1 & No-2]**
- (f) If Yes, at what levels. **(State-1, District-2, Block/town-3, Panchayat/Village-4)**
- (g) How frequently it meets. **(monthly-1, quarterly-2, half yearly-3, annually-4, time not specified-5, no meeting-6)**
- (h) Are villagers included in the committee in decision making? **[Yes-1 & No-2]**
- (i) If Yes, at what levels. **[District-1, Block/town-2, Panchayat/Village-3]**
- (j) Who convenes the meeting of the coordination committee?
- (k) Who presides over the meeting?
- (l) Is it useful in respect of sorting out problems in the management of ground water? (Provide copy of the minutes of last three meetings) **[Yes-1 & No-2]**

1.6 Notification details

- No. of districts declared for notification
- No. of blocks declared for notification
- (m) Year of notification
- (n) Was it publicized? **[Yes-1 & No-2]**
- (o) What is the impact of notification on water level **(increased-1, remained same-2, decreased-3)**
- (p) If increased, has the areas been denotified. **[Yes-1 & No-2]**
- (q) Through What method, you ensure increase/decrease in the level of ground water

(r) Is there any system to obtain permission for further extraction of ground water from the existing structures in notified areas? ☐
[Yes-1 & No-2]

(s) If Yes, what system. ☐
[Application-1, Verbal intimation-2, no procedure-3]

1.7 Is legislation enacted in your state based on the model bill circulated by Government of India? [Yes-1 & No-2] ☐

(a) If Yes, year of enactment

(b) Name of the Act (Obtain a copy of the Act)

(c) As per Act, if authority is constituted, who heads it at
State Level

District Level

Block Level

1.8 Whether the said Act is implemented? [Yes-1 & No-2] ☐

(a) If Yes, year of implementation

(b) Did you face any problems/constraints while implementing? ☐
[Yes-1 & No-2]

(c) If Yes, mention problems and constraints encountered

(e) What suggestions you give to overcome the constraints?

1.9 If No to 1.7 then what is the prevailing institutional mechanism for regulating use of ground water in your state? Please provide a detailed note on this.

(a) Since when?

(b) Is it effective? [Yes-1 & No-2] ☐

(c) If No, what are the constraints?

1.10 What are the methods of assessing ground water depletion?

(a) Is there any system of checking unauthorized sinking of ground water structures? [Yes-1 & No-2] ☐

(b) If Yes, specify

(c) Is there any penalty for unauthorized sinking of ground water structures? [Yes-1 & No-2] ☐

(d) If Yes, what penalty is imposed?

(e) How is this penalty collected/enforced?

(f) Who is authorized to impose penalty?

(g) What action is taken on those who fail to pay the penalty?

(h) Does the penalty provide an adequate deterrent? [Yes-1 & No-2] ☐

(i) If No, what are your suggestions?

(j) Is there any mechanism for grievance redressal among stakeholders in respect of use of ground water? [Yes-1 & No-2] ☐

(i) If Yes, who monitors this activity?

(ii) Is it satisfactory? [Yes-1 & No-2] ☐

(iii) If No, Give suggestions for improvement

(k) Does ground water regulation system in your state provide equity in respect of use of ground water by the weaker sections of the society? [Yes-1 & No-2] ☐

(l) Is it adequate and satisfactory? [Yes-1 & No-2] ☐

(i) Does the system meet every body's need? [Yes-1 & No-2] ☐

(ii) If No, what should be done to improve its functioning?

(iii) How do you find the response of the community towards this (equity) approach. [Overwhelming-1, Good-2, Poor-3] ☐

(m) If No to 'xvi'(a) do you favour community participation in ground water management? [Yes-1 & No-2] ☐

(n) If Yes, how? [Share in cost of installation-1, Share in monthly operation & maintenance-2, Powers to be given to Panchayats-3, Who in panchayat would handle this work-4]

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(o) Are there any informal practices or customary rights at local level to regulate the use of ground water? [Yes-1 & No-2] ☐

(p) If Yes, Give details?

1.11 Role of panchayati raj institutions

(a) Are panchayati raj institutions involved in ground water development in your state? [Yes-1 & No-2] ☐

(b) If Yes, specify the process (tick mark)

i) Selection of site for installation of tubewells ☐

- ii) Awareness generation about efficient use of ground water ☐
- iii) Giving permission for new installations ☐
- iv) Supervising the abstraction of water from the existing tubewells? ☐
- v) Collection of beneficiary's share of contribution ☐
- vi) Collection of beneficiary's share in the monthly O&M ☐
- vii) Grievance redressal among water users ☐
- viii) Others (specify) _____ ☐
- 1.12 Is existing institutional framework adequate to regulate ground water management in vulnerable areas? ☐
[Yes-1 & No-2]
- 1.13 What role NGOs play in ground water management in your state? (Tick Mark)
- a) Motivation ☐
- b) Awareness training on water use practices ☐
- c) Help in formation of users association/society ☐
- d) Collection of Community Contribution ☐
- e) Dispute resolution ☐
- f) Any other ☐
- 1.14 Data base management
- (a) Who collects and maintains data pertaining to ground water management
- At the village level
- At the panchayat level
- At the block level
- At the district level
- At state level
- (b) What is the reporting system at the village/town/district level? ☐
[Weekly-1, Fortnightly-2, monthly-3, quarterly-4, half yearly-5, annually-6, no fixed system-7]

(c) How reliable is the system of data collection and management at village/town /district level? ☐

[very reliable-1, reliable-2, not reliable-3]

(d) How do you get information about new installation and about extent of extraction of water in a village or ward of a town?

(e) Is the information quick and reliable? [Yes-1 & No-2] ☐

(f) Are any cross check applied? [Yes-1 & No-2] ☐

(g) If Yes, how frequently? ☐

[Weekly-1, Fortnightly-2, monthly-3, half yearly-4, annually-5, no checks-6]

(h) Who applies cross check?

(i) Do you have a regular inspection system to know the extent of utilization of ground water in a village, cluster of villages, town, city, block, district and state? ☐

[Yes-1 & No-2]

(j) If Yes, give the details

2. Water Use Practice

2.1 Are there any registered ground water users association/ society in your state? [Yes-1 & No-2] ☐

2.2 If Yes,

(a) Number of such associations

(b) Total membership

(c) Number Non-functional associations

(d) Is there any farmer's cooperatives in your state? [Yes-1 & No-2] ☐

(e) If Yes, their number

2.3 Do water users (under association/society) pay any monthly charges? [Yes-1 & No-2] ☐

- a) If Yes, what amount (Rs./month)?
- 2.4 Is there any provision of subsidy on use of electricity by association/society for abstraction of ground water? **[Yes-1 & No-2]**
- a) If Yes, what is the amount?
- 2.5 Who is the designated officer in charge of registration of ground water structure?
- 2.6 Is any fee charged for registration? **[Yes-1 & No-2]**
- a) If Yes, how much is the charge? (Rs.)
- 2.7 What are the procedures for registration?
[Through application-1, Verbal Request -2, Any other practice -3]
- 2.8 If through application, is the procedure. **[Simple-1, Complicated-2]**
- 2.9 Is the time stipulated for registration enough? **[Yes-1 & No-2]**
- 2.10 In case of notification and ban on installation of new tubewells when new users can not acquire access to water supply; how would new users take advantage of economic development opportunities through use of water?
- a) Is there any policy/law in this regard? **[Yes-1 & No-2]**
- b) If Yes, give details
- c) If No, give suggestions how interest of new users can be taken into account.
- d) Should the existing users be permitted to sell water to new users? **[Yes-1 & No-2]**
- e) Or the right to use water from existing tubewells wells will be extended to new users also. **[Yes-1 & No-2]**

(f) The above implies that the current water users increase their efficiency and save water which in turn would result in transfer of rights to new users. **[Yes-1 & No-2]** ☐

(h) If Yes, what way

(g) Would you suggest incentives to increase the efficiency of water use by current users? **[Yes-1 & No-2]** ☐

3. Water Quality

3.1 Is there any arrangement for testing the water quality? **[Yes-1 & No-2]** ☐

(a) If Yes, is it everywhere or only at a few locations? ☐
[everywhere-1, few locations-2]

(b) Which location?

(c) If Yes, who undertakes the testing?

3.2 What mechanism is adopted to test the quality?

3.3 What is the regulatory mechanism for preventing deterioration in quality of ground water?

3.4 Is it adequate and satisfactory? **[Yes-1 & No-2]** ☐

3.5 If No, give suggestions

4. Commercial Use of Ground Water

4.1 What is the policy on bulk sale of ground water by major operators?

(a) Are there any restrictions on the quantity of water that can be extricated from a tubewell? **[Yes-1 & No-2]** ☐

(b) Also is there any water structure used on sharing basis? ☐
[Yes-1 & No-2]

(c) If Yes, number of such structures in respect of
(i) Domestic use

(ii) Agriculture

(iii) Other uses

4.2 Do the owners of these structures pay any amount at the time of registration for sale of ground water? **[Yes-1 & No-2]**

(a) If Yes, periodicity of payment
(Monthly-1, Annually-2, One time-3)

4.3 How much per month (Rs.)

(a) For what quantity

4.4 Is the amount adequate for checking over exploitation?
[Yes-1 & No-2]

(a) If No, give your suggestions

5. Ground Water Usages

<i>Usages</i>	<i>Quantity of Use (%)</i>
Drinking purpose	
Irrigation	
Other uses	
Sale	

6. Existing Policies for Promoting use of Ground Water

(a) Are there policies or incentive for promoting efficiency in use of ground water and discouraging wastes? **[Yes-1 & No-2]**

(b) If Yes, give the details

(c) If No, do you feel the need for such policies? **[Yes-1 & No-2]**

(d) If Yes, give details

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7. Was it mandatory to take permission from local ground water authority before applying for loan for creation of new ground water structures? (Yes-1, No-2)

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