



Chapter-II

Performance Audit

2.1 Performance Audit on Water Supply Management in Bhopal and Indore Municipal Corporations

Chapter-II: Performance Audit

Urban Development and Housing Department

2.1 Performance Audit on Water Supply Management in Bhopal and Indore Municipal Corporations

Executive Summary

Water Supply is one of the functions in the list of 18 functions entrusted to Urban Local Bodies (ULBs), under 74th Constitutional Amendment. Under the Municipal Corporation Act, 1956, ULBs are provided power for supplying proper and sufficient water for public and private purposes.

The area of Madhya Pradesh (MP) is 3.08 lakh Sq. km., which is 9.37 *per cent* of the area of India (32.88 lakh Sq. Km). The population of the State is 8.23 crore (6.16 *per cent* of India's population). In MP, the average surface water availability is 78 litre per capita daily (lpcd) against 135 lpcd as per MoUD norms. Thus, there is a gap of 57 lpcd between demand and supply of water in the state. Bhopal Municipal Corporation (BMC) and Indore Municipal Corporation (IMC), the largest MCs of the State- were selected for Performance Audit to assess the status of water supply management in Madhya Pradesh. The period of coverage of the PA was from April 2013 to March 2018.

The important findings of performance audit are given below:

- There were differences in quantity of water received from source (filtration plant) and water distributed to consumers through Over Head Tanks/Reservoirs ranging from 30 to 70 *per cent* in both MCs due to non-existence of leakage detection cell to monitor water loss, valves operation system and non-installation of flow meters in distribution system.

(Paragraph 2.1.6.3)

- Leakage cases were attended with the delays ranging from 22 to 182 days as tenders for repair works were invited separately for each case at zone/ward level by Asst. Engineer/Sub-Engineer instead of opting for an annual rate contract at ward/zone or corporation level.

(Paragraph 2.1.6.4)

- There were differences between water supply achievement as shown by MCs and actual water supplied to the extent of nine to 20 lpcd and 36 to 62 lpcd in BMC and IMC respectively. The difference was due to the fact that the MCs calculated the per capita demand of water by taking into account the water available at filter plants instead of water available in Over Head Tanks.

(Paragraph 2.1.6.5)

- Due to improper zoning, non-existence of pressure gauge and non-maintenance of valve operation schedule, un-equal and less than required pressure of water was supplied on alternate days for 30 to 60 minutes by both MCs and in only five zones in Bhopal Municipal Corporation and four zones in Indore Municipal Corporation water was provided daily. However, in SLB *gazette* notification, duration of water supply indicated by BMC and IMC were two to four hours and 30 minutes to one hour daily.

(Paragraph 2.1.6.6)

- Authorised water connections were provided only in 5.30 lakh households (56.32 per cent) out of 9.41 lakh households.

(Paragraph 2.1.6.9)

- During the period 2013-18 4,481 water samples (physical, chemical and bacteriological) were adverse (below BIS 10500 standard) in both MCs, but it could not be ascertained from records what action has been taken by MCs. Independent water sample testing was conducted jointly and it revealed that out of 54 water samples, 10 water samples were found adverse having turbidity and faecal coliform. As a result, 8.95 lakh residents (3.62 lakh in BMC and 5.33 lakh in IMC) were supplied contaminated water. The Public Health department also reported 5.45 lakh cases of water borne diseases during the above period.

(Paragraphs 2.1.7.1 & 2.1.7.3)

- Out of 45 test checked Over Head Tanks/reservoirs in 23 cases, neither the Over Head Tanks/reservoirs were cleaned at regular interval nor any biological test of the silt of the OHT were conducted which was mandatory to ensure quality of water supplied. In both MCs the sub-engineer responsible for cleaning failed to discharge his duty while the higher technical officer (Assistant Engineer or Executive Engineer) never monitored this work at their level.

(Paragraph 2.1.7.4)

- Indore Municipal Corporation was supplying bore well water without any testing. Out of the 20 bore well water samples jointly collected and tested, all the samples were either having Iron, Nitrate, Calcium, Conductivity or Faecal Coliform more than the prescribed BIS 10500 norms which can lead to liver, heart, pancreatic damage, diabetes, diarrhoea, vomiting, stomach pain, digestive problems, jaundice, typhoid and kidney stones.

(Paragraph 2.1.7.5)

- As per SLB guidelines, 90 per cent recovery efficiency of water charges is to be done. Audit noticed that an amount of ₹ 470.00 crore was outstanding towards water charges in both MCs.

(Paragraph 2.1.8.2)

- No monitoring mechanism was developed for water supply at State level as well as MCs level.

(Paragraph 2.1.10.1)

- Water audit was not conducted by MCs and therefore estimation of losses in water supply system could not be ascertained.

(Paragraph 2.1.10.2)

- There was no comprehensive Management Information System (MIS) at State as well as at MCs level for management control and to evaluate the outcomes of water supply system.

(Paragraph 2.1.10.3)

2.1.1 Introduction

Water is an essential natural resource i.e. surface¹ and ground² water; a

¹ Surface water is water on the surface of the continents such as in a river, lakes or wetland.

² Ground water is the water found underground in the cracks, and spaces in soil, sand and rock.

fundamental need of living being and invaluable national wealth. Water Management planning has regard to all the competing demands for water and seeks to allocate water on an equitable basis to satisfy all uses and demands. It is the obligatory responsibility of every local body to provide potable water supply to the residents of the area under their respective jurisdictions.

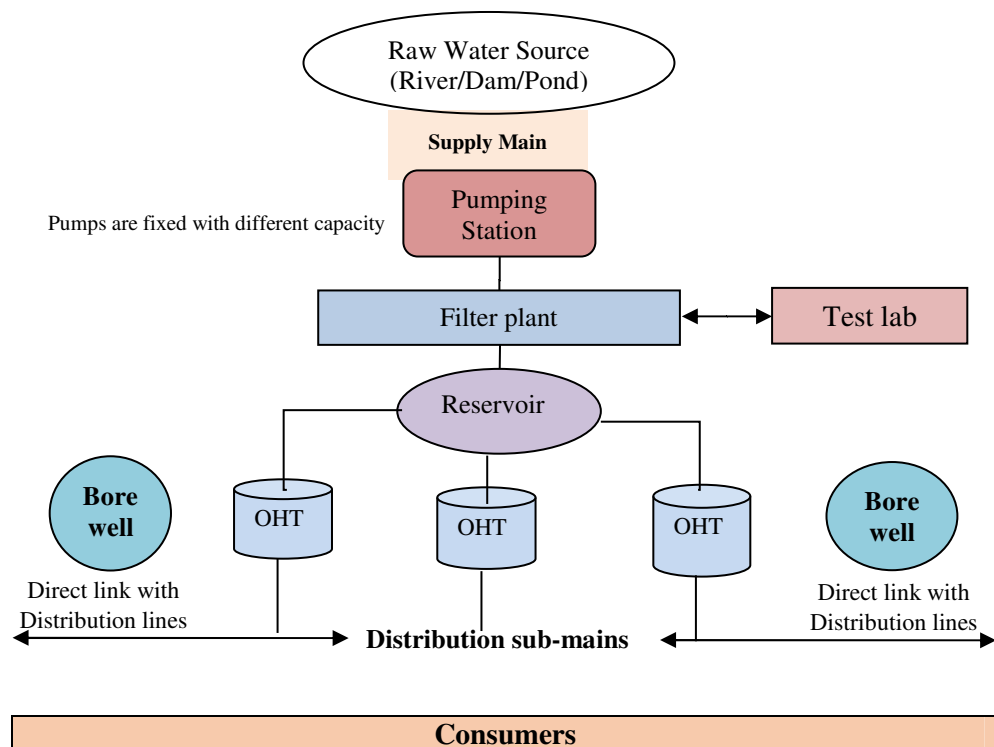
As per Article 243W of the 74th Constitutional Amendment, water supply is one of the key functions, in the list of 18 functions entrusted to Urban Local Bodies (ULBs).

The area of Madhya Pradesh (MP) is 3.08 lakh Sq. km., which is 9.37 *per cent* of the area of India (32.88 lakh Sq. Km). The population of the State is 8.23 crore (6.16 *per cent* of India's population 133.51 crore). In MP, the average surface water availability is 81.50 lakh hectare-meters. Against 135 lpcd as per norms decided (2008) under Service Level Benchmarking (SLB) issued by Ministry of Urban Department (MoUD), only 2.34 Billion Cubic Meter (BCM)/78 litre per capita daily (lpcd) could be fulfilled as per available water. Thus, there is a gap of 57 lpcd between demand and supply of water in the state. Out of 16 Municipal Corporations (MCs) in MP, Bhopal Municipal Corporation (BMC) and Indore Municipal Corporation (IMC), the largest MCs of the State, having 23.64 lakh and 29.06 lakh population respectively as of March 2018, ward-wise details shown in *Appendix-2.1.1* were considered for Performance Audit.

Water supply involves the management of water taken from water sources and making it available to the consumers involving various stages.

The water management system is represented through the flow chart given under:

Flow Chart-2.1.1: Representing the various stages of Water Supply in MCs



2.1.2 Organisational set up

At State level, Urban Development and Housing Department (UDHD) is designated for financial and administrative control of Urban Local Bodies (ULBs) under which Urban Administration and Development Directorate (UADD) monitors the funding to the ULBs and utilisation thereof. Under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Atal Mission for Rejuvenation and Urban Transformation (AMRUT), State Level Steering Committee (SLSC)/State Level Technical Committee (SLTC) have been constituted for four³ identified cities under the chairmanship of Minister, Urban Administration and Development for appraisal of the Detailed Project Reports (DPRs). ULBs are self-governed bodies which make rules and policies for their smooth functioning.

At Directorate level, the Engineer-in-Chief (ENC) is assisted by Superintending Engineer (SE), Executive Engineer (EE), Assistant Engineer (AE), Sub-Engineer and they technically assist ULBs for implementation of projects.

At Municipal Corporation (MC) level, the Commissioner is assisted by SE (Water supply), EE (Water supply), Assistant Engineer (AE), Sub-Engineer and other staff to discharge their duties for smooth functioning of the water supply.

2.1.3 Audit Objectives

The Performance Audit aimed to assess whether Bhopal Municipal Corporation (BMC) and Indore Municipal Corporation (IMC) were able to provide sufficient, regular and required quality of water to all citizens in municipal areas of Bhopal and Indore.

2.1.4 Audit Criteria

Audit criteria were sourced from the following:

- Madhya Pradesh Municipal Corporation Act, 1956 and Madhya Pradesh Municipalities Act, 1961;
- Central Public Health Environment Engineering Organisation (CPHEEO) Manual on Water Supply and Treatment and Operation & Maintenance Manual and National/State water policy;
- Bureau of Indian Standard 10500 for drinking water;
- Financial Rules, MP Public Works Department (PWD) manual, order/circular issued by GoI and GoMP;
- Sustainable Development Goals (SDGs) with targets of water for all by 2030;
- 13th Finance Commission's recommendation on Service Level Benchmarking (SLB) for water supply in ULBs; and
- Service Level Benchmarking (SLB) Hand book issued by Ministry of Urban Department (MoUD).

³ Bhopal, Indore, Jabalpur and Ujjain

2.1.5 Audit Coverage and Methodology

Performance Audit covered period from 2013 to 2018 through test check of records in the offices of the Principal Secretary, UDHD, Commissioner, UADD as a nodal department along with two MCs viz. Bhopal and Indore.

The overall status of BMC and IMC at-a-glance is shown in **Table 2.1.1** below:

Table 2.1.1: Status of BMC and IMC at-a-glance

Sl. No.	Items	Units	BMC	IMC
01	Getting status of State Municipal Corporation	Year	1983	1956
02	Area	Sq. Km.	285.9	280
03	Population (as per 2011 census)	lakh	19.22	21.95
04	Projected population (2018)	lakh	23.64	29.06
05	No. of Zones and wards	No.	19/85	19/85
06	Number of water sources	No.	04	03
07	No. of filter plants	No.	14	03
08	Total no. of households	lakh	4.20	5.21
09	Total no. of water connections (as of March 2018)	lakh	2.77	2.53
10	Total water demand per day	MLD	363	525
11	Total water supplied per day	MLD	279	485
12	No. of OHTs/SR	No.	136	86
13	Length of distribution net-works	Km	2100	1850

(Source: BMC & IMC)

The entry conference was held with the Commissioner cum Secretary, UDHD on 10 September 2018, in which audit objectives, methodology and criteria for the PA and name of sampled MCs were discussed.

Exit conference was held with Principal Secretary, UDHD, Bhopal on 26 April 2019. The replies of the Government and views expressed during the exit conference have been suitably incorporated in the report.

Audit findings

2.1.6 Availability and supply of water

2.1.6.1 Non-assessment of institutional demand for water

CPHEEO Manual, prepared by MoUD and adopted (1962) by State Government, provides that 135 lpcd of water supply for all purposes may be ensured to each person of the State including full flushing system. Further, in CPHEEO Manual, norms for institutional⁴ requirement of water were also laid down. It is the responsibility of SE (Water supply) to meet the technical standards and social needs in the most cost effective way.

Audit scrutiny revealed that BMC and IMC assessed the actual need of water for households. However, the actual need of water to institutions within the MCs were not assessed. Thus, the concerned SEs failed to evaluate the actual demand for institutions in the MCs jurisdiction.

⁴ For hospitals: 340 to 450 lpcd (per bed), hostels and boarding schools/colleges: 135 lpcd, day schools/colleges: 45 lpcd, restaurants: 70 lpcd (per seat) and for cinema and theatre: 15 lpcd.

In exit conference, Principal Secretary, UDHD stated (April 2019) that in order to maintain the economy in design of the project, it was required that a demand assessment should be made on realistic terms. Both MCs had accommodated institutional demands in Atal Mission for Rejuvenation and Urban Transformation (AMRUT).

The reply is not acceptable as in the DPRs of AMRUT, no institutional demand was included in respect of the ongoing institutes of the BMC and IMC.

2.1.6.2 Data manipulation of SLB targets to show better performance

The 13th Finance Commission for granting performance grant had recommended nine conditions out of which adoption of Service Level Benchmarking (SLB) for four⁵ core services was one (8th) of the mandatory condition. For water supply, nine⁶ indicators were decided by MoUD. A Cell was to be constituted at State level and also at ULB level. For this purpose, baseline data was to be gathered by MCs and after validation of data, SLBs targets for succeeding fiscal years and SLB achievement of the previous year were to be published in the *gazette*. Periodical review for the achievement of the targets was also to be carried out by SLB cell of the ULBs as well as the State. As per MoUD order (April 2017), better performing ULBs will only be eligible for receiving the performance grant.

No periodical review was conducted by SLB cell at State level as well as MC level before publishing SLB targets and achievement.

During scrutiny of records related to SLB at State level, it was noticed that although SLB cell⁷ was constituted (February 2012), no periodical review of SLB targets and achievements was done by the SLB Cell during the period 2013-18. Resultantly, the actual status of targets notified and achievement of the targets by MCs could not be reviewed and SLBs achievements were incorrectly notified in the *gazette*.

On being pointed out, the State Government accepted (October 2018) that no separate monitoring was done for SLB targets and achievement at State level.

Scrutiny of records related to nine SLB indicators in both MCs, revealed that a core team headed by Additional Commissioner and a Nodal Officer (City Engineer) was constituted in MCs for collecting data and review of the achievement of the targets. The Core team compiled/prepared SLB achievement for the current year as well as SLB targets for next year on the basis of information made available by the concerned wings of MCs and the same was forwarded by the Commissioner MCs to the State for publishing without properly reviewing the actual status of achievement of targeted indicators. The status of SLB targets, achievement thereof and actual achievement, assessed by audit is shown in **Appendix-2.1.2**. Audit findings related to each notified target, its achievement and actual status i.e. difference in water received and distributed, non-revenue water, per capita demand and supply of water, duration of water supply, water connection, metering,

⁵ Water supply, Sewerage, Solid waste and Storm water

⁶ Coverage of water connections, per-capita water supply, metering status, non-revenue water, water supply duration, water filtration sufficiency, public complaints redressal, recovery of O&M and recovery efficiency of water charges.

⁷ Superintendent Engineer, Executive Engineer, Urban Governing Officer, Assistant Engineer and MIS expert

filtration sufficiency (quality water), revenue recovery, O&M cost recovery, are discussed in para 2.1.6.3, 2.1.6.4, 2.1.6.5, 2.1.6.6, 2.1.6.9, 2.1.6.10, 2.1.7 and 2.1.8.2 respectively.

In exit conference, the Principal Secretary, UDHD accepted the audit observation and stated (April 2019) that Commissioner MCs had been instructed to review periodically for deciding SLB targets and achievements. The periodic review would also be conducted by SLB Cell at State level.

Fact remains that during the 2013-18 no periodical review was conducted by State SLB Cell as well as the core team of MCs. Thus, the Commissioner/Additional Commissioner /nodal officer of Core team failed to fulfill their responsibility to review the targets.

Recommendation: SLB Cell at State and MC level should conduct periodical review of the SLB targets and achievements.

2.1.6.3 Huge difference between quantity of water received and distributed due to water losses

As per CPHEEO O&M Manual, water losses can be termed as physical⁸ and non-physical⁹. The major activities in the leak detection work in distribution system involve preliminary data collection and planning, pipe location and survey, assessment of pressure and flow, locating the leaks and assessment of leakage. It is the responsibility of AE/Sub-Engineer to undertake inspection visit in the service area during water supply timing and note the visible leaks, leaking valves, cross connections and to cause timely detection and rectification of leakages in concerned service area.

During the scrutiny of records related to raw water received, filtered and transmitted to Bhopal for distribution to the citizen through Over Head Tanks (OHTs), it was noticed that there was difference between water received and distributed in BMC jurisdictions as shown in **Table 2.1.2** below:

Table 2.1.2: Status of water received and distributed in BMC area (water in MLD)

Year	Quantity of raw water received for filtration	Quantity of water filtered	Loss of water between raw water, filter water per cent thereof	Water distributed from OHTs/SRs	Loss of water between filter water, OHTs per cent thereof	Loss of water	Per cent of loss compare to raw water received
1	2	3	4 (2-3)	5	6 (3-5)	7 (2-5)	8
2013-14	1,50,920	1,44,220	6,700.00 (4)	1,05,010	39,210 (27)	45,910	30
2014-15	1,50,640	1,44,100	6,540.00 (4)	1,04,890	39,210 (27)	45,750	30
2015-16	1,66,360	1,59,200	7,160.00 (4)	1,02,730	56,470 (35)	63,630	38
2016-17	1,66,060	1,58,890	7,170.00 (4)	1,02,420	56,470 (36)	63,640	38
2017-18	1,98,143	1,90,651	7,492.00 (4)	1,01,891	88,760 (47)	96,252	49

(Source: BMC)

⁸ Physical losses occur mainly due to leakage in the network from pipes, joints & fittings, reservoirs and overflows of reservoirs & sumps.

⁹ Theft of water through illegal, disconnected connections, under-billing through defective meters, water wasted by consumer through open or leaky taps, public stand posts and hydrants.

Non-revenue water ranged from 30 to 70 per cent in both MCs.

It can be seen from the above table that overall non-revenue¹⁰ water (NRW) ranged from 30 per cent to 49 per cent and percentage of NRW is increasing due to non-existence of leakage detection equipment/ Cell to monitor water loss and valves operation system which shows lack of monitoring mechanism to control the leakage under water supply system. On the other hand, in SLB gazette notification, water supply wing of BMC, has shown NRW ranging from 15 per cent to 26 per cent. The loss of water between OHTs to consumers end cannot be determined due to absence of flow meters¹¹ at OHTs and water meters at the consumers' end.

In reply, the Chief Engineer (Water Supply), BMC stated (February 2019) that AE and Sub-Engineer of the concerned zones were made responsible for line losses and theft of water. Further, for reducing water losses, efforts were being undertaken.

Fact remains that no action was taken against responsible officers for reducing NRW.

In case of IMC, filtered water was transmitted from Mandleshwar WTP to control tower at Bizalpur, Indore city which was approximately at the distance of 70 kilometers. No flow meters were installed to measure filtered water transmitted from filter plants to control tower. The status of water received from filter plants to Indore city for distribution is shown in **Table 2.1.3** below:

Table 2.1.3: Status of water received and distributed in IMC area (water in MLD)

Year	Quantity of raw water received for filtration	Total filtered water released	Loss of water between raw water, filter water and per cent thereof	Water available in OHTs	Loss of water between filter water, OHTs and per cent thereof	Loss of water	Per cent of loss compare to raw water received
1	2	3	4 (2-3)	5	6 (3-5)	7 (2-5)	8
2013-14	*	98,592.27		55,826.97	42,765.30(43)		
2014-15	1,27,190.00	1,18,676.00	8,514.00(07)	44,953.77	73,722.23(62)	82,236.23	65
2015-16	1,50,808.00	1,26,397.54	24,410.46(16)	45,433.08	80,964.46(64)	1,05,374.92	70
2016-17	1,67,624.00	1,33,866.30	33,757.70(20)	51,215.95	82,650.35(62)	1,16,408.05	69
2017-18	1,67,771.00	1,49,832.50	17,938.50(11)	58,652.75	91,179.75(61)	1,09,118.25	65

(Source: IMC) * No raw water data available in IMC

As evident from the above table, the actual NRW available for distribution against total raw water released was ranging from 65 per cent to 70 per cent while in SLB gazette notification it was shown zero to 50 per cent by IMC which did not match with the actual status. The huge NRW was due to non-existence of leakage detection system and lack of monitoring of Supervisory staff i.e. SE/EE (water supply). As a result, huge amount of water was wasted as NRW. It showed the improper management system of water supply in IMC. It was the responsibility of the in-charge Engineer of filtration and distribution to take effective measures to check and control the loss of water.

In reply, the Commissioner IMC stated (February 2019) that audit has considered the quantity of water distributed through overhead tanks only,

¹⁰ Non-revenue water includes loss of water though leakage, waste, metering errors, unbilled water and illegal connections.

¹¹ Flow meter is a device for measuring flow rate and total flow of water.

while there is significant quantity of water distributed through direct supply (without storage in OHTs).

The reply of the IMC is not tenable as IMC could not quantify the water supplied directly to consumers and ascertain the causes of losses in water supply system.

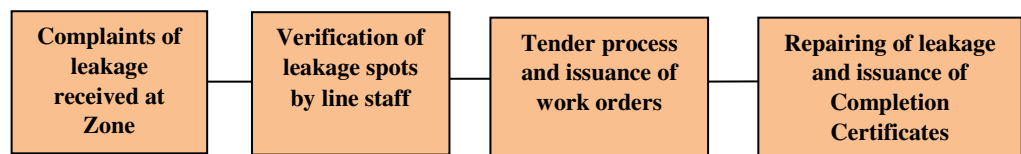
In exit conference, Principal Secretary, UDHD stated (April 2019) that for systematic reduction of NRW and scientific control of quality and quantity of drinking water, Supervisory Control and Data Acquisition (SCADA) system was being deployed in all AMRUT cities of the State.

2.1.6.4 No leakage control programme in existence

CPHEEO manual for water supply projects, for operation and maintenance of Water Supply System envisaged that leakage of water in the transmission system occurs by way of leakage from pipes, joints & fitting, reservoirs & overflows of reservoirs & sumps. The objective of leakage control programme is to reduce to a minimum the time that elapses between the occurrence of a leak and its repair. Unaccounted for Water (UFW) should be limited to 15 per cent. A maintenance schedule is required to be prepared to improve the level of maintenance of water transmission system and AE/Sub-engineer was to ensure implementation of the schedule. It is the responsibility of Operational Management (EE) to introduce process for reducing and controlling leakages.

During the course of audit, it was found that neither any procedure for detecting leakage (visible & non-visible) was adopted nor any leakage cell was constituted by MCs. In both MCs, out of 3530¹² leakage cases, audit test checked 105¹³ complaint cases of leakage, which revealed that cases had been attended with delays ranging from 22 to 182 days. Stages of detecting leakages and repairing process is given below in **Chart 2.1.2**:

Chart-2.1.2 Process for detection of leakages and repairing



The above process followed for detection and repairing of leakages was noticed through relevant records i.e. complaint register, repairing files and tender files maintained by MCs. After completing the work, AE/Sub-engineer issues completion certificate. However, no records/ verification note was found to ascertain the duration between complaint received and its verification. Further, it was found that after verification of the leakage at site tender process were initiated for each case separately at zone/ ward level. As a result there were delays ranging from 38 to 178 and 20 to 151 days in issuance of work orders for the repairing work in BMC and IMC respectively. Further, delays ranging from 01 to 06 days and 01 to 12 days in BMC and IMC respectively were also noticed between the issuance of the work orders and completion of leakage repair work. The reason for delay may be attributed to the tendering process followed by the MCs, as an overall annual rate contract

¹² Gravity main-657 and Transmission -2873.

¹³ BMC-17 cases and IMC 88 cases.

was not adopted in MCs. Year-wise leakage cases and expenditure from control tower to the consumers are given below in **Table 2.1.4** below:

Table 2.1.4: Year-wise status of leakage cases and expenditure on the maintenance of leakage

(₹ in crore)

Sl. No.	Year	Total no. of leakage cases		Number of leakage cases				Expenditure incurred on leakage maintenance	
		BMC	IMC	Gravity main		Transmission		BMC	IMC
				BMC	IMC	BMC	IMC		
01	2013-14	63	239	03	41	60	198	0.12	1.59
02	2014-15	124	471	12	40	112	431	0.26	2.55
03	2015-16	133	598	12	42	121	556	0.30	3.09
04	2016-17	154	884	08	76	146	808	0.42	4.24
05	2017-18	183	681	09	70	174	611	0.45	3.36
Total		657	2873	44	269	613	2604	1.55	14.83

(Source: MCs)

It is evident from the above table that yearly leakage cases as well as expenditure incurred on repair of the leakage was increasing due to non-preparation of regular O&M plans. The delay in repairing could have been avoided by adopting rate contract. Further, it is also evident that leakage in transmission¹⁴ lines was more than the leakage in gravity main¹⁵. It shows that the pressure control system was not in existence to control the pressure in transmission lines. Thus, SE and concerned AE/Sub-engineer failed to control the line losses of water.

The photographs below depict leakages in main line of MCs:

Photographs showing the leakages in main lines of MCs water supply



¹⁴ Transmission mains are designed to move large quantities of water from sources of supply to distribution main lines.

¹⁵ Gravity schemes are water distribution schemes without pumping; only the power of the earth gravity force is used to bring the water from a high entry point to the lower outlets.

On being pointed out, the Commissioner, BMC accepted (December 2018) that no separate leakage detection/ maintenance Cell was constituted. As and when the leakage cases come to the notice of the concerned engineer the corrective action had been taken accordingly.

In reply, Commissioner IMC stated (February 2019) that pipelines of the water supply in the city were very old and got damaged due to construction works i.e. construction of flyover, laying gas pipelines and telephones cable. As the complaints received regarding affected water supply area was due to invisible leakage, the remedial action had been taken up.

In exit conference, Principal Secretary, UDHD stated (April 2019) that work under AMRUT and Urban Infrastructure Development Scheme for Small and Medium Town (UIDSSMT) are under progress in MCs. After completion of AMRUT and UIDSSMT, water losses will be come under control.

Fact remains that the MCs had not adopted any suitable procedure for reducing the leakage and failed to prevent loss of water due to delay in attempting leakage repairs.

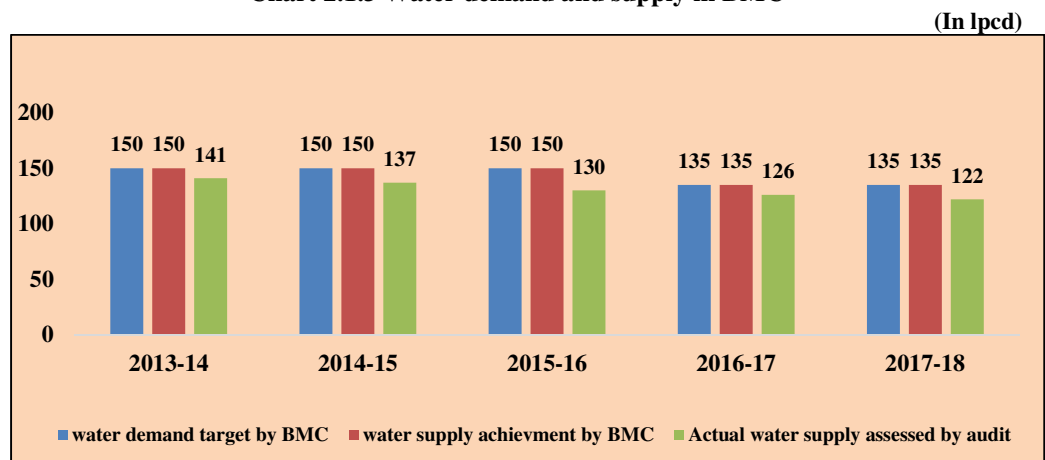
Recommendation: Leakage detection cell should be formed as required in the CPHEEO manual to reduce the water losses and Rate Contract for leakage repair should be introduced at ward/zone or corporation level.

2.1.6.5 Huge gap between targeted demand and actual supply of water

CPHEEO Manual and SLB MoUD guidelines provide that 135 lpcd of water supply for all purposes may be ensured to each person of the State including full flushing system. For this purpose, actual need assessment was to be determined by conducting survey in Municipal area.

Test-check of records of SLB indicators on per capita water supply revealed that the MCs calculated the per capita demand of water by taking into account the water available at filter plants for filtration. However, per capita demand of water calculated¹⁶ on the basis of water supplied from OHTs, revealed that there was difference in water supply target fixed, water supply achievement claimed by MCs and actual water supply to the consumers as detailed in the Charts below:

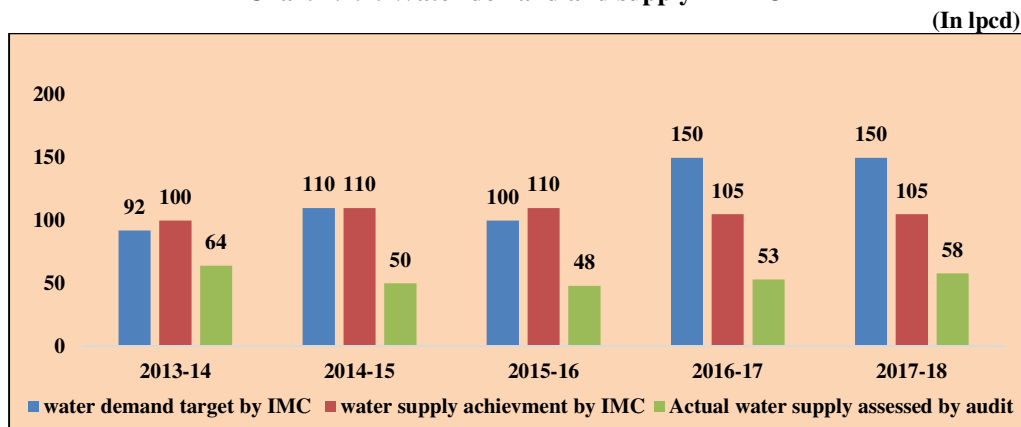
Chart 2.1.3 Water demand and supply in BMC



(Source: BMC)

¹⁶ Total water supplied per day in litres/Population based on Growth rate

Chart 2.1.4: Water demand and supply in IMC



(Source: IMC)

Huge gap between water supply achievement and actual water supplied.

It is evident from the above Charts (2.1.3 and 2.1.4) that the difference in water demand targeted, water supplied as shown by MCs and actual water supplied as calculated by audit was due to non-reviewing of SLB targets and achievement by MCs and calculation of demand on the basis of total water available at filter plants rather than actual water supplied through OHTs which indicates lack of monitoring by the supervising staff of MCs. While the achievement of BMC was marginally short of the target fixed, there was a substantial shortfall in IMC.

IMC showed inflated per capita water supplied in SLB achievement ranging from 100 to 110 lpcd against actual water supply calculated by audit ranging from 48 to 64 lpcd. However, in BMC the gap between SLB achievement and actual water supply assessed by audit was ranging from nine *per cent* to 20 *per cent*.

In reply, Commissioner MCs stated (February & March 2019) that demand of water was calculated on the basis of population served. However, no reasons were intimated for non-conducting survey and non-reviewing the SLB targets and achievement.

In exit conference, the Principal Secretary, UDHD had not given specific reply on the issue.

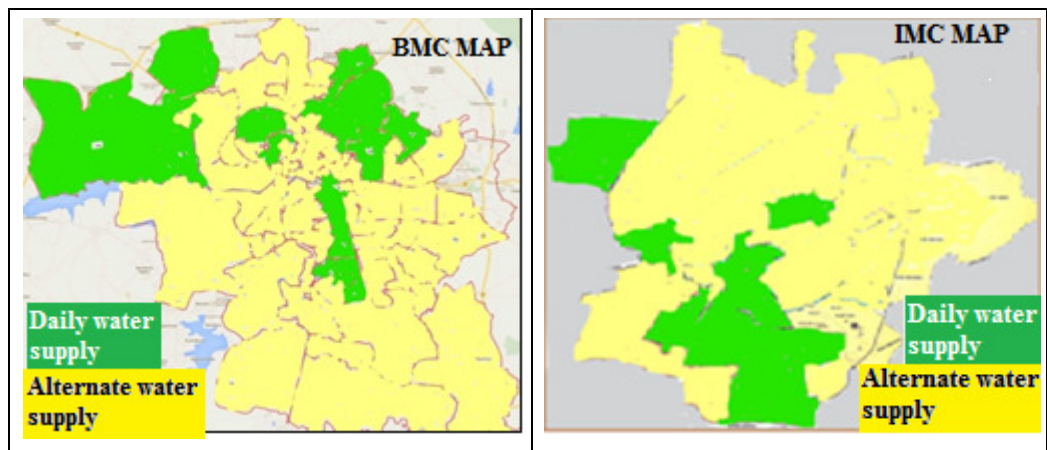
Fact remains that the MCs had not observed the provisions *ibid*.

2.1.6.6 Improper Zoning was done for equal distribution of water

CPHEEO manual envisages that zoning in the distribution system ensures equalization of supply of water throughout the area. The valves between the zones should be kept closed and not partially opened. The layout should be such that the difference in pressure between different area of the same zone or same system does not exceed three to five meter. As per the O&M manual, it is the duty of EE to monitor, review and reschedule of inflows¹⁷ into service reservoirs and sumps, in accordance with the delivery schedules in the relevant service areas. Concerned AE/JE/Sub-engineer are to maintain supply pressure in distribution lines.

¹⁷ Average volume of incoming water in unit time

During the course of audit, it was found that MCs had divided distribution system in different zones and also fitted valves for regulating the pressure in the distribution system. However, pressure gauge was not fitted for measuring pressure in the zones and valves operation schedule was also not maintained. Thus, in absence of valve operation schedule and pressure measure equipment, the required pressure and equal water distribution throughout all zones could not be ascertained by audit. Further, it was also noticed that in MCs, the water was being supplied for 30 to 60 minutes on alternate days while in five zones (01, 03, 06, 09 and 16) at Bhopal and four zones (09, 12, 13 and 16) at Indore the water was being provided on daily basis for 30 to 60 minutes. The maps of MCs shown below indicated un-equal distribution of water:



(Source: BMC and IMC)

During the joint physical inspection (August 2018 and October 2018), it was found by audit that pressure of water at tail end was very low in zone 01, 06 and 19 in BMC and 01, 10, 13, 18 and 19 in IMC. Further, OHT water filling records of IMC revealed that the OHT were not filled with full capacity which was also one of the causes of low pressure. However, in SLB *gazette* notification, duration of water supply indicated by BMC and IMC were two to four hours and 30 minutes to one hour daily.

In exit conference, Principal Secretary, UDHD stated (April 2019) that District Metered Area (DMA) structuring has been made for supplying required water at desired residual pressure to the design population from each OHT.

2.1.6.7 Non up-dating the maps and profile drawing of distribution system

CPHEEO O&M manual envisages that the comprehensive maps of distribution system which provide an overall view of the system with location of reservoirs, pumping stations, valves location maps and hydrants etc., are to be prepared. It also envisages that distribution plan and profile drawings, which show the depth of pipe, pipe location and distance from location point are also to be prepared. Further, the maps are to be up-dated by conventional survey¹⁸. It is the responsibility of operational management (EE) to update the distribution system plans/ maps.

¹⁸ Conventional survey means survey conducted by the methods i.e. field survey, topography and conventional methods.

No records regarding updation of maps and profile drawings by conducting conventional survey was available in the selected MCs as envisaged in the CPHEEO O&M manual.

In exit conference, Principal Secretary, UDHD stated (April 2019) that MCs Bhopal and Indore are being instructed to update the maps and profile drawings of distribution system and maintain proper records of it.

2.1.6.8 Non-preparation of operation and maintenance plan

According to CPHEEO O&M manual, a comprehensive operation and maintenance plan shall be prepared to cover all the facilities. A central operation and maintenance cell shall be created which will have responsibility of supervision, monitoring and analysing all operation maintenance activities contained in the operation and maintenance plan. Supervisors shall be assigned duties to check the operation and maintenance by adopting check lists prepared by the management with reference to the plan. It is the responsibility of operational management headed by SE to prepare O&M plans.

During test check of records of both MCs, it was observed that no operation and maintenance plan was prepared. It was also seen that supervisory staff was neither assigned duty regarding operation and maintenance nor check lists were prepared for this purpose. Further, inspection registers at the site of filter plants and pump houses were also not maintained. Thus, SE had not fulfilled the duty of preparing the O&M plan and no inspection register was maintained in support of inspection conducted by the supervisory authorities. Resultantly, the cases and cost of repair and maintenance was increasing year to year as shown above in **Table 2.1.4**.

In the absence of inspection and maintenance registers, regular and timely maintenance of the machines and inspection conducted by the supervisory officers could not be ascertained.

In exit conference, the Principal Secretary UDHD stated (April 2019) that Commissioner MCs are being instructed to create a dedicated operation and maintenance cell. The officer of the Cell will timely supervise and inspect the system periodically and proper record will be maintained.

2.1.6.9 Households without water connections

As per SLB, all the households are to be brought into the water connection network. Further, Directorate UADD, issued a circular (March 2017) which envisaged that ULBs are required to conduct survey of properties and get all the properties identified having no connection and take initiative to provide connection by arranging water connections camps.

Scrutiny of records revealed that out of 9.41¹⁹ lakh, only 5.30²⁰ (56.32 per cent) lakh households were having authorised water connections and 4.11²¹ (43.68 per cent) lakh households were out of water connection network.

4.11 lakh households out of water connection net-work.

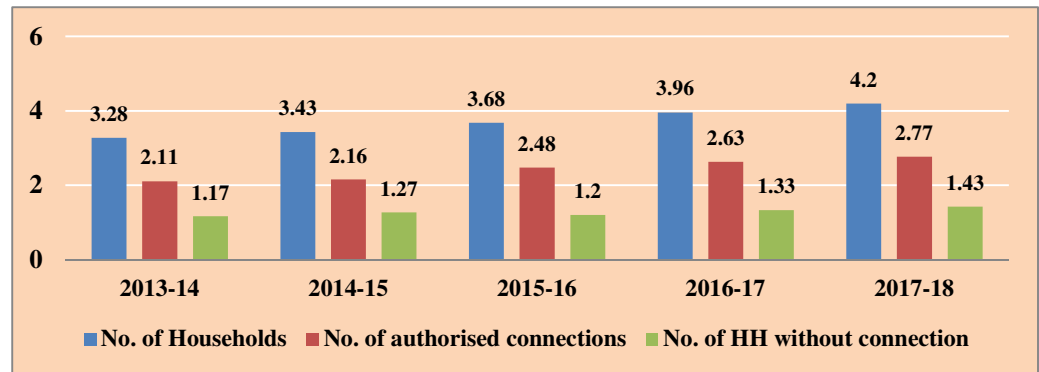
¹⁹ 4.20 lakh HHs in BMC and 5.21 lakh HHs in IMC.

²⁰ 2.77 lakh connections of BMC and 2.53 lakh connections in IMC.

²¹ 1.43 lakh HHs without connections of BMC and 2.68 lakh HHs without connections in IMC.

The bar-charts below shows the status of households, with connections and without connections:

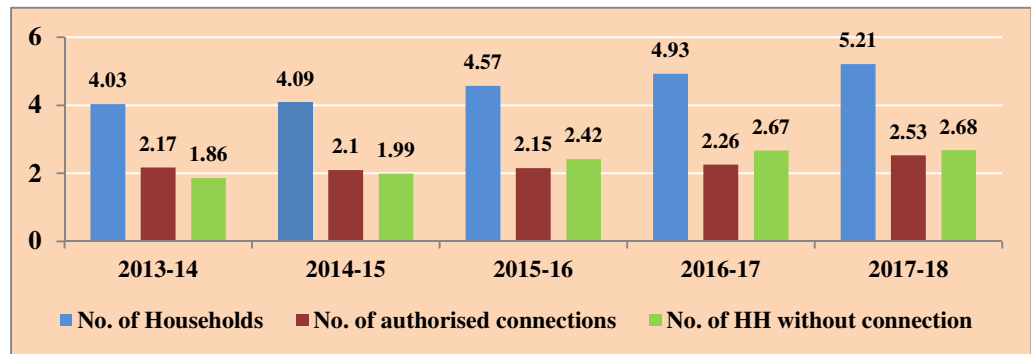
Chart 2.1.5: Year-wise status of households, authorised and without connections of BMC (Figure in lakh)



(Source: Records of BMC)

In the above chart, 63,447²² households being supplied water through 555²³ bulk connections were also considered for analysis.

Chart 2.1.6: Year wise status of households, authorised and without connections of IMC (Figure in lakh)



(Source: Records of IMC)

In IMC, the water provided through 658 bulk connections were also included in above chart for analysis.

Further, it is evident from the above Chart 2.1.5 that during the period 2013-18 in BMC, the actual connection against total households was ranging from 63 to 68 *per cent*. However, BMC had notified inflated data indicating SLB achievement ranging from 67 to 93 *per cent* during 2013-18.

In exit conference, Principal Secretary, UDHD stated (April 2019) that both MCs will be instructed to bring all the household in water connection network.

Fact remains that, Commissioner MCs reported manipulated data without reviewing the achievement of the SLB indicators and 4.11 lakh households were still out of water connection net.

²² 8,280; 749; 19,861 and 34,557 houses are in existence in multi, seven storied and colonies respectively.

²³ 154 bulk connections, 133 multi-storied, 08-seven storied and 260 colonies.

2.1.6.10 Water connection without metering

As per CPHEEO O&M manual, a water meter is a scientific instrument for accurate measurement of quantity of water distributed to the consumers. Further, SLB of the MoUD, specifically mentioned that *cent per cent* metering of water supply connection are to be done.

Un-fruitful expenditure of ₹ 16.53 crore on installation of water meter.

During scrutiny of records relating to water charges levied and collected, it was revealed that in BMCs, under Jawaharlal Nehru National Urban Renewal Mission (JNNURM), a tender was awarded (December 2012) for installation of 1,41,393²⁴ water meters and an amount of ₹ 16.53²⁵ crore was paid (September and October 2018). However, none of the consumers was served the water bills on the basis of meter reading.

In case of IMC, no meter was installed and the water charges were recovered on the basis of flat rate. However, in *gazette* of SLB the metering status was shown inflated as ranging from 20 to 72 *per cent* and three to 25 *per cent* in BMC and IMC respectively. However, no reason was intimated by MCs in this regards.

In exit conference, the Principal Secretary, UDHD stated (April 2019) that BMC stated that work order for spot billing had been given (April 2018) while IMC stated that in AMRUT, metering would be done.

Fact remains that non-metering/water connections affect the revenue collection of the MCs.

Recommendation: Effective action should be initiated to bring all households under water connection net-work and cent percent metering should be done.

2.1.6.11 No preparedness on implementation of Sustainable Development Goal-6

Sustainable Development Goals (SDG)-6 envisage to ensure safe and affordable drinking water to all, improve water quality, increase water efficiency, protect and restore water related ecosystems and participation of local communities in improving water management by 2030. It is the primary responsibility of GoI to follow-up and review at the national level with regard to progress made in implementing the goals and targets. For this purpose, Ministry of Statistics and Programme Implementation (MoSPI) constituted (October 2018) a High Level Steering Committee (HLSC). At State level, SDG Cell was constituted on November 2018 by State Planning Commission, Government of MP.

No preparedness for SDG-6 at State level

On being enquired regarding implementation of SDG-6, Commissioner, UADD intimated (May 2018) that neither any committee was constituted nor any plan made for community participation as well as improvement in efficiency of water use. Further, at State level, it was intimated (February 2019) that no action was initiated in this regard.

²⁴ Agreement 21 for 88,829 meters (1152/- @ ₹ 1100/- each) and agreement 29 for 52,564 meters @ ₹ 1287/- each

²⁵ ₹ 9.77 crore (88,829*1100/-each) and ₹ 6.76 crore (52,564*1287/- each) total ₹ 16.53 crore

In the exit conference, Principal Secretary, UDHD stated (April 2019) that in many schemes i.e. JNNURM, AMRUT, UIDSSMT and *Mukhya Mantri Shahari Peyjal Yojna* were sanctioned for water supply; all the schemes were targeted for completion till the end of 2020; after completion of all the schemes, safe and affordable water will be available to all the population in sufficient quantity.

Fact remains that neither any mapping of schemes nor any guideline/plans were prepared at State level to achieve the SDG-6.

2.1.7 Quality of water supplied

As per Bureau of Indian Standard 10500, drinking water used for human consumption shall comply with the required parameters in respect of physical, chemical, biological and bacteriological i.e. colour, odour, pH, turbidity, total dissolved solids, hardness, alkalinity, elemental compounds such as iron, manganese, sulphate, nitrate, chloride, fluoride, arsenic, chromium, copper, cyanide, lead, mercury, zinc and coliform bacteria etc.

2.1.7.1 Quality of supplied water not ensured

State Water Policy envisages that quality of surface and ground water shall be tested on regular basis by the concerned department. As per CPHEEO manual, the objective of the Water Works Management was to ensure that the water supplied is palatable and free from undesirable taste and odour, for which laboratories with adequate facilities manned by qualified personnel are essential. The aim of laboratory examination of water is to ensure that potable water conforming to the drinking water standard is supplied to consumers. O&M manual envisages that the responsibility of Operational Management (EE) is to monitor alum dosage, chlorine dosage. Mainly four types of tests were to be conducted in laboratory i.e. physical, chemical, bacteriological and biological analysis to observe the criteria given in **Table 2.1.5** below:

Table 2.1.5: Types of the water tests required to be done

Sl. No.	Types of test	Brief description of the test
01	Physical analysis	It determines aesthetic quality and assesses the performance of treatment units.
02	Chemical analysis	It determines concentrations of chemical substances which may affect the quality of water
03	Bacteriological	This examination indicates the presence of bacteria characteristic of pollution and hence the safety of water for consumption.
04	Biological analysis	It provides information on cause of objectionable tastes and odours in water or clogging of filter and dictating remedial measures.

(Source: CPHEEO manual)

During the test check of records of MCs, it was noticed that BMC collected 2,99,692²⁶ and IMC collected 74,889²⁷ water samples from various sources during 2013 to 2018 and tested regularly. In BMC, no physical and chemical samples were reported adverse while 433 bacteriological samples were

Timely action was not taken on adverse water test reports.

²⁶ Physical 1,58,559, chemical 1,26,766 and bacteriological 14,367

²⁷ Physical 31,329, chemical 16,551 and bacteriological 27,009

reported adverse. In IMC, 3,074²⁸ physical, 147²⁹ chemical and 827³⁰ bacteriological samples were found below BIS 10500 standard. On IMC's adverse reports, the Chief Chemist had reported the matter to the CE/ AE for taking remedial action in this matter.

CE/AE could not make available the records in support of action taken against the adverse water test reports. Hence, it could not be ascertained from records what action has been taken by MCs.

Further, in respect of BMC and IMC, the status of water borne diseases was sought from Public Health and Family Welfare Department of MP. The year wise detail of the water borne diseases is shown in **Table 2.1.6** below:

Table 2.1.6: Data related to water borne disease in BMC and IMC urban areas during 2013-18

Sl. No.	Year	Cholera				Acute Diarrhoeal diseases				Typhoid				Viral Hepatitis			
		BMC		IMC		BMC		IMC		BMC		IMC		BMC		IMC	
		C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
1	2013	4	0	3	0	91712	0	6294	0	8348	0	163	0	4887	0	104	0
2	2014	0	0	1	0	93446	0	12775	0	7591	0	318	0	2592	0	162	0
3	2015	0	0	2	0	68511	0	8712	0	5470	0	229	0	3992	0	168	0
4	2016	0	0	1	0	70435	0	7769	0	7387	0	552	0	4398	0	143	0
5	2017	0	0	0	0	53672	0	4407	0	6992	0	128	0	5657	0	43	0
6	2018	0	0	0	0	61328	0	490	0	3693	0	72	0	2349	0	5	0
Total		4	0	7	0	4,39,104	0	40,447	0	39,481	0	1,462	0	23,875	0	625	0

(Source: Directorate Health Services) C-Cases, D-Death

It is evident from the above table that during the period 2013-18, 5,45,005 cases of water borne diseases were reported in BMC and IMC. Thus, the possibility of contaminated water being supplied by the MCs during the period could not be ruled out.

In exit conference, the Principal Secretary, UDHD stated (April 2019) that Standard Operating Procedure (SOP) would be prepared to ensure the quality of drinking water.

Recommendation: Immediate and remedial action is to be taken on adverse water test reports and effective system to be adopted to intimate consumer.

2.1.7.2 Improper dosing and storage of coagulant

The purpose of applying coagulant (*Alum/ Poly Aluminium Chloride*) is to remove the particulate impurities and colour from the water being treated. Dosing of coagulant is to be decided by jar test³¹. CPHEEO O&M manual envisages that alum should be stored in clean and dry place, as the moisture has tendency to cake the material.

²⁸ In 2013-14- 376, 2014-15-555, 2015-16-1333, 2016-17-262 and 2017-18-548 Physical samples were found substandard.

²⁹ In 2013-14 - 03, 2014-15 - Nil, 2015-16 - 05, 2016-17 - 03 and 2017-18-136 Chemical samples were found substandard.

³⁰ In 2013-14-105, 2014-15-98, 2015-16-121, 2016-17-50 and 2017-18-453 Bacteriological samples were found substandard.

³¹ The jar test most widely used method employed to evaluate the coagulation process and to aid the plant operator in optimizing the coagulation, flocculation and clarification process.

During the course of audit, jar test reports of four laboratory³² were checked. Through the test reports, it was noticed that sample source, date of collection, date of analysis and temperature of the sample were not mentioned by concerned laboratory of MCs. Further, in ten jar test reports the use of alum was found similar (35 ppm) for different turbidity i.e. 72.4 and 310 (*Appendix 2.1.3*). Thus, the reports provided to audit showed negligence of the Chemists and exact quantity of Alum/Poly Aluminium Chloride (PAC) to be used could not be ascertained. Further, during joint physical inspections (August and October 2018) of filter plants of both MCs, it was noticed that alum was not stored by the MCs as per laid down provision. It was kept in the open without adopting any precaution, resultantly the material caked. The photographs showing the storage condition of the alum below:

Photographs showing the improper storage of alum



It is evident from above photographs that MCs kept the alum without following the provision *ibid* and were using the caked alum for purification of water, which increases the turbidity³³ of water and had adverse effect on the quality of water. This was also confirmed through reports of lab tests conducted in State Research Laboratory, Bhopal.

On being pointed out, the BMC stated (December 2018) that dosing were decided after the jar-test. However, jar test-reports were incomplete and improper. Resultantly, the actual jar-tests conducted could not be ascertained.

In reply, IMC stated (February 2019) that for removal of turbidity during rainy season, dosing were decided as per jar test. After rainy season, in Narmada river, turbidity level was found 3-5 Nephelometric Turbidity Unit (NTU)³⁴ so no dosing was required.

³² Kolar WTP, Khatpura WTP, Arera hills of BMC and Madleshwar WTP of IMC

³³ Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates.

³⁴ NTU is unit of measuring turbidity of water.

In the exit conference (April 2019), no specific reply was given on the issue.

Fact remains the analysis of jar test reports indicate that it was not done properly, resultantly, exact quantity of coagulant could not be ascertained which is mandatory for filtration of water and in turn turbidity in water may increase.

2.1.7.3 Adverse water samples found in independent water quality testing

For assessing the quality of water supplied, joint sampling of water was conducted (August and September 2018) by Audit along with MC's officials. Total 54 samples were collected, out of which 30 samples (03 from source, 06 from filter plants, 06 from OHT and 15 from consumers) were from BMC and 24 samples (02 from source, 04 from filter plants, 06 from OHT and 12 from consumers) were collected from IMC. The collected water samples of both the MCs were got independently tested from the State Research Laboratory (SRL), Bhopal.

Out of 30 samples in BMC, in two water samples turbidity was 6.3 to 13.1 NTU against permissible limit of 1 to 5 NTU as per BIS 10500 norms³⁵. In three water samples, faecal coliform was found 30 to 60 count against the norm of zero count. Further, out of 24 samples in IMC, in five water samples faecal coliform was found 40 to 140 count against the norm of zero count.

The adverse water samples pertained to 13³⁶ wards of BMC and 15³⁷ wards of IMC which has been depicted in the map of MCs below:

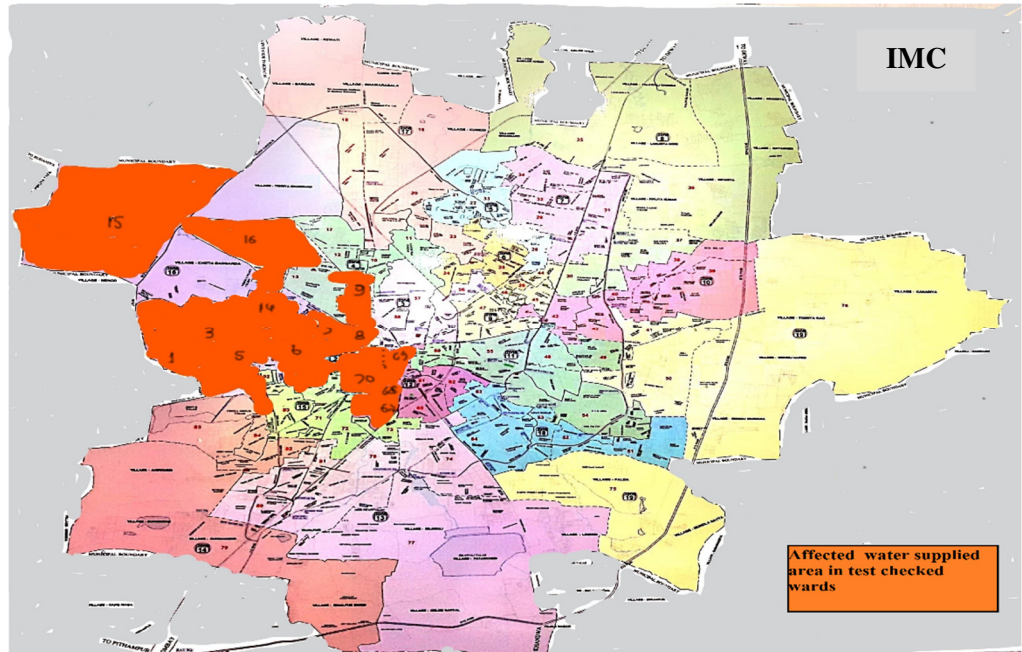
The map of MCs showing infected water supplied areas



³⁵ Turbidity norms 1-5 NTU and Faecal coliform- Nil count.

³⁶ Wards (populations)- 11 (31,795), 12 (27,686), 13 (31,143), 14 (31,834), 15 (23,906), 16 (26,033), 17 (29,875), 18 (30,881), 19 (24,269), 20 (23,695), 22 (23,911), 23 (25,834) and 24 (30,748)

³⁷ Wards (populations)- 1 (36,266), 3 (38,345), 4 (34,708), 5 (38,400), 6 (37,495), 7 (35,054), 8 (38,202), 9 (34,580), 14 (36,336), 15 (38,419), 16 (38,471), 67 (29,718), 68 (29,203), 69 (33,887) and 70 (34,164)



(Source: Adverse water samples of BMC and IMC)

Thus, 8.95 lakh residents (3.62 lakh in BMC and 5.33 lakh in IMC) of the area were likely to be affected due to supply of contaminated water having faecal coliform. It shows lack of monitoring of filter plants at operational level as well as at distribution level. On the adverse reports, the EE, SRL, Bhopal stated (February 2019) that presence of turbidity in clear water, indicates non-maintenance of filter media in the filter plants of the concerned MCs. It was also stated that possibility of water borne diseases could not be ruled out due to contaminated water (having coliform).

However, it was noticed that in respect of the samples collected and tested by the MCs all the samples were within the permissible limits. These samples were collected jointly both by the MCs and audit team at the same time and from the same area.

In reply (January 2019), BMC had not accepted the audit observation stating that the sampling process and testing may be defective.

The reply of BMC is not tenable as sampling was done jointly with the laboratory team of the BMC. The Chief Chemist, SRL Bhopal had provided training to audit party on water sample collection technique. Further, the State Research Laboratory also reported that the samples collected by the audit team were of acceptable standard.

Commissioner IMC stated (February 2019) that remedial action would be taken and accordingly intimated to audit.

In the exit conference (April 2019), no specific reply was given on the issue.

2.1.7.4 Regular Cleaning of Over Head Tanks (OHTs)/Reservoirs' not done

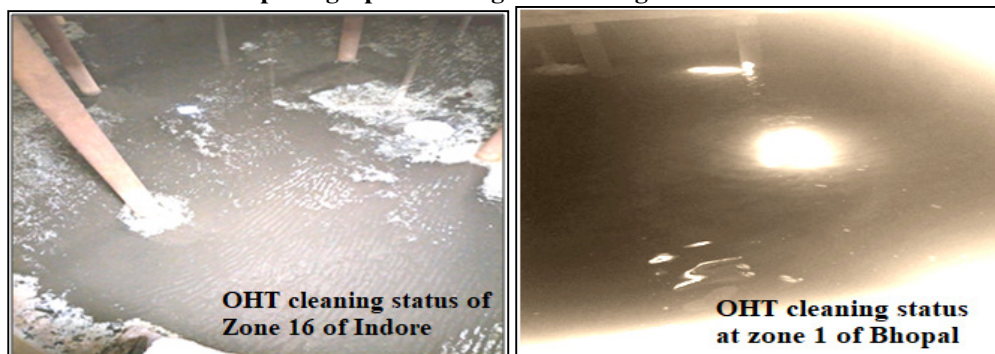
As per CPHEEO O&M Manual, OHTs/reservoirs are to be cleaned at regular interval (at least once in six months by BMC) and sample of water and silt/mud accumulated in the tank is to be collected for biological analysis to see the presence of snails and worms. It is the responsibility of Operational

Management (Dy. Assistant to the EE) to formulate and monitor periodic cleaning of all tanks, and sub-engineer to adhere to the provision/instruction issued in this regard.

Non-cleaning of OHT/Reservoirs at regular interval.

During joint physical inspection of 45³⁸ OHTs/SRs out of 222³⁹ OHTs/SRs in selected MCs by audit, it was noticed that 23 OHTs/SRs were not clean and log-books for cleaning were also not maintained in 13 cases and in 10 cases it was incomplete. Further, it was also noticed that none of the sample for biological test was taken at the time of cleaning of OHTs in selected MCs. The following photographs show that the OHTs were unclean:

The photographs showing the cleaning status of MCs



The sub-engineer responsible for cleaning failed to discharge his duty while the higher technical officer (Assistant Engineer or Executive Engineer) never monitored this work at their level. Thus, the mandatory requirement to provide safe drinking water to every citizen could not be ensured.

In exit conference, the Principal Secretary, UDHD stated (April 2019) that instructions to comply with the provision of CPHEEO manual would be issued again.

2.1.7.5 Supply of Bore well water without testing

The quality of ground water depends on solvent and dissolves minerals from the rocks. The most common dissolved mineral substances are sodium, calcium, magnesium, potassium, chloride, bicarbonate, and sulphate. Water that contains a lot of calcium and magnesium is said to be hard. Dissolved mineral constituents can be hazardous to animals and plants in large concentrations.

During test checks of records of IMC, it was found that as of January 2018, 4945 bore wells supplied 20 MLD water in their jurisdiction without any quality testing. No bore well drinking water was being supplied in BMC.

Independent water samples of bore well water (20) were taken jointly (February 2019) in the zones/wards where bore well water was being supplied and got it tested from State Research Laboratory, Bhopal. The deficiencies were noticed in the test reports of the bore well water are shown in **Table 2.1.7** below:

³⁸ Bhopal-27 and Indore-18

³⁹ Bhopal-136 and Indore-86

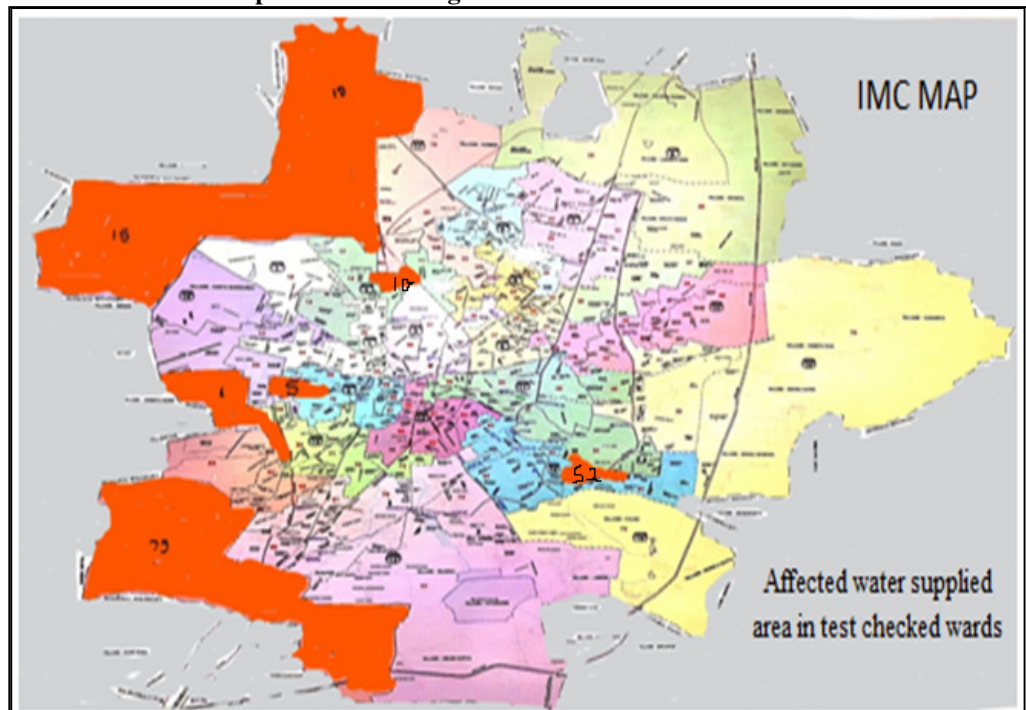
Table 2.1.7: Status of the bore well water testing reports

Sl. No.	Details of Characteristics	No. of samples	Limits (As per BIS norms)	Presence limit found in testing	Impacts
01	Iron Fe+++	01	1.0 mg per litre	4.0 mg per litre	Iron overload can lead to hemochromatosis which can lead to liver, heart and pancreatic damage as well as diabetes. Weight loss and joint pain is basic symptoms of it.
02	Nitrate NO ₃	08	45 mg per litre	58.46-120.16 mg per litre	Nitrate levels at or above this level in infants is cause of blue-baby syndrome may have diarrhoea, vomiting and or be lethargic.
03	Calcium Ca++	01	200 mg per litre	284-292 mg per litre	Stomach pain, digestive problems and kidney stones are the main systems of the excess dose of calcium.
04	Conductivity	20	*250 micro S/cm	789-3570	It is directly proportional to the hardness of the water.
05	Faecal Coliform per 100 ml	15	Nil count	20-880 count per 100 ml	The presence of faecal coliform in drinking water cause of diarrhoea, jaundice, typhoid and chronic stomach problem.

(Source: Test reports)*As per WHO 1993 standard

It is evident from above table that in the municipal area of IMC, the quality of bore well water supplied to the citizens, was not as per the norms of BIS 10500 and thus hazardous to the health of the people drinking the water. The affected areas in IMC are shown below:

The map of IMC showing the bore well water affected wards



(Source: Adverse bore well water samples of IMC)

Thus, in IMC, the above 20 adverse samples revealed that 2.59 lakh residents of seven⁴⁰ wards were supplied with infected water. Non-testing of water quality by Commissioner, IMC is a serious negligence of the duty, and has exposed the consumers to serious health hazard. This also indicates that this kind of situation might be existing in other areas being supplied with the bore well water.

In reply IMC stated (February 2019) that the area where water was tested and not fit for drinking, notice boards were fixed to indicate the same.

The matter was also brought to the notice (March 2019) of Principal Secretary, UDHD, Commissioner, UADD and Commissioner, IMC for corrective action.

Recommendation: No bore water should be supplied without testing and remedial actions should be taken swiftly and consumers should be informed.

2.1.8 Financial Management

2.1.8.1 Status of funds released to Municipal Corporations

Financial outlay of MCs under the maintenance grant of State, water supply schemes (JNNURM and AMRUT) and through budget allocation the year-wise status for water supply is shown in **Table 2.1.8 (i) and (ii)** below:

Table 2.1.8 (i)- Funds received/allocated fund and expenditure of BMC thereof during 2013-14 to 2017-18 for water supply

(₹ in crore)

Items	2013-14		2014-15		2015-16		2016-17		2017-18	
	Rect.	Exp.	Rect.	Exp.	Rect.	Exp.	Rect.	Exp.	Rect.	Exp.
Grant under Central and State Sector Scheme										
Maintenance grant	0	0	8.89	8.89	8.89	8.89	9.69	9.69	8.80	8.80
JNNURM	72.70	47.09	20.77	46.39	51.93	100.33	00	38.54	00	71.97
AMRUT	Funds release under AMRUT in 2016-17 onwards						18.30	15.47	112.70	115.53
Total	72.70	47.09	29.66	55.28	60.82	109.22	27.99	63.70	121.50	196.30
Revenue										
Water tax	28.32	-	30.90	-	30.22	-	40.26	-	44.20	-
Total	28.32	-	30.90	-	30.22	-	40.26	-	44.20	-
Budget figure										
Electricity	76.00	56.72	90.00	57.99	68.02	60.74	70.00	70.38	88.00	85.30
Chemical	6.00	2.02	6.00	4.59	6.20	3.44	6.00	5.62	6.50	5.31
Maintenance	5.18	1.90	6.05	2.82	2.60	3.29	6.96	2.44	3.65	3.54
Other	14.67	7.86	21.86	14.63	28.78	11.18	15.96	17.96	28.87	21.72
Total	101.85	68.50	123.91	80.03	105.60	78.65	98.92	96.40	127.02	115.87
Capital	3.29	2.65	23.19	3.73	8.78	4.62	19.29	26.10	22.97	16.22
G. Total	206.16	118.24	207.66	139.04	205.42	192.49	186.46	186.20	315.69	328.39

(Source: Directorate & MCs budget)

⁴⁰ Wards (population)- 01 (36,266), 05 (38,400), 10 (36,513), 15 (38,419), 18 (38,775), 52 (30,922) and 79 (39,273).

Table 2.1.8 (ii)- Funds received/allocated fund and expenditure of IMC thereof during 2013-14 to 2017-18 for water supply*(₹ in crore)*

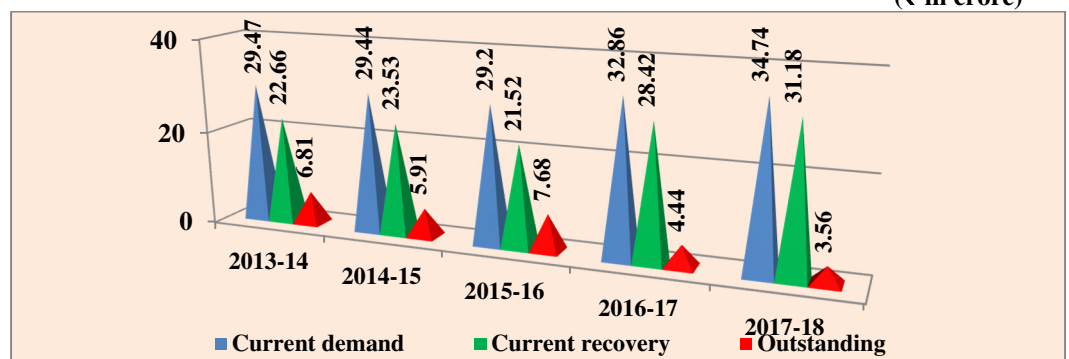
Items	2013-14		2014-15		2015-16		2016-17		2017-18	
	Rect.	Exp.	Rect.	Exp.	Rect.	Exp.	Rect.	Exp.	Rect.	Exp.
Grant under Central and State Sector Scheme										
Maintenance grant	7.04	7.04	7.75	7.75	7.75	7.75	8.45	8.45	7.68	7.68
JNNURM	00	00	00	00	00	00	00		00	00
AMRUT	Funds release under AMRUT in 2016-17 onwards								115	115
Total	7.04	7.04	7.75	7.75	7.75	7.75	8.45	8.45	122.68	122.68
Revenue										
Water tax	26.48	-	38.05	-	20.60	-	30.03	-	41.64	-
Total	26.48		38.05		20.60		30.03		41.64	-
Budget figure										
Electricity	143.00	115.34	132.08	113.71	115.00	146.60	171	163.02	198.85	191.14
Chemical	1.76	1.03	1.81	0.65	1.85	0.82	1.15	0.21	1.25	0.42
Maintenance	12.72	6.88	16.71	7.63	15.10	5.36	67.86	7.60	67.25	6.55
Other	74.99	18.17	76.24	17.90	65.70	19.56	96.92	20.58	138.50	31.25
Total	232.47	141.42	226.84	139.89	197.65	172.34	336.93	191.41	405.85	229.36
Capital	78.13	37.81	102.11	28.77	89.56	5.86	209.20	14.07	165.22	25.20
G. Total	344.12	186.27	374.75	176.41	315.56	185.95	584.61	213.93	735.39	377.24

(Source: Directorate & MCs budget)

During the scrutiny of budget, grant register and accounts of MCs it was found that MCs were not fully utilizing the grants received or funds allocated through budget. No reasons were intimated by MCs for non-utilisation of funds.

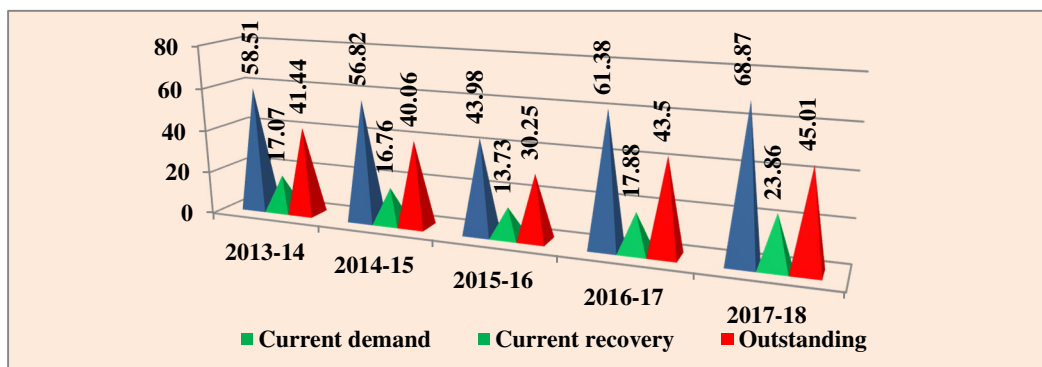
2.1.8.2 Very low recovery efficiency of water charges

SLB of the MoUD, specifically mentioned (2011) that 90 per cent efficiency in collection of water supply related charges should be done and 100 per cent recovery should be made against O&M expenses. Further, Para 225 of the MP Municipal Corporation Act 1956 stipulates that the arrears of the water charges are to be recovered from consumers and in case of non-recovery the water connection should be disconnected. It is the responsibility of ward in-charge, in-charge revenue, assistant revenue inspector and water charge clerk along with zonal officer of concerned zone to raise demand and collect the water charges. The year wise details of the realised revenue in MCs are shown in **Charts 2.1.7 & 2.1.8** below:

Chart-2.1.7 Year-wise demand, recovery and outstanding water charges in BMC*(₹ in crore)*

(Source: BMC)

Chart-2.1.8: Year-wise demand, recovery and outstanding water charges in IMC
(₹ in crore)



(Source: IMC)

Water charges amounting to ₹ 391.22 crore remained un-realised as against individual households.

It is evident from above chart that actual recovery of water charges was ranging from 74 to 90 per cent in BMC and 29 to 35 per cent in IMC. However, recovery notified in SLB by BMC was ranging from 82 to 90 per cent and 47 to 78 per cent by IMC. The inflated data was shown by core team and water supply wing as well as Commissioner of the MCs to show better performance. Thus, an amount of ₹ 48.81 crore and ₹ 342.41 crore was outstanding in BMC and IMC respectively as water charges as of March 2018 (*Appendix-2.1.4*) which included outstanding amount of water charges prior to 2013-14. Besides, an amount of ₹77.97 crore remained un-realised as on March 2018, on 40 bulk connections⁴¹ holders in IMC while an amount of ₹ 0.78 crore in respect of consumer charges⁴² was outstanding as on March 2016 in BMC. Thus, the zonal officer of the concerned zone along with ward in-charge, in-charge revenue, assistant revenue inspector and water charge-clerk had failed to fulfil their responsibility.

Inflated water charges recovery shown in SLB achievement ranging 47 to 90 per cent in both MCs.

Actual recovery of water charges against O&M expenditure⁴³ was found ranging from 38 per cent to 41 per cent and 12 per cent to 27 per cent respectively in BMC and IMC as shown in *Appendix-2.1.2 (SLB)*, while it was shown 42 to 65 per cent and 50 per cent as achievement respectively by BMC and IMC to project better performance.

In the exit conference, Principal Secretary, UDHD stated (April 2019) that instructions were being issued to MCs to improve the recovery of water charges.

Fact remains that only 12 per cent of water charges could be recovered as of March 2018 in IMC.

Recommendation: Monthly targets and plan for effective recovery should be initiated.

2.1.8.3 Loss of revenue due to erroneous demand of water charges

As per Municipal Corporation Act, when any amount declared by or under the provision (132-A for imposition of user charges) are to be recoverable or

⁴¹ Bulk water supply connections means connections provided for bulk potable water by the MC to consumer.

⁴² It is one-time charge taken from new connection holder. No consumer charges in IMC.

⁴³ O&M expenditure includes electricity, chemicals, maintenance and other expenditure, shown in Table 2.1.8 (i) and (ii).

payable, on account of any tax imposed within the limits of the city shall have become due, the Commissioner shall, present to any person liable for payment a bill for the sum claimed as due. As per information made available by BMC, the annual demand of the water charges were raised by considering total number of water connections multiplying with prevailing prescribed⁴⁴ rate and twelve months.

During the course of audit in BMC, it was noticed that there was difference between demand raised by BMC and the demand worked out by audit. BMC had raised erroneous demand without ascertaining the actual number of authorised connections in existence as shown in **Table 2.1.9** below:

Table 2.1.9: Status of erroneous demand of water charges in BMC

(₹ in crore)

Year	EWS connection and amt. @ ₹30/- per month rate		Domestic connections @ ₹180/- p. m.		Non Domestic + Commercial connection @ ₹500/- p. m.		Industrial connections @ ₹600/- p. m.		Total no. of connections	Total Demand ⁴⁵ to be raised (no. of con.*rate*12)	Actual demand raised by BMC	Diff.
	No.	Charges	No.	Charges	No.	Charges	No.	Charges				
1	2	3	4	5	6	7	8	9	10 (2+4+6+8)	11 (3+5+7+9)	12	13
2014-15	24,388	-	1,26,312	-	2,180	-	120	-	1,53,000	-	-	-
2015-16	24,388	0.88	1,58,209	27.28	2,180	1.31	120	0.09	1,84,897	29.56	29.2	0.36
2016-17	25,331	0.88	1,71,657	34.17	2,238	1.31	122	0.09	1,99,348	36.45	32.86	3.59
2017-18	--	0.91	--	37.08	--	1.34	--	0.09	--	39.42	34.74	4.68
Total												8.63

(Source: BMC)

Revenue loss amounting to ₹ 8.63 crore due to erroneous calculation of demand by BMC.

It is evident from the above table that BMC raised less demand of water charges than the actual as per registered connections. Thus, due to erroneous calculation of demand, BMC had to bear a loss of ₹ 8.63 crore during the period 2013-18.

In exit conference, the Principal Secretary, UDHD stated (April 2019) that the matter will be reviewed by revenue wing of BMC and demand in respect of actual water supply connections will be issued.

Fact remains that due to incorrect demand BMC had to suffer revenue loss.

2.1.9 Ancillary issues

2.1.9.1 Safety norms not adopted

As per CPHEEO O&M Manual, a safety programme is a must for a water supply system. A safety officer who can devote part time or full time to the job in a large organization (Corporation) may be designated as responsible for the programme. A Safety Committee may also be constituted. Fire extinguishers should be refilled annually or as needed. It is the responsibility of AE/Sub-engineer to ensure safe operations of safety and firefighting equipment.

Safety norms were not adopted.

During the scrutiny of records related to adherence to the safety norms of MCs, it was found that neither safety committee was constituted nor any safety officer deployed at filtration plant. Further, it was also noticed during

⁴⁴ As per Order of Commissioner, BMC dated 20 April 2010 Per month EWS - ₹30, Domestic – ₹180, Non-domestic & Commercial – ₹500 and Industrial - ₹600.

⁴⁵ The demand of the year is calculated by considering the water connections of last month of the previous financial year.

joint physical inspections that the refilling of fire extinguishers was not done even after lapse of two to three years from the date of last refilled mentioned on the fire extinguishers.

On being pointed out, the EE in-charge of water supply, IMC accepted the fact and stated (September 2018) that Safety Committee/Officer would be constituted/ deployed and to refill the fire extinguisher work order had been issued (September 2018). In reply, EE water supply, BMC stated (January 2019) that neither safety committee was constituted nor safety officer post was sanctioned in BMC for water supply. Thus, AE/Sub-engineer failed to fulfil his responsibility.

Fact remains that by not constituting safety committee and not appointing safety officer by commissioner MCs, safety of water supply operations was not ensured.

In exit conference, the Principal Secretary, UDHD stated (April 2019) that instructions will be given to comply the provisions of safety and also refill the fire extinguishers on time.

2.1.9.2 No water reserved for firefighting demand

CPHEEO manual envisages that it is usual to provide for firefighting demand as a coincident draft on the distribution system along with the normal supply to the consumers as assumed. A provision⁴⁶ in kilolitres per day may be adopted for communities greater than 50,000. It is desirable that one third of the firefighting requirement form part of the service storage. The balance requirement may be distributed in the several static tanks at strategic points.

During scrutiny of records related to firefighting demand of water in MCs, it was revealed that neither was there any provision for firefighting demand made nor were static tanks created at different points, for fulfillment of water demand if fire breaks out in the city. In BMC, it was found that a proposal (March 2018) was moved for construction of 51 hydrants at various points, but no action was taken in this regard.

In reply during exit conference, it was stated (April 2019) that hand pumps had been excavated near fire hydrants so that sufficient amount of water is available in case of fire. For construction of five hydrants, a proposal is under process.

Fact remains that in the absence of reserve water for fire-fighting, extinguishing fire incidents will be delayed and may result in more physical and financial damages.

2.1.9.3 Human resources

CPHEEO Manual prescribes norms for staff to be deployed at each level for operation & maintenance and laboratory of water works for various capacities. Further, MP Municipal Corporation Act envisages that the corporation shall appoint officers and servants for the efficient performance of the functions of the Corporation by Commissioner, subject to the rules made by the State government in respect of the set-up, strength, recruitment and other conditions of service and reported to MIC. Appointment of any officer by MIC shall be

⁴⁶ Based on the formula of $100\sqrt{p}$ where p=population in thousand

subject to the prior confirmation of the State Government.

At State level, it was noticed that for restructuring the strength of MCs, the State Government approved “Ideal staff pattern for ULBs” in February 2014 and accordingly the proposal for revision of sanctioned strength and requirement of staff were sent by BMC and IMC under new policy (September 2016/ August 2016 & September 2017) for the vacant posts.

In MCs, the posts of technical, field and office staff for water supply were given in **Table 2.1.10** as of March 2014 and March 2018:

Table 2.1.10: Staff position of MCs for Water Supply as on March 2014 before proposal and as of March 2018

Sl. No	Details of the posts	Staff position as of March 2014		Staff position as of March 2018		Vacancy with reference to sanction as of March 2018	Percentage of vacancy as of March 2018
		Sanction	working	Sanction	working		
1	BMC						
A	Technical	110	78	114	102	12	11
B	Field Staff	1383	869	1383	921	462	33
C	Office Staff	134	108	134	129	5	4
	Total	1627	1055	1631	1152	479	29
2	IMC						
A	Technical ⁴⁷	50	62	91	56	35	38
B	Field Staff ⁴⁸	603	547	571	487	84	15
C	Office Staff ⁴⁹	193	175	197	162	35	18
	Total	846	784	859	705	154	18

(Source: Selected ULBs)

Deficit staff adversely affected the water supply system.

Further, it was noticed that after adoption of ideal staff pattern, the strength of MCs was revised but still there was overall 29 per cent and 18 per cent shortfall of staff in BMC and IMC respectively. Despite this, water supply wings of MCs did not demand any staff for water supply wings. Thus, due to shortage of manpower, the supervision and quality of water supply was adversely affected in the MCs. However, no ward-wise specific information in respect of field staff was provided by MCs.

In exit conference the Principal Secretary, UDHD stated (April 2019) that Commissioner of the MCs will be instructed to fulfil the shortage of staff as per provisions of Municipal Corporation Act with the approval of State Government.

Recommendation: Adequate staff on each level should be deployed for effective water supply system.

2.1.9.4 Training

CPHEEO manual provides that the staff engaged in water supply work were to be imparted training in respect of various sectors to improve group level of operational efficiency, to acquaint the group with the new development and increase community awareness of water works operation. In training, the subjects to be included were; laboratory control tests, design of component

⁴⁷ Technical Staff involve Executive Engineer, Assistant Engineer, Assistant Draftsman, and Chemist and lab assistant.

⁴⁸ Mechanic, Supervisor, Operator, Pump attended and plumber, valve-man and helper

⁴⁹ Adm. Officer, Assistant Executive, Divisional Accounts and bill-clerks.

works of the scheme and systems management, Accounting, budgeting and financial management. Each one of the supervisory and operating staff deployed on the water works should be trained appropriately at least once in three to five years of his service period.

Trainings were not conducted.

At State level, scrutiny of training calendar revealed that no training was conducted for improvement of level of operational efficiency, increase community awareness and laboratory control tests. In 2016-17, only one training for two days was mentioned on water supply in calendar but no slots were mentioned in respect of training. Reason was sought for non- conducting of training for water supply as envisaged in the Manual.

In reply, Registrar, National Institute of Governance and Urban Management, MP, Bhopal stated (March 2019) that no specific training was conducted on water supply. However, during foundation course for newly appointed officer the trainings on water supply management were conducted as per seasonal availability. However, no reason was intimated in this regard.

Further, Audit scrutiny in selected MCs revealed that neither any persons were sent for water supply training nor training records were maintained.

On the issue, the Commissioner MCs stated that compiled information on training is not available.

Thus, neither State nor MCs, adhered to the provisions of the manual to improve the efficiency and community awareness of water works operation.

In exit conference the Principal Secretary, UDHD stated (April 2019) that in the training calendar of National Institute of Governance and Urban Management, Bhopal, a separate courses will be included to improve the water supply system of the ULBs.

2.1.10 Monitoring mechanism

2.1.10.1 Monitoring on progress of water supply scheme was not conducted

As per CPHEEO Manual, the State Government should monitor general progress of water supply schemes of local bodies in respect of planning, implementation, operation and maintenance.

Audit found that no monitoring mechanism was developed at State level for monitoring the water supply system in the ULBs.

On this being enquired, the Principal Secretary replied (October 2018) that no manual for monitoring was prepared for this purpose and also no plan for supervision and monitoring was made.

During the course of audit, it was observed that MCs had not maintained any records in respect of monitoring and supervision. As a result, monitoring/supervision of higher authority at any site could not be ascertained.

In exit conference the Principal Secretary stated (April 2019) that monitoring as per provisions of CPHEEO manual is done at division level by EEs and at directorate level by ENC and SE at monthly intervals.

Fact remains that no records were made available in support of monitoring either at State level or ULB level.

No monitoring mechanism in existence for water supply.

2.1.10.2 Water Audit not conducted

As per CPHEEO O&M Manual, Water Audit of water supply scheme can be defined as the assessment of the capacity of total water produced by the Authority and the actual quantity of water distributed throughout the area of service of the authority, thus leading to an estimation of the losses.

Audit enquired regarding instruction issued for water audit and status of water audit in ULBs. At State level, the Principal Secretary, UDHD replied that no instruction was issued in this regard.

In both MCs, no water audit was conducted. Hence, the actual evaluation of the water supply system could not be ascertained.

On this being pointed out, Commissioner, BMC stated that action is being taken in this regard, a work order for water audit had been issued (November 2016) to Studio Galli Ingegneria (SGI) and inception report were received (December 2016). However, in the reply, IMC stated that no water audit was conducted.

In exit conference (April 2019), no specific reply was given on the issue.

Fact remain that objective of water audit could not be fulfilled as no water audit was conducted.

Recommendation: Water audit may be conducted to evaluate the outcomes of the existing water supply.

2.1.10.3 Management Information System (MIS) was not developed

Management Information System (MIS) is defined as a formal system of making available to the management accurate, timely, sufficient and relevant information to facilitate the decision making process to enable the organization to carry out the specific function effectively and efficiently in the tune with organisation's objectives. As far as water supply system is concerned, the performance of the system depends upon reducing and controlling leaks, undertake measurement of flows and pressure and ensuring the quality control of water supply system. It is the responsibility of operational management level to generate data on MIS from subordinate offices for processing. As per State Water Policy, it is essential to develop information system in this regard.

During the audit of water supply system, it was observed that at State as well as MCs level, the information system related to human resources, training profile of the staff, data related to leakage detection and attended, routine operation and maintenance information, regular check-up of data of valves and data related to water test reports were not in existence. Resultantly, management control as well as outcomes of efficient and effective water supply system could not be assessed.

In exit conference, the Principal Secretary, UDHD stated (April 2019) that it will be ensured that Water Management MIS system will be set-up in proper manner.

In absence of MIS the performance of water supply system could not be ascertained at any level.

Recommendation: MIS system should be developed at State as well at ULBs level; for effective control of water supply system.

2.1.11 Conclusion

Even though, SLB Cell was constituted at State level, it failed to periodically review the SLB targets and achievements thereof, whereas MCs published inflated SLBs achievements continuously without reviewing the actual status of achieved targets to show better performance of their water supply system. Due to improper zoning in MCs, there was unequal distribution of water in some of the municipal areas as supply was either with low pressure or on alternate days. Due to non-existence of leakage detection cell and regular maintenance plans, the non-revenue water reached up to 30 to 70 *per cent* and repairing cost of the leakage was increasing yearly. In the two MCs, 4.11 lakh (43.68 *per cent*) households were still out of water connection net-work. Records in support of the remedial action taken on the adverse water test reports were not available in the MCs. In IMC, the bore well water was supplied without water testing, which is a serious lapse on the part of water supply officers of IMC. In both MCs, it was found that none of the sample for biological testing was taken from OHTs/SRs, and most of the test-checked OHTs/SRs were found unclean. Independent water quality testing conducted jointly by audit revealed that out of 54 samples, 5 samples each in both MCs were sub-standard while all 20 bore well water samples in IMC were sub-standard. Shortage of operational and technical staff in both MCs continued to adversely affect the timely maintenance of water leakage, collection of revenue, quality water supply and distribution system. Due to non-conducting of Water Audit as required under CPHEEO O&M Manual, effective and efficient working of water supply system, required quality and quantity of water to citizen as well as the cost recovery of the water supplied could not be evaluated by MCs. In absence of MIS, State and MCs had failed to take policy decision to strengthen the water supply system.