

Chapter III

Performance Audit of Water Management System in Delhi

Delhi Jal Board (DJB) constituted under Delhi Jal Board Act 1998, is responsible for supply and distribution of potable water to the inhabitants of National Capital Territory (NCT) of Delhi. DJB receives raw water, mainly from Yamuna river, Bhakhra - Beas storage and upper Ganga canal. Such raw water is received at the water treatment plants (WTPs) of DJB situated at Chandrawal, Wazirabad, Bhagirathi, Haiderpur, Nangloi, Sonia Vihar and Bawana (not in operation). The capacity of the water treatment plants is 710 million gallon per day (MGD). The performance audit of the water management system in Delhi covers the period from 2002-03 to 2006-07. Our review disclosed the following broad findings:

Highlights

Against the projected demand of 1050 million gallon per day (MGD), the actual production of potable water in Delhi was only 780 MGD resulting in a shortfall of 25 per cent. DJB had planned a number of projects for augmentation of water supply but most of these projects have fallen behind schedule compounding problem of water shortage in the city.

(Paragraphs 3.8, 3.9, 3.9.1, and 3.9.2)

There is considerable inequitable distribution of water in different parts of Delhi. DJB has failed to timely complete construction of underground reservoirs and booster pumping stations in West, North-West and South-West Delhi for rationalization of water distribution.

(Paragraph 3.9.3)

Delhi has distribution losses of 40 per cent of total water supply which is abnormal and significantly higher than the acceptable norms of 15 per cent prescribed by the Ministry of Urban Development. The system of leakage detection and management was inefficient. Delayed repair of leaks in transmission and distribution lines in 2006-07 alone led to estimated loss of 84 million gallons of water.

(Paragraphs 3.11.1 and 3.11.3)

Large number of consumers (41 per cent) are being supplied water either without meter or with meter that have become defective. DJB has lost Rs. 173.77 crore during 2003-07 due to its failure to rectify meters timely.

(Paragraphs 3.14 and 3.14.1)

About 56 per cent of the total water supplied in Delhi during last five years did not fetch any revenue resulting in loss of Rs. 1990.54 crore. The percentage of non-revenue water also increased from 53 per cent in 2002-03 to 65 per cent in 2006-07, further aggravating the problem.

(Paragraph 3.14.2)

A significant amount of Rs. 368 crore was in arrears for collection against outstanding bills. The DJB did not enforce action against defaulting customers as per provision laid down in the DJB Act 1998.

(Paragraph 3.14.4)

The Board has not formulated any comprehensive policy/plan for regulating exploration of ground water in Delhi.

(Paragraph 3.16)

Monitoring of projects for rain water harvesting with DJB's financial assistance was not done effectively.

(Paragraph 3.16.1)

The responses received from the resident welfare associations show high level of dissatisfaction in the services provided by the DJB in terms of quality and quantity of water supplied.

(Paragraph 3.17)

Summary of recommendations

- *In view of the serious problem of water shortage in Delhi, DJB may ensure that various plan projects for augmentation of water production and supply are progressed and completed on time through effective planning and implementation.*
- *The projects related to rationalization of water distribution may be executed promptly for ensuring equitable distribution of available water.*

- *The system of plugging leakages may be strengthened with a view to minimizing wastages and loss of revenue on account of non-revenue water. The specialized leak detection equipment may be procured early.*
- *Effective steps may be taken to improve the quality of drinking water by adopting better quality control methods and sustained monitoring in order to ensure that water being supplied is potable and conforms to the standards prescribed by the Government.*
- *DJB may take effective steps to minimize the number of unmetered connections to facilitate billing and revenue collection on actual water consumption basis.*
- *The revenue collection machinery may be revamped and efforts may be made to reduce the arrears of outstanding water charges.*

3.1 Introduction

Delhi Jal Board (DJB) constituted under Delhi Jal Board Act 1998 is responsible for the supply and distribution of potable water to the inhabitants of National Capital Territory (NCT) of Delhi. The Water Treatment Plants (WTPs) situated at Chandrawal, Wazirabad, Bhagirathi, Haiderpur, Nangloi, Bawana and Sonia Vihar with installed capacity of 710 MGD receive raw water mainly from Yamuna river, Bhakhra - Beas storage and Upper Ganga canal. In addition, 100 MGD of ground water is lifted through various ranney wells and tube wells. DJB provides 780 MGD against the requirement of 1050 MGD of water due to shortage of raw water.

DJB supplies water in bulk to New Delhi Municipal Council (NDMC) and Delhi Cantonment Board (DCB). These agencies look after the distribution and supply of water to inhabitants residing within their areas. There were 16 lakh water connections in MCD area of Delhi as of March 2007.

The main functions of the Board pertaining to water management were to:

- (i) treat, supply and distribute water for household consumption or other purposes to those parts of Delhi where there are houses, whether through pipes or by other means;
- (ii) regulate and manage the exploitation of ground water in Delhi in consultation with Central Ground Water Authority;
- (iii) promote measures for conservation, recycling and re-use of water; and

- (iv) make provisions for un-filtered water supply.

3.2 Organizational set up

DJB functions under the Chairpersonship of the Chief Minister of the State and is assisted by a Vice Chairperson who is nominated by the Speaker of the Legislature and 16 other members consisting of 10 political and *ex-officio* members and six administrative/executive members. Member (Water) heads the Engineering wing for water activities which is under the overall control of Chief Executive Officer (CEO). He is assisted by Chief Engineers/Superintending Engineers/Executive Engineers.

3.3 Scope of audit

The performance audit was conducted between April and August 2007, covering the period 2002-03 to 2006-07, through scrutiny of records at DJB Headquarters, WTPs/Booster Pumping Stations, water construction/maintenance divisions and Zonal Revenue Officers. The performance audit examined *inter alia* the progress of various plan schemes undertaken by the Government of NCT of Delhi to improve the water supply situation in Delhi, initiatives taken to conserve water as well as to improve the quality of water and the system of assessment and collection of revenue.

3.4 Audit methodology

The audit methodology included:

- Selection of 27 out of 53 construction/maintenance divisions, 13 Zonal Revenue Officers (ZROs) out of 25 and all nine water treatment plants. The selection was done by picking up the units which were listed at even numbers from the list of offices.
- Ascertaining public perception regarding the functioning of DJB by circulating a questionnaire to 487 number of Residential Welfare Associations (RWAs) chosen at random out of 1100 number of RWAs registered with 'Bhagidari Cell' Government of NCT of Delhi.
- Seeking views of the DJB on the preliminary audit findings.
- Formulation of observations and make recommendations on the basis of the views and comments of the DJB.

3.5 Audit objectives

The objectives of the audit were to verify whether:

- DJB ensured adequate supply of water to different parts of the city as per norms prescribed by the Ministry of Urban Development, Government of India in terms of per capita supply.
- Various schemes undertaken to augment water supply were being implemented in a planned and efficient manner.
- There was equitable distribution of water to different areas and the ancillary projects planned to rationalise the water supply have been implemented timely.
- The leakage detection and its management was efficient and ensured prompt repair of transmission and distribution network to minimise the loss of water.
- Effective action is taken to minimise loss of revenue on account of unmetered connections, defective meters and theft of water etc.
- The quality of potable water at treatment plants, reservoirs and that being supplied to households was as per norms; and
- Prompt action was taken to address the problems of the customers for ensuring better customer satisfaction.

3.6 Audit criteria

The audit criteria used in the performance audit included:

- strategic goals and objectives, the targets to be achieved by the DJB for capacity building to ensure sustainable water supply services;
- provision contained in the DJB Act, 1998 and plan documents;
- quality of water as per prescribed standards; and
- system of assessment and collection of revenue.

Audit Findings

Water is a prime national resource, a basic human need and a precious national asset. High rate of urbanization and population growth in metropolitan cities in India including Delhi have laid tremendous stress on drinking water supply systems. Growth process and expansion of economic activities inevitably led to increasing demands for water for diverse purposes; domestic, industrial,

agricultural, recreation etc. The nation's capital is perpetually in the grip of a water crisis due to increasing gap between demand and supply.

To provide potable water supply at reasonable economic price to the satisfaction of the habitants of NCT of Delhi is the mission of DJB. A memorandum was signed each year between the Board and Government of NCT of Delhi with assurance of reduction in non-revenue water, reduction of operating losses, replacement of defective meters, metering of un-metered connections, augmentation of water supply by constructing various underground reservoirs and construction, completion and commissioning of Sonia Vihar WTP with all ancillary works on due date. Improvement of collection efficiency was a matter of utmost concern. DJB failed in many of these areas as reflected in succeeding paragraphs.

3.7 Consultative Mechanism

As per Section 8 of DJB Act, 1998, the Government may constitute a Water Consultative Council with the object:

- to advise the Board on policy matters and formulation of annual and five years plans;
- to give expert advice on administrative, financial and technical matters;
- to advise the Board on matter pertaining to the interest of consumers and issues affecting the environment ; and
- to advise the Board on any matter on which the Board seeks its advice.

The Council was constituted in August 1998 but no meeting was ever held as of August 2007. This defeated the very purpose for which the Council was set up.

3.8 Water requirement, production and shortfall

The production capacity of water in Delhi during Tenth Plan period was 780 million gallon per day (MGD) against the requirement of 1050 MGD (based on a norm of 60 gallon per capita per day as per Ministry of Urban Development, Government of India norms prescribed in the Master Plan of Delhi 2001), thus, leaving a wide demand-supply gap of 270 MGD. The trends in the projected requirement, actual production and shortfall in supply of water during Seventh to Tenth five year Plan were as given in the table below:

Table 3.1: Requirement *viz-a-viz* production of water

Five year plan	Population in lakh	Requirement* of water in MGD	Production of water in MGD	Short fall	Percentage shortfall
7th (1985-90)	94	658	437**	221	33.59
8th (1992-97)	110	770	580	190	24.68
9th (1997-02)	138	966	650	316	32.71
10th (2002-07)	176	1050	780	270	25.71

*Requirement was computed by the Department at 70 GPCD (gallon per capita daily) up to ninth Five Year Plan and at 60 GPCD during Tenth Plan.

** Installed capacity

Due to increasing urbanisation and population growth in Delhi, requirement of potable water increased significantly from 658 MGD in Seventh Plan to 1050 MGD in Tenth Plan registering a growth of 60 *per cent*.

DJB has not been able to keep pace with the rapid urbanization of the city. The water supply infrastructure has failed to match the demand. Despite Government efforts to improve production of potable water, the demand and supply gap persists in the range of about 25 to 34 *per cent*. Against the requirement of producing additional quantity of 400 MGD during Tenth Plan to fully meet the projected requirement, DJB could increase production by only 130 MGD of water during this period. The percentage shortfall came down by seven *per cent* during Tenth Plan mainly on account of increase in the production capacity (130 MGD) and downward revision in water supply norms from 70 gallon per capita daily in Ninth Plan to 60 gallon per capita daily in Tenth Plan. Persisting shortfalls in production of potable water led to significantly reduced supply of water to the residents of national capital at an average rate of 44 gallon per capita per day against the reduced norm of 60 gallon per capita per day. As per Government's own admission, per capita water supply in different parts of the city is not uniform indicating that certain areas of Delhi are severely affected by water supply shortage and are getting supply much below the average rate of 44 gallon per capita per day.

3.9 Projects for augmenting water production and supply

DJB planned various schemes to increase production and improve supply of potable drinking water to the inhabitants of Delhi. The major schemes identified for implementation during the Tenth five year Plan were:

- Construction of 140 MGD WTP at Sonia Vihar for augmentation of water in Delhi;
- Recycling of waste water at Wazirabad, Chandrawal, Haiderpur and Bhagirathi for producing 45 MGD of safe potable water;

- Construction of Under Ground Reservoirs (UGRs) and Booster Pumping Stations (BPSs) all over Delhi for rationalization and better distribution of water; and
- Renovation of Chandrawal water works.

An audit appraisal revealed that huge demand and supply gap persisted during Tenth Plan due to delay in operationalisation of the Sonia Vihar WTP, non-completion of allied works of this plant, delay in construction of re-cycling plants, delay in construction of UGRs and BPSs, lack of planning to regulate and manage the exploration of ground water, and improper management of leakages. The details of slippages in implementation of these projects are discussed in the succeeding paragraphs.

3.9.1 Sonia Vihar Water Treatment Plant

DJB constructed a 140 MGD WTP at Sonia Vihar in December 2004 at a cost of Rs. 188.80 crore to cater to the water requirement of the Trans Yamuna area as well as South Delhi. Twenty three UGRs were also required to be constructed at an estimated cost of Rs. 194 crore for the distribution of potable water that came out of the WTP. Out of 140 MGD, 90 MGD water was to be allocated to South Delhi, 35 MGD to Tahirpur and 15 MGD to Shastri Park.

Audit scrutiny of the records revealed the following:

(i) The Sonia Vihar WTP was to become fully operational by December 2003. Though the construction of the treatment plant was completed in December 2004, the plant could not be made fully functional due to non-availability of raw water from Tehri Dam. The plant started functioning only in June 2007 after the Government of Uttar Pradesh released 140 MGD raw water for the plant. Thus, the projected augmentation of 140 MGD through Sonia Vihar treatment plant could not be achieved during Tenth Plan due to delayed operationalisation of the plant.

(ii) Though the plant has since become fully operational in June 2007, the plant is not functioning at its full capacity due to non-construction of reservoirs and peripheral lines. Out of 28 UGRs, only 10 UGRs have so far been commissioned as of August 2007. Due to non-completion of the UGRs, the plant is treating only 112 to 119 MGD of water.

Thus, water supply to the residents of South Delhi, Tahirpur and Shastri Park was affected due to delayed operationalisation of the plant and delay in completion of ancillary and peripheral works.

Department stated (November 2007) that full supply of raw water from Tehri to plant was available only during Monsoon Season and could utilize about 120 MGD. The reply of the Department confirms the audit observation that the plant is not operating to its full capacity even after four years of the original scheduled date of completion.

3.9.2 Recycling of waste water

During the course of treatment of raw water at WTPs, 8-10 *per cent* water goes waste due to back wash of filters and the clarifloculators. In view of the scarcity of raw water, DJB proposed to recycle waste water of existing WTPs of Haiderpur, Wazirabad, Bhagirathi and Chandrawal to produce 45 MGD potable water. The status of creation of facilities for recycling in these plants was as under:

Table 3.2: Status of creation of facilities for re-cycling

Name of recycling plant	Date of resolution passed by the Board	Date of award of work	Tendered amount (Rs. in crore)	Stipulated date of completion	Latest position
Bhagirathi (10 MGD)	27.07.99 at Rs. 6.18 crore	09.08.2005	13.34	14.10.2006	Work-in-progress
Wazirabad (11 MGD)	03.06.1999 Rs. 6.86 crore	December 2005	27.80	14.04.2007	Only 40 <i>per cent</i> completed
Haiderpur (16 MGD)	24.09.1999 Rs. 10.44 Crore	23.09.2005	26.59	06.04.2007	Not yet commissioned
Chandrawal (8 MGD)	28.01.2005 Rs.14.66 crore	28.02.2007	12.86	28.06.2008	Work-in-progress

Despite the need for establishing recycling facilities being felt and accepted as early as 1999, the DJB took six years in awarding the work for construction of these facilities at Bhagirathi, Wazirabad and Haiderpur which led to enhancement in the project cost of first three plants from Rs. 23.48 crore to Rs.67.73 crore (188 *per cent*). The Board also failed to ensure completion of work on the three recycling WTPs by the stipulated dates. On account of these delays, residents of Delhi were deprived of additional quantity of 37 MGD of water.

Department stated (November 2007) that there was a delay of three-four years in finalizing the appropriate technical design and obtaining the views of evaluation committee.

The reply of the Department is not acceptable, as the entire project was to be implemented during Tenth Plan to meet serious water shortages in Delhi and,

therefore, technical design should have been finalized and evaluated in a time bound manner.

3.9.3 Rationalization of water distribution and construction of more UGRs/BPSs

There is inequitable supply of water in different parts of city, as a result, some parts of Delhi for example the Northern Zone receives far more water supply than the South Zone. Since there was also significant mismatch between demand and supply of water, rational distribution of the water that was available, was one of the priorities of the DJB to minimize imbalance and improve customer satisfaction in affected areas. DJB engaged a consultant to recommend the most appropriate arrangement required for rationalization of water distribution. The study recommended construction of additional reservoirs and booster pumping stations in West, North-West and South-West Delhi. On the basis of study conducted by the consultant, DJB passed a resolution in July 2004 for the construction of 14 UGRs and BPS at different locations in Delhi at an estimated cost of Rs. 263 crore.

Audit analysed the progress achieved in construction of UGRs and observed that the work at most of the locations has still not commenced. The status of construction of the reservoirs is indicated in the table below:

Table 3.3: Status of Underground Reservoirs

Sl. No.	Name of the UGR's	Proposed capacity (in million litres)	Date of award of work	Tendered amount (Rs. in crore)	Stipulated date of completion	Position of construction UGRs as of August 2007
1.	Nangloi (Nilothi)	52.5	24.08.2006	43.00	10.03.2008	Work in progress (physical progress 70% and financial progress 60%)
2.	Kirti Nagar	20.9	15.02.2006	10.76	15.05.2007	Work in progress (physical progress 65% and financial progress 50%)-
3.	Pitampura	21.4	Work yet to be awarded (Tender opened on 17.08.2007)	-	-	Work not yet started
4.	Awantika	20.0	-	Work not yet awarded.	-	Work not yet started.
5.	Qutub garh	7.8	Letter of intent to be issued	-	-	Work not yet awarded
6.	Janakpuri	15.5	-do-	-	-	Work not yet awarded
7.	Daulat pur	5.2	25.06.2007	5.31	24.09.2008	Work in progress
8.	Rohini, Sector -7	20.5	Work not yet awarded	-	-	Land has been allotted by DDA. Work of

						construction yet to commence
9.	Karala	24.3	Work not yet awarded	-	-	The land is yet to be acquired
10.	Sultan pur Dabas	5.0	02.03.2006	4.21	01.03.2007	Work in progress (Physical progress 25% and financial progress 10 %).
11.	Bawana	27.1	17.07.2007	15.00	16.01.2009	Work yet to be started.
12.	Shakur Basti	23.6	Work not yet awarded	-	-	Land yet to be allotted by DDA
13	MBR at Palla	48.9	Yet to be tendered	-	-	Work yet to commence.
14	Narela	5.8	Yet to be tendered			Work yet to commence.

After three years of passing of resolution by the Board to construct 14 UGRs, work had not commenced on 10 UGRs as of August 2007. In two cases of construction of UGRs at Kirti Nagar and Sultanpur Dabas, the work was to be completed by March 2007 and May 2007 respectively. However, the progress of work at these locations was extremely slow and so far only 25 per cent and 65 per cent physical progress had been achieved respectively. In the remaining two cases of UGRs at Nangloi and Daulatpur, the works are scheduled to be completed in 2008. Thus, there were significant delays in commencement and completion of UGRs at different locations in Delhi which delayed the rationalization of water distribution in different parts of Delhi.

Department stated (November 2007) that there was no delay in the construction of the UGRs as no specific time line was given for the construction. The Department added that these UGRs were not required to be built immediately as their construction was to be synchronized with the availability of water. The reply is not acceptable as (i) two works planned for completion by May 2007 are far behind schedule, and (ii) timely commencement and completion of other UGRs would have facilitated rationalized distribution of water already available.

3.9.4 Renovation of Chandrawal water treatment plant

The erstwhile Delhi Water Supplies and Sewerage Disposal Undertaking had approved a scheme of renovation of Chandrawal water works in February 1988 at a cost of Rs. 1.85 crore. Subsequently, an estimate of Rs. 3.80 crore was also approved in August 2000 for renovation of 20 old patersons and 10 Jessop make filters at Chandrawal water works. The CEO, DJB decided to club both the estimates into a single scheme in March 2002. The tenders were invited in August, 2005. Audit examination, however, disclosed that the tenders were yet to be finalized as of August 2007. One of the reasons that was holding up finalization of the tenders was non- review of the estimates which were framed in

1988. Despite approval of the renovation work as early as 1988, the actual award and execution of work has been delayed for about 20 years. Delay in carrying out necessary renovation and replacement of filters would affect cost-effectiveness and efficiency of operations of the plant.

Executive Engineer (E&M) stated in September 2007 that delay in finalisation of renovation work has led to deterioration of the condition of the plant to such an extent that no repair was possible except for its complete replacement. EE further stated that DJB was incurring substantial expenditure on maintenance of old filter media and the efficiency of the units had drastically reduced. To maintain the supply, extra labour was required. If the implementation was delayed further, the units might totally collapse leading to reduction in filtering capacity and, thus, the production.

The reply of the EE supports the audit contention that the Department has not shown any urgency in carrying out necessary renovation and repair work at the plant.

Recommendations

- (i) *Given the serious problem of water shortage in Delhi, the Board should ensure that various plan projects for augmentation of water production and supply are progressed and completed on time through effective planning, designing, tendering, execution and monitoring.*
- (ii) *The projects identified and undertaken for rationalisation of water distribution may be executed promptly for equitable distribution of available water.*

3.10 Replacement of old distribution lines

The water distribution system in Delhi is more than a century old. Since some of the mains are very old, replacement work of 797 km of water mains was carried out in the Ninth Plan. Government of NCT of Delhi proposed a target of 1500 km replacement of old distribution lines during the Tenth Plan. The Department fixed annual targets and achievements as under:

Table 3.4: Status of replacement of old distribution lines

Head	Unit	10 th Five Year Plan	2002-03		2003-04		2004-05		2005-06		2006-07		Total	
			T*	A**	T	A	T	A	T	A	T	A		
Replacement of old water distribution lines	Kilo Meter	1500	300	264	200	156	300	71	120	284	227	350	1147	1125

*T = Target

**A = Achievement

Audit scrutiny revealed that against the target of replacement of 1500 km old distribution lines in the Tenth Plan, DJB fixed a target of 1147 km only (76 *per cent*). DJB could replace only 1125 km of the distribution line against this target. However, it seen in the context of the overall target of the Tenth Plan (1500 km), the shortfall in achievement of target was 25 *per cent*.

Further, while DJB's performance was lagging during the first three years of the Tenth Plan, it over shot the target during the next two years of the Plan period, indicating that the annual targets in the Tenth Plan were not set rationally.

3.11 Leak detection management

Leak detection and its management is very vital for any water utility as it results in substantial saving of water that would have otherwise gone waste. It also helps ensuring supply of quality water to the end users by controlling contamination in the distribution system. The distribution net work of DJB is divided into different operating zones, each headed by an officer of the rank of the Executive Engineer. Leakages are detected through patrolling/surveying of trunk transmission mains and distribution networks by the Departmental staff of Leak Detection Cell and various maintenance divisions (operating Zones). The maintenance divisions are required to undertake repair work as soon as the leak is detected. DJB has also set up central control room to receive complaints from the public regarding water leakages. Appropriate follow up action is required to be taken by the operating zones on receipt of such complaints.

An audit appraisal of leak management in DJB revealed the following:

3.11.1 Loss due to leakages and theft

As per Economic Survey of Delhi of 2005-06, the total distribution losses, which include leakage in pipes and theft of water through unauthorized connections, was of the order of 40 *per cent* of the total water supply. This was abnormally high not only in comparison to the acceptable norm of 15 *per cent* prescribed by the Ministry of Urban Development but also quite high as compared to 10 to 20 *per cent* level of distribution losses in developing countries. Efficient leak management can help address the problem of water shortage in Delhi to a significant extent.

3.11.2 Lack of monitoring

Leak Detection Cell of DJB conducts surveys of transmission and distribution lines for detection of leaks and reports the leakages to the zones concerned for immediate repair/corrective action. The Report of the Comptroller and Auditor General of India for the year ended March 1997 had pointed out lack of feed back

mechanism in DJB for monitoring action taken by the respective zones for prompt plugging of leaks after being reported by the Cell. Superintendent Engineer (P) Water confirmed (March 2007) that the Cell did not get action taken reports from respective operating zones on regular basis indicating that no significant improvement had taken place in detection and management of leak, its control and follow up despite being pointed out by Audit. Department stated (November 2007) that instructions have been issued to the staff for submission of timely action taken reports in leak cases.

3.11.3 Delays in plugging leakages

The number of leakages detected by Leak Detection Cell during 2002-07 varied between 233 and 973. The number of leakages detected during 2006-07 was 822. Audit analysis of delay in plugging leaks for the selected year of 2006-07 disclosed that:

(a) 101 leaks (12 *per cent*) remained unplugged as of March 2007. The period of pendency of these leaks ranged between eight to 268 days. The Department in their reply (November 2007) stated that leaks were plugged timely but due to delay in receipt of feed back from the concerned divisions regarding repairing these leakages, the number of leakages non attended appeared to be high. After being pointed out in audit, Department issued instructions for timely submission of action taken reports (ATR) in leak cases. The reply of the Department confirms the audit observation that no regular monitoring of leak cases is carried out to ensure that zones concerned have taken timely action to repair the transmission and distribution lines.

(b) Out of 721 leaks which were plugged in 2006-07, there were significant delays in 131 cases (18 *per cent*) ranging upto 120 days or more as is shown in the table below:

Table 3.5: Delay in plugging of leaks

Sl. No.	Number of leaks	Delay in plugging leaks (beyond seven days)
1.	64	Upto 30 days
2.	39	30 to 90 days
3.	13	90 to 120 days
4.	15	Above 120 days

Delay in repairing of leakages resulted in estimated loss of 84 million gallon of water valuing Rs.21.79 lakh for the year 2006-07.

3.11.4 Obsolete equipment

Efficient detection and management of leakage especially in underground water pipes would require proper equipment for timely detection of leaks. Audit scrutiny of equipment inventory of Leak Detection Cell of DJB disclosed that out of 92 leak detection equipment procured during 1987-2000, only 12 equipment (13 per cent) were functional as of August 2007. Non-availability of proper equipment with the Cell is bound to affect its capability to detect leaks promptly in underground transmission network.

Audit examination further revealed that tenders were invited in June 2005 for the purchase of 41 leak detection equipment on the basis of report of a consultant submitted to the Board in February 2005. The board awarded the work for the supply of specialized equipment at a cost of Rs. 47.24 lakh in October 2006. The equipment required to be supplied by the firm by August 2007 were awaited as of November 2007.

3.11.5 Delay in finalization of scheme for prevention of water wastage

The Board approved a scheme in October 1999 for study of unaccounted flow and prevention of water wastage in Delhi at a cost of Rs.1.97 crore. It was after seven years that the Board invited expression of interest in October 2006 and awarded work in July 2007 at a cost of Rs.1.11 crore plus service tax and education cess. Thus, there was a delay of more than seven years in initiating concrete action on the scheme for prevention of water wastages in Delhi which highlights inefficiency of the leakage management system.

Recommendations

- (i) Board may put in place an efficient computerized leakages monitoring system to ensure that leakages in the transmission and distribution system are repaired by the respective zones promptly within the time norms prescribed by the Board to minimize wastage of water and loss of revenue.
- (ii) The leakage detection infrastructure may be modernized and strengthened for quick detection of leaks with the help of specialized equipment.

3.12 Quality control mechanism

3.12.1 Testing of alum used in treatment of water

Alum-Ferric (alum)/Poly-Aluminum Chloride (PAC), which are chemical coagulant, are used in the treatment process of water in WTPs. DJB purchases alum and PAC centrally through open tender for utilization at all WTPs.

As per provision of the contract agreement, the Department was required to get the samples of alum/PAC picked up at random and tested at the National Physical Laboratory (NPL), New Delhi once in a month in the presence of the officials of Director General Supplies and Disposal (DGS&D), firm's representatives and DJB.

Audit scrutiny revealed that only 13 samples were lifted during 2004-07 of which, seven samples (54 *per cent*) did not conform to I.S. specification. By the time the test results were received from NPL, the substandard alum/PAC had already been utilized during the course of treatment process of potable water. Thus, there was no mechanism which assured DJB about the purity and effectiveness of the chemicals before they were actually used in water treatment. Use of untested chemicals for treatment of water may seriously compromise the quality standards of water supplied to the residents of Delhi. Audit also observed that DJB did not test alum/PAC in its own laboratories stationed at various water works, which were equipped with required instruments and chemicals for testing alum and PAC. Department in their reply has confirmed that in cases where the samples tested by N.P.L. fails the test, the material cannot be traced as it gets mixed with other supplies and consumed at the plant. The Department further stated that to avoid the controversy between Department and DGS & D, the system of third party test was introduced and testing by DJB was suspended.

3.12.2 Inadequate monitoring of water quality

DJB is expected to ensure that water supplied to the residents of NCT of Delhi is potable and conforms to the standards prescribed by Bureau of Indian Standards, Government of India. DJB has set up six water testing laboratories all over Delhi to check the quality of drinking water being supplied. If the water samples are found unfit for drinking, reasons of contamination are required to be investigated and the zonal maintenance staff has the responsibility to rectify the problem immediately.

Audit examination disclosed that the number of samples found unsatisfactory has increased considerably during last four years from 0.73 *per cent* in 2002-03 to 2.85 *per cent* in 2005-06 and 1.88 *per cent* in 2006-07. Details of samples tested and found unsatisfactory during 2002-07 are in the table below:

Table 3.6: Samples found unsatisfactory

Year	No. of samples taken	Samples found unsatisfactory	%age of samples found unsatisfactory
2002-03	103797	757	0.73
2003-04	103842	776	0.75
2004-05	113384	3201	2.82
2005-06	104532	2982	2.85
2006-07	110928	2090	1.88

The data is furnished by Director, Quality Control, DJB.

Scrutiny of records in the office of Director, Quality Control indicated that out of 2090 unsatisfactory samples reported during 2006-07, no ATRs were received in the Directorate in respect of 1874 (90 per cent) unsatisfactory samples as of March 2007.

The Department stated (November 2007) that wherever unsatisfactory reports were received, corrective action was taken within 24 hours but sometimes delays occurred due to communication gap between the field officers and quality control.

Recommendations

- (i) *Appropriate mechanism should be put in place to ensure that adequate numbers of samples are taken from all supplies received, for testing at NPL/departmental labs. DJB should ensure that chemicals that have not been quality tested should not be used for purification of water in its treatment plants.*
- (ii) *DJB may take effective steps to improve quality of drinking water supplied to the residents of Delhi by adopting better quality control procedures and mechanism at treatment plants and in the transmission and distribution network.*

3.13 Distribution of water

Supply of water from WTPs is shared among NDMC, DCB and MCD areas. It was noticed that there was no metering system in MCD area to ascertain actual bulk supply of water to each zone for distribution to consumers. Availability of water was assessed on capacity of water lines. Besides, there was no co-ordination between distribution zones and their zonal revenue officers to compare the quantity of water billed with quantity of water supplied. Hence, audit was unable to ascertain zone-wise distribution losses. The Department stated (November 2007) that DJB was planning to install the bulk meters in distribution system and execution was expected by October 2008.

Recommendation

Necessary steps may be taken for zone-wise metering of water distribution and collection of revenue for effective monitoring of water losses and detection of revenue leakages.

3.14 Metering of water supply

Measurement of supply of water for domestic, commercial and industrial purposes through service connections is essential for proper billing and realization of water charges. Details of number of connections and status of metering during the period covered under audit were as under:

Table 3.7: Status of metering

Year	Metered connection	Un-metered connection	Bulk water connection	Total
2002-03	1099011	308090	3315	1410416
2003-04	1125373	329435	3352	1458160
2004-05	1169239	329278	3427	1501944
2005-06	1213049	335052	3493	1551594
2006-07	1252502	342867	3538	1598907

It would be seen that the number of unmetered connections increased from 3.08 lakh in 2002-03 to 3.43 lakh (11 *per cent*) in 2006-07. The Economic Survey of Delhi (2005-06) reported that out of 12.13 lakh water connections as on March 2005, five lakh meters were defective or non-functional. Such a large number of consumers (41 *per cent*) being supplied with water without any water meters or with defective meters is a colossal wastage of a valuable resource and contributes significantly to poor financial health of DJB.

3.14.1 Loss due to demand raised on average basis

Billing in cases of faulty meters is done on average basis. The year-wise position of demand raised and consumption billed both on average and actual basis during 2003-07 was as under:

Table 3.8: Billing on actual/average basis

Year	Actual reading basis			Average reading basis			Average loss of revenue due to demand raised on average basis instead of actual meter reading basis (Rs. in crore)
	quantity of water consumed (kilo liters in crore)	Total revenue demanded on actual reading basis (Rs.in crore)	Average realisation per kilo liters (in Rs.)	quantity of water consumed (kilo liters in crore)	Total revenue demanded on average billing basis (Rs.in crore)	Average realisation per kilo liters (in Rs.)	
2003-04	5.54	26.31	4.75	22.64	81.12	3.58	26.48
2004-05	6.64	29.09	4.38	27.17	88.40	3.25	30.70
2005-06	10.53	85.31	8.10	29.19	189.74	6.50	46.71
2006-07	10.86	93.91	8.65	24.61	143.03	5.81	69.88
						Total	173.77

Data for the year 2002-03 was not furnished

It would be seen from the foregoing that DJB had lost Rs. 173.77 crore during the years 2003-04 to 2006-07 due to its failure to rectify faulty meters timely. The Department agreed with audit findings and stated that a proposal was under examination for installation of captive water meters for selected colonies and to undertake water accounting (November 2007).

3.14.2 Water not fetching any revenue

Of 3392 MGD of water produced during 2002-07, 1895 MGD of water constituting 56 *per cent* of the total production did not yield any revenue due to theft, leakages and free supply. This led to revenue loss of Rs.1990.54 crore during 2002-07. The year-wise position of water produced, quantity of water for which demand was raised and the water for which no demand was raised during 2002-07 is given in the table below:

Table 3.9: Non-revenue water

(in MGD)				
Year	Water produced	Billed quantity of water	Water that was not yielding revenue	Percentage of non-revenue water
2002-03	658	310.80	347.20	52.77
2003-04	673	313.30	359.70	53.45
2004-05	669	339.98	329.02	49.18
2005-06	672	279.54	392.46	58.40
2006-07	720*	253.60*	466.40	64.78
Total	3392	1497.22	1894.78	55.86

* Figures as per Revised Budget Estimates

The level of non-revenue water (NRW) in Delhi has increased from 53 *per cent* in 2002-03 to 65 *per cent* in 2006-07 which was unacceptably high. The Department stated in June 2007 that increases in NRW during 2006-07 was due to fixation of an average of 20 kl/30kl of water per month to domestic consumers whose water meters were non-functional. Subsequently in November 2007, the Department added that water accounting was possible only when there was metered supply in all part of Delhi. They further stated that 20 *per cent* consumers of Delhi were supplied water free of cost through stand posts and water tankers as part of Government welfare measures.

The Department's reply is not acceptable as the quantity of non-revenue water is too high and has sharply increased during Tenth plan reaching the peak level of 65 *per cent* in 2006-07. Such a situation if allowed to continue may further lead to serious financial crisis in DJB.

3.14.3 Shortfall in recovery of water charges

Department fixes annual targets of recovery on the basis of total collection of water charges for the year 2001-02 plus ten *per cent* thereof for the year 2002-03, 70 *per cent* of arrear as on 1st April of the year plus 80 *per cent* of current expected demand upto 2004-05. From the year 2005-06 onwards, the targets were fixed as 60 *per cent* of recoverable arrears plus 80 *per cent* of current expected demand. The year-wise position of targets and achievement during 2002-03 to 2006-07 was as under:

Table 3.10: Targets and achievements

(Rupees in crore)

Year	Target	Achievement	Shortfall	Percentage of shortfall w.r.t. targets
2002-03	171.17	168.74	2.43	1.42
2003-04	223.51	186.13	37.38	16.72
2004-05	278.40	321.91	+ 43.51	+15.63
2005-06	360.92	316.79	44.13	12.23
2006-07	472.58	444.91	27.67	9.85

Despite the targets being low, the Department was not able to achieve the revenue collection targets and there was significant shortfall during four out of five years of the Tenth plan.

To achieve the targets, Department floated a rebate scheme year after year and liberalized the policy of regularisation of un-authorized water connections. The position of rebate given and revenue collected under the scheme during the period 2003-04 to 2006-07 was as below:

Table 3.11: Rebate allowed and revenue collected

(Rupees in crore)

Year	No. of cases	Amount of rebate allowed	Revenue collected
2003-04	36847	3.01	9.48
2004-05	95494	15.52	21.41
2005-06	72746	11.76	23.86
2006-07	92322	14.00	29.93-
Total	297409	44.29	84.68

Data for the year 2002-03 was not furnished.

Audit scrutiny revealed that Department collected revenue of Rs. 84.68 crore after allowing for a rebate of Rs. 44.29 crore during last four years. The rebate scheme does not provide any incentive to consumers who pay their water bills regularly and in fact it may encourage the defaulters not to pay the bills in the expectation of a future write off.

The Department stated (November 2007) that the rebate scheme was introduced to bring more households under the pay for water system. The reply is not acceptable as the revenue losses of the DJB on account of non-revenue water are already very high as discussed in the paragraph 3.14.2 above, and, therefore, the Board needs to strengthen its monitoring and recovery enforcement mechanism instead of adopting liberal schemes of write off or rebates.

3.14.4 Collection of Arrears

Non-collection of revenue as per the prescribed billing schedule results in accumulation of arrears and indicates inefficiency of revenue collection machinery. Audit noticed a huge build up of revenue arrears in DJB which increased steeply from Rs. 147.67 crore in 2002-03 to Rs. 368.34 crore in 2006-07. Year-wise position of recoverable arrears was as under:

Table 3.12: Revenue arrears

(Rupees in crore)

Year	Arrears against regular connections	Arrears against connections that had been disconnected		Total arrear
		No. of cases	Amount	
2002-03	121.89	36868	25.78	147.67
2003-04	131.20	42597	30.60	161.80
2004-05	156.15	44565	34.04	190.19
2005-06	261.38	49470	38.80	300.18
2006-07	310.88	62816	57.46	368.34

The Department conceded (November 2005) that an amount of Rs. 94 crore was irrecoverable being the arrears of water charges and an estimated 1.23 lakh customers had not deposited water charges over the past one decade. Further, as of March 2007, Rs. 130.32 crore was outstanding in 1659 cases wherein the outstanding amount in each case was Rs. 1.00 lakh or more.

Section 68 of the DJB Act, 1998 stipulated that ZROs would issue a notice of demand to the person liable to pay the water charges if such charges have not been paid within 15 days of the presentation of the bill. Section 82 and 87 of the Act further stipulates that if a person does not pay the demand within 30 days of the demand notice, he shall be deemed to be in default. A person in default shall pay such penalty as determined by the Board, not exceeding 20 per cent of the amount of the charge failing which the amount shall be recovered under a warrant by distress and sale of movable property or the attachment and sale of immovable property.

Audit scrutiny revealed that no action was ever initiated by the ZROs as per provision of the Act, to recover the outstanding arrears/dues from the consumers resulting in huge accumulation of arrears.

Recommendations

- (i) *DJB may take effective steps to minimize the number of unmetered connections to facilitate billing and revenue collection on actual water consumption basis.*
- (ii) *Necessary steps need to be taken to arrest the increasing trend in the non-revenue water and bring it down to a reasonable level by strengthening its monitoring system, introducing better leakage detection and management system, and enforcing penal provisions of the Act in cases of theft or default in payment of water bills.*

3.15 Tanker Services

To supplement water supply in deficit areas, Delhi Jal Board resorts to carriage of water through tankers. These are supplied through departmental as well as hired tankers every year. Each year DJB receives complaints regarding poor movement of tankers, unauthorized diversions from areas they were meant to supply and even complaints of water being sold off. With a view to tracking the movement of such tankers, DJB decided to install Global Positioning System (GPS) on Departmental tankers through a service provider. DJB got installed GPS system on 24 tankers as part of a pilot project at the rate of Rs. 3861 per tanker per month for a period of three years on a service contract signed with the service provider in July 2005. The work of installation of GPS on additional 205 Departmental vehicles was awarded to the same service provider in September 2006 at a total cost of Rs 2.73 crore at the rate of Rs. 3700 per vehicle per month for three years. The work commenced in October 2006. The contractor was required to submit standard reports for each vehicle including vehicle activity report, a daily vehicle report summary as well as vehicle status and vehicle speed etc.

An audit appraisal of reports and data generated of the GPS revealed as follow:

- (i) Departmental tankers were making two to four trips per day against the norms of 5 to 6 trips a day, whereas, hired tankers were performing 7 to 8 trips per day. Department stated (November 2007) that due to shortage of drivers the norms of five to six trips per day could not be adhered to. The Department's reply is not tenable as it could have hired services of drivers on contract basis to ensure maximum utilization of Departmental tankers and minimize dependence on private tankers.
- (ii) Despite serious problems in the implementation of the GPS system, it has not been discontinued as of November 2007. Lack of proper planning and monitoring at the stage of pilot study resulted in the Department being presented

with a *fait accompli* and it was forced to continue the project pegged at Rs. 2.73 crore.

3.16 Management of ground water

DJB, being the nodal agency for supply of water in Delhi, is expected to have comprehensive data on the ground water potential and a plan/policy to regulate exploitation of ground water in Delhi. Audit observed that as of November 2007, there was no policy in place to manage ground water or regulate its exploitation. The Board was not aware of the quantity of ground water being explored authorisedly and unauthorisedly. This indicates Board's failure to keep watch over the exploration of ground water in Delhi.

DJB approved "Delhi Water Board Amendment Act, 2002" vide a resolution in May 2002 to control, regulate and manage ground water. Later on, "Delhi Water Board Amendment Bill 2006", to regulate and control the use of ground water in NCT Delhi, was put up for approval of Board incorporating salient features of model bill circulated by Government of India in 2005. No legislation has been introduced or approved till date. The Department stated (November 2007) that the bill has been approved by Delhi Cabinet and proposed to be placed before Assembly shortly.

3.16.1 Rain water Harvesting

Rain water harvesting is a simple economical and eco-friendly technique of preserving water. It is also an effective way of recharging ground water. Delhi Government approved a scheme for "Setting up of Water Mission and use of new technologies for conservation, harvesting and recycling of water" for implementation during Tenth five year Plan. Under the scheme, financial assistance is given to Resident Welfare Associations/Group Housing Societies/Schools etc., to a maximum of Rs.50,000 or 50 *per cent* of the cost of rain water harvesting system, whichever is less. The maximum limit was increased to Rs. One lakh with effect from 02 February 2007. DJB has given financial assistance of Rs. 51.19 lakh in 108 cases during February 2003 to March 2007. As per terms and conditions of agreement, the party receiving the financial assistance was required to submit a report with regard to maintenance of rain water harvesting system every six months—one before the onset of monsoon and one after the monsoon was over. Further, the officials of DJB were required to carry out random inspection of the rain water harvesting system to ensure that the system was properly maintained. In case of default in the maintenance of the system, the entire amount paid as assistance was to be recovered from the institution/party.

Audit scrutiny revealed that Department did not enforce the conditions of the agreement. Consequently, during 2002-07, in 97 out of 108 cases (90 per cent) no maintenance reports were received from the parties concerned. Only seven inspections (six per cent) were carried out by the Department. In all the seven cases, the Department found the system either muddy, silted or only partially functional. Agreeing with the Audit view, Department proposed (November 2007) 100 per cent inspection of beneficiaries of rain water harvesting assistance instead of present 25 per cent checking of beneficiaries for the proper maintenance of the system.

Recommendation

DJB may formulate a comprehensive policy/ plan for regulating ground water exploitation in Delhi by authorized and unauthorized sources. Department may carry out periodical inspection of the Rain Water Harvesting Systems where the financial assistance has been granted to different beneficiaries/organizations.

3.17 Public perception regarding water supplied by DJB

To ascertain the level of public satisfaction on the quality of services provided by DJB, Audit obtained a list of RWAs from the Government of NCT of Delhi maintained under the Bhagidari Scheme. A detailed questionnaire was sent to randomly selected 485 RWAs out of about 1100 registered RWAs in Delhi. The questions sought information on the number of hours water was available, sufficiency of water, adequacy of pressure and whether it could reach upper floor without assistance of a pump, quality of water supplied, the complaint redressal mechanism and public awareness regarding execution of work done by the DJB. Response was received from 113 RWAs which is tabulated as under:

Table 3.13: Public perception

Audit Questions	RWAs response
Availability of water	40 per cent stated that they received water supply for less than 2 hours in a day 48 per cent received water for two to four hours a day 12 per cent received water for more than five hours a day
Sufficiency of water	37 per cent respondents stated that they received sufficient water 63 per cent did not have sufficient water
Quality of waters	67 per cent respondents found the water worthy for drinking 33 per cent respondents found it unfit for drinking
Complaints	44 per cent respondents were satisfied with the complaint redressal mechanism 41 per cent were not satisfied with the redressal of complaints and 15 per cent did not comment

The responses received from RWAs indicated high level of dis-satisfaction both in terms of sufficiency and quality of water supplied. The complaint redressal was also poor and the duration of water supply in different parts of Delhi was highly skewed.

Recommendation

The Board may strengthen the existing mechanism for settlement of complaints through computerized registration and effective monitoring for timely redressal of grievances in a satisfactory manner.

3.18 Follow up action on previous Audit Report

A performance appraisal on “Water Supply System in MCD” featured in the Report of the Comptroller and Auditor General of India for the year ended March 1997. The report had pointed out the shortage of 20 gallons per capita demand daily, poor quality of water, losses on account of free water supply to large category of consumers, unmetered water supply, supply of water to consumers with defective meters, very high distribution losses largely on account of absence of metering system and large uncollected water charges.

While forwarding the Action Taken Note, the Department assured (November 2005) to reduce the arrear of water charges by fixing targets for collection of arrears in every zone, setting up site recovery camps and arranging additional cash counters for collection of revenue. DJB also mentioned that it had now permitted the consumers to purchase and install their own meters in replacement of defective meters and bulk water meters were being installed at WTPs in Haiderpur and Gokulpuri for measurement of water being issued for distribution.

The current performance audit findings, however, indicate that no effective action has been taken on the previous recommendations contained in the Audit Report for the year ended March 1997.

3.19 Conclusion

DJB has been struggling to cope with the increasing demand for water supply. Most of its projects for augmentation of water production capacity and rationalization of water distribution in different parts of Delhi have fallen behind schedule compounding the problem of water shortage in the National Capital. The leak detection management system is inefficient and results in loss of substantial water from the transmission and distribution network. More than 50 per cent of the water supplied does not fetch any revenue for the Government and the satisfaction level of Resident Welfare Associations about the quantity and

quality of water supplied is very low. DJB has not formulated any comprehensive policy or plan for regulating exploitation of ground water in Delhi. The projects for recycling of waste water have also not been commissioned as planned. We would encourage the management to address these core issues in the coming years.

3.20 Acknowledgement

The draft performance audit was communicated to the Government and Delhi Jal Board in October 2007. The reply of the Board was received in November 2007 and discussed in meeting held in December 2007 has been taken into account and incorporated in the performance audit report. The reply of the Government of NCT of Delhi has not so far been received.

New Delhi

(P. K. MISHRA)

Dated:

Accountant General (Audit), Delhi

Countersigned

New Delhi

(VINOD RAI)

Dated:

Comptroller and Auditor General of India