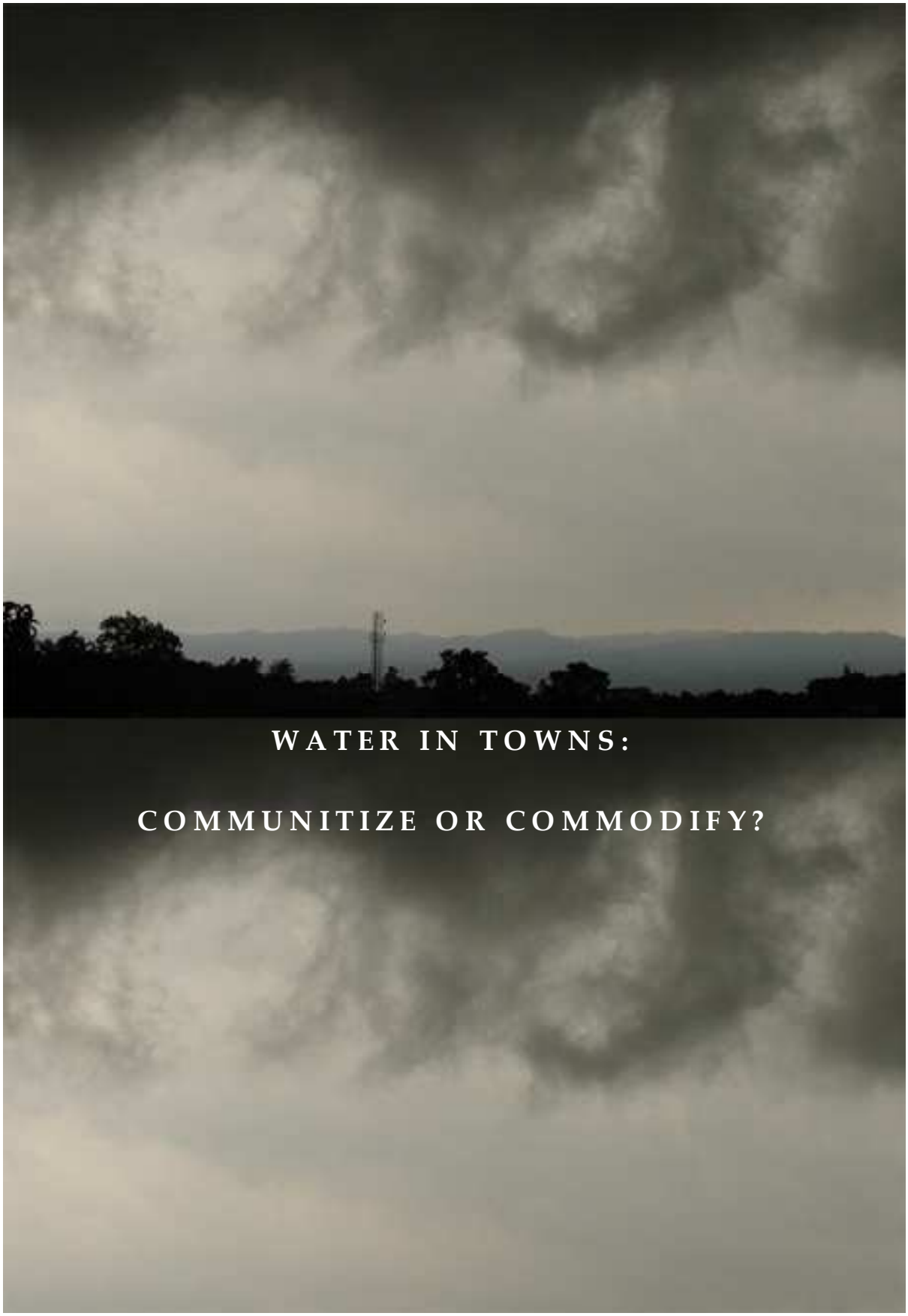

WATER IN TOWNS:

COMMUNITIZE OR COMMODIFY?

About the cover:

A picture of Dehradun's heavily overcast September sky with the middle range of the Himalaya forminga massive backdrop.

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Acronyms

ADB – Asian Development Bank

UJS – Uttaranchal Jal Sansthan

UPSVANN – Uttaranchal Peyjal Sansadhan Vikas Avam Nirman Nigam

AME – Academy for Mountain Environics

ATF – Alt.Tech Foundation

BCIL – Biodiversity Conservation India Limited

WWD – Water Works Department

Units

MLD – Million Litres per Day

KL – Kilolitres

KM - Kilometres

LPM – Litre Per Minute

KWH – Kilowatt Hour

OHT – Overhead Tank

HP – Horse Power

LPCD – Litre per Capita per Day

Conversions

We have adhered to the British usage of 'grammes' [not 'grams'], 'programmes' and not 'programs', and so on. We have avoided miles in preference to kilometres, and kept away from acres and chosen hectares instead. We have used Celsius instead of Fahrenheit and all references to dollars are to US dollars.

In India we have locally specific scales like lakhs and crores. A lakh is equivalent to 100,000. There are 10 lakhs in a million. And there are 10 million in a crore. The reader will do well to bear in mind that 1 HP = .786 Watts and 1 KL = 1000 L.

The units of computation that the book uses throughout this presentation are:

MLD – Million litres per day

KL – Kilolitres

LPM – Litre per minute

KWH – Kilowatt hour

OHT – Overhead tank

HP – Horse power

LPCD – Litre per capita per day.

01. Overview

Water is not about water. Water is about building people's institutions and their power to take control over decisions.

When we began this effort at Dehradun on a Rapid Action Analysis of the existing water supply systems in this ancient valley town that we chose under the *24x7 Urban Water Supplies – New Innovations for Meeting MDGs in South Asia*, we didn't quite realize that this was a town that was as ripe as it is for a change to a full-service 24x7 system.

We approach the study as part of an innovative process of feasibility assessments and transformation of towns (ranked in 4 tiers from 1 million to less than 100,000) to usher in a nation-wide template for full service continuous water supply. We recognize the key elements of the process to be:

a) A recognition of the key role of communities to extend Private-Public-People Partnerships since the word 'public' has very nearly become representative of only the Government, and not of the people.

b) Identifying different situations for towns so as to capture a variety of urban situations

c) Initiation of process implementation through small, specific demonstration projects.

We launched upon this task of blueprinting a programme for providing continuous water supply to Dehradun after consultations with ADB, who expressed their willingness to support the effort.

We have been working in the Dehradun region since the early nineties. In 1996, the group conducted a city-wide study of Dehradun and launched a year-long campaign advocating a full-service continuous water supply system. So when the idea of having such a system in India was initiated by the ADB, the natural choice of the Consulting Group was Dehradun, thanks to the strength of our experience of such interventions in the city.

Over 50,000 collective hours of data collation, analysis and research has gone into this project. A contingent of over 40 people was the driving energy behind it. We have focused on a framework for planning of the urban water supply in Dehradun for we hope the far term with directions will be enduring and sustainable in terms of resource and operational management. As understanding of the planet, the city's growth patterns, and technologies change in the years ahead, it is our hope that succeeding generations of planners and city fathers of Dehradun will add dimensions to these strategic thrusts.

This project is about people first, then about water. Put another way, it is about human ecology first, then about ecology. By stating it this way it helps to define the direction and spectrum of measures offered, namely, one: that local management is no longer the exclusive responsibility of the government, and two: local management can only be done through and with community participation. This is not a passive document even if the prose necessarily is turgid considering the nature of the presentation. It is a call for action.

Overview of Dehradun's Water Situation

Placed in the water divide between the Ganga and Yamuna within the Doon valley, this town has immense surface resources and ample rainfall. But the city water supplies are dependent for over 70 per cent of its needs, on tubewells. While tubewells offer an elegant mechanism for physical decentralization, sustainability demands that over the longer term citizens look for surface sources both with a view to better utilization of natural resources and cutting the huge, recurring energy cost that water supply involves.

Dehradun's supply and management systems have undergone changes since the new State was born in 2000. Several policy and programme initiatives support the transformation of the water systems. Some of these policies need better articulation, while others are conducive for proactive efforts to be launched.

Serendipity, they say, is the happy encounter, quite by chance, of something that you least expected on a venture. That quite sums up what we felt at the heartening outcome of the Action Analysis process. It has gained such rapid acceptance that the initiation of the implementation process with appropriate local institutions seems far less daunting. Continued traction over the next set of processes and pursuit of the mid-term goals set by the state Government of demonstrating water efficiencies in two of Dun's communities will pave the way for a more sustained and sustainable effort toward achieving 24x7 in nearly half the towns of Uttaranchal.

The RAA Team

We have acquired a combination of talents and resources to establish our long-term goals. We stitched together a team that had geologists, geophysicists, vernacular architects, civil engineers, project and task managers, and urban planners. We, as well, got theater artistes, singers and actors who could touch the hearts and minds of people on the idea of managing water and of the simple steps they could adopt. The intent has been to keep it simple, and demystify policy exhortations of another past.

02. Acknowledgments

It is a cliché to say that this book would not have been possible but for … and sometimes such clichés are all too true. Then to say that one person made this possible will be all but true. These acknowledgments perform a twin function. In writing it, of course, we have been dependent on countless acts of support, guidance and even generosity. But perhaps more important, in engaging with the challenges of the communities in Dehradun and therefore of a deeply divided society, we have depended on many simple folk who have no reading, but offer insights that never cease to surprise.

We are extremely grateful to the community groups and individuals who are constantly participating in our quest to understand the problems and solutions related to water supply system in the urban area. The invaluable support we have received from the communities in Gandhigram and Indira Nagar–Shastri Nagar localities are a source of inspiration for all our efforts. Like they say at the Oscars, the name list is long. But each one deserves special regards, besides our heartiest thanks. Those invaluable inputs from local plumbers, pump attendants and all other staff and individuals from across every walk of life whose practical knowledge and understanding have provided a qualitative difference to this effort, cannot be adequately recognized. We will just say, Thank you to all. We are grateful to Shri Bhudev Lakhera for being a silent but sturdy pillar of support; for just being the kind of inspiring political leader that the country needs more of. And then there are all the officials and elected members of the Corporation, or the State, who sat through with rapt attention through many of our community meetings.

Institutions Deserving of Special Thanks

Our sincere thanks go to all the staff and officials of the Uttaranchal Jal Sansthan (UJS) and Uttaranchal Peyjal Sansadhan Vikas Avam Nirman Nigam (UPSVANN) for their tireless support. The knowledgeable inputs and insight provided by Mr. S.K. Gupta, Secretary Administration, Mr. G.D. Raturi, Superintending Engineer, Mr. S.K. Sharma, Waterworks Engineer, Mr. L.K. Adhlakha, Executive Engineer of Uttaranchal Jal Sansthan and Mr. D.K. Gupta, Chief Engineer, UPSVANN, Mr. S.K. Semwal, Deputy Manager, Mr. S.K. Agarwal, Executive Engineer, Mr. Rastogi also from UPSVANN helped us shape this document. Our special thanks go to Mr. H.P. Uniyal, Chief General Manager, Uttaranchal Jal Sansthan and Mr. P.K. Sharma, Managing Director, UPSVANN, for their constant support and critical inputs which helped us to make qualitative improvements in the document.

Uttaranchal Jal Sansthan and UPSVANN deserve great applause in their sincere effort to breathe life into plans that will have far-reaching implications in the years ahead, if this document is taken note of.

The Government

We are thankful to Dr R.S. Tolia, Former Chief Secretary, Shri M. Ramachandran, Chief Secretary, Shri Pandey, Secretary, Drinking Water, Shri Ravi Shankar, Secretary, Irrigation for encouragement in the initial phase. We are extremely thankful to Mr. Subrata Biswas, Additional Secretary, Urban Development GOUA for his critical interventions during the various stages of the project.

Work at Dehradun on its water veins will not be complete without addressing the needs of those haloed Central or State institutions such as the Forest Research Institute, or the Wildlife Institute of India, among a host of others. Our thanks go to each of the senior officers and heads of institutions who heard us, and then invited and accepted our intrusion into their institutional water supply systems. They didn't stop there. Even as we go to Press, the heads of these institutions are seeking to persuade their people to ring in changes required to convert their networks to continuous water supply systems.

Our special thanks go to Dr. S.S. Negi, Director, Forest Research Institute and a team of Engineering Cell staff, Mr. Madhwal, Dy. Director and the staff of the Survey of India, Dr. Y.M. Reddy from Indira Gandhi National Forest Academy, Dr. M.O. Garg, Director, Indian Institute of Petroleum and its staff from Engineering Cell, Dr. Kumar, Director, National Institute for Visually Handicapped and their staff, Mr. Mehta, Inspector General and Mr. Hira Singh, Deputy Inspector General of the Indo-Tibetan Border Police for their interest and support for the programme.

The ADB

The Dehradun flagship programme under the 24x7 Urban Water Supplies–New Innovations for Meeting MDGs in South Asia--was facilitated by ADB. There is one man at the bank who stands resolutely between an image that the Indian activist carries of an institution that is a 'peddler for capitalist profiteers' and the Bank's own earnest to ensure that the loans and grants of the ADB reach the right beneficiaries. His name is K E Seetharam, Senior Water and Sanitation expert. It was his quiet resolve to make us all, as countrymen, proud of ourselves with achievements such as these that goaded us into taking up this daunting assignment. His encouragement and his urge for action have enabled rapid assimilation of the process. We are particularly grateful for his effort to personally undertake a mission to Dehradun at a critical juncture to bring synergies in the process. Our thanks

are due to the entire ADB team for their continued support for carrying forward this task, and particularly the effervescent and cheerful, Ms Ellen Pascua, who kept a vital link between all efforts.

We hope to be able to redeem these inputs with efforts which will help us to achieve 24x7 water supply in several urban areas in South Asia.

The Consulting Group

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03. A Snapshot

For a quick summary of what this document presents, we have chosen to do a wide-canvas of the issues that centrally impinge on the long-term view one takes on the urban water supply development scenario, existing and emerging, in Dehradun city.

01. There are two stumbling blocks to addressing urban water supply and this is universal. One is the resistance to any change that will disempower the government as a stakeholder and the other is the inherent challenge of succeeding and securing acceptance of any solution that may be suggested.

02. Is water supply to be privatized or communitised? Our study reveals that what we need is regardless of these two forms. What it needs is responsible enterprise whether emanating from an enterprise or community itself. This implies good management with diligence and recognition of daily dynamics of operating 'business'.

03. The problem is not intractable. Broken down to its basics it is about establishing a sound FCR mechanism (full capital recovery that includes amortization costs) and a feasible revenue model that sustains O&M. The existing tariffs of the government are economically feasible. If the management is right, the FCR mechanism should be successful.

04. Dehradun's people have little to complain on costs knowing that in Chennai, citizens pay Rs. 10 per KL, in Mumbai Rs.5.50, or in Bangalore Rs. 6.00.

05. The cost in Dehradun is lower thanks to the unique fact that it is only one among a cluster of about 20 towns in India (over 200,000 population) which rely over 75 per cent on groundwater. The cost is lower in towns like Dehradun and Jammu because there is no long-distance sourcing. This also means that local power generation becomes feasible though one sees the apparent snags in such a proposition.

06. The impasse of electrical arrears has to be resolved. Over 50 per cent of the cost of water in Dehradun represents the cost of power. The arrears today stand at a whopping Rs. 209 million, with Rs. 60 million having accrued as liability in 2004-05 alone. There is then the debilitating effect of intermittent power supply that needs serious attention.

07. Community acceptance of water efficiency is obvious. What is not is their acceptance of such a possibility because they don't know what it takes to make for such efficiency. There is, too, reluctance, even unwillingness to participate in a community-based effort at core

management levels; the fear of failure, and of recrimination from fellow community members, is high apart from them not being inclined.

08. How does one get the government to realize that they have no business being in business? How does one make the government realize that they should not be seeking grants and development funds that need no repaying, unless it is in the area of education or poverty?

09. With the New Connection tariffs in Dehradun raised over the years from Rs. 1200 in the 80's to Rs. 3715 now, to create water infrastructure for a new colony is profitable, not just feasible. What it means is good engineering, planning and scheduling and efficient execution without graft. If such a culture is evolved, the handing over of the operations of one local model to a responsible group, which will inevitably have to be accountable to the local users, becomes eminently possible.

10. The O&M cost in the city is at an average of an affordable Rs. 70 per household. The big proviso is, of course, good management with orientations and skill development at basic management that will ensure that each such area is managed without deviation. Dehradun has had a tariff regime which is unlike most other states in India except perhaps for Uttar Pradesh from whom the Uttaranchal State inherited its administrative regimen, when it was born in 2000. There are no meters for billing water supply.

The tariff has remained, therefore, insensitive to quantum of water used. This is, however, not a disadvantage for Dehradun. By nature, people in slum settlements and LIG / MIG segments are responsible users of water, or any other resource, because they don't have enough of it. And the 20 per cent of the town which makes for the HIG segment are easier monitored because of the fewer number of homes in any residential area.

To have a dual or multiple tariff regime will only make for poor management, and one that will not be system-based. It is clear that the devolution of water-use management at the local area can make for big difference, even if such local water management is in the hands of a responsible enterprise, or a voluntary association or, ideally, in the hands of representative residents.

11. The total 'business value' of water supply for the Jal Sansthan has registered nearly Rs 10 crore in 2004-05, which at current population level represents a per capita value of Rs 150 plus.

12. Dehradun is not an industrial town though the government is unfortunately driving a campaign to draw more capital investments to the city and the state.

13. Today Uttaranchal's GDP is about Rs. 12,000 crore shows a composition of tourism revenue to be 20 per cent, out of a total services revenue that comprises 43 per cent. Industry represents a mere 24 per cent and agriculture accounts for 33 per cent. The State government has been seeking to take some cues from states like Kerala, in its bid to increase its share of tourism business, which will perhaps help to reduce the state's dependence on agricultural revenue and its annual vulnerabilities.

14. The big picture suggests that Dehradun's water planners may have to factor in some of this potential growth in industry and tourism into its water infrastructure growth strategy. But then the figures still don't sound alarming. At a projected population of 800,000 by 2025 the water requirement can still be met with the same pattern of groundwater consumption as the city has had over the last 40 years since tubewells became a phenomenon in the 1960s.

15. Dehradun is a unique watershed which receives more than twice the Indian average rainfall, though this has been a freak occurrence for the last five years. If the plans ensure that a sustained incremental implementation of harvesting plans is put into orbit over the next twenty years there can be no water shortage in Dehradun.

16. What the town needs is not massive infusion of development capital into large, ecologically unsustainable long-distance water sourcing projects. What it needs is a more focused effort within the valley to ensure that there is capacity building among the people to realize the significance of harvesting and conservation. While this will meet with scepticism from the conventional planner, some vision and foresight and sets of pragmatic plans can make the transformation possible.

SECTION 1

Situational Analysis

04. Background

Dehradun was a sleepy little settlement up until the 1940's, with a very minor presence of the colonizers which took the form of the RIMC of the British garrison and of the Forest Research Institute which came in the wake of the large-scale logging of the Terai forests of the late nineteenth century. The Partition of India brought hordes of Hindu refugees from across a border Sir Cyril Radcliffe squiggled in the early turbulent months of 1947. Many of these refugees from Sind and Punjab wound their way into this lush valley in the early 1950's.

For the three decades after, as the city acquired many Central Institutions there was no reason to even think of water as a resource much less as a commodity.

In today's bustling Dehradun the idea of making it water-surplus invites the mirth of the old-timer who has seen the town growing into a city. The mantle of state capital that has fallen on Dehradun's shoulders doesn't sit with comfort. For it means the unsavoury prospect of far more growth and the need for wrestling with the new challenges of resource management.

The vigilante groups of voluntary organisations who are a spin-off from the grassroots political movements that were part of the pangs of birth of the state of Uttaranchal have today assumed the role of being activists on issues of community development in the state and the city.

Water has invited the attention of many such activist groups, particularly in Dehradun. The PHE manuals have been a subject of debate and discussion.

This is a town that has been known from the time of the legendary princess Rani Roopmathi (16th century) for its water canals which were upgraded eventually in the pre- and post-independence decades. The city is steeped with lores from the deep distant past encased in the *Pani Puran* which has echoed in recent times down Dehradun's worn streets. For Dehradun and for the new State of Uttaranchal, knowledge systems[1] on water is not new. People quickly understand the implications of Full Service Water Supply. Implementing a 24 x 7 system should not therefore be difficult. Besides, we'd like to hope that after many decades, the time has now come for such a change, and for restoration of a healthy water supply system that the valley town has indeed known in the past.

[1] UJS's vision is *Swachh-Nirantar-Paryaapth* (Clean-Continuous-Optimum) Water Supply, estimates and projections are difficult to make when there are really no reliable databases. Baseline data don't stand up to hard scrutiny. But our need for drawing up financial contours is real.

Touchstones of Performance

Technically, in the present context, continuous supply of water can be established. But mere continuous water supply will not be sustainable unless it is characterized by these attributes of sustainability:

Economic Efficiency

The Doon valley has been blessed with more than twice the Indian average annual rainfall over the last four monsoons. The concerns are confined to the tasks of storage, treatment and distribution, or reaching it to the end-user. This is a rare city that does not have to be overly worried about sourcing water. There are then the recurring costs of operations and maintenance, apart from which is the allocation for future replacement, or what in accounting terms is called depreciation. Sustainability of the supply systems critically depends upon the ability to renew the system with the savings accrued. Therefore, the revenues collected must at least match the services provided. There is today an estimated revenue loss of Rs 2.00 per KL of water. And the bad news is that it still doesn't account for the capital investment and the cost of such investment. When we consider the entire city supply of nearly 114.32 MLD water out of which if even a mere 15 per cent is reckoned to be leakages, it means Rs 200,000 ($5000) a day, or a whopping Rs.73 million a year (about USD 2 million).

Over four decades, Dehradun has consciously or unwittingly got into a spiral of dependence on tubewells (over 75 per cent of water supply), while there is such a huge scope for tapping surface sources. By this, we are not suggesting long-distance sourcing of waters from rivers like Song [as it has been recently proposed by the Government] or Tons, but by vigorously introducing, localized plans that will help harvest rainwater better, and making conservation a culture among the campus-based institutions which make for 25 per cent of the city's population, as well as the rest of the town's dwellers. This can yield a rich haul if homes are guided with a *Catch Rainwater* programme that can assist them with basic information required to run such a programme efficiently and successfully.

The lop-sided dependence on tubewells has made the system heavily dependent on power supply. The electricity bills of several tubewells far exceed the revenues recoverable at current prices. Let us hasten to add that this as a problem is not half as grim as those energy costs and logistics that will stem out of sourcing from rivers that are far-flung[2].

[2] Cities like Chennai and Bangalore incur as much as 75 per cent of their water cost on energy alone by sourcing from far flung rivers. As the matrix of cost characteristics across other urban agglomerations in India shows, Dehradun can count on its blessings: Its end-cost of water supply is far lower than those in most towns in the country because of its non-dependence on long-distance sourcing. This only shows that there is a seeming picture of high energy cost in Dehradun. If power supply

This offers little potential for sustenance as the State has several competing demands on its resources. Sustained performance cannot be achieved without dedicated power lines and very strict monitoring of power use. It is common knowledge that subsidies, in the name of reaching basic services to the poorer communities, often tamper with the economic parameters of the supply systems. The conditions of the poor seem to justify the lowering of prices, even if artificially, to enable access to this vital basic necessity. In fact, if only the notional cost of their time and effort to collect water from a common source is taken, the poor will be paying more per unit of water.

This has led to a piquant economic situation, where the perceived political necessity of universal subsidized pricing has rendered near stagnant levels of service prices with exponential increase in the cost of sourcing, treatment, supply and disposal.

Continuous water supply will remain a non-starter if it does not recognize the necessity of the service being cost-effective. There is thus need for a culture shift at work from source and supply improvements to conservation and user-efficiency. Can every stakeholder make that subtle difference between use, utilization and exploitation? Therein lies the key.

Environmental Soundness

The Doon Valley is a watershed planner's dream: high rainfall, regular and dense precipitation, and so a massive reservoir of groundwater. The sub-Himalayan geology makes for very high infiltration[3].

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is not intermittent, and operational efficiency is enhanced, Dehradun can continue to keep its water tariffs as low as it is. For starters, this means dedicated power lines and strict monitoring of power use.

[3] This high penetration, hydrogeologically, and the introduction of the technology of DTH (Down the Hole Hammer) which enabled drilling TWs in Boulder Beds with the World Bank coming in to support promotion of this technology. is the reason Dehradun opted for tubewells in the 1970s. Nearly twenty towns across the sub-Himalayan region, including Jammu, in the 2500-km long belt, have similar conditions with water drawn from up to 100 m plus as depth.

However, even though there is an abundance of water, planners must recognise that this can be an 'inexhaustible resource' only when urban water planning uses it in an environmentally sound manner. The unusually high rainfall of over 2200 mm every successive year since 2000 [the 100-year average is about 1200 mm] has lulled the government and the citizen into a sense of confidence[4].

Frothing waters of the River Tons to the west of Dehradun.

It needs hardly to be said that there is little guarantee that such a trend of plentiful rains will continue. Prudence dictates that good planners focus on efficiently utilizing the incidence of rainfall in the valley. The city's lush and undulating topographic setting offers a textbook model for effective sourcing and distributing of water with energy-free, gravity-based engineering of distribution. Long-term sustainability of the water supply system will depend on continuously addressing the issues of Dehradun's water resource base, which means its storage capacities must be optimized to make the most of energy supply. Further, these concerns have to be taken to every street and home. Sewage disposal challenges must be met today to guard against the future possibility of the city's waste water penetrating the deep aquifers and contaminating the subterraneous fresh water zones. And that means education, right down the stakeholder lines.

In terms of infrastructure Dehradun's 1,200 km of pipes is subject to chronic metal fatigue through the impact of a sporadic water supply. A continuous supply system would offer a definite remedial to this and to the increased threat of oxidation to the pipes that reduces the life span of the entire system. Also, the sustained loss of water through leaks in the pipe system must be addressed with right earnest. This requires the skill and ingenuity of the last-mile workers, the plumbers and line staff, and

[4] This 'doubling' of rainfall, now emerging after a half-decade as some sort of pattern, is beyond the understanding of most experts. All one can infer with some certainty is that this is part of the cataclysmic climatic changes that pervade the globe thanks to the impact of greenhouse gases.

a system of monitoring and reporting of their performance, with incentives, financial and in terms of recognition that the better performer secures[5].

Equity

The current system is unsustainable because it is not equitable. The availability of water to communities at various rungs of the socio-economic ladder varies far too enormously – from a dismal 30 LPCD in the squalid parts of the town to a sinful 500 LPCD for the influential and affluent. A primary reason for this state of affairs is the set annual tariff which every one pays equally, regardless of the amount of water consumed individually.

The fixed tariff levy, regardless of quantum of water used, has its advantage, though: the cost of collection of the tariff that the Jal Sansthan incurs is low. A serious downside is that such a non-discriminating tariff does not punish with a stiffer levy for higher consumption.

A mitigation plan for the long term will be a system which ensures healthy monitoring of specified user limits. This will allow more equitable distribution of water across communities. Such a system has to be backed by adequate policy and, of course, demonstration in diverse situations, so as to raise confidence of every constituent stakeholder.

Endogeneity

This is easier said than done. In any centrally administered process, the human face to development is invariably lost. And the legacy of governance across India has only compounded matters. To make for leaner and more accountable administration, local empowerment[6] of operations and maintenance can offer solutions that bring quick reflex and quicker response time to snags to efficient water supply. This can take the form of either a cooperative institution or enterprise of the community, which will monitor such continuing work relating to efficient water supply in their area.

Any such agency must be self-reliant in technology, finances and skills to ensure sustenance. Dependence on external inputs cannot be for prolonged periods, especially in critical aspects of management. It has been growingly realized and demonstrated that when the user community gets

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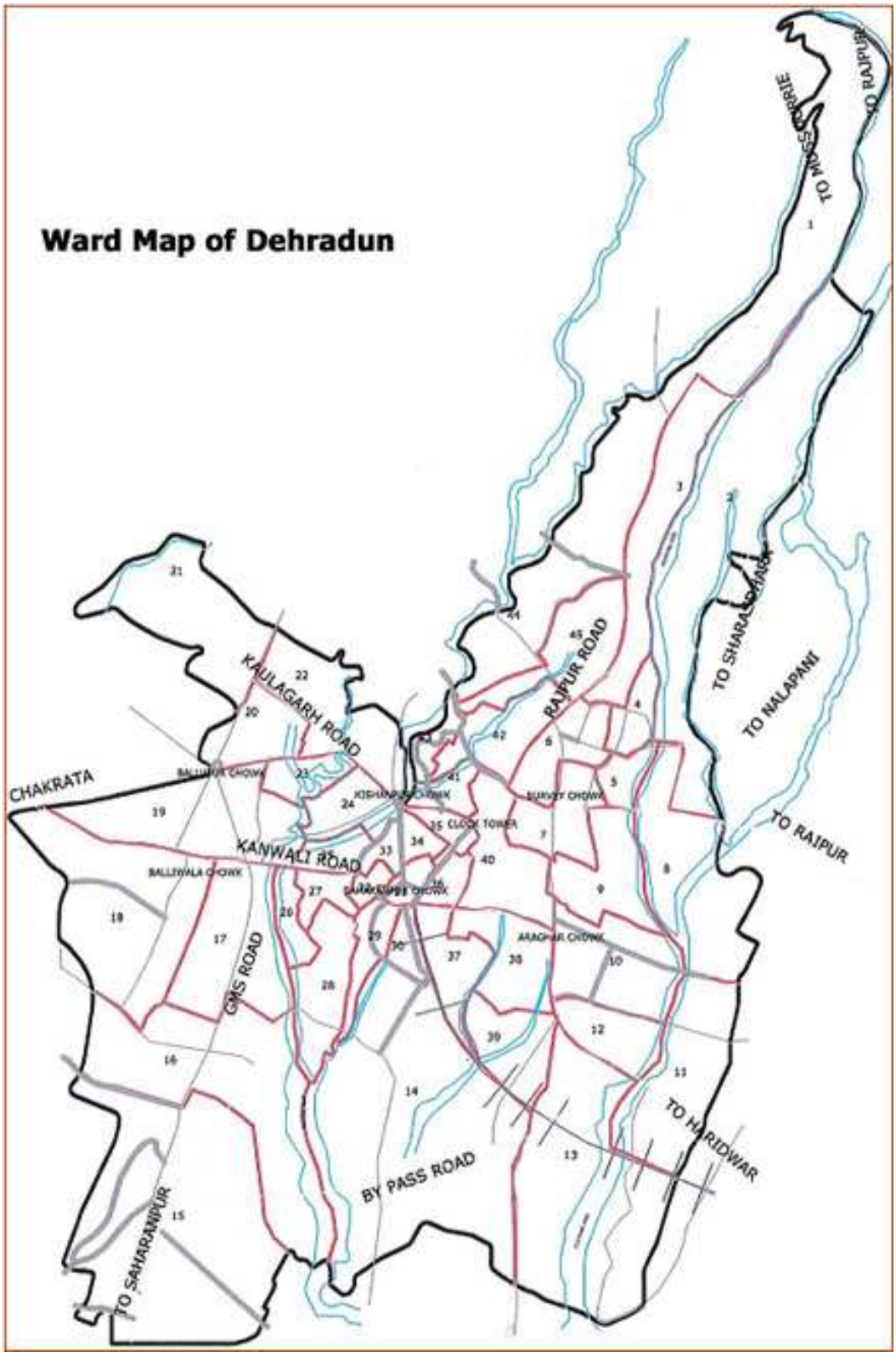
[5] If Singapore has achieved a single-digit leakage rate of six per cent it was only thanks to an iron hand, and a work culture that recognized rewarding achievement, and focused on consistent planning and target-based management.

[6] Again, 'local management' is not merely in the geographic context. It also encompasses the challenge of looking at localizing expertise and resource pools to bring focus on core competencies. If, for instance, the Jal Sansthan zeroed in on being a bulk supplier to a couple of dozen local area networks [LANs], greater synergies can be put into play. There will be convergence, in any case, since the objective of both the Jal Sansthan and of such LANs for water supply is to offer quality water supply on a continuous scale.

involved in the management of their resources, the systems perform better. This is because there is a greater sense of ownership, and much less downtime in the fixing of immediate operational snags or equipment overhauls that are critical to the supply system. That future in which the community itself appropriates the system for sustained care will eventually prove to be the least-cost solution.



The digits represent ward numbers.

Table 1 City Overview			
No.	**THEME**	**SITUATIONS**	**REMARKS**
1	City Setting	Doon Valley	Between the Mussoorie Ridge and the Shiwaliks
2	City Character	Primate City	Administrative, educational institutions, trade & commerce
3	Growth Axis	S-E Physical Expansion	Towards urban fringe
		N-S Activity Expansion	Along Rajpur Road
4	Road Network	Dendritic	Major arteries converge at Clock Tower
		Ring Radial	
5	Skyline	N-S Tending	Longitudinal
6	Rivers	Bindal Rao & Rispana Rao	Seasonal & waste water Carriers. forms the immediate watershed of Dehradun (95 Sq. Kms)
7	Intermediate Public Transport	City Bus	Main N-S, E-W Axis
		Vikram	Neighbourhood level
		Auto Rickshaw	Travel costs high
8	Terminals	Intra & Inter City	Centrally located
		ISBT (2004)	Southern tip
		Transport Nagar, Clement Town	
9	Busy Nodes	Prince Chowk, T-Junction	T-junction
		Dilaram Bazar	T-Junction
		Subash Chowk	
		Saharanpur Chowk	Staggered T
		Dharampur Chowk	Staggered T
		Railway Station	
10	Landmarks	Clock Tower	Traditional/Monumental
		Secretariat/Vidhan Sabha	Administrative
		Railway Station	Terminal
		Bus Station	Terminal
11	Districts	Institutional	Well-spread thru' the city
		Industrial	S-E
		Commercial	N-S retail
			E-W wholesale
		Residential	Spread – Mixed land use
12	Water Supply	Piped Water Supply & Standposts	Intermittent supply
13	Sewerage & Drainage	Partial Coverage In The City Open/Semi Covered	Laying of sewer, master plan in preparation

Panoramic view from half-way up the road to Mussoorie.

The Defining Environment – The Doon Valley

Dehradun evokes in most Indian minds the picture of a picturesque hill town that is cool and away from the dust and heat of the plains. A ride into the valley town by air or by road initially reinforces that impression as you wind down the Shiwalik hills that hem the valley until you encounter the humidity and peak hour traffic of a workday.

The Doon valley nestles 77°35'0"E–78°20'E longitude & 29°57'30°N–30°30'30" N latitude. Bounded as it is by river Yamuna in the NE and river Ganga in the SW, the valley spreads over an expanse of 1853 sq. km. A water divide, running NE-SW, separates the NW flowing River Asan from the SE flowing River Song. The river system is such that Rispana flowing SSW takes a near-right angle turn and joins the SW-flowing River Suswa which eventually meets River Song. The lesser Himalayan formations (Shiwaliks) play an important role in the water resource regime of the Doon region, especially to the west of the water divide as most of the urbanization has been taking place in this belt. The Mussoorie range is the source of several tributaries like Asan, Song, Rosanna (southern slopes). The geological formations within the Doon Valley have high porosity. Infiltration rates are very high.

The Krol and Tal formation in the Mussoorie ridge is the origin and source of several tributaries flowing N-S. The presence of springs in this belt results in surface water flows but development activities like road construction etc. have degraded these resources. The Dehradun valley comprises of the oldest Doon gravels in the lower reaches, which also determines availability of water below ground level. The isopachs indicate availability of water at a shallow depth in the south of the city whereas in the northern part of the city, the depth to groundwater is higher.

The Mussoorie range at 6,000 feet and over to the North defines the Doon valley.

Dehradun nestles at 2,600 ft MSL.

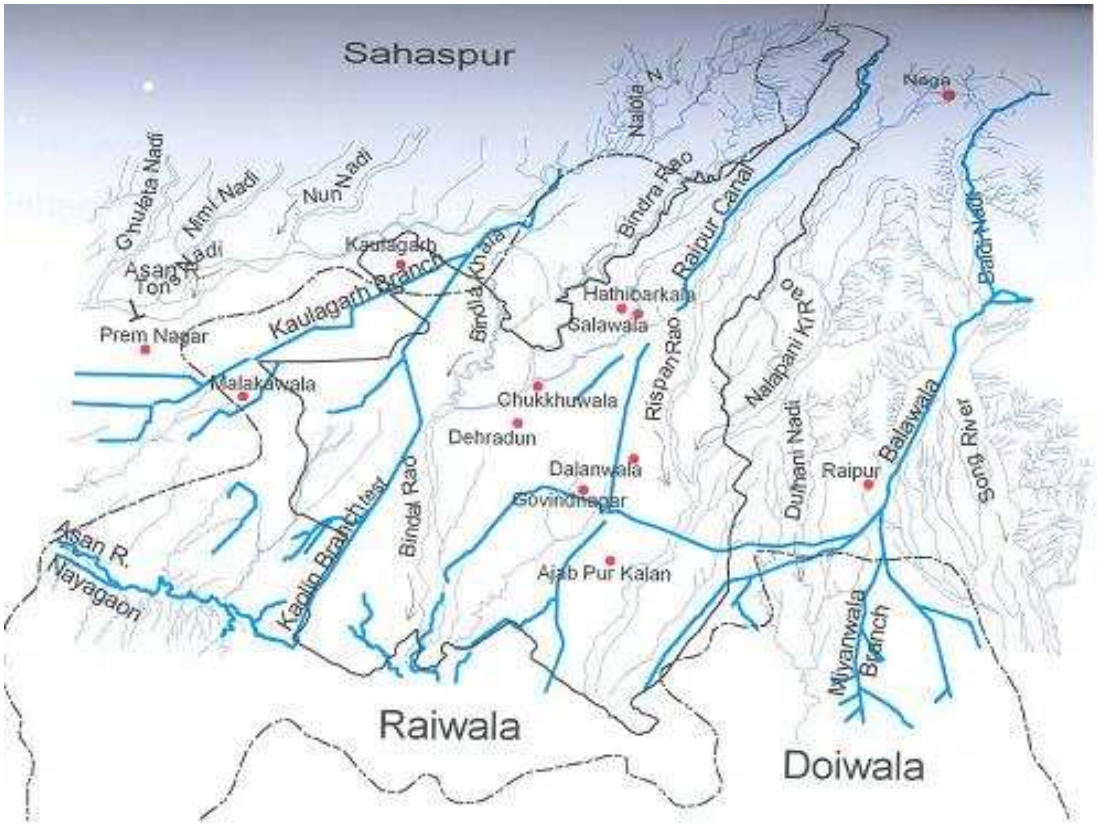
The Rispana and Bindal watersheds are confined to the immediate physical and natural features of the Dehradun urban agglomeration and constitute only 5 per cent of the total Doon valley. Rispana and Bindal drains most of the watershed flowing N-S and both these streams have their confluence beyond Clement Town near village Kargi and flows as River Suswa. Being intermittent streams and wastewater carriers, the increase in the built-up area in Dehradun has resulted in alteration of drainage routes, resulting in waterlogged areas during the rainy season. Flash floods often also impact the slum settlements spread along these streams.

Dehradun's sharp physical growth over the last 40 years has led to chronic problems such as settlements in low-lying areas requiring the plinth level to be raised as a safeguard against flooding in the settlements of Kanwali Road, Yamuna Colony, Chukuwala, Lunia Mohalla, among other localities. The Rajpur Road acts as a N-S ridge separating Bindal and Rispana Rao. The city's drainage pattern is almost parallel in the upper reaches and dendritic in the rest of the watershed. The upper ridge of nearly 14 km--from Rajpur to Dilaram Bazaar--is descriptive in itself. Here is an average relief of 20 m in 1 km which indicates a greater runoff from the upper reaches. This results in flooding in the lower parts of the city thanks to the absence of efficient drainage systems that respond to varying slopes within the city i.e. from Rajpur towards Saharanpur Chowk.

Another 14 km longitudinal stretch indicates a gentle relief of 7m in 1km and this region forms the most densely populated region of Dehradun.

A section of the canal network of Dehradun which are upgrades from a 500-year inheritance from Rani Roopmati's time.

The prominent feature of Dehradun is its spread of canal networks flowing from the nearby catchments. The alignment of the canals is along the N-S direction and follows the natural slope. A clear relationship among the city dwellers and the canal system can be established in the city. The urban dwellers mostly living alongside use the canal water for daily domestic needs. Women washing clothes with synthetic detergents that pollute the waters, is a common sight across this network. Some segments of the canal have been covered recently. Currently the waterworks is sourcing water from the Bijapur canal, which is also supplying water to the Raj Bhavan, the Governor's residence.



The canal network of Dehradun

Geographic Setting of the City

If the sprawling valley that straddles the two timeless rivers marks the setting, the town of Dehradun in itself occupies about a quarter of the valley's geographic spread [65 sq. km. of the 270 sq. km expanse]. The headquarters of Dehradun district, Dehradun [30°19' N latitude and 78°20' E longitude] is equidistant to the ancient holy towns of Haridwar and Rishikesh [about 40 km] and forms a circuit of religious and nature tourism. The city is surrounded by river Song on the east, river Tons on the West, Upper Shiwaliks and lower Himalayan ranges in the north and the stately Sal forests of the Shiwalik range to the south. Mussoorie, the ageing queen of hill stations, overlooks to the north. It is the largest city of the hilly region of Uttar Pradesh and is well connected by rail and road transport.

Perched at an altitude of 640 M above mean sea level, the sheet of land undulates with the lowest altitude at 600 M in the southern part, and the highest altitude at 1000 M on the northern part. The city slopes gently from north to south and southwest, with a gradient of 1:37.5. It is heavily criss-crossed by a number of seasonal streams and *nallas*, which are locally known as *Khalas*. The drainage of the city is borne by the two rivers, Bindal and Rispana Rao. The direction of flow of streams and *nallas* in

the eastern part is north to south and in the western part it is north to southwest. Dense patches of forests exist along the outer limits of the regulated area.

There has been a high variation in annual rainfall during 1999-2003. The first of the five years recorded rainfall of 2562 mm while 2003 recorded 1832 mm. Figures for the last two decades show such sharp variation that the City's Met office really has no reliable extrapolations to offer. The average rainfall during the four monsoon months (June to September) is 1879 mm and the average for the five years (1999-2003) is 2361 mm. Moreover, the moisture regime in monsoon months is relatively higher than the preceding months. This helps in the development of thick, dense undergrowth which prevents soil erosion, and enhances groundwater recharge. There is no provision for storm water drainage except a few places, which allows the rainwater to flow in the seasonal drains.

Origin and Growth

The valley is an ancient haloed ground. History blends with mythology as stories of Drona's heroic exploits echo down the time-worn stone steps of the temple around which the town has grown. Around the region, no more than two hours away is the renowned site of the Lac Palace [*Laakha Mandal*] where the Pandavas are believed to have been conspired to be killed by their royal cousins, Kauravas. The valley stirred into life again, after a millennium, 400 years ago with the coming of Guru Ram Rai, a Sikh Guru who found refuge in this valley, thanks to the Raja of Tehri who gave him asylum. The development of the city was further accelerated with the British establishing two military cantonments in 1872 and 1908. In 1878, a training college was set up for forest rangers, which evolved into the Imperial Forest School, and later with greater activity became the Imperial Forest Research Institute and College with the 500-hectare land expanse that it now enjoys.

The construction of the mile-long Paltan Bazaar (from Clock Tower to the Gurudwara) led to trade transactions with the surrounding settlements, which resulted in rapid growth. After the Second World War, a new Cantonment, Clement Town, and an Ordnance Factory rose. A number of other national institutes and offices -- Indian Institute of Petroleum Exploration, Indian Photo Interpretation Institute, Oil and Natural Gas Corporation and Survey of India -- were established at Dehradun which contributed considerably to the growth and physical expansion of the city. With the setting up of these institutions, and offices and public schools, there was growth of ancillary activities and other infrastructure facilities, too. The demand for informal services also grew resulting in rapid expansion of slums.

05. Dehradun's Water Resources

Water Sources

Services infrastructure in any city revolves around water, and has as its prime determinant of basic services, this precious liquid. Sewerage and sanitation, and potable water supply depend on availability, and effectiveness of distribution network and design. It helps run several economic activities successfully. It is the basis of life, yet societies need to remind themselves periodically that we can run out of this precious liquid if we don't prize it dearly enough.

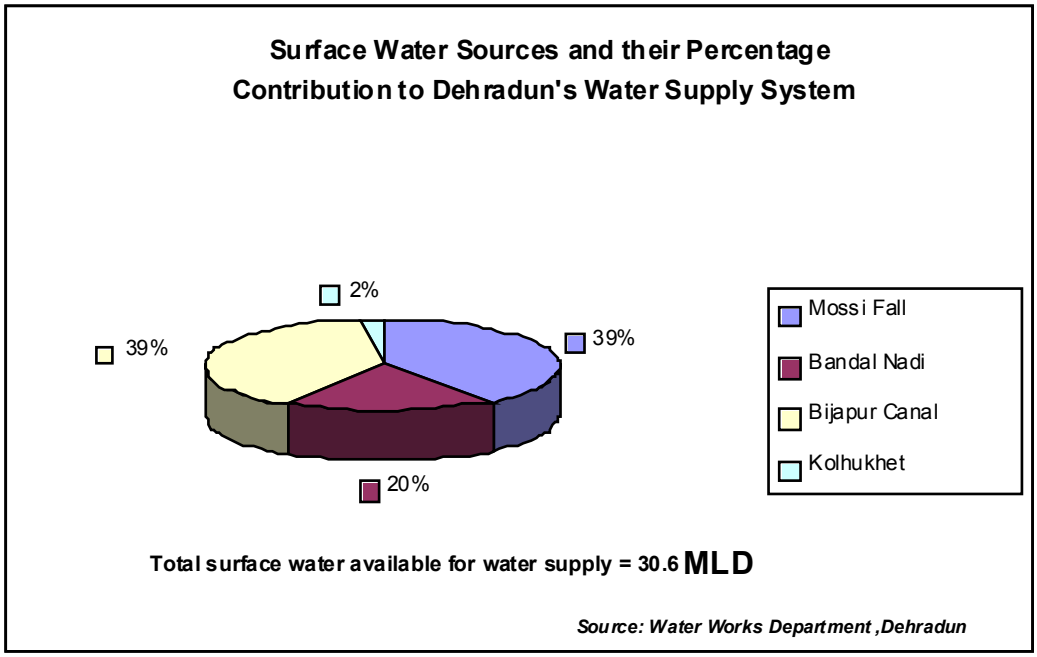
River Tons, upstream the Doon valley: pristine on its early course.

Surface Water Sources

Dehradun's formal water supply system is more than a century old. Dehradun's water supply system started with surface water systems developed with water from the Mossi Fall, a short stream to the SE of the Mussoorie Town overlooking Dehradun. This and the establishment of the water works at Dilaram Bazaar, which also received water from the Bandal Nadi, were the only sources that served

the city for many years. The surface water sources were failing to meet the growing demand. In the seventies a major thrust to drawing groundwater was provided with the formation of the Jal Nigam.

Over the last decade availability of water from the Bandal Nadi has reduced to 6 MLD from 9 MLD, whereas sources like Mossi Fall and Bijapur Canal have augmented the water supply for the city of Dehradun. Apart from feeding the city, the Bijapur canal supplies water to Raj Bhavan and the Cantonment. Surface water sources contribute up to 27 per cent of the city's water supplies. The



Dehradun's surface water sources, in all, account for less than 30 per cent of the city's daily water use of over 1.2 mlpd.

establishment of ancillary services like the treatment plants has also been part of such augmentation.

Groundwater sources

Dehradun is among a handful of cities in the Sub-Himalayan region [Jammu being another singular example] that is massively reliant on groundwater resources. That is not a cause for concern in these towns, and has indeed served as an advantage in the last two decades of haphazard water planning. This is a region where a year's rainfall can mean a staggering 15 million litres of rainwater received per hectare of land coming down from the skies that offers a per capita water availability of 900,000 litres against the Indian average of 130,000.

Three-fourths of the supply in Dehradun is from drawing of groundwater. Dehradun's drinking water demand is currently met with 56 tubewells. Recent estimates of WWD show total water produced from these tubewells is 83.72 MLD, which accounts for 73.23 per cent of the total city water supplies. The water is available at a lesser depth in the southern parts of the city while it drops

towards the north, owing to the geo-hydrological conditions in the valley. The average depth in the valley town's tubewells is 120 m, varying across the town from a low of 19.6 m to a high of 96 m.

There is a downside to this fact that a majority of the city's requirement for water depends on tubewells: city water supply is vulnerable with its heavy dependence on the grid power supplied by the Uttaranchal Power Corporation Limited. There is no dedicated electricity supply arrangement for tubewells in Dehradun. This is apparent sharply in the summer months when water is scarce. Even in recent months [June–August 2005], electricity has been the major cause for scarcity of water supply in several areas of the city.

06. City Water Supply System

Supply Systems

The big picture on user patterns in the valley town offers hope for good and efficient planning into the future. For all its faults in the present-day, Dehradun is pretty clearly segmented on its consumption contours.

Between domestic, institutional and commercial establishments, home water needs of the city claim nearly 80 per cent, while industry and commerce account for a little over 15 per cent. Some commercial and industrial users are offered bulk supplies. The water demand of most of the Central government institutions is largely met with captive campus infrastructure of their own. This infrastructure, like in the rest of Dehradun, relies again on tubewells. The Cantonment that hosts some Indian army contingents has its own systems, too. The institutional segment and the Cantonment together consume 30 per cent of the available water in Dehradun. That leaves the Jal Sansthan to address the remaining 70 per cent of the city's need. The slum population of Dehradun is relatively dense with nearly 120 such settlements spread over the 65-km land spread of the city, and accounting for just over a quarter of the entire population.

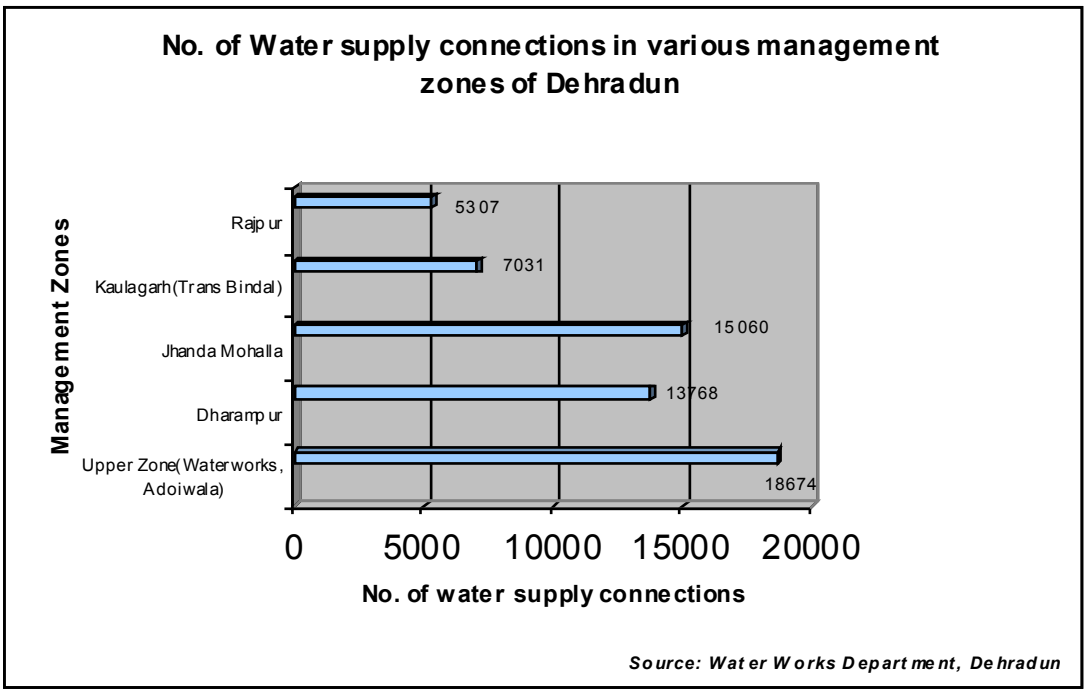
Table 2 Overview of Drinking Water Supply			
S.N0	**Description**	**2001**	**2005**
1	Population		Revised Estimates On 31.03.05
	City population (in lakhs)	4.77	5.28
	Approx. increase in population (expected due to capital formation)	0.34	0.8
	Floating population	0.5	0.75
	Boarding school population		0.29
	Total population	5.61	7.12
2	Requirement of water/day	112.2	96.12 MLD
3	Industrial requirement	15	15 MLD
	Total requirement	127.2	125.54 MLD
4	Available water		
	Mossi fall (surface)	12	12 MLD
	Bandal river	6	6 MLD
	56 tubewells	77.39	83.72 MLD
	Bijapur canal		12 MLD
	Kolhukhet		0.6
	Total production	95.39	114.32 MLD
5	U.A.W	28.62	14.92 MLD
6	Water distributed	66.77	99.50 MLD
7	Shortfall	60.43	11.22 MLD
8	Storage capacity	22.75	35.27 MLD
9	Storage requirements	39.74	62.77 MLD
10	Shortfall in storage	13.59	27.5 MLD
11	Average water availability per head	119	135 LPCD
Source: Uttaranchal Jal Sansthan, Water Works Department – Dehradun			

In urban Dehradun there are 60,510 connections under various categories viz domestic, commercial, industrial and bulk. Growth in new connections has been low – at an annual increase of 3.45 per cent connections over the last three years. On an average 1500 new connections are added every year as per the Water Works Department. There is just a marginal increase in the other categories of connections, too.

Table 3 Decadal Increase in Number of Connections in Urban Dehradun				
Category	**Units**	**1995**	**2005**	**% Decadal Increase**
Domestic	No.	34782	49839	43.29
Non Domestic/Commercial	No.	6465	7270	12.45
Bulk (metered)	No.	94	167	77.66
Janata/Others (Unmetered)	No.	1758	3234	83.96
Total Piped Connections	No.	43099	60510	40.40
Total Sewer Connections	No.		12092	
Pipeline Length	Km	689	1200	74.17
Staff per 1000 Connections	No.	9.3	6.3	
Source: Coping Costs for Intermittent Water Supply in Dehradun, AME,1995 & Water Works Department,2005				

Organic growth of the city with little conscious, far-term planning in the early decades, meant water supply pipelines were laid as new areas or new streets and homes rose in a locality over time. The process of integration into the pre-existing systems got little attention, leading to varying estimates of supply and actual availability. This led to greater number of joints, which put the whole system under extreme stress and hastened its breakdown. For some years now, the reliability of water quality has been seriously in question. Moreover the sewerage system is yet to fully evolve. That raises concern over disposal, apart from the more serious fret over water quality.

The Dehradun water supply zones are arbitrarily divided into five divisions. This typifies most water supply utilities that operate an intermittent water supply regimen. Each zone is managed by an Assistant Engineer. The water supply network among these zones is so integrated that one zone cannot be distinguished from another as the command area of a tubewell has multiple supply areas. These zones are for the management of the Jal Sansthan's activity and have no predefined relation to a source or command area.



The upper zone of the city, serviced from the waterworks at Adoiwala, also has the advantage of being traditionally surface-water fed.

There are two semi-urban and rural zones viz. Pitthuwala and Jogiwala in the SE and SW respectively, which form the immediate urban fringe of Dehradun city. The water connections in these two zones total up to 36,118. The partial transformation of these two zones from rural to urban is taking place but these two zones are at present being classified as rural zones.

Hours of Supply

Water security as a coinage goes back to no more than 30-40 years. For all urban humans, simply the fact that the precious liquid doesn't flow off the tap raises insecurities that prompt wasteful spending on 'personal infrastructure' – a sump tank at home, a pump to haul water up, and an OHT atop the roof. What does it take to offer water security to a town's citizens? To define a solution, we first set out the challenges that confront Dehradun.

Supply varies from 3 to 7 hours in different parts of the city depending upon the topography and specific system that supplies water in different areas.

The supply hours are conventionally seen as an indicator of reliability of water supply but the topography of Dehradun is such that high variation in the ridges and the low-lying areas makes this indicator deceptive. Several localities receive water for long hours but the actual water received by the user is less. Apart from natural conditions that have not been factored into the design, the management of intermittent supply has time variations within and across the city due to a multiplicity of control systems in the locality. Most of the wards receive average daily water supply of 3-6 hours.

Table 4 Drinking Water Supply Hours in Dehradun

S.No.	Supply Hours	No of Wards	Ward Numbers
1	3-4	16	2,3,5,7,8,11,12,13, 14, 17, 24,26,27,29,30,36
2	4-5	11	9,10,16,18,35, 37, 41,42,43,44,45
3	5-6	10	15,20,21,23,25,28,31, 38, 39, 40
4	6-7	8	1, 4, 6,19,22,32,33,34

Source: Primary Survey, 2005

It's either no power, or no storage...

There are 10 tubewells and only four OHTs in Trans Bindal Zone offering a total capacity of 2550 KL capacity. The two OHT's with a capacity of 1350 KL have become idle as the discharge in tubewells is not enough to fill the storage in a stipulated time. The reason? There is no uninterrupted spell of power supply that is adequate to fill the OHT's capacity! The other eight tubewells are directly connected to the main lines, as there is no investment in OHTs. This means low pressure and poor distribution. The population of Trans Bindal Zone is approximately 44,000 and the current practice of providing direct water supply poses problems of pressure and inequity in distribution. Several localities receive longer duration of water supply at the expense of other areas.

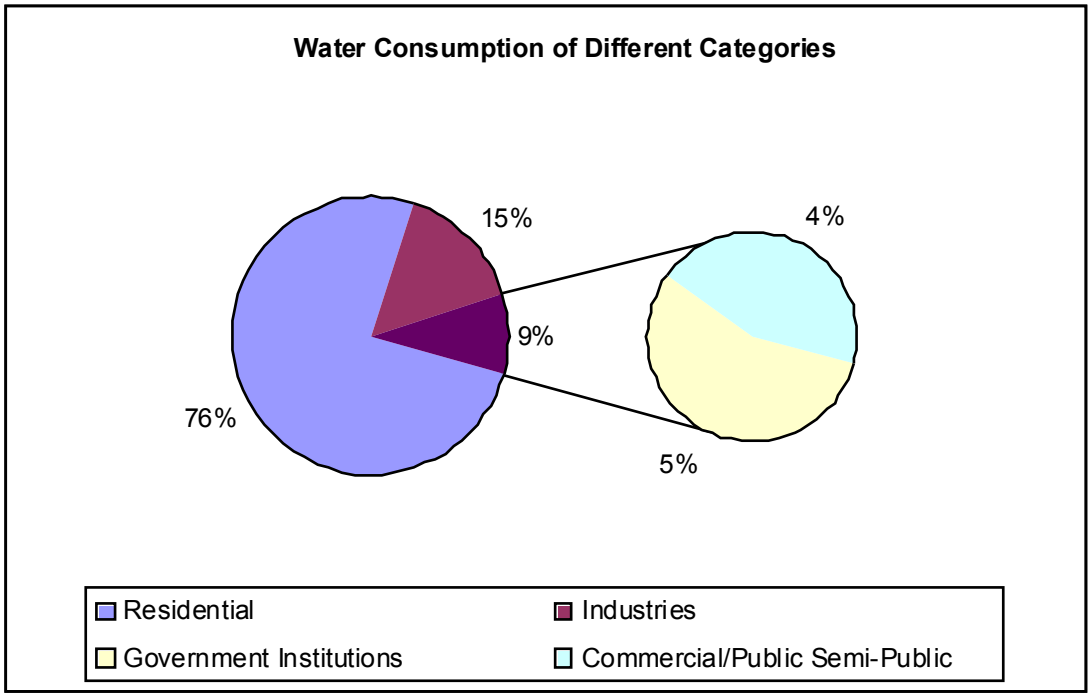
A few localities in Dehradun also receive water supply at the odd midnight hour viz. Prakash Vihar, Teacher's Colony, Govindgarh, Shanti Vihar.

Intermittent water supply leads to higher coping costs at the consumer end, as such water insecurities lead to higher investments in pumps, individual storage tanks and sump tanks at homes.

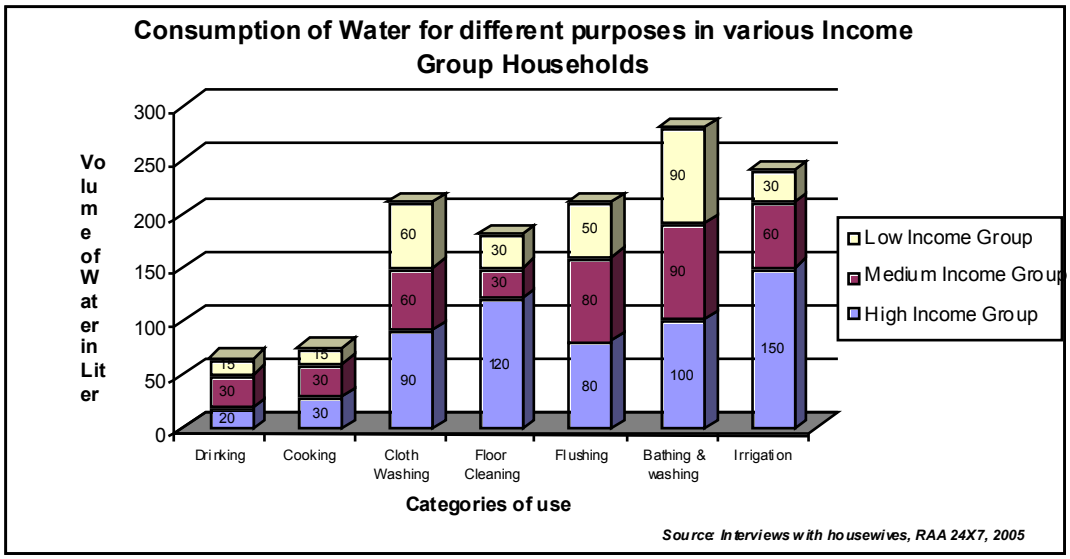
Table 5. Salient Facts for Low Pressure Water Areas in the City	
Low Pressure Areas	**Zone Description**
Arya Nagar, Ekta Vihar, Dobhalwala, Mayur Vihar, Keshav Vihar, Adhoiwala, Salawala, Nashville Road, Kalidas Road, Old Survey Road	Valve operations are not sufficient given the challenging land contour.
Chaman Vihar, Pratap Nursery, Saraswati Vihar, Ajabpur, Banjarawala, Sarthi Vihar, Balawala,	The Pithuwala and Jogiwala zones are in the process of transition from rural to urban. The current distribution infrastructure in this region cannot provide water at optimal pressures
Patthribagh, Bhandaribagh, Vidya Vihar, Tehri Rehabilitation Colony	Jhanda and adjoining areas are experiencing extreme population expansion and density. As a consequence water supply to some regions is being affected
Loharwala, Mayur Vihar, Keshav Vihar, Dharampur Danda, Ajabpur Danda, Jyoti Vihar	Dharampur Zone is experiencing high population densities which is hampering water supply delivery at sufficient pressure to some areas.
Kaulagarh Chungi, Kaulagarh Tank, Rajendra Nagar St. No. 8, Nachghar, Sirmour, Kaulagarh Road, Mall Road, Chakrata Road receive long hours of supply while Rajendra Nagar, St. No. 8 and adjacent areas like Kishannagar Chowk to Ballupur colonies receive water at varying intervals.	In the Trans Bindal area an inequitable valve control system has led to variability in the water pressure delivery to some areas
Source: Field Visits & Newspapers	

Consumption Pattern

Residential use, as we noted before, accounts for by far the largest consumption of water chalking up three-fourths of the demand in the city. Industrial, commercial and government institutions make up for the rest. City water supply is therefore dedicated largely to meeting domestic water needs and not industrial and commercial use. The demand from the industrial sector is geared to grow thanks to the State government's efforts to invite commercial and industrial growth to the Dehradun region. This will have a cascade effect of growth in the population of shops, offices, hospitals, hotels and restaurants, and a host of other trading and retail stores down the value chain. Dehradun also serves as a gateway to over two million pilgrims a year who transit the town. This puts even more pressure on the existing water system raising commercial and residential usage in short, sporadic spells.



Residential is clearly the segment that needs most focus in planning.



The survey establishes an old truth: the poor conserve more, and the rich are profligate and insensitive to resource use.

Some typical households in different economic categories have been logged for the general pattern of use. The comparison shows that it varies sharply from a low of 50 LPCD to a high of 275 LPCD.

Slums – Need for Special Attention in Basic Services

Squalour and neglect mark this section of Gandhigram, a slum settlement of the town.

One of the most debilitating aspects of any urban spread in India today is the growth of slums. Slums, typically are thickly populated and make for the most squalid parts of the town, and pose serious challenges to development planning. In Dehradun, as in India generally, slums have become a sensitive political issue with every party doing its best to protect these vote banks. Thus any option to relocate or demolish these slums does not exist. Upgrading these areas requires funds that are hard to come by. The problem remains conveniently ignored and the slums continue to exist with barely a semblance of public utilities.

In Dehradun, slums have grown from three in 1970 to nearly 120 today. In 1996 there were 69 regulated[7] slums. The figure rose to 118 in 2003 accommodating more than 1.4 lakh people. In 2001, the Dehradun Municipal Corporation estimated that 79 slums played host to nearly 120,949 people. The current list released by the municipal corporation in 2005 'recognises' 103 slum settlements in the Dehradun urban area with nearly 230,000 residents.

Water Supply in the Slums

The slum water distribution network in Dehradun has historically been a demand-driven extension of pipelines, and consequently poorly designed. Further, the distribution network is characterized by low water pressure, resulting in little or no water received at the tap. The Water Works Department has over the years examined the logistics for distribution, and has responded with design configurations. But lack of sufficient funds[8] has prevented their implementation.

[7] Although slums are technically illegal settlements, the inability of the government to find alternative settlement sites for them forces the government to, instead, tacitly acknowledge these settlements as existing *de facto* rather than *dejure*. Such recognition allows the government to extend public utilities to them. However, in the absence of sufficient funds such public utilities where they exist are few and inadequate.

[8] It is interesting to note in this regard that the Central Government of India has recently launched the ambitious National Urban Renewal Mission (NURM), which includes service delivery mechanisms for slum areas. Uttaranchal has shown interest in seeking to draw funds under the NURM schemes. NURM funds are attractive since they are disbursed without loss of time if the purport and objectives of a proposal are transparent, with clear milestones and a road map for execution that ensures no deviation of timeframes. The NURM seeks accountability from the local body for funds that are extended for implementation. With demand for adequate housing for weaker sections rising, the state's own Urban Reforms programme seeks to rationalize the availability of land for weaker sections under the city's masterplan. However, some problems remain. The Consulting Group is firmly of the understanding that the land use classification for these slum settlements needs a fresh look as old slum areas have slowly been transformed into LIG or even MIG settlements, while new slum settlements are coming up in new localities, in greater numbers than ever before. If such re-classifications are initiated there is the risk that NURM funds will be used to upgrade LIG or MIG neighbourhoods instead of the real slums.


Long lines of empty containers … and tired faces.

Currently, the public tap or standpost is one of the means for water delivery to the slums. The water is supplied intermittently necessitating long lines of people[9] at the tap. Apart from the obvious hardship of drawing water from such a source, standposts are also major water leakage points. Taps are seldom repaired when broken. As a consequence there is general consensus amongst all stakeholders[10] that the standposts need replacing with more direct household connections.[11]

Table 6. Hours of Supply in Sampling of Slums

Hours of Supply	Name of the Slum	Approximate Households	Status
17	Vijay Nagar Adhoiwala	300	Non-Notified
24 (at standpost)	Balmiki Mohalla	300	Non-Notified
20	Shiv colony	40	Non-Notified
24	Raj Colony no 4	150	Non-Notified
24	Mangal basti Rajiv Nagar	300	Non-Notified
24	Sagargiri Colony Balbir Road	200	Non-Notified
24 (Hand Pump)	Kargi Bindal Nai Basti	30	Non-Notified
24	Lunia Mohalla 2	130	Notified
24	Lunia Mohalla 1	15	Notified
24	Lunia Mohalla 3	15	Notified
24	Saiyad Mohalla	150	Notified
16	Madrasi Colony	110	Notified
17	Shridev Suman Nagar	1500	Non-Notified
24	Jawahar Colony	150	Non-Notified
17	Sanjay Colony Guru Road	400	Non Notified
	New Tubewells Proposed		
1	Singal Mandi	90	Non-Notified

[9] We did a rapid assessment tour of more than 120 slum settlements in Dehradun. Thirty-six per cent of the slum localities reported uncertainty and unavailability of drinking water. Considerable time was also reported spent in collecting water from these standposts.

[10] The stakeholders are the various government water bodies and the Consulting group

[11] As of this writing, the Jal Sansthan has been attempting to put an end to the practice of erecting standposts. Their aim is to progressively provide connectivity direct to the home, or shift to hand pumps that draw groundwater. This needs deft and tact since the pulpit politician doesn't find this an agreeable proposition. The Jal Sansthan has been discreet in this effort, and is phasing out these standposts with as little attention drawn to the process as possible.

2	Chabil Bagh Khurbura	800	Non-Notified
2	Bhata Basti Harbanswala	110	Notified

07.Water Quality

Quality of Water

We have said this before: heavy reliance on Dehradun's groundwater resources for water supply, is not as alarming as it seems. But there are other dimensions that bear an impact on the basic premises for such policy planning approaches and directions.

The drinking water quality is, for instance, largely determined by the characteristics of the sub-surface water and hydrogeological conditions. The completion reports for the tubewells recommend chlorination. Drinking water quality is a critical component in city water supply. Quality of water at source and at the user end will determine effectiveness of treatment or health of the network.

Water quality samples collected by the NEERI[12] during winter, summer and monsoon months offer some signposts for the future.

The total hardness count during winter months was under permissible limits (451 mg/l being the highest) spread across the city. Except at the Dilaram Bazaar Water Works, rest of the samples indicated calcium content beyond prescribed limits. In areas where water is scarce, water quality is again determined by the permissible limits. The water sourced from Mossi Fall flows through the limestone belt in the Mussoorie range. And as it courses down the pipes, the deposit accumulates on internal pipe surfaces as well as at the storage tanks of the filtration plants. The excess of calcium in water impacts pipelines and human health.

Intermittent water supply has other ramifications, too: the relative higher incidence of scaling on the surface of pipes. This affects badly the life of pipelines. Chlorination is done using bleaching powder and the concentration of chlorine used is such that a contact period of 5-6 hours is maintained. Water emanating from taps carries a strong residual odor. Total dissolved solids (TDS) have also been found to be high in tubewell sources across the city.[13] At few sample locations, the residual chlorine was found to be more than prescribed limits in pipelines closer to the treatment plant or tubewell source. Tubewells with a greater depth to the static water level, like in the Upper Zone, show relatively higher hardness (magnesium and calcium).

[12] National Environmental Engineering Research Institute.

[13] See Annexure

Bacteriological contamination is usually observed at surface sources. The concentration of fecal as well as total coliform at raw water intakes was high in Shahanshaai Ashram during summer at 860 per 100 ml. Contamination was also observed at point sources like standposts and taps that get water supply from the Shahanshaai filter plant. There was no chlorine content reported at these points. The residual chlorine content is increased slightly during the monsoon season as a preventive measure to disinfect potential biological and chemical contamination.

Status of water treatment facilities

Shahanshaai Filteration Plant

Water from the Mossi Fall is diverted through a channel and collected in a tank constructed about 4 km from the Shahanshaai ashram water treatment plant. The tank has two chambers. The top of the large chamber is covered by GI wire mesh to keep waste materials from falling in. A 14" GI pipeline conveys water from the chamber by gravity to the water treatment plant. The pipe is reduced to 12" to enhance the pressure to reach the plant. The treatment plant is located at an altitude of 1042 metres and provides sufficient head to supply water through gravity. The Shahanshaai Ashram supplies water to storage tanks at Dhak Patti; Balyogi Ashram; Chironwali; Survey Tank; Water Works. These tanks, primarily supply water to residents of the upper zone. The treatment process is time-tested and conventional.

The raw water is passed through alum. There are five rapid sand filters and the filter media is made up of layers of gravel, coarse sand and fine sand. Backwashing is done in 48 hours. During the monsoon season the cleaning is done twice a day if turbidity of water calls for such a step. The amount of water used for backwashing is close to 5000 litres for each filter.

Shahanshaai Filter Plant - Settling tank

A Water Outlet Nozzle

There has been no significant daily variation in the raw water

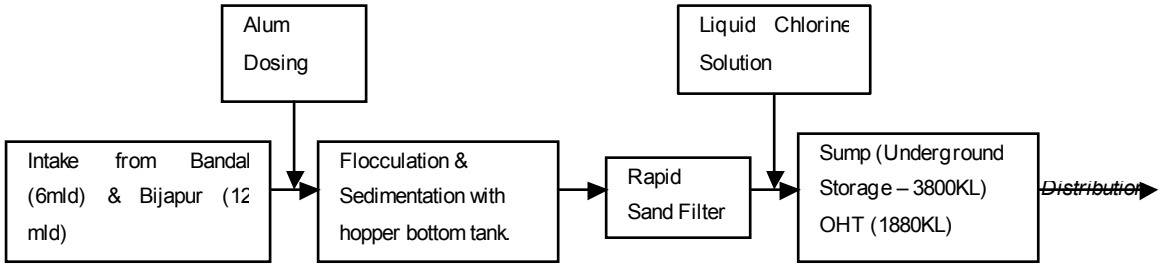
quality, but seasonal variations at surface sources usually occur.[14]

Dilaram Bazaar Water Works

This network is perhaps closest to the ideal of surface water, gravity-fed distribution that Dehradun will have done well to have. As we said, surface water sources are confined largely to the Upper Zone of Dehradun.

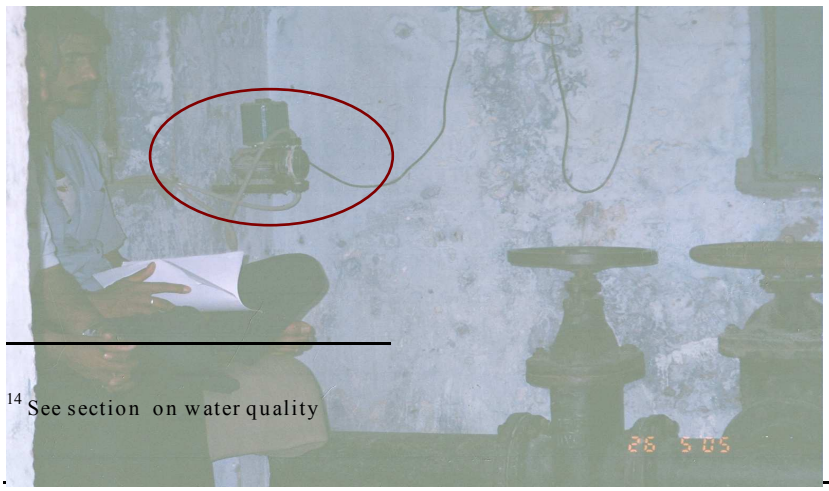
The Bandal raw water is brought from a distance of 18 km by diverting the flow of river to a channel. The raw water (6 MLD) is taken to (the collection chamber) treatment plant by gravity through a 14" GI pipeline network. The other source is the Bijapur canal (12 MLD) located nearly 8 km from the water works. The capacity of the four underground tanks for distributing water is 4.99 MLD and the capacity of the OHT is 1.89 MLD. The alum dosing is done when the raw water enters the inlet channel and is then flowed to the sedimentation tank.

Process throughput of Filtration Plant at Dilaram Bazaar Water Work



Chlorination of Tubewell Water

Dehradun's tubewells have online chlorinators working while water is being pumped to the OHT. The chlorination of water forms the basis for treating groundwater drawn by tubewells, and is used as a disinfecting media before distribution of water. Liquid chlorine and sodium hypochloride are used as disinfectants. Chlorination has been outsourced to local contractors and supervised by the Jal Sansthan with regular random samples taken at different times. Guidelines need to be developed for ensuring the right mix and appropriate quan-tity of disinfectant doses. The contact period of chlorine is kept at 5-6 hours, to ensure the water is



[14] See section on water quality

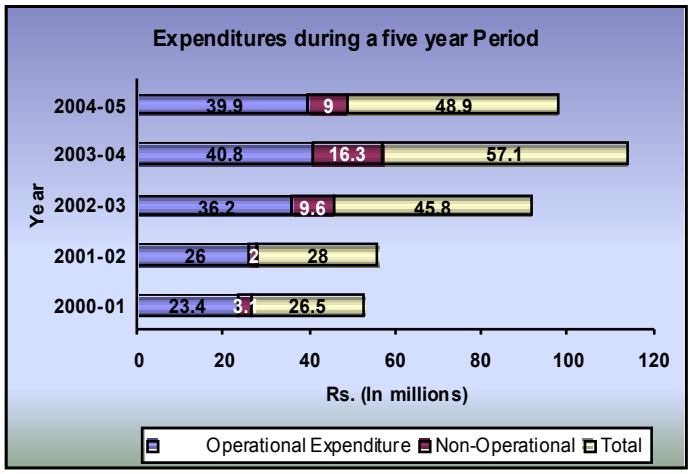
Chlorinator in Nehru Colony Pump House

not infected en route the distribution system.

08. The Story of Numbers

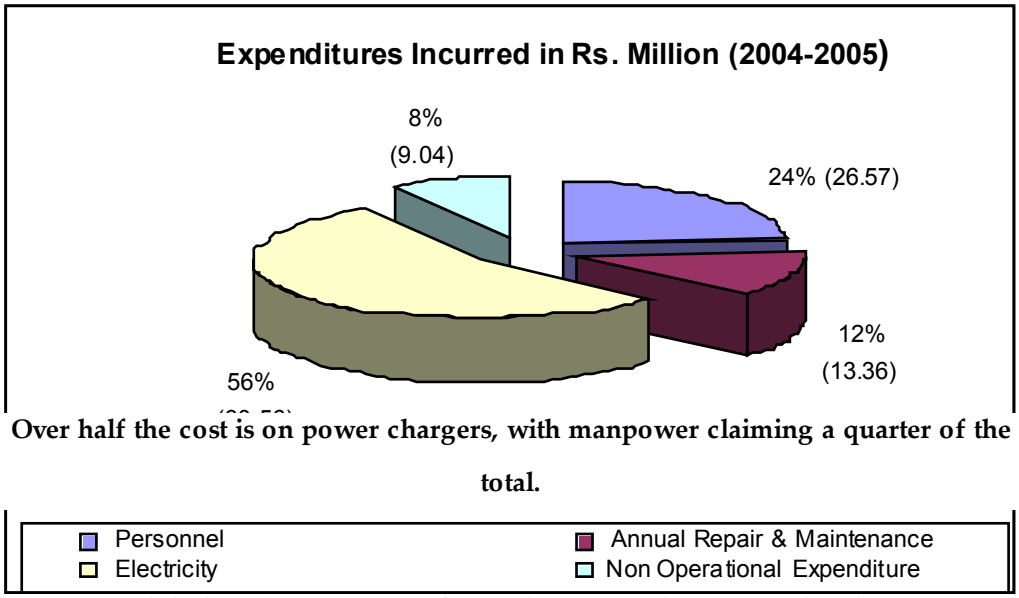
City-wide Water Expenditures

Like anywhere in the developing world, organized information is scare in Dehradun, too. The archaic data collection machinery is nearly not reliable. Inferences, conjec-tures and considered estimates serve analysts better on any planning exercise. Expenses incurred by the Jal Sansthan are broadly as operational and non-operational expenditure needs. The actual amounts do not show any particular trend over the past five years. One significant observation is that the increase in expenditure since 2001 is not commensurate with the increase in service.



The rise in expenditure over the half-decade has not meant a service upgrade.

The increase in expenditure in 2003-04 is due to the civil construction works undertaken by the Jal Sansthan. There is a nominal drop in operational expenditure incurred during the same period.



Over half the cost is on power chargers, with manpower claiming a quarter of the total.

As in any urban water supply system globally, electricity cost forms the major chunk in Dehradun's water supply. Only the nature of the power cost is different: the bill relates to the tubewells that draw water and feed the distribution. Personnel costs come second. Put together they constitute nearly 83 per cent of the total expenditure incurred during 2004-05. Non-operating include smaller investments in infrastructure and costs of contracts given out for tubewell operation and maintenance.

A detailed assessment of the expenditure profile for 2004-05 indicates that bulk of the expenditure is on Administration & Personnel cost and electricity charges. Very little has been spent on aspects relating to water treatment, pipeline renewals and quality assurance. Investment in good practices of management is non-existent.

City-wide Water Revenue

The revenue streams for the Uttaranchal Jal Sansthan are complex as it is based on different tiers of tariffs.

Table 7. Annual Water Revenue Statement of Water Works Department

Year	Water Charges	Water Tax	Sewer Tax	Others	Total (Rs)	Rs Millions
2002	32,414,292	26,813,240	3,221,295	4,384,389	66,833,216	66.83
2003	36,481,678	24,774,005	31,72,420	7,096,686	71,524,789	71.52
2004	41,028,268	26,346,071	3,385,081	7,009,378	77,768,798	77.76
2005	56,383,995	27,451,380	3,898,304	103,72,332	98,106,011	98.10

Source: Water Works Department, Dehradun
Note: The statement indicates that the annual loss to the Jal Sansthan is approximately 11 per cent of the total expenditure incurred during the last financial year.

On the basis of the total revenues and the amount of water supplied, the revenue realized works out to Rs 2.30 per KL of water for 2004-05.

Surface Water Sources

Dehradun's water supply system is almost a century old. Water supply in the town started with surface water systems with the first such project drawing water from the Mossi Fall. With this came the establishment of the Waterworks at Dilaram Bazaar. Later water was drawn from the Bandal Nadi, which is, to this day, also conveyed to the Dilaram Bazaar treatment plant. These surface water sources were failing to meet the growing demand, and a major thrust to drawing groundwater was provided with the formation of the Jal Nigam, which was established to access finances from the World Bank.

Table 8. Surface Water Sources	
Source	**Availability (MLD)**
Bandal River	6
Kolhukhet	0.6
Mossi Fall	12
Bijapur Canal	12
Total	30.6

Dehradun's Mossi Fall and Bandal system are indeed very old systems. Capital costs incurred at the time of their creation do not have a bearing on the current costs as they have been amortized. The recurring cost in the filtration unit and treatment is marginal. These sources cater only to the upper zone of the city. Surface sources, if distance is not a factor, always offer feasible, long-term, efficient solutions because they take advantage of gravity-fed distribution options.

Since the last decade the availability of water from the Bandal Nadi has reduced by 3 MLD from 8 MLD, whereas sources like Mossi Fall, Bijapur Canal have augmented the water supply. Apart from these two source, the Bijapur canal supplies water to the Dadra Pumping Station, Raj Bhavan and Cantonment area. The surface water sources contribute to a shade over the quarter of the city water supplies.

Economics of Surface Water Supply

The cost of such surface water production is estimated from the scanty information available at a disaggregated level of each source. At the city level the O&M costs *excluding* the electricity bill for 2004-05 is Rs 48.83 million. The cost per KL of these costs works out at Rs 1.30.

The recurring costs in the filtration unit and the new storages have to be accounted. The cost of water produced from each of the surface sources is as follows:

Table 9. Cost of Sourcing and Distributing Surface Water			
Treatment Plant	Treatment Capacity	Daily Treated	Cost of Treatment
1 Dilaram	21 MLD	16 MLD	0.20 per KL
2. Shahanshai	14 MLD	10 MLD	See note below

Table 9 shows the centralized treatment plant located in water works premises is treating 16 MLD of water. The monthly expenditure on treatment facilities is approximately Rs 1 lakh. Therefore the total cost per kilolitre of water treated is Rs. 0.20. There is no specific detail about the Shahanshaai filter plant but the similar process of treatment is carried out and the cost per KL of water would be similar to that of the Dilaram Bazaar water works, irrespective of the quantity of

water treated in both the plants. The maintenance cost could be marginally higher in Shahanshaai filter plant as the water is sourced from the Mussoorie range, which has rich limestone mineral deposits.

Cost of sourcing and distributing City-wide water

The cost of water production is estimated from the scanty information available at a disaggregated level of each source. Estimates have been made from city level information on the overall O&M costs and the specific costs of tubewell operation. At the city level, O&M costs for 2004-05, excluding electricity, is Rs 48.83 million. Again, a little extended arithmetic on the data available shows the cost per KL to be Rs 1.35, on the basis of 99 MLD.

Assuming an optimistic 15 per cent line loss for the 114.94 MLD produced, the cost of electricity per KL of water distributed is (Rs. 1.67~Rs. 1.70). Were we to assume the same quantum of water is produced throughout the year [114 MLD], the cost per KL of water is nearly Rs. 3. And if you reckon with 15 per cent transit losses due to leakage, this cost rises to Rs. 3.50. And, that is just the cost of energy.

Cost of Energy for Distribution

Crunching these numbers on cost of energy has been an exercise that combined data, good estimations and interpolations made on the basis of our long years of experience and understanding.

The cost of pumping has been estimated only for the tubewells for which current electricity bills could be accessed. The cost of electricity per KL of water produced varies from Rs 0.96 to Rs 5.70 in the sampled tubewells, with a deceptive statistical average of Rs 2.61. Considering the 2004-05 cost of electricity the power cost per KL of water drawn touches nearly Rs. 1.70 per KL.

Table 10. Electricity Expenditures for the Sampled Tubewell Locations

S. No	Location	Units Con-Summed [KWH]	Connec-ted Load [KW]	Total unit Charges	Meter Rent	Electricity Duty	Total Bill	Discharge [LPM]	Production/ Month [KL]	Cost per KL (in Rs.)
1	Dalanwala	45532	60	102447	600	6829	109876	1750	46080	2.38
2	Khurbura	32676	75	73521	600	4901	79022	1700	46080	1.71
3	Vijay Colony		25	10000	600	12419	23019	300	4320	5.33
4	WWD	40789	46	91775	600	6118	98493			
5	Shivlok Colony	22260	36	50085	600	3339	54024	750	28800	1.88
6	Kaulagarh Octroi	31060	64	69885	600	4659	75144	1200	34560	2.17
7	Dalanwala-II	44040	67	99090	600	6606	106296			
8	Survey Chowk	109280	122	245880	600	16392	262872	2000	46080	5.70
9	Kanak	13230	75	29767	600	1984	32352	800	23040	1.40
10	Badrinath Colony	36380	57	81855	600	5457	87912	2500	57600	1.53

11	Rajendra Nagar	38467	98	86550	600	5770	92921	1300	57600	1.61
12	Tibati Market	23004	64	51759	600	3450	55810	2000	46080	1.21
13	Rajendra Nagar-II	34894	64	78511	600	5234	84346	1900	46080	1.83
14	Kaulagarh Octroi –II	33130	47	74542	600	4969	80112	1600	34560	2.32
15	Loharwala	19189	39	43175	600	2878	46654	600	11520	4.05
16	Nimbuwala	2528	32	12800	600	379	13779	725	14400	0.96
17	Gandhi park	73600	64	165600	600	11040	177240	2500	63360	2.80
18	Dobhalwala	30000	75	67500	600	4500	72600	570	14400	5.04
19	Hathibarkala	3200	8	7200	600	480	8280			
20	Karanpur	45540	75	102465	600	6831	109896	1450	46080	2.38
						Average Cost per KL				2.61

Where electricity costs of tubewell operations exceed the difference between the tariff and other O&M costs, the Jal Sansthan is unable to pay the dues. These had accumulated to a whopping Rs 209.75 million by 2004-05. While on the average calculated for the selected tubewells the electricity charges alone are higher than the tariff by a mere Re 0.11, there are very few tubewells, which are operating at those costs. This study couldn't get to the bottom of these costs for sheer lack of reliability of any of the data that could be accessed. The work on water supply that this group will continue to do into the future in Dehradun will help us fathom these aspects better.

All areas today where supply is provided through tubewells are intrinsically cost-deficit areas, the deficit varying according to the tubewell characteristics. The cost-deficit areas in the city are thus governed by the geographical features. It bears repetition that the surface water sources are limited to the upper zone of Dehradun while all other zones are dependent on tubewells.

While the cumulative energy arrears till March 2005 are Rs. 209 million, the electricity expenditure for March 2004-05 alone stands at Rs. 60 million. The tariff order of 2005-06 indicates that the tariff structure for public water works category is already at an efficient level and does not need any revision. However, minimum charges of Rs. 400/kW/month being the highest in all categories need a re-look. The Uttaranchal Regulatory Commission notes in this context that there is no eventuality when the licensee would not be able to recover minimum charges. Water Works being always in operation, this eventuality will never arise. The Commission has, therefore, done away with Minimum Charges for this category. The electricity charge for public water works is fixed at Rs. 2.25 per KWh. If the bill is not paid by the due date, a late payment surcharge is charged at 1.25 per cent per month on the unpaid amount of the bill for the period.

There is a compelling case for dedicated electricity supply to tubewells. This will ensure water to consumers during the supply hours to begin with and if such dedicated power is continuous, any local area can achieve 24x7. It becomes all the more important when water supply is directly

distributed without an OHT, from a particular tubewell. The failure of electricity and thus hindrance to supply of water has raised serious concerns from different sections of users. Protest demonstrations of residents in front of the Jal Sansthan offices is a sore, and frequent, sight. These are usually met with knee-jerk measures of unbudgeted release of funds to offer emergency remedies.

The Jal Sansthan has accepted the existing incapacities of the system with so much resignation that it has budgeted for purchase, six mobile gensets in the current year, to bring temporary relief and appease vociferous user segments. Reports are rampant of indiscriminate shifting of working pumps from tubewells in a poorer locality, to bring relief to a more influential residential hub. An appeal for dedicated electricity lines to the tubewells has even been made to the Ombudsman, Uttaranchal Electricity Regulatory Commission.

People's ire in Dehradun is on edge. The government is sitting on a mild powder keg. One difficult summer can make life for water administrators hot under the collar, in more ways than one.

09. Where the Power Lies

Uttaranchal Peyjal Sansadhan Vikas Avam Nirman Nigam

A basic axiom of good management anywhere is the establishing of role clarity. Knowing that accountability can be sought only if there is authority is a basic prerequisite. Historically, water administration in Dehradun has evolved in ways that have left each of the three institutions disempowered one way or other. Let us look at the scenario existing.

The Uttaranchal Peyjal (drinking water) Sansadhan (resources) Vikas (development) Avam (and) Nirman (construction) Nigam (corporation) (UPSVANN) designs and executes the water supply and sewerage schemes. This is a for-profit company by the nature of its constitution. These assets once created are handed over to the Uttaranchal Jal Sansthan (UJS) for operation and maintenance of these schemes. The Jal Sansthan is a not-for-profit institution modeled on the lines of a social welfare agency.

Primarily UJS and Water Works Department (UJS) hold the responsibility of supplying drinking water to the population of Dehradun. The Water Works Department is the key agency for sourcing, treating, storing, and distributing drinking water through the existing piped network. The Superintending Engineer (Urban) heads the Water Works Department and is based in Dehradun. The WWD falls under the broad umbrella of the Jal Sansthan.

The primary problem with such an arrangement is that the supply utility, the Jal Sansthan, has little concern for capital investments in infrastructure and the need for raising adequate revenues for sustenance of the assets that are created by the UPSVANN, or the Jal Nigam. The UPSVANN in turn faces the same predicament on the issues of capital cost recovery that the Jal Nigam is responsible for. The inherent conflict in the very objectives that the charters of the two agencies, as they are constituted – one as a corporate entity, and the other as a not-for-profit organization -- needs serious and immediate review.

Legal Status

The Uttaranchal (UP Water supply and Sewerage Act, 1975) Adaptation and Modification Order, 2002 was passed on November 07, 2002. As per this order UPSVANN replaces the UP Jal Nigam, which has the jurisdiction over the entire State excluding the cantonment areas.

While the primary objectives of the UPSVANN are to "develop drinking water sources and execute works related to drinking water across the State", the Act also provides for the institution to function as a construction agency for other departments of the State Government and outside the State[15]!

Uttaranchal Jal Sansthan

The Chapter III of the Act refers to the Jal Sansthans, which the State has power to establish wherever it is deemed necessary with also the power to alter its jurisdiction.

After the formation of the new State, the Garhwal and Kumaon Jal Sansthans were merged to form the Uttaranchal Jal Sansthan, which has jurisdiction of the entire State.

Uncannily, the Uttaranchal State embedded as its motto right at its inception the very objectives of the MDG 2015. Though stated elsewhere in these pages, it bears repetition: *Swachh-Niranthar–Paryaapth* [clean-continuous-optimum] water supply.

Legal Status

The Act also states, `Jal Sansthan for all purposes be deemed to be a local authority under Chapter III; Section 18, Sub section (5)', thereby giving it scope to continue after the Constitutional 74th Amendment which transfers these functions to the local authority.

Need for Corporatisation, Regulatory and Technical Advisory Bodies

In seeking to address this issue in this document for Dehradun, we are keeping an eye on the challenges before us all on other such towns across Uttaranchal, or India. If Dehradun's water governance has to achieve the preconditions for corporatisation, it has to acquire a combination of social, economic and political institutions which permit it to respond to technological opportunities. But this is the story, almost without exception, across the country. The question is: why do Indian bureaucrats fail?

Why, as in most East Asian NICs, don't we have better public management? One, we need specialists to have stable tenure where they can acquire expertise and display commitment; and two, we need shorter lines of authority, which will make for quicker decisions. The real solution is to change systems and procedures and reward bureaucrats for results, and not for adherence to procedure and process. Investing in training civil servants is another must. This will empower them with managerial skills, while educating them in the economics and values of running without losses.

[15] In the 1980's, the Jal Nigam managed continuous water supply in Bundelkhand and Kaval towns, but it was not sustained for many reasons.

UPSVANN is a body corporate and is essentially to function as such a corporate entity. To achieve this, it has to battle a crippling legacy of systems that go back to the yoke of colonialism the country carried, and then the debilitating tradition of buck-passing that the Indian bureaucracy has elevated into an art form. There is then the ambiguity that the contradiction of the Uttaranchal Jal Sansthan being registered as a Society, akin to a non-profit institution, creates. The cumulative impact is that a culture of accountability, with defined deliverables and an approach to managing affairs that recognizes target orientation, does not exist.

There has been a recent move to merge these two institutions and create a corporation. This has been strongly resisted by some quarters and is the cause of a deal of uncertainty and lack of motivation among a large section of the workforce, who are concerned about the nature of the future services and their role. Only when the capital costs and the financial costs are incorporated into the utility's costing and pricing, and recovery efforts are commensurate, will greater efficiency and accountability be brought in and the entire network of supply systems can be hoped to be financially sustained.

The Nigam is responsible for setting of performance standards and reviews. Since the Nigam is primarily the service provider of infrastructure for water, this power of review should be vested in another neutral agency which can offer objectivity to the exercise. While the need for a regulatory body exists in all civic services, and the State has established a regulatory commission for the power sector, the situation vis-à-vis water supply and sanitation is still very nascent. The government must initiate the possibility of increasing the number of service providers, set standards and explore with citizens the potential role of the regulatory body so that such a regulatory body does not end up being a mere grievance redressal cell, but brings a proactive dynamic.

There is need for civil society groups and technical institutions to handhold the process of transforming the city's supplies. Institutions such as the Alt.Tech Foundation, the Academy for Mountain Environics, Technology and Research Network, the People's Science Institute, Sanchar and a host of other such institutions with the professional and managerial prowess to offer deliberate analysis and objective counsel on directions to be pursued, could be invited to assess technology options, create a conducive climate for the community to seek and secure continuous supply, and to continue the mission till the water supply systems are sustained largely by the local community itself.

There is a crucial enabling role that institutions such as these can play in engineering the directions that policy and rules should assume in order to steer control into hands of communities, with democratic, consultative and transparent methods of implementation.

This apart, their role in instituting good practices vertically down the value chain will be significant. Good management combined with responsible participation of representatives of user groups upon

whom powers to manage are vested will make for a potent blend that will spell success and efficiency.

10. Building Water Efficiencies

There is a compelling case for building across-the-board water efficiencies in order to ensure economic viability for water supply in Dehradun. Such efficiencies must target distribution/usage problems and rationalization of management.

The Jal Sansthan has to install a task sequence mechanism with involvement from every member of the organization to revitalize operations from the point where the water flows from the OHT into the distribution lines of every area, be it domestic, industrial or commercial. The Jal Sansthan's revenue mechanism fails on three counts: leakages, unauthorized use and non-payment of legitimate bills. Some of the areas that need diligent attention without loss of time are:

a. *Improving efficiencies in the cost of distribution of water by plugging leakages or replacing old pipe in the distribution network.* Currently, more than half the water is 'lost' or is not accounted for by the data and mass of statistics that the Jal Nigam or the Jal Sansthan have on record. We make, therefore, this studied inference on the extent of loss on leakage. While the official figures are as low as 15 per cent, the comprehensive study undertaken earlier by us in 1998 points to 47 per cent, and if one reckons with administrative inefficiencies, it could be pegged as high as 58 per cent.[16]

b. *Preventing illegal tapping of water by providing a more efficient grid for delivery of water at sustained pressure.* Currently, the pressure varies erratically, forcing those residing in low pressure areas to adopt a variety of coping measures including pumping, larger storages and even puncturing the distribution network with illegal installation of suction pumps to draw more water into individual homes.

c. *Ensuring economies in water usage by removing water insecurity.* Currently, due to the curtailed and sometimes irregular supply of water, users are forced to adopt methods for storing water beyond their requirements. Such make-shift storage measures are inherently inefficient since their transport and storage inevitably involves spillage and waste.

[16] Dehradun is in good company. Toronto has a leakage rate of over 30 per cent, while Montreal has reported a decadal average of over 40 per cent. Right here in India, Bangalore's unofficial estimates of such leakage loss are suggested to be over 54 per cent. Most Indian cities don't fare any better. This is one of the [obviously] unstated reasons for most Water Boards' reluctance to consider in earnest a 24 x 7 option.

d. *Extending the life and fatigue-resistance of the pipe-distribution system*. Currently, the pipe distribution network is in constant need of repair. Such repairs are forbiddingly expensive and as well lead to water outage that only feeds user insecurities.

e. *Monitoring usage patterns in high consumption areas.* Currently, because of the fixed tariff structure, high-income neighbourhoods consume a disproportionate amount of water.

Remedial action

Once repairs and replacement of the dilapidate sections of the existing pipe distribution network have been effected to stop leakage and improve water pressure, we propose that most of the other distribution/usage problems be effectively remedied by instituting a 24x7 water supply. Of course, there are exceptions to this proposition (extent of 15–20 per cent of the city's lines) where a complete overhaul will be an option that is ineluctable.

Building A Case for Continuous Water Supply

The two big challenges that confront Dehradun's water system are persistent loss of water through leakage in the pipeline system, and energy supply on an even, uninterrupted basis. Deterioration and rupture of pipelines is primarily due to the initial brunt of water pumped at high pressure that these pipes, and especially pipe-joints, must bear when water is released intermittently through the distribution network. Such pressures will be obviated when water is allowed to flow continuously. In addition, pipes that carry an irregular supply of water are highly susceptible to corrosion and deterioration. Air locks sharply affect the age of such assets. Having a continuous water supply thus makes sound economic sense in terms of the huge costs saved from an extended life-span for the pipe distribution system and the prevention of seepage. Further, continuous water supply will obviate the tremendous sense of water insecurity that currently leads to a significant loss of water and high coping costs incurred on illegal siphoning and inefficient storage.

In any 24x7 supply system there remains the issue that water supplied on a continuous basis will be susceptible to its misuse especially in a context where a common tariff structure exists. It is not without surprise that the only excessive use of water recorded in Dehradun is found in the upper income neighbourhoods, given their water needs for extensive lawns, car-washing, and domestic appliances that are water-intense. Simple and cost-effective strategies, however, can be easily introduced to curtail such usage. For instance, the Consulting Group proposes a simple strategy of installing monitoring mechanisms in such neighbourhoods: involve the participation of local residents in charting usage patterns. Where there is abuse, users will be notified and their water

supply turned off if they don't conform. This is a regime that will be difficult to achieve, unless user resistance and recalcitrance is broken with such a deliberate strategic measure to involve representatives of the community in such monitoring processes and evaluations thereof.

Dependence on the Power Grid for Water

The Jal Sansthan is reeling under the impact of the onerous burden of arrears that it has to clear to the state power utility, the UPCL. With poor servicing of this current liability, the Jal Sansthan is faced with the prospect of even poorer quality of service from the power utility. How does the Jal Sansthan transform this vicious spiral into a virtual one? There are two strategic directions that are before the Jal Sansthan. The first option is a two-step process: one, to make a borrowing to wipe the existing cumulative liability of up to Rs. 200 million plus (Rs. 60 million of this staggering cumulative arrears has been chalked up in just the last financial year) off its balance sheet couple with a Business Plan that will map fund and cash flows in the years ahead in a way that the loan repayment is made feasible; two, to then negotiate with the power utility, on good commercial terms, to provide dedicated energy supply to all the tubewells under the command of the Jal Sansthan. This will need some further effort and investment from the UPCL to offer such a priority set of power supply lines to the tubewells.

Localized Power Modules

The second option before the Jal Sansthan is somewhat radical, but makes for a viable proposition, especially given the unique feature of the particularly heavy dependence on tubewells in the town. If, as we suggested earlier, the Jal Sansthan were to orchestrate with the professional assistance of groups such as the Alt.Tech Foundation or the Environics Trust and a clutch of other such voluntary action groups in Uttaranchal, the setting up of a series of local power generation modules, completely dedicated to supplying the energy needs of the pumps at these tubewells, its dependence on the UPCL can be drastically brought down, even if not eliminated.

The installation costs of such localized power modules—covering the genset, the building to house the equipment and the acoustics for the system—will be in the region of Rs. 30,000 per KW. The peak load demand of the current population of 60 tubewells at an average of 40 KW will be in the region of Rs. 72 million for the entire town as a lifetime investment. This works out to a per capita investment of a piffling Rs. 150 at Dehradun's current population level.

This investment for each of the dedicated tubewell systems can be met out of borrowings that are amortised over eight to ten years.

Portending New Ways of Resource Management

Such local generation can have an enormous advantage in that the feedstock can move away from the traditional, extractive fossil-fuel-based (diesel) to renewable sources of energy, thus making the entire system of water supply enormously ecologically sustainable. India, apart from China, has the world's most effective technologies in the areas of biomass gasification or bio-diesel manufacture from seed extractions of neem [*azadirachta indica*], mahua [*madhuca indica*], pongamea [*pongamea pinnata*], jetropha [*jetropha curacas*] and other sub-tropical tree species that are abundant in the sub-continent. The avenues this will open for creating livelihood opportunities, and not merely employment, for thousands of villagers is exciting as a socio-dynamic spinoff.

Because the technology and operational systems for running micropower plants with such renewable feedstock are relatively new, even the best development analysts have remained skeptical of their performance, their operational viability and economic efficiency, even if they have not doubted their ecological feasibility, or their technology effectiveness. The challenge, really, lies in good micro-managing with adequate training of staff in these very simple operational processes.

If the Jal Sansthan takes the first innovative step, with the tacit support and endorsement of the ADB, and implements such a local infrastructure measure in one or two communities as a pilot demonstration where the tubewell is dedicated entirely to the area with no inter-zonal demands on its distribution, the success of its implementation will trigger a cascade of such ecologically sound creation.

First Step to Innovation

If Edison's bulb and Graham Bell's telephone heralded the last century, we are at the cusp of a new century which portends resource-management systems that are beyond our present understanding. There is need to think past the solutions we have inherited so far. If the Jal Sansthan, the Jal Nigam, the waterworks department and the government backs such a *First Step to Innovation* in Dehradun with the active endorsement of such a proposal by the ADB, we will have together forged a new direction in urban water supply development.

It will bear repetition that this is possible in Dehradun because of its unique situation of dependence on an extremely local supply source with tubewells.

24x7 Power Can Energise New Technology

If such 100 per cent reliance of energy supply is secured, and if local management is vigorous at the operational levels (regardless of whether it is from the Jal Nigam, the Jal Sansthan, community groups, or a local enterprise for water supply), the next step will be the avoidance of the huge capital

cost that construction of new OHTs demand. Instead, at less than half the cost, a suitable sump tank capacity at the ground level can be created, and the local power generating plant can host a set of hydro-pneumatic pumps that will maintain the pressure constantly in the distribution lines. Such a hydro-pneumatic system has met every parameter of performance—economic (both capital and revenue terms) efficiency, reliability, low-maintenance demand—across hundreds of such installations in urban and rural India.

The need for 24 x 7 power that HPS demands will also have been met by the First Step to Innovation.

Again, among development analysts and even more so in the government, there is lack of awareness, comprehension of such technologies and unfounded apprehensions on the levels of skills needed for post-installation maintenance.

This needs a quantum shift in the thresholds of professional analysis and resistance to change. This group is committed to providing all necessary technical and professional support to identify a network of such delivery organization, technologists and implementation agencies, were the government to decide to incubate such innovation.

Building Managerial Efficiencies

From all that this document records, it is obvious that cost efficiencies have to be extended to include the management of water. Currently, the water supply system in Dehradun is managed by two state-wide bodies, the Jal Nigam and the Jal Sansthan (*see Appendix for details*). To recount, the Jal Nigam is responsible for planning, conceptualizing and building water delivery systems, while the Jal Sansthan is responsible for its actual operation and maintenance. However, while the Jal Nigam is responsible for financing such systems, the Jal Sansthan is not compelled by economic efficiencies. Such a disconnect between two arms of the government does not encourage fiscal responsibility. The Consulting group proposes a two-fold strategy:

a) *The merger of the Nigam and the Sansthan into an autonomous regulatory body which can oversee the choice of technology, implementation of projects, and the equitable distribution of water.* Its other functions of actually planning and building water systems can be contracted to private parties. The intent is to decentralize and hive functions to bring in greater fiscal prudence, and role clarity to all functionaries. A spinoff will be across-the-board efficiencies in terms of managing time and resources leading to greater savings in overall costs, and paving the way for offering quality service to the end-user.

b) The devolution of the Sansthan's responsibility for tariff recovery and O&M to local management. The Consulting group proposes that actual tariff recovery and O&M can be

done by local management, initially with the help of this Consulting group, and other such institutions who have the managerial competence to deliver, and eventually--as the community understands the process and is trained--by the user-groups themselves. The tariff will be used to pay for the bulk water received, and for repairs and maintenance of the system under such local community control. Such devolution has tremendous scope to generate fiscal responsibility since the users themselves will be directly responsible for revenues generated and costs incurred. Other consequences are implicated as well. Non-payment of water dues will be de-risked with such a system since local management will bear greater ownership having to bear the costs. Remedial action therefore—such as user-conformity to bill payments or unauthorized use—, will be quick and efficient. However, the social pressures generated, as the management and the user will be in direct interface everyday, will probably not require penal remedial action like cutting off water for non-payment. In the context of Uttaranchal, local communities have, apart from peer social pressures, also adduced to the wrath of local deities if such behaviour is noticed among the users! Where large quantities of water are used, monitoring by local users will ensure compliance within acceptable limits determined by the locals themselves.

The Politician's Wield and Influence

If Dehradun's water governance has to achieve the preconditions for corporatisation, it has to acquire political institutions which permit it to respond to technological opportunities.

Through this entire document we have had little to say of the role of the politician. This is odd in a democracy that clearly has a strong nexus established between our people and their elected leaders. This is not intentional. It is just that the system of elected leaders and the Executive functionary only recognises the need for the 'blessings' of a politician, and not an active role in the clearance, funding and translation of plans and objectives, from such an elected person. Besides lack of professional knowledge among most such 'party workers' who turn leaders and then are rewarded with office-holding at various levels in ministries and corporations or municipalities such as the one in Dehradun, there is complete, even abject, dependence of the political leader upon the bureaucrat for [a] knowing what needs to be done, and [b] what needs to be spent for creating any welfare benefit to a constituency of people who elected him/her.

The only 'weapon' that the politician turned office-holder wields is the threat of 'transferring' officers in the bureaucracy, if they don't 'conform' to the politician's directions. And in a scenario of so many conflicting needs clamouring for attention, the politician knows not how to prioritize, and the bureaucrat finds discretion is the better part of valour. The more reactive pronouncements that the

politician makes in her desire to appease her constituency, only compounds matters. This is a vicious spiral that has bred both ineptitude among political appointees and office-holders amongelected people, and insecurity, resignation and apathy or, worse, servitude among the bureaucrats.

Beyond Party Lines

How can the politicians of Uttaranchal -- its ministers, zilla parishad members and heads, or corporators -- see the immense benefit of implementing water plans? How can warring political parties, vying with each other for their share of the constituency's loyalty, become aware of the tangible benefits of making water available to its 'vote banks' beyond narrow party lines? These are questions that can offer deep dimensions to the very fundamental change we need in the administrative process, which can come only if there are proactive politicians who go beyond the static, stagnant policy mindsets that have enriched vested interests, specially the state personnel – elected, appointed -- or their hangers-on.

Our hope, in recent times, is the internet, and the television. Change in Uttaranchal's smaller towns as well, apart from Dehradun's squalid slum settlements that host nearly 230,000 of the city's population, will surely take place at a faster pace. Because they know too much -- through cable, TV and slowly but increasingly through the net. These people may not be able to articulate economic policies, but they see clearly enough, who has power and who does not, and whose is legitimate and whose is not.

The impulse to control that the bureaucracy still clings to, will take more time to diminish. But the flood of information that is now available will force transparency in the government.

As Liaquat Ali Khan, a carpenter residing in an LIG colony of the city said with anger ill-concealed, "How many more months can the corporator avoid coming down our street? How many more years can the minister not visit our *mohalla*? They can't get away with just promises made."

What's in it for all the stakeholders?

Table 11. Stakeholders Motives and Aspirations

	Corporation Employees	*Community*	*Bureaucracy*	*Government/ Political*	*Private Enterprise*
Existing Needs	• Assured Employment • Other Income Avenues	• Assurance on Water price line • Say in Decision - Making	• Power and influence	• Vote Bank • Funds for Party and self	• More contract business • Higher management skills for his people and material resources to deliver Time/ Quality/ Cost
Power	• Unionisation	• None	• Decision making (Top down)	• Power over bureaucracy • Drive	• None, unless he is a big contractor with

			• Financial Control • Influencing policy to protect their interests	Contract-friendly projects	'influence' and ability to offer speed monies.
Fears	• Loss of employment • Greater income to Private Enterprise when infrastructure is already existing	• Increase in price • Worsening quality of service (Fears came true in Power Sector)	• Loss of power/ influence • Loss of grants/ Funds Assistance • Fear of being accountable to public with no authority or control	• Fear of vote bank reprisal on failure • Loss of control for a disempowered bureaucracy • Fear of greater efficiency of new water regime showing up their incompetence	• Reprisal from bureaucrats and politicians • Loss of business • Payments servicing • Loss of business reputation
Mitigation measures, plans needed	• Ensure long-term interest protected	• Contract damage clauses on enterprise for-Non-performance, stability of tariff, Transparency and information Management by enterprise to community (on price, supply, logistics, maintenance)	• Elevated to play advisory role • Sharpen their role as 'keepers of knowledge'	• Create an environment of assurance for all stakeholders, with view to protect vote banks	• Impart stability to his business • Insulation from bureaucracy/politicians • Clear contract guidelines
	• By ensuring continued role in a revised water regime	• Citizen Awareness Campaign to enhance Information on rights and claims of community on Bureaucracy	• Devise Strategy and Regulations against user abuse	• Find means of ensuring revenues to serve their political machinery (!)	• Infusion of Management development systems
	• Reskilling to ensure continued productivity in new contexts	• Brief Directory for community of who is liable for what			• Replicable and scalable models of contract works
	• Ensuring stake in Enterprise projects with quid pro quo of this segment's sharing knowledge and organizational memory of services	• Helplines to access Bureaucracy Right to Information and right of recourse to community	• Babus tell us: Tomorrow is another word for Today. That the system is eternal. Change this		• 'Clean' work environment without social/ institutional snags

The Water Sweepstakes

This mapping of the stakeholders and what they seek beyond economic value encapsulates the predicament of conflicting aspirations that our study brought to manifest. At the core of every group's need is awareness, for each constituent, from which will emerge the secure knowledge that all can win, if they created transparency. When transactions are brought to the public domain, efficiency will be rewarded all round. This is not a romantic notion that this consulting group carries, but is a measurable target that can be achieved with a rising pyramid of steps that are taken in an atmosphere of mutual trust, recognition of capabilities and convergence of objectives.

Building Jal Sansthan's Niche

De-risking Water Retailing

The Jal Sansthan has been saddled with a historical baggage of conflicting end-objectives. As a not-for-profit institution, it is committed by its charter to providing water as a social welfare measure even if it is at the cost of economic efficiency. Over successive years of such inefficient economic functioning, it has now invited the uncharitable judgment of being an organisation that has failed to deliver.

What is not realised, it must be said in fairness and to the credit of the Jal Sansthan, is that the slow process of debilitating morale and effectiveness that the lack of funds has caused, has inflicted serious damage to the very vitals of its functioning.

The Jal Sansthan's current personnel strength in Dehradun is not formidable -- it hovers around 350-400 in the city, apart from another 1,000 it employs across the State in the other urban settlements. A third of this human resource strength is workers at the field level: plumbers, and other field staff. The Jal Sansthan has also, wisely, chosen to outsource two work areas: [a] repairs of minor nature which still remain within its domain and purview; and [b] tubewell operations on a daily basis that are given out as sub-contracts in order to avert potential threats of growing unionisation.

Therein, however, lies the irony. What is a welfare organisation doing, taking the stance of a 'capitalist profiteer' by outsourcing staff and resources in a way that they can avoid permanent employment, is the obvious question, and one that raises red faces among the Jal Sansthan's senior officers.

Our discreet, informal survey of several Jal Sansthan personnel show uncertainty of the future, dissatisfaction at stagnant salaries, lack of role clarity, and unstructured interventions from either

superiors within the Jal Sansthan or from the government or elected representatives, all of which has led to cynicism and lack of motivation.

Core Strengths

The answers to these lie, among other solutions, in defining and homing down on the core strengths of the Jal Sansthan. Our surveys showed that its strength lies in running the core infrastructure of the city, and indeed in all the fifty-plus towns of the State to which its authority extends. This means focus on the running in Dehradun of the tubewells under its command, and protecting the life and effectiveness of the central feeding lines at the source of such tubewells. It also means narrowing down the Jal Sansthan's resources and energies to keeping the profitable Upper Zone works that are fed by the surface water sources, in good working condition.

Lean and Mean Operation

The Jal Sansthan can therefore bring meanness to its operations by defining its role as bulk water suppliers, and tender out the distribution within sectors and zones to individual community groups and/or responsible enterprises or entrepreneurs which will then risk-manage successfully the distribution in terms of taking care of [a] leakages, [b] bill servicing of users in their respective territories, and [c] the bringing of unauthorised users into the bill-paying net.

It is recommended that the Jal Sansthan recognise this 'transfer of risk', and devise a reward mechanism that will ensure that such local community groups, or Jal Sudharan Samitis, are rewarded with a transfer of the economic benefit accruing to the Jal Sansthan out of such de-risking strategies.

If the Jal Sansthan bills for bulk water supply to the Local group at the pumping station, it is de-risked on the following costs:

[a] The leakages in the distribution system that deprives the Jal Sansthan of a chunk of the revenue;

[b] Unauthorised use which the Jal Sansthan is currently not able to monitor with severity, for want of effective monitoring mechanism; and

[c] Collection of revenues promptly and in time, which is at present inefficient thanks to a legacy that denies the Jal Sansthan the receipt of money without delay.

If the retailing of water is therefore handed over to such local groups, the Jal Sansthan will have transferred all attendant risks. This will enable focus on the core function of improving energy efficiency of its pumps, maintenance of its tubewells, and improved quality of work at its water treatment plants.

The current loss to the Jal Sansthan accruing out of such water retailing is up to over 50 per cent by our studied estimates, and by the unofficial admission of the Jal Sansthan. The Jal Sansthan will find it economically viable to home in on a pricing strategy that will ensure that its energy and professional and administrative costs are met with an earnings margin to take care of the need for the creation of a sinking fund to defray costs on future eventualities that are unforeseen.

This will afford the Jal Sansthan the time and opportunity to enhance its quality of interface with the other water infrastructure partner, the Jal Nigam, and with the Sansthan's own Water Works Department.

Water Bottling from the *Dev Bhumi*

The Garhwal has been known for centuries to be the *dev bhumi* [God's land] to millions of Hindus in the sub-continent. The therapeutic properties of the haloed land's waters are legendary.

If the Jal Sansthan works on a brand strategy and builds on the powerful equity that this ancient land represents, it can turn an excellent business opportunity to its distinct advantage.

The Garhwal region alone, which nestles to the western half of the State, covers the famed pilgrimage centres of the chaar dham [the four sacred centres] of Kedarnath, Badrinath, Yamunotri and Gangotri, apart from numberless other towns like Uttarkashi that are many millennia old, if you were to go by the Vedic texts and references in the 5,000-year-old Puranas that are still living religious symbols of reverence for the Hindus.

The Jal Sansthan, it is recommended, should set up its first bottling plant as an innovation measure, built to stringent hygiene standards for offering a set of branded products that can be sold in several markets within the state, and elsewhere in India and abroad. The example of how the neighboring state, Himachal Pradesh, built its equity and export earnings on apples is a story that Uttaranchal can well emulate with water as its value offer.

Twin Value Proposition

The immediate market that presents itself is the 12 to 14 million pilgrims who visit Uttaranchal in the seven months between April and November every year, before winter and snowfall in the upper reaches of the State. The larger Indian market is also a potentially powerful segment since Himalayan waters offers the twin value proposition of [a] being sacred and steeped in religious significance, and [b] being perceived anywhere in the world to be clean, pure and fresh.

Such a brand strategy should help to create a rich product mix that offers a spectrum of value options from the affordable to the high-end segment of natural, mountain water in the class of Evian or

Perrier in the international market. The Jal Sansthan can either launch such business initiatives on its own, or offer concessions to resourceful and responsible entrepreneurs under stringent environmental guidelines and parameters, and thus ensure the concessionaire fees are adequate to meet the Jal Sansthan's own needs of servicing its personnel costs and cost-deficits in other segments when it is forced to accept losses on grounds of equity and welfare of power sections.

Such initiatives as these are not without historical precedence and can be shaped with economic pragmatism and ecological sensitivity.

Section 2

Design and Planning — The Way Ahead

11. Shaping their Destiny

The Situation Analysis indicates that water supply to Dehradun's citizens can be transformed into a viable 24x7 continuous Full-Service Water Supply. The water resources, the technologies and local management systems can be brought into place with a financial mechanism in place. The analysis also points towards an enabling environment and programme directions which can eventually serve as a template for other towns, particularly in Uttaranchal.

Dehradun has historically taken the route of high-cost and energy-intense groundwater sources over the last three decades. Profligate water use has been the rule, with no conscionable understanding of the dire implication in the far term of such disregard of water as a finite resource.

Design and Planning of Implementation tasks have to reflect upon policy aspects and programmes that directly lead to the transformation of existing supply regime to a full-service scenario.

A series of persistent, cascading set of efforts are needed to transform the city's water supply into a Full Service Continuous Supply. This needs concerted focus on conservation, better management of distribution, and energy efficiencies that will help to make supply cost-efficient. Given that Doon Valley is declared an ecologically fragile microregion, the faster the turn to the city's and the valley's surface sources (sans the distance factor), the greater will be its hope for sustenance.

The government should desist from looking for grants and finance-in-assistance for creating new infrastructure or upscaling of existing equipment and systems. This is a mode of operation that has been followed in the last fifty years post-independence with no degree of success. We need a financial mechanism that can break costs down to the last user unit in a manner that recovery of the capital cost [by way of new connection fees] is enabled.

The tariff so engineered will be able to meet the cost of O&M. The personnel costs of the corporations that create infrastructure has to be met out of the management costs that every such capital works execution will carry. This 'price' of professional managers within the Jal Nigam and the WWD should be backed by defined outputs on performance, with parameters defined right at start.

In a world that is moving to proactive offers from a clutch of international development institutions as well as institutions such as the NURM, securing funds is not a challenge, as long as the implementing authority [the Jal Nigam or the WWD] is unequivocal in its commitment to recovery of full cost, both in capital and revenue expenditure terms.

In the design and planning of such a regime of implementation there are several initiatives that need to be implemented:

1. State's intent to provide 24x7 urban water supply systems.

2. Scope for creating decentralized units amenable to local management..

3. Effective structures for accountable local management systems.

4. Enabling provisions for incorporating knowledge from responsive institutions.

5. Policies for mandatory water harvesting and conservation measures.

6. Convergence of various development programmes.

7. Policies to provide for diversity of financing options.

1. State's Intent to Provide 24x7 Urban Water Supply Systems

The Government has explicitly stated its intention to draw up a road map for providing water on a 24x7 basis at the State level[17]. In the PSP workshop in June 2005, hosted in Bangalore by the ADB, the State Government had set the following Mid Term Goals for itself:

- 24x7 in 8 major towns by 2007-08
- Enable Rainwater harvesting in most areas
- Waste water treatment for all the towns of Uttaranchal in five years
- Making the water utility sustainable, both economically and ecologically.

The state government has also drawn up an explicit framework of this process:

- Year I: Pilot Studies & Capacity Development
- Year II - III: Consolidation and coverage of eight towns that will go 24x7, as well as adding other gravity-fed towns to this portfolio of towns.
- Improvements in head capacity in 35 other towns in the state that have low-head based water supply at present.

[17] The Nigam has drawn up a Masterplan for Dehradun which envisages decentralizing the city's water supply into 46 zones. Each zone under this plan will be equipped with adequate drinking water infrastructure in terms of operational source, storage, and distribution. The zones will thus be self-contained units with independent supply commands and sources. For more information on the current water supply infrastructure in the proposed 46 zones, see Appendix 2.

Comment: The challenge ahead is for the government to push on with a more detailed charting and finalizing of action plans for work across the State. This will give the right impetus for implementation.

2. Scope for Creating Decentralized Units Amenable to Local Management

One of the major constraints in enabling local management of water in Dehradun is the complexity of the water management zones that currently exist, which impair managerial accountability and economic efficiency given the ambiguity in geographic and territorial authorities of zonal administrators. Legal and institutional provisions are currently being instituted by the State to overcome these stumbling blocks.

Comment: The State must persevere to push through these changes.

3. Effective Structures for Accountable Local Management Systems

The local community must be empowered to manage these systems. While successful examples abound in various development contexts, the State and other enabling institutions have to play an important catalytic role and assume responsibility for this transition in each zone. This will enable the water authorities to focus on their core competence in managing source and storage, while the oddities of a local dynamic will be taken care of by the people themselves, with representative bodies of their own managing the distribution. The water authority will have de-risked the threats of poor recovery of tariff costs and leakages that currently add to their enormous cost burden.

Comment: This is easier said than done. The significant link to such enabling is, in ADB terms, a 'champion' from among the community, or a voluntary group that is not only dedicated to serve this objective, but is also managerially competent.

4. Growing your Own Water

Responsible disposal of sullage and sewage, or waste water, is an entire proposition on its own, requiring tertiary sewage treatment plants. Technology in this area has evolved rapidly across many Indian cities with mechanical and electro-mechanical treatment systems that are low on maintenance skills, and offer enduring performance values. The water treated is as clarified as potable water and there are many technologies which make this water potable, too. These systems are available in a cost bandwidth of Rs. 10 lakhs for an on-line capacity of 100,000 litres. These tertiary systems claim little space (300 sq. yards for a system of this capacity).

The implications of such steps to reuse waste water are enormous. More than one-third of the fresh water need of the city can be met out of such treated water. That, in today's consumption terms,

means over 40 mlpd for Dehradun! The island-state of Singapore, pressed as it has been for water given the acute paucity of landmass, has made technology leaps in treatment of what their planners call 'used water' (they no longer call it waste water). On Singapore's National Day this year, on September 09, the government launched, with much fanfare, a million bottles of drinking water grown out of such 'used water' that is now treated at an elaborate complex to the north of Singapore. The National Day launch called it 'Nu Water'.

Dehradun can, with resolve, emulate this effort and set a significant benchmark for the rest of urban India to follow. This will only require commitment from the government and inviting professional groups to create these infrastructure facilities with little or no red tape.

Comment: This will not require the blessings of the political regime as much as the ingenuity and dynamism of a few officers in the nodal agencies that relate to water.

5. Catch-water Plans

There is then the need for local initiatives to expand into encouraging harvesting of rainwater, create and manage these waste water treatment systems, and maintain the gardens of the local area. This is a formidable challenge even if the technology is as old as time, and requires very little as cost, and much less as effort. This needs the simple acceptance of a stark reality that will be upon us not so long from now – water shortages.

Comment: The government can do very little in this area. This has to be an initiative that local community groups and voluntary organizations catalyse across residential blocks with a catch-water campaign and three or four centers in the city helping and enabling people to set up such installations in their homes at their own costs. It will be easy for home owners to see the cost advantage of such an installation given the cost of energy in individual homes on pumping water from sump tanks to small overhead tanks atop roofs. This will need an awareness campaign, community meetings and group meetings with office-bearers of government institutions which have their own campus infrastructure for water.

6. Inviting Knowledge from Responsive Institutions

Uttaranchal is a young state, with hope still in the air and the urge to learn and incorporate lessons and insights from institutions across the globe. Strangely, that impulse has not extended to an area of such serious concern as water should be. The state's approach to water management has continued to be passive. This must change.

Managing water in Dehradun is not as daunting as it is in many cities of its size and spread. Because in most towns, there is the challenge of also reckoning with the source of water itself. Blessed as the

valley has been with an abundance of the resource, all it has to focus on is good management, think scale, and evolve models that are replicable. This will equip the government to address the more challenging tasks that await it in many other hill towns across Uttaranchal.

This shift in outlook will in itself bring transparency to management, will restore financial health of the water authorities, bring quality service to users, and devolve authority to communities who shape their destinies on their own with the government's greater resource-base helping only on the bulk supply at costs that will be efficient to both stakeholders.

Comment: This requires long-term managerial stamina among water officials and planners. The government has to play the coach, and not an authority that takes top-down approaches. A select cadre of officers must be offered stability of tenure in postings in order that they can deliver on the plans the government charters.

7. Policies for Mandatory Water Harvesting and Conservation Measures

Water harvesting has been made mandatory by statute. The enforcement of this statute is however not within the purview of water agencies. Provision for this must be made within the water laws, so that each of the local water bodies/units assumes these tasks as part of a general water management system.

Comment: Conservation of water is seen as a voluntary activity. However, in a full Service water system such a practice must be mandatory and enforced so as to ensure economic efficiencies and water sustainability.

8. Convergence of Various Development Programmes

A formidable operational challenge has been time-sequencing of several geographically competing activities. The classic example is of water lines being disturbed by road construction or cable laying or vice-versa. Such programmes must be dovetailed. The NURM of the Government of India and Urban Reforms Programme of the State Government lay specific emphasis on such integration across sectors.

Comment: Integration of these efforts at the zonal management level can enable time and cost savings, which in turn will make local management of resources more viable.

9. Policies to Provide for Diversity of Financing Options

Initiatives for several types of financing mechanisms must be brought into play for mobilizing investments needed for infrastructure transformation and sustenance. For instance, self-financing by

users, government's statutory plan support, and private and institutional financing should be explored.

Comment: Planners must be vigilant, however, to the threat of commercial exploitation.

12. Setting the Groundrules

The directions for transformation are already taking shape and some of them are critically defining the template for implementation across several towns. Defining the terrain of water governance for Dehradun city will have far-reaching implications for the rest of the state of Uttaranchal. Suppression of human endeavour, either from within the government, or from outside by any representative stake-holding group will be regressive.

Formulating, therefore, sets of directions and premises that the city needs to address the far term need in a manner that it is system-oriented, thinks of the end user as customer, and undertakes healthy policy explorations …, all this is vital for setting the tone for this new century's challenges of rapid urbanization and alarming unpredictability of climatic and weather conditions.

City level efforts at creating viable water supply zones

The Nigam has instituted a masterplan for Dehradun to decentralize the city's water supply into 46 self-contained zones, each with its own infrastructure in terms of operational source, storage and distribution (*for more details see Appendix 2*).

Demonstration of community practice

Identifying a zone or pocket for demonstration is based on the bedrock concept of the supply command of a zone being the node. If the area has the source, the storage, and the distribution network in place, it would be a candidate for taking on local management. Moreover, the initiative to transform the city water supply into 46 decentralized water zones based on source-and-storage provides the basis for such community practice to emerge rapidly. Replicability and scalability are two parameters that need constant priming if we need to reach fruition on a city-wide 24x7 efficiently and on strict timeframes.

The two zones identified by the consulting group – Gandhi Gram and Shastri Nagar -- for demonstration represent water zones, which are diverse in nature in terms of characteristics of communities, available infrastructure and efforts being done to achieve zonal water supply. Gandhigram is a transformed settlement from a typical slum to a LIG neighbourhood. This will provide various options available for implementation in other 44 zones. Shastri Nagar is one such zone, which is a planned residential neighbourhood with its own source and storage.

Institutional 24x7 practice

Dehradun has been known to be a serene seat for research institutions over several decades. The wealth of institutional diversity and the opportunities for high-end learning or technology development has attracted people to the city. Though most of the institutions are not dependent on city water supplies and have their own, fairly large dedicated water supply systems [in campus lands that range from 1 to 5 sq. km], clearly there is need for efficient planning and design of their ageing water infrastructure. These institutions, too, suffer from the lack of continuous water supply. Electricity is the limiting factor for all institutions as groundwater is the source of supply with tubewells that help draw from the depths.

Water supply systems are fairly defined but the associated factors of water pricing and O&M costs are mismatched. These institutions are obliged to provide water at a subsidized price to the resident population and so any idea of recovery carries no excitement for the management of these institutions. With funding emanating from the distant national capital, there is no incentive for bringing about cost efficiencies. The presiding heads of these institutions are by norm not keen on any such initiative. There are other greater priorities of mainline work that demand their time and attention. Water and its management is not a priority since other administration tasks are clamoring for attention. Most of the institutions are under the purview of Central Public Works Department (CPWD) which executes engineering and civil works for the respective institutes[18].

The Consulting Group's study of over a third of all institutions in the city helped present the matrix that follows:

Sl.No.	Common Issues	Situations	Measures
1	Concentrated residential pockets	Mostly group housing. Better control over system process and least cost for infrastructure development and maintenance	Focus on compact residential pockets within the institute.
2	Subsidized water charges	Water charges not based on actual consumption.	The realization of water price has to be addressed in the institutional policy
3	Engineering Cell in place with most of the institutions	Some institutions under CPWD totally depend on CPWD and the O&M is given on full or partial contract.	
4	Tubewell is the major drinking water source	More concerns about energy expenditure	Tubewell management becomes critical.
5	Budget allocations are approved by the govemment	Many institutions restrict themselves within the budget.	Some institutions have the flexibility to ask for additional budget, if needed for improvement.

[18] See annexure for list of institutions

A dedicated team for mobilizing these institutions and timely investments can rapidly transform institutional water supply.

Evolving Communication Systems for Adapting To Change

Water is a concern for all. The need for creating awareness is essential to address the various facets which are conceived in the future or in the changed situations. Communication tools like street plays, puppet shows, and songs entertain while they educate. They also help to build a human face to these lifeless plans and policies that are beyond the comprehension of the common man.

It serves as a rich dialogue to clear doubts and apprehensions about water issues in a changed situation. The moral strength building is the key for promoting local level management by the people.

Water not as a Commodity

Efforts are on to introduce participatory approaches to learn, understand and strategise water as a precious resource, and not as a 'commodity', from different perspectives. Campaigns at the community level to measure discharge and line pressures have been conducted with, in one case, over 700 households participating on a Sunday afternoon. There has been a unique display of people's enthusiasm and their willingness to respond. Awareness with action will stir people to come alive to the situation, while enabling them to participate. This begins the second and important phase of dialogue on micro issues concerning water which involves discussing technical and social problems within the community. Such constructive dialogue requires sharing technical and scientific information with local communities and involves building a scientific temper for appreciating the information and consolidating the knowledge systems for water management.

Breaching the 'Us and Them' Barrier

The government in itself is a social institution which must also know the community aspiration and concerns about the service delivery. The government's role is also of a facilitator as well as provider of services to the people. There has to be a greater role, or programmes to promote decentralization which has also been listed in the 74th Constitutional Amendment Act. The importance of sharing of responsibilities among the people and government shall be one significant drive critical to the management and sustenance of water as well as basic urban services. Team work or a culture that breaches the barrier of 'us and them' between the government and the user, has to be promoted among several departments and within departments to better understand the dynamic of situations that arise daily, and to work collectively on resolving the problem.

Today in Dehradun, collective efforts within the communities have also given rise to a denomination of informal and micro-level institutions (*mohalla samitis*, or, loosely translated, community committees) which work towards the betterment of the locality in terms of improving the local services to the extent possible with the available financial means. Moreover these local institutions have to be developed as agents for inducing efficiencies and promote better user practices at the community and individual level.

Conducting concurrent research and monitoring practices

Concurrent research and support to various agencies is essential for moving from the current energy-intensive water supply systems to gravity-fed surface water systems for the city. Every town in the State has a distinct geological and geographical condition that needs to be managed with various aspects of city development and trends in water management being monitored, with appropriate inputs being offered to local and State level managers. The critical areas identified are:

a) City Development and Demand Management

b) Augmenting Surface Sources including intensive Rainwater Harvesting

c) Financing Mechanisms and Pricing Options

d) Technical Design Options for Source Management, Storage and Supply

e) Water Quality Assessment and Assurance

f) Integration with other Civic Services

Key recommendations

a) Decentralization of the 46 zones must be enabled by the government with official framework for enabling local institutions to take charge of O&M by March 31, 2006.

b) Demonstration Projects have to be taken up to establish recovery of O&M costs in Phase I;

c) Amortization of capital costs (depreciation etc.) in Phase II and;

d) Current capital cost in Phase III

e) Installation of Demonstration projects in Gandhi Gram and Shastri Nagar to be taken up. The launch is proposed, all things remaining on keel, to be on December 15, 2005 and to be completed by February 28, 2006.

f) Development planning measures to introduce creative constraints on installation of tubewells to be established with optimal use of existing infrastructure resources.

g) Concerted action is scheduled to be taken to promote a Stop Leakages Campaign across the city's water distribution network by January 2006. The campaign will be implemented on a war footing to serve as demonstration for other towns in Uttaranchal of such a measure that will help to deter creation of additional or excess infrastructure. This needs the fullest cooperation of the State government with its Information and Publicity Department directed to make a coordinated effort. It is recommended that the ADB also throws in its weight to influence the State government to promulgate this measure.

h) A concerted awareness campaign to raise consciousness of conservation among the citizens of Dehradun across all economic and social tiers.

i) The urban development authority ensures vigorous implementation and adherence to the bye-laws relating to water harvesting and other related water measures amongst all sectors of water users.

Way ahead

A set of tasks have already been initiated on the basis of the broader analysis and emerging conditions. A consensual set of activities emerged at the presentation of the recommendations of the draft final report at the tripartite workshop of August 09, 2005.

The ATF and the AME have taken the lead with the backing of the Government of Uttaranchal and has begun the activities in the two communities of Gandhi Gram and Shastri Nagar from mid August.

The Key Objectives to achieve with PDA

General

- Water and Beyond Water
- Dun – Model Town for Power of Self-governance
- Train people to shape their own water destinies
- Address issues ranging from Water to Health and Hygiene
- Work with the JS and NGOs and Local Government
- Demonstrating social participation is key.
- Training for young members in planning and implementation relating to water issues.

- If Self-governance is nurtured over the first two years consistently – with healthy managerial interventions – Health and Nutrition, Education and Sanitation can also be addressed by the nodal group/s.

Communication—Needs Beyond Water

- Door-to-door communication
- Folk art and theater – for awareness, information and counselling
- Water and hygiene
- Water and conservation
- Water and Health practices
- Water and Cost
- Water and Leakages
- Water and Energy
- Milk for infants and Malnutrition
- Adherence to Sanitation practices from every resident
- Instituting awards for Sanitation Practices between Colonies and Campuses – ADB Annual Award for Best Water Practice?
- Helping them understand potential for revenues, and strength of microcredit.
- Helping members start commercial services to residents by nurturing a microfinance system that encourages local entrepreneurship.

Faith in Process

- Making every home and dweller part of the process
- Build faith in themselves and their power to change things
- Identify young men and women who can be employed, with the economics of water sustaining their employment
- Finding external solutions to combating water will not be as half effective as building the strength from within
- The Thrust: Helping People to Help Themselves is *the* path.

Local Logic

- Regional or Local Insertion of administration is the future
- This means Institutional Reshaping for Water and Sanitation.
- Greater flexibility at the level of the Nodal Group – Within the Broader Framework [legal and administrative]
- Local Logic will – with appropriate guidelines and technologies – serve as the best way out of urban and environmental challenges.

Jal Sudhar Samitis

- Such Nodal Groups should recognize the Extra-Local Implications of urban and regional processes of the more complex agglomeration – the JS or the JN which should and will play an Enabling Role, with their economics sustained by the activities of the Nodal Group/s.
- The Local Logic also serves as a natural platform for participation by members and citizens who are direct beneficiaries.
- Local Power *cannot* be effective without a well-articulated, and concerned Institutional Framework.

Citizen & Consumer Rights

- Citizen and Consumer are not synonymous.
- The Rights also vary.
- Citizenship involves concern over Use of Scarce Resources; and priorities for development. This is a collective dimension and far broader than of the consumer.

Words and Language

- For Local Logic, critical is attitudes and values.
- Words reflect and reinforce them.
- Communication can transform the conventional into powerful, out-of-the-box practitioners.
- This means information. Knowledge.
- This also means valuing the 'interdependence' between the 'insider' Local Nodal Group/s and the 'outsider' Urban Bodies.

- Needs breaking down barriers between Us and Them. Co-learning and Co-operation are the key planks.
- All this above can descend into jargon, *if* a unique, personal 'language' or 'vocabulary' is not evolved by the Nodal Group.

Objectives Already Under Way

Action Area I: Community 24x7 Practice

Demonstration 24x7 in Zone 20 and Zone 24 Dehradun has been initiated on August 16. The Inception Report and the detailed plan of action are under preparation.

Action Area II: Institutional Practice

Apart from several institutions in the town, the prestigious Lal Bahadur Shastri Academy in Mussoorie, which is the haloed portal for every successful entrant to the Indian Administrative Service, has also indicated interest in improving water systems.

The detailed assessments have been initiated and Inception Report is prepared.

Action Area III:Communication

This activity is an ongoing one with focus on demonstration areas. A detailed proposal has been drawn up for extending the communication campaign across the city and to launch the `Stop Leakages Campaign'.

Puppetry and street folk that take the message home.

Action Area IV:Research

A proposal for an Urban Environmental Workbook to put together city information on a common basis and identify mechanisms to integrate with the NURM has been developed and the team established to undertake this task.

13. Into The Future

To bring a city-wide 24x7 programme to fruition one has to start with one step at a time. No significant recommendation will be accepted by any stakeholder across the board without demonstrated success.

If you looked at Dehradun and realized that only a quarter of the entire valley is today the urban settlement (65 sq km out of 270 sq km), you will see that water in the long run will be about managing the valley's resources and not about sourcing from an unfeasible long distance.

The city has three distinct sections of water users:

1. *Institutional*: This segment has in-campus infrastructure of its own and is not reliant on the municipal water supply. It makes for 25 per cent of the city's population and 30 per cent of the geographic lay.
2. The slum and LIG segments are today treated as poorer cousins with no priority planning to meet their water needs with dedicated infrastructure. The municipal corporation's statistics for 2005 indicate that the total slum dweller population is 230,000—making for over 35 per cent of the city's total population.
3. The rest of the population which is as reliant as Segment 2 on the municipal water supply board, but has a more dependable water supply regimen because it falls in the upper economic reach and can therefore secure this resource with greater ease.

Like in most cities across Asia, the one big factor that can defeat every plan that one makes for the long-term future, is leakage. This has to be combated on a war footing across the city and across every user segment with a two-pronged strategy: awareness of the enormous loss and cost; and concerted execution plans over timeframes to plug every termination and joint in the distribution lines across the city.

The problem is compounded by the fact that the life of 70 per cent of the pipeline network of the city is beyond its life cycle. An infrastructure plan that will efficiently upgrade or replace the ageing assets with careful planning and utmost consciousness of capital cost is an imperative. This timeframe should not exceed two years from now.

No 24x7 plan can be put into plan if leakages are not brought down to a single digit level. This will be a serious, even daunting, challenge and will need the most attention from every stakeholder.

Issues of health and hygiene and therefore maintenance of static storage are not capital-intensive but require organisational management. This is easier achieved if the culture of good practices devolves right down from the administrators to user groups.

All capital works can continue to be in the ownership and hands of the water authorities, but there must be transparency. Personnel and administration costs of the government authorities, for instance, need to be factored into capital cost projections in a manner that they do not have to look for other revenue avenues beyond the installation phase.

The drive for water efficiency has to be taken up with specific, identified residential pockets being provided such demonstrated models. The key should be the ability to think scale and replicability. This is fundamental to the long haul of bringing 24x7 city wide.

The first step the Consulting group has suggested is to look at two communities which represent the spectrum of social and economic segments – from slum/LIG to MIG, and HIG at the other end of the scale.

The important thing is to document through this process the potential snags in performance or in cost efficiency; managerial elements that need to be inducted into process of water supply management; all factors that go to make for replication of the effort with similar models for capital works execution and O&M execution being created for more communities.

The other key element to the process of such template-making is to impart, as a value, to the entire set of stakeholders that this is about not helping from the outside but about enabling from within.

14. Annexure

Table A - Annual Increase in Water Connections in Various Categories (2002-2005)							
Year	Residential		Commercial	Industrial	Bulk	Total	Annual Increase
	Metered	Unmetered	Metered	Metered	Metered	Number	%
2002	45072	3120	4883	2095	162	55332	
2003	46535	3128	4829	2141	165	56798	2.65
	81.93	5.51	8.50	3.77	0.29		
2004	48096	3134	4896	2178	166	58470	2.94
	84.68	5.52	8.62	3.83	0.29		
2005	49478	3140	5044	2217	167	60046	2.70
	87.11	5.53	8.88	3.90	0.29		

Source: Water Works Department, Dehradun

Table B - Annual Increase in Various Connection Categories					
Year	% increase (domestic metre connections)	% increase (unmetreed domestic connections)	% increase (commercial connections)	% increase (industrial connections)	% increase (bulk connections)
2002-2003	3.25	0.26	-1.11	2.20	1.85
2003-2004	3.35	0.19	1.39	1.73	0.61
2004-2005	2.87	0.19	3.02	1.79	0.60

Table C - Annual Increase in Revenue under Various Categories (2002-2005)						
Year	Water Sales	Water Tax	Sewer Tax	Others	Total (Rs)	Rs Millions
2002	32414292	26813240	3221295	4384389	66833216	66.83
%	48.5	40.1	4.8	6.6		
2003	36481678	24774005	3172420	7096686	71524789	71.52
%	51.0	34.6	4.4	9.9		
2004	41028268	26346071	3385081	7009378	77768798	77.76
%	52.8	33.9	4.4	9.0		
2005	56383995	27451380	3898304	10372332	98106011	98.10
%	57.5	28.0	4.0	10.6		

Source: Water Works Department, Dehradun

Table D - Rainfall in Dehradun from 1973-2003													
Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual Rainfall
1973	104	27.9	40		34	310	1256.5	645.7	363	125.1	0	9.9	2916.1
1974	26.5	18.4	6.2	14.8	21.2	139	735.5	553.1	92.3	26	0	57.9	1690.9
1975	79.7	69.7	113.5	0	29.4	324.7	554.4	477.1	520.1	54.8	0	0	2223.4
1976	20.7	72.4	22	6.7	38.3	156.3	819.6	653	167.9	1.3	0	0.5	1958.7
1977	51.7	2	6.6	29.3	61.8	228.1	849.8	750.4	438.7	18	0	52.2	2488.6
1978	6	59.2	164.5	44.8	9.1	293.7	630.7	816.2	574.1	2.4	64.6	8.4	2673.7
1979	58.7	115.9	13.8	24.2	39.8	245.7	521	588.4	33.9	0	0.8	26.3	1668.5
1980	16	18.3	52.4	8.3	6.2	261.5	615.8	904.6	223.7	7	21.7	12.4	2147.9
1981	77.9	8.7	82.2	13.6	109.6	285.4	758	505.8	97.8	0	76.8	8.5	2024.3
1982	78.1	62.4	197	52.8	57.4	71.4	540.4	642.7	55.7	16.6	1.3	50.3	1826.1
1983	82.1	25.1	73.1	125.9	121.2	155.3	353.2	871.9	341.8	44.8	0	5.2	2199.6
1984	12.2	148.6	6.6	5.6		394.2	879.6	403.4	328.8	0.4	0	10.5	2189.9
1985	69.4	5.2	4.5	27	49.4	75.2	653.4	622	336.5	195.3	0	58.5	2096.4
1986	10.9	97.6	55.3	33.8	74.6	304.2	805.8	730.5	198.7	164.5	7.5	48.5	2531.9
1987	28.7	53.2	67.3	40.2	127.6	95.2	297.9	637.2	388.5	19.1	0	12.5	1767.4
1988	22.7	40	108.7	37.8	44.3	328.2	526.6	607.4	244.2	0	0	60.5	2020.4
1989	111	8.8	15.4	4.8	20.7	202.2	714.1	674.5	265	21.7	24.1	62.1	2124.4
1990	1.2	121.2	98.2	35.1	114.4	183.8	903.4	887.1	460.7	33.6	7.2	121.9	2967.8
1991	11.6	56	50.6	54.1	21.2	265.2	306.3	481.5	288.1	0	11.7	43.9	1590.2
1992	81.6	40.5	13.5	1.8	26.3	156.1	571.8	980.1	191	7.7	6.8	0	2077.2
1993	77.1	63.1	112.2	11.2	40	269.3	534.4	744.7	458.9	0	1.4	0	2312.3
1994	57.2	56.9	1.9	78.2	9.4	217.7	724.2	776.9	65	0	0	2.2	1989.6
1995	53.3	73.9	39.2	14.6	0.8	83.5	494.5	630.1	310.3	2.2	0.5	9.3	1712.2
1996	40.3	106.2	45.5	13.4	10	355.8	604	962.1	282.3	57.7	0	0	2477.3
1997	34	21.9	65.6	111.1	130	397.4	785.6	558.5	385.8	94.5	44.8	90.8	2720
1998	5.4	72.4	117.7	78.6	86.3	110.4	855	1114.2	270.2	248	0.9	0	2959.1
1999	57.3	4.2	4.9		6.9	398.4	795.3	536.3	671	75.8	0	9.9	2560
2000	71.5	110.9	44.4	12.4	141.1	308.4	767.3	724.7	381.2	0.2		0	2562.1
2001	42	2.2	31.8	51.1	131.5	505.4	803.4	613.2	134.2	2.9	1.4	9.4	2328.5
2002	47	139.1	65.7	62.6	24.1	126.4	164.8	643.7	273.5	17.9	0	0.2	1565
2003	38.6	98.9	49.6	13.8	31.2	138.5	424.7	601.3	436.1				1832.7

Source: Forest Research Institute, Dehradun

Table E Drinking Water from Surface Water Sources				
Rivers	**Canals**	**Lean Period Discharge**	**Water used for drinking purposes**	**Irrigation purposes**
Bandal River, Baldi River, Song River	Kalinga	100	10	90
Noon River	Bijapur	30-40	20	20
Mausi Fal	Eastern Canals	14	12	2
Dewra Nadi		135		135

Source: Samrika, Uttaranchal Jal Sansthan

Table F List of Municipal Wards in Dehradun	
Ward No.	**Ward Name**
1	Rajpur
2	Sahasradhara Road
3	Arya Nagar
4	DL Road
5	Rispana
6	Mannsingh Wala
7	Karanpur
8	Adhoiwala
9	Dalanwala (N)
10	Dalanwala (S)
11	Rajivnagar Danda
12	Dharampur
13	Ajabpur
14	Bhandaribagh
15	Majra
16	Niranjanpur
17	Kanwali
18	Vasant Vihar
19	Maharani Bagh
20	Ballupur
21	Kaulagarh
22	Rajinder Nagar
23	Sri Dev Suman Nagar
24	Idgah
25	Shivaji Ward
26	Gandhi Gram
27	Laxman Chowk
28	Patel Nagar
29	Lakhi Bagh
30	Rithamandi
31	Jhanda Mohalla
32	Indresh Nagar
33	Khudbuda
34	Dandipur
35	Lunia Mohalla
36	Dhamawala
37	Chander Nagar
38	Race Course (S)
39	RaceCourse (N)
40	MPK
41	Chukhuwala
42	Bakralwala
43	Indira Colony
44	Vijay Colony
45	Salawala

Table G Water Quality of Treatment Plants and Tube Wells											
Sl. No	**Sampling point**	**Temp**	**pH**	**Turb**	**TDS**	**T-Hard**	**Ca**	**Mg**	**Cl**	**SO4**	**DO**
		^{0}C		**NTU**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
1	Raw water intake (Bindal River) Dilaram Bazaar, Filter House	15	7.8	0.65	220	189	39	22	3	40	8.5
		15	7.8	0.7	218	186	39	21	3	40	8.4
		15	7.8	0.65	217	186	39	21	4	42	8.4
2	Clear water Reservoir, Dilaram Bazaar Filter House	16	8	0.65	239	204	40	26	8	50	
		16	8	0.65	239	207	40	26	4	51	
		16	8	0.65	238	205	40	26	6	50	
3	Raw water intake (Mausi Fall) Shahanshai Ashram, Filter House	12	8	0.35	433	404	87	45	26	132	11.5
		12	8.1	0.4	418	392	82	46	20	135	11.1
		13	8.1	0.4	417	394	84	45	22	133	11.9
4	Clear water Reservoir, Shahanshai Ashram, Filter House	13	8	0.15	407	392	82	45	24	176	
		13	8.1	0.15	406	396	83	46	28	176	
		12	8.1	0.2	412	396	82	46	26	175	
5	Tubewell Survey Chowk, Pump House	23	7.9	0.4	339	309	78	28	18	49	
		23	7.9	0.4	340	311	78	28	18	51	
		23	7.9	0.45	340	310	78	28	18	49	
6	Tubewell MDDA Colony, Dalanwala	23	7.8	0.35	309	322	73	34	10	60	
		24	7.8	0.4	310	320	72	34	10	60	
		23	7.9	0.4	309	320	72	34	10	60	
7	Tubewell No. 5 OHR, Nehru Colony-1 Block	24	8	0.45	319	314	71	33	14	24	
		24	8	0.4	318	315	71	33	14	25	
		24	8	0.5	319	314	71	33	14	24	
8	Tubewell No.2 Dharampur Pumping Station	24	8	0.3	354	300	74	28	16	52	
		24	8	0.35	354	298	73	28	15	52	
		24	8	0.35	354	300	74	28	16	53	
9	Tubewell No. 1 Kaulagarh	25	7.9	0.45	452	380	95	35	20	111	
		25	7.9	0.5	452	380	95	35	22	112	
		25	7.9	0.55	452	382	96	35	22	112	
10	Tubewell Street No. 8, Rajendra Nagar	24	7.9	0.35	417	384	97	34	16	73	
		24	7.9	0.4	417	382	96	34	16	74	
		24	7.9	0.35	417	382	96	34	16	74	
11	Tubewell No. 2 Naighar, Street No. 11, Rajndra Nagar	24	7.8	0.35	403	348	91	29	22	63	
		24	7.8	0.35	403	348	91	28	22	62	
		24	7.8	0.35	403	348	91	29	22	62	

Table G Water Quality of Treatment Plants and Tube Wells											
12		23	7.9	0.35	398	364	94	31	26	49	
		23	7.9	0.3	398	365	94	31	25	48	
	Tubewell Vijay Park	23	7.9	0.35	399	365	94	31	26	49	
13	Tubewell No. 1,2,3,4, Niranjanpur, Jhanda Over Head Reservoir	23	7.8	0.35	532	450	114	40	82	20	
		23	7.8	0.3	532	452	114	41	81	21	
		23	7.8	0.3	531	450	114	40	82	20	
14		24	8	0.3	355	310	80	27	13	48	
	Tubewell No. 1 Khurbuda	24	8	0.35	355	310	80	27	14	49	
		24	8	0.3	355	308	80	26	14	49	
15			7.8	0.35	418	340	88	29	44	22	
	Tubewell No. 1 Patel Nagar		7.8	0.35	417	342	88	30	44	22	
			7.9	0.3	418	340	87	30	45	23	
16		24	8	0.3	336	298	76	26	10	62	
	Tubewell No. 1 Nehru Colony, B-Block	24	8	0.4	336	298	76	26	10	63	
		24	8	0.35	337	300	77	26	10	63	

List of Institutes in Dehradun Having Independent & Water Works Drinking Water Supplies.

List of Institutional Buildings Under CPWD

Indo Tibetan Border Police

Indira Gandhi National Forestry Academy

State Forest Office

Survey of India, Hathibarkala

Survey of India, EC Road (Geodetic Division)

Forest Survey of India

Zoological Survey of India, Kaulagarh

Archeological Survey of India, Kaulagarh

CPWD Residential Colony, Subhash Road

Income Tax Colony, Mohini Road & Balbir Road

Other Institutes with Independent Water Supply

Oil and Natural Gas Commission, Kaulagarh

Wildlife Institute of India, Chandrabadni

Wadia Institute of Himalayan Geology, GMS Road

Forest Research Institute, Chakrata Road

Anthropological Society of India

Indian Institute of Petroleum, Mokkampur

Central Soil and Water Conservation Research Institute, Kaulagarh

Institutes Reliant on Jal Sansthan's Water Works Department

National Institute of Visually Handicapped, Rajpur Road

President's Body Guard

15. Appendix 1

The Jal Nigam [UPSVANN]

The functions of the Jal Nigam are the following:

- Preparation, execution, promotion and financing of schemes for supply of water and for sewerage and sewage disposal;
- Render all necessary services in regard to water supply and sewerage to the State Government and local bodies, on request to private institutions or individuals;
- Prepare State plans for water supply, sewerage and drainage on the directions of the State Government;
- Review and advise on tariffs, taxes, levies and charges of water supply in all areas administered by the Jal Sansthan and other local bodies which have signed up agreements with the Nigam;
- Assess requirements of capital works materials and arrange for their procurement and utilisation;
- Establish standards for water supply and sewerage services;
- Perform all functions, not stated herein, which were being performed by the Local Self-Government Engineering Department before the commencement of this Act;
- Review annually technical, financial, economic and other aspects of water supply and sewerage system of all Jal Sansthan centres or of local bodies which have entered into agreements with the Nigam;
- Establish and maintain a facility to review and appraise the technical, financial, economic and other aspects of every water supply and sewerage scheme in the State;
- Operate, run and maintain any waterworks and sewerage system, if and when directed by the State Government, on such terms and conditions and for such period as may be specified by the State Government;
- Assess requirements for manpower and training in relation to water supply and sewerage services in the State;

- Carry out applied research for efficient discharge of the functions of the Nigam or the Jal Sansthan;
- Other functions entrusted to the Nigam by or under this Act, or by the State Government by notification in the Gazette.

Powers of UPSVANN

The Powers of the Nigam are:

a) The Nigam shall, subject to the provisions of this Act, have power to do anything, which may be necessary or expedient for carrying out its functions under this Act.

b) Without prejudice to the generality of the foregoing provision, such power shall include the power to -

- Inspect all water supply and sewerage facilities in the State by whomsoever they are operated;
- Obtain such periodic or specific information from any local body and operating agency as it may deem necessary;
- Provide training for its own personnel as well as employees of the local bodies;
- Prepare and carry out schemes for water supply and sewerage;
- Lay down the schedule of fees for all services rendered by the Nigam to the State Government, local bodies, institutions or individuals;
- Enter into contract or agreement with any person, firm or institution, as the Nigam may deem necessary, for performing its functions under this Act;
- Adopt its own budget annually;
- Approve tariffs for water supply and sewerage services applicable to respective local areas comprised within the jurisdiction of Jal Sansthans and such local bodies as have entered into an agreement with the Nigam;
- Borrow money, issue debentures, to obtain subventions and grants and manage its own funds;
- Disburse loans to local bodies for their water supply and sewerage schemes;
- Incur expenditure and to grant loans and advances to such persons or authorities as the Nigam may deem necessary for performing the functions under this Act.

- Power to call for reports and information.

(c) The Nigam may call for such reports and information from a Jal Sansthan or local body. It is also empowered to issue directions to a Jal Sansthan or local body.

The directions so issued shall be complied with by the Jal Sansthan or local body concerned as speedily as possible. In case such Jal Sansthan or local body disagrees with such direction, or experiences any difficulty in complying, it shall refer the matter to the State Government whose direction shall be final.

The Jal Sansthan

The functions of the Jal Sansthan shall be as follows:

- Plan, promote and execute schemes of and operate an efficient system of water supply;
- Where feasible, to plan, promote and execute schemes of, and operate, sewerage, sewage treatment and disposal and treatment of trade effluents;
- To manage all its affairs so as to provide people of the area within its jurisdiction with wholesome water and, where feasible, efficient sewerage service;
- To take such other measures, as may be necessary, to ensure water supply in times of any emergency;
- Such other functions as may be entrusted to it by the State Government by notification in the Gazette.

Powers of a Jal Sansthan

(1) Every Jal Sansthan shall, subject to the provisions of this Act, have power to do anything which may be necessary or expedient for carrying out its functions under this Act.

(2) Without prejudice to the generality of the foregoing provision such powers shall include the power to –

- exercise all powers and perform all the functions relating to water supply, sewerage and sewage disposal of the area which lies within its jurisdiction;
- acquire, possess and hold lands and other property and to carry any water or sewerage works through, across, over or under any highway, road, street or place and, after reasonable notice, in writing to the owner or occupier, into, through, over or under any building or land;
- abstract water from any natural source and dispose of waste water;

- to enter into contract or agreement with any person or body as the Jal Sansthan may deem necessary;
- to adopt its own budget annually;
- to introduce or amend tariff for water supply and sewerage services, subject to approval of the Nigam and collect all taxes and charges for these services as may be prescribed:

[Provided that no decision to introduce or amend such tariff shall be taken except by a special resolution in that behalf brought after giving such notice as may be prescribed, and passed by a majority of two-thirds of the members of the Jal Sansthan;]

- Incur expenditure and manage its own funds;
- Obtain loans, advances, subventions and grants from the Nigam.

16. Appendix 2

Zonewise Characteristics of Dehradun Water Supply Master Plan

Table H: Zone-wise Characteristics of Dehradun Water Supply Master Plan								
Sl.No	*Sl.no.of Zone*	*Subzone*	*Name of Zone*	*Population including floating*	*Source*	*Availability of water in MLD*	*Demand @ 155 LPCD (in MLD)*	*Shortfall / Surplus (MLD)*
1	2	3	4	7		8	9	10
	1		Rajpur					
1		1(a)	Shahanshahi ashram	3621	Surface Water	1.2	0.56	0.64
2		1(b)	Dhakpatti	3766	Surface Water			
3		1(c)	Balyogi	4729	Surface Water			
4		1(d)	Kishanpur	5504	Surface Water			
				12079	Surface Water			
5	2		Hathibarkala	3551	Surface Water			
				7296	Surface Water			
				6809	Surface Water			
44	39		Dhoran	13394	Surface Water			
45	40		Sahastradhara Road	9822	Surface Water			
			TOTAL	66950		14.1	10.38	3.72
6	3		DL Road	9552	Tubewell		1.48	-0.04
	4		Dilaram bazar waterworks					
7		4(a)	Vijay colony	10002	Tubewell	0.14	1.55	-1.41
8		4(b)	Rajpur road	70090	Surface Water	24.7	10.86	13.84
9	5		Cement road	9435	Tubewell	1.73	1.46	0.27
10	6		Parade ground	21814	Tubewell (3)	4.42	3.38	1.04
	7		Dalanwala					
11		7(a)	Curzon road	16821	Tubewell	1.44	2.61	-1.17
12		7(b)	Sanjay colony	13066	Tubewell	2.4	2.03	0.37
13	8		Nagar Nigam	32058	Tubewell	6.34	4.97	1.37
14	9		Prempur	12576	Tubewell (2)	2.4	1.95	0.45

15	10		Kaulagarh	6057	Tubewell	1.15	0.94	0.21
16	11		Rajender Nagar	31546	Tubewell (4)	4.42	4.89	-0.47
17	12		Dobhalwala	10722	Tubewell (2)	2.4	1.66	0.74
18	13		Tagorevilla	17689	Tubewell	1.92	2.74	-0.82
19	14		Vijay Park	19777	Tubewell (2)	3.55	3.07	0.48
20	15		Yamuna colony	12848	Tubewell	0	1.99	-1.99
21	16		Kurbuda	19314	Tubewell	1.54	2.99	-1.45
22	17		Jhanda Mohalla	42574	Tubewell (2)	4.51	6.60	-2.09
23	18		Panditwari	3957	Tubewell	1.15	0.61	0.54
24	19		Vasant Vihar	10794	Tubewell (2)	3.26	1.67	1.59
25	20		Indranagar	10529	Tubewell (2)	3.46	1.63	1.83
26	21		Maharani Bagh	4070	Tubewell	2.11	0.63	1.48
27	22		Kaonli	10376	Tubewell	0	1.61	-1.61
28	23		Engineers Enclave	8987	Tubewell	2.11	1.39	0.72
29	24		Gandhi Gram	10280	Tubewell	0	1.59	-0.15
30	25		Lakshman Chowk	18185	Tubewell	2.11	2.82	-0.71
31	26		Patel nagar	26645	Tubewell	2.11	4.13	-2.02
32	27		Niranjanpur	11204	Tubewell	2.69	1.74	0.95
33	28		Green park	2765	Tubewell	0	0.43	-0.43
34	29		Majra upper	8817	Tubewell	0	1.37	-1.37
35	30		Majra lower	13809	Tubewell	0	2.14	-2.14
36	31		Pathribagh	5388	Tubewell	0	0.84	-0.08
37	32		Vidhya Vihar	5012	Tubewell	0	0.78	-0.78
38	33		Rest camp	16797	Tubewell	2.4	2.60	-0.20
39	34		Race course	23312	Tubewell	2.4	3.61	-1.21
40	35		Nehru colony	17884	Tubewell (2)	4.13	2.77	1.36
41	36		Dharampur	7406	Tubewell	1.92	1.15	0.77
42	37		Ajabpur	13008	Tubewell (2)	2.59	2.02	0.57
43	38		Mothorawala	8550	Tubewell	0	1.33	-1.33
46	41		Adhoiwala	12193	Tubewell	0.96	1.89	-0.93
47	42		Badrish colony	4178	Tubewell	1.15	0.65	0.50
48	43		Ajabpur Danda	6188	Tubewell	1.68	0.96	0.72

49	44		Shastrinagar	4922	Tubewell	2.11	0.76	1.35
50	45		Defence colony	3789	Tubewell	0.96	0.59	0.37
51	46		Kedarpuram colony	4490	Tubewell (2)	1.44	0.70	0.74
			GRAND TOTAL	700048		119.1	108.51	10.59
Source: UPSVANN								

Note: '-' indicates deficit within specific zone and '+' indicates surplus infrastructure has been proposed in the master plan such that source and storage is available within the zone.