UNICEF, Mumbai and Institute For Resource Analysis And Policy, Hyderabad in association with Water Supply and Sanitation Department, Government of Maharashtra

Promoting Sustainable Drinking Water Supply and Sanitation in Rural Maharashtra

Institutional and Policy Regimes

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[The research report identifies the specific criteria for legal & regulatory, administrative and policy reforms needed for sustainable rural water supply and sanitation in Maharashtra and suggest key reform measures.]

CONTENTS

Executive Summary

Over the years, the State of Maharashtra had tried with a variety of rural water supply systems, with increasing accent on decentralized operation and maintenance. While some of them have been successful, some have failed on several fronts. The reasons for this were: technical systems for water supply often designed without due consideration to the local hydrological system or the socio-economic realities; appropriate policies with regard to level of investment, staffing, water supply technology, coverage of systems, and operation and maintenance were not followed; and due consideration was not given to the capabilities of the local agencies in handling O & M of the scheme; and the poor did not have adequate incentive to access water from the public system, severely affecting their willingness to protect them from damage and to pay for the services.

In certain other cases, the institutions for ensuring sustainable allocation of water from water resources system are absent at the local level or the local agencies such as the Panchayati Raj Institutions (PRI) lack organizational wherewithal. In certain other cases, the legal, financial and human resource capacities required for the local agencies to perform effectively are neither devolved nor decentralized. The paucity of human resources poses a threat to effective performance.

The approach used in the study was to first examine the degree of decentralization in governance of selected rural water supply schemes in these states; assess the management performance of the schemes; and analyze the human resource capabilities of the agencies and institutions involved in running the schemes. Subsequently, the governance practices, management performance and institutional capabilities in schemes are compared against the techno-institutional characteristics, and institutional--legal, regulatory and administrative--, and policy regimes for rural water supply schemes in the state to identify how the latter provide enabling or disabling environment sustainability. A proper evaluation of the performance of the government schemes and their outcomes/impacts was carried out to know what works, and under what conditions. .

For comparative analysis of performance of schemes, primary survey was undertaken in six divisions of Maharashtra covering 12 districts and twelve water supply schemes. Different types of schemes were covered in the study, both single village and multi-village schemes. The types of sources for these schemes are: surface water; subsurface water and groundwater. Different technological models covered are: bore well/dug well/percolation well based single village piped water supply (PWS) scheme; reservoir based regional as well as single village water supply schemes; and river-lift based regional as well as single village PWS schemes. A total of 855 households under these one dozen schemes were covered in the primary survey, while secondary data on these schemes were collected from the line agencies concerned.

The learning emerging from the action research project on MWUS were used to gain insights into the key policy interventions required for improving the sustainability of rural water supply schemes, and enhancing their developmental outcomes. In addition to the samples, review of international literature on institutional and policy regimes for sustainable rural water supply was undertaken. The findings emerging from the comparative analysis of schemes, the review of international and national literature, the findings from the action research on MWUS and the outcomes of consultations were synthesized to identify the reforms needed.

1. The State of Maharashtra has made significant progress in improving the access of rural communities to water supplies for domestic uses, in terms of physical access to the source and the quality of water supplied over the past 10 years. But, even today, only half the rural households have access to tap water, and it includes those who access it from nearby sources and distant sources. Out of this, only 63 per cent of the tap water is treated. But, in terms of high quality water supplies, only 20.6 per cent of the rural households have access to treated tap water within their dwelling premise. If we include those households which get treated tap water near their dwelling premise, the percentage would go up to 29.5, i.e., another 12 lac households.

2. Nearly 20 per cent of the rural households still depend on distant sources for their domestic water supplies. Of this more than 45 per cent depend on unprotected sources including uncovered open wells and canals, springs, ponds etc.

3. Nearly 1/6th of the rural households (15.7%) depend on hand pumps for domestic water supply. But, only in 14% of the cases, the households own these systems, and therefore have complete control over their functioning and management. In the remaining 86% of the cases, the households are dependent on sources which are publicly owned, and hence have no control over the management of these systems.

4. Between 2001 and 2011, number of rural households having any type of sanitation facilities increased from 18% to 38%. But, the inter-district variations are remarkable. The extent of toilet coverage varies from a lowest of 11.9% in Parbhani to 70.7% for Sindhudurg. This variation can be explained by the differences in economic conditions, which actually changes the ability of the rural households to access improved water supply and sanitation facilities. Analysis using district and taluka level data shows a strong correlation between average per capita income of the district and the extent of toilet adoption in the rural areas.

5. Rural households are willing to invest in securing improved water supply such as treated water delivered through pipes which can reduce the time and effort required for collecting water and produce maximum health benefits.

6. There is significant inter-regional difference in access to water supply from public systems in terms of nature of access and supply levels. The proportion of rural habitations having access to pipe water supply (PWS) varies from as low as 37.3% for Nagpur to as high as 72.4% for Amravati division. The proportion of rural households having access to PWS varies from a lowest of 44% for Nagpur and Konkan to a highest of 72% for Amravati. The percentage of households having individual tap connections varies from as low as 21% for three divisions, viz., Marathwada, Konkan and Nagpur, to the highest of 36% for Amravati.

7. Bacteriological contamination of all types of water sources at the source level and poor chemical quality of water supplied by groundwater based sources are issues facing sustainable rural water supply in Maharashtra. While the former is due to anthropogenic activities, the latter is due to poor natural quality of groundwater

8. The per capita water supply is highest for Konkan division, with 129 per day of average supply and is as low as 21 lpcd for Nagpur. The rich water resource endowment of the region with good number of surface reservoirs, adequate capacity of the water supply infrastructure and the high affordability of the rural communities in the region to pay for the services might have helped improve the water supply situation.

9. Among the households covered by PWS, the monthly O & M expenditure per HH is highest for Konkan (Rs.49/month), followed by Pune division (Rs 40/month). It is lowest for Nagpur division (Rs.17/ month). The two important factors, which can influence the O & M cost are the proportion of the households which enjoy individual tap connection and the volume of water supplied per household.

10. A comparative assessment of performance of rural water suppy schemes in six divisions of Maharashtra carried out showed the following:

a. The management performance of single village schemes which are based on surfce water is better than that of their grounwater and sub-surface water counterparts. The overall performance of water supply schemes based on surface reservors is also better than that of shemes based on groundwater and sub-surface water. The indicators used for comparative performance evaluation are: water supply coverage; adequacy of water supply; quality of water supply;average annual operation and mainenance costs;and revenue recovery.

b. The degree of decentraliztion and community participation in management of the scheme is much better for the single village schemes based on groundwater which were designed and built by the Zilla Parihad and the Gram Panchayat. But, in the case of regional water supply schemes, the schemes were built and operated by the MJP, which is a centralized agency.

c. In the case of single village schemes, most of the governance functions relating to water supply are performed by the local self governing institution of the Gram Panchayat and some by the ZP, whereas in the case of regional schemes based on reservoirs supplying water to many villages, MJP performs many of these functions along with the ZP and GP.

d. The single village surface water based schemes are run with lower number of technical and managerial staff as compared to groundwater based schemes in terms of staff per 1000 covered HHs, though they have higher number of contractual staff as compared to groundwater based single villae schemes. The regional schemes have lowest number of contractual staff per 1000 connected households.

11. The over-whelming dependence of the State on groundwater resources for rural water supplies appears to be driven by the stated goalof decentrlized management of water supply schemes, as village communities are generally happy managing schemes that are small. But, this has come at the cost of sustainability of water supplies not only from the point of view of providing sufficient quanties of water for meeting domestic water requirements throuout the year, but also in terms of the cost effectiveness.

12. Excessive withdrawal of groundwater for irrigated agriculture threatens the sustainability of wells and hand-pump based rural water supply schemesis in the hard rock areas of Maharashtra. The enforcement of Maharashtra State Groundwater Regulation Act of 1993 hasn't been effective in regulating groundwater use by irrigators for protection of drinking water sources.

13. In regions with similar physical characteristics vis-à-vis hydrology, geo-hydrology and topography, the regional water supply schemes and single village schemes that are based on surface reservoirs ensure water supplies of higher dependability to the rural areas, as compared to schemes that are dependent on wells. The quality of water is better for schemes which tap water from surface reservoirs, as compared to those which tap water directly from rivers, groundwater.

14. Contrary to the popular notion, the O & M cost per HH is lesser for single village scheme based on surface reservoir, and that of regional water supply scheme based on reservoirs is comparable with dug-well based single village scheme.

15. If the comparative evaluation of the cost of water supply schemes take into account the actual life of the schemes and the oportunity cost of the failure to supply water during the lean season, the full economic cost of water supply provision would be much higher for groundwater based schemes.

16. The State of Maharashtra has the largest number of irrigation projects with reservoirs, water diversion and river lifting in the entire country. There are a total of 66 major schemes, 233 medium and 2777 State sector minor irrigation projects. These projects are scattered all over the geographical area of the State though there is relatively higher concentration of schemes in the Pune and Nagpur regions.

17. A large amount of water remains un-utilized in irrigaiton reservoirs pf the State at the end of the irrigation season, the largest amount being in reservors in Pune and Konkan regions and lowest in Aurangabad region. The non-irrigation use from many schemes is less than planned use. During 2009-10, the total amount of un-utilized water in the reservoirs was to the tune of 1985 MCM. This is quite substantial if one considers the total amount of water required to meet domestic water needs in the entire State of Maharashtra.

18. When thousands of villages including those in the water-rich regions of the State reel under water shortage for meeting survival needs, the water stored in such large and expensive infrastructure goes un-utilized. Such a precarious situation prevails due to sheer lack of infrastructre for transporting the water from these reservoirs to the areas experiencing drinking water shortage in different parts of the State.

19. Currently, the willingness on the part of the GP or ZPs to take charge of running the regional water supply schemes is largely absent. Most of the regional schemes are still run by the MJP, while in a very few cases where the number of villages covered is small, the ZP had taken over the system running. The important reasons for this are the technical sophistication of the schemes, the lack of qualified staff to take care of the maintenance and fear of the financial burden of 'high O & M costs'. Further, the

response of the VWSSC in terms of taking over the village level maintenance of the scheme is also not encouraging.

20. Regional water supply schemes based on surface reservoirs are introuced when single village schemes based on local groundwater fail in the summer season. The fact that there are no regional water supply schemes based on groundwater in Maharashtra for transfering groundwater from distant localities due to the problems of technical feasibility suggests that comparison of performnce should be between single village schemes based on groundwater and single village schemes based on surface reservoirs.

21. In spite of this, the regional water supply schemes based on reservoirs perform well in terms on physical and economic indicators. While single village schemes based on surface reservoirs appear to perform better than the regional counterparts on many counts, they may not be feasible hydrologically and technicaly given the fact that surface reservoirs are few and their geographica spread across the is not good.

22. Overall, management decentralization is found to be working in the case of single village schemes, while the VWSSCs are totally dysfunctional in most of the vilages under multi-villages. Further, governance functions are decentralized in the case of single village schemes, with GP performing most of the functions, while a few left to the ZP. Whereas in the case of multi-village schemes based on reservoirs, many of the governance functions are left to theMJP.

23. The factors that explain higher management performance levels in the case of water supply schemes which tap surface water from reservoirs, can be as follows: a] the schemes tap dependable water source and the chemical quality of the water is good; b] the schemes are planned, designed and operated by a professional agency like the MJP and therefore can be run efficiently from technical and economic points of view; and c] the agency can protect the sources from any threat to its sustainability from competing uses. As a result, the village communities also show greater willingness to obtain individual tap connections in such schemes. Improved access to water supply in terms of physical access to the source, and better quantity and quality of water would also promote greater use and adoption of improved sanitation systems.

24. Providing the rural households with reliable and dependable source of water supply which ensures adequante quantity of water for domestic needs would boost adoption of improved toilets by the households, if their economic conditions are favourable. Further, piped water supply to the households through individual household connection would would increase the chances of use of the toilets already constructed by all the members of the household because of the convenience in fetching water for flishing the toilet and personal hygeine.

The approach of planning, designing and implementing rural water supply schemes as single use systems has to get replaced by schemes which can take care of both domestic and productive uses of the village community. Further, if sustainability of the source has to become a priority, then the strategy has to change from groundwater based single village schemes to reservoir based regional water supply schemes, unless proper enforcement of groundwater regulation is done. With the large number of major and medium reservoirs scattered across the State, and with around 2,000 MCM of water remaining un-utilized in these storage systems at the end of the irrigation season every year, augmenting water supplies of the existing village or regional schemes should be possible with the building of large distribution network using pipelines.

To ensure sustainable water supply in rural areas, major reforms are need on the policy font. Having recognized drinking water as the priority sector in the State water policy, water resources in different river basins in the State of Maharashtra needs to be allocated across different competing use sectors by a legitimate agency, to ensure sufficient water availability for basic survival needs, rather than leaving it to the market forces to decide The selection of technology for water supply should be driven by resource sustainability and source sustainability considerations rather than the goal of 'management decentralization'. Whereas the decisions on the nature of institutions to manage water supply schemes should be driven by the technology choice rather than vice versa. Professional institutions with required technical knowhow and expertise and financial resources are required to design, build and run technically sophisticated schemes. Further, the institution, which designs the scheme, should ideally run it.

For sustainable water use, the decision on levels of water supply should take cognizance of the socio-economic and climatic factors while working out the domestic water requirement for different regions. The policy framework should also be an "enabling" to allow the line agencies concerned to work out the per capita water requirement based on the criteria set by the local sell- governing institutions. Investment policies in water supplies should take into account considerations such as opportunity cost of inadequate supplies, poor dependability of the source or the permanent failure of the source before completion of the design life in costing of various water supply options. The pricing of water has to be driven by the considerations of long-term marginal cost of production and supply of water, and the socio-economic conditions of the target community in order to make the scheme financially viable, while ensuring affordability. With major spatial variation in water resource endowment and socio-economic conditions, uniform pricing across the State will not work. Investment policies for rural water supply in difficult areas should be flexible and liberal to accommodate costly systems.

On institutional development front, the VWSC needs to be properly trained so that they can take effective part in design and O&M of single village schemes. Thus community can feel the incentives and take active part in operation and maintenance of the systems. The scheme with multiple uses should consider all the available sources in the area in order to judiciously use them.

In the case of regional water supply schemes covering large number of villages, the system operation should be handled by the MJP. As they are involved in planning and execution, such an approach would improve the operational efficiency. The financial and human resource capacities of the MJP need to be strengthened so that they could play an effective role in rural water supply management.

For sustainable sanitation, provision of subsidy for construction of toilets alone will not be sufficient. The reasons for non-adoption of toilets in rural areas are not merely economic. There is a need to focus on health and hygiene education leading to increased demand for sanitation by the households and behavioral changes. That said, access to water supply source will have a bearing on improved sanitation practices, in the sense that if lack of physical access to piped water supply is severely limiting the ability of a household to access manage for meeting its domestic requirements, the same can influence the family's decision to go for improved sanitation system. There is a greater need for designing water supply projects with due consideration to sustainable sanitation as one of the goals.

Promoting Sustainable Water Supply and Sanitation in Rural Maharashtra:

Institutional and Policy Regimes

1. Introduction

Ever since independence, India had invested a whooping sum of nearly Rs. 68,000 crore towards improving water supplies in rural areas through various schemes and programmes during the plan periods till 2007. The aim underlying these efforts was improving the coverage of the schemes in terms of number of villages and hamlets. Though remarkable achievements were made in terms of improving the coverage vis-à-vis the habitations and population, the overall achievements do not commensurate with the scale of investments that have gone into the sector owing to increasing number of habitations slipping back to the "no-source category". This is because of the several threats rural water supply sector is facing, and can be summarized as: poor sustainability of water supplies owing to unsustainable resource base; soaring operation and maintenance costs due to absence of regular upkeep, and poor cost recovery, both resulting in poor financial working of the system; and inequity in access to water across different segments owing to lack of adequate institutional capacities built at the local level for water distribution.

The condition vis-à-vis rural household sanitation, which to a great extent is also linked to domestic water supply situation, is poor in Maharashtra, though some progress was made during the past 10 years in terms of boosting adoption of individual household latrines in the rural areas of the State. While large-scale public investments were made to subsidize individual household latrines by poor households under Total Sanitation Campaign, open defecation is still very rampant amongst the adopter households. Many villages, which once become open defecation free (ODF), have slipped back to their original stage due to lack of proper attention being paid by the change agents to the input that can bring about the required behaviour change including sustainable provisions for reliable water supplies.

Over the years, the State of Maharashtra had tried with a variety of rural water supply systems, with increasing accent on decentralized operation and maintenance. While some of them have been successful, some have failed on several fronts. There are several reasons for this. First: often the technical system for water supply were designed without due consideration to the local hydrological system, or the socio-economic realities of the locality. Second: appropriate institutions for their management were not created or nurtured, or inappropriate policies are followed with regard to level of investment, staffing, water supply technology, coverage of systems, and operation and maintenance. *Third*: the local agencies were not involved in the planning of scheme, and in the process due consideration was not given to the capabilities of the local agencies in handling O & M of the scheme. The result was considerable gap in O & M. Fourth: the poor did not have adequate incentive to access water from the public system, severely affecting their willingness to protect them from damage and to pay for the services.

In certain other cases, the institutions for ensuring sustainable allocation of water from water resources system are absent at the local level or the local agencies such as the Panchayati Raj Institutions (PRI) lack organizational wherewithal. This is particularly relevant in situations where water resources are scarce and rural water supply sector faces severe competition from irrigation and other uses. In certain other cases, the legal, financial and human resource capacities required for the local agencies to perform effectively are neither devolved nor decentralized. The paucity of human resources poses a threat to effective performance.

In the past, there were very few attempts to look at the factors that lead to effective local self-governance and management of water supply schemes that goes beyond analysis of local factors, be it social, political or administrative.

The aim of the proposed research is to **i**dentify institutional and policy reforms needed for sustainable water supply in rural Maharashtra, which would also accelerate adoption of improved household toilets. This is done by: 1] assessing selected techno-institutional models of rural water supply, vis-à-vis: a) the degree of decentralization and devolution in the governance, b) the management performance, c) human resource capabilities of the agencies/groups managing them, and d), degree of community participation in management; and, 2] analyzing the manner in which changes in institutional and policy regimes affect the working of schemes both favorably and adversely. The study specifically examined how mainstreaming of the concept of supplying water for productive as well as domestic needs would help improve the sustainability of rural water supply schemes.

The study involved primary survey in six divisions of Maharashtra covering 12 districts and twelve water supply schemes. Different types of schemes were covered in the study, both single village and multi-village schemes. The types of sources for these schemes are: surface water; subsurface water and groundwater. Different technological models covered are: bore well/dug well/percolation well based single village piped water supply (PWS) scheme; reservoir based regional as well as single village water supply schemes; and river-lift based regional as well as single village PWS schemes. A total of 855 households under these one dozen schemes were covered in the primary survey, while secondary data on these schemes were collected from the line agencies concerned.

1.1 Rationale for the study

The World Bank (2008) report highlights that “substantial expenditure is incurred by the Government of India (GoI) on rural water supply during the last decade. But, very little is known on how effective this expenditure has-been in providing safe water to rural population. Also, there is hardly any analysis of the cost of water supply schemes, cost recovery and subsidies, and the impact of technology choice and institutional arrangements on the level of service”. Pattanayak et al. (2007) too observed that there were only a few rigorous scientific impact evaluations showing that RWSS policies were effective in delivering many of the desired outcomes. Their analysis showed that RWSS policies are complex with multiple objectives; use inputs from multiple sectors; provide a variety of services (water supply, water quality, sanitation, sewerage, and hygiene) using a variety of types of delivery (public intervention, private interventions; public private partnerships, decentralized delivery, expansion or rehabilitation); and generate effects in multiple sectors (water, environment, health, labor). The fact that the communities are mostly dependent on multiple sources of water supply, including informal sources makes evaluation of policy impacts often complicated.

The rural water supply schemes in Maharashtra are generally planned for meeting the domestic water supply needs of the population. But, rural populations have many productive water needs. Poor rural households, which are not dependent on agriculture and allied activities for their livelihood, may need water for meeting one or more of the productive water needs such as kitchen garden, homestead, livestock keeping etc.

The type of productive water need of a household would depend on the cultural background, the agro-climatic setting and occupational profile of the household. As regards the influence of culture, tribal communities in India generally keep small ruminants such as goat; they also raise chicken; undertake backyard cultivation of vegetables; the tribal communities in north-eastern region rear pigs in their homestead (GSDA, IRAP and UNICEF, 2011).

In rural areas, conflicts occur between using water for meeting economic goals and meeting social goals. When water becomes scarce, the poor communities often compromise on their personal hygiene needs in an effort to find water for productive needs. Failure on the part of the water supply agencies to provide water for productive as well as domestic needs would result in the households not being able to realize the full potential of water as a social good. This can happen because of two reasons: 1] available water gets reallocated (Lovell, 2000; van Koppen et al., 2009; Moriarty et al., 2004); and 2] they end up spending substantial amount of time and effort to find water sources to meet the productive needs, which would reduce their ability to fetch water from public systems and use for personal hygiene. This generally impacts on their productivity in the long run by becoming susceptible to water related diseases.

Another possible outcome is that the agency has not designed the infrastructure for multiple uses, but the system by default becomes a multiple use system. Some of the unplanned uses may damage it (van Koppen *et al*., 2009). Water supply systems that do not consider the needs of rural communities for sustainable livelihoods, fail to play an important role in their day to day life. As they are not able to perform economic activities out of the water supplied through public systems, communities show low level of willingness to pay for the water supply services. This affects the sustainability of the systems as official agencies are not able to recover the costs of their operation and maintenance. Thus a vicious circle is perpetuated.

But, there is growing appreciation of the fact that whenever such unplanned uses take place from "single use systems" without causing much damage to the physical infrastructure, it brings about improvements in all four dimensions of livelihood related to water. These dimensions are: freedom from drudgery; health; food production; and, income (van Koppen *et al*., 2009). This leads us to the point that a marginal improvement in drinking water supply infrastructure and a marginal increase in the volume of water supplied could enhance the value of water supplied remarkably in social as well as economic terms (Meinzen-Dick, 1997; van Koppen *et al*., 2006; van Koppen *et al*. 2009).

Often it is believed that additional water resources to meet multiple needs would be difficult to find in a water supply scheme. Contrary to this, in most instances, ensuring sustainable allocation of water for the household needs from the available resources, rather than overall availability of water in a locality is a real issue. While some of this would require reallocation of water from water-intensive irrigated crop production, the ongoing action research on multiple water use systems (MWUS) showed that it is possible to augment existing water supplies, and develop models to supply water in rural areas to meet the productive needs of the most vulnerable communities even in the most drought prone areas.

The piloting of such systems is being done in three locations, each one representing a unique agro-climatic and socio-economic setting. It starts with designing systems that can supply water for multiple needs in the village on a sustainable basis throughout the year, and working out institutional arrangements for their implementation. Subsequently, a full-fledged social cost-benefit analysis of the project will be carried out to on the basis of the direct costs incurred for the project, direct benefits accrued from it, and the positive and negative externalities it induces on the society, using primary data collected from the households on various attributes. The outcomes of this project, along with the assessment of the various techno-institutional models for managing rural water supplies and performance of selected rural water supply schemes, policies for sustainable rural water supply and sanitation in rural Maharashtra would be designed.

1.2 Goal and Objectives of the Research

The goal of the study is to evolve policies for sustainable rural water supply in Maharashtra, which will help promote household level sanitation. The objectives are as follows:

i. Understand the overall governance and management of rural water supply schemes in the states of Maharashtra vis-a-vis:

   a. Governance practices
   b. Management performance
   c. Human resource capabilities
   d. Community participation and devolution

ii. Analysis of techno-institutional models of water supply and their influence on the (management) performance of water supply schemes and developmental outcomes, with particular reference to MWUS

iii. Analyze how the institutional setting and policy regimes relating to rural water supply sector affect the governance and management of rural water supply schemes

iv. Identify the nature of institutional and policy reforms needed for ensuring sustainable drinking water supply in rural areas

2. Approach and Methodology

The approach used in the study was to first examine the degree of decentralization in governance of selected rural water supply schemes in these states; assess the management performance of the schemes; and analyze the human resource capabilities of the agencies and institutions involved in running the schemes. Subsequently, the governance practices, management performance and institutional capabilities in schemes are compared against the techno-institutional characteristics, and institutional--legal, regulatory and administrative--, and policy regimes for rural water supply schemes in the state to identify how the latter provide enabling or disabling environment sustainability. In this context, it is important to mention that there are several projects implemented by GoM on rural water supply, each having its own organizational set ups and policies[1]. A proper evaluation of the performance of these schemes and their outcomes/impacts is essential to know what works, and under what conditions. Samples will be selected from such projects for comparative analysis.

The learning emerging from the action research project on MWUS were used to gain insights into the key policy interventions required for improving the sustainability of rural water supply schemes, and enhancing their developmental outcomes. In addition to the samples, review of international literature on institutional and policy regimes for sustainable rural water

[1] Some of them are *Apla pani* supported by KFW, *Jal Swaraj*, Bharat *Nirman*, NRDWP and the rural regional water supply schemes under Maharashtra *Jeevan Pradhanaran*. Yet, the state lacks a coherent policy for rural water supplies.

supply and case studies from Indian states on policy initiatives for sustainable rural water supply was undertaken.

The study began with a consultation with water supply experts and government policy makers from the state of Maharashtra to consolidate the past learnings, and to finalize the study design. The findings emerging from the comparative analysis of schemes, the review of international and national literature, and the findings from the action research on MWUS were synthesized to identify the reforms needed.

2.1 Conceptual framework for the study

The conceptual framework for analyzing the factors influencing the overall governance and management of rural water supply is given in Figure 1. Study components included:

i. Governance practices that exist in planning, construction and management of rural water supply schemes in the state of Maharashtra. "Water governance refers to the range of political, legal, social, economic and administrative systems that are in place for effective management of water resources and their service delivery at different levels of society. Governance translates into political systems, laws, regulations, institutions, financial mechanisms and civil society development and consumer rights". In the context of rural water supply, this can pertain to planning of water supply schemes; quality of delivery of water supply services; fixing of water prices or water tax; and investment for water supply infrastructure.

ii. Management performance of the rural water supply schemes, comprising physical performance, economic performance and financial performance: this would involve detailed analysis of the performance of selected (sample) schemes vis-à-vis the following: water supply coverage, adequacy, reliability, and quality of water supplied; the capital and operational cost of water supply, particularly the cost per unit volume of water supplied against the alternatives that exist; the revenue recovery in the form of water tariff against the investments. The adequacy of water supply would be assessed in relation to water requirements for productive and domestic purposes.

iii. Institutional performance of rural water supply agencies, covering human resource capabilities, community participation and devolution of powers from top to the bottom level. This would include: study of technical, managerial and financial capabilities of the agencies involved in the planning, development management of the schemes against what is required to run them efficiently; and, degree of community participation in managing water supply scheme.

iv. Techno-Institutional Characteristics: Certain schemes perform better than certain others under certain physical environments, because of the unique techno-institutional characteristics of the system. MUWS is one such system which has unique techno-institutional characteristics as they tap water from different sources, use different principles, norms and mechanisms for water allocation.

v. Institutional and policy framework relating to water: some of the key documents are: Maharashtra State Water Policy, 2003; The Maharashtra Water Resource Regulatory

Authority Act, 2005. The water policy documents would be studied with particular reference to the guidelines pertaining to water tax/fee, water allocation priorities, and water quality monitoring. The Acts would be studied with particular reference to the provisions related to groundwater withdrawal; the pollution of water bodies; powers of the officials of agencies concerned with enforcement; penalties for violation of norms and regulations. We would also study rural water supply administration, including the state level institutions and local community organizations covering organizational structure; administrative hierarchy; rules and procedures; staffing; reporting systems; and transparency and accountability.

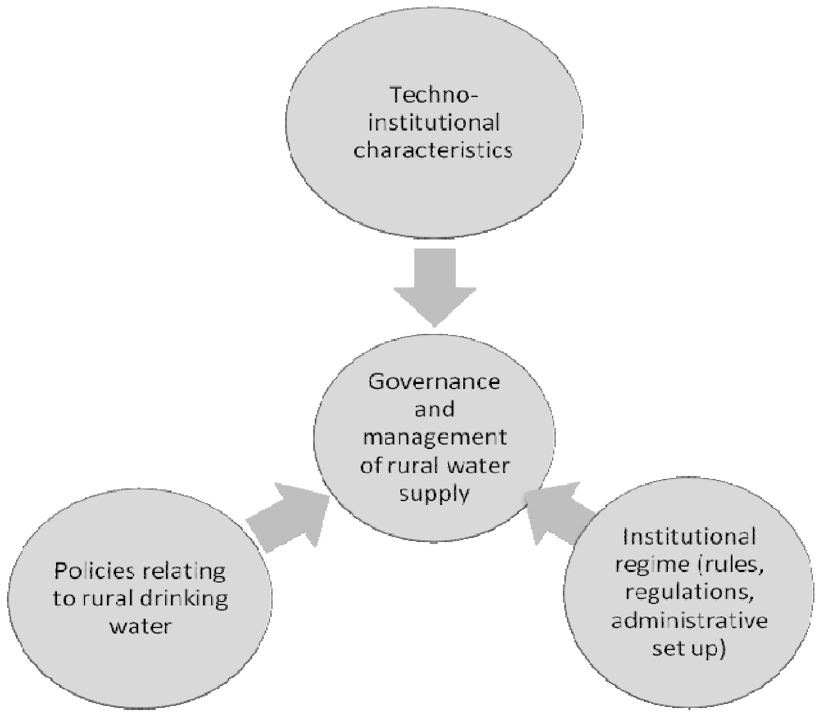


Figure 1: Conceptual framework for the study

2.2 Sampling procedure and method of analysis

A total of twelve schemes representing six different regions of Maharashtra were selected to analyze the scheme performance. Out of these, seven were individual piped water supply schemes and five were regional piped water supply schemes (Table 1). While sampling of the scheme, care was taken to ensure that two different types of schemes from the same type of geo-hydrological and hydrological setting were selected for comparison. This is to nullify the influence of the physical environment on the performance of schemes.

Table 1: Details of the selected schemes

Division	District	Type of Scheme	Block	Name of the RWSS	Year of Completion

Nagpur	Bhandara	Individual GP scheme based on dug well	Bhandara	Jamni	2011
	Gondia	RWSS based on surface reservoir	Amgaon	Bangaon	2007
Amravati	Amravati	Individual GP scheme based on dug well	Nandgaon kh.	Papal	2001
	Yavatmal	RWSS based on surface reservoir	Pusad	Malpathar 40 villages	2006
Aurangabad	Hingoli	Individual GP scheme based on open (infiltration) Well	Hingoli	Adgaon	2010
	Osmanabad	RWSS based on surface reservoir	Osmanabad	Dhoki 4 Villages	2005
Nashik	Nandurbar	Individual GP scheme based on bore well	Shahade	Brahmanpuri	2011
	Jalgaon	Individual GP scheme based on reservoir	Bhusawal	Fekari	2011
Pune	Solapur	RWSS based on river lifting	Sangola	Shirbhavi and 81 villages	2005
	Pune	RWSS based on surface reservoir	Mawal	Karla	1997
Konkan	Thane	Individual GP scheme based on percolation Well	Dahanu	Gholwad	2010
	Sindhudurg	Individual GP scheme based on river lifting	Sawantwadi	Devasu	2005

In each village falling under a scheme and which is chosen for the survey, a total of 50 households were surveyed to understand aspects such as water supply adequacy, reliability and quality of water. From each chosen single village water supply scheme one village and from each chosen regional water supply scheme two villages were selected for the survey. Thus, in total, 17 villages and 850 households were surveyed.

An understanding of the governance in rural water supply and sanitation practice was developed through interview of the stakeholders, local political leaders, civil society groups, senior officials of state rural water supply bureaucracies, officials of regulatory agencies and the user communities (consumers) on the effectiveness of the roles of every other stakeholder (either in rule making or rule implementing) on one or more of the following: a] planning water supply schemes; b] quality of water supply services for rural areas; c] fixing water prices or water taxes; d] taking investments decisions in water supply infrastructure; and e] operation & maintenance of rural water supply schemes. Since the focus is on understanding how far governance of rural water supply is decentralized, these observed practices were compared against those which promote decentralization.

The institutional and management performance of the utilities was studied by analyzing data collected from the managers of the schemes and communities which are served by them on various physical, socio-economic and institutional factors which determine these performance variables. The water administration was studied by analyzing the data from the state level and local level bureaucracies concerned with drinking water supply.

Comparison between two different techno-institutional models of water supply from similar physical setting within a state was carried out to understand the influence of techno-institutional characteristics on management performance of schemes. Such analysis was done under two geological settings. Whereas, comparison between schemes with different organizational sets up and operational policies from within the state was undertaken to analyze the influence of water supply administration (institutional set up and policies) on scheme performance.

3. Water Resources in Maharashtra and Water Use Patterns

3.1 Rainfall: magnitude, patterns, variability

The State lies between lat 15°35' and 22°02' N and log 72°36' and 80°54'E. The state has a tropical monsoon climate. The annual rainfall varies from 400 mm in certain parts of Marathwada to 6000 mm in the western Ghat region. Figure 2 shows the isohyets of Maharashtra. It can be seen that parts of western Maharashtra and Konkan region have very high rainfall, with its values exceeding 2500 mm, annually.

The Sahyadri mountain range provides a physical backbone to the State on the West, while the Satpuda hills along the north and Bhamragad-Chiroli-Gaikhuri ranges on the East serve as its natural borders. The State has five distinct physiographic regions, namely Deccan Plateau, Central Highlands, Eastern Chhotanagpur Plateau, Western Ghats and Coastal Plains.

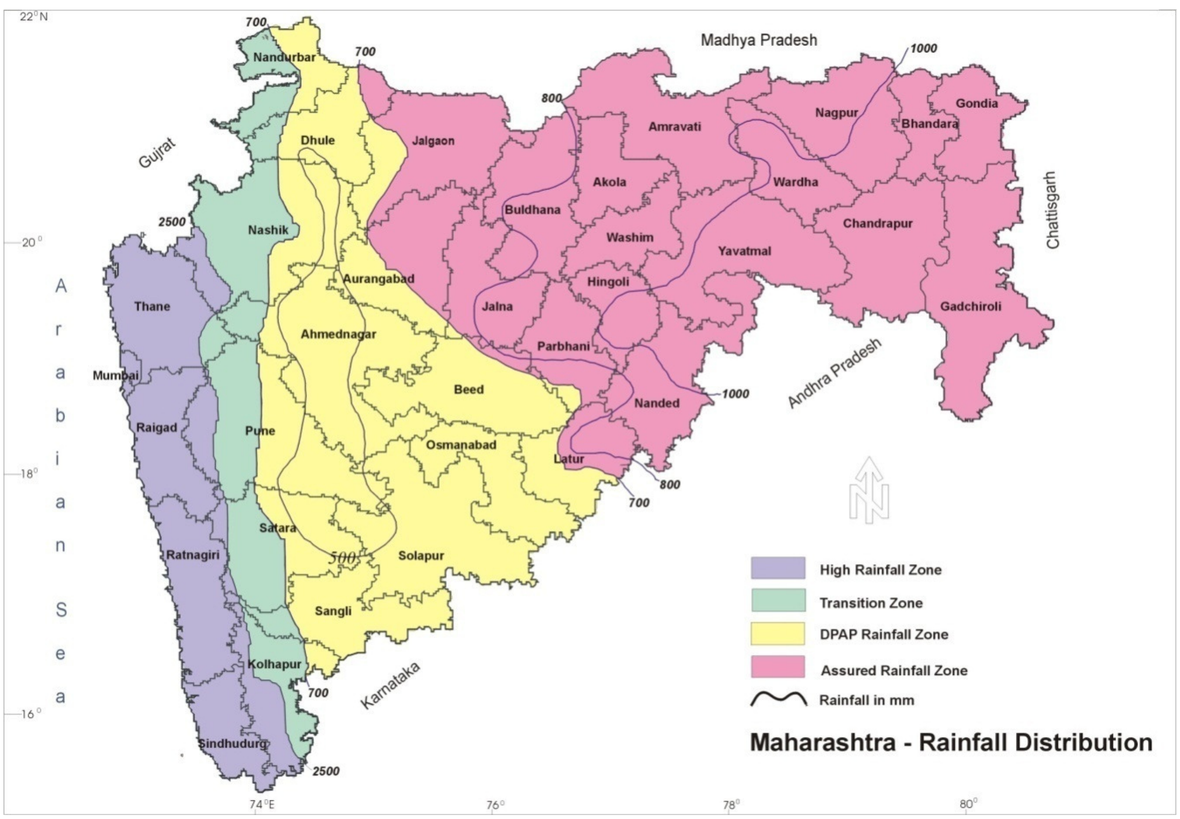


Figure 2: Rainfall distribution map of Maharashtra

The average rainfall of state is around 1300 mm of which 88% occurs during June to September and remaining between October and December. This uneven distribution of rainfall has an important bearing on the State's water resources planning. One-third area of the State falls under rain-shadow region with scanty rainfall. Nearly 1/4th of the drought prone area of the country is in the State of Maharashtra.

3.2 River basins, surface water resources, and dependability

The geographical area of the state is divided into basins of Krishna, Godavari, Tapi, Narmada and narrow basins of west flowing rivers of Konkan (Figure 3).

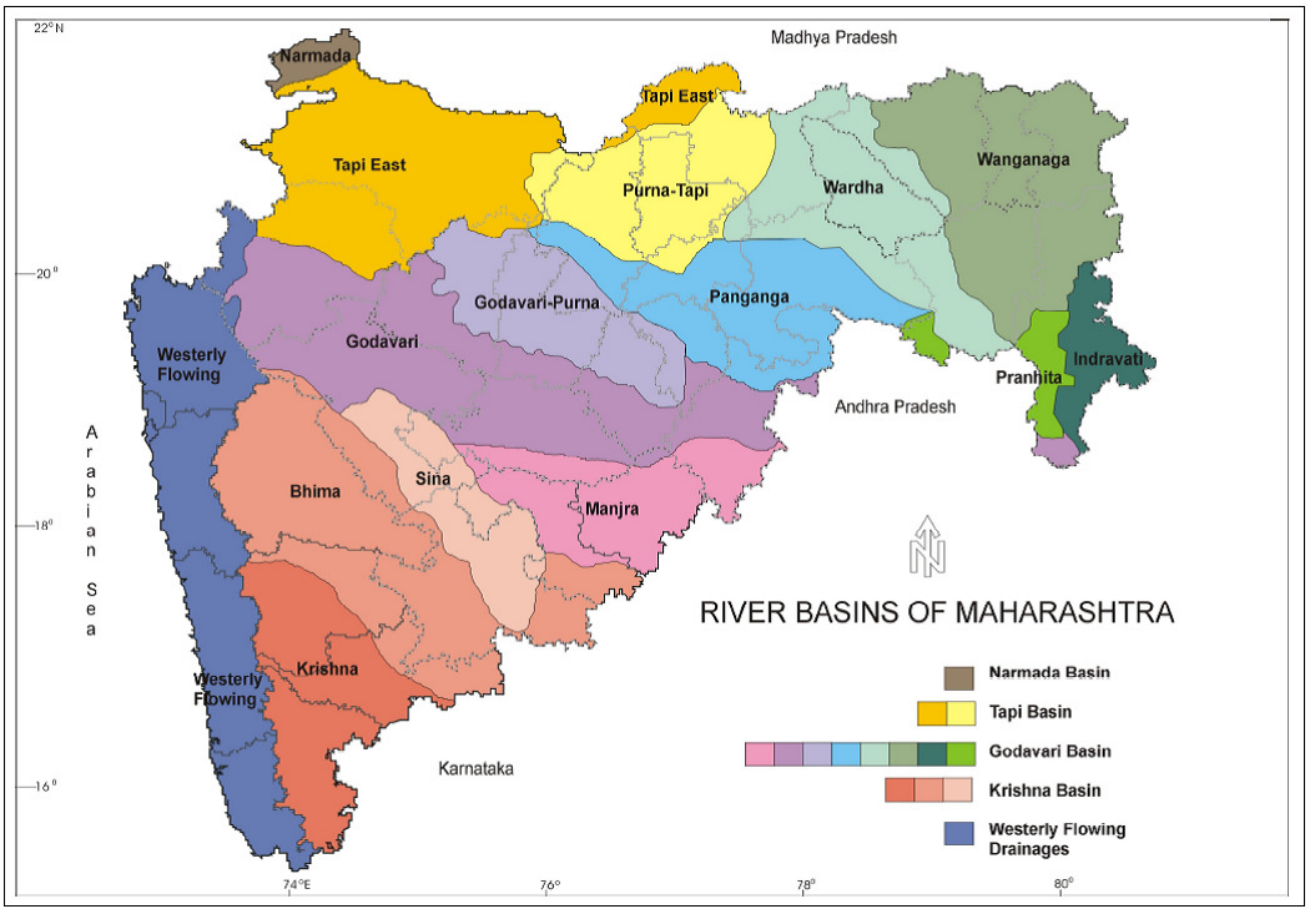


Figure 3: Map showing river basins of Maharashtra
(Source: GSDA and CGWB, 2011)

Table 2 gives the total renewable water availability and utilizable surface water resources of the basin which fall fully or partly in Maharashtra (source: based on GOI, 1999). As can be seen from Table 2, the utilizable water resources of some basins are far less than the renewable water resources the difference being highest for the West-flowing Rivers located south of Tapi. This is due to topographical and other constraints, particularly lack of viable sites for impounding the water.

Table 2: The river basins falling in Maharashtra (fully or partly) and their surface water potential

Name of the River Basin	Total Basin Area (sq. km)	Area of the Basin within Maharashtra (Sq. Km)/% Area of the Basin in Maharashtra	% Area of Maharashtra covered by the Basin	Total Renewable Surface Water of the Basin (75%) Dependability (MCM)	Total Utilizable Surface Water Resources of the Basin (BCM)
Godavari	312812.0	152199/48.65	49.40	80550.0	76300.0
Krishna	258948.0	69425/26.80	22.5	60140.0	58000.0
Tapi	65145.0	51504/79.06	16.7	14500.0	14500.0
Narmada	98796.0	1538/1.55	0.50	34500.0	34500.0
Mahanadi	141589.0	238/0.17	0.07	66900.0	49990.0
West Flowing Rivers South of Tapi*	113067.0	32806/29.01	10.70	200940.0	36210.0
Total		307710	100.0	457530.0	269500.0

(Source: based on Table 3.6 & Annexure 3.1, p 420-42, GOI, 1999)
*No break up of renewable water resources for the basins which are falling fully in Maharashtra, i.e., in the Konkan region is available.

Thus the figures are not suggestive of the total amount of surface water available for development inside Maharashtra State. The average annual availability in above basin within Maharashtra territory is anticipated as 163.82 BCM, out of which permissible use as per inter-state tribunal award is 125.94 BCM (Sodal, 2006).

Nearly, 89% of the State's geographical area falls in the three major river basins, viz., Godavari, Krishna and Tapi. While Krishna is considered to be a water-scarce basin, Godavari and Tapi are water-rich basins. The part of Godavari basin which is falling in Maharashtra's administrative territory, is the upper catchment of the basin. In the case of Krishna river basin, the upper catchment area extends over parts of Maharashtra and Karnataka.

The amount of utilizable water resources which can be tapped by Maharashtra State depends on the percentage area of the basin falling within the State and the amount of water allocated by various interstate water dispute tribunals to the State from the respective basin. The relevant tribunal awards for Maharashtra are Godavari Water Disputes Tribunal (GWDT), Krishna Water Disputes Tribunal (KWDT) and Narmada Water Disputes Tribunal (NWDT).

The Godavari Water Dispute Tribunal Award (1980) allows the party States to utilize the water from the main river up to certain designated points within their territory, and does not specify the quantum of water. As per the award, Maharashtra can harness for beneficial uses all waters of Godavari up to the Paithan dam site on the Godavari main river, and up to Siddheswar dam site on Purna River, a tributary of Godavari. In addition, the award provides for diversion of 80 TM (i.e., 2,266 MCM) of the Godavari water from Polavaram Project to Krishna River upstream of Vijayawada Anicut. The water thus diverted in the Krishna will be shared among Andhra Pradesh, Karnataka, and Maharashtra as 45 TMC by Andhra Pradesh and 35 TMC by Karnataka and Maharashtra.

The KWDT had allocated 560 TMC (15,859 MCM) of the total 2060 TMC of dependable yield assessed at Vijayawada site to Maharashtra in 1973. The allocation was subsequently reviewed in 2004 and a further allocation was made from the newly assessed dependable yield of 2173 TMC.

The ultimate irrigation potential of Maharashtra through both surface water and ground water resources was estimated as 12.6 m. ha. Surface irrigation potential to the tune of about 0.27 m. ha was created in the State prior to 1950. Since agriculture is prominent occupation of the rural population, the State has concentrated on construction of irrigation projects after Independence. Thus, it had witnessed a manifold increase in irrigation potential creation. By 2005, I had created 4.0 m. ha of irrigation potential from surface water resources. For this, it had constructed almost 2700 major, medium and minor irrigation projects (Sodal, 2006).

The share of major, medium, minor (State sector) and minor (Local sector) irrigation projects in the total irrigation potential created was 44.06 per cent, 13.40 per cent, 19.96 per cent and 22.58 per cent respectively. The additional irrigation potential created during 2005-06 was 1.17 lakh hectares showing an increase of 2.2 per cent over the cumulative achievement by the end of June 2005. The actual utilization of irrigation potential in 2005-06 was 20.13 lakh hectares (38.05 per cent) as against the potential of 51.73 lakh hectares created up to the end of June 2005 (Source: *Economic Survey of Maharashtra, 2006-07*).

3.3 Irrigation projects and their water availability

With half of India's dams located within its territory (Sodal, 2006), Maharashtra has one of the largest numbers of surface water reservoirs in the country (Figure 4). As on 1998, the State had a total reservoir storage capacity of 22.1 km^3 and 12.9 km3 of storage under construction. They together accounted for 14% of the total storage capacity of 250 km^3 of storage in the Country at that point of time (source: Water and Related Statistics, CWC, 1998).

By the end of June 2007, a total of 66 major, 233 medium and 2777 State sector minor irrigation projects were built in the State. The State had carried out a Water Audit of selected Major, Medium and State-run minor irrigation projects as on October 15, 2008. This covered 52 major projects (73 reservoirs), 199 medium project (having 201 reservoirs), and 1756 minor projects, with a total of 2007 projects. It showed that all the sub-basins of the WFRs of Konkan south of Tapi were water abundant, with more than 12,000 m^3 of water available per ha of CCA. Whereas, in the case of Godavari basin, three sub-basins were deficit basins, four were normal, one water surplus and one water-abundant. In the case of Krishna, out of a total of five sub-basins, two are highly deficit, two normal and one was water-abundant. In the case of Tapi also, out of the five sub-basins, three were in the deficit category and the remaining two in the normal category (Table 3).

Here, the water surplus basins are those where the total water available is in the range of 8000-12,000 m^3 per CCA, normal sub-basins are those where the availability is in the range of 3000-8000 m^3 per CCA, deficit basins are those with water availability in the range of 1500-3000 m^3, and highly deficit basins are those with water availability less than 1500 m^3 per CCA.

One interesting finding emerging from the water audit for the irrigation year 2007-08 was that out of a total design live storage capacity of 27,773 MCM, the actual live storage on 15th October, 2007 was 24,442 MCM. Out of this, a total of 16,806 MCM was diverted for irrigation through canals, and reservoir and river lift. Direct water use from the reservoirs for irrigation was 1844 MCM, which accounted for 9.1 per cent of the total irrigation water use. The total water loss on account of evaporation from the reservoirs was 3878 MCM, which accounted for 16 per cent of the total live storage of these reservoirs. The loss was lowest for major reservoirs (13%) and highest (24%) for medium reservoirs. In the case of minor reservoirs, the loss was 22 per cent of the total live storage. The un-utilized storage (excluding the hot weather inflow and design carry over) at the end of the irrigation year 2007-08, as against the total live storage recorded on 15th October, 2007, was 7.5 per cent (i.e., 1630 MCM).

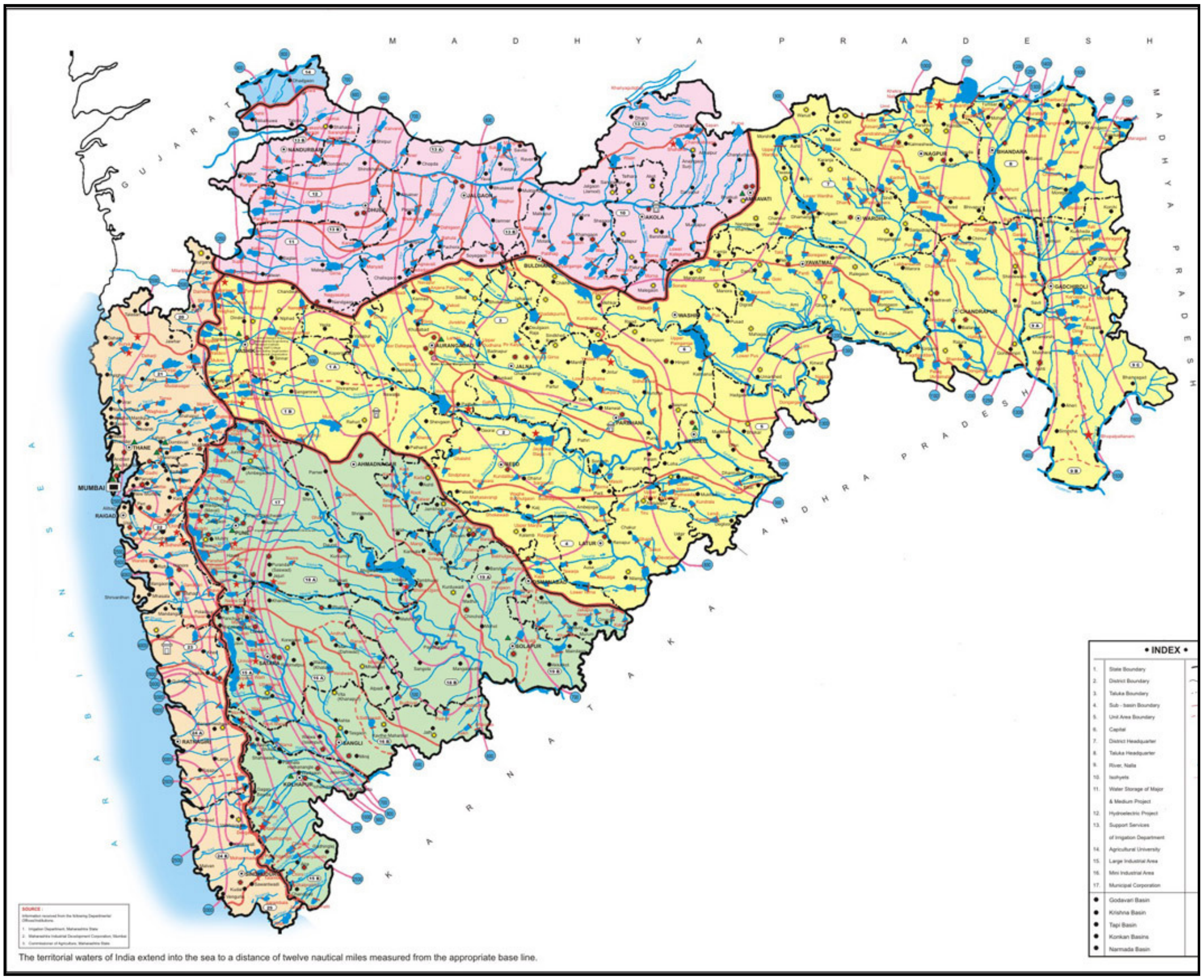


Figure 4: Map shpowing distribution of surface reservoirs in Mahasratra

Table 3: Categorization of river basins and their sub-basins according to water availability

Sr. No	Name of River Basin	Name of Sub-Basin	Classification for planning on the basis of water availability per Unit CCA
1	Godavari	Upper Godavari	Normal
		Lower Godavari	Deficit
		Purna	Do
		Manjra	Do
		Godavari-Sudha-Swarna	Normal
		Painganga	Do
		Wardha	Do
		Middle Wainganga	Surplus
		Lower Wainganga	Abundant
2	Tapi	Purna	Deficit

		Girna	Do
		Panzara	Normal
		Middle Tapi (Satpuda)	Normal
		Middle Tapi (South)	Deficit
3	Narmada	Narmada	Surplus
4	Krishna	Upper Krishna (west)	Abundant
		Upper Krishna (east)	Highly deficit
		Upper Bhima (up to Ujjani)	Normal
		Remaining Bhima	Normal
		Sina-Bori-Benetura	Highly Deficit
5	West Flowing Rivers in Konkan	Demanganga-Par	Abundant
		North Konkan	Do
		Middle Konkan	Do
		Vashishti	Do
		South Konkan	Do
		Terekhol-Tillari	Do

Source: Report on Water Auditing of Irrigation Projects in Maharashtra State: 2007-08, (Government of Maharashtra, 2009)

3.4 Geology, geo-hydrology and groundwater resources

The State of Maharashtra has a heterogenous geology (Figure 5). Nearly 75 per cent of the State's geographical area is underlain by hard rock formations of Deccan Trap origin. Around 15% of the area is underlain by crystalline formations in the districts of Chandrapur, Bhandara, Garhchiroli and part of Nagpur district in Vidarbha region. Nearly, 10 per cent of the geographical area is underlain by alluvial formations extending from Dhule, Jalgaon, Buldhana and Amravathi districts, covering only portions of these districts' total geographical area.

The total renewable groundwater resource in the State was estimated to be 32961 MCM and the net groundwateravailable for utilization is 31214 MCM. Out of these, 1508 MCM is earmarked for domestic and industrial requirement and the remaining is available for future irrigation.

Between 1988 and 2004, the groundwater use has increased by 4030 MCM, from 11050 to 15090 MCM. The present irrigation draft is to the tune of 14,240 MCM. Thus at the aggregate level, the net groundwater balance in the State is positive. But, using these aggregate figures for planning of groundwater development schemes would be disastrous.The reason is that a major portion of the un-utilized groundwater exists in the areas where demand for groundwater does not exist for either irrigation or drinking and/or is in areas, which are not favourable for development. This suggests the presence of areas which face over-exploitation of groundwater, particularly those areas which receive low rainfall and have semi-arid climatic conditions, and which do not have large areas under surface irrigation.

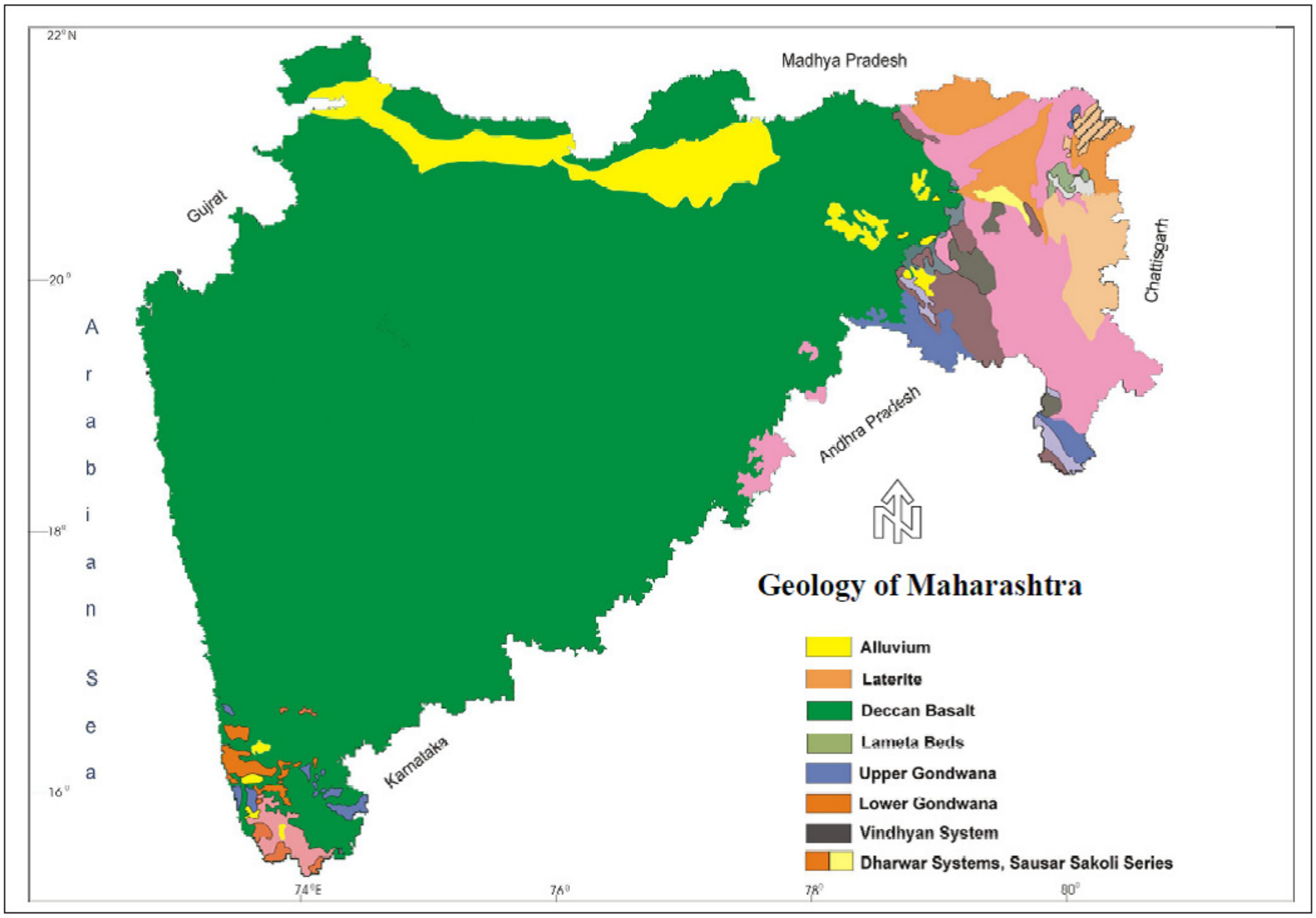


Figure 5: Map showing geological formations of Maharashtra
(Source: GSDA and CGWB, 2011)

3.4.1 Groundwater over-exploitation in the State

Groundwater is a major source of water not only for drinking and domestic uses, but also for irrigation in the State. In the early stage of groundwater development, open wells formed the major source of irrigation. Cheap electricity and rural electrification triggered intensive and extensive groundwater use. There are around 17.42 lac wells for a total of 137 lac operational holdings in the State, of which 16.45 lac are open wells.

As per the most recent estimates, out of the total 1505 watersheds in the States, 76 are 'overexploited', i.e., the groundwater development is more than 100 per cent of the recharge and the water table during both pre and post monsoon shows a declining trend. Twentywatersheds are categorised as 'critical' where groundwater draft is more than 90 per cent of the recharge and where water table, either during pre or most monsoon or both shows significant declining trend and 163 watersheds are categorised as 'semi-critical' where groundwater development is between 70 and 90 per cent of the recharge and where water table in both pre or post monsoon interval, shows declining trend. A Map of Maharashtra State with the watersheds falling in different categories vis-à-vis stage of groundwater development is shown in Figure 6.

Hence, as per the official estimates, groundwater over-exploitation is a problem which has affected hardly 5 per cent of the State's geographical area. But, these estimates are far from the reality as far as the stage of groundwater development in the State is concerned, if the minor irrigation statistics on the extent of well failures in the state is any indication. Minor Irrigation Census dated as far back as 2001 showed that, 9.3 per cent of the dug wells, 4.3 per cent of the shallow tube wells and 10.7 per cent of the deep tube wells in the State had failed, and a slightly larger percentage of the wells are not in use. The percentage is 10.9 for dug wells, 7.9 for STWs, and 13.6 for deep tube wells. Further, out of the 77,708 deep tube wells, 59.9 per cent suffered from poor discharge (Source: authors' own analysis using Minor Irrigation Census data 2001). These figures suggest that the extent of over-exploitation is much larger than what the official figures of groundwater balance suggest.

One reason for this anomaly, as pointed out by Kumar and Singh (2008) is that the groundwater outflows or the base flow, which reduces the amount of utilizable groundwater in the natural recharge and induced recharge into the aquifer, is not taken into account while estimating the net groundwater balance (also see Kumar *et al*., 2012).

There are also issues relating to the estimation of draft. The groundwater withdrawal figures are heavily under-estimated, because except for Latur and Osmanabad, the draft from irrigation bore wells and tube wells have not been fully accounted for. It is a well-known fact that there are large numbers of bore wells/ tube wells, which are not electrified, but serve as the main source of irrigation in all the parts of the State. The exact statistics about their number is not available. Further, it appears that much of the areas categorized as 'groundwater abundant' are those which are hilly. Not only that these areas are suitable for groundwater exploitation, but they do not hold much groundwater due to steep groundwater flow gradients.

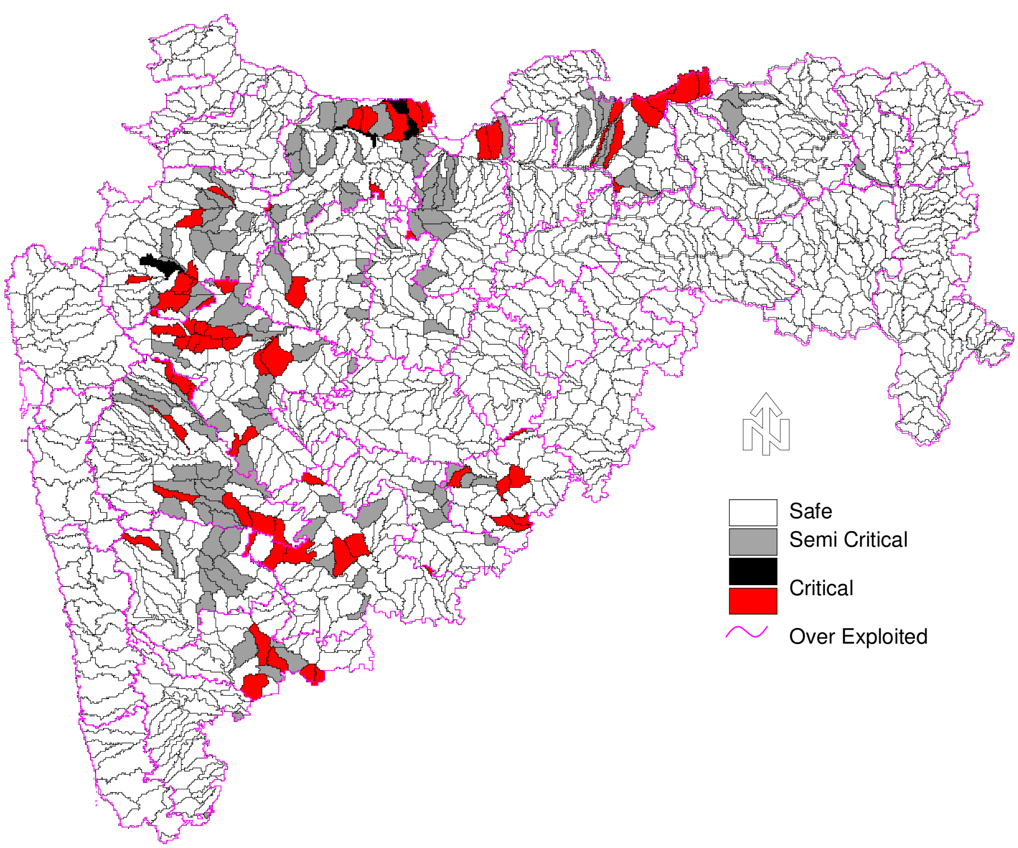


Figure 6: Status of groundwater development in Maharashtra

3.5 Competitive water use sectors and water use pattern

As per the estimates available from Maharashtra Water and Irrigation Commission (GoM, 1999), the amount of water available for planned use from all the river basins in Maharashtra is about 139.23 billion cubic metre (BCM). In 1996, about 39.48 BCM of water (26 % thewater available for planned use) was used for different purposes, namely: domestic use; agriculture; industry; and hydro & thermal power generation, across basins. Agriculture sector (including irrigation and livestock) accounted for 81%the total water use, followed by Hydro and thermal power generation (9%), domestic (7%) and industry (3%) sector. However the proportion of water used by different sectors variedamong basins as per the nature of growth of agriculture and other sectors (Figure 7).

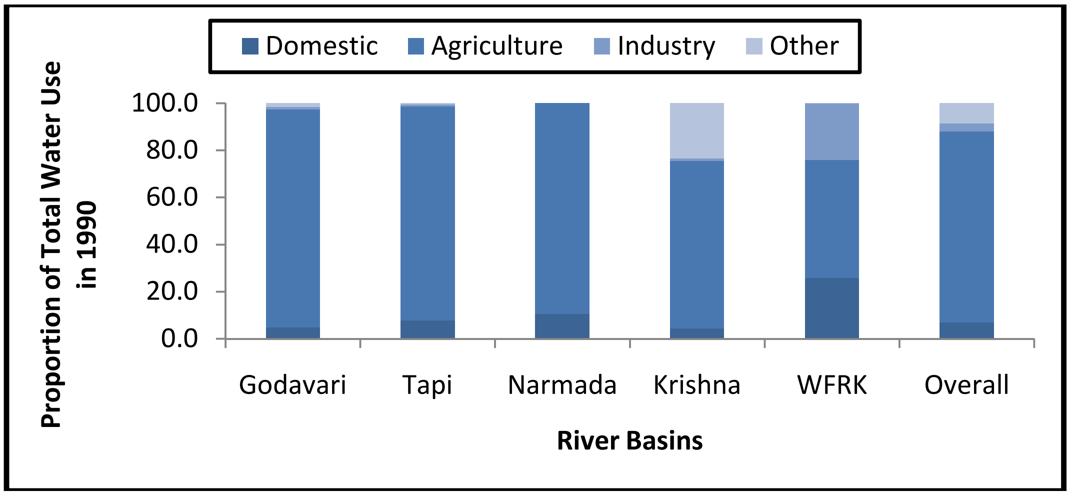


Figure 7: Basin-wise water use demand in the year 1990 across various sectors in Maharashtra

As per the statistics released by Government of India, annual requirement of water for domestic purposes (including for Cattle) in Maharashtra was estimated to be around 4.09 BCM in 2001, which increased to 4.69 BCM in 2006 and will be 6.7 BCM bythe year 2025.

Irrigation Commission report projects that by 2030, the total water demand would increase to 103.71 BCM (70 per cent of the water available for planned use) at the state level, with highest demand generated (43.45 BCM) in Godavari basin (Table 5). For domestic use, highest demand would be in Godavari (2.07 BCM), followed by west flowing rivers in Konkan (WFRK) (1.95 BCM) and Krishna basins (1.43 BCM). Overall, water demandfor domestic use in 2030 was projected to be around 6.18 BCM, an increase of 3.42 BCM of 1996 levels. There are two main reasons for the increase in domestic water requirements in these basins: first, increasein population growth leading to greater water demand for domestic uses; and second, planning of greater number of multi-village rural water supply schemes on surface reservoirs due to unreliability of the schemes based on groundwater sources.

Table 5: Basin-wise water supply and projected water demand in Maharashtra

River Basin	Available water for planned use (BCM)	Projected demand in the year 2030 for (BCM)				
		Domestic	Agriculture	Industry	Others	Total use
Godavari	38.88	2.07	40.38	0.68	0.32	43.45

Tapi	9.32	0.73	10.56	0.77	0.18	12.23
Narmada	0.34	0.006	0.25	0.00	0.00	0.25
Krishna	18.36	1.43	27.44	0.42	3.11	32.39
WFRK	72.32	1.95	12.03	1.40	0.003	15.38
Overall	**139.23**	**6.18**	**90.66**	**3.25**	**3.62**	**103.71**

(Source: GoM, 1999)

4. Status of Water Supply and Sanitation in Maharashtra

4.1 Rural drinking water reforms in Maharashtra

According to the Census of India (GoI, 2011), Maharashtra has nearly 23.83 million households, with 13 million households in rural areas and 10.8 million households in urban areas. About 68 per cent of them have access to tap water sources and 50 per cent have access to improved latrines. The corresponding figures in rural areas are about 50 per cent and 35 per cent, respectively. Obviously, the progress in the rural areas is far from being satisfactory. But still these figures are marked improvement from the year 2001, when only about 45.5 per cent and 18 per cent of the rural households had access to tap water and any type of latrine facility, respectively. Further, there is some improvement in the proportion of rural households having drinking water available within their premises (increased from 38.9 per cent in 2001 to 42.9 per cent in 2011).

In Maharashtra, demand responsive approach for delivery of rural water supply and sanitation services was made operational in 2000. Prior to that, during early 1980s, there was an emphasis on single village schemes which mostly tapped local aquifers. Regional rural water supply schemes started in a big way in the late 1980s, and particularly, during mid to late 1990s. These schemes drew water from large reservoirs, and were considered to be better than the single village schemes based on underground water as they involved economies of scale and the water was of better quality (Sangameswaran, 2010). Between the mid 1980's and 1990's, the State government implemented various schemes for improving the water supply coverage through financial support from the World Bank, the German Development Bank and DFID. In 1995, Maharashtra became the first State in the country to prepare a White Paper on the water situation in the State and to initiate institutional reforms with a view to improve the performance of local bodies that are responsible for provision of drinking water and sanitation facilities (Das, 2006). The White Paper primarily addressed the issues of disparity in water supply, level of service and groundwater depletion. A few recommendations were made concerning water supply in rural areas, enforcement of various legislations, stressing upon more effective management of water supplies and decentralization.

For drinking water, a master plan consisting of a number of detailed proposals was adopted in 1996. The overall goal of the proposals was to make Maharashtra free of tankers--, a major source of drinking water for villagers during summer months--, by the year 2000. As per the master plan, water supply norm became more stringent, with supply rate increasing from 40 to 55 lpcd. More importantly, a source dependability criterion of 95% was adopted for water sources. This meant that the surface water schemes had to be taken up in a big way, as groundwater based schemes were found to be less dependable, with sources drying up during summer months. Thus, the regional supply schemes acquired prominence. This led to the establishment of a parastatal agency called the Maharashtra Jeevan Pradhikaran (MJP) (Sangameswaran, 2010). The MJP built, tested and then handed over schemes to the concerned local authorities to operate and maintain. For each completed scheme, MJP charged a commission of 17.5 per cent on the total costs to meet its overhead costs and other administrative expenses. However, the tanker-free programme was not a complete success. It required huge financial outlay; and the regional supply schemes brought in their own problems which include high capital costs, lack of willingness of local authorities to take over the schemes, and inequity in distribution of water between head-end and tail-end villages (Sangameswaran, 2010).

With the change in the State Government in 1999, the centrally sponsored SRP was initiated in 4 districts of the State. By the year 2000, in principle the role of government was shifted from service provider to that of policy formulation and capacity building agency. During the reform process, communities were encouraged to decide the water supply schemes of their choice and efforts were made to ensure their sustained involvement through cost sharing. Decisions on the type of scheme, the implementing body (whether it should be the Gram Panchayat, the Zilla Parishad or an NGO), as well as the technical service provider (whether it should be MJP, the ZP, or a private party) rested with the GS at least nominally. These ambitious reforms were in a sharp contrast to the pre-2000 situation, where both the need for drinking water and the manner of its provision was determined by State departments, parastatal agencies such as MJP, ZPs and Panchayat Samitis.

Further, a major role is to be played by village water and sanitation committees (VWSCs), which are elected by the GS and are technically sub-committees of the GP. They would have funds directly devolved to them, would maintain accounts separately (from the general accounts of the GP) and plan and implement the scheme autonomously (Sangameswaran, 2010). Again, during this phase there was a technological shift from regional supply schemes based on reservoirs to single village schemes based on groundwater. It was believed that mobilising local community and costs recovery, which are important components of the supposedly 'demand driven approach', would be easier in small single village schemes.

In 2002, German KFW funded a 'demand-driven' scheme, called Aaple Pani, which was initiated in three districts of the State. In the year 2003, the World Bank financed Maharashtra Rural Water Supply and Sanitation Project, also called as Jalswarajya, was initiated to cover rural areas of remaining 26 districts of the State. The overall objectives of Jalswarajya were to increase access to RWSS services and to institutionalize decentralized delivery of RWSS services by local governments (RSPMU, 2004). Jalswarajya relied on voluntary participation by communities, wherein communities select water supply and sanitation services from a menu of options, and targeted provision of RWSS services by project administrators (Pattanayak *et al*., 2007). As per the project guidelines, community contribution to the capital cost was kept at 5 per cent for tribal villages and 10 per cent for non-tribal villages; and communities were also required to bear 100% of the O&M costs. The rest of the capital cost was met by the project.

4.2 Types of infrastructure and techno-institutional models in rural water supply

As discussed in earlier section, around 94 per cent of total geographical area of Maharashtra is underlain by hard rock formations. Because of the basic characteristics of the rock formations, physiography and inter-annual variability in the rainfall, there are severe limits on the occurrence of groundwater (GoM, 1999). But traditionally, majority of the villages in the State depend on wells for meeting their drinking water needs.

Till the year 1985, most of the rural water supply schemes in Maharashtra were based on either dug wells or bore wells. During 1985 to 1997, there was increase in the number of piped water supply schemes which were based on surface water sources. During 1991 to 1998, some 17 single village schemes based on groundwater and 50 regional schemes mostly based on surface water sources were implemented under the various externally supported projects (Das, 2006). The shift in water supply technology from groundwater sources to surface water based sources during this period was mainly due to: i] growing over-exploitation and depletion of groundwater, which continued to threaten the physical sustainability of water supply sources; ii] the general perception that regional schemes bring economies of scale, and quality of water from surface sources is better; and iii] stringent water supply norms. These changes led to emergence of new kind of institutional set up where MJP played an all important role of constructing and handing over schemes to the concerned local authorities to operate and maintain them. However, regional water supply schemes became unpopular due to the problems enlisted in Section 2.1, in spite of the fact that these reservoir-dependent schemes were more sustainable than groundwater based schemes in rural areas in lieu of the fact that not much control could be exercised on groundwater withdrawal by farmers.

Among the many problems facing the regional water supply schemes, which are otherwise superior to groundwater-based singe village schemes, the lack of willingness on the part of local authorities to take over management is the most crucial one. This lack of willingness mainly stems from the fact that the local authority, which in this case is the Village Panchayat, lacks technical knowhow, finance, management (source: washinstitute.org), and governance capabilities to run the schemes, which are sophisticated socio-technical systems, at the local level. Particularly, the fund availability for O & M is a major issue.

As a recent evaluation of WASAN Sector in India pointed out, decentralization is also fraught with problems at the local level due to issues of 'accountability'. In the case of Maharashtra, MJP takes up execution of rural water supply scheme on requests from concerned Zilla Parishad/GPs and/or when the rural scheme cost is equivalent or above Rs. 50 lac. On completion of such schemes, MJP is expected to hand over the scheme to ZP (in case of multi-village scheme) and GP (in the case of small schemes) for operation and maintenance. In such case, it receives the funds directly from the WSSD (Gawade, 2012). Hence, they have no special incentive to make sure that the system so built runs reliably and efficiently. It is no surprise that the GP are typically reluctant to take up the operation and maintenance of the schemes.

As a result of these developments, village-level schemes (mostly based on groundwater) of water provision were again started to be looked upon as a better alternative. Along with this shift in the scale of organisation of water systems also came the shift from a supply-driven approach to a demand-driven approach (Sangameswaran, 2010). Under this new approach, efforts were made to empower local level institutions to demand water supply schemes from the governmental authorities. Further, Gram Sabha and VWSC were given the authority to decide on the kind of scheme, and also to implement, operate and maintain them. The official authority of the State government departments (including MJP, ZP) was considerably reduced. However, this demand driven approach largely remained only on paper. Without technical capacity to scrutinize the plan and design of the schemes, approve DPRs and supervise execution, and techno-managerial capabilities to run them, the local Panchayats and VWSCs were not able to exercise the powers vested with them.

This is evident from the fact that out of 13,515 completed schemes, only 1,951 schemes were handed over to GP. Most of the success in terms of community contribution to the capital cost of the water supply infrastructure came only in the schemes which were externally aided and had a huge financial allocation for the community mobilization. Further, inability of the VWSC to encourage users to pay water fee affected the overall financial recovery, which also adversely impacted on the overall performance of the schemes. Till March 2007, the dues outstanding in respect of execution and maintenance of rural piped water supply schemes from

ZP/GP amounted to about Rs 504 crore (Figure 8). Data presented in Figure 1 also makes it clear that the dues outstanding with respect to water charges are major (72 per cent) and those related to community (popular) contribution is only minor (only about 4 per cent). Moreover, as almost 80 per cent of the implemented schemes during the reform era tapped groundwater, ability of such sources to supply water in summer or during drought year was questionable.

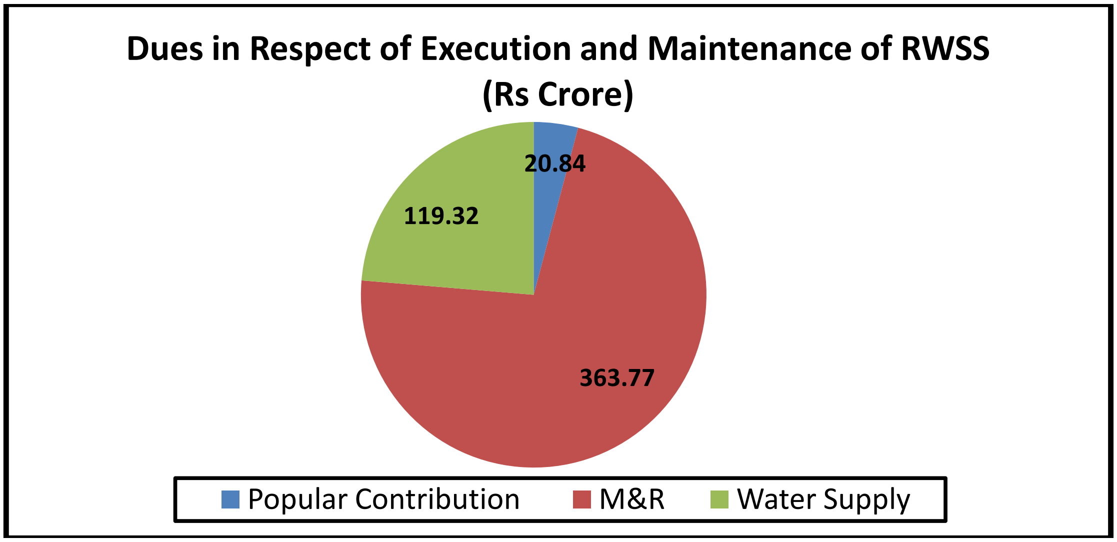


Figure 8: Amount due from ZP/GP in till March 2007
(Source: MJP Annual Report 2007-08)

4.3 Water supply and sanitation coverage in rural areas

Overall, performance of water supply sector in terms of 'coverage' is encouraging. Between 2001 and 2012, number of rural habitations which are fully covered with drinking water supply has increased from 67 per cent to 87.5 per cent. However, mere increase in coverage does not mean availability or easy access to the service. Still, only 43 per cent of the total households have access to water within the household premises (Figure 9). Reliability of water supply remains a big issue. As seen in many rural areas of western Maharashtra, water is supplied only for 1-2 hours per day and in many other areas especially in the Marathawada region, water is supplied only once in 3-4 days. Further, about 23.5 per cent of the rural population in covered habitations is provided with less than 40 lpcd of water.

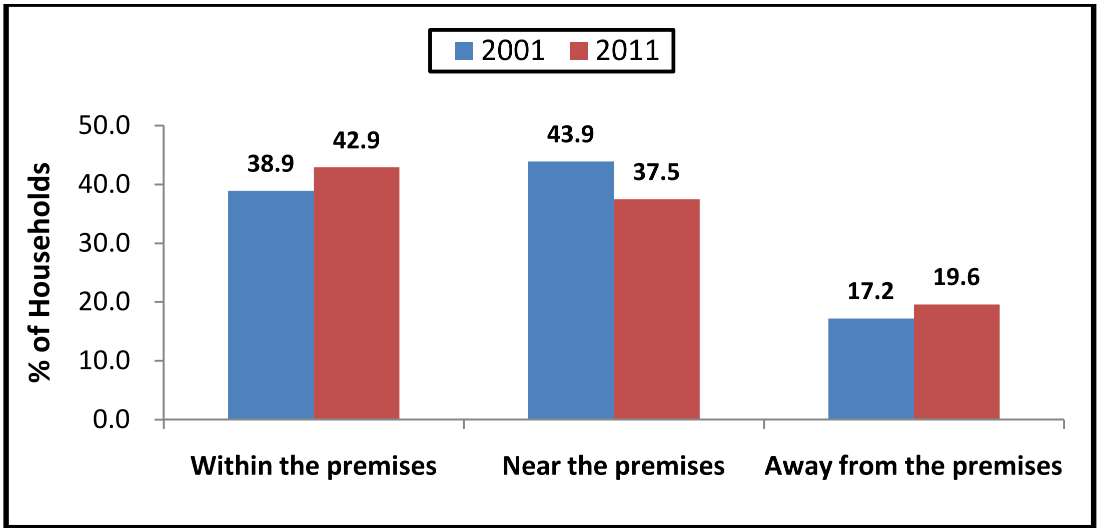


Figure 9: Location of drinking water source from the rural households
(Source: Census of India, 2011)

Even at present 47 per cent of the households continue to be dependent on groundwater based sources (Figure 10). As a result, source sustainability is emerging as major challenge in many regions. During 2012-13, about 1,595 rural habitations slipped back to 'no-source category' due to drying up of sources. At other places deteriorating groundwater quality itself is making source unusable as evident from slipping back of 161 habitations on account of poor water quality. Thus, there is a need to refocus on exploring surface water based schemes to meet the growing domestic and productive water demands of the village community.

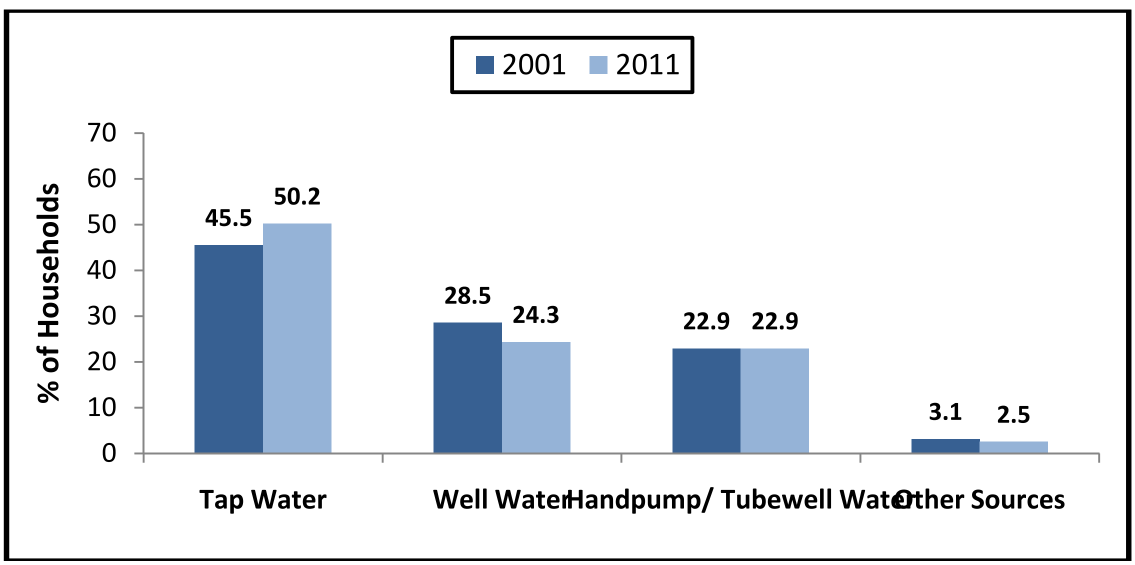


Figure 10: Main source of drinking water for the rural households
(Source: Census of India, 2011)

On sanitation front, the progress is far from desired. Between 2001 and 2011, number of rural households having any type of sanitation facilities increased from 18 per cent to 38 per cent (Figure 11). Still, almost 56 per cent of the households practice open defection. Various studies have shown that the constraints to adoption of latrines are not merely those which can be overcome by behavioral changes. But, the TSC in the State is still focusing on awareness and education. As a matter of fact, there is a general perception among experts in the sector that increased and effective IEC materials would lead to faster adoption and increased use of use of improved toilets. In an effort to achieve the targets (see TARU, 2009), little attention is being paid to such details as the actual investment being made by the household for building the infrastructure against the total subsidy received in certain cases, location of the toilet, and chances of use of the said infrastructure for purposes other than sanitation. This results in fund misuse and poor outcomes. In certain situations, the subsidy available for construction might be too small in comparison to what is required by the households to build a proper functional toilet, with the household not going for it, in spite of the subsidy. In certain other situations, the household may not have space in the dwelling premise for sufficient for constructing a toilet.

The progress in sanitation shows the failure in understanding the determinants and motivational factors behind household demand for sanitation and constraints to adoption including competing priorities of the households, with the result that TSC funds are poorly-targeted in terms of 'activities' and socio-economic segments. Clearly there is a need for revising the strategy.

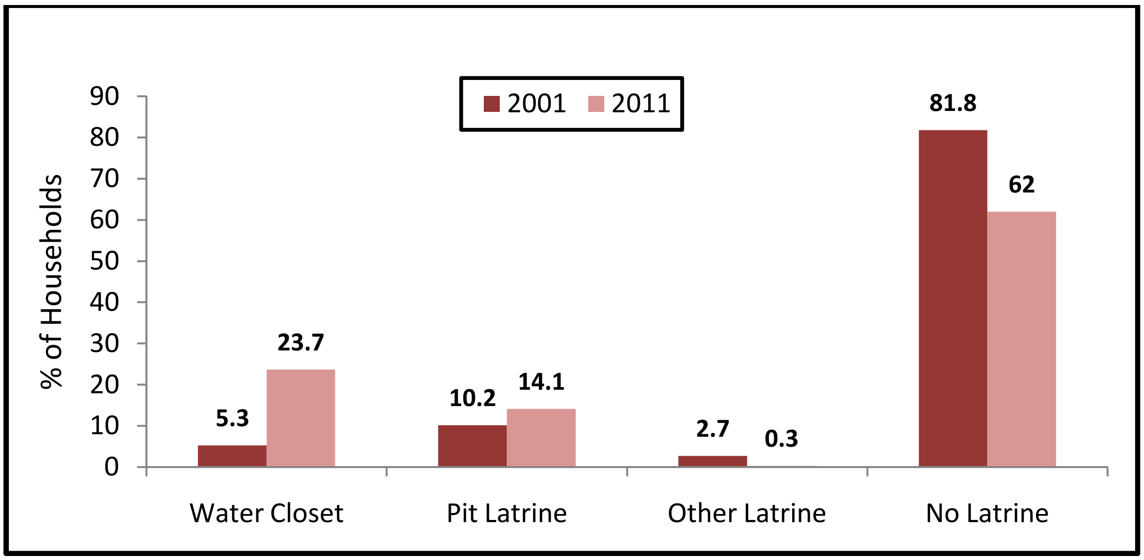


Figure 11: Availability and type of latrine facility with rural households
(Source: Census of India, 2011)

On institutional front, both GSDA and MJP have taken a lead role in providing technical knowhow in implementation of rural water supply schemes. However, a review of the functions of these agencies suggests some major changes in their composition and working (GoM, 2004). Important suggestion for GSDA included: i] structural changes and skill up-gradation (trainings that can further improve their hydro-geological skills and help them develop better understanding of the needs and expectations of the decision making bodies) required to contribute better under the new reform policy; ii] to develop user-friendly tools that can be of help to decision makers; iii] to explore funding opportunities for developing the planning tools; and iv] to operate as a service provider and compete for technical support services such as source identification, yield certification, execution of watershed development programmes. Major suggestions for MJP were: 1] to facilitate capacities building of local bodies and to encourage them to raise their own resources; 2] to work as a strategic business unit with its own business plan and targets; and 3] to act as a professional and independent technical service provider. It is still not clear how far such changes have been affected in the respective agencies but surely it will make their performance much better and result oriented. On other side, ability of local level institutions, such as GP and VWSC to manage the transferred schemes is uncertain. They seem to lack the technical knowhow required for proper operation and maintenance of the schemes (including clearance of plan, design and project supervisions). Further, as clear from the data presented in Figure 6, GP/VWSC role was mainly confined to mobilize community contribution towards the capital cost of the scheme.

4.4 Water supply-sanitation nexus in rural areas: emerging issues in Maharashtra

Frequency analysis involving data on status of the rural HHs vis-a-vis access to drinking water sources (such as within their premises, near the premises and away from the premises) and their status vis-à-vis adoption of improved toilets show higher incidence of adoption of improved toilets by those having access to tap water within the dwelling premises (Figure 12) . The regression analysis between percentage of households in each taluka with access to water supply within the dwelling premise and the percentage HHs having toilets show an R^2 value of 0.32. Such a relationship can occur because of two reasons. First: those having drinking water sources within the premises are more likely to be rich as compared to those having water sources, either near the premise or away from the premise, and that the economic status of the families does influence the adoption of improved toilets, as found in the analysis elsewhere. Second: those having improved access to water supply by virtue of water connection within the dwelling will be in a better position to use improved sanitation systems.

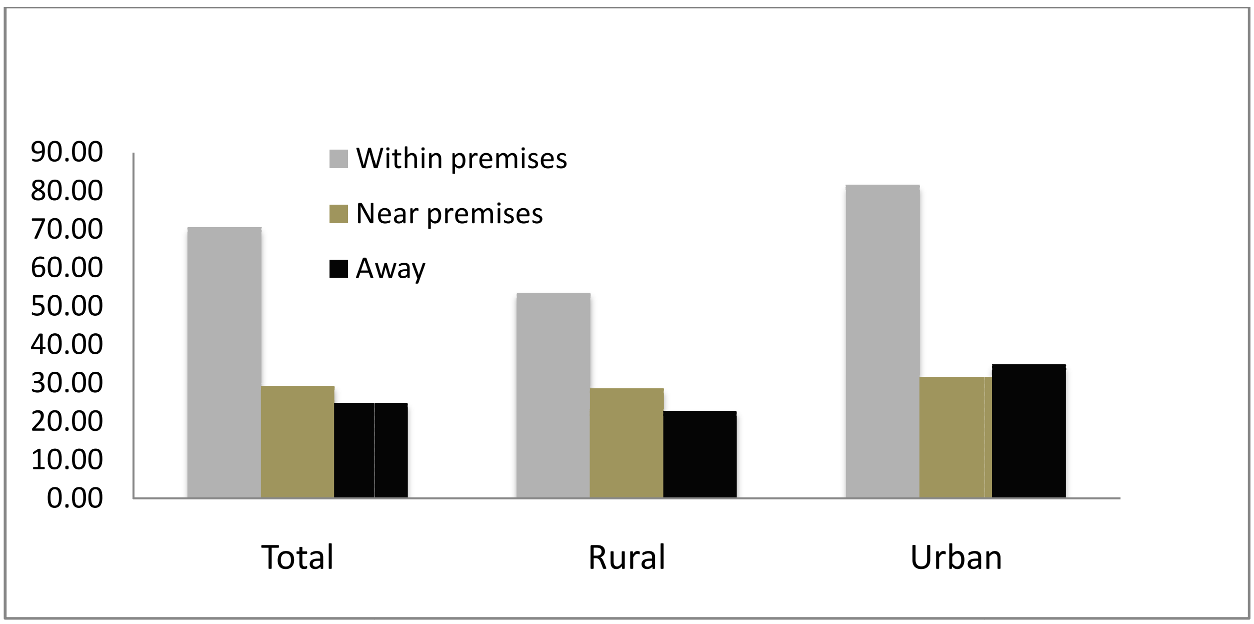


Figure 12: Proportion of HHs having latrines by access to drinking water source, Maharashtra

Regression analysis involving district-level data on percentage HHs with access to 'water sources within the dwelling premise' and the percentage of HHs with access to improved toilets show a strong correction. The districts with high percentage of HH having access to water sources within the dwelling premises had high percentage of HHs with improved toilets (Figure

13). Similar relationship emerged when regression was run with rate of adoption of toilets against: 1] average per capita income of HHs in the taluka ($R2= 0.51$); 2] average literacy rate of the HHs in the taluka ($R2= 0.629$); and 3] percentage of HHs having assets within the households in each taluka (0.624). While it is now established that literacy rate and economic conditions of the family could influence the adoption of improved sanitation systems in rural situations, the strong correlation between adoption of toilets and access to drinking water sources required further investigation.

This was done by doing a regression between average district level per capita income and: 1] percentage HHs with access to water sources within the dwelling; and, 2] percent HHs having good assets in the households. The regression analysis showed a strong linear relationship between per capita income and access to drinking water sources, and asset holding and access to drinking water sources. This seems to suggest that the relationship between drinking water access and adoption of individual HH toilet is due to auto correlation.

Nevertheless, the access to tap water supply seems to have a great bearing on the sanitation practices followed by the households. A very recent survey carried out in Andhra Pradesh showed that the extent of use of individual household latrines is higher among those who have access to tap water within the dwelling premises connection when compared to those who depend on distant sources such as wells and hand pumps. When the water supply source is away from the dwelling, a much smaller percentage of the households who actually own toilets use them. This can be explained by the difficulty the members of the household, particularly children, will have in obtaining water from the distant public sources, for flushing toilets, which can be around 10-15 litre per use.

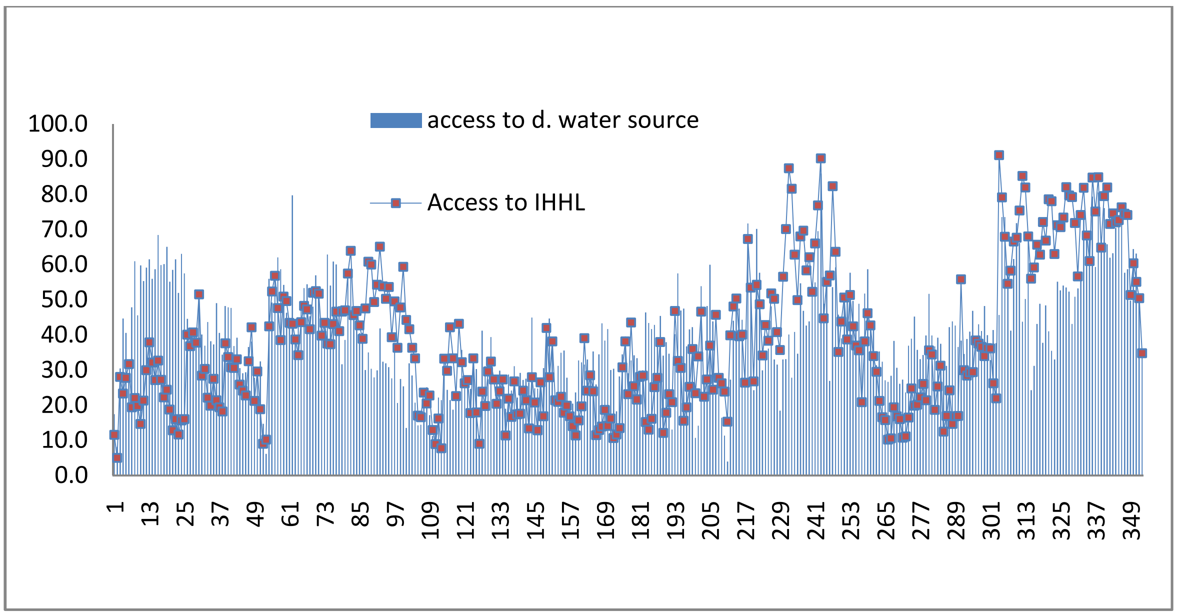


Figure 13: Access to drinking water within the premise and toilets for rural HHs, Maharashtra

5. Institutional and Policy Framework Relating to Rural Water Supply and Sanitation

5.1 Institutional framework for managing rural water supplies

5.1.1 Agencies and organizational structures

Water Supply and Sanitation Department (WSSD), GoM is the State nodal agency for formulating, implementing, operating and maintaining regional water supply schemes in both rural and urban areas (Figure 14). The GSDA, the MJP and WSSO are the three line agencies supporting the Water Supply and Sanitation Department.

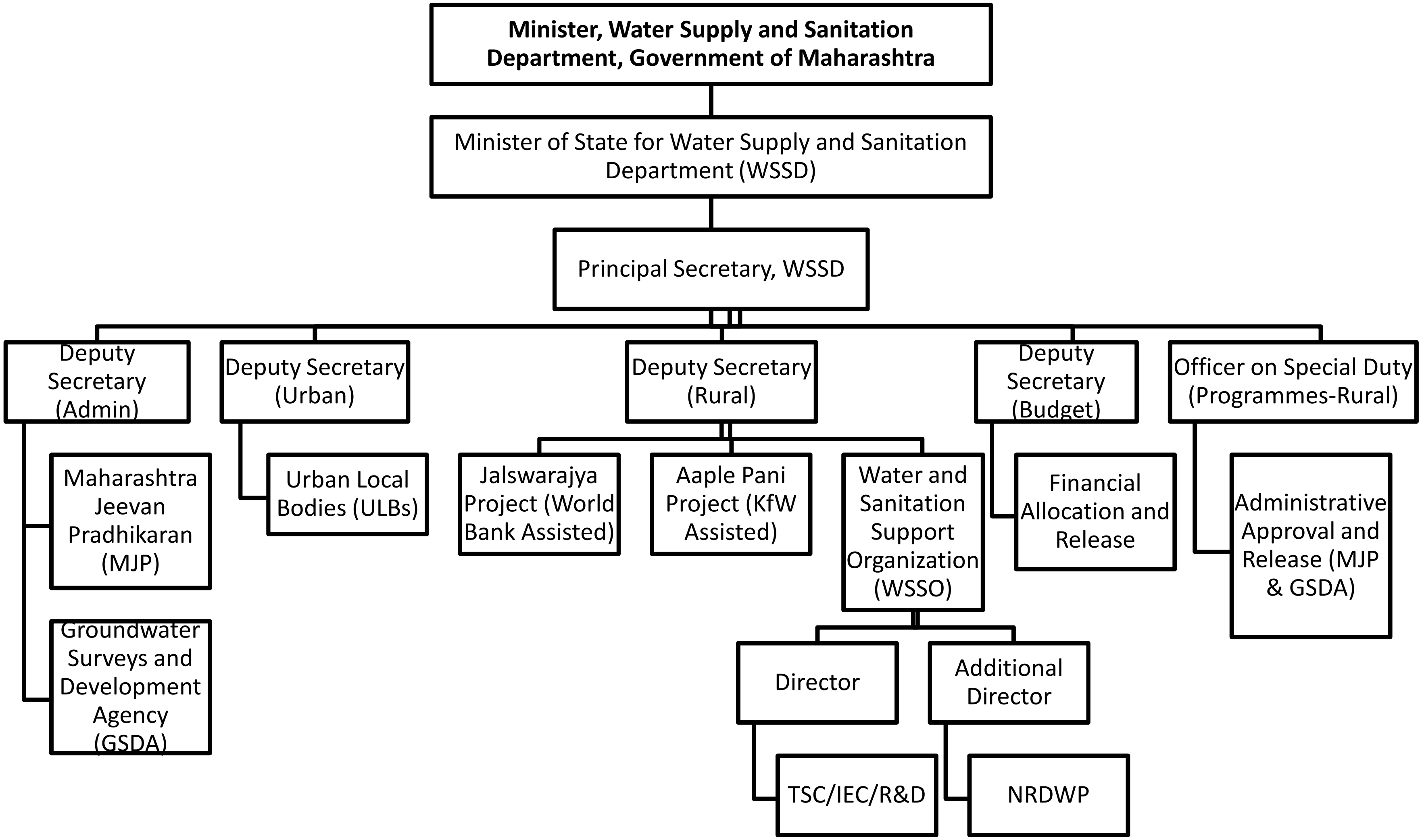


Figure 14: Organogram of Water Resources Department, Government of Maharashtra
(Source: Information provided by MJP Office, Mumbai)

The GSDA is a technical agency (mostly geologists), and entrusted with the responsibility of overall development and management of ground water. Its Directorate is located in Pune, which is assisted by six regional and 33 district level offices. The organogram for GSDA is provided in Figure 15.

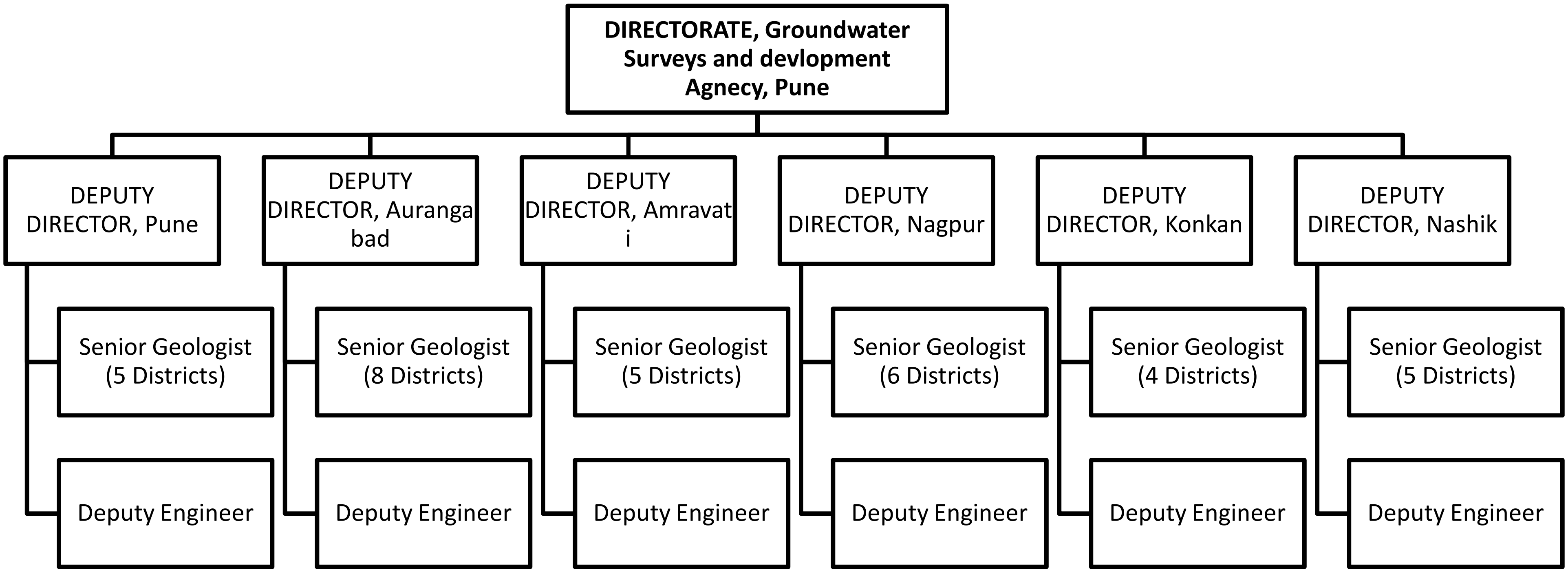


Figure 15:Organogram of Groundwater Surveys and Development Agency, Government of Maharashtra
(Source: As per the information available on GSDA webpage)

As per the Maharashtra Government Resolution of 30th June 2003,there are a total of 1365 sanctioned posts in GSDA, including 892 technical and 473 non-technical posts. In addition, there are 869 posts which had been transferred to ZP but are under the administrative control of GSDA. However, at present, it has an overall strength of only 1526 (1005 with GSDA and 521 on deputation to ZP) professional and support staff in various disciplines including hydro-geology (with remote sensing & GIS specialization), chemistry, cartography, and field expertise (Figure 16). GSDA also has a separate engineering and geophysical wing with expertise in groundwater development, management, protection and artificial recharge techniques. For last 40 years, GSDA is engaged in the exploration, development and augmentation of groundwater resources in the State through various schemes. This mainly includes, drilling of bore wells/tube wells under Rural Water Supply Programme, rendering technical guidance under minor irrigation programme by locating suitable dug well sites, strengthening of groundwater sources by water conservation measures, artificial recharge projects, specific studies related to the periodic status of groundwater availability, and protecting the existing groundwater resources through technical assistance under Groundwater Act.

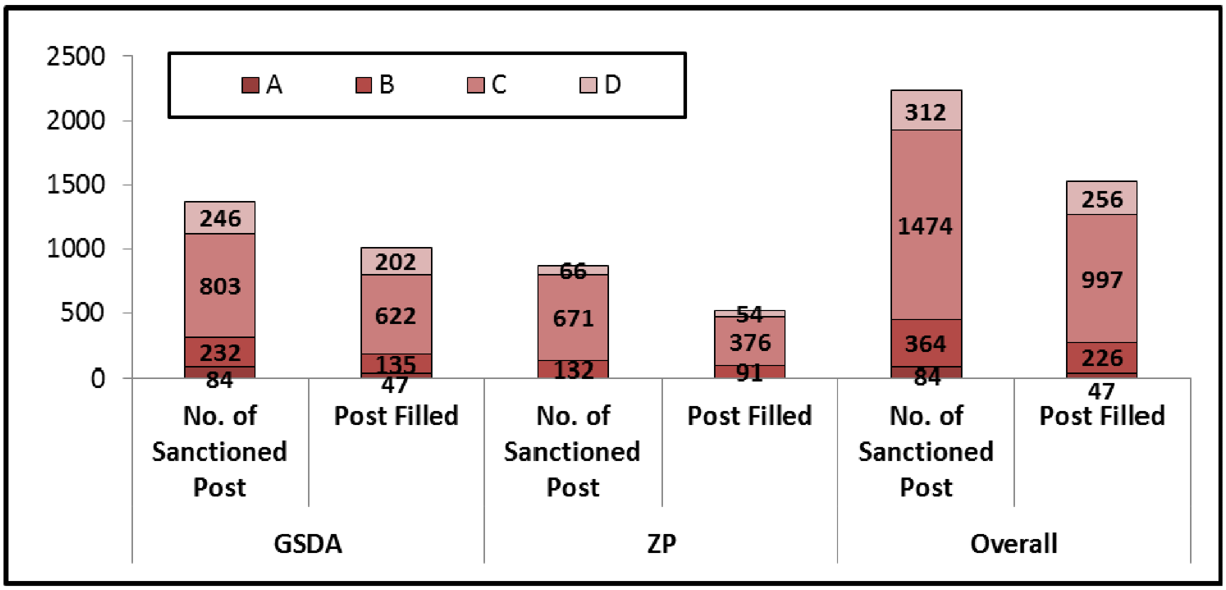


Figure 16: Sanctioned post vs. position filled under various staff categories, GSDA

[Note: Details of the staff category is provided below:

Staff Category	GSDA	Zilla Panchayat (ZP)
A	Senior Management, Senior Geologists, Senior Chemist, Senior Administration officials	Deputy Engineer, Assistant and Junior Geologists
B	Deputy Engineer, Assistant and Junior Geologists, Assistant Chemist, Analyst, Planning officer, Assistant Administrative	Junior Engineer, Rigman, Driller, Compressor Operator, Clerks, Drivers
C	Junior Geophysicist, Junior Chemist, Assistants and Clerks	Assistants and Peons
D	Peons, Helpers, Watchmen	Peons, Helpers

(Source: World Bank, 2012)

The MJP mainly consists of engineers and implements the piped water supply schemes. The MJP with central office in Mumbai and Navi Mumbai has field offices spread across the entire State. Overall, there are five Zonal offices, 16 circle offices, 44 work/project divisions and 151 sub-divisions. The complete organogram of MJP is provided in Figure 17a.

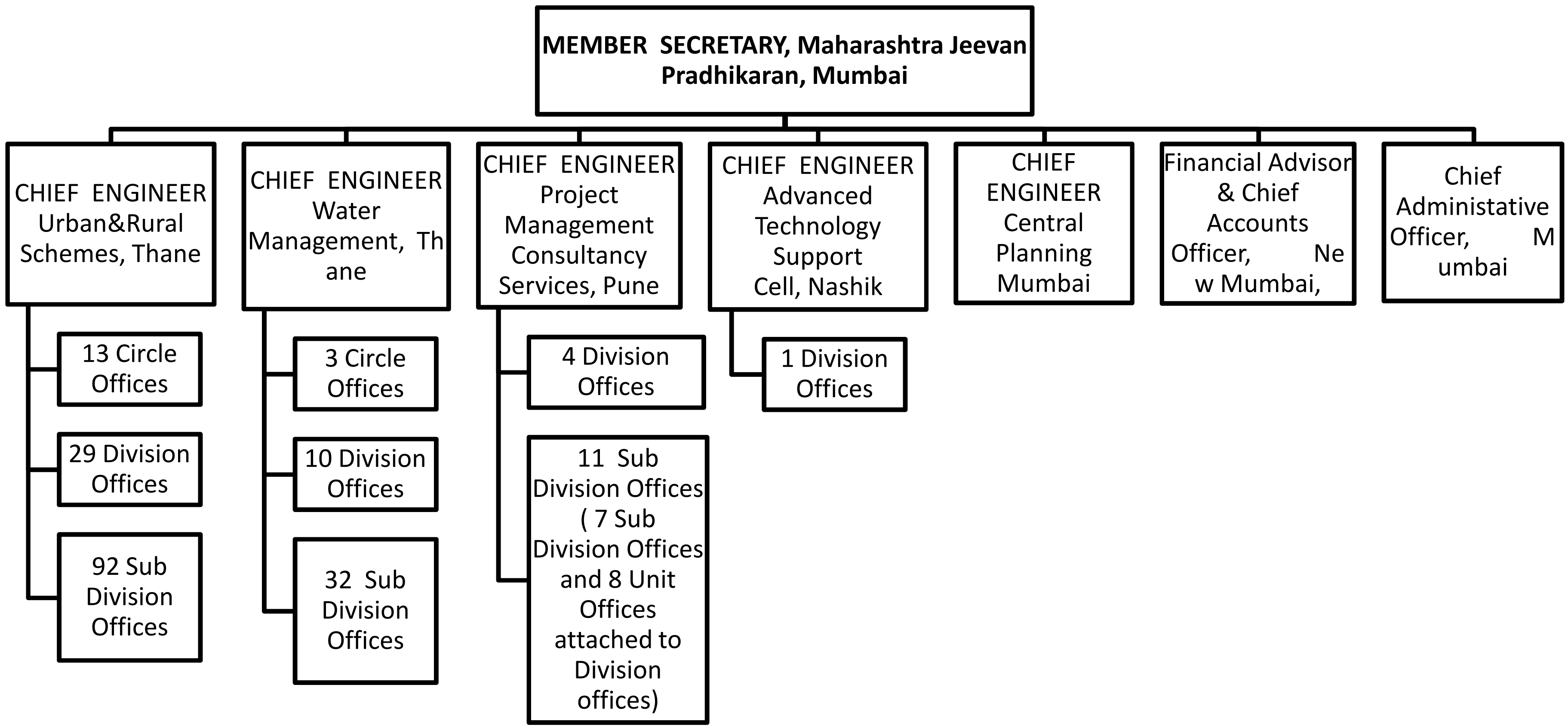


Figure 17a: Organogram of Maharashtra Jeevan Pradhikaran, Government of Maharashtra
(Source: Information provided by MJP office, Mumbai)

The Member Secretary, who is the Chief Executive Officer of the MJP, has the status of Secretary to Government. There is also a Member Secretary (Technical), to exercise technical control over field works, and to whom the Superintending Engineers for coordination, central planning, designing and monitoring report. There are also other subordinate officers and staff. Overall staff strength of MJP is 7186, with 1575 (21.9 per cent) technical, 2947 (41 per cent) non-technical and 2664 (37.1 per cent) contract based positions (Figure 18). The primary responsibility of MJP is planning, design, investigation, detailed engineering and execution of water supply and sewerage schemes in the State. Additionally, MJP arrange finances for these schemes. On the successful completion of these projects, MJP hands them over to the respective local bodies. To settle the administrative expenses, MJP receives a fixed amount on total project costs which has been currently fixed by GoM at 17.5 per cent of the value of projects.

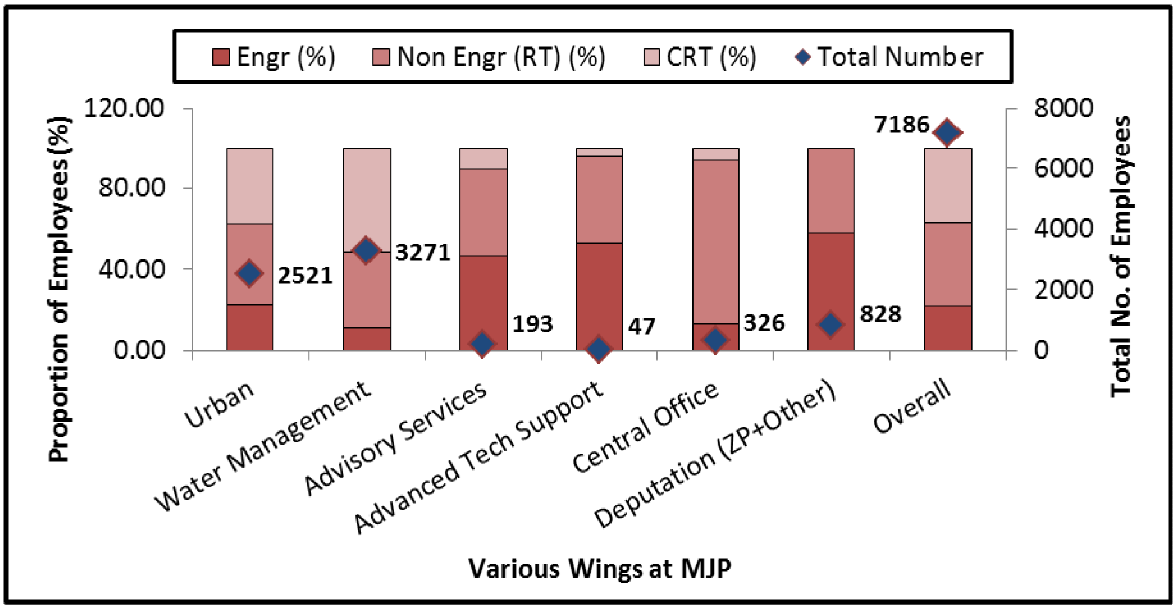
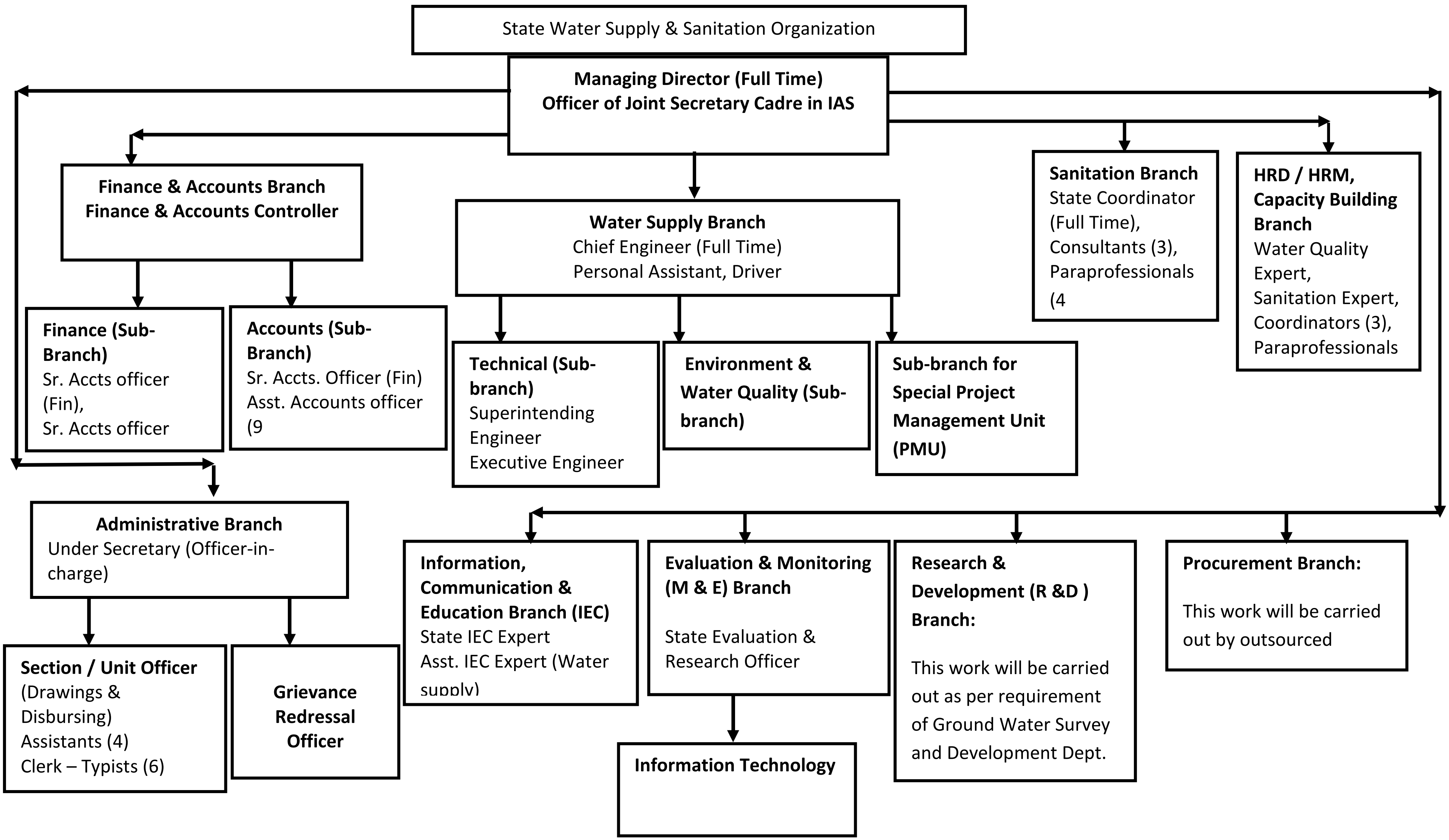


Figure 18: Employee proportion in the various wings at MJP
(Source: Information provided by MJP office, Mumbai)

As per the changes brought about by the Government Resolution (GR) of June 2003, some of the functions and functionaries of the GSDA and MJP were transferred to Zilla Parishads (ZP). The Water Supply Department of Zilla Parishads mainly comprises these transferred functionaries and is responsible for implementing water supply and sanitation reform programmes. A Reform Support and Project Management Unit (RSPMU) was also set up in order to facilitate the RWSS reforms process. The RSPMU operates at the State and the district level. Detailed functions of organizational units for water supply and sanitation in rural areas of State is given in Table 6.

Figure 17b: Organogram of Water Supply and Sanitation Organization



In order to implement State level rural water supply programme and national rural water supply programme in the State of Maharashtra successfully as per guidelines of the Central Government and to implement and monitor rural water supply programmes in general, the Government has decided to establish State level Water Supply and Sanitation Organization.The main objective of this organization is planning, implementation and monitoring of rural water supply and sanitation projects and programmes sponsored by Central and State Government and also financed by external agencies.

The main responsibilities of this organization are to prepare annual action plan; providing technical and administrative assistance to local organizations in planning and implementation of schemes; developing Information, Communication and Education (IEC) and also developing Management Information System (MIS) for monitoring of rural water supply and sanitation programmes. The WSSO will be responsible for implementing the policy guidelines of rural water supply and sanitation Programmes and State Water Supply Mission. It will act as Directorate for water supply and sanitation department, in all respects. The organization was formed only in 2009 and is still evolving.

Table 6: Functions of organizational Units

Institutions at Various Levels	Area of Functioning
Water Supply and Sanitation Department	State-level institution. Formulates and implements policies, operates and maintains regional water supply schemes in both rural and urban areas
MJP	Most important government body for urban water supply. Also implements rural water supply schemes. Formulates and executes schemes and determines tariff structures, though its objectives do not encompass financial sustenance.
GSDA	Responsible for overall development and management of groundwater resources. Implements schemes based on groundwater resources mostly in rural arrears.
WSSO	Responsible for implementing the policy guidelines of Rural Water Supply and Sanitation Programmes and State Water Supply Mission
MIDC (Maharashtra Industrial Development Corporation)	Though not a regular agency for domestic water supply, it does supply water to a few towns
PHD (Public Health Department)	The State level division of the department executes water supply and sanitation works
ZP (Rural Drinking Water Department)	Mainly provide technical service and approve funds to villages served by rural water supply schemes.
RSMU	Set up in the rural drinking water department of ZP to facilitate the RWSS reforms process.
Gram Panchayat (GP) and Gram *Sabha*	GP is responsible for demanding new drinking water supply schemes from the ZP. Gram Sabha is empowered to decide on the kind of scheme, the implementing body, as well as about the technical service provider.
Village Water and Sanitation Committee (VWSC)	Sub-committees of the GP. VWSC have funds directly allotted to them; maintain accounts separately (from the

	general accounts of the GP). They plan, implement, operate and maintain the village water supply scheme autonomously.
Capacity Building Consortiums (CBC)	Mainly involved in community mobilization at village level.

(Source: Adapted from Pangare et al., 2004 and authors' own review)

5.1.2 Supply and cost norms for rural water supply and sanitation schemes

As per the Government of Maharashtra Resolution dated 27 July 2000, delivery of 40 litre per capita per day (lpcd) was established as a water supply norm for the rural areas. From within this, 3 litre is to be provided for drinking purpose, 5 litre for cooking, 15 litre for bathing, 7 litre for washing utensils and house, and 10 litre for ablution. Villages or habitations with no source within 1.6 km in plain area and 100 m elevation in hilly area were selected to be covered by the RWSP.

The 12th Finance Plan approach suggests enhancement in per capita supply from 40 lpcd to 55 lpcd for rural areas. However, GoM continue with the supply of 40 lpcd citing constrained ground water resources in increasing the per capita supply levels. The Water Quality Standards as per IS:10500 are followed.

Regarding the cost norms for implementing piped water supply schemes across the State, GoM has recommended standards in 1999 (Table 7). Since then, these norms have not been revised and no provision for inflation was kept that could be accounted while planning the new schemes (World Bank, 2012).

Table 7: Cost norms for implementing piped water supply schemes in Maharashtra

Type of Scheme	**Cost Norms in INR Per Capita**	
	Non-Konkan Area	Konkan Area
Hilly Areas	2,120	2,320
PWS with static lift of more than 30m	1,790	1,970
PWS with static lift upto 30m	1,390	1,530

(Source: World Bank, 2012)

These cost norms are for the new piped water supply schemes but they are also used for augmentation of the existing scheme, if the cost is lower than the new scheme. In case of schemes where the per capita cost is above than the standard norms, separate approval at the State level is required. Field experiences suggest that the present cost norms are insufficient to cover the current capital cost of the schemes and need to be revised (World Bank, 2012). To avoid approvals at the State level and delays in implementation, the current practice is to limit the scheme components in way that the total cost remains below or at par with the prescribed standard norms. This approach has two implications: First, the new or augmented schemes may not be able to cover the entire population of the habitation under consideration. Second: sustainability (i.e. drinking water security at the household level) may not be ensured (World Bank, 2012). It is important to mention here that NRDWP has kept around 20 per cent of the total allocation towards its sustainability component but does not suggest any cost norm. Further, 100 per cent of these funds will be provided by the Central government. Thus, it is high time now that the State should revise the present cost norms to better serve the uncovered or partially covered; quality affected; and slipped back habitations.

5.1.3 Administrative procedures

Once a rural water supply schemes are planned, they are taken up for implementation with administrative approval and technical sanction of the designated authorities (Table 8). For a single village piped scheme up to 50 Million, GP have been given responsibility for execution with the technical support from ZP and MJP. Whereas for the single village schemes costing above INR 50 Million, MJP is in charge of execution and role of GP is confined to operation and maintenance.

For multi-village schemes costing up to INR 25 million, ZP is responsible for the entire execution and role of GP is confined to O&M and that too under the technical supervision of ZP. For the multi-village schemes above 25 million, responsibility of execution shifts to MJP. Here again role of GP is restricted to O&M of the system. Thus, it is quite clear that the role of GP/VWSC is mainly restricted to O&M of the schemes. For the project with high cost, even the O&M function is performed under the technical supervision of ZP or MJP.

Table 8: Administrative procedure for implementation of the planned rural water supply schemes

	Single Village Piped Scheme				**Regional Piped Scheme**			
	Project Cost (in Million)				**Project Cost (in Million)**			
	Up to INR 5	INR 5 to 25	INR 25 to 50	Above INR 50	Up to INR 5	INR 5 to 25	INR 25 to 30	Above INR 30
Administrative Approval	*Gram Sabha*	ZP	ZP	GoM	ZP	ZP	ZP	GoM
Technical Sanction	Executive Engineer, ZP	Regional SE (NRDWP)	CE (WSSSO/ NRDWP)	Member Secretary (MJP)	Executive Engineer, ZP	Regional SE (NRDWP)	CE (WSSSO/ NRDWP)	Member Secretary (MJP)
Execution	GP (VWSC)	GP (VWSC)	GP (VWSC)	GP (VWSC) Thru MJP	ZP	ZP	MJP	MJP
Monitoring	ZP	SE (MJP)	CE (MJP)	Member Secretary (MJP	ZP	SE (MJP)	CE (MJP)	Member Secretary (MJP
O&M	GP (VWSC)	GP (VWSC)	GP (VWSC)	GP (VWSC)	GP (VWSC) with technical support from ZP			Federated VWSCs with technical support from MJP

(Source: GoM GR dated 30 August 2010 and GoM dated 4 June 2011)

5.2 Legal and policy framework relating to rural water supply

GoM established the Ground Water Survey and Development Agency (GSDA) in 1972 to scientifically tap the groundwater resources in the State. Soon after, the Maharashtra Water Supply and Sewerage Board Act (MWSSB Act) was passed in 1976. Under the Act, Maharashtra Water Supply and Sewerage Board (MWSSB) was set up in 1977 to take over the functions and assets of the Public Health Engineering (PHE) department of GoM.

Due to groundwater over-exploitation and resulting water scarcity in many areas during 1990's, a large number of settlements in Maharashtra had to depend on tankers to meet their drinking water requirements and more so during the summer months. In order to manage the exploitation of groundwater for the protection of public drinking water sources, the Maharashtra Groundwater (Regulation for Drinking Water Purposes) Act, was passed in 1993. The Act prohibited the construction of wells within a radius of 500m from a public drinking water source, if both are in the area of the same watershed. Further, the Act empowered the appropriate authority (district collector in this case) to restrict or prohibit extraction of water (for any purpose other than for drinking) from any well in a identified 'water scarce' area (as advised by GSDA) during the scarcity period, if such well is within a distance of one kilometer of the public drinking water source (GoM, 1993). However, as noted by Phansalkar and Kher (2006) the Act was not preventive in nature, but only corrective. For instance, the provisions of the Act were only enforceable either in watersheds declared as 'overexploited' or if a specific locality was notified as scarcity affected in a particular year. There were no provisions for registration of wells or for making applications mandatory for sinking new wells. It does not even provide for compulsory licensing of drilling companies or agencies.

The White Paper on the State's water situation equated the reality of drinking water scarcity to inadequate infrastructure development and to the excessive dependence on unreliable sources. Further it identified the need for massive capital investments for developing the required infrastructure for fulfilling the drinking water requirements of the state. As a result, the then State government amended the MWSSB Act and established the Maharashtra *Jeevan Pradhikaran* (MJP), a statutory body constituted from erstwhile MWSSB in 1997, giving the State the authority to raise capital from the open market. With the help of the MJP and the GSDA, the Government of Maharashtra embarked on a mission to provide sustainable water supplies for both urban and rural areas. In 2003, Maharashtra became one of the few States in India to adopt a State Water Policy. It laid emphasis on management, operation and maintenance of these services by community level organizations and appropriate local level bodies (GoM, 2003).

Of late, GoM has passed the Maharashtra Groundwater (Management and Development) Act 2009, which replaced the earlier groundwater Act of 1993. This new Act is more holistic and aims at "facilitating and ensuring sustainable equitable and adequate supply of groundwater of prescribed quality, for various category of users, through supply and demand management measures, protecting public drinking water sources and establishing the State Groundwater and District Level Authority to manage and to regulate, with community participation, the exploitation of ground water within the State of Maharashtra". As per the section 3(1) of the Act, the Maharashtra Water Resources Regulatory Authority (established under section 3 of the Maharashtra Water Resources Regulatory Authority Act, 2005) shall be the State Groundwater Authority. GSDA has also been provided with more footholds under the Act.

In contrast to the Groundwater Act of 1993 which empowered the District Collector (in consultation with technical officer) to notify the area as 'over-exploited' or 'water scarce' (and that too in an ad hoc manner), the new groundwater Act empowers the State groundwater authority to notify an area but only on the basis of: recommendations from the GSDA; views of various institutions working in the groundwater field; and views of the users of the groundwater of the area. The decision to notify an area has to be based on scientific studies on groundwater balance and quality; and groundwater estimation. The Act calls for establishment of a Watershed Water Resources Committee (WWRC) to promote and regulate the development and management of groundwater in the notified area. The Act envisaged several restrictions such as, ban on the construction of wells; prohibition on groundwater pumping from the existing deep-wells (more than sixty metre deep); stipulation on deep-wells users to follow the groundwater use plan and crop plan. All these measures are now in operation in notified areas. Unlike the earlier Act which was silent on groundwater quality, the new Act put emphasis on the protection and preservation of groundwater quality of all the existing drinking water sources in the State.

Further, in both notified and un-notified areas, registration of all the well owners is made mandatory (section 7 of the Act); and drilling of deep wells for agriculture and industrial use is prohibited (section 8.1 of the Act). Additionally, section 12 of the Act made it compulsory for the registration of drilling rig owners and operators in the State. The Act also empowered the State authority to identify the potential areas for recharge (for artificial groundwater recharge schemes), in consultation with the GSDA and the CGWB. The Groundwater Act, 2003 also empowers the District Authority (officer not below the rank of *Tahsildar*) to enforce the decisions of WWRC. Whenever necessary, The District Authority or any officer duly authorized by it, after giving prior notice to the owner or occupier of any land, may initiate an inquiry or implement or enforce any decisions in connection with the protection of a public drinking water source or with the maintenance of a public water supply system. The District Authority can seize any equipment or device utilised for illegal sinking or construction and can demolish the executed work either fully or partly. Further, the District Authority can also direct any groundwater user who does not comply with the provisions of this Act and rules framed there under to close down the extraction of groundwater, and can temporary disconnect its power supply and seal any hydraulic work which is found to be illegal. Though, the Maharashtra Groundwater (Management and Development) Act 2009 is a major improvement over the earlier Act, its' effectiveness in arresting groundwater exploitation can only be judged once it is implemented across the State.

5.3 Government resolutions relating to rural water supply

Between 2000 and 2004, WSSD passed seven GRs to operationalize the RWSS reform policy across the State (GoM, n. d.). The first GR, dated 27 July 2000, relates to implementation of the rural water supply programme (RWSP) as per the central government revised guidelines for ARWSP. As per the GR, delivery of 40 lpcd was established as a water supply norm. From within this, 3 litre is to be provided for drinking purpose, 5 litre for cooking, 15 litre for bathing, 7 litre for washing utensils and house, and 10 litre for ablution. Villages or habitations with no source within 1.6 km in plain area and 100 m elevation in hilly area were selected to be covered by the RWSP. Further, priority was given to the villages/habitations with large SC/ST population; those affected by quality problems (excess salinity, iron, fluoride, arsenic or other toxic elements or bacteriological contaminated sources); schools and Anganwadis; and habitations where the quantum of availability of safe water from any source is less than the adopted norm. However, these supply norms were simply based on the principal of meeting basic minimum need of drinking water for the rural population, and not based on the concept of water security for the community. An action research study on developing multiple-use water system models in Maharashtra by IRAP, GSDA and UNICEF (2011) has shown that the poor rural households, which are not dependent on agriculture and allied activities for their livelihood, have many productive water needs at the household level. Such households may need water for kitchen garden, homesteads, livestock keeping, or running small scale industries. When water becomes scarce, these poor communities often compromise on their personal hygiene in an effort to find water for productive needs. Thus, there is a need to revise the conventional supply norm, taking into cognizance, various domestic and productive needs of the village community.

Other important aspects of this GR are that it included: a) focus on community participation and involvement of women in RWSP; b) keeping aside 15% of the fund under Minimum Needs Programme (MNP) and ARWSP for the district O&M fund; c) undertaking sub-mission projects in the habitations which are affected by water quality and having a source sustainability problem; d) setting up of water quality monitoring and surveillance; and e) conducting human resources development especially at grass root level. One another ambitious feature was to cover all the schools with safe drinking water by the end of 9^{th} five-year plan with 50per cent share from central government.

The second GR, dated 16 September 2001, related to implementation of sanitation reforms, namely Sant Gadge Baba Village Sanitation Campaign and Rashtra Sant Tukdoji Maharsja Clean Village Competition. The third GR, dated September 3 2001, was on implementing revised rural water supply programme with focus on community participation and guidelines for programme implementation. The main feature of this GR was that the demand for RWSS scheme should be made by Gram Panchayat to the ZP, through a resolution passed in the GS. Further, for the new scheme costing up to Rs 75 lakh, ZP was empowered to accord administrative approval and technical sanction as per the prevailing powers. The technical supervision of the work is to be done by VWSC and ZP/MJP.

The fourth GR, dated 14 February 2002, was on implementation of scheme (Shivkalin Pani Sathvan Yojana) for augmenting the supply of water for drinking and domestic use and strengthening of drinking water sources by utilizing rain water. Under the GR, the measure to collect rainwater for drinking and other purposes by roof top rain water harvesting on all public and government buildings and private house, and various recharge structures was adopted. Programme was to be taken up in 100 villages/habitations of each district from government and other public funds. Under the scheme, priority was given to tanker fed/scarcity villages during last three years. However till date, in only 32 rural habitations, which is only 0.03 per cent of the total covered habitations in the State, rainwater harvesting based schemes were implemented (Source: National Rural Drinking Water Programme database). The major reason for the failure of this programme is the hydro-geological profile of the State that makes water conservations and recharge difficult. More than 90 per cent of the area is under hard rock which is nonporous and unsuitable for recharge (Das, 2006). Further, high rainfall areas have steep terrain along with non-porous formation, which makes recharge schemes ineffective.

The fifth GR, dated 19 October 2002, was on formation of social audit committee in accordance with the revised policy of water supply and sanitation. Under the revised policy, VWSC was entrusted with the powers to appoint the contractors, purchase materials, appoint auditors, supervise the work, collect project cost (10 per cent community share), handle the fund allotted by the State government, and 100 per cent O&M of the scheme. The sixth GR, dated 30 June 2003, entrusted the responsibility of source certification for RWSS schemes to other State government empanelled competent agencies along with the GSDA. Some staff of GSDA was also transferred to the ZPs for implementation of new demand-driven policy. The seventh GR, dated 28 April 2004, also related to availing services of private service providers for finalization sources under the World Bank financed Jalswarajya Project and the KfW (German Government) supported *Aaple Pani* Project.

From 2008 onwards, around 20 different GRs mostly relating to the administrative, financial and managerial aspects of rural water supply and sanitation have been passed by the Government of Maharashtra. A brief description of these GRs has been provided in the Table 9.

Table 9:Various GRs, on water supply and sanitation, issued by Government of Maharashtra from 2008 onwards

GR	Brief Description
GoM GR dated 20 May 2008	O&M Incentive fund was kept for GPs to encourage O&M cost recovery at the GP level. 10% of the funds available under ARWWSP or NRDWP and 15% of the State budget for Water supply are used for this fund.
GoM GR dated 10 June 2008	As per this GR, Primary Health Centre (PHC) issues the RED/GREEN/YELLOW card to GPs based on participatory sanitary surveys conducted twice in a year along with Sarpanches/Gramsevaks of respective GPs. RED Card is issued to GPs if: water disinfection is irregular; insanitary conditions exists around the drinking water sources; water leakages through valves and pipes are common; there is inadequate stock or non-availability of bleaching powder of standard quality; and there are incidences of water borne epidemics. YELLOW Card is issued to those GPs where threat of contamination of safe water sources exists due to insanitary conditions around the water sources.
GoM GR dated 19 July 2008 and GR dated 17 March 2010	These GRs encourage 100% house connections in all piped water supply schemes.
GoM GR 15 June 2009	Jeevan Sanjivani Yojana was launched through this GR. This is an incentive scheme launched by the GoM in 2009 for reviving those water supply schemes which are defunct on account of non-payment of electricity bills. Under this scheme, interest on the outstanding electricity bill amount is waived off partly by WSSD (25% from O&M Grants) and partly (75%) by electricity board. Under this scheme, GP/ZP/MJP are eligible to receive benefits provided they pay 50% of the outstanding electricity bills to qualify to participate in the scheme. The scheme's extension ended on 31 March 2012.
GoM GR 17 August 2009	Guidelines for allocating O&M Incentive fund were revised. One of the significant decisions was to provide 50% subsidy on electricity bill of functional RRWS and individual schemes to encourage continued operations of schemes.
GoM GR 11 January 2010	Mini Water Supply Schemes using dual pumps was launched through this GR. This is a special programme of the State primarily targeted to provide piped water supply to those habitations which are currently served from high yield spot sources such as hand pumps or open wells having minimum yield of 2800 litres per hour. The programme also covers those habitations which are partially covered by piped distribution network. The programme will enable use of hand pumps in absence of electric supply to run the power pump. The schemes are implemented in the State by Zilla Parishads and within the specified cost ceiling of Rs. 2.50lac per scheme. There is no community contribution expected in the scheme but it should be maintained by GP. Funds for the programme are provided from

	NRDWP (Sustainability) and routed through GSDA to Zilla Parishads. So far, 2503 dual pumps have been installed and made operational in the State.
GoM GR dated 17 March 2010	The 12th Finance Plan approach suggests enhancement in per capita supply from 40 lpcd to 55 lpcd. However, through this GR, the state continued with the supply of 40 lpcd owing to constrained ground water resources.
GoM GR dated 17 March 2010	Priority for planning source strengthening measures (under Shivkalin Yojana) along with other improvements was placed while planning a water supply scheme.
GoM GR dated 30 August 2010	This GR describes the implementation arrangements depending on the nature and scale of the planned water supply schemes.
GoM GR 31 January 2011	NRDWP does not envisage any community contributions. But through this GR, the State has fixed community contributions of 5% of the cost of the proposed water supply improvements for SC/ST dominated habitations and 10% for general category populated habitations are envisaged in the programme. The contribution is a combination of cash and kind and to be given in two instalments. The contributions also apply to those villages where source strengthening measures are planned along with a new water supply scheme (under coverage component of NRDWP).
GoM GR dated 4 March 2011	Total of 4000 positions for 33 ZPs have been sanctioned through this GR. Out of these, 1673 posts (41%) are for technical staff.
GoM GR dated 25 March 2011	2645 of 4000 sanctioned positions for ZPs are to be supported by WSSD.
GoM GR dated 30 March 2011	The Water Quality Monitoring and & Surveillance programme was formulated. It has three components: a) Water Quality Testing and Monitoring; b) Water Quality Surveillance; and c) Information Management System.
GoM GR dated 27 May 2011	Nirmal Gram GPs were given priority while planning for water supply schemes.
GoM GR dated 4 June 2011	MJP was made executing agency for all the multi-village scheme costing Rs 25 million and above.
GoM GR dated 6 July 2011	As per this GR, Block Resource Centres have been established in the State at the block level to strengthen the role of Blocks (Panchayat Samiti) in guiding, supporting and monitoring water and sanitation services in villages.
GoM GR dated 7 September 2011	This GR listed the key responsibilities of the District Water and Sanitation Mission (DWSM)
GoM GR dated 18 November 2011	The purpose of this GR was to encourage adoption of house connections by weaker sections of rural society. To achieve this, a subsidy of Rs 4000 is granted to SC families with 5% of contribution from them in cash and kind.
GoM GR dated 12 March 2012	Water and Sanitation Support Organization (WSSSO)to function as Directorate of Water Supply and Sanitation under the WSSD and shall remain accountable to State Water and Sanitation Mission.

	GSDA and MJP shall act as State Technical Agencies and shall support WSSSO in delivering its mandate. Further, NRDWP funds will be released to the accounts maintained by WSSSO, which shall release it for various purposes.
GoM GR dated 22 March 2012	Additional 25 posts have been created in the Water Supply and Sanitation Department headquarter at Mumbai.

(Source: Compiled from World Bank, 2012)

It is important to mention here that most of these GRs' were passed after the launch of National Rural Drinking Water Programme (NRDWP) in 2009. The impacts of these GRs on the performance of State water supply and sanitation sector can only be visible once the habitations targeted under NRDWP, i.e. habitations having poor water supply coverage; water quality affected; and slipped back habitations, are covered by the formal public water supply systems.

5.4 Total Sanitation Campaign as an Institutional intervention in sanitation sub-sector

In rural sanitation, the Government of Maharashtra (GoM) has made innovative approaches. Between 1997 and 2000, the GoM constructed about 16.6 lakh toilets with a subsidy of around Rs 456 crore. However, only 57 per cent of the toilets constructed under this programme were being used for the purpose for which they were built. These outcomes made government realize the importance of education and awareness creation is paramount as critical ingredient for a successful sanitation programme.

Building on the experience, the State government launched Sant Gadge Baba Sanitation Campaign (clean village campaign) in 2000. The campaign aimed at promoting a competitive spirit among villages to create a clean environment through community self-initiatives. The IEC campaign was sponsored by the Rural Water Supply and Sanitation Department, GoM without any subsidy or grants. However, the department did reward the wining villages at the district, division and State level. It is estimated that during the campaign (2000-2004), village community built Rs 800 crore worth of sanitation infrastructure. In the year 2002, GoM initiated another new approach, namely Open Defecation Free Villages, for promoting clean 'environmentally sanitized' villages. The underlying concept of the approach was that unless each and every member of the community changes his/ her behaviour towards sanitation, everyone in the community is at health risk (GoM, n. d.).

TSC was launched in 2000 only in the rural areas of four districts. Subsequently by 2004, it was extended to cover all the districts in the State. Between the year 2000 and 2012, around 71 lakh individual household latrines were constructed in the rural areas, an achievement of 73.8 per cent against the TSC target for the State. According to the TSC data, by June 2012, in three districts, i.e., Gadchiroli, Ratnagiri and Sindhudurg, 100 per cent of the targeted household were covered with the sanitation facilities. However, the census 2011 data show only 34.8 per cent of the rural households as having access to improved latrines. This slow progress can be attributed to the strategy used by TSC. The Campaign focused on bringing behavioral changes though education and awareness in the rural communities who are practicing open defecation, and are devoid of access to latrines. But as evident from several research studies (Jenkins and Scott, 2007), there are other constraints, some permanent (such as poverty, space unavailability, tenancy) and some temporary (such as competing priorities, lack of relevant knowledge) which influences household decision not to adopt latrines.

Without understanding these constraints, it is very difficult to make rural areas free of open defecation.

The TSC is now being rechristened as Nirmal Bharat Abhiyan (NBA) by the Ministry of Rural Development of the Government of India. Under the NBA, the subsidy for construction of individual toilets has been raised to Rs. 10,000 from Rs. 2200 allocated earlier under TSC. Another major departure which the new scheme has made from the TSC is that the every rural household, which does not have a toilet, would be eligible for availing of the benefits of the scheme, unlike in the case of TSC which was only meant for the BPL households. In order to mobilize financial resources for implementing the scheme, it is envisioned that towards the construction of each individual household toilet, a total of Rs. 4500 would be made available from MGNREGS. But, since 60% of the MGNREGS funds are to be utilized for payment of wages for the unskilled labour, it is understood that a total of Rs. 2700 would be spent for digging of toilet pits and only Rs. 1800 can be allocated for construction of toilet superstructure, including the materials.

6. Key Issues in Water Supply and Sanitation

6.1 Access to water supply sources

Nearly 43% of the rural HHs has drinking water facility available within the premises in 2011. Of these, nearly 75 per cent have access to tap water, which includes both treated and untreated tap water. The remaining 25 per cent depend on open wells (covered and uncovered) and hand-pumps and tube wells almost in equal proportions. No household, which is accessing water from within the dwelling premise, is reported to be using water from sources like canals, ponds and springs.

Nearly 37.5 per cent of the rural households access drinking water near their dwelling premises. Nearly 39 per cent of them have access to tap water (treated and untreated), another 30% depend on hand pumps and tube wells; and 27% depend on open wells (including covered and uncovered). The balance 3.3 per cent depends on other sources including canals, ponds and springs.

Nearly 19.6 per cent (25.53lac) of rural households access drinking water from away the premises. The break up is as follows. Nearly 6.1 per cent depend on hand pumps and tube wells; another 8.9 per cent depend on open wells (both covered and uncovered); 3.5 per cent depend on treated or untreated tap water. In sum, only 18 per cent of those who depend on sources away from dwelling get tap water; but as high as 75 per cent use water from tube wells/ hand pumps and open wells (31% and 44% respectively). Another 6.7 per cent depend on a variety of sources such as canals, ponds and springs.

Overall access situation is captured in Table 10. As it clearly indicates, with increase in distance to the source, the dependence of formal and improved sources of water supply reduces. An increasing percentage of the HHs depend on

Table 10: Source-wise access of Households to water supply

Type of Access	No. of HHs	Percentage HHs depending on			
		HP & TW	Tap Water	O. Wells	Other sources
Within Dwelling premise	5582353	13	75	12	0
Near the Dwelling	4881040	30.4	39.1	27.2	3.3
Away from dwelling	2553259	31.1	17.8	44.6	6.6

As per Census 2011, more than half (50.2%) of the households have 'tap' as source of drinking water in the rural areas. But, not all that is treated water. Going by the standard definition of 'tap water' used by National Sample Survey Organization, it is expected that the tap connection is within the dwelling premise, and that it carries treated water. But, the criteria used in Census 2011 for classifying a drinking water source are slightly liberal, and water from any public source which is connected to a proper distribution system and a tap for supplying it (private or public tap) is called 'tap water', and that households which depend on tap connections near the dwelling premise or away from dwelling premise are also included in the category of 'tap water' users. It is evident from the fact that only 43 per cent of the rural households have drinking water facility available within their dwelling facility.

There is some degree of spatial variation in rural population's access to 'tap water' across the State. For instance, there are 202 talukas where the rural households' access to tap water is less than 50 per cent. In 46 talukas, the access is in the range of 50-60 per cent. In another 34 talukas, it is 60-70 per cent and in 69 of them, it is more than 70 per cent. The talukas falling in different categories vis-à-vis percentage access of rural population to tap water is given in Figure 19.

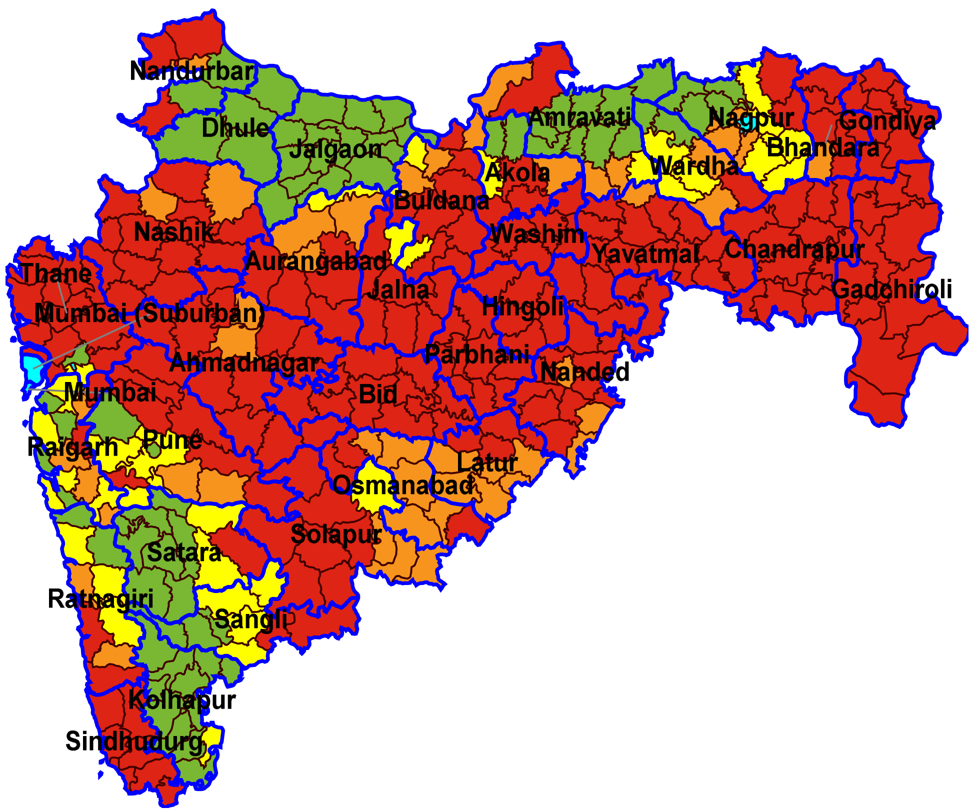


Figure 19: Taluka-wise percentage of households with access to tap water

Census 2011 also shows that out of the total of 65.4 lac households in rural areas which have access to tap connection, only 63 per cent have access to treated water supplies. This means, actually, only 32 per cent of the rural households have access to water from taps, which is treated.

Nearly 23 per cent of the rural households depend on hand pumps/bore wells for their water supply. Here again, like in the case of tap water, some regional variation is observed. May talukas in Marathawada and Vidarbha region have high percentage of rural HHs dependent on hand pumps and bore wells and the extent of dependence on such sources is less for the Konkan region.

Another 24.3 per cent of the rural households depend on water from open wells, which do not have a distribution system. Of these wells, only 13 per cent are 'protected' and the remaining 87 per cent sources are 'uncovered'.

Nearly 2.5 per cent of the households depend on sources such as canals/rivers, ponds and springs for their domestic water supply.

As regards characteristics of the source, overall, 58.10 per cent of the rural households depend on improved sources of water supply in Maharashtra. This basically include those who have access to treated tap water (32%), those who use hand-pumps and bore wells (23%) and those who use water from protected open wells ((24*0.13=3.10%). There are 147 talukas where less than 60 per cent of the HHs had access to improved water sources. There are 98 talukas where 60-70 per cent of the HHs had access to improved sources; 49 talukas where more than 80 per cent of the HHs had access to improved sources (Figure 20).

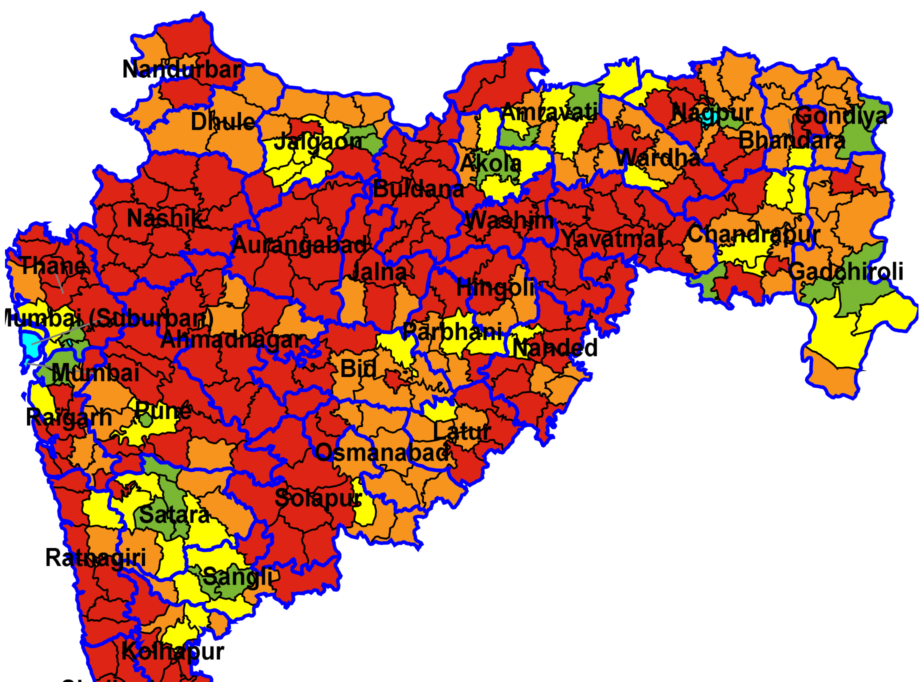


Figure 20: Taluka-wise percentage of households with access to improved water sources

The overall change in access to drinking water sources and types and characteristics of the source being used are summarized, division-wise in Table 11. The biggest improvement in physical access to water sources and the type of water source came from Konkan region, with a 9.7 per cent increase in percentage of HHs having drinking water source within their dwelling premises. Further, the proportion of HHs having access to tap water has gone up by 13.0 per cent in the region. The lowest progress was made in Nashik and Aurangabad divisions. While the decadal progress is poor for Nashik, it started off from a comfortable level in 2001, with more than 55 per cent of the HHs having access to drinking water facility within the premises and more or less the same percentage of HHs having access to 'tap water'. Konkan is one of the most prosperous regions in Maharashtra, whereas Aurangabad is not so progressive.

Table 11: Changes in access to water and types and characteristics of water supply sources

Divisions	% of households having			Change in percentage points during 2001-2011	
	Drinking water facility Within Premises	Tap as a source of drinking water	Improved source of drinking water	Drinking water facility Within Premises	Tap as a source of drinking water
Amravati	44.92	51.48	55.34	5.72	5.17
Aurangabad	44.25	41.91	55.92	2.37	0.79
Konkan	65.71	47.29	57.39	9.65	12.77
Nagpur	52.02	36.14	63.43	8.06	6.65
Nashik	57.03	57.88	54.07	1.65	3.04
Pune	68.53	59.99	63.17	8.83	3.52
Maharashtra	59.40	50.25	58.12	5.98	4.70

6.1.1 Regional variations in access to water supply

Major regional variations do exist in terms of access to water supply (Table 12). Amongst the six divisions for administration of rural water supply in the State, Amravati division has the highest proportion of both habitations and households covered by piped water supply schemes. While 72.4 per cent of the habitations are covered, 72 per cent of the households are also covered. Also, in term of number of households covered by individual household connections, Amravati stands at the top, with 36 per cent of the rural households having access to individual household connection. But, amongst those households which enjoy access to PWS schemes in rural areas, the proportion of households having access to piped water supply systems is highest for Pune division (69 per cent), followed by Khandesh and N. Maharashtra. Amravati division has only the third position.

Table 12: Regional variation in household covered, amount of water supply, O&M expenditure and revenue recovery

Name of Division	% Habitations covered by PWS	% HHs covered by PWS	No. of HHs in the Division having IHHC as a % of Total HHs	No of HHs in the Division having IHHC as % Total HHs covered by PWS	Average Per Capita Water Supply per Day	Monthly average O & M Expenditure per HH	Average Tax paid by the HHs per Month
Marathawada	51.2	55	21	39	30	17	12
Konkan	50.7	44	21	48	129	49	33
Nagpur	37.3	44	21	48	21	33	21

Khandesh & N. Maharashtra	53.5	55	31	56	62	33	27
Pune	47.2	47	33	69	22	40	36
Amravati	72.4	72	36	50	36	30	16

(Source: authors' own analysis based on data from MJP as on 2012)

Among those households, which enjoy access to PWS, the average per capita water supply was estimated to be highest for Konkan division (129litre per day), followed by Khandesh and N. Maharashtra with 62 litre per day. The per capita water supply is very low for Nagpur (21lpcd), Pune 922lpcd) and Marathwada regions (30 lpcd) and Amravati (36lpcd), and is lower than the average per capita supply stipulated for meeting basic survival needs (see for instance, Gleick, 1998 on water for basic survival needs). The highest per capita water supply of 129 lpcd for Konkan division can be attributed to the abundance of water in the reservoirs of the region, with very little demand from irrigation sector. However, it is important to keep in mind that these are average figures for the region as a whole, which again are applicable to the portion of the rural households which have access to PWS. Whereas, in regions such as Marathwada and Pune, the low per capita water supply can be attributed to a variety of reasons: the limited water resources (both groundwater and surface water) and greater competition from irrigation sector; the poor development of infrastructure for using the available water from the few reservoir schemes in the region, which have surplus water.

In surface water surplus and abundant regions of Maharashtra, which include Nagpur, Pune and Amravati divisions, the low per capita supply can only be attributed to heavy dependence on groundwater based schemes.

6.2 Deteriorating condition of the technical infrastructure

The problem of low daily per capita water supply is compounded by the deteriorating condition of the water supply infrastructure. During 2012-13, as many as 1508 habitations slipped back to no source category because of the old age of the systems. Out of these maximum reported habitations were from district Ahmednagar (373), followed by Kolhapur (329) and Satara districts (282). Further, 845 habitations slipped back because of inadequate supply of water at the delivery point, thereby raising serious questions about the quality of the constructed infrastructure. Out of these, maximum reported habitations were from district Pune (174), followed by Sindhudurg (134) and Beed (124) districts. It was also found that around 80 habitations slipped back on account of poor O&M of the systems. Maximum number of habitations on this account were reported from district Nandurbar (38), followed by Thane (20) district.

6.3 Issues of sustainability of resource base

Traditionally in rural areas of Maharashtra, households were dependent on wells for meeting their drinking and other domestic water demands. Almost 80% of the implemented schemes during the reform era tapped groundwater. At present 47% of the households depend on groundwater sources which includes bore wells and hand pumps. However, ability of such sources to supply water in summer or during drought year is questionable. The schemes based on groundwater sources mostly run dry or offer limited discharge during summer months.

Source sustainability is emerging as major challenge in many regions. During 2012-13, about 1,595 rural habitations slipped back to 'no-source category' due to drying up of sources. The main reason for this is over-exploitation of groundwater in the hard rock areas, resulting from uncontrolled draft for irrigated agriculture. Maximum number of such slipped back habitations were reported from district Sangli (311), followed by Thane (195), Ratnagiri (175), Jalna (154), Buldana (112), and Aurangabad (94) districts. At other places deteriorating groundwater quality itself is making source unusable as evident from slipping back of 161 habitations on account of poor water quality. Maximum number of slipped back habitations on this account were reported from district Chandrapur (32), followed by Yavatmal (29), Wardha (19), and Solapur (19) districts. Thus, there is a need to refocus on exploring surface water based schemes to meet the growing domestic and productive water demands of the village community.

6.4 Linkage between Quality of Water Supply Service and Willingness to Pay

A simple frequency analysis was carried out using block level data on the number of households, from each of the three distinct categories of access (viz., water within the premise, water source near the premise or water source away from the premise), using treated piped water supply to see whether there is any trend in preference of the rural households via-a-vis type of domestic water supply they would like to enjoy. Treated piped water supply was chosen because it is the most ideal source of water people like to have in villages in terms of quality and easiness. Since people can also change the degree of access on the basis of their payment power, the type of domestic water supply would also indicate the willingness to pay.

Analysis involved comparing the total number of HHs depending on treated tap water from each block in each category of 'water access', as a percentage of the total HHs in the block. The results of the analysis are presented in graphical form in Figure 21. It shows that a much larger percentage of HHs obtain treated tap water in their dwelling than those who get it near the dwelling. The difference was larger as compared to those who obtain treated tap water from sources away from their dwelling. The percentage HHs accessing treated tap water in their dwelling is consistently higher than counterparts with distant sources across the blocks. Getting connection for treated tap water within the dwelling premise is much more expensive than getting it near the dwelling premise and the cheapest source of 'tap water' is that which is obtained from distant common sources such as common stand post. This trend shows that when water is of good quality and there is easiness in collecting it HHs show greater willingness to pay for water supply services. When water is untreated, and not supplied through taps, people do not like to invest in going for domestic connection.

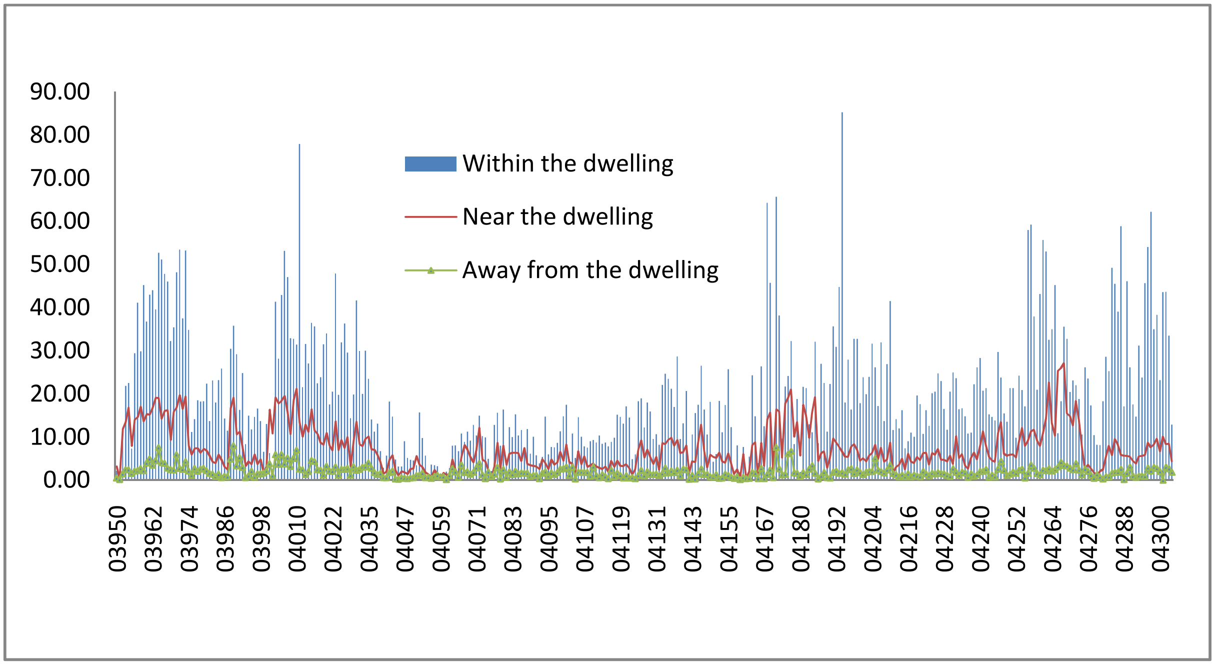


Figure 21: Differential access to water with changing quality: treated tap water

As regards hand pumps, nearly 15.7% of the households depend on this improved source of water supply in the entire state. The total number of households which depend on hand pumps is 20.43lac. But, only 13.8% of them have HPs in their dwelling premise. Since these hand-pumps are located within the dwelling premise, one can assume that these are privately owned. More than half of them (56.2%) depend on hand pumps near the dwelling premise. In all, around 30% depend on HPs located away from the dwelling premise. Therefore, in total, around 86 per cent of the cases, the HPs must be publicly owned as they are either located near the dwelling premise or away from the dwelling premise. Figure 22 shows the total number of households which have access to hand pumps across different Tehsils of Maharashtra, within the dwelling, near the dwelling and away from the dwelling, respectively. It can be seen from the figure that in majority of the Tehsils, more number of households depend on distant HPs as compared to those who depend on HPs located within the dwelling or near the dwelling.

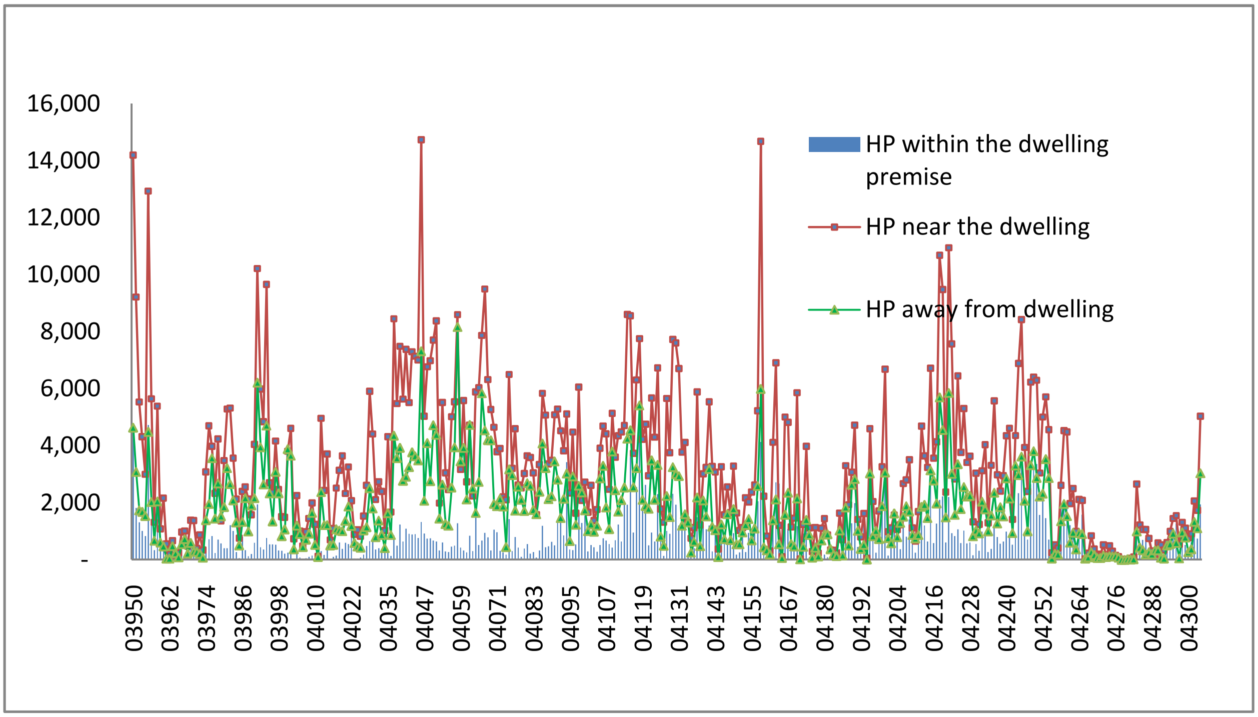


Figure 22: Proportion of population depending on HPs, with varying degree of access

6.5 Linkage between quality of water supply and cost of supplying water

An analysis was carried out using the data available with the MJP on the number of habitations covered by various piped water supply schemes in different district of Maharashtra, the number of households from these habitations actually having individual tap connections and the average O & M cost for the habitations covered. From these figures, the average O & M expenditure per household (which receive PWS) was worked out by dividing the total O & M cost per annum by the estimated total number of households covered by the PWS. A simple regression was run with the estimated average O& M Cost against the proportion of the HHs covered by PWS having individual water supply connections (Figure 23a). It showed a positive correlation between the two. The relationship was logarithmic. This basically means that when larger proportion of the households goes for individual household connections, the average cost per HH supplied with PWS increases. But from the chart it is also evident that with every one percent increase in individual household connection, the average unit cost per PWS covered HH does not increase by the same proportion or the total O & M cost for the scheme does not increase by the same proportion. In other words, if we consider only those households which are connected with individual taps, the O & M cost per HH reduces with increase in number of tap connections in the entire scheme. This means, there are significant economies of scale.

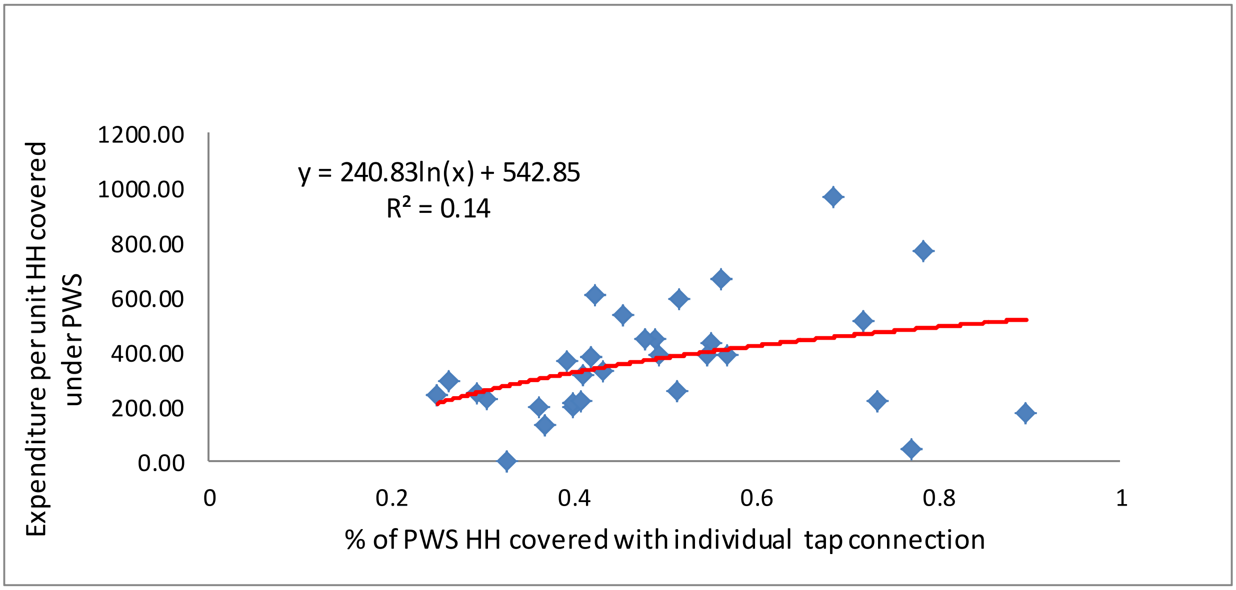


Figure 23a: Expenditure per HH vs. average no. of HH connections

6.6 Issues of inter and intra-sectoral equity

The National Water Policy 2012 document duly recognizes the fact that economic principles need to guide pricing of water. But, one important issue concerning pricing is that the mere use of economic principles does not address the issue of water allocation across different sectors of water economy, and this would lead to compromising on several of the objectives such as equity and social justice, water for environment etc., though these are part of the policy objective (points under 1.3, (i) and (ii). The document is silent on water allocation priorities, an important aspect of policy framing. The use of economic principles suggests that net marginal returns from the use of water should be a basis for its price when used for "production", if water supply has to be made affordable'. It is quite well known that the marginal returns from the use of water in manufacturing are much higher than that of crop production. This means, the manufacturing sector will be able to pay prices much higher than what irrigators can pay. So, if we blindly follow this "affordability" criterion without rules and mechanisms for water allocation, industries might be able to walk away with all the water in some really water-scarce basins. This will be at the cost of livelihood of millions of farmers, and other productive water needs of the communities. This problem can be addressed only through clearly spelling out water allocation priorities in the policy document. That done, actual allocation in different basins will have to be decided on the basis of the overall availability, the competing demands, but using the policy goals. Pricing can then be used to encourage efficient use in each sector and financial working.

Also, the criteria that will be used for pricing of water for domestic uses, which are "non-economic" (drinking & cooking, washing, cleaning and personal hygiene) need to be explicitly stated. The general economic approach is to go by the "long-term marginal cost" pricing. In that case, the resource cost and environmental degradation due to its use will have to be considered along with the cost of production and supply of water. While this will ensure cost recovery and efficient use, how do we ensure that the poor are able to access water of sufficient quantity?

At present the Water Policy document only mentions about access to safe water for drinking & sanitation, as one to receive top priority. But, it is important to make allocations in volumetric terms from the utilizable renewable water resources in each basin. But, to start with the water scarce river basins should be taken up.

6.7 Unsustainable resource use

The rural water supply schemes in Maharashtra are generally planned for meeting the domestic water supply needs of the population, with the result that the per capita supplies maintained by the PWS schemes is very low(23lpcd at the aggregate level). But, rural populations have many productive water needs. Households need water for meeting livestock needs, particularly livestock drinking[2]. A small percentage of the farmers in Maharashtra own irrigation wells, and their ownership is skewed towards large and medium farmers. Rural households, which do not have their own farm land and irrigation sources, prefer water for growing vegetables to meet their domestic needs as it is important for the nutritional security of the families. Households, which are not dependent on agriculture and allied activities for their livelihood, may need water for meeting one or more of the productive water needs such as pottery, fishery, pickle-making and duck-keeping. This will be important for households that are economically poor.

The failure of water supply agencies to design the water supply system for multiple uses results in the communities not being able to realize the full potential of water as a social good as they end up spending long hours trying to fetch water for productive needs, or reallocating the available supplies for productive needs. An action research project on piloting multiple-use water systems for rural households, being implemented by GSDA, IRAP and UNICEF in three locations in Maharashtra, namely village Varoshi in district Satara; village Chikhali in district Chandrapur; and village Kerkatta in district Latur, confirms that rural communities do have various domestic and productive water demands which are not met by the existing water supply systems. During summer months, the sources run dry in all the selected locations and thus were not able to meet even the basic drinking water need. As a result, the rural households have to depend on alternate sources of water, which are often unprotected, to meet their various domestic and productive water demands (IRAP and UNICEF, 2011).

6.8 Water quality issues

Water quality is as important a concern in rural water supplies as quantity. The water quality problems facing rural Maharashtra has three important dimensions, i.e., physical quality of water, chemical quality of water and bacteriological quality of water.

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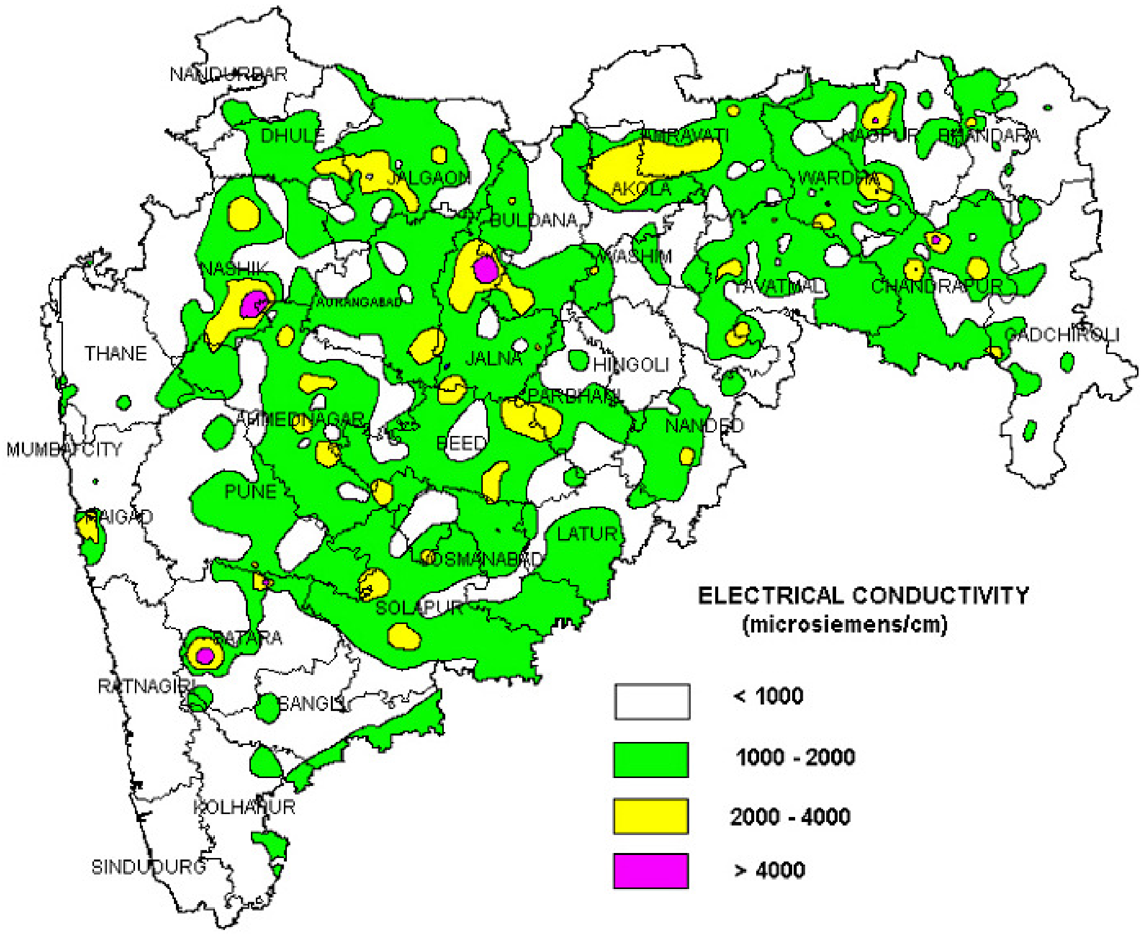
[2] But, this is applicable to agricultural families which have no source of irrigation. Families which have sources of irrigation would be able to shift their families and cattle to the farms.

While there is a heavy dependence on groundwater resources for water supply in Maharashtra, groundwater resources have certain natural quality problems in some areas, with levels of salinity and fluoride above permissible levels. Figure X shows the areas having excessively high levels of salinity in groundwater. As per the WHO standards, levels of salinity in groundwater



above 500 ppm make it unsuitable for drinking. Here the areas where the electrical conductivity is more is more than 1000 (or 600ppm) can be treated as problematic areas. The map shows that such areas are large in all except the Konkan region.

Bacteriological contamination has significant impact on the health of poor people, as the unprotected water sources are mostly used by the poor people. In the entire State of Maharashtra, access to piped water sources is significantly higher in richer and richest quintile and nearly 1/5th of the bottoms most sections of the society are still dependent on unimproved and surface water sources. Nearly 1/4th of the rural population of the State is served by unprotected water sources, and majority of them belong to the poorest sections of the society.

In a rapid assessment of extent of bacteriological contamination of drinking water sources from various anthropogenic sources (at the source level), carried out by GSDA, PHE and UNICEF, Mumbai (2010), a representative sample of 6000 sources from a total of 1200 habitations spread over 186 blocks from 15 districts were covered. The findings showed that in most of the project districts, major water supply source is Hand Pump (HP) followed by Piped Water Supply (PWS) beside Nashik, Amravati, Buldana, Raigad and Latur.

The extent of bacteriological contamination of tested water samples ranges from 34% (Buldana) to 83% (Nanded). This contamination is spread across all the technology types. The piped water supply system in Nagpur, Solapur and Pune reported more than 50% contamination. Water samples from HPs in Aurangabad, Nanded and Nandurbar are found to be bacteriologically contaminated. In districts such as Chandrapur, Nanded, Aurangabad, Solapur and Thane, the incidence of contamination in dug well was above 80% and 10%-43% of the population are dependent on this source in these districts. In terms of magnitude of contamination dug well, which served 1/4th of the population, is the most contaminated source. However, in terms of spread of contamination HP is the most vulnerable source since it caters to 2/5th of the rural population.

Table 13 provides the percentage of the water samples from different sources, which were reported to be contaminated, and the extent of dependence of the rural communities on each of these sources in the 15 surveyed districts. These data were used to assess the health risk of the communities. Our assessment shows that the exposure to health risk is as high as 80 per cent of the population in Nanded to the lowest of 31% in Jalgaon and Nandurbar.

Table 13: Extent of Dependence of Population on Different Types of Water Sources and the Extent of Bacteriological Contamination of these Sources

Name of District	Percentage Population Served by				% contaminated water samples from				Estimated Population affected by contamination
	HP	PWS	DW/ OW	PP	HP	PWS	DW/ OW	PP	
Aurangabad	67	19	14		61	79	91		68.6
Jalgaon	59	23	18		24	27	58		30.8
Nagpur	18	67	15		63	36	70		46.0
Wardha	26	50	24		26	53	78		52.0
Nanded	60	16	14		74	83	91	85	70.4
Nashik	44	7	48		77	78	85		80.1
Solapur	27	64	9		48	65	78		61.6
Pune	31	64	5		52	55	70		54.8
Raigad	30	27	43		40	62	66		57.1
Nandurbar	64	9	17		21	59	73	36	31.2
Chandrapur	44	18	38		37	50	94		61.0
Amravati	33	44	23		33	51	66		48.5
Buldana	38	44	14		38	48	15		37.7
Latur	33	31	50		33	31	50		45.5
Thane	47	10	43		68	58	85		74.3

Source: Strengthening Household Water Safety and District Level Water Quality Profiling, A consolidated water quality report from 15 districts of Maharashtra

A survey carried out by UNICEF and GSDA in 11 districts of Maharashtra showed incidence of fluoride in water samples from all types of drinking water sources in six districts. The graphical representation of the estimates on the extent of contamination of sample water sources under four different categories viz., hand pumps, open wells, piped water supply and PP is given in Figure 23b. The highest incidence of excessive amount of fluoride was found in water samples of Aurangabad, followed by Nanded.

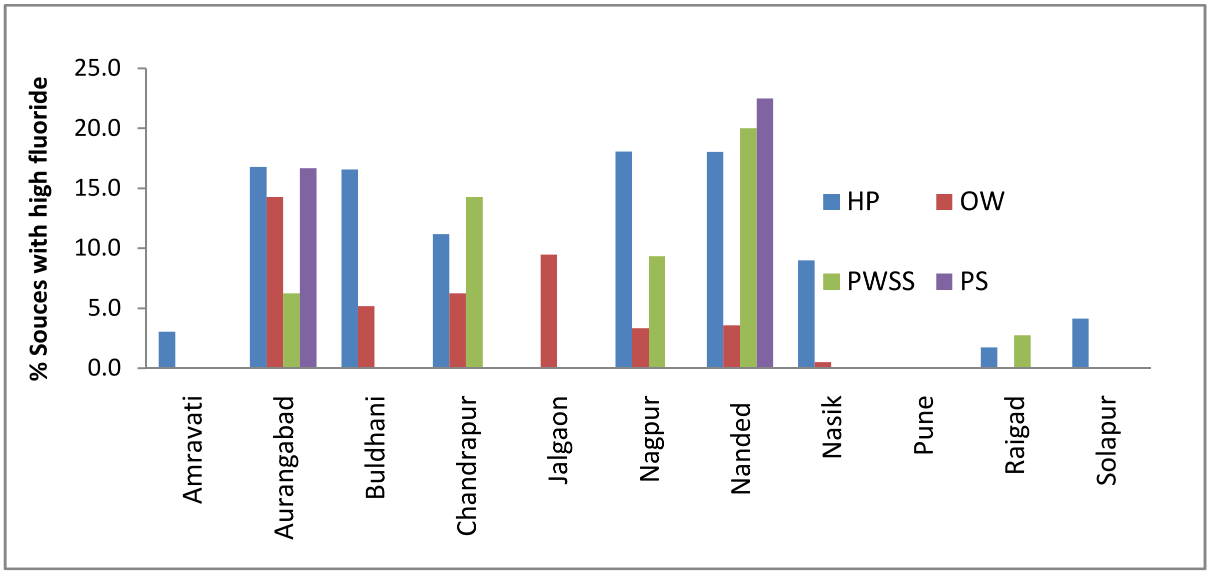


Figure 23b: Percentage samples with high fluoride content in different types of water sources, across 11 districts

6.9 Slippage in Sanitation Progress

Remarkable efforts were made by the State government to boost the adoption of improved toilets in rural areas ever since the launching of the Total Sanitation Campaign in 1999, which offered subsidies to BPL families for construction of improved latrines. The idea is to make the villages open defecation free (ODF). As a result, the adoption of individual household toilets in the State has gone up from 18.2% to 38% of the rural households during 2001-2011.

An important institutional mechanism used by the TSC to promote improved sanitation in rural areas is to award Nirmal Gram Puraskars to the Gram Panchayats which have become open defecation free. The award offers a one-time financial incentive (Rs 50,000) to the Gram Panchayats, which have succeeded in motivating the village households to build individual household latrines and stop open defecation. Maharashtra has taken significant leap forward in terms of school sanitation with successful models like Swacchata Doot and School in Development.

But, there are serious issues of sustainability of the efforts, while the focus of the programme is on achieving the targets. In many instances, the villages, which were once declared ODF, slip back. Even with IHHLs, the families prefer open defecation over the use of toilets. The most serious problem is the lack of focus on bringing about behavioural changes across socio-economic segments and across different age groups. The other problem is the lack of recognition of the need for providing good access to dependable source of water supply for proper use of the toilets. Often the rural families do not own sufficient space for construction of toilets near their dwelling. Even without these, they construct toilets because they often get tempted to the financial incentive being offered by the government to construct the toilets, without much appreciation for the health benefits of practicing improved sanitation. Peer pressure also seems to be working in certain cases. In certain cases, due to economic constraints, the structure is used for purposes other than sanitation, such as storage of firewood and fodder. Over-reporting of the structures constructed and false reporting were also found to be rampant among the aspirants of NGP.

A rapid assessment of the aspirants of NGP carried out in 32 districts of Maharashtra, which covered 252 blocks, 406 Gram Panchayats, 9836 households, 781 schools and 778 Anganwadis conducted by nine KRC brought out the following. Only 8 % of the visited GPs are having 100 % coverage in terms of household sanitation and 60 % of the aspirants GPs are below 80 % coverage. Out of the 32 districts assessed in case of 17 districts not a single GP was found with 100 % access to household toilets. Out of the total 9836 interviewed HH, 75 % were found to have access to toilet of which 79 % have reported using the toilets. Hence, 40% of the surveyed households were found to be resorting to open defecation. The possible reasons for dysfunctional status of toilet were: lack of superstructure; lack of water supply; broken platforms and misconception about the toilet use.

Further, 2/3rd of the surveyed HHs were found to be dumping/disposing solid and liquid wastes indiscriminately while 1/4th of families connected with sewer or drain. Indiscriminate disposal of wastes further increases the chances of microbial contamination of drinking water and epidemic. Only 44 % of the HHs are disposing child excreta in toilet and 1/3rd of the used toilets were found to be maintained properly.

During the rapid assessment 781 Schools and 778 Anganwadis were covered and 94 % schools and 81 % Anganwadis were found with sanitation facilities. The percent maintenance in schools and Anganwadis was reported as 57 and 58 respectively. The availability of water supply in schools and Anganwadis is also found to be a great cause of concern which has the direct implication of use, operation and maintenance of toilets. Only 69 % of schools and 59 % of Anganwadis reported having water supply availability. Overall, only 37% of the GPs were generally found clean while the transect estimates 33 % GPs as open defecation free status.

7. Analysis of Performance of Selected Schemes in Rural Maharashtra

7.1 Management Performance

Here, a detailed assessment of the performance of different types of schemes, comprising physical performance (water supply coverage, adequacy, quality of water supply); economic performance (the capital and operational cost of water supply, particularly the cost per unit volume of water supplied against the alternatives that exist); and financial performance (revenue recovery)was undertaken using data primary and secondary data obtained from sample schemes, and results are presented to enable a comparative evaluation of scheme performance.

7.1.1 Water supply coverage

As regards coverage, 45 per cent of the rural households were found to be covered by formal water supply in the selected schemes. There are significant differences in coverage across water supply technologies. Highest coverage was seen to be achieved in a single village scheme based on bore well (94.5%), followed by multi-village schemes based on surface reservoir (80.5%), and single village scheme based on river lifting (74.2%) and reservoir (73.7%). The regional scheme based on river lifting had the lowest coverage (Table 14). As Table 14 shows, the single village schemes based on dug wells, percolation wells and infiltration well also have relatively lower percentage coverage as compared to reservoir based single and multi-village schemes (42.7%, 47.3% and 60.4%, respectively).Notably, there is a remarkable difference in coverage between schemes that tap surface reservoirs and that lift river water directly, when the scheme has to supply water for large number of villages (73.8% against 21.9%).

Differences in coverage were also seen with change in type of source. In the case of single village schemes, those tapping water from surface sources are (73.8%) are found to be performing better than those tapping groundwater (64.2%) and sub-surface water (57%).

As regards proportion of households with individual tap connections, it was highest for single village scheme based on river lifting and surface reservoir (74.3 and 73.7%, respectively) and the lowest (35.6%) for single village scheme based on sub-subsurface water. Nearly 63% of rural households that are covered by regional water supply scheme based on reservoirs also had individual household tap connections.

Differences in coverage were also seen with change in type of source. In the case of single village schemes, those tapping water from surface sources are found to be having the highest percentage of individual tap connections (73.7%), followed by those tapping groundwater sources (48.2%) and those tapping sub-surface water had the lowest percentage of households having individual tap connection (35.6%).

Overall, it appears that the water supply schemes based on surface reservoirs, both single village schemes and multi-village schemes, show relatively better performance as compared to single village schemes tapping groundwater, and sub-surface water, and regional schemes lifting water directly from the river, in terms of the proportion of the households actually served by them and proportion of households provided with individual tap connections.

Table 14: Household covered with water supply schemes under different techno-institutional arrangements

Type of Scheme & Source	Technology	Avg. no. of HHs/scheme	Average no. of HHs covered/ scheme	Overall % of HHs covered	Average no. of HHs covered with individual piped connection/ scheme	Overall % of HHs covered with individual piped connection
Individual GP (Ground water based)	Bore Well	555	522	94.1	310	55.9
	Dug Well	384.5	164	42.7	164	42.7
	Overall	441.33	283.3	64.2	212.7	48.2
Individual GP (Sub-Surface	Infiltration Well	508	307	60.4	307	60.4
	Percolation Well	1059	501	47.3	250	23.6
	Overall	783.5	404	51.6	278.5	35.6
Individual GP (Surface water based)	Surface Reservoir	1140	840	73.7	840	73.7
	River Lifting	132	98	74.2	98	74.2
	Overall	636	469	73.8	469	73.7
Regional (Surface water based)	Surface Reservoir	9904.67	7223	80.50	5916.8	62.9
	River Lifting	50275	11005	21.9	-	-
	Overall	19997.25	7979.4	43.7	-	-

(Source: Authors’ own analysis using primary data collected from various water supply agencies)

7.1.2 Adequacy of Water Supplies

In terms of daily per capita supply, all the schemes were found to be supplying at par or above the State adopted norm of 40 lpcd in all seasons, except in case of the one individual scheme (tap sub-surface flow using infiltration well) that supply only 32 lpcd during summer months. The estimated per capita supply levels maintained by different types of sample schemes studied are provided in Table 15a. It shows that overall the average per capita water supply is slightly higher for groundwater based scheme than their counterparts based on reservoirs and river lifting. But, this is because in open well based schemes, an excessively high level of supply is achieved (110 to 117lpcd) primarily due to a small percentage of the targeted households (42.7) being served.

In the overall assessment what emerges is that in the case of single village schemes based on groundwater, percolation wells and infiltration wells, the average level of water supply per capita is slightly better due to the extent of coverage of the targeted households. For instance, the schemes that tap surface reservoirs, supply water to 73.7% of the total households considered in the design. Whereas the schemes that extract groundwater and sub-surface water supply water to significantly lower proportion of households (57%).

Another important factor which needs to be considered while analyzing the performance of the schemes is that the norms for per capita water supply considered for designing the scheme is in the range of 40-55 lpcd. While the targeted water supply is achieved in the case of single village reservoir based scheme, the actual per capita supply is slightly less than the norm (of 55lpcd) for the regional water supply schemes.

Further, as household water demand could vary from place to place depending on the socio-economic dynamic of the household and the cultural factors over and above the climatic factors,a final assessment of the performance can be made only if we see what proportion of the actual water demand is being met by the scheme.

Table 15 a: Physical Performance of Different Types of Water Supply Schemes

Type of Scheme	**Source**	**Average amount of Water to be supplied as per Design**		**Actual amount of water supplied per scheme (LPCD)**			**Frequency and Average hours of water supply/day**					
							Monsoon		Winter		Summer	
		LPCD	hour/ day	M	W	S	Frequency range	hours/ day	Frequency range	hours/ day	Frequency range	hours/ day
Individual GP (Ground water based)	Bore Well	40	8	40	40	40	Once/day	1	Once a day	1	Once a day	0.67
	Dug Well	47.5	4.5	117.5	117.5	110	Twice/day to once/ 2days	1.5	Twice/day to once/ 2days	1.5	Twice/day to once/ 2days	1.5
	Infiltration Well	-	-	40	40	32	Once/day	1	Once a day	1	Once a day	1
	Percolation Well	40	8	80	80	80	Once/day	4	Once a day	4	Once a day	4
Individual GP (Surface water based)	Surface Reservoir	40	1.5	40	40	40	Twice/day	1	Twice a day	1	Twice a day	1
	River Lifting	40	-	70	40	40	Once/day	1	Once a day	1	Once a day	1
Regional (Surface water based)	Surface Reservoir	55	10	45.75	48.75	46.25	Once/day to once/2 days	3.83	Once/day to once/2 days	4.17	Once/day to once/2 days	4.83
	River Lifting	55	20	55	55	55	Once/day to once/2 days	20	Once/day to once/2 days	10	Once/day to once/2 days	10

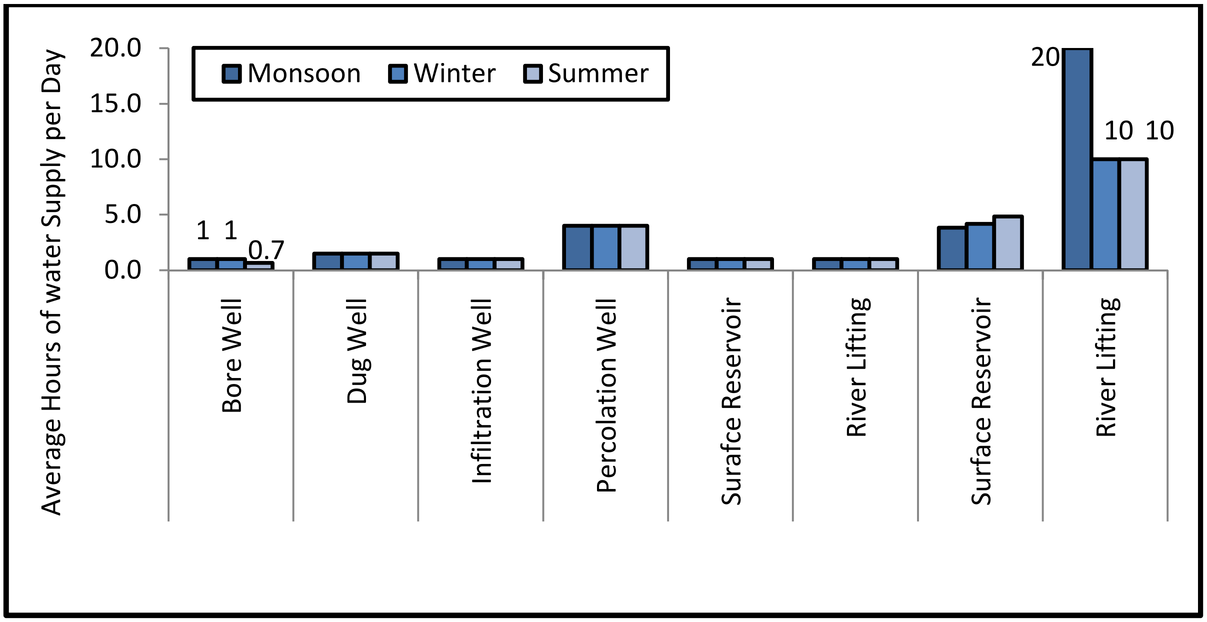


Figure 24:Scheme and source-wise average rate of water supply (Hours/day)
(Source: Authors' own analysis using primary data collected from various water supply agencies)

Within the scheme, no major variation is seen in the frequency of water supply across different seasons. Amongst schemes, frequency of water supply ranged from twice a day to once in two days for single village scheme based on groundwater; twice a day for single village scheme based on surface reservoir; once a day for individual village scheme based on river lift; once a day to once in two days for regional schemes based on both surface reservoir and river lift. In terms of hours of daily water supply, regional schemes based on surface water fare much better than any other schemes (Figure 24). On an average, such schemes were found to supply water for 7.9 hours per day during monsoon; 5.6 hours per day during winter; and 6.1 hours per day during summer. Individual scheme that abstract groundwater using bore well showed poorest performance, supplying water only for one hour during monsoon and winter; and for 0.67 hours per day during summers. As discussed earlier, sustainability of schemes based on groundwater in supplying water during summer months is uncertain.

A realistic assessment of the comparative performance of the schemes cannot be made merely on the basis of data on per capita supply levels maintained by the schemes. It is also important to know the current per capita requirements as this can change from region to region and from location to location depending on the socio-economic and climatic conditions and cultural settings. Once that is known, one should know as to what extent the requirements are met from the new scheme and the per capita water use. The latter indicators are perhaps more important as many villages have dual schemes, an old one and the new one (which includes common wells, hand pumps etc.) and people might be able to tap water from them as well.

The analysis of data on household level water use shows that per capita water use is highest for households under single village river lift scheme (around 80lpcd), followed by 75lpcd for dug well based scheme and 59 lpcd for regional schemes based on reservoirs (Table 15b). The lowest per capita water use was found in the case of bore well based scheme (28.6lpcd). What is interesting is that the per capita requirement was also proportionally low for bore well based scheme, and that the entire requirement is met by the scheme. One possibility is that due to water shortage, the communities are reducing their water demands by not going for economic activities such as livestock keeping. In other cases, where the water use is high, the communities might have demanded a new scheme to meet their domestic water requirements like in the case of the dug well based scheme, or the single village reservoir scheme or the multi-village scheme.

Table 15b: Average per Capita Water Use against the Requirements of Households under Different Schemes

Type of Scheme	Source/ Technology	After the selected scheme					
		Per capita water requirement (litres/day)			Per capita water use (litres/day)		
		Monsoon	Winter	Summer	Monsoon	Winter	Summer
Individual groundwater based	Bore well	28.6	28.6	28.6	28.6	28.6	28.6
	Dug well	69.1	69.1	81.7	69.1	69.1	81.5
Individual sub-surface water based	Infiltration well	53.8	53.8	67.2	53.8	53.8	67.2
	Percolation well	34.4	34.4	34.4	34.4	34.4	34.4
Individual surface water based	Surface reservoir	32.7	33.1	33.1	32.7	33.1	32.9
	River lift	79.6	79.8	80.3	79.6	79.8	80.3
Regional surface water based	Surface reservoir	53.5	53.4	64.5	53.3	53.6	64.3
	River lift	43.7	43.9	47.5	43.3	43.5	46.2

As regards the extent of fulfillment of the household water requirement, there is significant improvement with the introduction of new schemes in all except the case of multi-village scheme based on reservoir. The largest change is in the case of individual scheme tapping sub-surface water. Marginal improvement is also observed for the bore well based schemes, surface reservoir based single village scheme and river lifting based multi-village scheme. However, in the case of the multi-village scheme based on reservoir, the situation deteriorated (Table 15c). This might have happened because the coverage of the scheme in terms of number of villages and HHs might have increased, and many of those which were earlier not covered by PWS are covered by the newly introduced scheme, and the new source functions as a supplementing source. This is partly explained by the fact that nearly 45% of the households depend on secondary as well as primary source to meet their household water needs (Table 15d).

Nevertheless, in the case of single village scheme based on surface water, currently 100% of the requirement is met from the new source, as compared to 97.3 per cent for sub-surface schemes and 90.4% for schemes based on groundwater.

Table 15c: Extent to which water requirement are met by the primary source before and after introduction of the current water supply scheme

Type of Scheme	Resource tapped	Technology used	% of household's total water requirement met by primary source		% Change
			Before scheme	After scheme	

	Groundwater	Bore well	99.7	100	0.3
		Dug well	85.8	85.6	-0.2
		Overall	90.4	90.4	0.0
	Sub-surface water	Infiltration well	85.0	95.5	10.4
		Percolation well	83.3	99	18.8
		Overall	84.2	97.3	13.1
	Surface water	Surface reservoir	96.7	100.0	3.4
		River lift	100	100.0	0.0
		Overall	98.4	100.0	1.7
Regional Scheme	Surface water	Surface reservoir	87.8	77.6	-11.6
		River lift	95.6	98	2.5
		Overall	89.1	85.8	-3.3

(Source: Authors' own analysis using primary data)

7.1.3 Quality of Water Supply

The degree of access to the source and the percentage of HHs which exclusively depend on the primary source can be good indicators of the quality of water supply from a source. The first one would decide whether the households are able to access water from a particular source with ease or not. Here, we would consider only those who access water from the source within the premise as well as those who have individual HH tap connection. The second one would indicate how much importance the source has in meeting the water needs of the households covered by the scheme. The outputs of the analysis carried out using the data collected from the field in this regard are presented in Table 15d.

The proportion of households which depend exclusively on the primary source is higher for surface water based schemes. Across technologies, in the case of bore well scheme and single village scheme based on river lift, all the households depend exclusively on the primary source. On the other hand, none of the households covered by the scheme supplying water through percolation well depend exclusively on the same. Significantly high proportion of selected households under the surface reservoir based single village scheme(98%) depends exclusively on the primary source. In the case of multi-village reservoir based schemes, nearly 50% of the households depend exclusively on the primary source, and the remaining 45.7% depend on both the primary source and common sources (Table 15d). The importance of the source is also highest for single village schemes based on surface water, with 98% of the households exclusively depending on the primary source.

Overall, amongst different water sources, the degree of access to water supply source appears to be much higher for single village schemes based on surface water (85.2%) as compared to those based on groundwater (62.3%) and sub-surface sources (35.3%). The figures however change with change in technology. In the case of bore well based scheme the degree of access is the highest (92.3%), followed by single village scheme based on surface reservoir (86.3%) and river lift (84%). It is 70.6% for percolation well based scheme and 54.3% for multi-village scheme based on surface reservoirs. But, it is also noteworthy that in the case of bore well based scheme, the average amount of water used by the households is very less (see Table 15b).

Table 15d: Access to Water Supply from the Sample Sources and Degree of Dependence

Type of Scheme	Source/ Technology	Proportion (%) of total households with			Overall proportion of HHs who exclusively depend on the primary water source	Tap connection (HH, within dwelling, near dwelling) & Common Source
		Individual HH tap connection	Tap connection within the dwelling	Stand post near dwelling		
Individual groundwater based	Bore well	40.4	51.9	7.7	100.0	0.0
	Dug well	47.3	0.0	0.0	47.3	52.3
Individual sub-surface water based	Infiltration well	70.6	0.0	0.0	70.6	29.4
	Percolation well	0.0	0.0	0.0	0.0	100.0
Individual surface water based	Surface reservoir	51.0	35.3	11.8	98.0	2.0 (stand post)
	River lift	66.0	18.0	16.0	100.0	
Regional surface water based	Surface reservoir	36.0	18.3	0.0	54.3	45.70
	River lift	50.0	0.0	0.0	50.0	50.0 (only common source)

(Source: Authors' own analysis using primary data)

An alternative indicator for and perhaps a more accurate way of measuring the performance of a new water supply scheme is the average reduction in distance to the source. As a result of introduction of improved source of water, the distance travelled by the members of the household to collect water has reduced considerably after introduction of new schemes. Maximum reduction in distance travelled per sample households was found in the surface reservoir based multi-village scheme, which is followed by surface reservoir based single village scheme; sub-surface water based single village scheme; bore well based single village scheme. The least reduction was in the case of regional river lift schemes (Table 15e).

Table 15e: Scheme-wise distance travelled per household to access water from primary source

Type of Scheme	Source/ Technology	Average Distance of the Household to the New Source of Water (m)		Reduction in distance travelled per household (m)
		Current Source	Old Source	
Individual groundwater based	Bore well	26	423	397
	Dug well	5.4	87.4	82
Individual sub-surface water based	Infiltration well	20	511	491
	Percolation well	22	368	346

Individual surface water based	Surface reservoir	4.3	757	752.7
	River lift	9	285	276
Regional surface water based	Surface reservoir	34.5	1080.5	1046.0
	River lift	65	140	75

(Source: Authors' own analysis using primary data)

7.1.4 Capital and operational cost of water supply

Capital cost, in terms of rupees per unit volume of water supplied per scheme, was found to be highest (Rs 0.57 per litre) for regional schemes that are based on surface reservoirs. Lowest was for individual schemes that are based on surface water (Rs 0.10 per litre). Among the schemes that are based on groundwater and sub-surface water, the scheme based on percolation well has the highest capital cost (Rs 0.37) per litre of water supplied, which is followed by the one based on infiltration and bore wells (Rs 0.15/lit each); and dug wells (Rs 0.14/lit). But, one needs to use these figures with caution. There are many reasons for this. First: the life of the system would differ drastically with changing type of scheme. Though the water distribution infrastructure would have the same life across schemes, the life of the source would change across resource types. A large or medium reservoir which taps surface water from a large catchment would generally have a long life. At the same time, a well, which taps aquifer in the hard rock area, would have a very short life of 10-12 years. Second: wells are not substitute for regional water supply schemes. Instead, RWSSs are resorted to when local groundwater based sources fail due to droughts or resource depletion. Since they address the specific problem of source sustainability, comparison of costs between such schemes would be inappropriate.

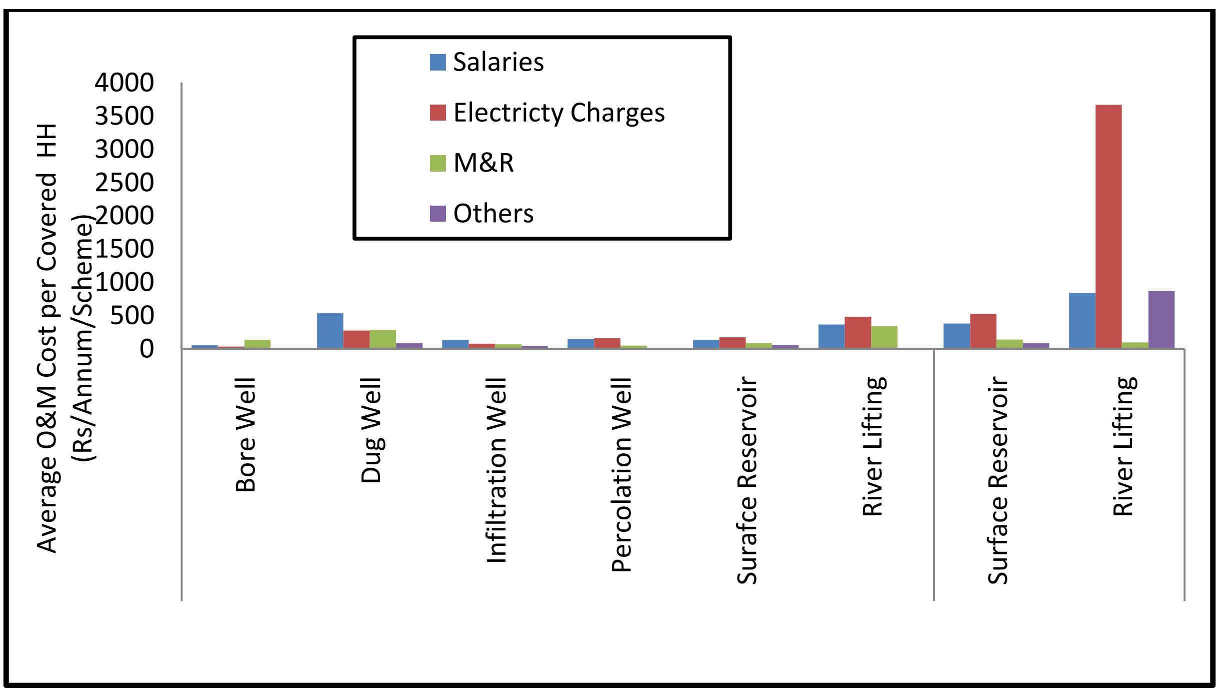


Figure 25: Scheme and resource-wise O&M cost per covered Household (HH)

(Source: Authors' own analysis using primary data collected from various water supply agencies)

As regards the average operational cost per household for the HHs covered by formal water supply, highest was for the regional schemes based on river lifting (Rs.5467), followed by single village scheme based on river lifting (Rs. 1190) (Table 16). One reason for the exceptionally high O & M cost for the regional water supply scheme based on river lifting is that a relatively small proportion of the households considered for design of the scheme actually benefit from it. This could be due to poor yield from the catchment. The average operational cost per household was lowest for the bore well based scheme and schemes based on infiltration well (Rs. 322) and percolation well (Rs.369). Interestingly, for the reservoir based multi-village scheme, the average O & M cost per year was only Rs. 1138 per HH, which is slightly lower than the O & M cost for the dug well-based scheme (Rs. 1181). This is contrary to the general perception that regional water supply schemes incur high operation and maintenance costs. The O & M cost was much lower for the single village scheme based on surface reservoir (Rs.445), which is less than half that of the dug well based scheme.

But to understand what factors contribute to the cost differences, it is necessary to look at the break up of these cost figures. The output show that the average maintenance and repair (M&R) cost per household (covered by the scheme) was the lowest for percolation well based scheme (Rs. 50/HH/annum), followed by infiltration well based scheme (Rs. 65/HH per annum). M&R was significantly higher for the individual village scheme based on wells (Rs 284/household/annum). For surface reservoir based schemes the values were Rs.86/HH/annum to Rs. 140/HH/annum, for single village scheme and regional water supply scheme, respectively.

Average salaries per covered household was also quite high in groundwater based individual schemes (Rs 373.4), next only to surface water based regional water supply schemes (Rs 473.3). Further, average electricity charges were significantly higher for regional schemes based on river lifting (Rs 1154.6/household covered), as water transport and distribution involved many stages of pumping to take water to high elevations. The electricity charges as a percentage of the annual O & M cost varied from 15 for single village bore well based schemes to the highest of 67 for regional water supply scheme based on river lifting. It would be seen that the electricity charges significantly contributed to the differences in O & M cost across scheme types.

Table 16: Annual Operation and Maintenance Cost (per HH) of Different Types of Water Supply Schemes

Type of Scheme	**Source**	**No. of Schemes Selected**	**Average Cost of Construction of RWSS (Rs Crore)**	**Average O&M Cost per HH covered (Rs/Annum/Scheme)**								
				Salaries		**Electricity Charges**		**M&R**		**Others**		**Overall**
				Amount	% to Overall	Amount	% to Overall	Amount	% to Overall	Amount	% to Overall	Amount
Individual GP (Ground water based)	Bore Well	1	0.19	55.2	24.2	34.5	15.2	134.7	59.2	3.2	1.4	227.6
	Dug Well	2	0.33	532.5	45.1	276.6	23.4	284.5	24.1	87.6	7.4	1181.2
	Infiltration Well	1	0.47	130.3	40.4	78.2	24.2	65.2	20.2	48.9	15.2	322.5
	Percolation Well	1	3.29	143.7	38.9	159.7	43.2	49.9	13.5	16.0	4.3	369.3
Individual GP (Surface water based)	Surface Reservoir	1	0.74	128.6	28.9	171.4	38.5	85.7	19.3	59.5	13.4	445.2
	River Lifting	1	0.15	367.4	30.9	480.0	40.3	342.9	28.8	0.00	0.0	1190.2
Regional (Surface water based)	Surface Reservoir	4	15.98	382.4	33.6	526.5	46.2	140.0	12.3	90.0	7.9	1138.9
	River Lifting	1	99.09	837.1	15.3	3667.2	67.1	94.1	1.7	869.2	15.9	5467.6

Source: Authors' own analysis using data furnished by MJP, 2012

7.1.5 Recovery of Water Tariff

Average water tariff per household connection varied from Rs 30/month/connection in bore well based groundwater schemes to Rs 75/month/connection in surface reservoir based regional schemes. For other covered household under regional water supply schemes, average bulk tariff varied from Rs 6 per kiloliter to Rs 8.33 per kiloliter.

Overall, average tariff collection (tariff recovery as a percentage of the total demand), was significantly higher for schemes that tap water surface water (70.5 %) than those which tap groundwater and sub-surface water (63%). It is to be kept in mind that the surface water based schemes also have significantly high proportion of the households under individual tap connection (Figure 26). Technology wise, average tariff collection was highest for regional scheme lifting river water (99.8%), which is followed by schemes extracting groundwater through dug wells (79.8%) and a bore well (79.25%); individual schemes tapping water through river lift (71.7%) and surface reservoir (70%); regional schemes dependent on surface reservoir (63%); and schemes extracting sub-surface water through water through infiltration (58.6%) and a percolation well (18%).

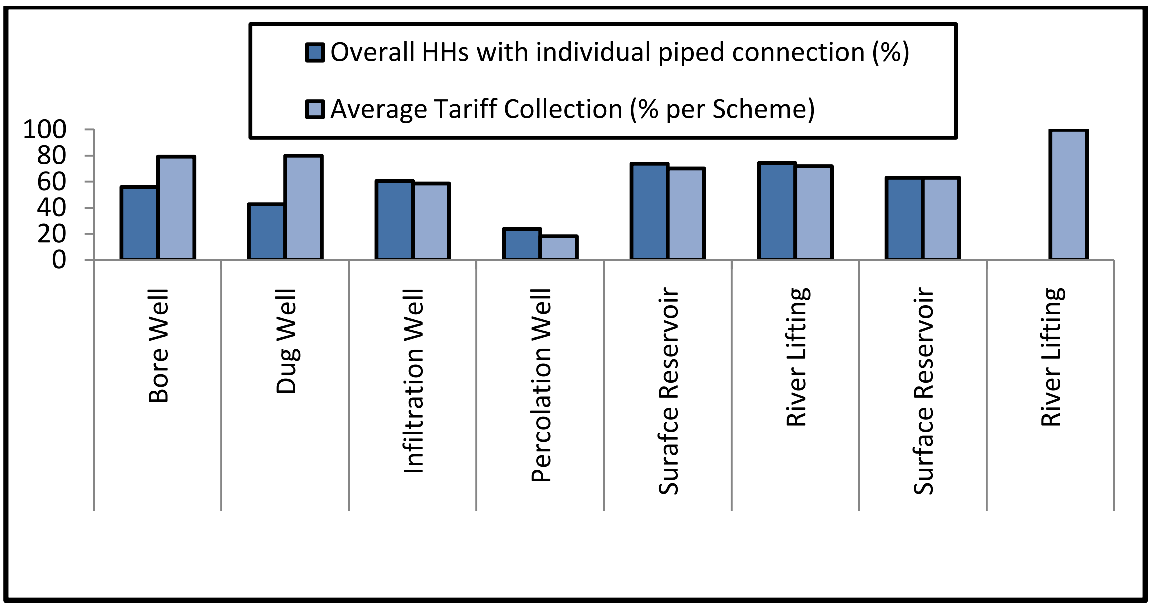


Figure 26: Scheme and source-wise individual HH connection and tariff collection
(Source: Authors' own analysis using primary data collected from various water supply agencies)

7.2 Degree of Decentralization in the Management of Rural Water Supply

Under the sector reforms, Village Water and Sanitation Committee is expected to perform many functions relating to the planning, design, execution and management of water supply at the local level for promoting decentralized management and community participation. For understanding the degree of decentralization in management, observed roles and responsibilities of GP/VWSC was compared with those that are expected.

As regards planning and designing of schemes, in 10 out of 12 selected schemes, planning and design of water supply schemes was undertaken by either technical wing of ZP or MJP. Only in two individual schemes, one based on dug well and other one on percolation well, planning and design of the scheme was carried out by VWSC. Further, in only 50% of the selected cases, GP built the scheme but they were found to operate all the selected individual schemes. However, as per the approved administrative procedures which are listed in table 6, all single village piped scheme with project cost ranging from 5 million to above INR 50 million has to be executed by GP. But MJP and ZP were found to have executed two of the selected 7 individual schemes (Table 17).

In the case of single village schemes, in most cases, the scheme was built by the GP, while in one case, the scheme was built by ZP and in another the scheme was built by the MJP. Nevertheless, in all cases, the scheme was operated by the GP.

In case of regional schemes, MJP emerged as the major player performing the function of main system management, while the operation and maintenance of the scheme components at the village level is done by the VWSSC. But, that too is done under the technical supervision of MJP. It is quite clear from this arrangement that the majority of management functions are in the hands of agencies such as MJP, and the ZP or the GP do not take charge of the system operation.

Table 17: details about decision on various aspects of water supply in selected schemes

Type of Scheme	Source	Average cost of construction (Rs Million)	Scheme Planned and Designed by	Scheme built by	Scheme Operated by	Institution Managing WSS in village
Individual GP (Ground water based)	Bore Well	1.9	ZP	GP	GP	GP
	Dug Well	3.3	VWSC, MJP	GP, MJP	GP	GP, VWSC
Individual GP (Sub-surface water based)	Infiltration Well	4.7	ZP	ZP	GP	VWSC
	Percolation Well	32.9	VWSC	GP	GP	VWSC
Individual GP (Surface water based)	Surface Reservoir	7.4	ZP	GP	GP	VWSC
	River Lifting	1.5	ZP	GP	GP	VWSC
Regional (Surface water based)	Surface Reservoir	159.8	MJP	MJP	MJP, VWSC	MJP,VWSC
	River Lifting	990.9	MJP	MJP	MJP	VWSC

(Source: Authors' own analysis using primary data collected from various water supply agencies)

Table 18 provides the details of the expected roles and no. of VWSC actually performing these roles. In the case of single village schemes, only a few functions are performed by every VWSSC. Seven out of the 13 identified functions are not performed by some of the VWSSCs. Marked difference is found between the VWSSC of regional schemes and that of single village schemes in terms of the number of functions being performed by the VWSSC. In the case of regional water supply schemes, less than 1/3rd of the village water and sanitation committees perform some of the roles vested with them (8 out of the 13). In other cases, the committees are largely defunct. Certain activities are not performed by any of the VWSSCs. For instance, none of the VWSSC of the regional schemes takes up roles like preparation of village water safety and security plan. Hence, it can be summarized that overall involvement of the village communities in the management of rural water supply is lesser for regional schemes as compared to local schemes.

Table 18: Roles Performed by the VWSSC against the Expectations

Functions expected of VWSC	**No. of VWSC performing the following Function**	
	Regional Scheme (Total of 183 VWSCs)	Individual Schemes (Total of 7 VWSCs)
Ensuring community participation & decision making in all phases of scheme activities	57	7
Organizing community contributions towards capital costs	0	7
Operating bank account for depositing community cash contributions and O&M funds	57	6
Preparation of village water security plan	0	3
Planning, designing, and implementing all water related activities in the village	57	7
Planning, designing and implementing all sanitation related activities in the village	57	3
Procuring construction materials/goods and selection of contractors (where necessary) and supervision of construction activities	57	6
Ascertain drinking water adequacy at the household level including cattle needs	48	4
Tariff Collection	57	7
Empowering of women for day to day operation and repairs of the scheme	0	5
Participation in communication and development activities in other villages	9	2
Testing of supplied water quality	57	7
O & M supervision and monitoring	57	7

7.3 Human Resource Capabilities

Though, there are no standard norms being followed in the State regarding number of agency staff required to handle water supply; distribution; and maintenance functions, it was found that the number of staff handling such functions were extremely low. Overall per 1000 households covered by water supply, only 0.33 technical staff; 0.21 managerial staff; 0.14 financial staff; 1.27 other non-technical staff; and 2.94 contract based staff were found to be handling the water supply functions. Number of technical staff was too low considering that the major functions for executing projects in case of individual village schemes and almost all the functions in case of regional water supply schemes are handled by them.

Among the schemes, highest no. of technical staff per 1000 covered households was found in individual groundwater based schemes (1.2) and lowest in individual surface water based schemes (no employee). Managerial staff was also highest in case of groundwater based schemes (3.5 per 1000 covered HHs) and lowest in individual surface water based schemes (no employee). However, non-technical staff per 1000 covered households was highest in individual surface water based schemes (4.3) and lowest in regional surface water based schemes (1.1). Further, only surface water based regional schemes had employed the contractual staff.

7.4 Governance of Water Supply

In this section, we would examine how far the governance of rural water supply has been decentralized by comparing the governance system prevailing in different types of schemes. While the governance is the art of rule-making, the key areas for rule making which are relevant in the context of rural water supply and which are being addressed in the research pertain to who decides on the following: a] the type of scheme; b] the source of water for the scheme; c] the water supply schedules; d] duration and timing of water supply; e] the individual connection charges; f] mode of pricing water and water rates; g] the penalty for non-payment; h] presence of complaint redressal mechanism; and i] the frequency of water quality monitoring. The outputs of the analysis are summarized scheme-wise in Table 19.

The results show that in the case of single village schemes, the governance of rural water supply is more or less decentralized, with mostly the GP deciding on the type of scheme and source, water supply schedules, duration and timing of water supply, the individual connection charges, mode of pricing water and water charges, penalty for non-payment of water charges wherever it exists and frequency of water quality monitoring. To an extent, the ZP is also found to be involved in performing some of the governance related functions. Contrary to this, in the case of regional water supply scheme, the ZP and MJP together replace the GP/ZP, with some of the governance roles being performed only by the MJP. For instance, in the case of regional scheme based on reservoirs, the MJP was perceived to have a significant role in deciding on the type of scheme, type of source, water supply schedule, timing and duration of water supply, individual tap connection charges, mode of pricing water and water rates, and frequency of water quality monitoring. At the same time, in the case of single village schemes, most of these decisions are taken mostly by the GP and to an extent by the ZP.

Table 19: Decentralization in Governance under Different Techno-Institutional Models of Water Supply

Who Decided on the following?	Percentage of Households Responding to the options																									
	Bore well Based Scheme to Individual GP					Reservoir to Many GPs						River Lift to Many GPs					River Lift to one GP					Reservoir to one GP				
	MJP	ZP	GP	ZP, GP and CL	Don't Know	MJP	ZP	GP	MJP and GP	PHC	Don't Know	MJP	ZP	GP	CL	Don't Know	MJP	PHC	GP	CL	Don't Know	MJP	ZP	GP	CL	Don't Know
Type of Scheme		45	55			26	25	47			2			99		1			50		50		100			
Type of Source		42	42	14	2	56	23	19			2	34	65			1			46		54		100			
Water Supply Schedule	1	1	92	5	1	12	23	62			3	1		78		21			44		56			100		
Duration and Timing of Water Supply			100			49		50						60		40			42		58			100		
Individual Tap Connection Charges	2	1	96	1		50		50						48		52			52		48			100		
Mode of Pricing Water and water rates	4	3	88	5		46		39	15					99		1			42		58			100		
Penalty for non-repayment – Yes	11					5											10									
Penalty for non-repayment – No	89					95						100					90					100				
Penalty decided by	3		11		25	8					66			14		86			10		90					
Complaint Redressal – Yes	100					99						81					66					100				
Complaint Redressal – NO						1						19					34									
Frequency of Water Quality monitoring	6		93		1	41		39		11	9			100				10			90			100		

8. Issues in Rural Sanitation

8.1 Variation in Sanitation Coverage across the State

There has been a notable improvement in rural sanitation in Maharashtra during the past 10 years, if the Census data are any indication. The percentage of households having improved toilets went up from a mere 18.2 to 38, by adding a total of 29.45 lac toilets in rural areas of the State in 10 years. Yet, nearly 55.2 per cent of the rural HHs does open defecation and 6.2 per cent access public toilets. As per 2001 Census, all 31 districts in the State have more than 60 per cent of the rural households without access to improved toilets. But, by 2011, this came down to 21. In 3 out of the remaining 12 districts, the number of HHs having no toilets is less than 30 per cent; the percentage is in the range of 30-45 per cent in four districts, and in another five districts, the percentage is between 45 and 60 (Figure 27).

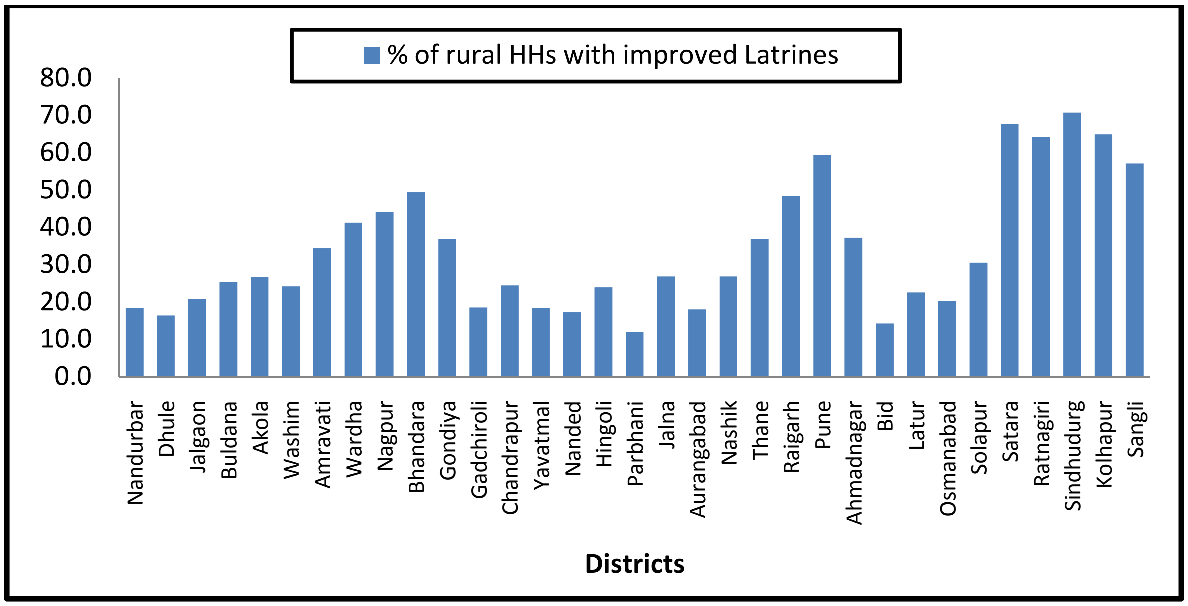


Figure 27: District wise variation in adoption of improved latrines, Maharashtra
(Source: Census of India, 2011)

8.2 What are the determinants for adoption of improved sanitation and hygiene practices?

The Total Sanitation Campaign (TSC), launched in 1999, was a major institutional reform in India's sanitation sub-sector. It marked a paradigm shift from a centralized supply driven Government schemes to a community-based "demand-driven" programme for improving the living environment in rural areas (WSP/GOI, 2008). The programme therefore provides very little subsidies for actual physical infrastructure, and embarks on social marketing techniques such as information, education and communication (IEC) to stimulate household demand for sanitation. Therefore, understanding the behavioral aspects for adoption of improved sanitation practices by the community and progress achieved under TSC for all components are the keys to evolve strategies for successful implementation of sanitation programmes in rural areas.

As discussed earlier in section 3.4 of the report, regression analysis involving district-level data of Maharashtra on percentage HHs with access to 'water sources within the dwelling premise' and the percentage of HHs with access to improved toilets show a strong correction.Similar relationship emerged when regression was run with rate of adoption of toilets against: 1] average per capita income of HHs in the taluka; 2] average literacy rate of the HHs in the taluka; and 3] percentage of HHs having assets within the households in each taluka (0.624). While it is now established that literacy rate and economic conditions of the family could influence the adoption of improved sanitation systems in rural situations, the strong correlation between adoption of toilets and access to drinking water sources required further investigation.

The primary data from the household survey carried out in the villages covered by the twelve sample schemes selected for performance assessment was used to see whether any relationship exists between access to water supply sources and adoption of improved toilets. Results of the analysis of the data are presented in Table 20. It showed that 72 per cent of those having access to tap water owned toilets, against 55 per cent for those who are dependent on public sources (stand post near the premise and away from the premise). The data clearly shows that access to piped water supply in the dwelling premise is not a pre-requisite for owning toilets, as more than half of those who do not have this facility also own toilets. But, the differential adoption rates could be because of the following two factors: 1] in certain cases poor access to water supply might reduce the ability of the households to fetch additional water required for flushing toilets; and,2] those having tap connections are economically better off than those using public sources.

Table 20: Type of Access to Water Supply and Sanitation

	Total No. of HHs	No of HHs Having Toilets	No of HHs Not Having Toilets	% of HHs Having Toilets
Access to Tap Water	485	347	138	72
Access to Public Water	369	204	165	55
Overall	854	551	303	65

Source: analysis based on primary data collected from 854 rural households

Nevertheless, the access to tap water supply seems to have a great bearing on the sanitation practices followed by the households. A very recent survey carried out by IRAP in Andhra Pradesh showed that the extent of use of individual household latrines is higher among those who have access to tap water within the dwelling premises connection when compared to those who depend on distant sources such as wells and hand pumps. When the water supply source is away from the dwelling, a much smaller percentage of the households who actually own toilets use them. This can be explained by the difficulty the members of the household, particularly children, will have in obtaining water from the distant public sources, for flushing toilets, which can be around 10-15 litre per use.

However, it is important to mention here that the influence of access to piped water supply on sanitation would be just as much as the influence of access to piped water supply on the ability to access more water. In other words, if lack of physical access to piped water supply is severely limiting the ability of a household to access manage for meeting its domestic requirements, the same can influence the family's decision to go for improved sanitation system.

9. Findings of the Study

25. The agencies concerned with rural water supply in Maharashtra are Maharashtra Jeevan Pradhikaran; Water and Sanitation Support Organization (WSSO); Groundwater Survey and Development Agency (GSDA); Zilla Parishad (ZP); the Village Water Supply and Sanitation Committee (VWSSC) under the Gram Panchayat. The key roles in the sector are: policy formulation (governance role); administrative approval of schemes; technical sanction; scheme execution; monitoring and O & M. What role a particular agency plays depends on the nature of the scheme (whether single village scheme or regional scheme) and the size. For instance, in the case of administrative approval, this is within the ambit of the GP if the total project cost is less than 50 lac rupees. But for a regional water supply scheme costing the same amount, it would be within the powers of the ZP to give the administrative approval. Further, for a scheme costing above Rs. 5 crore, the administrative approval can be given only the government, i.e., the Principal Secretary. Similar variations are found for functions such as technical sanction; monitoring and O & M. Only in the case of execution, it is within the powers of the VWSSC to carry out the work, irrespective of the size, if the scheme is "local" (i.e., single village based).

26. Each of the three professional organizations viz., the MJP, GSDA and WSSO are headed by one deputy secretary who reports to the Principal Secretary of the Department of Water Supply, Government of Maharashtra.

27. The Water Supply and Sanitation Support Organization's role is to enable community participation in management of rural water supply schemes and to promote adoption of improved sanitation practices in the villages. The organization is quite new and is still evolving.

28. The State of Maharashtra has made significant progress in improving the access of rural communities to water supplies for domestic uses, in terms of physical access to the source and the quality of water supplied over the past 10 years. But, even today, only half the rural households have access to tap water, and it includes those who access it from nearby sources and distant sources. Out of this, only 63 per cent of the tap water is treated. But, in terms of high quality water supplies, only 20.6 per cent of the rural households have access to treated tap water within their dwelling premise.

29. If we include those households which get treated tap water near their dwelling premise, the percentage would go up to 29.5, i.e., another 12 lac households.

30. Nearly 20 per cent of the rural households still depend on distant sources for their domestic water supplies. Of this more than 45 per cent depend on unprotected sources including uncovered open wells and canals, springs, ponds etc.

31. Nearly 1/6th of the rural households (15.7%) depend on hand pumps for domestic water supply. But, only in 14% of the cases, the households own these systems, and therefore have complete control over their functioning and management. In the remaining 86% of the

cases, the HHs are dependent on sources which are publicly owned, and hence have no control over the management of these systems.

32. As regards rural sanitation, between 2001 and 2011, number of rural households having any type of sanitation facilities increased from 18% to 38%. Still, almost 56 per cent of the rural households practice open defection in the State. But, the inter-district variations are remarkable. The extent of toilet coverage varies from a lowest of 11.9% in Parbhani to 70.7% for Sindhudurg. This variation can be explained by the differences in economic conditions, which actually changes the ability of the rural households to access improved water supply and sanitation facilities. Improved access to water supply also enables better use of improved toilets. Analysis using district level and taluka level data of the percentage HHs having improved toilets and the percentage households having individual tap connections show strong correlation. A strong correlation was also found between average per capita income of the district and the extent of toilet adoption in the rural areas.

33. Households are willing to invest in securing improved water supply such as treated water delivered through pipes which can reduce the time and effort required for collecting water and produce maximum health benefits. This is evident from the fact that consistently higher percentages of HHs across Tehsils have access to treated water from piped systems in their dwelling premises as compared to those obtaining water supply through such systems away from the dwelling premises, in spite of the fact that securing household connections involve payment of connection charges.

34. There is significant inter-regional difference in access to water supply from public systems in terms of nature of access and supply levels. The proportion of rural habitations having access to pipe water supply (PWS) varies from as low as 37.3 per cent for Nagpur to as high as 72.4 per cent for Amravati division. The proportion of rural households having access to PWS varies from a lowest of 44 per cent for Nagpur and Konkan to a highest of 72 per cent for Amravati. The percentage of households having individual tap connections varies from as low as 21 per cent for three divisions, viz., Marathwada, Konkan and Nagpur, to the highest of 36 per cent for Amravati.

35. Bacteriological contamination of all types of water sources at the source level and poor chemical quality of water supplied by groundwater based sources are issues facing sustainable rural water supply in Maharashtra. While the former is due to anthropogenic activities, the latter is due to poor natural quality of groundwater

36. The per capita water supply is highest for Konkan division, with 129 per day of average supply and is as low as 21 lpcd for Nagpur. Amravati division has an average per capita supply of 36lpcd, and Khandesh and N. Maharashtra has 62 lpcd. The rich water resource endowment of the region with good number of surface reservoirs, adequate capacity of the water supply infrastructure and the high affordability of the rural communities in the region to pay for the services might have helped improve the water supply situation.

37. Among the households covered by PWS, the monthly O & M expenditure per HH is highest for Konkan (Rs.49/month), followed by Pune division (40). It is lowest for Nagpur division

(Rs.17/month). The two important factors, which can influence the O & M cost are the proportion of the households which enjoy individual tap connection and the volume of water supplied per household. Pune has the highest percentage of 'PWS covered HHs with individual tap connections (69). Whereas, Konkan has the highest average per capita water supply (129 lpcd).

38. A comparative assessment of performance of rural water suppy schemes in six divisions of Maharashtra was carried out using data collected from the households covered by the schemes, the data provided by the official agency which have planned, designed and built the scheme, i.e., MJP. The analysis covered the managerkal perofmance, governance, decentraliation and community participation. The following are the findings of the analysis:

    a. The management performance ofsingle village schemes which are based on surfce water is better than that of their grounwater and sub-surface water counterparts. The overall performance of water supply schemes based on surface reservors (both single village and multi-village) is also better than that of shemes based on groundwater and sub-surface water. The indicators used for comparative performance evaluation are:water supply coverage (proportion of HHs covered by PWS, proportion of HHs having individual tap connection); adequacy of water supply (per capita supplies and per capita water use, extent to which supply requirements are met from the source); quality of water supply (degree of access to the source, average reduction in distance tothe source after the introduction of new source and the percentage of HHsdependingexclusively on it);average annual operation and mainenance costs;and revenue recovery.

    b. The degree of decentraliztion and community participation in management of the scheme is however much better for the single village schemes based on groundwater which were designed and built by the Zilla Parihad (in one case) and the Gram Panchayat (in four cases). All the village water and sanitation committees were reported to be performing six out of the 13key roles vested with them, while the remaining roles are perfomed by a lesser number of VWSSCs. But, in the case of regional water supply schemes, the schemes were built and operated by the MJP. Further, only in less than one third of the cases (57 out of the 183 VWSSC covered), the VWSSCs were performing some of the key roles, while in the rest of the cases, they are totally dysfunctional.

    c. In the case of single village schemes, most of the governance functions relating to water supply are performed by the local self governing institution of the Gram Panchayat and some by the ZP, whereas in the case of regional schemes based on reservoirs supplying water to many villages, MJP performs many of these functions along with the ZP and GP.

    d. The single village schemes based on surface water are run with lower number of technical and managerial staff as compared to groundwater based schemes in terms of number of staff per 1000 covered HHs, though they have higher number of contractual staff as compared to groundwater based single villae schemes. The regional schemes have lowest number of contractual staff per 1000 connected households.

39. The over-whelming dependence of the State of Maharashtra on groundwater resources for rural water supplies appears to be driven by the stated goal decentrlized management of water supply schemes, as village communities are generally happy managing schemes that are small. But, this has come at the cost of sustainability of water supplies not only from the point of view of providing sufficient quanties of water for meeting domestic water requirements throuout the year, but also in terms of the cost effectiveness.

40. Excessive withdrawal of groundwater for irrigated agriculture threatens the sustainability of wells and hand-pump based rural water supply schemesis in the hard rock areas of Maharashtra, with drinking water sources such as open wells, bore wells and handpumps getting dried up towards the onset of summer, due to lowering of water table and mining of aquifers. The enforcement of Maharashtra State Groundwater Regulation Act of 1993 hasn't been effective in regulating groundwater use by irrigators for protection of drinking . The failure of schemes forces the water supply agency concerned to resort to costly measures such as tanker water supply or stretching the infrastructure of the existing regional water supply schemes based on surface reservoirs to tide over the crisis in villages.

41. Lowering of water table, and reduced life and poor yield of underground sources mean high cost of production and supply of unit volume of water from the schemes based on such sources.

42. In regions with similar physical characteristics vis-à-vis hydrology, geo-hydrology and topography, the regional water supply schemes and single village schemes that are based on surface reservoirs ensure water supplies of higher dependability to the rural areas, as compared to schemes that are dependent on wells. The quality of water is better for schemes which tap water from surface reservoirs, as compared to those which tap water directly from rivers, groundwater.

43. Contrary to the popular notion that the operation and miantenance (O & M) cost of regional water supply schemes is higher than that of decentralized individual village based scheme that are dependent on local sources such as wells, the O & M cost per HH is lesser for single village scheme based on surface reservoir, and that of regional water supply scheme based on reservoirs is comparable with dug-well based single village scheme. This is in addition to the advantage of higher dependability and longer life of the systems. More importantly, the factor which causes major differences in the O & M cost is due to the higher salary being paid to the staff of the water supply agency.

44. If the comparative evaluation of the cost of water supply schemes take into account the actual life of the schemes and the oportunity cost of the failure to supply water during the lean season, the full economic cost of water supply provision would be much higher for groundwater based schemes. This is because of the fact that the cost of water supply through tankers to tide over crisis during summer time to remote villages is often prohibitively high.

45. The State of Maharashtra has the largest number of irrigation projects with reservoirs, water diversion and river lifting in the entire country. There are a total of 66 major schemes, 233 medium and 2777 State sector minor irrigation projects. While all the major and medium schemes are reservoir based schemes, the minor schemes consist of reservoirs, river lifting and diversion. These projects are scattered all over the geographical area of the State though there is relatively higher concentration of schemes in the Pune and Nagpur regions.

46. As indicated by a review of water audit report of irrigation projects in Maharashtra for the period 2007-08, and 2009-10, a large amount of water remains un-utilized in irrigaiton reservoirs pf the State at the end of the irrigation season, the largest amount being in reservors in Pune and Konkan regions and lowest in Aurangabad region. Surprisingly, the non-irrigation use from many schemes is less than planned use. During 2009-10, the total amount of un-utilized water in the reservoirs was to the tune of 1985 MCM. This is quite substantial if one considers the total amount of water required to meet domestic water needs in the entire State of Maharashtra.

47. It is a very appalling that when thousands of villages including those in the water-rich regions of the State reel under water shortage for meeting survival needs, the water stored in such large and expensive infrastructure goes un-utilized. Such a precarious situation prevails due to sheer lack of infrastructre for transporting the water from these reservoirs to the areas experiencing drinking water shortage in different parts of the State.

48. Currently, the willingness on the part of the GP or ZPs to take charge of running the regional water supply schemes is largely absent. Most of the regional schemes are still run by the MJP, while in a very few cases where the number of villages covered is small, the ZP had taken over the system running. The important reasons for this are the technical sophistication of the schemes, the lack of qualified staff to take care of the maintenance and fear of the financial burden of ‘high O & M costs’. Further, the response of the VWSSC in terms of taking over the village level maintenance of the scheme is also not encouraging. Majority of the VWSSCs formed under regional water supply schemes do not take up any of the functions expected to be performed by them.

49. Regional water supply schemes based on surface reservoirs are introuced when single village schemes based on local groundwater fail in the summer season. The fact that there are no regional water supply schemes based on groundwater in Maharashtra for transfering groundwater from distant localities due to the problems of technical feasibility suggests that comparing the performance of RWSS based on surface reservoirs and single village schemes based on groundwater on capital and O & M cost criteria would be inappropriate. The comparison should be between single village schemes based on groundwater and single village schemes based on surface reservoirs.

50. Yet, the regional water supply schemes based on surface reservoirs perform well in terms on physical and economic indicators such as the extent of coverage, the per capita supplies maintained, the proportion of HHs with individual tap connections,the degree of access to

the source, per capita water use and the annual O & M cost per household. While single village schemes based on surface reservoirs appear to perform better than the regional counterparts on many counts, they may not be feasible hydrologically and technicaly given the fact that surface reservoirs are few and their geographica spread across the is not good.

51. The degree of decentralization and community participation in management of water supply is found to be better in the case of singlevillage schemes. As regards decentralization, the single village schemes are mostly built and operated by the GP, whereas the multi-village schemes are built and operaated by the MJP, with the GP and ZP hardly showing any willingness to run them.As regards commmunity participation, in the case of single village schemes, the VWSSCs perform larger number of the functions expected of them, when compared to multi-village schemes.Overall, management decentralization is found to be working in the case of single village schemes, while the VWSSCs are totally dysfunctional in most of the vilages under multi-villages. Further, governance functions are decentralized in the case of single village schemes, with GP performing most of the functions, while a few left to the ZP. Whereas in the case of multi-village schemes based on reservoirs, many of the governance functions are left to theMJP.

52. The factors that explain higher management performance levels in the case of water supply schemes which tap surface water from reservoirs, can be as follows: a] the schemes tap dependable water source and the chemical quality of the water is good; b] the schemes are planned, designed and operated by a professional agencylike te MJP and therefore can berun efficiently from technical and economic points of view; and c]the agency can protect the sources from any threat to its sustainability from competing uses. Since the treatment of raw water from the reservoirs can be done in a cost effective manner, and the supplies are more dependable than that from the local sources and generally free from chemical contaminants such as TDS and fluoide, the village communities also show greater willingness to obtain individual tap connections.Improved access to water supply in terms of physical access to the source, and better quantity and quality of water would also promote greater use and adoption of improved sanitation systems.

53. Type of access to water supply influences sanitation practices in rural areas. As has emerged clearly from the analysis of primary and secondary data on access to water supply sources and adoption of improved sanitation practices by the households, providing the rural households with reliable and dependable source of water supply which ensures adequante quantity of water for domestic needs would boost adoption of improved toilets by the households, if their economic conditions are favourable.The household survey showed that while 72% of those having access to tap water owned improved toilets, only 55% of those depending on public water sources owned them. Further, piped water supply to the households through individual household connection would would increase the chances of use of the toilets already constructed by all the members of the household because of the convenience in fetching water for flishing the toilet and personal hygeine.

10. Strategies for Improving Rural Water Supply and Sanitation in Maharashtra

10.1 Augmenting Water Supplies and Improving Distribution Infrastructure

One of the key strategies to improve the performance of rural water supply schemes in Maharashtra is to ensure greater dependability of the sources. Our analysis has shown that surface reservoir based schemes are more dependable than those tapping groundwater and sub-surface water. Maharashtra has one of the largest concentrations of large and medium reservoirs, primarily meant for irrigation.

As per water audits carried out by the irrigation department of Maharashtra, there is availability of un-utilized flows by the end of the irrigation season and the evaporation rates are also high. This means, there is enormous scope for improving the performance of these reservoirs. Keeping the water in the reservoirs till the end of summer increases the evaporation hugely, as evaporation rates are very high during the hot summer. While one can argue that water in many reservoirs is earmarked for meeting drinking water requirements during summer months, it is also evident that the planned water utilization is not realized. The water utilization for non-irrigation purpose in many projects has been lower than planned, while in some cases, the urban water supply has been found to be little higher than the planned allocation. This includes basins which are water abundant and water surplus, as well as those which are water deficit and highly deficit and normal basins. The following paragraphs illustrate this phenomenon.

In Bhima (Ujjani) project of CADA Solapur, which falls under 'highly water deficit' category, the water use for non-irrigation purpose was 3% less than the PIP provision.

In Katepurna project of AIC Akola, which falls in the 'water deficit' category, the non-irrigation use was 67% of the provisions in the project report. In Manjra project, which also falls in the same category, water used in Rabi by canal flow was 150% of PIP whereas non irrigation use was only 65% of PIP. Utilisation in HW was against the PIP. In Purna project, which also falls in the same category, water utilisation by canal in Rabi & HW was higher than the provision in PIP by 40% and 15% respectively, whereas the non-irrigation use was lower than the PIP by 30%. In Manar project of AIC, Nanded, the actual non-irrigation use was only 63% of the PIP.

In Khadakwasla and Pawna projects, which fall under 'normal' category, non-irrigation use of water is very high mainly due to supply of water to Pune and Pimpri-Chinchwad Municipal Corporations. On Dhudhganga project, which falls under 'water-abundant' category, non-irrigation use was 21% less than PIP provision and most of the irrigation done on river lift against the water provision made on canal utilization in (PIP). Situation similar to Dhudhganga project has been observed on Warna, Tulsi, & Radhanagari projects also (GoM, 2009).

The water audit report of the irrigation projects for the year 2009-10 also showed similar trends. The summary of water audit for 2300 schemes covered in the water audit is given in Table 21. The audit results basically point to the fact that many irrigation projects in the State, which are in water deficit as well as in the water abundant regions, have surplus water even by the end of the irrigation (summer) season. This is a highly discouraging trend that when thousands of villages in many parts of Maharashtra face acute water shortage during summer months, the water stored with large and costly infrastructure goes un-utilized. This is due to sheer lack of infrastructure for distribution of water from these reservoirs to areas facing drinking water shortage at times of necessity. This surplus water can be used to augment non-irrigation supplied. The increased allocation of water from these reservoirs for non-irrigation use can also help prevent the evaporation losses from the reservoirs.

This would require building of water distribution network using pipelines across the State to enable transport of water from these reservoirs to areas which experience severe water shortage. Provision should also be made for storing the water diverted from the reservoirs in local surface storages in the areas of demand, in order to cope with the inter-annual variability in rainfall and stream flows. This water can be used for distribution within the villages through feeder pipelines to feed water to the existing piped distribution system in the villages.

Table 21: Summary of water auditing data for irrigation projects in Maharashtra (2009-10)

Name of Region	Irrigation use (MCM)	Non-irrigation use (MCM)	Un-utilized water (MCM)	Total storage (MCM)	Non-use as percentage of total storage
Aurangabad	999.5	536.3	52.5	1588.4	3.3
Nashik	1825.4	557.1	157.3	2539.9	6.2
Amravati	441.6	153.2	231.6	826.4	28.0
Nagpur	1985.2	322.9	163.1	2471.2	6.6
Pune	6687.7	1158.6	918.4	8764.7	10.5
Konkan	438.1	412.9	462.1	1313.1	35.2
Total for Maharashtra	12377.5	3141.1	1985.1	17503.7	11.3

(Source: Report of Water Auditing of Irrigation Schemes in Maharashtra 2009-10)

Banking on the large reservoirs which provide dependable water supplies, as source of water for regional water supply would enable treatment of the raw water, owing to economies of scale. Provision of good quality treated water would motivate the communities to go for individual household tap connections, thereby improving the degree of access to water.Improved access to dependable water sources would motivate the rural households with favourable economic conditions to go for toilets as they would be able to derive maximum benefits out of them.

10.2 Building Institutional Capacities

Our analysis shows that the local village level institutions are not equipped to mange rural water supply systems, particularly when the systems are technically sophisticated or large. Even the ZPs are not adequately equipped to run the regional water supply schemes.Under such circumstances, it is appropriate to hand over the charges of operation and miantenace of the regional water supply schemes to professional agencies and limit the role of the local sel governing institutions such as the Panchayat to the ‘overall governance of the schemes’, until capacities are built in the local PRIs to run such sophisticated schemes. Insisting on local PRI to run rural water supply schemes would only result in these local bodies making technoloical choices that are unsound from the point of view of sustainable water supply.

The governance role for the PRI would include taking decisions on: i] the criteria to be used and process to be followed for determining the per capita supplies and water supply schedules, against standard norms on per capita supply being followed at present; ii] who or which agency should fix the water charges; and, iii] what should be the criteria for fixing water charges; and, iv] the process of awarding the contract for building the schemes.In addition, the VWSSC can also undetake collection of water cess from the users. Nevertheless, in the case of single village schemes, the limited manaagement functions the VWSSC perform shouldcontinue.

Our analysis shows that the staff strength of MJP, which is the primary agency for planning, execution, monitoringof rural water supply schemes in Maharashtra, has reduced over time in terms of the permanent technical staff who are competent to run the schemes. The agency depends heavily on contractual staff. This can pose serious challenge to long term sustainability of rural water supply in the State. The situation appears alarming when one looks at the staff strength per thousand HH or per habitation covered under the schemes built and run by the agency. While the number of schemes and the coverage in terms of number of habitations and households has increased over time, the overall staff strength has actually reduced. The human resource and financial capacity of this agency needs to be strengthened to meet the future challenges with more number of villages and habitations getting catered to by the regional schemes, and with the additional responsibility of O & M being handed over to the MJP.

11. Policies for Sustainable Rural Water Supply and Sanitation in Rural Maharashtra

11.1 Inter-sectoral water allocation policies

The National Water Policy (2012) envisions that domestic water supply gets priority over other sectors of water use in water allocation decisions. The policy also emphasizes on using economic principles for pricing of water. But, the use of the economic principles for pricing of water would be inappropriate without prior allocation of water for various sectors of water use. The reason is that the economic principles suggest that marginal returns from the use of water should form the basis for fixing water prices for ensuring affordability. Since the marginal returns are very high for manufacturing, the affordability in this sector would be generally high. Under such circumstances, the blanket use of this policy can lead to over-allocation of water from river basins to manufacturing sector and other sectors where water is used for economic activities, depriving the priority use sectors.

Hence, it is important that from the total renewable surface water in the basin, which includes what is already appropriated through reservoirs and diversion systems and the "un-committed flows", a portion is first allocated to the high priority sector of domestic water use in rural and urban areas, based on the actual requirements of the respective sectors. Further allocation from the balance can be made to other competing use sectors such as irrigation and industry. The demand of water for drinking and domestic uses can be estimated on the basis of the population size and the realistic norms of per capita water supplies. Even in the most water-scarce sub-basins of Krishna and Godavari, the available renewable surface water resources would be far higher than the amount required for the domestic water needs of the population in rural and urban areas of the basin.

But, in order to affect physical allocation of water to the areas of demand, it is important that the infrastructure for water storage and distribution be created. As is evident from the water audit report of the irrigation projects of the State, though a portion of the water stored in many irrigation reservoirs built is earmarked for non-irrigation uses, in many instances, the actual water allocation (release) for non-irrigation uses is much less than the volumetric provision done at the time of project planning. Further, the water audit reports show that many reservoirs have large amount of water remains un-utilized even at the end of the irrigation season. This happens because of the lack of clear cut and enforceable water allocation policy.

11.2 Investment policies in rural water supply

There is a need for life cycle cost analysis (LCCA) in choosing the best alternatives in water supply systems. The investment policies relating to water supplies need to take into take into account the concerns of source adequacy, source dependability and long term sustainability of the sources, and cannot be merely driven by size of the onetime capital investment required per capita, or the O & M requirements per capita. Taking into account considerations such as opportunity cost of inadequate supplies, poor dependability of the source or the permanent failure of the source before the design life in costing of various technical models of water supply would encourage investments in expensive (capital intensive) options which are cost effective in the long run.

11.3 Policies relating to selection of source and technology for rural water supply

The policy regarding selection of technology for water supply should be driven by resource sustainability and source sustainability considerations rather than consideration of decentralized management of the water supply scheme. Ideally, the sources wherein the physical allocation of water for domestic water supply is not technically feasible and whose sustainability is likely to be threatened by competition from other sectors of water use needs to give way to those wherein such allocation of water and its enforcement are possible. Reservoir based piped water supply schemes are the best bet technologies for rural water supply in terms of dependability and source sustainability. This is because it is easy to enforce restrictions on the use of the resource by competing users and the land use in the catchments which yield water. They are far more superior to schemes based on wells and bore wells, which tap hard rock aquifers, as is evident from the well hydrographs. The schemes which tap water from flowing streams and rivers should be resorted to only when such sources are highly dependable in terms of quantity and quality across seasons. Further, groundwater based schemes can be resorted to in alluvial areas where the chances of seasonal depletion of the aquifers do not exist.

11.4 Policies relating to selection of institutional models for managing rural water supply

The current policy relating to rural water supply is like putting the cart before the horse. Since decentralization is given thrust in rural water supply, the tendency is to go for schemes which the Panchayat water supply and sanitation committees can manage. Instead, the nature of technology chosen for water supply based on the consideration of sustainability of the resource and source, should guide the institutional choice. From a study of the geo-hydrological and geo-hydrological environment of the State, it is imperative that local groundwater based rural water supply schemes won't be able to provide reliable water supplies in most situations, except in the small pockets of alluvium. The thrust would therefore be on reservoir based schemes.

Large and medium reservoirs, which ensure dependable supplies, are very few in the State of Maharashtra. It is a little more than 300 in number. Again, many of them are located in a few water-abundant river basins, requiring large-scale water transport. Therefore, such schemes can offer economies of scale, only when large number of villages is covered under a single scheme. This would obviously offer a lot of challenges from the point of view of hydraulic engineering in design and operation. This is because such systems would require sophisticated high capacity pumping machinery, long distance water transport, piped water distribution, flow regulators, pressure control devices, and on-line real time monitoring using systems such as SCADA.

Professional centralized institutions with required technical knowhow and expertise and financial resources are required to design, build and run such technically sophisticated schemes. More importantly, the institution, which designs the scheme, should ideally run it, for efficient management.

Under the current circumstances, the local Gram Panchayats won't be able to run such schemes. The Zilla Panchayats also may not have the required technical knowledge and expertise to run such schemes. Even the limited numbers of schemes, which these ZPs are currently running, were designed by MJP, and face problems in operation. Only those schemes, which are very small in size, covering a few villages should be handed over to ZPs. The groundwater based schemes and other single village water supply schemes can be handed over to Gram Panchayats to run. The large regional water supply schemes should be handed over to the MJP.

11.5 Policies and norms relating to water supply levels

There are no clear cut policies and norms relating to the level of water supply to be maintained in rural water supplies in Maharashtra like in other parts of the country. The water supply for the State-funded schemes is decided on the basis of a standard norm of 40lpcd. Whereas in some of the externally funded schemes, liberal norms for water supply are used, wherein the per capita supply norm used ranges from 55-70 lpcd. But, the actual amount of water accessed by the communities is far less than this in three of the six divisions of Maharashtra. These norms are not arrived at on the basis of any scientific assessment of the actual water requirement of the rural households for meeting the domestic water needs for maintaining good health and hygiene and environmental sanitation.If improved latrines are to be adopted by rural families, then the per capita domestic water requirements would increase significantly. Additional water would be required to take care of the productive water needs such as livestock rearing, backyard cultivation and kitchen gardens. The policy on water supply levels should take into account socio-economic and climatic factors while working out the domestic water requirement for different regions. At the same time, it should be an "enabling" framework, which allows the line agencies concerned to work out the per capita water requirement based on the criteria set by the local sell- governing institutions, i.e., the Gram Panchayat on what uses the domestic supply should cover. This would mark a freedom from the standard and outdated norms relating to per capita supply levels. Liberal norms on domestic water supply levels would promote improved sanitation.

11.6 Policies relating to pricing of water supplies and subsidies

Ideally, for ensuring financial viability of the schemes, pricing of water for domestic water supply should be driven by marginal cost considerations. Here, the marginal cost would include the following: i] the long-term marginal cost of infrastructure for production and supply; ii] the environmental cost of degradation of water resources due to diversion from the natural system and pollution of water bodies due to wastewater return flows; and, iii] the opportunity cost of depletion of the water.

If we go by this norm, the cost of water supply would keep varying widely between regions, with very high costs in naturally water-scarce regions and comparatively low costs in water abundant and water surplus regions (Arghyam/IRAP, 2010). Secondly, for many water supply systems, particularly those in water scarce regions, the long term marginal cost of water production supply would work out to be so enormous that most people in rural areas would find it un-affordable. Since what is being achieved through provision of water supply for basic needs is a 'social good', with positive welfare effects of individual household water security[3], it is desirable to

[3] The welfare effects would include reduced malnutrition and infant mortality, increased environmental sanitation, reduced school drop-out and better employment opportunities.

introduce subsidies in order to ensure that every household is able to access water to meet the basic requirements.

The foregoing discussions point to the fact that a uniform price for water across regions, without taking into cognizance the socio-economic realities and the cost of obtaining water, would be irrational. The policy for water pricing should be such that the actual prices are decided by the 'long term marginal cost' and 'affordability' considerations. Adoption of such a policy would allow flexibility in fixing water charges. It would mean that in some regions, the extent of subsidy required would be very high, whereas it would be quite low in regions which are water abundant and where the communities are rich.

11.7 Policies for chemically affected areas like fluoride, salinity, nitrate

There are many difficult areas and regions (like hilly/mountainous regions and coastal strips) where obtaining adequate amount of good quality water from the natural system for making water supply provision would be extremely difficult. Besides these, these are areas which are affected by fluoride and nitrates. At least in some of these areas, getting surface water from reservoirs would be prohibitively expensive due to topographical constraints. In such situations, unconventional methods of water supply, such as desalination, de-fluorination, roof top rain water harvesting etc., will have to be resorted to. But, investment decisions for such alternative water supply systems should be based on a proper evaluation of the cost, against that of the more conventional measures such as regional water transfers. In all probability, schemes based on such technical systems would be far more expensive than the conventional schemes. For instance, it was found that roof top rainwater harvesting systems, though physically viable in high rainfall areas (Kumar, 2004; Kumar, 2009), would be very expensive, with the unit cost of water supply touching around Rs. 75 per m^3 of water (Kumar, 2009). This suggests that investment policies for rural water supply in such difficult areas should be flexible and liberal to accommodate costly systems.

11.8 Immediate and long term action points

The above discussed policies for sustainable rural water supply and sanitation in Maharashtra can be grouped into the immediate, mid-term and long term action points depending on the priority needs of the sector (Table 22).

Table 22: Action points for sustainable rural water supply and sanitation in Maharashtra

Sr. No.	Type of Action	Requisite Policy for	Key Considerations	Major Action Points/Recommendations	Cost Implications
1.	Immediate and Mid-term	Investment in rural water supply	a) Investment decisions should not be merely driven by size of the onetime capital investment required per capita, or the O&M requirements per capita. b) It should take into account considerations such as opportunity cost of inadequate supplies, poor dependability of	a) Need for a life cycle cost analysis (LCCA) in choosing the best alternatives in water supply systems (source adequacy, source dependability and long term sustainability).	

			the source or the permanent failure of the source before the design life in costing of various technical models of water supply.		
		Selection of source and technology for rural water supply	a) Such policies should be driven by resource sustainability and source sustainability considerations rather than consideration of decentralized management of the water supply scheme.	a) Because of ease in enforcement of restrictions on the use of the resource by competing users and the land use in the catchments which yield water, reservoir based piped water supply schemes are the best bet technologies for rural water supply in terms of dependability and source sustainability. b) They are also far more superior to schemes based on wells and bore wells, which tap hard rock aquifers. c) Schemes which tap water from flowing streams and rivers should be resorted to only when such sources are highly dependable in terms of quantity and quality across seasons. d) Groundwater based schemes can be resorted to in alluvial areas where the chances of seasonal depletion of the aquifers do not exist.	
		Selection of Institutional model for managing rural water supply	a) Nature of technology chosen for water supply based on the consideration of sustainability of the resource and source, should guide the institutional choice. b) Professional centralized institutions with required technical knowhow and expertise and financial resources are required to design, build and run such technically sophisticated schemes.	a) Local groundwater based rural water supply schemes won't be able to provide reliable water supplies in most situations, except in the small pockets of alluvium. The thrust would therefore be on reservoir based schemes. b) Many of the large and medium reservoirs are located in a few water-abundant river basins, requiring large scale water transport. Thus, such schemes can offer economies of scale	

			c) The institution, which designs the scheme, should ideally run it, for efficient management.	only when large number of villages is covered under a single scheme. c) Only those schemes, which are very small in size, covering a few villages should be handed over to ZPs. The groundwater based schemes and other single village water supply schemes can be handed over to Gram Panchayats to run. The large regional water supply schemes should be handed over to the MJP.	
		Water supply levels norms	a) Policy on water supply levels should take into account socio-economic and climatic factors while working out the domestic water requirement for different regions.	a) Concerned line agencies to work out the per capita water requirement based on the criteria set by the local self-governing institutions, i.e., the Gram Panchayat on what uses the domestic supply should cover. b) Liberal norms on domestic water supply levels would promote improved sanitation.	
		Rural water supply provisions in chemically affected areas.	a) Investment decisions for such alternative water supply systems should be based on a proper evaluation of the cost, against that of the more conventional measures such as regional water transfers. b) Investment policies should be flexible and liberal to accommodate costly systems.	a) Unconventional methods of water supply, such as desalination, de-fluorination, roof top rain water harvesting etc., needs to be promoted.	
2.	Long-term	Inter-sectoral water allocation	a) Infrastructure for water storage and distribution be created.	a) From the total renewable surface water in the basin a portion is first allocated to the high priority sector of domestic water use in rural and urban areas, based on the actual requirements of the respective sectors. b) Further allocation from the balance can be made to other competing use sectors such as	

				irrigation and industry.	
		Pricing of water supplies and subsidies	a) Pricing of water for domestic water supply should be driven by marginal cost considerations. b) Uniform price for water across regions, without taking into cognizance the socio-economic realities and the cost of obtaining water, would be irrational.	a) Actual prices are decided by the 'long term marginal cost' and 'affordability' considerations. This would allow flexibility in fixing water charges. b) For e.g., in water scarce areas (very high cost of water supply), the extent of subsidy required would be very high, whereas it would be quite low in regions which are water abundant and where the communities are rich.	

12. Conclusions and Recommendations

The reforms which started in early 1990s have changed the way rural water supply was operated and managed in the State. New Acts, institutions, and policy were framed all through the course but still the overall coverage to improved water sources remains low in rural area. Further, some of the landmark decisions taken earlier with regard to the choice of technology, i.e. shift of focus from groundwater based individual supply schemes to surface water based regional supply schemes, were revoked and that had an adverse impact on the supply source sustainability. It has been shown that provision of household water supply and sanitation has a strong positive impact on the mortality rate for children below five years. But, this is not the case for community stand posts or wells (World Bank, 2010). This is significant information for framing sustainable water supply policies for Maharashtra, as community stand posts and wells are the main mechanism for water delivery in rural areas of the State.

Further, both the quality and quantity of water supplied in rural areas remains a matter of concern. A UNICEF supported study by IRAP (2011) found that in the project villages in Satara, Latur and Chandrapur districts, there is greater scarcity of water in the summer months. GoI (2008) report highlights that though the present trend to measure coverage in terms of litre per capita per day (lpcd) underscore the principle of meeting the basic minimum need of drinking water for all the rural population on a sustainable basis, there is a need to shift from the conventional norms of lpcd to ensure drinking water security for all in the community.

Overall, the reform agenda seems to have got compromised on physical sustainability in rural water supply and the role of technology choice in ensuring that. Instead, it had focused simply on decentralization. Here again, institutional arrangements are not put in place to ensure that the local institutions responsible for decentralized management have adequate institutional capabilities for governance and management of rural water supply. Even in the case of single village schemes, the Village Water Supply and Sanitation Committees do not perform all the management functions.

Progress in sanitation sub-sector is far from satisfactory. Though the State started some innovative approaches in early 2000, the efforts were not sustained in the years to follow. TSC which started in 2000 in the State with just four districts now covers all the districts but the coverage remains abysmal due to absence of any proper State rural sanitation policy. In 2011, 55.8 per cent of rural households in the State are still without access to any sanitation facilities. A study estimated that the total economic impacts of inadequate sanitation in India amounts to Rs 2.4 trillion a year, which is equivalent to 6.4 per cent of the country's GDP in 2006. These adverse economic impacts of inadequate sanitation include costs associated with death and disease; accessing and treating water; and losses in education, productivity, time, and tourism (WSP, 2010). Clearly there is a need for revising the strategy, with a focus on overcoming the temporary and permanent constraints facing the rural communities in adopting improved toilets.

The approach of planning, designing and implementing rural water supply schemes as single use systems has to get replaced by schemes which can take care of both domestic and productive uses of the village community. Further, if sustainability of the source has to become a priority, then the strategy has to change from groundwater based single village schemes to reservoir based regional water supply schemes, unless proper enforcement of groundwater regulation is done. With the large number of major and medium reservoirs scattered across the State, and with around 2,000 MCM of water remaining un-utilized in these storage systems at the end of the irrigation season every year, augmenting water supplies of the existing village or regional schemes should be possible with the building of large distribution network using pipelines.

To ensure sustainable water supply in rural areas, major reforms are need on the policy font. Having recognized drinking water as the priority sector in the State water policy, water resources in different river basins in the State of Maharashtra needs to be allocated across different competing use sectors by a legitimate agency, to ensure sufficient water availability for basic survival needs, rather than leaving it to the market forces to decide Having said that, selection of technology for water supply should be driven by resource sustainability and source sustainability considerations rather than the goal of 'management decentralization'. Whereas the decisions on the nature of institutions to manage water supply schemes should be driven by the technology choice rather than vice versa. Professional institutions with required technical knowhow and expertise and financial resources are required to design, build and run technically sophisticated schemes. Further, the institution, which designs the scheme, should ideally run it.

For sustainable water use, the decision on levels of water supply should take cognizance of the socio-economic and climatic factors while working out the domestic water requirement for different regions. The policy framework should also be an "enabling" to allow the line agencies concerned to work out the per capita water requirement based on the criteria set by the local sell-governing institutions. Investment policies in water supplies should take into account considerations such as opportunity cost of inadequate supplies, poor dependability of the source or the permanent failure of the source before the design life in costing of various technical models of water supply. The pricing of water has to be driven by the considerations of long-term marginal cost of production and supply of water, and the socio-economic conditions of the target community in order to make the scheme financially viable, while ensuring affordability. Therefore uniform pricing across the State will not work. Investment policies for rural water supply in difficult areas should be flexible and liberal to accommodate costly systems.

On institutional development front, the VWSC needs to be properly trained so that they can take effective part in design and O&M of single village schemes. Thus community can feel the incentives and take active part in operation and maintenance of the systems. The scheme with multiple uses should consider all the available sources in the area in order to judiciously use them.

In the case of regional water supply schemes covering large number of villages, the system operation should be handled by the MJP. As they are involved in planning and execution, such an approach would improve the operational efficiency. The financial and human resource capacities of the MJP need to be strengthened so that they could play an effective role in rural water supply management.

For sustainable sanitation, provision of subsidy for construction of toilets alone will not be sufficient. The reasons for non-adoption of toilets in rural areas are not merely economic. There is a need to focus on health and hygiene education leading to demand for sanitation by the households and behavioral changes. That said, access to water supply source will have a bearing on improved sanitation practices, in the sense that if lack of physical access to piped water supply is severely limiting the ability of a household to access manage for meeting its domestic requirements, the same can influence the family's decision to go for improved sanitation system. There is a greater need for designing water supply projects with due consideration to sustainable sanitation as one of the goals.

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