

**Detailed Project Report
on
Water Audit, Leak Detection & Leak Reduction
for
Nagpur Municipal Corporation Nagpur**



**SUBMITTED TO :-
THE EXECUTIVE ENGINEER**
Water Works Department
Nagpur Municipal Corporation,
Pandit Jawaharlal Nehru Marg,
Sitabuldi, Nagpur – 440 012 [M.S.] India.



SHAH TECHNICAL CONSULTANTS PRIVATE LTD.

Consulting Engineers

407, Raheja Centre, Nariman Point, Mumbai – 400 021 [M.S.] India

Ph. : 020-22820018, 22871061, 22820121, Fax : 020-22023714

E-mail : stcmumbai@vsnl.com

I N D E X

Sr. No.	Description		Page No.	
			From	To
I	ABBREVIATIONS		I	I
II	EXECUTIVE SUMMARY		II	IX
01.	NAGPUR WATER SUPPLY			
	1.0	General	1	1
	2.0	Water Demand / Population	1	1
	3.0	Present Nagpur Water Supply Scenario	2	3
	4.0	Present Water Distribution System	4	5
	5.0	NMC Budget for Water Works Department (2003-2004)	5	5
	6.0	Water Auditors View on NMC Budget	6	6
	7.0	Water Audit & Leak Detection	6	6
02.	WATER AUDIT BEYOND NMC LIMIT			
	1.0	Raw Water Transmission Losses Through Canal	7	10
	2.0	Raw Water Tariff	11	11
	3.0	Action Plan Proposed	11	11
	4.0	Action Taken by NMC	12	12
03.	WATER AUDIT METHODOLOGY			
	1.0	Introduction	13	13
	2.0	Importance of Measurement & Metering	13	14
	3.0	Important Definitions for Water Audit Use	14	16
	4.0	Water Audit Work-Sheet & Steps for Calculating Non-Revenue Water & Water Losses	17	18

Sr. No.	Description	Page No.	
		From	To
04.	NINE TASKS OF WATER AUDIT & LEAK DETECTION		
	Task-1 System Input Volume	19	19
	Task-2 Billed Metered Consumption & Billed Un-metered Consumption	20	20
	Task-3 Calculate the Volume of Non-Revenue	21	21
	Task-4 Calculate the Unbilled Authorised Consumption	21	26
	Task-5 Calculate Authorised Consumption	26	26
	Task-6 Calculate Water Losses	27	27
	Task-7 Calculate The Apparent Losses	27	31
	Task-8 Calculate Real Losses	31	31
	Task-9 Assessment of Real Losses	31	38
	Summary of Performance Indicators	39	39
05.	LEAK DETECTION STUDY		
	1.0 Objective	40	40
	2.0 Present UFW Scenario for Nagpur City	40	40
	3.0 Methodology to Study Un-accounted for Water	41	48
06.	SLUM POLICY		
	1.0 Preamble	49	49
	2.0 Case Studies for Water Supply to Representative Slums	49	49
	3.0 CPHEEO Norms of Minimum Water Supply to Communities	49	49
	4.0 General Information About the Slum	50	50
	5.0 Cost of Water Supply in Nagpur City	50	50
	6.0 Categories of Structures	50	50
	7.0 Calculations for Water Charges	50	51
	8.0 Recommendations	51	68

Sr. No.	Description	Page No.	
		From	To
07.	ANNEXURES		
	Annexure-1 Cost of Water for Rated Capacity of 470 mld	69	69
	Annexure-2 Major Leak Detection	70	94
	Annexure-3 144 Test Zone Consumer Survey	95	129
	Annexure-4 Analysis of Maintenance Record	130	130
	Annexure-5 Details of Public Stand Post [PWR]	131	131
	Annexure-6 Average Flow Rate at Public Stand Post	132	132
	Annexure-7 Average Flow Rate at Consumer End	133	133
	Annexure-8 Water Tariff Structure	134	134

ABBREVIATIONS

Abbreviations

ALC	Active Leakage Control
APPX.	Approximate
AVG	Average
CPHEEO	Central Public Health Engineering & Environmental Organization
DPR	Detailed Project Report
ESR	Elevated Service Reservoir
GSR	Ground Service Reservoir
GL	Ground Level
ID	Irrigation Department
IWWA	Indian Water Works Association
LPS	Liter Per Second
MBR	Main Balancing Reservoir
MSL	Mean Sea Level
MLD	Million Liter Per Day
MM ³	Million Cubic Meter
ML	Million Liter
NMC	Nagpur Municipal Corporation
NRW	Non Revenue Water
PRBC	Pench Right Bank Canal
PWR / PWS	Public Water Supply
PWTM	Pure Water Transmission Main
RCC	Reinforced Cement Concrete
RBC	Right Bank Canal
STC	Shah Technical Consultant Pvt. Ltd.
UFW	Un-accounted for Water
WCL	Western Coalfield Limited
WTP	Water Treatment Plant

Conversions Commonly Used in Water Audit

1 m ³	=	1000 ltrs.
1 unit	=	1000 ltrs.
1 ml	=	1000 units / 1000 m ³
1 mm ³ /yr.	=	2.74 mld
1 mm ³	=	1000 ml
1 cusec	=	2.446 mld

Unit of Measure :- Unit of measure has been taken as mld (Million Liter Per Day) as all the Input & Output is considered in mld. These figures are calculated for annual consumption and divided by 365 days.

EXECUTIVE SUMMARY

Water Audit, Leak Detection & Leak Reduction for Nagpur Municipal Corporation, Nagpur

Executive Summary

Nagpur city the second capital of Maharashtra State with population of 2.35 million. It is practically at the centre of India.

Nagpur Municipal Corporation (NMC) manages treated water supply of 470 mld with annual budget on water supply is appx. 95 crore (expenditure) against actual receipt of only 50 crore (Revenue).

The preliminary audit report reveals that Un-account of Water (UFW) is 50% of pure water.

NMC has three sources of raw water.

- I] Pench Right Bank Canal off-take at 48.5 k.m. chainage at Mahadula (PRBC from Pench Dam)
- II] Kanhan River head works at Kampttee.
- III] Gorewada Tank.

NMC purchase appx. 625 mld of raw water from Irrigation Department & Gorewada Tank.

NMC generates only 490 mld of treated water from all the WTP against rated capacity of 470 mld.

NMC sales only 241 mld of water (as per billing records).

This report puts the effort to identify the causes for gap between quantum of raw water purchased / input and water sold. It provides priority for action plans to reduce water losses & UFW.

The water audit study reveals that :

- 1.0] The transmission losses of raw water through canal is ranging from minimum 20% to 35% depending on quantum of water releases in canal.

The quantum of water loss was estimated to the tune of minimum 100 mld to 250 mld.

If NMC recovers these losses, the additional water available from recovery of losses will be sufficient upto 2016 for expected population growth of city.

It is noted with great pleasure that NMC has taken initiative for laying of MS pipeline for transmission of raw water and discussions are started with irrigation department to provide the benefit of recovered losses in terms of providing addition fresh water to city. The total estimated cost of pipe line project was Rs. 162.62 Crores.

- 2.0] NMC is likely to save appx. Rs. 6.08 crore / year for 137 mm³ (existing requirement) and 8.44 crore / year for 190 mm³ Ultimate requirement due to difference of water tariff for canal Rs. 6.0 lakhs / mm³ against dam Rs. 1.56 lakhs/mm³. It is a additional benefit of bringing water by pipeline.
- 3.0] Meterisation at raw water off-take points, pure water transmission mains and all ESR has been recommended in water audit study with following advantages.
- 3.1] Savings in excess water charges paid to irrigation department – Rs. 1.95 crore / year.
- 3.2] Accountability of pure water input to distribution system.
- 3.3] Accountability of water for each zone as quantum of water receipt and quantum of water sold to consumer and UFW.
- 3.4] Equitable distribution of water.
- NMC has finalized the tender for purchasing of meter and likely to install the 1st lot of meter within a month time.
- 4.0] Water Audit study reveals that appx. 17.90 mld of water lost through water treatment plant for back wash and leakage losses.
- It was recommended to re-cycle the WTP water to avoid the water losses.
- NMC has floated the tenders for re-cycling of back wash water in WTP's.
- 5.0] The authorized un-metered unbilled consumption of NMC was estimated at appx. 22 mld costing NMC (appx. 4.40 crore) the major contributors are i) stand post, ii) tanker supply, iii) NMC offices, schools, hospitals etc. & iv) authorized unbilled connections.
- 6.0] The unauthorized consumption of NMC was estimated at 54 mld with estimated 45,600 un-authorised connection based on detailed survey carried out in 144 test zones.
- The most of the un-authorised connections are in slum areas, separate slum policy has been recommended to reduce the number of stand post and illegal connections.
- NMC has under taken the work of social survey to identifying the illegal connections and setup the central cell to speedily process application for regularization.
- 7.0] The detailed survey of consumers in 144 test zones reveals that bills given to appx. 89% consumers are not based on meter reading due to various reasons.
- The metering error contributes major share in UFW. The detailed study will start to quantify the UFW after NMC procure the meter and install at specified consumer location. The tenders are finalized and due for approval from standing committee. The detailed action plan will be proposed in final report on water audit.
- 8.0] Leak detection program for WTP, reservoirs, distribution mains, pumping mains has been carried out and details are given in the report. The leak detection program for service connections and distribution lines are under progress for 144 test zones & likely to be completed within next three month.

- 9.0] It is worth to mentioned that NMC has very effective active leak control program as the contracts to private agencies are given for each zones, based on rate fixed for each type of activities to carried out for leak repairing, once leak has been reported or identified, agency has to repair the leak immediately and has to take photograph of before repairing & after repairing. Thanks to above program the real losses (physical losses) are much less than apparent losses.
- 10.0] NMC has also taken up the following improvement / up-gradation of water distribution system for reducing the free water supply by Tankers. (The cost of water by tanker is Rs. 55.50/unit).
- A] Up-gradation / expansion of water distribution network with appx. 18.00 k.m. of pipeline network.
 - B] Improvement to North Nagpur water supply by diverting Pench water to North Nagpur, reduce the served by Kanhan water.
 - C] Improvement to feeder main of Nandanvan ESR and supply additional water to make daily water supply in Nandanvan area in place of alternate day supply.

The detailed project will be prepared after completion of on-going study of water losses at 144 test zones, the detailed project report will consist of

- I] Estimated UFW at service connections & micro level distribution network.
- II] Consumer metering errors, billing & its improvements.
- III] Targeted Economical level of UFW.
- IV] Action plan to achieve Targeted Economical level of UFW.
- V] Detailed cost estimates for action plan suggested.

CONCLUSION :-

The objective of submission of draft report is to implement of action plan to reduce discovered raw water & treated water losses given below, without waiting for final report on water audit & leak detection.

NMC shall immediately implement the action plan with payback period less than one year.

NMC shall make all efforts to replacement of Canal by close conduit pipe for transmission of raw water to save precious fresh water to the tune of minimum 100 mld to 250 mld.

NMC shall install the flow meters at all raw water, pure water transmission main & ESR/GSR inlets to

⇒ Save raw water cost by appx. 20%.

- ⇒ Accountability of water usage at zonal & sub zonal level.
- ⇒ Equitable distribution of water.

Recover the water losses at WTP's / Gorewada tank to the tune of 22 mld or more.

Immediately repair the discovered leakages (already many leakages has been repaired).

Implement the slum policy for water supply to reduce un-authorised consumption.

Continue the efforts to identify the illegal connections.

Revised the water tariff on cost basis.

NAGPUR MUNICIPAL CORPORATION

WATER AUDIT & LEAK DETECTION PLAN

SYSTEM INPUT = REVENUE WATER + NON REVENUE (UFW)

625MLD = 241MLD + 384MLD

UFW - 384MLD

REAL LOSSES (PHYSICAL LOSSES)	104.15MLD
UNIDENTIFIED LOSSES	43.49MLD

APPARENT LOSSES (ADMINISTRATIVE LOSSES)	236.36MLD
--	-----------

*EVAPORATION LOSSES AT GOREWADA	4.38MLD
---------------------------------	---------

SOURCE
1. PENCH DAM
2. KANHAN RIVER
3. GOREWADA

**CANAL LOSSES 20% TO 35%	100MLD TO 247MLD
---------------------------	------------------

RAW WATER TRANSMISSION
1. CANAL 48.5 Km. FROM PENCH DAM

RAW WATER LIFTING (PURCHASE FROM ID)
1. MAHADULA ON PRBC.
2. KAMTTEE ON KANHAN RIVER.

RAW WATER MEASUREMENT ERRORS (EXCESS BILLING)	112MLD
--	--------

LEAKS	0.0094MLD
-------	-----------

TRANSMISSION

1. BACK WASH OF FILTERS 2. LEAKS 3. OVER FLOW	17.9MLD
---	---------

PLANT OPERATION & TREATMENT
(5 NOS. OF WTP)

1. OVER FLOW 2. LEAKAGES 3. SEEPAGES	5.36MLD
--	---------

STORAGE
1. GOREWADA TANK
2. ESR/GSR - 43NOS.

LEAKAGES ON TRUNK MAIN	1.50MLD
STUDY UNDER PROGRESS	
TYPE OF LEAKAGE OBSERVED IN A YEAR	
1. PIPE JOINT LEAKAGE	1962 NOS.
2. PIPE BURST & LEAKAGE	2091 NOS.
3. VALVE LEAKAGE	1418 NOS.
ESTIMATED AT MINIMUM 15% LOSSES	***75MLD

DISTRIBUTION

UNIDENTIFIED WATER LOSSES	43.49MLD
---------------------------	----------

CONSUMER PREMISES

1. UNMETERED UNBILLED AUTHORISED CONSUMPTION 1. STAND POST 2. NMC BUILDING 3. UNBILLED	22MLD
2. ILLEGAL CONSUMPTION	54.16MLD
3. METERING ERROR/BILLING ERROR (STUDY UNDER PROGRESS) 89% OF BILLING PRODUCED AS AVERAGE + MINIMUM AS METER ARE NOT WORKING.	*** 48.20 MLD

* EVAPORATION LOSSES ONLY FOR GOREWADA IS CONSIDERED (NMC OWNERSHIP).

** CANAL LOSSES ARE BEYOND THE CONTROL OF NMC HENCE NOT CONSIDERED IN TOTAL UFW.

*** BASED ON PRELIMINARY STUDY OF 144 TEST ZONE & FIGURES ARE SUBJECT TO CHANGE AFTER DETAILED STUDY.

SUMMARY OF PERFORMANCE INDICATORS

Sr. No.	Description	
01.	Population of Nagpur City	23,50,000 souls
02.	System Input Volume	625 mld
03.	Actual Water Supply in Distribution System	490 mld (78%)
04.	Actual Water Sales	241 mld (38%)
05.	UFW (Gross)	384 mld (62%)
	5.1] UFW for Raw Water upto WTP	135 mld (22%)
	5.2] UFW for Treated Water	249 mld (40%)
06.	Total Non-Revenue Water (Administrative + Real)	384 mld (62%)
	6.1] Administrative losses (apparent losses + free water)	236 mld (38%)
	6.2] Real Losses	104 mld (17%)
	6.3] Unidentified Losses	43 mld (7%)
07.	Water cost / unit (1000 ltrs.)	Rs. 5.55/unit
08.	Minimum Water Tariff (1000 ltrs.)	Rs. 3.50/unit
09.	Total Water Connections (inclusive of authorized unbilled)	Appx. 2.0 lakhs
10.	Avg. no. of persons / connections (90% piped water)	10-11
11.	Total Water Connection (inclusive of unauthorized)	Appx. 2.45 lakhs
12.	Total Treated Water Losses (Real + Apparent) excluding raw water losses [490 mld – (billed consumption + unbilled authorized consumption)]	227 mld
13.	Treated Water Losses / Connections (12÷11)	926 ltrs./connection/day
14.	Treated Water Losses / Person (12÷1)	97 ltrs./person/day

Note :- All figures in % given with reference to System Input Volume (625 mld).

ACTION PLAN TO REDUCE WATER LOSSES

(Based on Draft Report on Water Audit & Leak Detection Program)

A] REDUCTION IN RAW WATER LOSSES :-

Sr. No.	Description of Water Losses	Quantum of Losses	Action Plan	Investment	Payback Period
01.	Raw Water Transmission Losses in Canal	*100-250 mld (Real Losses)	Laying of 2 X 1930 mm M.S. pipe line in two phase	Rs. 162.62 crore.	Ret Note
02.	Excess billing of Raw Water	127 mld (Apparent Losses) 1.95 Crore / year	Installation of Flow Meter at Raw Water Off-take points	Rs. 30.00 Lakhs	2 Months
03.	WTP Losses	17.9 mld (Real Losses)	Recycling of backwash of WTP water	Rs. 1.50 Crore	5 Months
04.	Gorewada Tank Leakage	4.78 mld (Real Losses)	Recycle improvement or gates	Rs. 0.50 Lakhs	7 Months

- Note :-**
- 1) Recovery of 100-250 mld of water at much less capital cost compare to development of any new source.
 - 2) Additional saving of 8.42 crore / year on water tariff (Payback period 20 year only by tariff charge)

B] REDUCTION IN TREATED WATER LOSSES :-

Sr. No.	Description of Water Losses	Quantum of Losses	Action Plan	Investment
01.	Un-metered Unbilled Consumption	22 mld	- Proposed Slum Policy & improvement to slum connectivity - Meterisation to NMC Properties	Rs. 3.30 Crore
02.	Un-authorized Consumption	27 mld	Improvement to billing system. Meterisation of all ESR/GSR for better accountability	Rs. 1.80 Crore
03.	Minimising Metering errors	**48 mld	89% of bills prepared are not based on meter readings. - Complete metering / reading / billing system needs improvement	
04.	Water Leaks in Distribution System	**75 mld	- PPP for better accountability maximum losses are in service connections - Most of leakages are in pipes less than 100 mm	
05.	Other Losses (Discovered Leakage)	1.525 mld	May be taken up by NMC active leak control program	

• Detailed estimates will be submitted along with final report.

** Detailed action plan will be submitted with final report.

NAGPUR WATER SUPPLY

Nagpur Water Supply

1.0] GENERAL :-

Nagpur City, the second capital of Maharashtra State, is a major center of education, culture & commerce. It is practically at the geographical center of India. All major highways and railways pass via Nagpur. Recently Nagpur is in lime light for its road infrastructure, cleanliness and upcoming Cargo Hub.

The Nagpur Municipal Corporation (NMC) manages water supply and waste water collection, treatment and disposal as also municipal solid waste management within the corporation limits having an area of 217.56 Sq. Km.

Nagpur is situated at a latitude of 21⁰-9' North and longitude 79⁰-6' East at altitude of 310 m appx. above sea level. Maximum average and minimum rainfalls are 1933 mm, 1205 mm and 606 mm respectively.

NMC has awarded the consultancy work for Conducting Water Audit, Leak Detection & Leak Reduction for Water Works Department of Nagpur Municipal Corporation, Nagpur to M/s Shah Technical Consultancy Pvt. Ltd., Mumbai.

2.0] WATER DEMAND / POPULATION :-

2.1] Population :-

Year	Population	Treated Water @ WTP	
		Demand (Mld)	Supply (Mld)
1991	17,00,000	290	369
2001	21,50,000	474	369
2004	23,50,000	489	470

2.2] Pure Water :- (Rated Capacity from existing WTP)

Kanhan Water Works	108.00 Mld
Pench Phase – I	113.00 Mld
Pench Phase – II	133.00 Mld
Pench Phase – III, Stage – I	100.00 Mld
Old Gorewada	16.00 Mld
Total	470.00 Mld

3.0] PRESENT NAGPUR WATER SUPPLY SCENARIO :-

The brief details of existing water supply schemes are:-

3.1] Old Gorewada Water Works :-

This was developed in the year 1911. It consists of an earthen bund across river Pili at a distance of about 8 Km. towards North-East of Nagpur city having gross and live storage capacities 8.82 Mm³ and 7.92 Mm³ respectively. On the downstream of Gorewada tank, conventional Water Treatment Plant of 16.0 Mld capacity is constructed. Treated water is collected in pure water sump of capacity 18.16 lakh ltrs. and then pumped to Seminary Hills G.S.R.

3.2] Kanhan Water Works :-

Surface water from the perennial river Kanhan, 18 Km away from the city. The head works are located 0.3 Km. down stream of confluence of river Kanhan and river Kolar.

Kanhan Water Works was commissioned in four phases during the years 1940 to 1970. The first phase capacity in year 1940 was 27.3 Mld which was then augmented to 63.6 Mld in 1954. The capacity was further augmented to 86.3 Mld in 1966 and finally to 109 Mld in 1970.

3.3] Augmentation to Nagpur Water Supply Scheme, Pench Phase-I :-

In 1970, the Irrigation Department of Government of Maharashtra executed a storage dam across river Pench for hydro electric project at Totaladoh and pickup dam at Navegaon Khairi. The right bank canal from this pickup dam was proposed to supply water to the Koradi Thermal Power Station as also about 247 Mld for Nagpur city water supply. It was planned to implement the scheme in stages and accordingly Phase-I scheme was sanctioned in the year 1975 and the scheme commissioned in March, 1982.

3.4] Improvements to Distribution System for Nagpur City Stage-I :-

Under Pench Phase-I scheme, three G.S.Rs Seminary Hills, Gittikhadan and Sitabuldi Fort have been constructed.

For proper distribution of water in all parts of city after execution of Augmentation to Nagpur water supply scheme Pench Phase-I, improvements to Distribution system for Nagpur City, Stage-I has been executed.

Under this scheme seven E.S.Rs have been constructed at Laxminagar (1 No.), Wanjarinagar (1 No.), Minimatanagar (1 No.), Sakkardara (2 Nos.), Lakadganj (2 Nos.) each having capacity of 2.27 ML. For proper distribution of water from these seven E.S.R.s distributions net work in seven zones has been provided.

3.5] Augmentation to Nagpur Water Supply Scheme Pench, Phase-II :-

After executing Phase-I scheme; Nagpur city was to receive 256 Mld of water from all sources. However, due to the losses due to leakages and other factors in the pipe lines, the actual supply to the city was to the tune of 130 Mld. Thus for 1991 census population of 16.57 lakhs, the actual supply from all sources

worked out to only 77 LPCD against an anticipated supply of 180 LPCD and hence Augmentation to Nagpur Water Supply Scheme Pench Phase-II was implemented.

Accordingly, Augmentation to Nagpur Water Supply Scheme Pench-II with Pench right bank canal as a source was sanctioned in the year 1989 and commissioned on 22/03/1994.

3.6] Improvements to Distribution System for Nagpur City, Stage-II :-

In order to distribute the additional quantity of water from Pench Phase-II scheme, equitably, it was necessary to strengthen the existing distribution and transmission system.

Accordingly, based on the recommendations of the Tripathi committee and considering future development of City, Maharashtra Jeevan Pradhikaran has prepared the scheme as 'Improvements to Distribution system for Nagpur City, Stage-II' which was administratively approved by Government vide G.R. No. WSS-1092/620/C.R. No. 117/92/UD-30, dated 19-11-1992 for Rs. 54.14 Crores.

The scheme envisages construction of 22.70 lakhs liters capacity R.C.C. E.S.R.s (Seven Nos.) at Ramnagar, Khamla, Jaripatka, Onkarnagar, Nandanwan, Subhannagar and Takliseem (Jaitala), feeder mains to feed all these reservoirs and distribution network.

3.7] Pench - III, Stage - I :-

Tata consulting Engineers (TCE) has prepared Master plan for Water supply & sewerage for Nagpur city upto year 2031. The digital base map for Nagpur City by aerial photography & complete piping network is imposed during Pench –III project.

After execution of Pench-III, Stage-I, Nagpur City has received 100 – 120 Mld of water. The scheme envisages additional Raw Water Pumping Machinery at Mahadula Pumping Station, Raw water gravity main from Gorewada Tank to New state of art Technology 120 Mld water treatment plant including pumping station at Gorewada. 1200 mm dia. M.S. treated water pumping main from WTP to Seminary Hill MBR.

Construction of R.C.C. 14 Nos. elevated service reservoirs 2.27 MI each at following locations & one ESR of 0.85 ml capacity at Wadi-Tekadi.

1) Nara, 2) Mahalginagar, 3) Wanjari, 4) Dhaba, 5) Dhantoli, 6) Reshimbag, 7) Boriyapura, 8) Gayatrinagar, 9) Chinchbhuvan, 10) Killa Mahal, 11) Bezanbag, 12) Kalamna, 13) Bharatwadi, 14) Dighori.

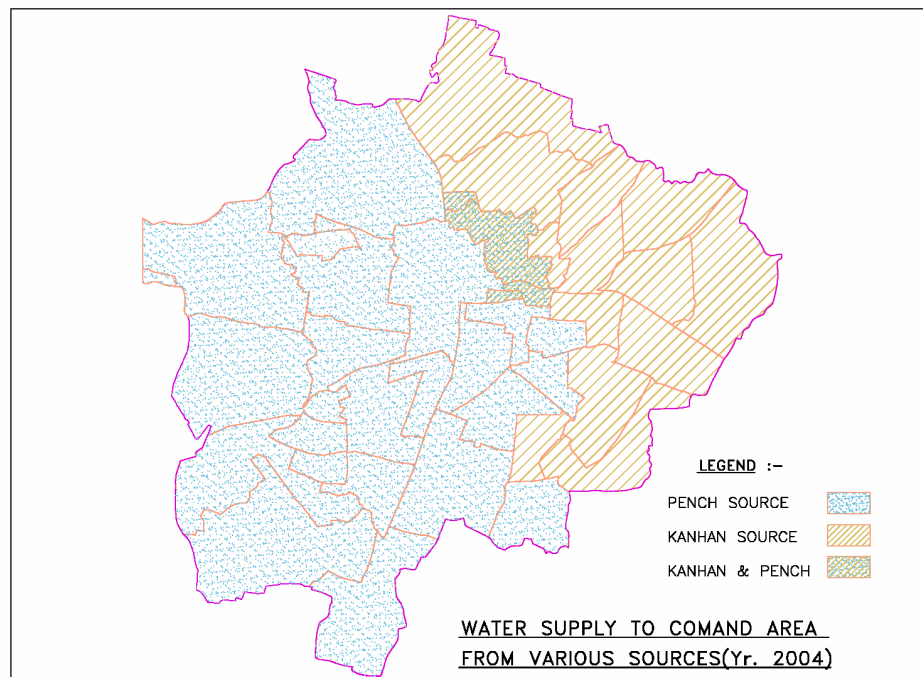
There are 43 service reservoirs in the city at 31 locations. Details of the existing reservoirs are given in Table. The existing storage capacity is 150.79 MI which @ 32% of the total supply.

4.0] PRESENT WATER DISTRIBUTION SYSTEM :-

Raw water supply to Nagpur city is from two major sources, Kanhan River (North-East direction) at Kamptee and RBC of Pench (North-West direction) at Mahadula near Koradi. Prior to Pench-III scheme, there were 28 service reservoirs in the city. After commissioning of Pench III, Ph.I City is served by 43 reservoirs. These 43 service reservoirs are located in 31 ESR/GSR command area in ten water distribution zones (administrative) of Water Works Department of NMC.

Existing water distribution system to Nagpur city is broadly divided in to three areas.

- 4.1] North / East / South part of Nagpur city with water supply from Kanhan Head Works & WTP.
- 4.2] North / West / South / Central part of Nagpur city with water supply from Pench project and WTP at Gorewada.
- 4.3] North / Central part of Nagpur city with water supply from both the sources i.e. Pench & Kanhan.



EXISTING TEN WATER DISTRIBUTION ZONES

ZONE NO.	Name of Zone	POPULATION (Yr. 2001)	No. of Connections
I	DHARAMPETH	2,50,000	20,525
II	LAXMI NAGAR	2,50,000	19,266
III	HANUMAN NAGAR	2,00,000	13,498
IV	DHANTOLI	2,00,000	14,346
V	NEHARU NAGAR	1,45,000	21,906
VI	GANDHIBAG	2,60,000	21,498
VII	SATARANGI PURA	3,20,000	20,271
VIII	LAKADGANJ	1,60,000	11,594
IX	ASHINAGAR	1,80,000	24,112
X	MANGALWARI	2,05,000	14,700

Water is supplied to the city by Master Balancing Reservoirs at Seminary Hills & Govt. House. Seminary hills and Govt. house are the two master balancing reservoirs from which the water is supplied to other reservoirs. These two MBR's also supply water to its command area. The reservoirs which get water from Kanhan are directly connected to pumping main.

5.0] NMC BUDGET FOR WATER WORKS DEPARTMENT (2003-2004) :-

(in Lakhs)

Expenses				Revenue		
1.	Establishment Expenses		550	1.	Water	*7,150
2.	Expenses			2.	Govt. Grant	1,900
	a)	Chemicals	100	3.	Other Income	516
	b)	Energy Bill	2,100			
	c)	Raw Water Charges for Pench	1,000			
	d)	Other expenses	236			
			3,436			
3.	Operation & Maintenance		702			
4.	Repayment of Loans		2,620			
	Revenue Expenditure		7,308			
5.	Capital / Development expenses		2,213			
	TOTAL		9,521			9,566

*Actual water charges receipt was appx. 5000 lakhs.

6.0] WATER AUDITORS VIEW ON NMC BUDGET :-

1.	Annual expenditure of Municipal Corporation on Water Supply	Rs. 95 Crore
2.	Total water charges demanded from consumers.	Rs. 71.50 Crore (deficit of 23.50 crores)
3.	Total Recovery against water bill	Rs. 50.00 Crore (arrears of 21.50 crores)
4.	State of Water Supply & Sales for last three years (No change in tariff)	
	Year	Water Supply
	2001-2002	370 mld
	2002-2003	370 mld
	2003-2004	490 mld
	Note :- Water supply rate has been increased by 32% but no increase in water sales figure.	
5.	Nagpur Municipal Corporation makes payment to Irrigation Department for	600 mld (annual average)
6.	NMC supplies treated water to city (Rated capacity)	490 mld
7.	NMC billing to all consumers against water supply	240 mld
8.	Total water losses / UFW / NRW are 360 mld i.e. <u>60% of total water purchased</u>	
9.	Cost of treated water is Rs. 5.55/1000 ltrs.	
10.	Above figures suggest that water audit required to be carried out to identify the causes and remedies for Un-account for Water (UFW) / Non Revenue water (NRW)	

7.0] WATER AUDIT & LEAK DETECTION :-

Water Audit & Leak Detection is divided in two parts.

- i] Water Audit beyond NMC limits i.e. losses upto raw water measurement points.
- ii] Water Audit for the quantum of water purchased from Irrigation Department.

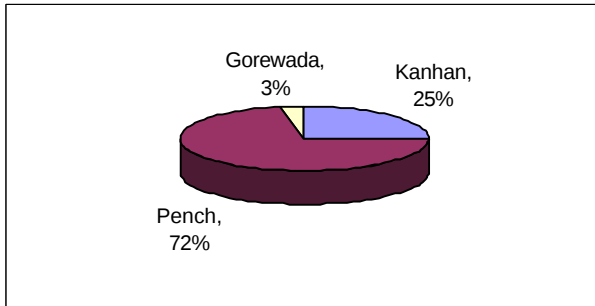
The detailed study of as a Part-A was not in the scope of water Audit but it was worth to include in the water audit report as it causes for major water loss.

WATER AUDIT BEYOND NMC LIMIT

Water Audit Beyond NMC Limit (Losses upto Raw Water Measurement Point)

1.0] RAW WATER TRANSMISSION LOSSES THROUGH CANAL :-

Pench & Nagpur Water Supply



Pench Dam



Important :-

72% of Raw water is from Pench – RBC on Chainage 48.5 km. at Mahadula. A possible breach of canal may cause the crisis for Nagpur Water Supply.

PRBC being the major source to of raw water for Nagpur city and also the source of major real water losses.

Right Bank Canal :-

RBC has a designed carrying capacity of 28.40 cumec. However, at present its carrying capacity has reduced to 21.23 cumec. This is because of bad condition of the canal. The canal lining is damaged badly. Siltation as well as vegetation growth has also occurred at numerous points. The canal structures, which were originally constructed for the baby canal are now causing obstruction to the flow. Also, many of the head / cross regulators as well as aqueducts have heavy leakages. Due to all these reasons, the carrying capacity of RBC has reduced considerably.

RBC supplies water to Nagpur Municipal Corporation for domestic water requirement of Nagpur city. It has to cater for industrial requirements of Koradi and Khaparkheda Thermal Power Stations also. The storage capacity of Groewada tank from where water is supplied to Nagpur city is only for the requirement of 7-8 days. As such, RBC has to run continuously without closure period. And hence, proper maintenance and repairs of the canal is not possible.

Regular maintenance of RBC is essential. If RBC breaches, then water supply to Nagpur city will be disrupted. Irrigation Department had asked NMC to increase the storage capacity of Gorewada tank so that maintenance and repairs of RBC could be done during the closure period. However, neither the storage capacity of the tank has been increase, nor any other alternate arrangements made by NMC. This is an important issue and needs to be sorted out early.



Photographs showing condition of Right Bank Canal



Photographs showing condition of Right Bank Canal

Hence during audit the quantification of canal losses were carried out as follows :

The transmission efficiency of 48.50 k.m. long PRBC – 65%* for partially lined canal (as lining of canal has been damaged at many places)

01]	Actual water measurement at Mahadula	458 Mld
02]	With 65% efficiency water to release from Pench dam to RBC	705 Mld
03]	Estimated transmission losses (leakages + theft + evaporation)	247 Mld

*Refer “Guidelines for Water Audit & Water Conservation” by Govt. of India.

During audit study the information gathered at Pench dam for water discharge through PRBC during hot weather (non-irrigation time) as follows :

Estimation of Canal losses based on Pench Right Bank Canal discharge data enquired from Irrigation Department for non-irrigation use (hot weather)

Rate of Water Discharge (with nil Irrigation)	Only from NMC	NMC + Koradi / Khaparkheda
In the month of March, 2005 enquired on 1 st week of March)	225 Cusec.	325 Cusec.
Total discharge in Mld	≈550 Mld	≈795 Mld
Less for Koradi / Khaparkheda TPS	–	175 Mld
Less for NMC	450 Mld	450 Mld
Canal Losses	100 Mld	170 Mld
% of losses (on productive use)	22%	27.2%

Above study suggest that losses to increase with irrigation use of canal with increase of water level & velocity at canal, as actual capacity of canal is 21.23 cumec ≈ 750 cusec ≈ 1835 mld with irrigation.

Note :-

The canal losses estimated based on guidelines of water audit, water conservation & data collection by inquiry made at Pench dam. The detailed audit of canal was not the scope of Water Audit. NMC/Irrigation department shall carryout the detailed audit for raw transmission losses through canal, however canal losses are ranging from minimum 20 to 35% and corrective action shall be taken immediately by raw water transmission through close conduit for Nagpur city and save huge loss of water.

2.0] RAW WATER TARIFF :-

Raw water tariff of Irrigation Department as applicable on 01/01/2005 was as follows.

01]	Raw water lifting from canal	Rs. 500/mld + 20% cess	Rs. 600 / mld
02]	Raw water lifting directly from Dam (Ref. Annexure-8)	Rs. 130/mld + 20% cess	Rs. 156 / mld
Saving in Tariff			Rs. 444 / mld

Hence,

- | | | |
|----|---|-----------------|
| 1] | Saving for existing water requirements (137 mm ³) | 6.08 Crore/Year |
| 2] | Savings for total water reservation (190 mm ³) | 8.43 Crore/Year |

Important :-

Savings / year is based on existing tariff structure and likely to increase with increase in tariff.

Note :-

NMC shall consider above savings as an additional advantages for transporting the water through close conduit.

3.0] ACTION PLAN PROPOSED :-

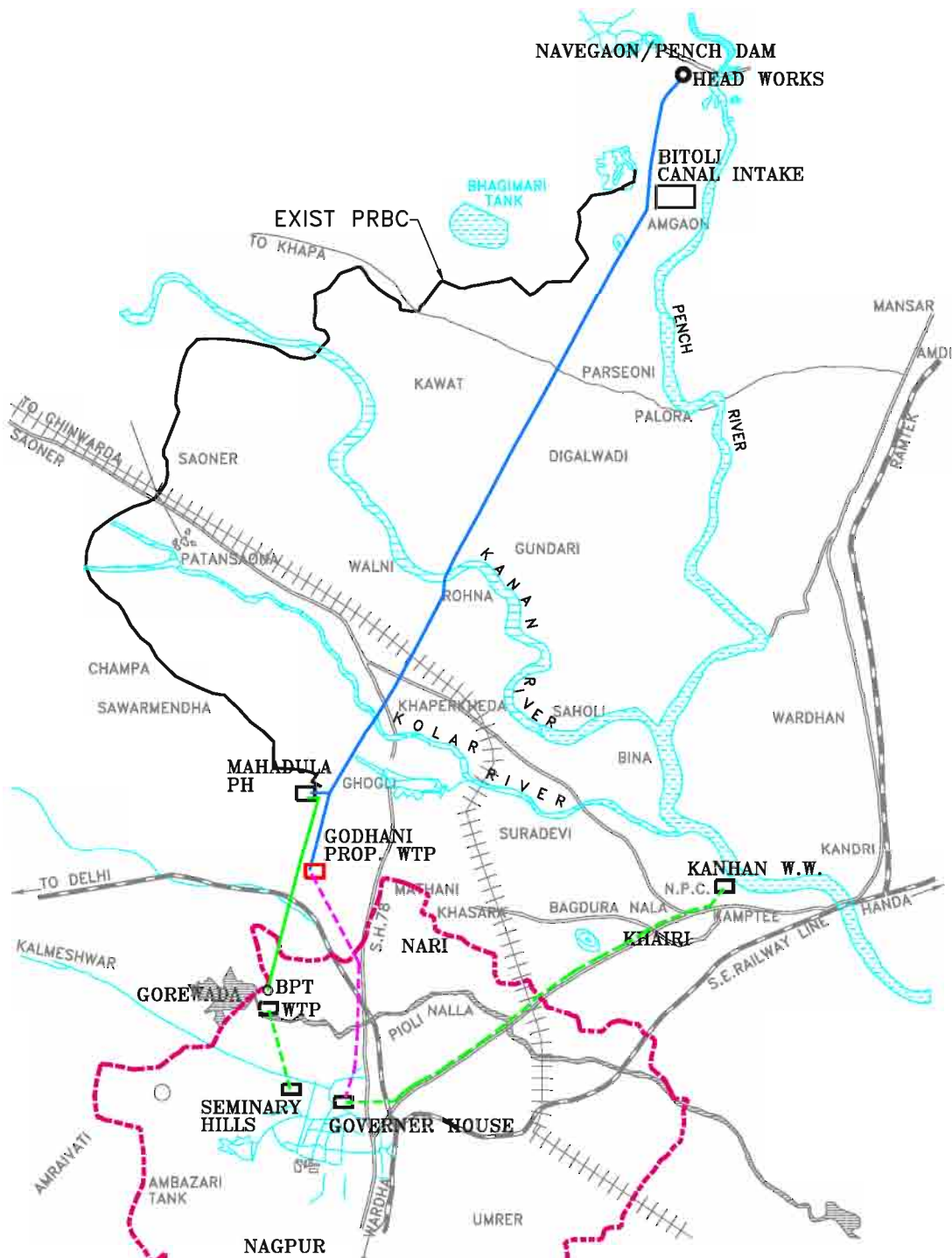
NMC shall make the alternative arrangement for transmission of raw water through close conduit to avoid leakage, theft & evaporation losses in canal with following advantages.

- 3.1] Reduce water losses from minimum 100 mld to 250 mld or more.
- 3.2] Additional water can be made available to Nagpur city & farmers.
- 3.3] Better maintained canal will increase productivity of water resources.
- 3.4] Reduced salinity & water logging for agriculture land adjoining to canal.
- 3.5] NMC can avoid enhancement of local storage capacity of Gorewada & can save the existing forest as Pench dam will be a bigger and reliable water storage for city.
- 3.6] Water tariff saving to the tune of 8.43 crore / year, a good 18% savings in variable cost.

4.0] ACTION TAKEN BY NMC :-

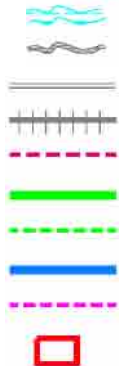
- 4.1] Appointed consultant for preparation of DPR for Pench-IV (name given to the project).
- 4.2] Feasibility report has been submitted by consultant with investment for pipe line was 162.64 crores.
- 4.3] Standing Committee has approved to the project for 162.64 crores.
- 4.4] NMC has taken initiation for raising the fund for project.
- 4.5] Project will take 2 year to complete.

PENCH DAM



LEGEND:-

- 1) RIVER
- 2) NALLA
- 3) ROAD
- 4) RAILWAY LINE
- 5) MUNICIPAL LIMIT
- 6) EXIST. RAW WATER TRANS. MAIN
- 7) EXIST. PURE WATER TRANS. MAIN
- 8) PROP. RAW WATER TRANS. MAIN
- 9) PROP. PURE WATER TRANS. MAIN
- 10) PROPOSED WTP



CLIENT :- **NAGPUR MUNICIPAL CORPORATION**
(PENCH PROJECT CELL)

PROJECT :- AUGMENTATION TO NAGPUR CITY WATER SUPPLY SCHEME PENCH - IV

STC Shah Technical Consultants Private Limited
407, RAHEJA CENTRE, NARIMAN POINT, MUMBAI - 400 021

INDEX MAP
PENCH - IV

SCALE NTS

REF. DWG. NO.

-

DRN. BY	PRG	09-03-05
CHD. BY	ASK	09-03-05
APPD. BY	ASK	09-03-05
DRG. NO.		

CADFILE:- PENCH-IV INDEX MAP

SHEET	OF	REV.
1 OF 1		0

WATER AUDIT METHODOLOGY

Water Audit Methodology **(For Quantum of water Purchased by NMC)**

1.0] INTRODUCTION :-

The problems of water and revenue losses are :

- *Technical* : not all the water supplied by a water utility reaches the customer.
- *Financial & Economic* : not all the water supplied is paid for.
- *Terminology* : lack of standardized definitions of water and revenue losses.

The objectives of this chapter is :

- Explained the standard terminology used for water audit.
- Procedure given for calculation of annual volume of real and apparent losses from a Water Balance.
- Recommend the most appropriate Performance Indicators for water audit use.

The actual quantity of water lost from a water distribution system will vary from utility to utility depending upon local factors such as topography, length of mains, number of connections and standards of service, and upon how well the system is being operated and maintained. In a well operated system, water losses should be continuously monitored and controlled, and noted each year in an annual report.

The annual volume of losses consist of two separate types of losses – Real (physical) and Apparent (non-physical), which are described in below :

2.0] IMPORTANCE OF MEASUREMENT & METERING :-

Reliable metering of all water volumes should and must be an integral component of water supply, water demand management and loss determination (Figure-1). The most important part of determining how much water is being lost in a system is to accurately quantify the volume of water which is entering that system. Metering of source meters for abstraction, treatment works production, imported and exported water, input volumes and inflows to sectorised distribution systems is essential for water balance calculations.

Measurements of night flow into sectors of the distribution system are extremely useful for rapidly identifying the presence of new unreported leaks, which can then be located and quickly repaired. This technique can be used irrespective of whether customers are metered or un-metered.

The primary purpose of customer meters is generating economic revenue based on metered consumption, but the accuracy of these meters is also a key issue in water balance calculations. Customer meters require careful management if representative and significant results are to be obtained.

An efficient organization will recognize and will deal with potential problems such as improper meter type or meter sizing, incorrect meter installation, meter encrustation, deterioration with age, flow rates less than the meter can reliably register, insufficient maintenance/replacement, frequency of calibration, inability to obtain readings, and influence of meter reading cycles.

Whenever actual metering is not possible, for example in activities such as stand post, etc., every effort should be made to estimate each component of water use accurately to determine realistic quantities for the water balance.

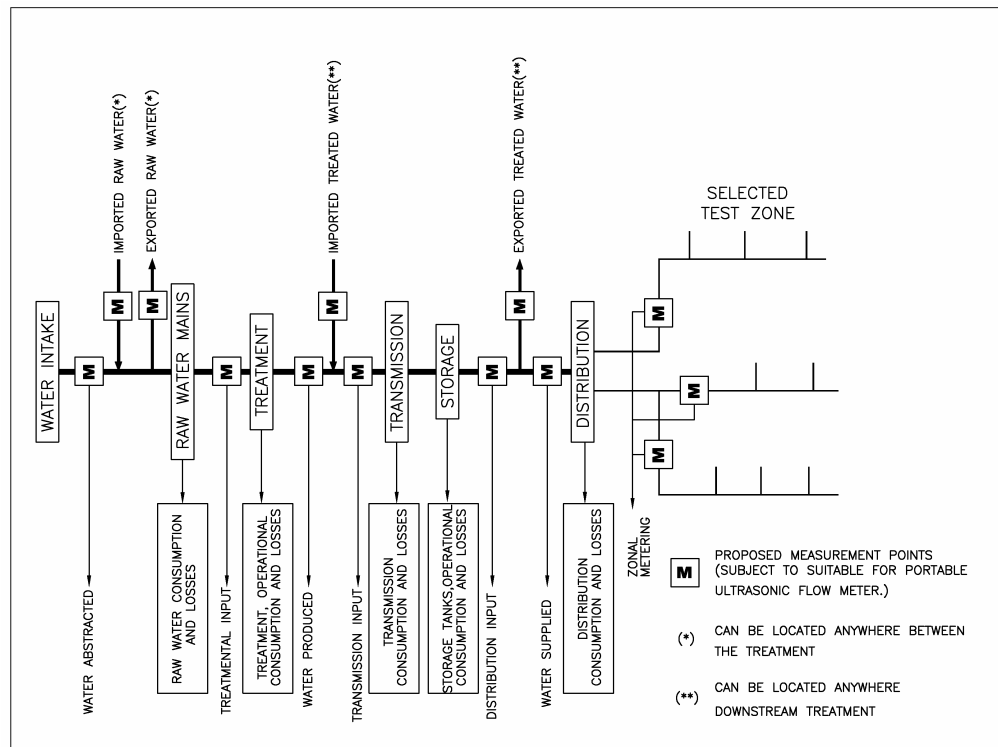


Figure No. - 1

3.0] IMPORTANT DEFINITIONS FOR WATER AUDIT USE :-

Any discussion relating to losses must be preceded by a clear definition of the water balance components and supplementary data use in water supply. However, there are significant differences in the definitions used in different countries. The IWA 'Best Practice' terminology in (Figure-2) below has been selected from countries which already have their own well-documented (but different) standard national procedure and terminology for Water Balance (France, Germany, Japan, UK & USA).

So, each national terminology differs from the IWA standard to some extent, not least because of different languages. Accordingly, when undertaking an international comparison or benchmarking study, it is necessary to first re-allocate the components of the national water balance into the same components as shown in (Figure-2). Where India do not yet have a standard for such calculations, the IWA standard terminology as shown in (Figures-1&2) is proposed as a model version for consideration. This terminology includes the following definitions :

“Water Abstracted” is the volume of water obtained for input to raw water mains leading to water treatment plants.

“Water Produced” is the volume of water treated for input to water transmission mains or directly to the distribution system.

“Water Imported and Exported” relates to the volumes of bulk transfers across operational boundaries.

“System Input Volume” is the volume of water input to a transmission system or a distribution system.

“Authorised Consumption” is the volume of metered and/or un-metered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for domestic, commercial and industrial purposes. It includes water exported.

Note that authorized consumption (Figure-2) includes items such as fire fighting and training, flushing of mains and sewers, street cleaning, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water. These may be billed or unbilled, metered or un-metered according to local practice.

“Water Losses” of a system are calculated as :

Water Losses = System Input Volume – Authorised Consumption.

Water losses can be considered as a total volume for the whole system, or for partial systems such as raw water mains, transmission or distribution. In each case the components of the calculation would be adjusted accordingly. Water losses consist of Real and Apparent losses, and are effectively identical to the previous IWSA definition⁽¹⁾ of Unaccounted for Water.

“Real Loses” are physical water losses from the pressurized system, up to the point of customer metering. The volume lost through all types of leaks, bursts and overflows depends on frequencies flow rates, and average durations of individual leaks.

“Apparent Losses” consist of unauthorized consumption (theft or illegal use), and all types of inaccuracies associated with production metering and customer metering. Under-registration of production meters, and over-registration of customer meters, leads to under-estimation of real losses. Over-registration of production meters, and under-registration of customer meters, leads to over-estimation of Real Losses.

“Non-Revenue Water” is the difference between the System Input Volume and Billed Authorised Consumption (Figure-2).

WATER AUDIT WORK SHEET

A	B	C	D	E
<u>System Input Volume</u>	<u>Authorised Consumption</u>	<u>Billed Authorised Consumption</u>	Billed Metered Consumption (including water exported)	<u>Revenue Water</u>
		M ³ /year	Billed Un-metered* Consumption	M ³ /year
		<u>Unbilled Authorised Consumption</u>	Unbilled Metered Consumption	
		M ³ /year	Unbilled Un-metered Consumption	
	<u>Water Losses</u>	Apparent Losses	Un-authorized Consumption	<u>Non-Revenue Water**</u>
		M ³ /year	Metering Inaccuracies	
		<u>Real Losses</u>	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
M ³ /year	M ³ /year	M ³ /year	Leakage on Service Connections up to point of Customer metering	M ³ /year

- Difficult has been experienced in completing the water balance with reasonable accuracy where a significant number of customers are not metered. In such cases, authorized un-metered consumption has been derived from sample metering of sufficient numbers of statistically representative individual connections of various categories, and/or by measurement of inflow into discrete areas of uniform customer profile (with data adjusted for leakage and diurnal pressure variations as appropriate).

** The IWA Task Force of Performance Indicators recommends that, if the term 'Unaccounted-for-Water' (UFW) is used, it should be defined and calculated in the same way as 'Non-Revenue Water' (NRW) in the above Table.

Steps for Calculating Non-Revenue Water and Water Losses

- Step-1 : Define *System Input Volume* and enter in Col. A
- Step-2 : Define *Billed Metered Consumption* and *Billed Un-metered Consumption* in Col. D; enter total in *Billed Authorised Consumption* (col. C) and *Revenue Water* (Col. E)
- Step-3 : Calculate the volume of Non-Revenue Water (Col. E) as *System Input Volume* (Col. A) minus *Revenue Water* (Col. E).
- Step-4 : Define *Unbilled Metered Consumption* and *Unbilled Un-metered Consumption* in Col. D; transfer total to *Unbilled Authorised Consumption* in Col. C.
- Step-5 : Add volumes of *Billed Authorised Consumption* and *Unbilled Authorised Consumption* in Col. C; enter sum as *Authorised Consumption* (top of Col. B)
- Step-6 : Calculate *Water Losses* (Col. B) as the difference between *System Input Volume* (Col. A) and *Authorised Consumption* (Col. B).
- Step-7 : Assess components of *Un-authorized Consumption* and *Metering Inaccuracies* (Col. D) by best means available, add these and enter sum in *Apparent Losses* (Col. C)
- Step-8 : Calculate *Real Losses* (Col. C) as *Water Losses* (Col. B) minus *Apparent Losses* (Col. C)
- Step-9 : Assess components of real losses (Col. D) by best means available (night flow analysis, burst frequency/flow rate/duration calculations, modeling etc.), add these and cross-check with volume of *Real Losses* in Col. C which was derived from Step-8.

Figure No.-2
Components of Water Balance for a Transmission System or a Distribution System.

4.0] **WATER AUDIT WORK-SHEET & STEPS FOR CALCULATING NON-REVENUE WATER & WATER LOSSES :-**

The best practice in management of water losses consists of a combination of continuous water balance calculations together with night flow measurements on a continuous or 'as required' basis. The water balance, usually taken over a 12-months period, should include :

- a thorough accounting of all water into and out of a utility system, including inspection of system records.
- an ongoing meter testing and calibration program.
- due allowance for the time lags between production meter reading and customer meter reading.

The water balance calculation quantifies volumes of total water into the system, authorized consumption (billed and unbilled, metered and un-metered) and water losses (apparent and real), see (Figure-2). Where continuous leak detection is not being practiced, the process may also include a benefit cost analysis for recovering excess leakage, leading to a leak detection program.

All water balance calculations are approximate to some degree because of the difficulty of assessing all the components with complete accuracy. The reliability is likely to be greatest when input volumes are purchased (with duplicate metering), and all water is measured through regularly maintained accurate customer meters supplying properties which do not have storage tanks. Storage tanks can result in low flow rates through service connections, and these low flows may not register accurately on the customer meter.

Step 9 of the calculation process recommends that volumes of Real Losses calculated by difference between Water Losses and Apparent Losses should be checked if possible by assessing the individual components of Real Losses from first Principle. A much improved understanding of Real Losses can be obtained by classifying components as follows :

- Background losses from very small undetectable leaks – typically low flow rates, long duration, large volumes.
- Losses from leaks and bursts reported to the NMC – typically high flow rates, short duration, moderate volumes.
- Losses from unreported bursts, found by active leakage control (ALC) – medium flow rates, but duration and volume depends on ALC policy.
- Overflows at, and leakage from, service reservoirs.

Methods of assessing Real Losses, other than from Water Balances, include :

- analyzing zonal flows based on test zone meter data.
- recording numbers and types of leaks and bursts and their average flow rates and durations.

- modeling calculations which allow for background leakage and pressure.

Although physical losses after the point of customer metering are excluded from assessment of Real Losses under this definition, they can sometimes be highly significant and worthy of attention for demand management purposes.

**NINE TASKS OF WATER AUDIT
AND
LEAK DETECTION**

Nine Tasks of Water Audit & Leak Detection

The total water audit & leak detection program has been carried out in Nine tasks as explained below :-

TASK-1 System Input Volume :-

1.1] Water Input or Purchase from Irrigation Department :-

Is the volume of water input to a transmission system or purchased from Irrigation Department (ID).

System input volume has been considered as water off-take from Mahadula Canal (Raw Water Pump House), Kanhan River and Gorewada Tank.

a)	Water Input from Mahadula Raw Water Pump House (based on actual flow measurement)	376 Mld $\cong$ 137 mm ³
b)	Water Input from Kanhan at Kanhan (based on actual flow measurement)	121 Mld $\cong$ 44 mm ³

1.2] Raw Water Intake :-

Raw water charges paid to Irrigation Department.

a)	Raw water charges for Mahadula	167 mm ³
b)	Raw water charges for Kanhan	55 mm ³
TOTAL		222 mm³
Total raw water quantity paid to Irrigation Department		$\cong$ 608 Mld
Raw water from Gorewada tank of NMC (5.83 mm ³)		17 Mld
TOTAL Raw Water Intake		625 Mld

A		B	C	D	E
System Input Volume					
1.	Identify and map sources.				
2.	Measure the water from each sources.				
3.	Adjust the figures for total supply.				
625 mld					

TASK-2 Billed Metered Consumption & Billed Un-metered Consumption :-

(Average quantity has been taken into account for Billing as per consumer data (2003-2004).

i)	Dharampeth Zone-I	48.16 MLD	
ii)	Laxminagar Zone-II	33.80 MLD	
iii)	Hanuman Nagar Zone-III	11.08 MLD	
iv)	Dhantoli Zone-IV	19.21 MLD	
v)	Nehrunagar Zone-V	16.99 MLD	
vi)	Sokta Bhavan Zone-VI	25.74 MLD	
vii)	Satranjipura Zone-VII	22.14 MLD	
viii)	Lakadganj Zone-VIII	9.55 MLD	
ix)	Ashinagar Zone-IX	15.31 MLD	
x)	Mangalwari Zone-X	39.27 MLD	241.380 MLD

A	B	C	D	E
System Input Volume		Billed Authorised Consumption	<i>Billed Metered Consumption (Including water exported)</i>	Revenue Water (Total billed quantity)
		241 mld	<i>Billed Un-metered Consumption</i>	mld
625 mld				

TASK-3 Calculate the Volume of Non-Revenue :-

Non Revenue Water = System Input Volume (Column-A) – Revenue Water (Column-E).

A	B	C	D	E
System Input Volume		Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water
			Billed Un-metered Consumption	241 mld
				Non-Revenue Water (System Input volume – Revenue Water)
625 mld				384 mld

TASK-4 Calculate the Unbilled Authorised Consumption (Metered & Unmetered Consumption) :-

There are following unbilled authorized consumption are identified during water audit study.

- Public stand post water supply appx. 6500 (0.22 LPS X 3 hrs.)
- Tanker water supply
- NMC offices, Schools, Hospitals.
- Public Parks & Gardens (old).
- Public Urinals.
- Un-metered unbilled connections – 7200.

1.1] Estimated Water Supply from Public Stand Post :-

NMC has appx. 6500 nos. of stand post in all 10 zones. Most of the stand posts were found without tap fixed on it and water was continuously flowing irrespective of productive use.

The volumetric flow measurement sample population spread in all ten water distribution zone with supply hrs.

The average flow rate	0.220 LPS
The average supply hours	3 hrs. / day
Total no. of authorised stand post	6500 appx.
Estimated water flow per day	$\frac{6500 \times 0.220 \times 3600 \times 3}{10,00,000} = 15.44 \text{ Mld}$
Cost of water	Rs. 5,550 / mld
Cost of water / day	Rs. 85,714/-
Cost of water supply / year	Rs. 3.13 crore.

Observations :-

- i) No taps on stand post.
- ii) No norms were followed for number of stand post vs population serve.
- iii) People are using flowing water of stand post for bathing & cloth washing.
- iv) Many places 24 hrs. water available on stand post.
- v) No policy for grant of new stand post.
- vi) Many of the stand post connections are in broken conditions & become source to polluted water.

Recommendations :-

- i) NMC shall provide individual house connections to slum dwellers and shall start removing the stand post.
- ii) NMC shall restrict water supply through stand post @40 lpcd as per CPHEEO norms wherever stand post can not be removed.
- iii) No. of stand post shall be restricted to as per 200 souls in slums as first step towards removal of stand post.
- iv) No stand post shall be given to the areas other than slums.

1.2] Tanker Water Supply :-

NMC provides water supply by tanker at free of cost where piped water supply is not available.

Appx. 250 trips / day of 4000 ltrs. tankers to cater mostly outer side of city i.e. Wadi, Dhaba, South-East Nagpur etc.

Estimated water supply per day

$$\frac{250 \times 4000 \text{ ltrs.}}{10,00,000} = 1 \text{ mld}$$

Supply through tanker increases in summer by 50% for three months cost of water with tanker distribution

$$\frac{\text{Rs. 200 / trip}}{4,000} = \text{Rs. 50.00 per thousand ltrs.}$$

Add water cost 5.55 + 50.00 = Rs. 55.55 / 1000 ltrs.

Additional cost / year 1000 units X 365 X 55.55 = Rs. 2.02 crore
inclusive of water cost.

Observations :-

- i) As water cost / 1000 ltrs. for NMC @Rs. 5.55 inclusive of water cost increases to Rs. 55.55 / 1000 ltrs. for tanker supply without income.
- ii) NMC shall immediately take action to bring all the areas under piped water supply.
- iii) Although only 1.0 mld of water supplied out of 500 mld water through tanker, it constitute major share of complaints from elected members and general public (about 50%).
- iv) Only 00.20% of water supplied through tanker but it takes much of productive time of NMC officials as consumer served by tankers are also not satisfied and they waste good amount of productive man hours every day.

Recommendations :-

- i) NMC shall arrange to bring the area served by tankers under piped network on priority basis.
- ii) NMC shall charge the water supply by tanker at subsidized rates instead of supplying at free of cost.

Action Taken by NMC :-

In the year 2004-2005 NMC has provided appx. 12.0 crore for expansion / up-gradation of distribution network with the objective of providing relief to areas served by tankers it is expected that 100 trips / day can be reduced after expansion of network.

1.3] NMC Offices, Schools, Hospitals, Gardens & Urinals :-

NMC has following infrastructure with appx. 13,500 employees.

A) NMC Schools :-

Nurseries	98 Nos.
Primary Schools	271 Nos.
Higher Primary Schools	61 Nos.
Middle School	22 Nos.
Jr. College & Others	03 Nos.

Appx. 70,000 students in above Institutes.

B) Others :-

NMC Gardens	38 Nos.
Gymnasium	08 Nos.
Badminton Hall	01 No.
Stadium	02 Nos.
Fire Stations	06 Nos.
NMC Offices	Central offices at Civil Lines & Mahal, 10 zonal offices etc.

The calculation of water consumption in NMC properties was very difficult as no metering was provided, however with calculation as per prescribed norms given in CPHEEO manual for specific use is given below.

Description	Estimated Water Consumption
NMC Hospitals (appx. 150 bed X 180 lpcd)	27,000 Ltrs.
NMC Schools (70,000 X 30 ltrs.)	21,00,000 Ltrs.
NMC employees in all offices (13,500 X 30 X 2) inclusive of visitors for visit.	8,10,000 Ltrs.
NMC Gardens 38 nos. (0.220 X 38 X 3600 X 3 hrs.)	90,000 Ltrs.
Public Urinal appx. 100 nos. (0.220X100X3600X3 hrs.)	2,37,600 Ltrs.
TOTAL	32,64,600 Ltrs.
SAY	3.65 Mld
Cost of Water Rs. 3.65 X 5550 X 365	0.74 Crore

Note :-

Calculations given above are only for indicative consumption, actual consumption shall be calculated by fixing of flow meter at each consumption point.

Recommendations :-

NMC, Water Works Department shall install the meter send the bills to all NMC offices, atleast for quantity supplied.

1.4] Authorised Unbilled Consumption :-

The detailed consumer survey in 144 test zones under ten water distribution zones of NMC covering 11906 connections about 3.61% of connections found without billing, but authorized by NMC. The detailed investigation of matter reveals that records has been missing at billing department while paper movement from various section or records was missing while updating or any other reasons.

Based on above survey which was spread all over Nagpur city (Refer Index Plan & Summary of Consumer Survey for Water Audit, Leak Detection Plan) the estimated numbers unbilled authorized consumers area.

Total no. of connections appx. 2.0 lakhs

$$2,00,000 \times 3.61\% \times 100 = \text{Say } 7200$$

$$\text{Appx. consumption @} 0.220 \text{ LPS} \times 7200 \times 3600 \times 3 = 1.55 \text{ mld}$$

$$\text{Appx. cost of water supplied } 1.55 \times 5550 \times 365 = 0.30 \text{ Crore}$$

Hence

Total authorized unbilled water consumption

Sr. No.	Description	Water Consumption (mld)	Annual Cost of Water (Rs. in Crore)
(i)	Estimated water supply from public stand post (appx. nos. 6500)	15.44	3.13
(ii)	Tanker water supply (250 trips / day)	1.00	2.02
(iii)	NMC buildings, gardens, schools, hospitals, urinals etc.	3.65	0.74
(iv)	Authorised unbilled consumption	1.55	0.30
Total estimated un-metered / unbilled water consumption		21.64	6.19
SAY		22.00	6.20

A	B	C	D	E
System Input Volume 625 mld		Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water
			Billed Un-metered Consumption	241 Mld
		Unbilled Authorised Consumption 22 mld	Unbilled Metered Consumption	Non-Revenue Water (System Input volume – Revenue Water)
			Unbilled Un-metered Consumption	
				384 mld

TASK-5 Calculate Authorised Consumption :-

$$\begin{array}{lcl} \text{Authorised Consumption} & = & \text{Billed Authorised Consumption} \\ \text{(Top of Col.B)} & & + \\ & & \text{Unbilled Authorised Consumption} \end{array}$$

A	B	C	D	E
System Input Volume 625 mld	Authorised Consumption (Billed Authorised Consumption + Unbilled Authorised Consumption) 263 mld	Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water
			Billed Un-metered Consumption	241 Mld
		Unbilled Authorised Consumption 22 mld	Unbilled Metered Consumption	Non-Revenue Water (System Input volume – Revenue Water)
			Unbilled Un-metered Consumption	
				384 mld

TASK-6 Calculate Water Losses :-

Water Losses = System Input Volume (Col.-A) - Authorised Consumption

A	B	C	D	E
System Input Volume 625 mld	Authorised Consumption (Billed Authorised Consumption + Unbilled Authorised Consumption) 263 mld	Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water 241 Mld
			Billed Un-metered Consumption	
		Unbilled Authorised Consumption 22 mld	Unbilled Metered Consumption	Non-Revenue Water (System Input volume – Revenue Water) 384 mld
			Unbilled Un-metered Consumption	
	Water Losses (System Input Volume – Authorised Consumption) 362 mld			

TASK-7 Calculate The Apparent Losses :-

Apparent Losses = Un-authorized Consumption + Metering Inaccuracies

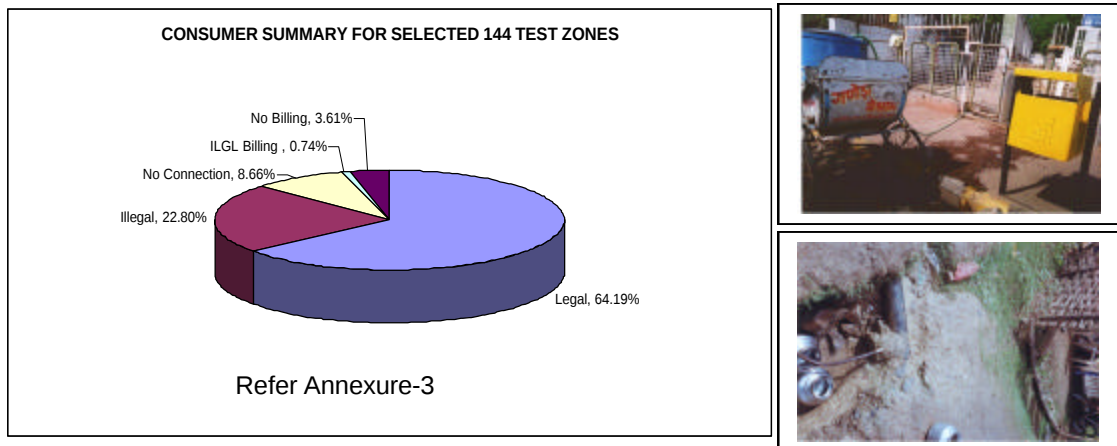
1.1] Un-authorized Consumption :-

From detailed consumer survey of 144 test zones, appx. 2715 of total 11906 consumers were found illegal, which is 22.80% of total consumers (Refer Annexure-3).

Estimated illegal consumer's appx. 22.80% is 45,600 Consumers
(22.80% of 2.0 lakhs consumers)

Estimated water consumption 54.16 mld
(0.165 X 2 hr. X 3600 X 45,600)

The cost of water consumption appx. 11.00 Crore / year.
(@Rs. 5.55 per Unit)



1.2] Metering Inaccuracies :-**A] Raw Water Measurement Losses to NMC :-****A-1] Raw Water From Mahadula Pumping Station :-**

As per Irrigation demand from NMC at Mahadula Canal (167 mm ³ for 2003-2004) based on rated capacity of pump	*458 Mld
As per actual Measurement, estimated water lifting (137 mm ³ for 2003-2004)	*376 Mld
Excess measurements or 30 mm ³ /annual (21.8%)	82.00 Mld

A-2] Losses at Kanhan Pump House :-

Water charges paid to Irrigation Department 55 mm ³	*150.70 Mld
Estimated water lifting from Kanhan (based on actual flow measurement)	121.00 Mld
Excess measurement & payment to Irrigation dept. (10.84 mm ³ /year)	29.70 Mld

*Annual average.

1. NMC purchase the raw water from Irrigation Department at PRBC Mahdula & Kanhan River.
2. No meter was installed at raw water offtake points.
3. Raw water charges were taken by Irrigation Department, based on pump rating capacity.
4. Water audit study reveals that appx. 20% excess payment are being made to Irrigation Department, the details are given below

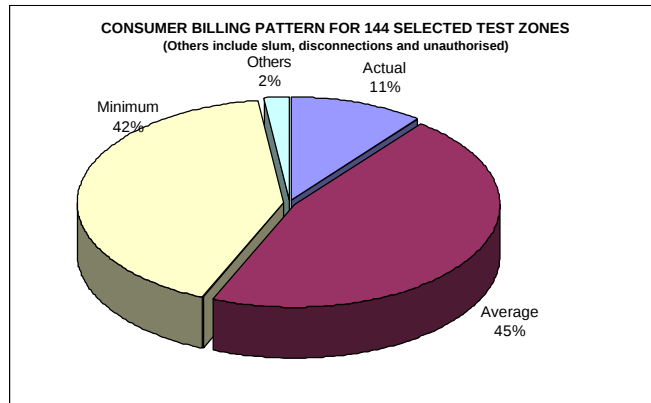
Hence total apparent losses at Raw Water off-take point to pure water sump is given below :

Sr. No.	Description	Excess Billing	
		In mm ³	In Rs. (Lakhs)
1)	Real losses (only for Pench water)	30.00	180
2)	Excess water lifting charges at Kanhan @1.38 lakhs/mm ³	10.80	15
	TOTAL	40.80	195

@112 mld

B] Measurement Losses in Distribution System :-

As per NMC record found to be 55% are working meter however after detailed consumer survey of 144 test zone it was found that only 706 metered connection out of total 6595 metered connections were billed as per actual meter reading i.e. less than 11%. 46% were billed as per average reading, 42% were billed as per minimum billing (Refer table type of billing Annexure-7).



The above figures suggest that appx. 89% of metered consumers are billed without considering of actual readings.

Preliminary study suggest appx. 20% under billing has been carried out due to non-works of meters, hence $(0.20 \times 241 \text{ mld} = 48.2 \text{ mld})$.

Detailed study is under progress to estimate the actual UFW in this account after installation of meters at consumer location (Refer chapter on leak detection plan).

The cases were found that average billing is continued even house has been expanded to multi-storied building with increase consumption.

- The discounting of NMC bills are regular practice, if consumer goes with complaint of higher bill, the office-in-charge offer the discount or minimum billing as settlement as there is no working meter or authentic meter reading records are available with him to argue with consumer.
- Meter readers who are employees of NMC are not visiting to most of the meter site before submitting the reading details. The officer-in-charge does not have any control over meter reader.
- Bills for regularized illegal connection (past drive) total 33,554 consumers can not be distributed as, the regularization drive initiated in past was in waste and no proper record of property, address were kept. Bills are printed based on average consumption and kept at zonal offices without distribution.
- Bulk consumer appx. 1400 nos. (out of total 2.0 lakhs consumers) are contributing 50% in total receipt (25 crore/year) where bills are prepared as per actual meter reading on monthly basis and controlled by head office of Water Works Department.

It is an important lesson for future regularization program to maintain the proper record to trace the consumer for meter reading, distribution and recovery of bills.

The metering inaccuracies observed as a major component of UFW and hence detailed study is initiated in 144 test zone. NMC has finalized the tender for high quality Class-B consumer meter and bulk meter to install at 1% consumer of test zone to estimate the metering inaccuracies and decide the metering policies.

- The water audit study suggested then metering at raw water off-take point itself can save appx. 20% of raw water charges to the tune of 1.95 crore / year with investment of less than 30 lakhs with payback period of just over 2 months.
- The accounting of water should start from zonal level & performances shall be assessed based on quantum of water received by zone and quantum of water sold to customer (billed or unbilled) and this accountability shall go down to ESR area to sub zones to individual consumer. Hence it was recommended to install the flow meter at each ESR inlet to start a better accountability for each zone on water receipt and water sold.
- Private participation in water distribution, meter installation, meter readings, bills preparation, bills distribution shall be encouraged as such a important revenue source of NMC has been ignored and causing major losses to water works accounts.

The detailed action plan will be suggested after study of installation of meters.

A	B	C	D	E
System Input Volume 625 mld	Authorised Consumption (Billed Authorised Consumption + Unbilled Authorised Consumption) 263 mld	Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water 241 Mld
			Billed Un-metered Consumption	
	Water Losses (System Input Volume – Authorised Consumption) 362 mld	Unbilled Authorised Consumption 22 mld	Unbilled Metered Consumption	Non-Revenue Water (System Input volume – Revenue Water) 384 mld
			Unbilled Un-metered Consumption	
		Apparent Losses 214.36 mld	Un-authorized Consumption 54.16 mld	
			Metering Inaccuracies (112 + 48.20) *160.20 mld	

*Study for metering inaccuracies of consumer meters are under progress.

Hence actual apparent losses can only be estimated after detailed study & figures given are subject to revise (Refer chapter on Leak Detection Plan).

TASK-8 Calculate Real Losses :-

Real Losses = Water losses (Col.-B) – Apparent losses (Col.-C)

A	B	C	D	E	
System Input Volume	Authorised Consumption (Billed Authorised Consumption + Unbilled Authorised Consumption) 263 mld	Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water 241 Mld	
			Billed Un-metered Consumption		
		Unbilled Authorised Consumption 22 mld	Unbilled Metered Consumption	Non-Revenue Water (System Input volume – Revenue Water) 384 mld	
			Unbilled Un-metered Consumption		
	Water Losses (System Input Volume – Authorised Consumption) 362 mld	Apparent Losses 214.36 Mld	Un-authorized Consumption 54.16 mld		
			Metering Inaccuracies 160.20 mld		
	Real Losses (Water Losses – Apparent Losses) 147.64 mld				
	625 mld				
*Unidentified Water Losses					

*Unidentified water losses included in Real losses.

TASK-9 Assessment of Real Losses :-

There are following sources of real losses in water system.

- Leaks at raw water transmission.
- Evaporation losses.
- Water treatment losses.
- Leaks / seepage of reservoirs.
- Overflows of reservoirs.
- Leaks of distribution mains.
- Leakages from valves & air valves.
- Leakages from service connections upto meter.
- Leakages in consumer premises after the meter (not in scope of water audit).

The first three losses are calculated and action plan is given separately as it required special attention.

The methodology adapted for leak detection program for NMC has been given in next chapter and study is likely to in details.

Complete within next three months, immediately after installation of zonal flow meters and consumer meters.

Measuring & estimating losses from discovered leaks the following methods has been adapted for measuring & estimating losses for discovered leaks are.

- i) Bucket and stop watch methods.
- ii) Portable Ultrasonic Flow Meter.
- iii) Volumetric measurement.
- iv) Measurements by partially filled pipe, V-notch etc.

The detailed list of discovered leaks with water loss figures are given below and detailed calculations are given in separate chapter.

1.1] Input Volume in Distribution System :-

Actual system input volume in to distribution system (Refer Task-1(B) of Preliminary Report)			490 Mld
A]	Pench Water		560.97 MLD
	i)	Gorewada (Old)	15.263
	ii)	Pench-I	112.047
	iii)	Pench-II	151.689
	iv)	Pench-III	*127.137
	TOTAL		406.156
	*Note Pench-III had been reduced to 100 mld after reduction in water level at Gorewada and valve failure		
	Hence net Inflow		379.019
	Less 2% meter error		(-) 7.580
	Net Inflow from Pench		371.439
B]	Kanhana Water		121.430
	Less 2% meter error		2.420
	Net Inflow from Kanhana WTP		119.000
	Hence Net Inflow to Distribution System (A+B)		490.430 MLD
	SAY		490.000 MLD

Based on preliminary study minimum distribution losses are estimated at appx. 15% of input volume into distribution system. The UFW on account of losses in distribution system including service connections upto consumer meter & metering errors shall be estimated accurately only after completion of detailed study of 144 test zones in 31 ESR/GSR command areas. The detailed leak detection plan is explained in next chapter.

Hence minimum distribution losses is $15\% \times 490 \text{ mld} = 73.50$, Say 75 mld.

1.2] Real Losses :-

A] Raw Water Transmission Losses :-

Raw water pumping main of 5.730 k.m. length between Mahadula Raw Water Pumping and Gorewada BPT was surveyed by water audit team and observed the leakages on Air Valve near Gondhni and measurement were taken and given in leak detection chapter estimated transmission losses are 0.009 Mld.

B] Evaporation Losses at Gorewada :-

Nagpur being hot & dry for six months in a year and estimated evaporation rate is 1.6 Mtr./year and with capacity curve the evaporation losses at Gorewada was estimated.

Avg. water level at Gorewada	315 – 312 msl
Capacity of Gorewada Tank between 315-312	3.19 mm ³
Rate of evaporation :- Oct. to Feb. (4.4. mm/day)	660 mm
Rate of evaporation :- March to May (10 mm/day)	900 mm
Rate of evaporation :- June to Sept. (manson) negligible	-
TOTAL	1560 MM

(Ref. :- Hydro meteorological Parameters given at www.cgwb nagpur.gov.in)

Hence annual evaporation losses $1.60 \text{ mm}^3 \cong 4.38 \text{ Mld}$
(50% of 3.19 mm³)

C] Leakages at Gorewada :-

Partially filled 450 mm pipe with half filled pipe was estimated (Ref. Annexure-2 major leak detection page L-2)	4.74 Mld
--	----------

Note :- The Fetri Rural Water Supply Scheme is designed based on losses from Gorewada tank.& old Goreada WTP leakages.

D] WTP Losses :-

The total WTP losses for old-Gorewada, Pench-I, II & III are measured as follows (Ref. Annexure-2, Page-40)

Old Gorewada WTP losses	0.27 Mld
Pench-I WTP losses	3.48 Mld
Pench-II WTP losses	3.06 Mld
Pench-III WTP losses	0.55 Mld
TOTAL	7.37 Mld

Hence total real losses from Mahadula pumping station to WTP (upto pure water sump) is

(A) + (B) + (C) + (D) [0.009 + 4.38 + 4.74 + 7.37]	16.50 Mld
--	-----------

E] Losses from Kanhan :-

Kanhan WTP with back wash water (Old WTP with filter bed)	2.63 Mld
Kanhan WTP with back wash water (new WTP with filter bed)	3.35 mld
Kanhan WTP losses (overflow leakages excluding backwash & others)	4.55 mld
TOTAL	10.53 mld

Total real losses upto pure water pump houses (Kanhan + Pench) – 27.03

1.3] Water Losses at Seminary Hills MBR :-

Real losses i) Seepage from GSR, ii) Leakages on air valves and iii) Leakages from pipe line / valves.

Seminary hills MBR has been located at highest contour of city with G.L. of 349.70 MSL. Hence all the leakages from MBR premises are formed in two water streams, visible on slope of the hill and hence measurements has been taken at following two location.

- 1) Slope of hill at WCL side.
- 2) Slope of hill at “Ludhra Mata” Church.

Assuming 20% of water being percolated in the ground.

1.4] Water Losses at Pure Water Transmission Main :-

Water losses at pure water transmission main has been detected at following places.

- 1] Kanhan pure water pumping main – joint leakages at many places.
- 2] Air valve lakages.
- 3] Un-authorised use of scour valve at Pilli Nadi by slum population.
- 4] Estimation of water losses at joint leakages with average 5 mm opening and pressure of appx. 40 mtr. of water column is $28 \text{ LPM} \times 12 = 280 \text{ LPM} = 0.6 \text{ Mld}$





- 5] Air valve leakages (Ref. calculation sheet) :- The estimated water losses through air valves were calculated on different air valves.



Real losses :- i) Pipe Joints, ii) Air Valves, iii) Corrosion / Old age of pipe.

Apparent losses :- i) Illegal tapplings, ii) Unknown branches.

1.5] Water Losses in Distribution System :-

1] Real water losses in distribution system :- There are following reasons for real water losses in distribution system.

a) Service connections :-

It contributes 15% of total leakage points reported by active leak control program of NMC.

b) Pipe joints :-

41% of total joints failures are in 100 mm pipe.

c) Valves :-

Appx. 1400 value leakages cases reported in year.

d) Pipe burst :-

90% of total pipe leakages are in ≤ 100 mm diameter of pipe line.

e) Illegal tapping holes on pipe line :-

The maintenance record of active leak reduction program shows details of total 5471 detected leaks in 8 zones out of total 10 zones.

1.6] Other Losses :-

During leak detection program various leaks were discovered and measured as given in annexure-2 the summary of real losses are given below.

Summary of Discovered Real Losses (Transmission Mains)

Sr. No.	Description	Life of Leakage [Years]	Supply Hrs.	Water Loss in MLD
1	Backwash Water Leakage at WTP, Pench -II [Lead Joint Leakage]	1/12	24	0.403
2	Kanhan Line [Air Valve Leakage Infront of Fookat Nagar,Chamar Nallah]	1	24	0.075
3	Pure Water Rising Main, From WTP to Seminary Hills.Gorewada, [Sluice Valve Leakage]	1	24	0.061
4	Seminary Hills MBR [Pench-II] Air Valve Leakage	5	24	0.069
5	Pure Water Supply Main, From Seminary Hills, Lourd Mata Mandir [Pipe Leakage]	1	24	0.060

Sr. No.	Description	Life of Leakage [Years]	Supply Hrs.	Water Loss in MLD
6	Seminary Hills [MBR Seepage, Near Mini Railway Track]	20	24	0.468
7	Loha Pulliya [Lead Joint Leakage at Wanjari Nagar ESR Feeder]	1	24	0.215
8	Opp. Arun Automobile [Air Valve Leakage, Ghat Road]	1	24	0.012
9	Murgiwala Valve [Near Tukdoji Putla]	3	5	0.012
10	Seepage loss at Fort GSR	>15	24	0.149
Total				1.524

DETAILED WATER AUDIT WORK SHEET (DRAFT)

A	B	C	D	E
System Input Volume 625 mld	Authorised Consumption (Billed Authorised Consumption + Unbilled Authorised Consumption) 263 mld	Billed Authorised Consumption 241 mld	Billed Metered Consumption (Including water exported)	Revenue Water
			Billed Un-metered Consumption	241 Mld
		Unbilled Authorised Consumption 22 mld	Unbilled Metered Consumption	Non-Revenue Water (System Input volume – Revenue Water)
			Unbilled Un-metered Consumption	
	Water Losses (System Input Volume – Authorised Consumption) 362 mld	Apparent Losses 214.36 mld	Un-authorized Consumption 54.16 mld	384 mld
			Metering Inaccuracies 160.20 mld	
		Real Losses 147.64 mld	<i>Leakages on Transmission and/or Distribution Mains 1.50 mld*</i>	
			Leakages and Overflows at Utility’s Storage Tanks/WTP 27.65 mld	
			<i>Leakage on Distribution Service Network Connections up to point of Customer metering 75 mld*</i>	
			<i>Unidentified Water Losses 43.49 mld*</i>	

***Note :-** Based on preliminary study of 144 test zones, figures subject to change after detailed study.

SUMMARY OF PERFORMANCE INDICATORS

Sr. No.	Description	
01.	Population of Nagpur City	23,50,000 souls
02.	System Input Volume	625 mld
03.	Actual Water Supply in Distribution System	490 mld (78%)
04.	Actual Water Sales	241 mld (38%)
05.	UFW (Gross)	384 mld (62%)
	5.1] UFW for Raw Water upto WTP	135 mld (22%)
	5.2] UFW for Treated Water	249 mld (40%)
06.	Total Non-Revenue Water (Administrative + Real)	384 mld (62%)
	6.1] Administrative losses (apparent losses + free water)	236 mld (38%)
	6.2] Real Losses	104 mld (17%)
	6.3] Unidentified Losses	43 mld (7%)
07.	Water cost / unit (1000 ltrs.)	Rs. 5.55/unit
08.	Minimum Water Tariff (1000 ltrs.)	Rs. 3.50/unit
09.	Total Water Connections (inclusive of authorized unbilled)	Appx. 2.0 lakhs
10.	Avg. no. of persons / connections (90% piped water)	10-11
11.	Total Water Connection (inclusive of unauthorized)	Appx. 2.45 lakhs
12.	Total Treated Water Losses (Real + Apparent) excluding raw water losses [490 mld – (billed consumption + unbilled authorized consumption)]	227 mld
13.	Treated Water Losses / Connections (12÷11)	926 ltrs./connection/day
14.	Treated Water Losses / Person (12÷1)	97 ltrs./person/day

Note :- All figures in % given with reference to System Input Volume (625 mld).

LEAK DETECTION STUDY

Leak Detection Study

1.0] OBJECTIVE :-

The second part of water audit is the preparation of leak detection and repair plan, the main objective is **Quantification of Unaccounted for Water (UFW)**

2.0] PRESENT UFW SCENARIO FOR NAGPUR CITY :-

A] As per Preliminary Water Audit Report :-

Sr. No.	UFW	ML	%	Rs. Crore	
					%
i)	Raw Water	37,691	16.90	1.65	2.30
ii)	Other Losses	1,464	0.60	17.55	24.90
iii)	Pure Water	90,746	41.00		
TOTAL		1,28,901	58.50	19.20	27.20

As the UFW rate for Pure Water is very high. The details of zone wise pure water UFW is as under.

Sr. No.	ZONE	QTY. SUPPLIED	QTY. BILLED		NET UFW (MLD)	
		IN MLD	IN MLD	BILLING %	MLD	% **
1	I DHARAMPETH	78.55	48.29	61.47	30.27	12.17
2	II LAXMI NAGAR	54.05	33.80	62.53	20.25	8.15
3	III HANUMAN NAGAR	27.91	11.08	39.69	16.83	6.77
4	IV DHANTOLI	36.16	19.21	53.13	16.95	6.82
5	V NEHARU NAGAR	27.22	16.99	62.44	10.22	4.11
6	VI SOKTA BHAWAN	61.03	25.74	42.18	35.29	14.19
7	VII+IX SATRANJIPURA + ASHINAGAR	115.12	37.45	32.53	77.55	31.15
8	VIII LAKHADGANJ	16.04	9.55	59.56	6.49	2.61
9	X MANGALWARI	44.26	39.27	88.72	4.99	2.01
10	PUMPING/FEEDER MAIN	29.65			29.65	11.93
TOTAL POP. FOR 10 ZONES		490.00	241.38	52.43	248.62	100.00
TOTAL UFW %						50.74

*Combined calculations for Ashinagar & Satranjipura

** Zonal contribution in total UFW

The unaccounted for water in Nagpur is approximate 50% of pure water supply and therefore the situation is alarming.

3.0] METHODOLOGY TO STUDY UNACCOUNTED FOR WATER (UFW) :-

The quantification of UFW is carried using following methods.

3.1] Audible Leak Detection Using Electronic Equipment :-

Audible leak detection uses electronic listening equipments to detect the sounds of leakage. The pressurized water creates audible sound waves that can be sensed and amplified by electronic listening equipments. The sound waves are evaluated to determine exact location of leak.

3.2] Zone Flow Measurement :-

Zone flow measurement is carried by isolating the section of the water system and water flow is allowed through a single line.

Actual flow rates are measured during normal course of operation and during test time when all consumption points are closed. The flow rates during test hours indicates the physical loss due to leaks and loss due to illegal connections.

For quantification of UFW using audible leak detection is more useful for real losses due to underground leaks. To estimate the apparent loss and major leakage, zone flow measurement is used. Therefore the methodology to study the UFW in distribution system is as follows:

3.3] Pre Test Activities :-

3.3.1] Selection of Test Zone :-

The test zone to be studied for UFW is selected with the help of zonal staff which includes the zonal office, Engineers and field staff.

3.3.2] Test Zone Selection Criteria :-

In each ESR command zone, test zone shall include following areas.

■ Housing Category :-

- 1) HIG
- 2) MIG
- 3) LIG
- 4) Slum

Zone with existing distribution system combination of Housing Category may also be selected.

■ No. of Consumer Connections :-

Along the length of the test zone, no. of service connections are restricted to 50 to 60 hours.

■ **Availability of Isolation Valves :-**

It is required to isolate the test zone from the distribution network. The lines with existing isolation valves avoids installation of valves.

■ **Availability of Present Status of Test Zone :-**

- Billing Status.
- Consumer Data.
- Existing Water Meter Details.

3.4] Pipe and Valve Survey :-

Pipe & Valve survey is required to identify and verify the alignment of mains, service connections, location of valves in distribution system, fixing of flow measurement and pressure recording points. If existing isolation valves are not available the location for isolation valves is decided during survey.

3.5] Consumer Connectivity Survey :-

Consumer to consumer survey is conducted in the test zone. The information regarding no. of connections, type of housing category, water meter details, condition of meters and stop tap details are collected during survey. Also the available records of test zone will be verified during survey and the level of satisfaction of consumers is studied.

3.6] Identification of Consumer :-

Identification of consumer for installation of new NMC water meter to study the consumption pattern. [1% of existing no. of meters in test zone selected will be replaced by new meter from NMC.]

3.7] Checking of Existing Flow :-

Checking of existing flow by installation of bulk flow meter and also using Ultrasonic Flow Meter in test zone during normal working hours. Also the flow rate in test zone will measured at consumer tap using bucket-filling method to check the average flow rate.

3.8] Testing of Valves :-

The existing valves will be checked whether working or not. The existing valves are also checked for the no. of threads in normal operating conditions, so that it can be restored to its normal condition of during and after the test.

3.9] Leak Detection Test :-

The leak detection using electronic equipments will be carried out during supply hours and the zone flow measurement will be carried during non supply hours so that the regular supply is not affected. Prior to start of zone flow measurement test all consumer taps are closed and lines with no stop taps are plugged, and also the consumers are appealed to co-operate during the test.

Flow during test hours is measured using flow meters and pressure are recorded on pre decided location. Test generally lasts for about 2 to 4 hours depending on the size and zone selected and the success of this method involves effective co-ordination as multiple activities are required during test.

Working in smaller zones with about 50 to 60 house service connections helps to pay attention to each houses, communication is better and also the normal supply In selected ESR command area is not disrupted.

During the test if the flow recorded is high then additional investigation are required like.

- 01] Audible Leak Detection.
- 02] Multiple Pressure Recordings.
- 03] Visual Leak Detections.

During the test the leak points located by the team are marked to leak repair teams to carryout leak repairs. Zones with major leaks detected, the flow and pressure measurements are rechecked to calculate the benefits of repairs.

On completion of study the connection for pressure measurements are plugged, the plugs and isolation arrangements provided are removed and the valves are opened to normal condition and the line is restored.

3.10] Equipments to be used During Test :-

- 01] Ultrasonic Flow Meters.
- 02] Pressure Gauges.
- 03] Pipe Locators.
- 04] Leak Locators.
- 05] Sounding Rods.
- 06] Tanker and Pump unit (if required).

The detailed breakup of activities along with the respective responsibilities to be shared is given in following table.

Also the team composition of consultant and NMC office staff and time schedule is given for reference.

BREAKUP OF ACTIVITY AND TASK ASSIGNMENT

SR. NO.	DESCRIPTION	RESPONSIBILITY OF			TASK ASSIGNED TO		
		STC LOCAL OFFICE	NMC ZONE OFFICE	NMC HEAD OFFICE	STC LOCAL OFFICE	NMC ZONE OFFICE	NMC HEAD OFFICE
1	Selection of Test zone	✓	✓		PC/JE	ZO/JE	-
2	Survey of test zone for						
2.1	Pipe and Valve location	✓	✓		PC/JE/ASST.	ZO/JE/VO	
2.2	Fixing of location for flow and pressure measurement	✓	✓		PC/JE/ASST.	ZO/JE	
2.3	Housing Category survey	✓	✓		JE/ASST.	ZO/JE	
2.4	Study of existing meter condition	✓	✓	✓	JE/ASST.	ZO/JE/MR	
2.5	Present status of supply in test zone	✓	✓		PC/JE	ZO/JE	
2.6	Number of house connection in test zone with category	✓	✓	✓	JE/ASST.	MI/MR	
2.7	Identification of consumer for replacement meter	✓	✓	✓	PC/JE	ZO/JE	WWPC
2.8	Estimation of items required for isolation of test zone	✓	✓		PC/JE	ZO/JE	
2.9	Population estimation of test zone	✓	✓		JE/ASST.	MI/MR	
3	Consumer record of test zone		✓	✓	PC/JE	MI/MR	
4	Billing record of test zone		✓	✓	PC/JE	MI/MR	
5	Issue and replacement of meter of selected consumer		✓	✓		ZO/JE	WWPC
6	Excavation and provision for flow measurement		✓	✓		JE/MAINT. AGENCY	WWPC
7	Flow and pressure measurement during normal working in test zone.	✓	✓		PC/JE/ASST.	ZO/JE	
8	Intimation to consumer of test zone regarding test	✓	✓		JE/ASST.	MR	
9	Plugging of house service connections in test zone	✓	✓		JE/ASST.	MR	
10	Isolation of test zone	✓	✓		PC/JE/ASST.	ZO/JE/VO	
11	Flow and pressure measurement in test zone for leak deduction.	✓	✓		PC/JE/ASST.	ZO/JE/VO	

SR. NO.	DESCRIPTION	RESPONSIBILITY OF			TASK ASSIGNED TO		
		STC LOCAL OFFICE	NMC ZONE OFFICE	NMC HEAD OFFICE	STC LOCAL OFFICE	NMC ZONE OFFICE	NMC HEAD OFFICE
12	Identification of major and minor leak in test zone						
12.1	<i>Visual inspection method.</i>	✓	✓		PC/JE/ASST.	ZO/JE	
12.2	<i>Leak locator</i>	✓	✓		PC/JE/ASST.		
12.3	<i>Sounding rod</i>	✓	✓		PC/JE/ASST.		
13	Restoration of service in test zone	✓	✓		JE/ASST.	ZO/JE/VO	
14	Estimation of leaks	✓	✓		PC/JE	ZO/JE	
15	Preparation of leak repair plan	✓	✓		PC/JE	ZO/JE	
16	Repair of leaks	✓	✓		PE	MAINT. AGENCY/ VO	
17	Retest if required	✓	✓		PC/JE/ASST.	ZO/JE/VO	

Note: Progress review meeting will be held on every Saturday at consultants local office.

PC - Project Coordinator, JE - Junior Engineer, ASST. - Assistant, VO - Valve Operator, ZO - Zonal Officer, BS - Billing Section, WWPC - Water Works Project Co-ordinator., Maint. Agency - Maintenance Agency

WORK PLAN FOR LEAK DETECTION

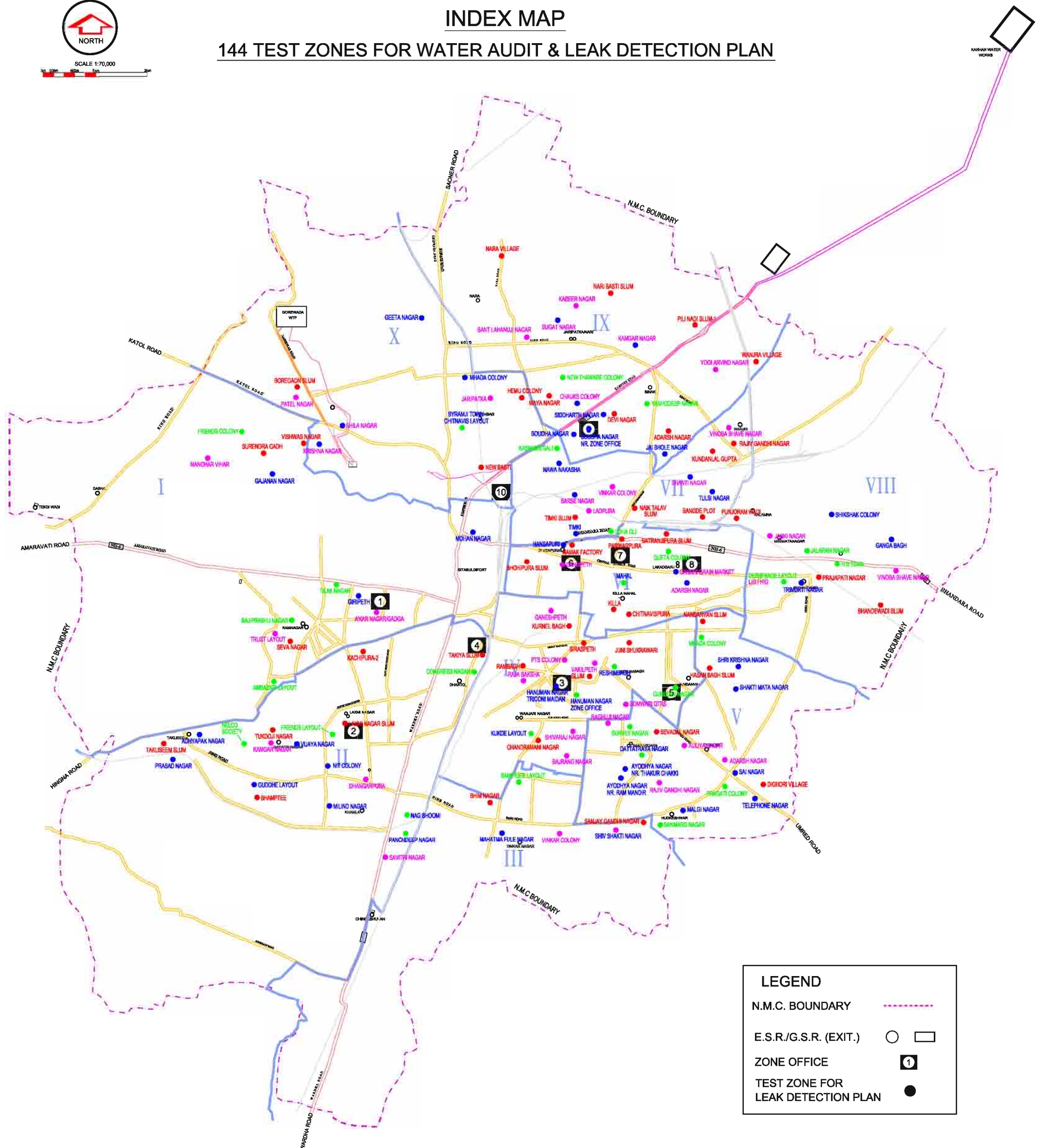
SR. NO.	DESCRIPTION OF ACTIVITY	Time in Days	Start	Finish	Duration in Days
	Pre Test Activity	69	18-Aug-04	08-Oct-04	
1	Selection of Test Zone	11	21-Aug-04	01-Sep-04	21-Aug-04 01-Sep-04
2	Submission of Drawing along with MOM	13	21-Aug-04	03-Sep-04	21-Aug-04 03-Sep-04
3	Preliminary Site Visit	50	23-Aug-04	12-Oct-04	23-Aug-04 12-Oct-04
5	Consumer and Billing Record for Test Zone.	48	01-Sep-04	19-Oct-04	01-Sep-04 19-Oct-04
6	Replacement of consumer meter.	46	06-Sep-04	22-Oct-04	06-Sep-04 22-Oct-04
7	Data Verification including site visit.	51	08-Sep-04	29-Oct-04	08-Sep-04 29-Oct-04



SCALE 1:70,000

INDEX MAP

144 TEST ZONES FOR WATER AUDIT & LEAK DETECTION PLAN



LEGEND

- N.M.C. BOUNDARY -----
- E.S.R./G.S.R. (EXIT.) ———
- ZONE OFFICE 1
- TEST ZONE FOR LEAK DETECTION PLAN ●

Summary of Test Zones for Water Audit, Leak Detection Work							
Zone No.	Zone Name	Housing Category					
		HIG	MIG	LIG	Slum	HIG/MIG	MIG/LIG
1	Dharampeth	Baji Prabhu Nagar	Gajanan nagar	Manohar Vihar	SurendraGadh		
		Ambajari Layout	Giripeth	Trust Layout	Vishwas Nagar		
		Friend Colony			Seva Nagar		
		Tilak Nagar			Ambedkar Nagar, Dharampeth		
2	Laxmi Nagar	Nelco Society / Patel Nagar	Prasad Nagar	Kamgar Nagar	Laxmi Nagar		
		Friends Layout	Gudhe Layout	Dhangarpura	Bhamptee Village	Panchdeep Nagar	
		Congress Nagar	Vijaya Nagar	Savitri Nagar	Tukdoji Nagar	Nag Bhumi layout	
			NIT Layout Gittikhadan		Takliseem		
			Milind Nagar		Takiya		
			Adhyapak Nagar				
3	Hanuman Nagar	Benerjee Layout	Mahatma Fule Nagar	Bajrang Nagar	Chandramani Nagar	Kukde Layout	Shiv Shakti Nagar No.1
				Shivraj Nagar (viswakarma nagar)	Bhim Nagar		
				Vinkar Colony	Sanjay Gandhi Nagar		
4	Dhantoli		Trikoni Maidan	Somwari Quarters	Juni Shukrawari	Reshimbag	
				Raja Baksha	Siraspeth	Hanuman Nagar	
				Ganeshpeth behind police stn.	Kurnel Bagh		
				PTS Colony	Rambag		
				Vakil Peth LIG	Vakil Peth Slum		
5	Nehru Nagar	Surve Nagar	Ayodhya Nagar(Near Ram Mandir)	Rajiv Gandhi Nagar	Sevalal Nagar	Dattatraya Nagar	
		Sanmarg Nagar	Ayodhya Nagar(Near Thakur chakki)	Raghuji Nagar	Dighori Village		
		Pragati Colony	Old Malgi Nagar	New Malgi Nagar	Hasanbagh Slum		
		Gurudeo Nagar	Sai Nagar	Adarsh Nagar	Nandanvan Slum		
		Mhada Colony	Telephone Nagar	Auliya Nagar			
			Shakti Mata Nagar				
			Shri Krishna Nagar				
6	Gandhibag (sokta bhavan)	Queta Colony	Hansapuri Old, Bhandra Road	Ganjipeth, near Shukawat ali Sq.	Bhohipura, near Santra market	Mahal Near Sangh Bldg.	Gandhi Gate Market
					Chitnavispura		Aadarsh Nagar
					Namak Factory Slum		
					Killa Mahal, near Pakwasa Hospital		
					Santranjipura		
7	Satranjipura	Loha Oli	Timki Near Ganjakhet Chowk	Ladpura Nandgiri Road	Timki Near Kurudkar Rd.		Barse Nagar
		Kashmiri Gali	Nawa Nakasha	Vinkar colony, tandapeth	Parwarpura, near Itwari		Shanti Nagar
			Tulsi Nagar	Vinoba Bhawe Nagar	Naik Talav Slum		
					Rajiv Gandhi Nagar		
					Bangde Layout		
8	Lakadganj	Deshpande Layout	Trimurti Nagar	Deshpande Layout Nr. Haldiram	Prajapati Nagar		
		H B Town	Gangabag, Pardi	Vinoba Bhawe Nagar pardi	Bhandewadi		
		Jalaram Nagar		Janki Nagar	Pujoramwadi, near Dipti signal		
				Shishak Nagar			
9	Ashi Nagar	Yashodeep Nagar	Anand Nagar	Yogi Arvind Nagar	Adarsh Nagar		
		New Thaware Nagar	Boudha Nagar, Indora Sq.	Jaripatka, near Choudri sq.	Devi Nagar		
			Boudha Nagar,Zone office		Hemu Colony		Chawks Colony
			Siddarth Nagar	Sant Lahanuji Nagar	Pili Nadi - 1		Sugath Nagar
				Kabeer Nagar	Wanjra village		Kamgar Nagar
					Maya Nagar		
					Nari Basti		
					Nara Village		
10	Mangalwari			Patel Nagar	Geeta Nagar	Byramji town	Shiela Nagar
			Mohan Nagar	MHADA Colony	New Basti		Krishna Nagar
					Borgaon Slum		
TOTAL		21	28	32	45	8	10

SLUM POLICY

DRAFT POLICY RECOMMENDATIONS FOR WATER SUPPLY IN SLUM AREA IN NAGPUR CITY

1.0] PREAMBLE :-

The population of Nagpur City in the year 2001 works out to around 21.50 lakhs. As per the slum study reports of Nagpur Municipal Corporation. The population residing in slum is 7.14 lakhs which works out to 33.21% of the total population of Nagpur City.

The total supply to Nagpur City from all sources is 510 MLD out of which in the proportion of population, the water reaching to slums is about 1/3 i.e. 170 MLD. In view of the fact that almost all slums are covered by piped water supply. Less than 50% of structures of slum are having legal connections & out of all the legal connections less than 20% of recovery is achieved. Water supplied in terms of quantity is at par with or more than the normal residential area. Responsibility of Wastage of water and revenue loss for the quantum of water supplied beyond 70 LPCD, lies with NMC, as slum dwellers do not have any utilization of water other than personal use.

2.0] CASE STUDIES FOR WATER SUPPLY TO REPRESENTATIVE SLUMS :-

To conduct case studies for water supply to slums, Rambagh Slum (Code No. 244) and a group of slums comprising Pandharabodi (Code No. 105), Sevanagar (Code No. 123) and new Pandharabodi (Code No. 116) slums were selected as representative slums. The studies were conducted during the period from 6/1/04 to 29/1/04 and, 21/1/04 to 6/2/04. It was found that the Rambagh Slums gets practically 24 hours water supply where as Pandharabodi and allied slums receive water for 3 to 4 hours.

Flow meters were installed at all the entry points of pipe lines leading to above slums. The inferences of the case studies were that the Rambagh Slum gets water to extent of 558 LPCD vis-à-vis 93 LPCD in the Pandharabodi and allied slums. The case studies conducted are annexed herewith. The average water supply for City is appx. 140 LPCD.

3.0] C.P.H.E.E.O. NORMS OF MINIMUM WATER SUPPLY TO (COMMUNITIES) :-

The norms are as follows :

- 3.1] For Public stand Post 40 LPCD
- 3.2] For others 70 LPCD

As could be seen from the case studies, water supply to the representative slums is much more than the prescribed norms.

4.0] GENERAL INFORMATION ABOUT THE SLUM :-

As per the slum data prepared by the NMC the population residing in 430 slums area is 7,14,425 souls housed in 1,24,274 structures. The number of persons per structure works out to 5.74. For the purpose of calculating water supply etc. the figure is taken as 6 persons per structure.

5.0] COST OF WATER SUPPLY IN NAGPUR CITY :-

The annual operation and maintenance cost of water supply to Nagpur City is appx. Rs. 95 crores (including of PENCH-III) for a corresponding water supply of 490 MLD. Thus the cost of water per unit of 1000 ltrs. Of water works out to Rs. 5.55.

As per the above stated cost of water, the annual dues payable to NMC from slums is about Rs. 35 crores. In view of the financial standard prevailing in the slums it is just not possible for NMC to recover such a huge amount. In the field of water supply the slums are on par with other localities but when the recovery aspect is taken into consideration, the slums are far behind as has already been stated in the foregoing paras. The situation therefore warrants formulation of a viable policy to ensure only necessary water supply to the slums and corresponding revenue recovery therefore.

6.0] CATEGORIES OF STRUCTURES :-

While drafting the policy, the structures in the slums have been categorised as below :

- 6.1] Kaccha Structure
- 6.2] Pacca Structure
- 6.3] Multi Storied Structure

The rate of water supply to Kaccha structure and P.W.S. is taken as 40 LPCD and for others it is 70 LPCD as per the CPHEEO norms (see Table-D).

7.0] CALCULATIONS FOR WATER CHARGES :-**A] Kaccha Structure :-**

i]	No. of persons per structure	6
ii]	Rate of Water Supply	40 LPCD
iii]	Total water supply in a day / structure	240 liters.
iv]	Total water supply in a month (240X31)	7440 liters i.e. 7.5 units.

With cost of water charges at Rs. 5.55 per unit, water charges per structure per month Rs. 40.70

B] Pacca Structures

i]	No. of persons per structure	6
ii]	Rate of Water Supply	70 LPCD
iii]	Total water supply in a day / structure	420 liters.
iv]	Total water supply in a month (420X31)	13020 liters i.e. 13.02 units.

With cost of water charges at Rs. 5.55 per unit, water charges per structure per month Rs. 72.26

In view of the financial status of the slum dwellers, the water charges per structure per month as calculated above need to be subsidised. The difference in the water charges as calculated and as recommended below can be made good from the slightly higher water charges levied to commercial establishment of other areas.

8.0] RECOMMENDATIONS :-

- 8.1] The water charges in the slums should be levied as part of property tax.
- 8.2] The meterisation in slum areas should be totally dispensed with for the following reasons.
 - 8.2.1] Very large establishment is required for meter reading, preparation of bills, dispatch of bills and recovery of water bills.
 - 8.2.2] It is very difficult to trace the illegal connection in the slum areas. Measures to identify illegal connections in the slum area lead to law and order situations.
 - 8.2.3] The recover of water charges becomes more cost effective and viable to greater extent when levied as a part of property tax.
 - 8.2.4] Duplication of work by the water & property tax departments needs to be avoided.
- 8.3] With a consideration of subsidy (appx. 30%) the following rate structure is recommended for the slum areas.
 - 8.3.1] Kaccha structure Rs. 30/- per structure per month.
 - 8.3.2] Pacca structure Rs. 50/- per structure per month.
 - 8.3.3] Double storied structure Rs. 80/- per structure per month

While implementing above tax structure, it is essential on the part of NMC that corrective measures for water supply system for slum area are under taken so that in no case water supply to a slum exceeds 70 LPCD. To achieve this, the NMC has to incur some expenditure for system corrections. After developing the revised system the probability of revenue recovery will be very high. Simultaneously water supply of the required level shall be achieved. The water as saved from slums can be diverted to other localities and corporation's revenue enhanced multifold.

Hence NMC can reduce the supply to maximum 50 MLD to slum area i.e. 10% of total 510 MLD of water with above measures & treat slum water supply system as a community water scheme with measured (ensured) water supply to each slum area & reduce the Unaccount For Water (UFW) for Nagpur City.



Water Loss at Stand Post / Illegal Connections in Slums

Table-A
LIST OF SLUMS IN NAGPUR CITY

Sr. No.	Identity Code	Name of slums	Old Code no.	Constituency	Status	Prabhag 2002	Also in Prabhag 2002	Zone 2002	PTS map available	House List available	Population	No. of structures	Source of Water Supply
1	NW2302	Gaddigudam(1)	322	C	Notified	14	30	10			4970	903	P/PWS/B/W
2	NW2303	East of Gaddigudam (1)	924	C	Not in Masterlist `98	14		10			520	94	P/PWS/B/W
3	NW2404	Khalasi Line (1)	314	C	Notified	30		10	Yes	Yes	2282	415	P/PWS/B/W
4	NW2403	Lala Garden	323	C	Notified	30		10	Yes	Yes	440	80	P/PWS/B/W
5	NW2401	Harijan Basti	324	C	Notified	30		10			555	100	P/PWS/B/W
6	NE2604	Kostipura	319	C	Notified	31		9			1014	184	P/PWS/B/W
7	CE0401	Zangripura	303	C	Notified	32		6			1085	197	P/PWS/B/W
8	CE0402	Bhankheda	309	C	In Masterlist but not notified	32		6	Yes		12755	2319	P/PWS/B/W
9	CE0403	Bansod Mohalla	310	C	In Masterlist but not notified	32		6	Yes		2131	387	P/PWS/B/W
10	CE0202	Boriyapura part(II) (North of Crrodach road)	311	C	Notified	32		6	Yes		1853	337	P/PWS/B/W
11	CE0201	Boriyapura(2)	312	C	Notified	32		6	Yes	Yes	5413	984	P/PWS/B/W
12	CE0101	Dobi Nagar	321	C	Notified	32		6	Yes		4919	394	P/PWS/B/W
13	CE0102	East of Dobi Nagar	926	C	Not in Masterlist `98	32		6	Yes		210	38	P/PWS/B/W
14	CE0704	Kumbharpura, Lodpura	299	C	Notified	33		7			2144	390	P/PWS/B/W
15	CE0601	Chimabaipeth	301	C	Notified	33		7	Yes	Yes	1726	314	P/PWS/B/W
16	CE0501	Kosaripura	304	C	Notified	33		7			2170	394	P/PWS/B/W
17	CE0502	Shobhakhet	306	C	Notified	33		7	Yes	Yes	3340	607	P/PWS/B/W
18	CE0602	Jagnath Budhwari Kumbharpura	317	C	Notified	33		7			1241	225	P/PWS/B/W
19	CE0603	Koshthipura, Bangali Panja	298	C	Notified	35		7			877	159	P/PWS/B/W
20	CE2503	Bhaldarpura(2)	290	C	Notified	43		6			4438	807	P/PWS/B/W
21	CE2501	Nayapura,Bhoipura	295	C	Notified	43	44	6			3041	553	P/PWS/B/W
22	CE2301	Lodhipura,Bajeria	297	C	Notified	44		6			2703	491	P/PWS/B/W
23	CE0302	Diwanshah Takiya	300	C	Notified	44	33	6	Yes		3250	591	P/PWS/B/W
24	CE0301	Mominpura Takiya	307	C	Notified	44		6	Yes		4341	789	P/PWS/B/W
25	CE0203	Boriyapura part(I) (South of Crrodach road)	311	C	Notified	44		6	Yes		6043	1098	P/PWS/B/W
26	CE030102	Panaipeth Mochipura	320	C	In Masterlist but not notified	44		6	Yes		750	145	P/PWS/B/W
27	CE2302	Lodhipura	326	C	Notified	44		6			3340	609	P/PWS/B/W
28	NW2301	Gaddigudam (2)	313	C	Notified	14	30	10			2550	463	P/PWS/B/W
29	NW2402	Khalashi Line(2)	315	C	Notified	30		10	Yes	Yes	150	27	P/PWS/B/W

30	NE2605	Kuraidpura	305	C	Notified	31	9		839	152	P/PWS/B/W
31	CE2502	Bhaldarpura(1)	296	C	Notified	43	6		3250	591	P/PWS/B/W
32	CE3001	Khapri Mohalla	291	C	Notified	45	6		2703	491	P/PWS/B/W
33	CE3002	Kumbharpura Itwari	292	C	Notified	45	6		2261	411	P/PWS/B/W
34	CE2901	Budhukhan Minara	293	C	Notified	45	6		3249	591	P/PWS/B/W
										77551	13604
1	CE1901	Minimata Nagar	027	E	In Masterlist but not notified	4	8		9532	1733	P/PWS/B/W
2	CE1601	Dy. Signal	036	E	Notified	4	8	Yes	Yes	11249	1729 P/PWS/B/W
3	CE2201	Punapur Village	067	E	Notified	4	8		812	148	P/PWS/B/W
4	CE2101	Bharatwada Village	068	E	Notified	4	8		988	180	B/W/W
5	CE1602	Sakharam Wadi	078	E	Notified	4	8	Yes	Yes	1144	189 B/W/W
6	CE1801	Chikhali	087	E	Notified	4	8		540	98	B/W/W
7	CE1604	East of Deputy Signal	957	E	Not in Masterlist `98	4	8	Yes	Yes	3189	563 B/W/W
8	CE1902	Panch Zopada (Minimata Nagar)	978	E	Not in Masterlist `98	4	8	Yes	Yes		
9	CE1605	Gopal Nagar (East of Dy. Signal)	979	E	Not in Masterlist `98	4	8		716	144	B/W/W
10	CE1606	Santoshi Nagar (S-E of Dy. Siganl)	980	E	Not in Masterlist `98	4	8		432	93	B/W/W
11	CE5001	Wathoda	022	E	Notified	5	8		1950	354	P/PWS/B/W
12	CE4901	Bhandewadi-2	026	E	Notified	5	8	Yes		4100	745 Partial
13	CE4501	Hasanbag 1&2	055	E	Notified	5	21	8	Yes	Yes	8180 1236 P/PWS/B/W
14	CE4601	Sonbaji Nagar	060	E	Notified	5	8		786	142	Partial
15	CE4802	Old Pardi	062	E	Notified	5	8		909	164	B/W/W
16	CE4404	Hiwari Nagar	064	E	Notified	5	8	Yes		4028	742 P/PWS/B/W
17	CE4406	New Panther Ngr.	328	E	Notified	5	8		2500	454	P/PWS/B/W
18	CE4701	Adarsha Nagar (West of ring road)	329	E	Notified	5	8		550	100	Partial
19	CE4702	Adarsha Nagar (East of ring road)	329	E	Notified	5	8		210	38	Partial
20	CE4704	Nehru Nagar	330	E	Notified	5	8		1350	245	B/W
21	CE4401	Jai Bajrang Nagar	332	E	Notified	5	8	Yes	Yes	660	120 B/W/W
22	CE4405	Hiwari Nagar,Padole Nagar-2	351	E	Notified	5	8		2100	382	P/PWS/B/W
23	CE5101	Sangharsh Nagar	353	E	Notified	5	8		2000	364	B/W/W
24	CE5201	Shivankar Nagar	354	E	Notified	5	8		1800	327	P/PWS/B/W
25	CE4801	NITE12:Chandra Nagar Near Nallah	367	E	In Masterlist but not notified	5	8		468	85	B/W/W
26	CE4703	Prajapati Nagar	400	E	In Masterlist but not notified	5	8		1378	250	B/W/W
27	CE5002	North of Wathoda (Along Road)	932	E	Not in Masterlist `98	5	8		200	36	Partial
28	CE4903	East of Hanuman Nagar on old Pathway	933	E	Not in Masterlist `98	5	8	Yes		460	83 Partial

29	SE1503	Tajbagh	002	E	Notified	6	5		9000	1636	P/PWS/B/W
30	SE1301	Bidipeth	003	E	Notified	6	5		1500	272	P/PWS/B/W
31	SE1502	Sindiban	005	E	Notified	6	5		800	145	P/PWS/B/W
32	CE5301	Dighori	021	E	Notified	6	5		1040	189	P/PWS/B/W
33	SE1601	Yaseen Plot	054	E	Notified	6	5		1800	327	Partial
34	SE1202	Sewadal Nagar	065	E	Notified	6	5	Yes	4737	861	P/PWS/B/W
35	CE5401	Harpur Nagar	082	E	Notified	6	5		1105	200	P/PWS/B/W
36	SE1501	Tajamma Colony	083	E	Notified	6	5		500	91	P/PWS/B/W
37	SE1602	Nirala (Gausia Plot)	085	E	Notified	6	5		1000	182	P/PWS/B/W
38	SE1603	Azad colony	953	E	Not in Masterlist `98	6	5		2500	454	P/PWS/B/W
39	SE1504	Auwaliya Nagar	964	E	Not in Masterlist `98	6	5		400	73	Partial
40	SE1505	NW of sindiban	965	E	Not in Masterlist `98	6	5		400	70	P/PWS/B/W
41	SE1801	Sanjay Nagar (North of ring road)	007	E	Notified	7	3		918	167	P/PWS/B/W
42	SE1402	NITE40: Kh.No.82/2 Mz.Sakkardara	396	E	In Masterlist but not notified	7	3		975	177	P/PWS/B/W
43	SE1802	Sanjay Gandhi Nagar (South of ring road)	402	E	Notified	7	3		1606	292	P/PWS/B/W
44	SE1803	New Nehru Nagar	927	E	Not in Masterlist `98	7	3		3000	545	P/PWS/B/W
45	CE1509	Shanti Nagar-1	029	E	Notified	19	7		9883	1796	P/PWS/B/W
46	CE1510	Shanti Nagar-2	030	E	Notified	19	7	Yes Yes	1430	122	P/PWS/B/W
47	CE1503	Shanti Nagar-3	031	E	Notified	19	7	Yes Yes	1410	114	P/PWS/B/W
48	CE1504	Shanti Nagar-4	032	E	Notified	19	7		539	98	P/PWS/B/W
49	CE1505	Shanti Nagar-5	033	E	Notified	19	7		2112	384	P/PWS/B/W
50	CE1506	Shanti Nagar CRPR colony	034	E	Notified	19	7		546	99	P/PWS/B/W
51	CE1508	Jagruti Nagar	035	E	Notified	19	7		1085	197	P/PWS/B/W
52	CE1507	Shanti Nagar	057	E	In Masterlist but not notified	19	7		2112	384	P/PWS/B/W
53	CE1502	Zopadpatti near Kuttewala B. M.	069	E	In Masterlist but not notified	19	7		90	16	P/PWS/B/W
54	CE4402	Gorakumbharpura	024	E	Notified	20	8	Yes Yes	2975	475	P/PWS/B/W
55	CE1701	Mehatarpura	038	E	Notified	20	8	Yes Yes	1092	198	P/PWS/B/W
56	CE1702	Sudarshan Nagar	039	E	Notified	20	8	Yes Yes	754	137	P/PWS/B/W
57	CE1703	NITE16: Plot No.50, Small factory area	371	E	In Masterlist but not notified	20	8		1000	182	P/PWS/B/W
58	CE4301	Nandanvan-1	023	E	Notified	21	5	Yes Yes	14420	2403	P/PWS/B/W
59	CE4302	Nandanvan - 2	056	E	In Masterlist but not notified	21	5	Yes Yes			P/PWS/B/W
60	CE4003	Juni Shukrawari	018	E	Notified	22	5		1715	311	P/PWS/B/W
61	CE4001	Kunbipura	019	E	In Masterlist but not notified	22	5		3898	709	P/PWS/B/W
62	CE4201	Gayatri Nagar	079	E	Notified	22	5	Yes Yes	1070	185	P/PWS/B/W

63	SE1203	Sakkardara	001	E	Notified	23	5	Yes	Yes	2703	491	P/PWS/B/W
64	SE1201	NITE39: Kh.No.25,36/2 Mz.Sakkardara	395	E	In Masterlist but not notified	23	5			1650	350	P/PWS/B/W
65	SE1303	East of Rajeev Nagar	934	E	Not in Masterlist `98	23	5			100	18	P/PWS/B/W
66	CE4202	Along Nagnallah side of Keshav Nagar	943	E	Not in Masterlist `98	23	5	Yes	Yes	40	7	P/PWS/B/W
67	CE1301	Telipura-1	050	E	Notified	35	7			1949	354	P/PWS/B/W
68	CE1304	Bhamti pura	086	E	Notified	35	7			1325	241	P/PWS/B/W
69	CE1303	Slum Near Tumania Masjid	327	E	Notified	35	7			700	127	P/PWS/B/W
70	CE1302	Boudhapura	408	E	Notified	35	7			1100	200	P/PWS/B/W
71	CE4104	Gujar Nagar	028	E	Notified	36	8	Yes	Yes	916	123	P/PWS/B/W
72	CE3401	Garoba Maidan -1	041	E	Notified	36	8	Yes	Yes	845	154	P/PWS/B/W
73	CE3103	Chinteshwar	047	E	Notified	36	8			3249	591	P/PWS/B/W
74	CE3101	Bairagipura	048	E	Notified	36	8			2976	541	P/PWS/B/W
75	CE3003	Ganga Jamuna,Koshthipura	052	E	Notified	36	8			221	40	P/PWS/B/W
76	CE1401	Satranjipura-1	053	E	Notified	36	8			3249	591	P/PWS/B/W
77	CE3104	Rampeth	059	E	Notified	36	8			1332	242	P/PWS/B/W
78	CE4105	Shivaji Nagar	010	E	In Masterlist but not notified	37	38	8		5471	995	P/PWS/B/W
79	CE4103	Bhuteshwar colony	011	E	Notified	37	8	Yes	Yes	9162	1666	P/PWS/B/W
80	CE4102	Nandaji Nagar	012	E	Notified	37	8			1066	194	P/PWS/B/W
81	CE4101	Gondapura, Shivaji	013	E	Notified	37	8			2274	413	P/PWS/B/W
82	CE3302	Hattinallah-1	044	E	Notified	37	8	Yes	Yes	9552	1736	P/PWS/B/W
83	CE3301	Hattinallah-2	045	E	Notified	37	8	Yes	Yes	7648	1390	P/PWS/B/W
84	CE3303	Dhivarpura	058	E	Notified	37	8	Yes	Yes	2372	431	P/PWS/B/W
85	CE3201	Deoghare(Mataghare) Mohalla	071	E	Notified	37	8			2600	472	P/PWS/B/W
86	CE3304	Boudha Mohalla	081	E	Notified	37	8	Yes	Yes	1995	363	P/PWS/B/W
87	CE3901	Killa	009	E	Notified	38	6			4873	886	P/PWS/B/W
88	CE3902	Alimia Chawl	014	E	Notified	38	6			2007	364	P/PWS/B/W
89	CE3703	Tulsibagh	015	E	Notified	38	6	Yes		3249	591	P/PWS/B/W
90	CE3701	Rahatekar wadi	016	E	Notified	38	42	6	Yes	1852	337	P/PWS/B/W
91	CE4002	Malipura	020	E	In Masterlist but not notified	38	6			3249	591	P/PWS/B/W
92	CE3903	Zopadatti on Shukrawari road	075	E	In Masterlist but not notified	38	6			442	80	P/PWS/B/W
93	CE3702	Chandani Mohalla	017	E	In Masterlist but not notified	42	4	Yes		632	115	P/PWS/B/W
94	CE3502	Habeeb ka akhada	008	E	Notified	45	6			1592	290	P/PWS/B/W
95	CE4403	Kumbhartoli-2	331	E	Notified	20	8	Yes	Yes	340	62	P/PWS/B/W
96	SE1302	Rajiv Nagar	006	E	Notified	23	5			260	47	P/PWS/B/W

97	CE3102	Kumbharpura GangaJamuna	046	E	Notified	36	8			1358	247	P/PWS/B/W	
98	CE3305	Chinchpura	042	E	Notified	37	8	Yes	Yes	1520	276	P/PWS/B/W	
99	CE2001	Bhandewadi-3	061	E	Notified	4	8			2313	421	B/W/W	
100	CE1603	Punjaram wadi	077	E	Notified	4	8	Yes	Yes	1265	250	B/W/W	
101	CE3004	Koshthipura, Hamalpura	049	E	Notified	45	6			2170	394	P/PWS/B/W	
102	CE4902	Hanuman Nagar	084	E	Notified	5	8	Yes		3132	569	P/PWS/B/W	
103	SE1401	Adiwasi Nagar	004	E	Notified	7	3			1500	272	P/PWS/B/W	
										219331	38728		
1	NW2101	Bhim Nagar	909	N	Not in Masterlist `98	1	10			815	148	P/PWS/B/W	
2	NE0601	Indora (3)	195	N	Notified	2	9	Yes	Yes	1557	253	P/PWS/B/W	
3	NE0603	Indora (4)	196	N	Notified	2	15	9	Yes	Yes	4561	776	P/PWS/B/W
4	NE0604	New Indora Zopda	197	N	Notified	2	9	Yes	Yes	433	64	P/PWS/B/W	
5	NE0102	Nara village	212	N	Notified	2	9	Yes	Yes	1989	362	P/PWS/B/W	
6	NE0201	Nari village	213	N	Notified	2	9			1352	246	P/PWS/B/W	
7	NE0401	Kasturba Nagar	218	N	Notified	2	9	Yes	Yes	943	171	P/PWS/B/W	
8	NE1002	Pili Nadi (2)	219	N	Notified	2	9			722	131	P/PWS/B/W	
9	NE1001	Bh.Anand Kausalyayan Nagar	337	N	Notified	2	9			2340	425	P/PWS/B/W	
10	NE0202	Takshashila	338	N	Notified	2	9			828	168	P/PWS/B/W	
11	NE0801	Ramaai Nagar	339	N	Notified	2	16	9		962	175	P/PWS/B/W	
12	NE0402	NITE 36: Kh.No.57,58/2 Mz.- Mankapur	392	N	In Masterlist but not notified	2	9			1748	318	P/PWS/B/W	
13	NE0301	NITE 37:(Kh.No.25/1-2-3 Mz.- Indora) / Martin Nagar	393	N	In Masterlist but not notified	2	9	Yes	Yes	431	128	P/PWS/B/W	
14	NE0302	Indira Nagar	410	N	In Masterlist but not notified	2	9	Yes	Yes	1323	367	P/PWS/B/W	
15	NE0101	East of Nara Village	901	N	Not in Masterlist `98	2	9			150	27	B/W/W	
16	NE0204	South of Taxshashila (Along Nari Road)	902	N	Not in Masterlist `98	2	9			140	20	P/PWS/B/W	
17	NE0203	South of Nari Village (Along Nari Road)	903	N	Not in Masterlist `98	2	9			50	6	P/PWS/B/W	
18	NE1003	Between Old & New Kamptee Road	911	N	Not in Masterlist `98	2	9			610	87	P/PWS/B/W	
19	NE2001	Sanjay Nagar	182	N	Notified	3	9	Yes	Yes	2631	470	P/PWS/B/W	
20	NE2007	Dhammadeep Nagar	211	N	Notified	3	9	Yes	Yes	1950	373	P/PWS/B/W	
21	NE1101	Pili Nadi (1)	214	N	Notified	3	9			2626	477	P/PWS/B/W	
22	NE2101	Kalamna Village	215	N	Notified	3	9			990	141	B/W/W	
23	NE1202	Wanjara (wasti) village	222	N	Notified	3	9	Yes	Yes	657	119	B/W/W	
24	NE1401	Wanjri	229	N	In Masterlist but not notified	3	9			884	160	P/PWS/B/W	
25	NE2004	Anand Nagar, Gondpura	237	N	Notified	3	9	Yes	Yes	761	138	P/PWS/B/W	
26	NE2005	Indira Mata Nagar	241	N	Notified	3	9	Yes	Yes	1709	310	P/PWS/B/W	

27	NE2010	Dhammadeep Nagar - 2	345	N	Notified	3	9	Yes	Yes	1209	215	P/PWS/B/W
28	NE2008	NITE 31: Kh.No. 92/1-2-3 Mz.- Binaki	386	N	In Masterlist but not notified	3	9			0	0	P/PWS/B/W
29	NE1501	Santosh Nagar (NIT Land)	387	N	Notified	3	9			1800	253	P/PWS/B/W
30	NE1301	Garib Nawaz Nagar (NIT Land)	389	N	Notified	3	9			6460	1174	P/PWS/B/W
31	NE1302	NITE34: b)Kh.No.Abdul Hameed Nagar	390	N	In Masterlist but not notified	3	9			600	109	P/PWS/B/W
32	NE1201	Wanjra (North Along Road)	912	N	Not in Masterlist `98	3	9			750	105	P/PWS/B/W
33	NE2003	North of Chamar Nallah/Sanjay Nagar	913	N	Not in Masterlist `98	3	9			399	72	P/PWS/B/W
34	NE2009	South of Dhammadeep Nagar	914	N	Not in Masterlist `98	3	9			550	78	P/PWS/B/W
35	NE2006	South of Indira Mata Nagar	930	N	Not in Masterlist `98	3	9			651	93	P/PWS/B/W
36	NE1102	South of pili nadi (1)	961	N	Not in Masterlist `98	3	9			325	59	P/PWS/B/W
37	NE1103	Matoshree Ramai Nagar	962	N	Not in Masterlist `98	3	9			639	115	PWS/B/W
38	NE1104	Bhimwadi	963	N	Not in Masterlist `98	3	9			750	136	PWS/B/W
39	NE2102	Nagraj Nagar (NE of Kalamna)	970	N	Not in Masterlist `98	3	9			250	45	PWS/B/W
40	NE3302	Aayesha Nagar	975	N	Not in Masterlist `98	3	9			674	122	P/PWS/B/W
41	NE2201	Bezanbagh (2)	201	N	Notified	14	10			1900	271	P/PWS/B/W
42	NW2102	Adiwasi Nagar (2)	203	N	Notified	14	10			1955	355	B/W
43	NE2202	Mekosabagh	204	N	In Masterlist but not notified	14	10			581	83	P/PWS/B
44	NW2201	Gadheghat chhawani	205	N	Notified	14	10	Yes	Yes	920	167	B/W
45	NW2204	Goa Colony	221	N	Notified	14	10			1135	206	P/PWS/B
46	NE2205	Dilip Nagar, Mukund Nagar	224	N	Notified	14	10			868	124	P/PWS/B
47	NE2204	Lumbini Nagar	239	N	Notified	14	10			2919	417	P/PWS/B/W
48	NE2203	Angulimal Nagar	240	N	In Masterlist but not notified	14	10			560	80	P/PWS/B/W
49	NW2202	Navin Basti Chhawani	407	N	Notified	14	10			2825	513	P/PWS/B/W
50	NE2504	West of Noga Factory	955	N	Not in Masterlist `98	14	10			770	110	P/PWS/B/W
51	NE2506	South of Punjabi Line (Near hanuman Temple)	967	N	Not in Masterlist `98	14	10			345	62	P/PWS/B/W
52	NE0605	Indora (2)	194	N	Notified	15	10	Yes	Yes	4269	780	P/PWS/B/W
53	NE0501	Jaripatka	199	N	Notified	15	10			3249	590	P/PWS/B/W
54	NE2301	Bezanbag (1)	200	N	Notified	15	10	Yes	Yes	1521	276	P/PWS/B/W
55	NE0606	South of Indora (2) Triangular Portion	908	N	Not in Masterlist `98	15	10	Yes	Yes	150	27	P/PWS/B/W
56	NE3401	Old Jaripatka & Matoshree Ramai Nagar	954	N	Not in Masterlist `98	15	10			1939	212	P/PWS/B
57	NE3402	Ambedkar Nagar Zopadpatti (East of Mahavir Nagar,Jaripatka)	968	N	Not in Masterlist `98	15	10			300	54	
58	NE1602	Rahul Nagar, Azad Nagar	180	N	Notified	16	9	Yes	Yes	3899	710	P/PWS/B/W
59	NE1601	Habib Nagar	210	N	Notified	16	9	Yes	Yes	2925	531	P/PWS/B/W
60	NE0901	Manav Nagar	243	N	Notified	16	9	Yes		2255	410	P/PWS/B/W

61	NE0903	Shende Nagar	340	N	Notified	16	9			2405	437	P/PWS/B/W
62	NE0902	N-W Corner of Shende Nagar	910	N	Not in Masterlist `98	16	9			150	27	P/PWS/B/W
63	NE1904	Along Chamar Nallah (North of Khobragade Nagar)	956	N	Not in Masterlist `98	16	9			42	6	P/PWS/B/W
64	NE1901	Panchsheel Nagar (1)	175	N	Notified	17	9	Yes	Yes	3697	617	P/PWS/B/W
65	NE3003	Binaki (1)	176	N	Notified	17	9			4614	838	P/PWS/B/W
66	NE3002	Binaki (2)	177	N	Notified	17	9			689	125	P/PWS/B/W
67	NE3004	New Mangalwari	178	N	Notified	17	9			1410	201	P/PWS/B/W
68	NE1801	Panchsheel Nagar (2)	207	N	Notified	17	9	Yes	Yes	1073	195	P/PWS/B/W
69	NE1701	BabaBoudha Nagar,Taj Nagar	208	N	Notified	17	9	Yes	Yes	5199	945	P/PWS/B/W
70	NE1903	Khobragade Nagar	220	N	Notified	17	9	Yes	Yes	1300	236	P/PWS/B/W
71	NE3001	Binaki (3)	228	N	In Masterlist but not notified	17	9			533	97	P/PWS/B/W
72	NE2901	Panchakua Kumbhar Basti	232	N	Notified	17	9			1151	209	P/PWS/B/W
73	NE2802	Bapukuti	238	N	Notified	17	9			660	120	P/PWS/B
74	NE2002	NITE17: Kh. No. 21/1 Mz. - Binaki	372	N	In Masterlist but not notified	17	9			1000	182	P/PWS/B/W
75	NE1902	Area Bet.Tajnagar, Chamarnallah & Panchsheel nagar	929	N	Not in Masterlist `98	17	9	Yes	Yes	700	129	P/PWS/B/W
76	NE2803	South of Vaishali Nagar along Calcutta Rly. Line	971	N	Not in Masterlist `98	17	9			1000	182	P/PWS/B/W
77	CE1102	Bahuli Vihir	165	N	In Masterlist but not notified	18	7			2274	413	P/PWS/B/W
78	CE1101	Gondpura,Prem Nagar (1)	170	N	Notified	18	7			4808	874	P/PWS/B/W
79	NE3102	Bokade Mohalla	171	N	In Masterlist but not notified	18	7			1110	160	P/PWS/B/W
80	NE2903	Joshiपुरa	179	N	Notified	18	7			839	152	P/PWS/B/W
81	NE2904	Binaki Tekada	209	N	Notified	18	7			572	104	P/PWS/B/W
82	NE2902	Sonartoli	216	N	Notified	18	7	Yes	Yes	1631	296	P/PWS/B/W
83	NE3202	Kundanlal Gupta Nagar	227	N	Notified	18	7			5420	774	P/PWS/B/W
84	NE3201	Indira Nagar	235	N	In Masterlist but not notified	18	7			2184	311	P/PWS/B/W
85	NE3103	Janta Nagar(Jamdarwadi)	344	N	Notified	18	7			665	95	P/PWS/B/W
86	NE3101	North of Bokade Mohalla	931	N	Not in Masterlist `98	18	7			1368	194	P/PWS/B/W
87	CE1201	Gujri Lalganj	161	N	Notified	19	7			988	180	P/PWS/B/W
88	CE1202	Kumbharpura,Musalmanpura	162	N	Notified	19	7			2600	473	P/PWS/B/W
89	CE1501	Kawarapeth	172	N	Notified	19	7			1780	323	P/PWS/B/W
90	CE1203	Kumbharpura, Musalmanpura	174	N	In Masterlist but not notified	19	7			1689	307	P/PWS/B/W
91	NE2501	Bhoslewadi-1	188	N	Notified	31	9			4049	736	P/PWS/B/W
92	NE2603	Lashkaribagh-1	189	N	Notified	31	9			1638	298	P/PWS/B/W
93	NE2602	Lashkaribagh-2	234	N	Notified	31	9			1424	259	P/PWS/B/W
94	NE2401	Indira Jyoti Nagar	242	N	Notified	31	9			865	159	P/PWS/B/W

95	NE2701	NITE 25: Unit No.2	380	N	In Masterlist but not notified	31	9			293	53	P/PWS/B/W	
96	NE2601	NITE39: Unit 1	394	N	In Masterlist but not notified	31	9			0	0	P/PWS/B/W	
97	NE2502	Slum Near Noga Factory	406	N	Notified	31	9			806	146	P/PWS/B/W	
98	NE2503	South of Noga Factory	925	N	Not in Masterlist `98	31	9			700	100	P/PWS/B/W	
99	NE2505	Matatoli (Motibagh) Basor Basti	966	N	Not in Masterlist `98	31	9			110	20	P/PWS/B/W	
100	NE2606	South of Lashkaribagh (Calcutta Rly.Line)	976	N	Not in Masterlist `98	31	10			500	70	P/PWS/B/W	
101	CE1004	Bairagipura	166	N	Notified	34	7			1520	276	P/PWS/B/W	
102	CE0801	Tandapeth	167	N	Notified	34	7			16245	2953	P/PWS/B/W	
103	CE1003	Khairipura	168	N	Notified	34	7			2938	716	P/PWS/B/W	
104	CE0901	Naikwadi, Lendi Talao	183	N	Notified	34	7			2599	472	P/PWS/B/W	
105	CE0902	Ram Nagar	184	N	Notified	34	7			1053	191	P/PWS/B/W	
106	NE2801	Balabhaupeth	190	N	In Masterlist but not notified	34	9	Yes	Yes	5017	912	P/PWS/B/W	
107	CE0701	Thakkargram (1)	191	N	Notified	34	33	7	Yes	Yes	1657	301	P/PWS/B/W
108	CE0702	Thakkargram (2)	192	N	Notified	34	7	Yes	Yes	1703	310	P/PWS/B/W	
109	CE0802	Chandrabhaga Nagar	206	N	Notified	34	7			5211	947	P/PWS/B/W	
110	CE1005	Bairagipura (2)	231	N	In Masterlist but not notified	34	7	Yes		5075	992	P/PWS/B/W	
111	CE0703	East of Thakkargram	928	N	Not in Masterlist `98	34	7			900	163	P/PWS/B/W	
112	NE0502	Bada Indora	198	N	Notified	15	10			806	146	P/PWS/B/W	
113	NE0904	Devi Nagar	336	N	Notified	16	9			592	107	P/PWS/B/W	
114	NE0602	Shravasti Nagar	217	N	Notified	2	9	Yes	Yes	1707	287	P/PWS/B/W	
115	NE3301	Rajeev Gandhi Nagar	181	N	Notified	3	9			2150	307	P/PWS/B/W	
116	CE1002	Bangla Desh (1)	225	N	Notified	34	7	Yes	Yes	7150	1300	P/PWS/B/W	
117	CE1001	Bangla Desh (2)	226	N	Notified	34	7	Yes	Yes	637	115	P/PWS/B/W	
											193065	33890	
1	SE1701	Manewada village	280	S	Notified	7	8	3	Yes	Yes	1700	309	P/PWS/B/W
2	SE0703	Jogi Nagar	271	S	Notified	8	3			5000	910	P/PWS/B/W	
3	SE2001	Mang Garodi Toli	281	S	Notified	8	3			1800	327	P/PWS/B/W	
4	SE0701	Dhadiwal Nagar	288	S	Notified	8	3			1500	273	P/PWS/B/W	
85	SE1102	Rahul Nagar	405	S	Notified	8	3			300	55	P/PWS/B/W	
6	SE2002	Rahate Nagar	945	S	Not in Masterlist `98	8	3			1200	218	P/PWS/B/W	
7	SE2003	Ramteke Nagar	946	S	Not in Masterlist `98	8	3			2200	400	P/PWS/B/W	
8	SE2201	Sonaji Kaikadi Nagar	973	S	Not in Masterlist `98	8	3			1000	182		
9	SE0609	Babulkheda	245	S	In Masterlist but not notified	24	3			5426	986	P/PWS/B/W	
10	SE0607	Ambedkar Nagar	268	S	Notified	24	3			169	35	P	

11	SE1002	Savatribai Fuley Nagar	276	S	Notified	24	3	Yes	Yes	4500	818	P
12	SE0608	Kunjilal Peth	283	S	Notified	24	3			3000	545	P/PWS/B/W
13	SE1101	Vasant Nagar	284	S	In Masterlist but not notified	24	3			1832	333	P/PWS/B/W
14	SE1001	Ramamai Nagar	346	S	Notified	24	3			400	73	P/PWS/B/W
15	SE1003	Bajrang Nagar	347	S	Notified	24	3			300	55	P/PWS/B/W
16	SE0603	New Babulkheda	255	S	Notified	25	4	Yes	Yes	1845	329	P/PWS/B/W
17	SE0605	Joshiwadi	262	S	Notified	25	4			650	118	P/PWS/B/W
18	SE0702	Bhim Nagar	264	S	Notified	25	4			1925	350	P/PWS/B/W
19	SE0606	Jaibhim Nagar	289	S	Notified	25	4			10000	1818	P/PWS/B/W
20	SE0602	Kausalya Nagar	404	S	Notified	25	4	Yes	Yes	2708	492	P/PWS/B/W
21	SE0501	Sayyad Baba Dargah	941	S	Not in Masterlist `98	25	4	Yes	Yes	350	64	P/PWS/B/W
22	CE3704	Gulab baba Zopadpatti	270	S	Notified	38	6			364	66	P/PWS/B/W
23	SE0801	Vakilpeth	265	S	Notified	39	3	Yes	Yes	3000	545	P/PWS/B/W
24	SE0902	Adiwasi Gondtoli	269	S	Notified	39	3			500	90	P/PWS/B/W
25	SE0302	Rambagh	244	S	Notified	40	3	Yes	Yes	2805	510	P/PWS/B/W
26	SE0201	Kafala Basti	267	S	Notified	40	3	Yes	Yes	600	74	P/PWS/B/W
27	SE0403	Jattarodi	272	S	Notified	40	3	Yes	Yes	3802	725	P/PWS/B/W
28	SE0401	Borkar Nagar,Basod Mahalla	274	S	Notified	40	3	Yes	Yes	1500	117	P/PWS/B/W
29	SE0303	Imamwada - 1	282	S	In Masterlist but not notified	40	3	Yes	Yes	2177	396	P/PWS/B/W
30	SE0402	Indira Nagar Jattarodi (2)	348	S	Notified	40	3	Yes	Yes	3600	283	P/PWS/B/W
31	SE0202	Jat Tarodi Behind Kundanlal Lib.	349	S	Notified	40	3			230	42	P/PWS/B/W
32	SE0404	Jat Tarodi - 2	350	S	Notified	40	3	Yes	Yes	2000	255	P/PWS/B/W
33	SE0101	Timber Market Sweeper Colony	398	S	In Masterlist but not notified	40	3			1052	191	P/PWS/B/W
34	SE0203	East of Kafila Bastee	958	S	Not in Masterlist `98	40	3	Yes	Yes	231	47	P/PWS/B/W
35	SE0405	North of Borkar Nagar	977	S	Not in Masterlist `98	40	3	Yes	Yes	736	99	P/PWS/B/W
36	SW0904	Takiya Dhantoli	246	S	Notified	41	4	Yes	Yes	707	128	P/PWS/B/W
37	SW0601	Kumbhartoli (1)	249	S	Notified	41	4	Yes	Yes	2247	408	P/PWS/B/W
38	SW0301	Gavalipura Tekadi	250	S	Notified	41	4			4669	850	P/PWS/B/W
39	SW0401	Anand Nagar	252	S	Notified	41	4	Yes		1001	181	P/PWS/B/W
40	SW0901	Takiya Dhantoli(2)Saraswati Nagar	258	S	Notified	41	4	Yes	Yes	1430	260	P/PWS/B/W
41	SW0902	Takiya Dhantoli (3) Saraswati Nagar	259	S	Notified	41	4	Yes	Yes	2380	386	P/PWS/B/W
42	SW3501	Choti Dhantoli	260	S	Notified	41	4			546	100	P/PWS/B/W
43	SW0503	Netaji Market	266	S	Notified	41	4	Yes		392	70	P/PWS/B/W
44	SW0501	Zopadpatti near Yeshwant Stadium	286	S	In Masterlist but not notified	41	4	Yes		952	173	P/PWS/B/W

45	SW0602	North of Kumbhartoli Toli (Chandani Nagar)	938	S	Not in Masterlist `98	41	4	Yes	532	97	P/PWS/B/W	
46	SW0903	S-E of Takiya Dhantoli (3)	939	S	Not in Masterlist `98	41	4	Yes	70	12	P/PWS/B/W	
47	SW0502	Sangam	950	S	Not in Masterlist `98	41	4	Yes	308	56	P/PWS/B/W	
48	CE3501	Gadikhana	248	S	Notified	42	4	Yes	3847	700	P/PWS/B/W	
49	CE2801	Zopadpatti near new S.T.stand	275	S	Notified	42	4		364	66	P/PWS/B/W	
50	CE3601	Karnalbagh - 2	279	S	In Masterlist but not notified	42	4		143	26	P/PWS/B/W	
51	CE2401	Adarsh Indiramata Nagar	409	S	In Masterlist but not notified	43	6		526	96	P/PWS/B/W	
52	SE0601	Kukde Layout	253	S	Notified	25	4	Yes	Yes	2068	376	P/PWS/B/W
53	SE0604	Chaudhari Mohalla	261	S	Notified	25	4	Yes	Yes	1500	196	P/PWS/B/W
54	CE3801	Siraspath,Saraipeth	247	S	Notified	38	6		7810	1420	P/PWS/B/W	
55	SE0901	Somwaripeth (2)	251	S	Notified	39	3	Yes	Yes	968	158	P/PWS/B/W
56	SE0301	Imamwada-1	254	S	Notified	40	3	Yes	Yes	1100	162	P/PWS/B/W
57	CE3602	Karnalbagh	257	S	Notified	42	4		4224	768	P/PWS/B/W	
58	CE2601	Sindikhana, Mangpura	263	S	Notified	42	4		2495	454	P/PWS/B/W	
59	CE2701	Gujarwadi	277	S	Notified	42	4		1657	301	P/PWS/B/W	

85516 14829

1	NW0401	Borgaon Gittikhadan	091	W	Notified	1	10	Yes	Yes	1725	313	P/PWS/B/W
2	NW0701	Zingabai Takli	132	W	Notified	1	10	Yes	Yes	910	165	P/PWS/B/W
3	NW0101	Gorewada Village	133	W	Notified	1	10			1745	317	P/PWS/B/W
4	NW0901	Mankapura Village	134	W	In Masterlist but not notified	1	10			260	47	P/PWS/B/W
5	NW0402	Adiwasinagar(Borgaon)	152	W	Notified	1	10	Yes	Yes	430	78	P/PWS/B/W
6	NW1101	Mankapur Zopadpatti	399	W	Notified	1	10			3210	583	B/W
7	NW0801	South of Zingabai Takli	904	W	Not in Masterlist `98	1	10			365	66	P/B/W
8	NW0102	North of Gorewada Village	905	W	Not in Masterlist `98	1	10			630	114	P/PWS
9	NW1001	North of Mankapur Zopadpatti	906	W	Not in Masterlist `98	1	10			550	101	
10	NW0602	Sonpur Village	907	W	Not in Masterlist `98	1	10			266	36	B/W
11	NW1801	North of Raj Nagar	920	W	Not in Masterlist `98	1	10			1795	326	B/W
12	NW0702	Zingabai Takli (North)	952	W	Not in Masterlist `98	1	10	Yes	Yes	3000	545	P/PWS/B/W
13	SW3101	Somalwada-1	109	W	Notified	9	2	Yes	Yes	4396	571	P/PWS/B/W
14	SW2702	Ramabai Ambedkar Nagar	127	W	Notified	9	2			3458	628	P/PWS/B/W
15	SW3401	Shivangaon Village	140	W	In Masterlist but not notified	9	2			3402	618	B/W/W
16	SW3001	Sonegaon	141	W	In Masterlist but not notified	9	2			1162	211	B/W/W
17	SE1901	Chinchbhanan	142	W	In Masterlist but not notified	9	2			1500	272	B/W/W
18	SW2701	Jaitala Village	145	W	In Masterlist but not notified	9	2			6013	1093	P/PWS/B/W

19	SW2601	Ekatmata Nagar	343	W	Notified	9	2	Yes	Yes	4564	586 B/W/W	
20	SW3601	Shivpuri	923	W	Not in Masterlist `98	9	2			266	48	
21	SW3002	Rahmat Nagar	942	W	Not in Masterlist `98	9	2			231	42 P/PWS/B	
22	SE2101	New Vaishali Nagar	949	W	Not in Masterlist `98	9	2	Yes	Yes	488	111 P/PWS/B/W	
23	SW2703	South West of Jaitala Village	959	W	Not in Masterlist `98	9	2			168	31	
24	SW2601	East of Ekatmata Nagar	960	W	Not in Masterlist `98	9	2	Yes		26	6 B/W/W	
25	SE1902	Shantiniketan Nagar (West of Chinchbhavan)	969	W	Not in Masterlist `98	9	2	Yes	Yes	285	59 P/PWS/B/W	
26	SW1503	Kamgar Nagar	107	W	Notified	10	2	Yes	Yes	4060	503 P/PWS/B/W	
27	SW1502	Tukdoji Nagar	108	W	Notified	10	2	Yes	Yes	3689	440 P/PWS/B/W	
28	SW1701	Gopal Nagar, Vijay Nagar	111	W	Notified	10	2	Yes	Yes	511	55 P/PWS/B/W	
29	SW1501	Subhash Nagar	137	W	In Masterlist but not notified	10	2			1295	235 P/PWS/B/W	
30	SW1601	Parsodi Village	138	W	In Masterlist but not notified	10	2			959	174 P/PWS/B/W	
31	SW2801	Bhamti	143	W	Notified	10	2			700	127 P/PWS/B/W	
32	SW1301	Takli Seem	144	W	In Masterlist but not notified	10	2			1638	298 P/PWS/B/W	
33	SW1401	NITE4: Kh.No.42/3Takliseem	359	W	In Masterlist but not notified	10	2			105	20 P/PWS/B/W	
34	SW1505	Ambedkar Nagar	403	W	Notified	10	2	Yes	Yes	245	45 P/PWS/B/W	
35	SW1504	East of Kamgar Colony	940	W	Not in Masterlist `98	10	2			455	62 P/PWS/B/W	
36	NW2504	Futala Basti Juni	096	W	Notified	11	1	Yes	Yes	2045	253 P/PWS/B/W	
37	NW2502	New Futala Basti-1	098	W	Notified	11	1	Yes	Yes	2513	457 P/PWS/B/W	
38	NW2503	New Futala Basti	101	W	Notified	11	1	Yes	Yes	990	180 P/PWS/B/W	
39	SW1107	Ambazari Pandharabodi	105	W	Notified	11	1	Yes	Yes	5040	591 P/PWS/B/W	
40	SW1201	Ambazari Pandhrabodi (West of Gandhinagar layout)	105	W	Notified	11	1			5397	981 P/PWS/B/W	
41	SW1101	New Pandhrabodi	116	W	Notified	11	1	Yes	Yes	1995	249 P/PWS/B/W	
42	SW1106	Sewa Nagar	123	W	Notified	11	1	Yes	Yes	1133	261 P/PWS/B/W	
43	SW1003	Sanjay Nagar	136	W	Notified	11	1	Yes	Yes	4123	586 P/PWS/B/W	
44	SW1104	Sudamnagri	157	W	In Masterlist but not notified	11	1			3185	579 P/PWS/B/W	
45	SW1108	Jyoti Nagar	158	W	In Masterlist but not notified	11	1			434	78 P/PWS/B/W	
46	SW1702	Joshiwadi	160	W	Notified	11	1			273	50 P/PWS/B/W	
47	SW1105	NITE5: Kh.No.53/1J Mz.-Ambazari	360	W	In Masterlist but not notified	11	1			252	46 P/PWS/B/W	
48	SW1103	NITE 11: Kh. No. 49 Mz.-Pandhrabodi	366	W	In Masterlist but not notified	11	1			0	0 P/PWS/B/W	
49	SW1001	N-W of Sanjay Nagar Along University Campus Compound Wall	947	W	Not in Masterlist `98	11	1	Yes		28	9 P/PWS/B/W	
50	SW1002	North of Sanjay Nagar Along LIT Compound Wall	948	W	Not in Masterlist `98	11	1	Yes		91	17 P/PWS/B/W	
51	NW1601	Gittikhadan	090	W	Notified	12	13	1	Yes	Yes	3445	626 P/PWS/B/W
52	NW1201	Dabha Basti	097	W	Notified	12	1	Yes	Yes	1065	193 P/PWS/B/W	
53	NW2701	Kachimet Wadi (Village Abadi)	099	W	Notified	12	1	Yes	Yes	1205	219 B/W	

54	NW1402	Hajari Pahad	100	W	Notified	12	1	Yes	Yes	1585	288	P/PWS/B/W
55	NW1602	Rajeev Gandhi Nagar	113	W	Notified	12	1	Yes	Yes	1015	184	P/PWS/B/W
56	NW1501	Surendragarh	112	W	Notified	12	1	Yes	Yes	7690	1398	P/PWS/B/W
57	NW1603	Vishwas Nagar	114	W	Notified	12	1	Yes	Yes	1225	223	P/PWS/B/W
58	NW0202	Makardhokda	124	W	Notified	12	1	Yes	Yes	575	104	P/PWS/B/W
59	NW1701	Manavta Nagar	153	W	Notified	12	1			1935	352	P/PWS/B/W
60	NW0201	Jagadish Nagar	333	W	Notified	12	1			2260	410	B/W/W
61	NW0301	Bornala	334	W	Notified	12	1			190	34	
62	NW1502	Pannalal Deshraj Nagar	341	W	Notified	12	1	Yes	Yes	3335	606	P/PWS/B/W
63	NW1702	Vikas Nagar	355	W	Notified	12	1	Yes	Yes	295	53	
64	NW1202	West of Bhivsenkhori Notified Area	915	W	Not in Masterlist `98	12	1	Yes	Yes	2345	426	P/PWS/B/W
65	NW1301	Ganga Nagar	916	W	Not in Masterlist `98	12	1			1820	330	B/W
66	NW1401	North of Hazari Pahad	917	W	Not in Masterlist `98	12	1	Yes	Yes	525	95	P/PWS/B/W
67	NW1403	South of Hazari Pahad	918	W	Not in Masterlist `98	12	1	Yes	Yes	1220	221	P/PWS/B/W
68	NW1604	South of Rajeev Nagar	919	W	Not in Masterlist `98	12	1			85	15	P/PWS/B/W
69	NW2501	North of New Futala Basti	935	W	Not in Masterlist `98	12	1	Yes	Yes	645	117	P/PWS/B/W
70	NW1703	Ramgiri Zopadpatti	972	W	Not in Masterlist `98	12	1			300	54	P/PWS/B/W
71	NW0502	Gittikhadan	092	W	In Masterlist but not notified	13	10	Yes	Yes	2144	362	P/PWS/B/W
72	NW1605	Krishna Nagar, Azad Nagar	093	W	Notified	13	10	Yes	Yes	5950	1082	P/PWS/B/W
73	NW2002	Sadar Mahapura	094	W	In Masterlist but not notified	13	10	Yes	Yes	2660	483	P/PWS/B/W
74	NW2001	Sadar Dhobipuda	095	W	Notified	13	10	Yes	Yes	1310	238	P/PWS/B/W
75	NW1903	Gondpura Tiger Gap	115	W	Notified	13	10	Yes	Yes	1715	312	P/PWS/B/W
76	NW0501	Dashrath Nagar	147	W	Notified	13	10	Yes	Yes	1570	257	P/PWS/B/W
77	NW0601	Police Line Takli	159	W	Notified	13	10			455	82	P/PWS/B/W
78	NW1902	North of Gondpura (Tigergap) Adjoining School	921	W	Not in Masterlist `98	13	10	Yes	Yes	130	23	P/PWS/B/W
79	NW1901	West of Gondpura (Tigergap) Around Ground	922	W	Not in Masterlist `98	13	10	Yes	Yes	995	181	P/PWS/B/W
80	NW0503	Adiwasi Nagar (south of yogendra Nagar)	974	W	Not in Masterlist `98	13	10	Yes	Yes	400	79	P/B/W
81	NW2203	Mangalwari Bazar Zopadpatti	230	W	In Masterlist but not notified	14	10			380	69	P/PWS/B/W
82	SW2303	Ajani Old Abadi	088	W	Notified	26	2	Yes	Yes	1820	330	P/PWS/B/W
83	SW2301	Ajani Chuna Bhatti	089	W	In Masterlist but not notified	26	2			1113	202	P/PWS/B/W
84	SW2302	Ambika Nagar	118	W	Notified	26	2	Yes	Yes	448	61	P/PWS/B/W
85	SW2402	Sahakar Nagar	119	W	Notified	26	2	Yes	Yes	1043	141	P/B/W
86	SW2401	Rajeev Nagar	128	W	Notified	26	2	Yes	Yes	805	107	B/W
87	SW2502	Priyanka wadi	150	W	Notified	26	2	Yes	Yes	525	95	B/W
88	SW3201	Mahatma Phule Nagar	335	W	Notified	26	2			301	55	

89	SW2501	Rahul Nagar	352	W	Notified	26	2	Yes	Yes	1064	158 B/W
21	SW3301	Panchadeep Nagar	944	W	Not in Masterlist `98	26	2			287	52 B/W
90	SW2903	Khamla	106	W	In Masterlist but not notified	27	2			1512	275 P/PWS/B/W
91	SW2001	Shiv Nagar	110	W	Notified	27	2	Yes	Yes	616	76 P/PWS/B/W
92	SW2901	Changdeo Nagar	126	W	Notified	27	2	Yes	Yes	217	27 P/PWS/B/W
93	SW1901	Shyam Nagar	129	W	Notified	27	2	Yes	Yes	693	97 P/PWS/B/W
94	SW2002	Gautam Nagar (Khamla)	130	W	Notified	27	2	Yes	Yes	308	40 P/PWS/B/W
95	SW2101	Danteshwari	131	W	Notified	27	2	Yes	Yes	2072	178 P/PWS/B/W
96	SW2902	Khamla Zopadpatti	139	W	In Masterlist but not notified	27	2			2198	400 P/PWS/B/W
97	SW2201	Kaikadi Nagar	149	W	Notified	27	2	Yes	Yes	287	35 P/PWS/B/W
98	SW2102	Danteshwari	342	W	Notified	27	2	Yes	Yes	371	68 P/PWS/B/W
99	SW2103	Dalpetshah Nagar	401	W	Notified	27	2	Yes	Yes	581	61 P/PWS/B/W
100	SW0701	Kachipura-1	103	W	Notified	28	2			1400	254 P/PWS/B/W
101	SW0801	Kachipura-2	104	W	Notified	28	2	Yes	Yes	1862	338 P/PWS/B/W
102	SW1801	Laxmi Nagar Zopadpatti	125	W	Notified	28	2	Yes	Yes	644	103 P/PWS/B/W
103	SW0702	Central Part of Kachipura	936	W	Not in Masterlist `98	28	2			406	74 P/PWS/B/W
104	SW0802	West of Kachipura - 2	951	W	Not in Masterlist `98	28	2	Yes	Yes	210	38 P/PWS/B/W
105	SW0101	Gond Toli, Marar Toli	102	W	Notified	29	1	Yes	Yes	3325	600 P/PWS/B/W
106	SW0202	Gadga Zopadpatti	155	W	In Masterlist but not notified	29	1			742	135 P/PWS/B/W
107	SW0201	S-W of Gadga Zopadpatti (Dr. Ambedkar Nagar)	937	W	Not in Masterlist `98	29	1			195	35 P/PWS/B/W
108	NW2601	Mariyam Nagar	122	W	Notified	30	10			1085	197 P/PWS/B/W
109	SW0203	Gaulipura behind Dick Dispensary	135	W	In Masterlist but not notified	30	10			525	95 P/PWS/B/W
110	SW0204	Indira Nagar(near football ground)	154	W	In Masterlist but not notified	30	10			1827	332 PWS/BW
										138962	23223
										TOTAL 714425	124274

Table-B**ABSTRACT OF FLOW STUDIES CARRIED OUT IN RAMBAGH SLUMS**

Sr. No.	Location of Meter	Flow Per Day
i)	3" size meter near Sarla Bhavan (only 10% flow considered) major flow in Imambada slum.	30,520 Ltrs.
ii)	2" size meter near Adarsh Electricals	1,05,200 Ltrs.
iii)	4" size meter in front of Gawali's House	5,82,700 Ltrs.
iv)	2" size meter near Mukesh Furnitures	1,78,866 Ltrs.
v)	6" size meter in front of 1 st Flight Courier	98,000 Ltrs.
vi)	4" size meter near 1 st Flight Courier	1,75,000 Ltrs.
vii)	4" size meter opposite 1 st Flight Courier (only 2/3 flow considered as it served the H.B. Colony also)	1,46,666 Ltrs.
viii)	4" size meter near Baidyanath Square	53,500 Ltrs.
TOTAL		13,70,452 Ltrs.

Population of slum 2455

$$\begin{aligned}
 \therefore \text{LPCD} &= \frac{13,70,452}{2455} \\
 &= 558
 \end{aligned}$$

Table-C

**ABSTRACT OF FLOW STUDIES CARRIED OUT IN
PANDHARABODI AND ALLIED SLUMS**

Sr. No.	Location of Meter	Flow Per Day
i)	Inlet near P.S. Shende's House	2,03,472 Ltrs.
ii)	6" size connection near kalimata Mandir	32,000 Ltrs.
iii)	4" size @ Seva Nagar	4,000 Ltrs.
iv)	4" size near Rajat Kirana Stores	84,780 Ltrs.
v)	6" size near Trust Layout	2,06,660 Ltrs.
vi)	4" size near Piyush Jewellers	65,000 Ltrs.
TOTAL		5,95,912 Ltrs.

Population of slum 6392 (year Sept., 2002)

$$\begin{aligned}
 \therefore \text{LPCD} &= \frac{5,95,912}{6392} \\
 &= 93.22 \text{ Ltrs.}
 \end{aligned}$$

Table-D**CPHEEO Norms Regarding Water Supply****2.2.8.3 RECOMMENDATIONS**

The Environmental Hygiene Committee suggested certain optimum rates for communities based on population groups. In the Code of Basic Requirements of Water Supply, Drainage and Sanitation (IS:1172-1983) as well as the National Building Code a minimum of 135 LPCD has been recommended for all residences provided with full flushing system for excreta disposal. However the Manual on Sewerage and Sewage Treatment recommends a minimum supply of 150 LPCD wherever sewerage is contemplated. After reviewing the recommendations on requirements for domestic, non-domestic, fire demand and industrial needs made in the earlier manuals, considering the prevailing practices and trends in the other countries and taking into account the feasibility and minimum needs, the following recommendations are made.

- i) For communities with population upto 20,000.
 - a) Water Supply through stand post 40 LPCD (min.)
 - b) Water Supply through house service connection 70 to 100 LPCD
- ii) For communities with population 20,000 to 1,00,000 100 to 150 LPCD
- iii) For communities with population above 1,00,000 150 to 200 LPCD

(a) Domestic and Non-Domestic Needs

While a minimum of 70 to 100 LPCD may be considered adequate for the domestic needs of urban communities, the non-domestic needs listed above would vary with their size and economic importance, requiring from 25 to 100 LPCD in addition. As a general rule, the following rates per capita per day are considered minimum for domestic and non-domestic needs.

Further, the requirements of each case will have to be studied with reference to local factors governing the different non-domestic needs before the optimum rate of supply for the community is decided upon.

ANNEXURES

Annexure-1
(Cost of Water Rated Capacity of 470 mld)

Annexure-1

Cost of Water for Rated Capacity of 470 Mld
(Based on 2003-2004 revised budget)

Fixed Cost		
Establishment Expenses	5.50 Crore	
O & M Expenses	7.02 Crore	
Loan Repayment	26.20 Crore	
TOTAL	38.72 Crore	Rs. 2.25/Unit
Variable Cost	34.36 Crore	Rs. 2.00/Unit
Development Cost*	22.13 Crore	Rs. 1.30/Unit
Net TOTAL	95.21 Crore	
Total cost on rated capacity of WTP		Rs. 5.55/Unit

*Development cost taken in line of sinking fund / Depreciation.

$$\text{Cost of water on billed} = 5.55 \times \frac{470}{241} = 10.82/\text{Unit}$$

Annexure-2
(Major Leak Detection)

ANNEXURE - 2

MAJOR LEAK DETECTION PLAN

LIST OF DISCOVERED LEAKAGES & MAJORED WATER LOSSES						
SUMMARY SHEET						
Sr. No.	Description	Life of Leakage [Years]	Supply Hrs.	Water Loss in MLD	Annual Loss @ Rs. 5.55 / Unit	Page No.
1	Near Godhani [Bypass Pump Station Road] [Air Valve]	1	24	0.0094	19078	L-1
2	Gorewada Tank Seepage + PWTM Leakages	>15	24	4.7389	9599893	L-2
3	Pench - I [Gorewada, Back Wash Water of Sand Filters at WTP]	>15	24	3.4878	7065499	L-4
4	Pench - II [Gorewada, Back Wash Water of Sand Filters at WTP]	>15	24	3.0647	6208348	L-5
5	Backwash Water Leakage at WTP, Pench -II [Lead Joint Leakage]	1/12	24	0.4032	67133	L-7
6	Pench - III [Gorewada, Back Wash Water of Sand Filters at WTP]	>3	24	0.5561	1126560	L-8
7	Kanhan- old [Back Wash Water of Sand Filters at WTP]	>15	24	2.6301	5327928	L-10
8	Kanhan-New [Back Wash Water of Sand Filters at WTP]	>15	24	3.3521	6790601	L-12
9	WTP Leakage, Other then Backwash [Kanhan River]	1	24	4.5519	9599893	L-13
10	Kanhan Line [Air Valve Leakage Infront of Fookat Nagar,Chamar Nallah]	1	24	0.0751	434563	L-14
11	Pure Water Rising Main, From WTP to Seminary Hills.Gorewada, [Sluice Valve Leakage]	1	24	0.0610	123547	L-15
12	Seminary Hills MBR [Pench-II] Air Valve Leakage	5	24	0.0691	140020	L-16
13	Pure Water Supply Main, From Seminary Hills, Lourd Mata Mandir [Pipe Leakage]	1	24	0.0599	121259	L-17
14	Seminary Hills [MBR Seepage, Near Mini Railway Track]	20	24	0.4680	1896219	L-18
15	Loha Pulliya [Lead Joint Leakage at Wanjari Nagar ESR Feeder]	1	24	0.2145	434563	L-19
16	Opp. Arun Automobile [Air Valve Leakage, Ghat Road]	1	24	0.0123	24854	L-20
17	Murgiwala Valve [Near Tukdoji Putla]	3	5	0.0120	24309	L-21
18	Evaporative Loss at Gorewada Tank	>15	24	4.3800	8872785	L-22
19	Seepage loss at Fort GSR	>15	24	0.1486	301026	L-23
Total				28.2949	58178076	
20	General Leakages Observed					L-24

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Near Godhani [Bypass Pump Station Road]
2	Type of leakage	Air Valve
3	Main Pipe Dia.	1300 mm
4	Air Valve Size	100 mm

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	5th March 2004
3	Time	11:50 A.M. to 12:10 P.M.
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Deepak Shiv 2. Manish Doye 3. Diman Biswas

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage Liters.	FLOW LPS
1	184	20.00	0.109
2	182	20.00	0.110
3	182	20.00	0.110
Average Flow in LPS			0.109

Life of Leakage 1 Years

Supply Hours 24 Hrs.

Total Vol. of Water lost per Day 9460 Lits/day

Total Vol. of Water lost per Day 0.0095 MLD

Total Vol. of Water lost per Annum 3452938 Lits/Annum

Total Unit of Water lost per Annum 3453 Units/annum

Cost of Water per Unit 5.55 Rs. / Unit

Cost of Leakage per Annum 19164 Rs. / Annum

Pl. Note: Nearby Shephard are using this water for drinking.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Type of Leakage	Gorewada Tank seepage & Old Gorewada Pure Water Rising Main Leakage)
2	Location	Gorewada
3	Pipe Dia.	0.457 m

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	5 th January 2005
3	Time	12:30
4	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni 5. Sunil Madavi

Flow Reading Details		
Duration of Flow	24	hrs.
No. of Pipes	1	No.
Dia. D	0.45	m
Radius R	0.225	m

Water Depth From Top edge of Pipe	0.225	m
-----------------------------------	-------	---



To Calculate è

Dim A	0.225 m
Dim B	0.000 m
è	1.571 radians

$$\text{Wetted Area A} = R^2 \left(\frac{\pi}{2} - \left(\frac{\sin(2\theta)}{2} \right) \right) / 2 = 0.079522 \text{ m}^2$$

To Calculate Velocity

Length of Pipe (L)	2.438 m
Time in secs (T)	4 sec
Velocity V	= L / T = 0.6095 m/s
Volume of Water Lost Q	= A x V = 0.04847 m³/Sec



Total Vol. of water lost per	4187669 Lits/day
Total Vol. of water lost per	4.1877 MLD
Total Vol. of Lost per	1528499251 Lit / Annum
Total Unit. of Lost per	1528499 Unit / Annum
Cost of Water per Unit	5.55 Rs./Unit
Cost of Leakage per Annui	8483171 Rs./Annum



Volume of Water Pumped to Fetry Village	5 Lit / Sec
Total Vol. of water lost per	432000 Lits/day
Total Vol. of water lost per	0.4320 MLD
Total Vol. of Lost per	157680000 Lit / Annum
Total Unit. of Lost per	157680 Unit / Annum
Cost of Water per Unit	5.55 Rs./Unit
Cost of Leakage per Annu	875124 Rs./Annum
Combined Loss of Water	4619669 Lits/day
Total Vol. of water lost per	4.620 MLD
Total Vol. of water lost per	<u>1686179251</u> Lit / Annum
Total Vol. of Lost per	<u>1686179</u> Unit / Annum
Total Unit. of Lost per	<u>5.55</u> Rs./Unit
Combined Cost	9358295 Rs./Annum



LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Old Gorewada	
2	Location	Gorewada	
3	Rated Capacity	16	MLD
4	No. of Filters Beds	3	Nos.
5	Filter Bed Wash Frequency	3	Nos. per Day

DETAILS OF SURVEY			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of Agency	Dinesh Rathi & Associates, Nagpur	
2	Date of Testing	31st January 2005	
3	Time	11:30	
4	Instrument Used	Ultrasonic Flow Meter.	
5	Leak Detection Team Members	1. Rajendra Jagtap	
		2. Arun Kumar Shah	
		3. Diman Biswas	
		4. Ravi Aloni	
		5. Sunil Madavi	
6	LOCATION OF FLOW METERS	Overhead Outlet	
7	PIPE DIA.	490.1 mm	
8	MATERIAL	CI	

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Liter
1	31-01-05	11:34	71.481	0.424	25090250
2	31-01-05	11:36	455.647	2.705	25125168
3	31-01-05	11:38	443.287	2.631	25179537
Total		0:04	323.472		89287



Actual Water required for Backwash 89287 Liters / wash

Actual water required for Backwash per day 267861 Liters / Day

Percentage of Backwash Water required against capacity of WTP 1.67%

Pl. Note: The actual quantity pumped per day for backwash is more as backwash water valves are not 100% closed and overhead tank is leak, therefore the operating hours of backwash water pumps for overhead tank is more.

LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Pench - I	
2	Location	Gorewada	
3	Rated Capacity	112	MLD
4	No. of Filters Beds	10	Nos.
5	Filter Bed Wash Frequency	10	Nos. per Day

DETAILS OF SURVEY			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of Agency	Dinesh Rathi & Associates, Nagpur	
2	Date of Testing	28th January 2005	
3	Time	14:00	
4	Instrument Used	Ultrasonic Flow Meter.	
5	Leak Detection Team Members	1. Rajendra Jagtap	
		2. Arun Kumar Shah	
		3. Diman Biswas	
		4. Ravi Aloni	
		5. Sunil Madavi	
6	LOCATION OF FLOW METERS	Outlet of Overhead Tank for backwash	
7	PIPE DIA.	650 mm	
8	MATERIAL	CI	

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Liter
1	28-01-05	15:01	120.690	0.404	23950994
2	28-01-05	15:02	365.432	1.225	23969978
3	28-01-05	15:03	384.678	1.289	23986936
4	28-01-05	15:05	388.405	1.302	24033888
5	28-01-05	15:07	383.318	1.285	24078465
6	28-01-05	15:09	339.648	1.138	24125731
7	28-01-05	15:11	301.557	1.011	24151933
8	28-01-05	15:13	317.985	1.066	24189808
9	28-01-05	15:15	322.168	1.080	24227483
10	28-01-05	15:17	320.986	1.076	24266107
11	28-01-05	15:19	321.715	1.078	24304702
12	28-01-05	15:21	87.290	0.292	24329760
Total		0:20	304.489		378766



Total Flow of Water per backwash of Filter	378766	Liters / wash
--	--------	---------------

Vol. of Water drained from Filter Bed before Wash				
Filter Bed No.	Length M	Width M	Depth of Water M	Vol. of Water M ³
10	12.775	8.3	0.7	74.22
Total Vol. of Water Drained per Wash				74

M³/wash

Total Vol. of Water Drained per Wash	74223	Liters / wash
--------------------------------------	-------	---------------

Leakage of water through backwash system.

Av. Flow Rate 86.837 LPS
 Duratin of Backwash 0:20 Min.

Total leakage	104204	Liters / wash
---------------	--------	---------------

Actual Water required for Backwash	348784	Liters / wash
------------------------------------	--------	---------------

Actual water required for Backwash	3487844	Liters / Day
------------------------------------	---------	--------------

Percentage of Backwash Water required
 against capacity of WTP

3.11%

Pl. Note: The actual quantity pumped per day for backwash is more as backwash water valves are not 100% closed, and therefore the operating hours of backwash water pumps for overhead tank is 22 hrs. and at the average flowrate of 86.837 lps therefore it results in extra pumping of 4.13 MLD

LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Pench - II	
2	Location	Gorewada	
3	Rated Capacity	135	MLD
4	No. of Filters Beds	12	Nos.
5	Filter Bed Wash Frequency	12	Nos. per Day

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	29th January 2005
3	Time	16:00
4	Instrument Used	Ultrasonic Flow Meter.
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni 5. Sunil Madavi
6	LOCATION OF FLOW METERS	Pump outlet
7	PIPE DIA.	464.6 mm
8	MATERIAL	CI

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Liter
1	29-01-05	16:13	180.011	1.168	24873741
2	29-01-05	16:15	159.556	1.036	24893584
3	29-01-05	16:17	151.563	0.984	24912277
4	29-01-05	16:19	153.929	0.999	24930571
5	29-01-05	16:21	154.846	1.005	24949324
6	29-01-05	16:23	146.804	0.953	24967785
7	29-01-05	16:25	68.785	0.446	24981294
8	29-01-05	16:27	64.258	0.417	24983820
9	29-01-05	16:29	64.145	0.416	24993598
10	29-01-05	16:31	142.099	0.922	25001421
11	29-01-05	16:33	136.557	0.886	25029170
12	29-01-05	16:35	141.350	0.917	25045942
13	29-01-05	16:37	142.295	0.924	25063115
14	29-01-05	16:39	62.191	0.403	25076843
15	29-01-05	16:41	61.759	0.401	25084544
Total		0:28	122.010		210803

Vol. of Water drained from Filter Bed before Wash				
Filter Bed No.	Length M	Width M	Depth of Water M	Vol. of Water M ³
12	9.8	9.1	0.5	44.59
Total Vol. of Water Drained per Wash				45 M ³ /wash

Total Vol. of Water Drained per Wash	44590	Liters / wash
--------------------------------------	-------	---------------

Actual Water required for Backwash	255393	Liters / wash
------------------------------------	--------	---------------

Actual water required for Backwash per day	3064716	Liters / Day
--	---------	--------------

Percentage of Backwash Water required against capacity of WTP	2.27%
---	-------

Pl. Note: Actual quantity of water pumped during backwash is more as the backwash valves of other filters are not 100% closed due to wear and tear.

LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Pench - II	
2	Location	Gorewada	
3	Rated Capacity	135	MLD
4	No. of Filters Beds	12	Nos.
5	Filter Bed Wash Frequency	12	Nos. per Day

DETAILS OF SURVEY			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of Agency	Dinesh Rathi & Associates, Nagpur	
2	Date of Testing	29th January 2005	
3	Time	16:00	
4	Instrument Used	Ultrasonic Flow Meter.	
5	Leak Detection Team Members	1. Rajendra Jagtap	
		2. Arun Kumar Shah	
		3. Diman Biswas	
		4. Ravi Aloni	
		5. Sunil Madavi	
6	LOCATION OF FLOW METERS	Pump outlet	
7	PIPE DIA.	464.6 mm	
8	MATERIAL	CI	

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/S	TOTALISER RD. Liters
1	29-01-2005	16:13	180.011	1.168	24873741
2	29-01-2006	16:15	159.556	1.036	24893584
3	29-01-2007	16:17	151.563	0.984	24912277
4	29-01-2008	16:19	153.929	0.999	24930571
5	29-01-2009	16:21	154.846	1.005	24949324
6	29-01-2010	16:23	146.804	0.953	24967785
7	29-01-2011	16:25	68.785	0.446	24981294
8	29-01-2012	16:27	64.258	0.417	24983820
9	29-01-2013	16:29	64.145	0.416	24993598
10	29-01-2014	16:31	142.099	0.922	25001421
11	29-01-2015	16:33	136.557	0.886	25029170
12	29-01-2016	16:35	141.350	0.917	25045942
13	29-01-2017	16:37	142.295	0.924	25063115
14	29-01-2018	16:39	62.191	0.403	25076843
15	29-01-2019	16:41	61.759	0.401	25084544
Total		0:28	122.010		210803

Actual Water required for Backwash	210803	Liters / wash
Actual water required for Backwash per day	2529636	Liters / Day

Percentage of Backwash Water required against capacity of WTP **1.87%**

Pl. Note: Actual quantity of water pumped during backwash is more as the backwash valves of other filters are not 100% closed due to wear and tear.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Backwash Header Leakage at WTP, Pench -2
2	Type of leakage	Lead Joint Leakage
3	Main Pipe Dia.	429.6 mm

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	28th January 2005
3	Time	1:30
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni 5. Sunil Madavi

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	48	224.00	4.667
2	48	224.00	4.667
3	48	224.00	4.667
Average Flow in LPS			4.667

Life of Leakage	1	Months
-----------------	---	--------

Supply Hours	24	Hrs.
Total Vol. of Water lost per Day	403200	Lits/day
Total Vol. of Water lost per Day	0.4032	MLD
Total Vol. of Water lost per Annum	147168000	Lits/Annum
Total Unit of Water lost per Annum	147168	Units/annum
Cost of Water per Unit	5.55	Rs. / Unit

Cost of Leakage per Annum	67133	Rs. / Annum
---------------------------	-------	-------------



Pl. Note: The loss of water more during backwash as the line is more pressurised.

LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Pench - III	
2	Location	Gorewada	
3	Rated Capacity	100	MLD
4	No. of Filters Beds	10	Nos.
5	Filter Bed Wash Frequency	2	Nos. per Day

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	29th January 2005
3	Time	13:30
4	Instrument Used	Ultrasonic Flow Meter.
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni 5. Sunil Madavi
6	LOCATION OF FLOW METERS	Overhead Tank Outlet
7	PIPE DIA.	531.5 mm
8	MATERIAL	CI

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Liter
1	29-01-05	13:50	721.695	3.627	24647214
2	29-01-05	13:51	713.071	3.584	24687137
3	29-01-05	13:53	697.749	3.507	24770529
4	29-01-05	13:55	658.370	3.309	24845264
Total		0:05	697.721		198050

Vol. of Water drained from Filter Bed before Wash				
Filter Bed No.	Length M	Width M	Depth of Water M	Vol. of Water M ³
10	12.7	9	0.7	80.01

Total Vol. of Water Drained per Wash **80** M³/wash

Total Vol. of Water Drained per Wash **80010** Liters / wash

Actual Water required for Backwash **278060** Liters / wash

Actual water required for Backwash per day **556120** Liters / Day

Percentage of Backwash Water required against capacity of WTP **0.56%**

Pl. Note: Actual Quantity is more as feed water is also released during Back wash.



LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Pench - III	
2	Location	Gorewada	
3	Rated Capacity	100	MLD
4	No. of Filters Beds	12	Nos.
5	Filter Bed Wash Frequency	2	Nos. per Day

DETAILS OF SURVEY			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of Agency	Dinesh Rathi & Associates, Nagpur	
2	Date of Testing	29th January 2005	
3	Time	13:30	
4	Instrument Used	Ultrasonic Flow Meter.	
5	Leak Detection Team Members	1. Rajendra Jagtap	
		2. Arun Kumar Shah	
		3. Diman Biswas	
		4. Ravi Aloni	
		5. Sunil Madavi	
6	LOCATION OF FLOW METERS	Overhead Tank Outlet	
7	PIPE DIA.	531.5 mm	
8	MATERIAL	CI	

FLOW READING DETAILS.

SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISED RD. Liter
1	29-01-2005	13:50	721.695	3.627	24647214
2	29-01-2006	13:51	713.071	3.584	24687137
3	29-01-2007	13:53	697.749	3.507	24770529
4	29-01-2008	13:55	658.370	3.309	24845264
Total		0:05	697.721		198050

Actual Water required for Backwash	198050	Liters / wash
---	---------------	---------------

Actual water required for Backwash per day	396100	Liters / Day
---	---------------	--------------

Percentage of Backwash Water required against capacity of WTP **0.40%**

Pl. Note: Actual Quantity is more as feed water is also released during Back wash.



LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP				
SR. NO.	DETAILS		DESCRIPTION	
1	Name of WTP		Kanhan- Old WTP	
2	Location		Kanhan H.W.	
3	Rated Capacity		63.6	MLD
4	No. of Filters Beds		7	Nos.
5	Filter Bed Wash Frequency		12	Nos. per Day

DETAILS OF SURVEY				
SR. NO.	DETAILS		DESCRIPTION	
1	Name of Agency		Dinesh Rathi & Associates, Nagpur	
2	Date of Testing		5th February 2005	
3	Time		9:30	
4	Instrument Used		Ultrasonic Flow Meter.	
5	Leak Detection Team Members		1. Rajendra Jagtap	
			2. Arun Kumar Shah	
			3. Sunil Madavi	
6	LOCATION OF FLOW METERS		Outlet of Overhead Tank for backwash	
7	PIPE DIA.		394.6 mm	
8	MATERIAL		CI	

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Liter
1	05-02-05	9:55	29.632	0.273	25365329
2	05-02-05	9:57	245.033	2.278	25383264
3	05-02-05	9:59	259.943	2.417	25414507
4	05-02-05	10:01	258.253	2.401	25445752
5	05-02-05	10:03	259.755	2.415	25477023
6	05-02-05	10:05	261.734	2.434	25507891
7	05-02-05	10:07	261.458	2.431	25539438
8	05-02-05	10:09	207.833	1.932	25569673
9	05-02-05	10:11	37.548	0.349	25583923
Total		0:16	202.354		218594



Total Flow of Water per backwash of Filter	218594	Liters / wash
--	--------	---------------

Vol. of Water drained from Filter Bed before Wash				
Filter Bed No.	Length M	Width M	Depth of Water M	Vol. of Water M ³
2	11	7.5	1.03	84.98
Total Vol. of Water Drained per Wash				85

M³/wash

Total Vol. of Water Drained per Wash	84975	Liters / wash
--------------------------------------	-------	---------------

Leakage of water through backwash system.

Av. Flow Rate 25.2332 LPS
 Duratin of Backwash 0:16 Min.

Total leakage	24224	Liters / wash
---------------	-------	---------------

Actual Water required for Backwash	279345	Liters / wash
------------------------------------	--------	---------------

Actual water required for Backwash	3352141.536	Liters / Day
------------------------------------	-------------	--------------

Percentage of Backwash Water required against capacity of WTP	5.27%
---	-------

Pl. Note: The actual quantity pumped per day for backwash is more as backwash water valves are not 100% closed, and therefore the operating hours of backwash water pumps for overhead tank is 24 hrs. and at the average flowrate of 25.233 lps therefore it results in extra pumping of 2.18 MLD

LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Kanhana- old WTP	
2	Location	Kanhana H.W.	
3	Rated Capacity	63.6	MLD
4	No. of Filters Beds	7	Nos.
5	Filter Bed Wash Frequency	12	Nos. per Day

DETAILS OF SURVEY			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of Agency	Dinesh Rathi & Associates, Nagpur	
2	Date of Testing	5th February 2005	
3	Time	9:30	
4	Instrument Used	Ultrasonic Flow Meter.	
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Sunil Madavi	
6	LOCATION OF FLOW METERS	Outlet of Overhead Tank for backwash	
7	PIPE DIA.	394.6 mm	
8	MATERIAL	CI	

READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Litre
1	05-02-05	9:32	131.775	1.225	25196466
2	05-02-05	9:34	264.751	2.462	25211297
3	05-02-05	9:36	260.342	2.421	25242534
4	05-02-05	9:38	260.653	2.424	25273855
5	05-02-05	9:40	261.842	2.435	25304814
6	05-02-05	9:42	229.090	2.130	25335912
7	05-02-05	9:44	27.816	0.258	25348651
8	05-02-05	9:45	24.964	0.232	25350348
Total		0:13	182.654		153882

Total Flow of Water per backwash of Filter	153882	Liters / wash
--	--------	---------------

Vol. of Water drained from Filter Bed before Wash				
Filter Bed No.	Length M	Width M	Depth of Water M	Vol. of Water M ³
5	11	7.5	1.03	84.98
Total Vol. of Water Drained per Wash				85 M ³ /wash

Total Vol. of Water Drained per Wash	84975	Liters / wash
--------------------------------------	-------	---------------

Leakage of water through backwash system.

Av. Flow Rate 25.2332 LPS
 Duration of Backwash 0:13 Min.

Total leakage	19682	Liters / wash
---------------	-------	---------------

Actual Water required for Backwash	219175	Liters / wash
------------------------------------	--------	---------------

Actual water required for Backwash	2630101.248	Liters / Day
------------------------------------	-------------	--------------

Percentage of Backwash Water required against capacity of WTP	4.14%
---	-------

Pl. Note: The actual quantity pumped per day for backwash is more as backwash water valves are not 100% closed, and therefore the operating hours of backwash water pumps for overhead tank is 24 hrs. and at the average flowrate of 25.233 lps therefore it results in extra pumping of 2.18 MLD
 in extra pumping of 2.18 MLD

LEAK DETECTION PLAN

LEAK DETECTION FOR BACK WASH WATER OF SAND FILTERS AT WTP

DETAILS OF WTP			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of WTP	Kanhana- new WTP	
2	Location	Kanhana H.W.	
3	Rated Capacity	45.4	MLD
4	No. of Filters Beds	6	Nos.
5	Filter Bed Wash Frequency	9	Nos. per Day

DETAILS OF SURVEY			
SR. NO.	DETAILS	DESCRIPTION	
1	Name of Agency	Dinesh Rathi & Associates, Nagpur	
2	Date of Testing	5th February 2005	
3	Time	10:30	
4	Instrument Used	Ultrasonic Flow Meter.	
5	Leak Detection Team Members	1. Rajendra Jagtap	
		2. Arun Kumar Shah	
		3. Sunil Madavi	
6	LOCATION OF FLOW METERS	Outlet of Overhead Tank for backwash	
7	PIPE DIA.	394.6 mm	
8	MATERIAL	CI	

FLOW READING DETAILS.					
SR. NO.	DATE	TIME Hr:Min	FLOW LPS	VELOCITY M/Sec	TOTALISER RD. Liter
1	05-02-05	10:43	42.891	0.398	25605273
2	05-02-05	10:45	240.396	2.235	25622561
3	05-02-05	10:47	297.460	2.766	25657092
4	05-02-05	10:49	311.133	2.893	25692573
5	05-02-05	10:51	288.018	2.678	25727103
6	05-02-05	10:53	55.081	0.512	25733713
Total		0:10	205.830	2.194	128440

Total Flow of Water per backwash of Filter	128440	Liters / wash
--	--------	---------------

Vol. of Water drained from Filter Bed before Wash				
Filter Bed No.	Length M	Width M	Depth of Water M	Vol. of Water M ³
1	10.75	7.65	0.82	67.43
Total Vol. of Water Drained per Wash				67

M³/wash

Total Vol. of Water Drained per Wash	67435	Liters / wash
--------------------------------------	-------	---------------

Actual Water required for Backwash	195875	Liters / wash
------------------------------------	--------	---------------

Actual water required for Backwash	1762872.75	Liters / Day
------------------------------------	------------	--------------

Percentage of Backwash Water required against capacity of WTP	3.88%
---	-------

Pl. Note: The actual quantity pumped per day for backwash is more as backwash water valves are not 100% closed, and therefore the operating hours of backwash water pumps for overhead tank is 24 hrs. and at the average flow rate of 25.233 lps therefore it results in extra pumping of 2.18 MLD

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Type of Leakage	WTP Leakage
2	Location	Kanhan River
3	Pipe Dia.	0.9 m
4	Pipe Material	AC Pipe

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	5 th February 2005
3	Time	12:30
4	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni 5. Sunil Madavi

FLOW READING DETAILS		
Time of Flow	24	hrs.
No. of Pipes	2	Nos.
Dia. D	0.9	m
Radius R	0.45	m
Water Depth From Top edge of Pipe	0.77	m

To Calculate è

Dim A 0.13 m

Dim B 0.32

è 0.780 radians

Wetted Area A $= R^2 (è - (\sin(2è)) / 2) = 0.057 \text{ m}^2$

Velocity

Length of Pipe (L)	4.65 m
---------------------------	---------------

Time in secs (T)	5 sec
-------------------------	--------------

Velocity V $= L / T$ **0.93 m/s**

Flow rate Q $= A \times V$ **0.05268 m³/Sec**

Total Vol. of water lost per 4551911 Lits/day

Total Vol. of water lost per 4.5519 MLD

Total Vol. of Lost per 1661447671 Lit / Annum

Total Unit. of Lost per 1661448 Unit / Annum

Cost of Water per Unit 5.55 Rs./Unit

Cost of Leakage per Annui 9221035 Rs./Annum



Pl. Note Above Leakage Includes following

1. Over flow of Pure Water Sump
2. Seepage
3. Leakage from Filter Bed.
4. General Leakage from Valves, Pipes etc.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Kanhan Line (in front of Pookat Nagar, Chamar Mallab)
2	Type of leakage	Air Valve
3	Main Pipe Dia.	1300 MM
4	Air Valve Size	100 MM

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	09th Feb. 2005
3	Time	15:20
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	23	20.00	0.870
2	23	20.00	0.870
3	23	20.00	0.870
Average Flow in LPS			0.870



Life of Leakage	1	Years
-----------------	---	-------

Supply Hours 24 Hrs.

Total Vol. of Water lost per Day 75130 Lits/day

Total Vol. of Water lost per Annum 27422609 Lits/Annum

Total Unit of Water lost per Annum 27423 Units/annum

Cost of Water per Unit 5.55 Rs. / Unit

Cost of Leakage per Annum 152195 Rs. / Annum

Pl. Note: Nearby Residential area are using this water for daily use.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Under water rising main, From WTP to Seminary Hills, Gorewade
2	Type of leakage	Sluice Valve of Air Valve
3	Main Pipe Dia.	1300 mm
4	Air Valve Size	100 mm

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	31th January 2005
3	Time	12:30
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	17	12.00	0.706
2	17	12.00	0.706
3	17	12.00	0.706
Average Flow in LPS			0.706

Life of Leakage	1	Years
-----------------	---	-------

Supply Hours	24	Hrs.
Total Vol. of Water lost per Day	60988	Lits/day
Total Vol. of Water lost per Annum	22260706	Lits/Annum
Total Unit of Water lost per Annum	22261	Units/annum
Cost of Water per Unit	5.55	Rs. / Unit
Cost of Leakage per Annum	123547	Rs. / Annum



PI. Note: Nearby Residential area are using this water for daily use.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Seminary Hills MBR [Pench-II]
2	Type of leakage	Air Valve
3	Main Pipe Dia.	1300 mm
4	Air Valve Size	100 mm

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	09th Feb. 2005
3	Time	12:30
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	25	20.00	0.800
2	25	20.00	0.800
3	25	20.00	0.800
Average Flow in LPS			0.800

Life of Leakage	5	Years
-----------------	---	-------

Supply Hours	24	Hrs.
Total Vol. of Water lost per Day	69120	Lits/day
Total Vol. of Water lost per Annum	25228800	Lits/Annum
Total Unit of Water lost per Annum	25229	Units/annum
Cost of Water per Unit	5.55	Rs. / Unit

Cost of Leakage per Annum	140020	Rs. / Annum
----------------------------------	--------	-------------



PI. Note: The loss of water more during leakages as the line is more pressurised.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Water supply main, From Seminary Hills, Loud Mata, Mendir
2	Type of leakage	Seepage Water of MBR, Seminary Hills
3	Main Pipe Dia.	1300 mm

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	7-Mar-2005
3	Time	11.45 A.M to 12.15 P.M.
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Dipak Shiv 2. Manish Doye 3. Diman Biswas

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	18	12.00	0.667
2	17	12.00	0.706
3	17	12.00	0.706
Average Flow in LPS			0.693

Life of Leakage	1	Years
Supply Hours	24	Hrs.
Total Vol. of Water lost per Day	59859	Lits/day
Total Vol. of Water lost per Annum	21848471	Lits/Annum
Total Unit of Water lost per Annum	21848	Units/annum
Cost of Water per Unit	5.55	Rs. / Unit
Cost of Leakage per Annum	121259	Rs. / Annum



LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Location	Seminary Hills [Near Mini Railway Track]
2	Type of leakage	MBR Seepage Water
3	Main Pipe Dia.	716.10 mm
4	Air Valve Size	100 mm

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	27th Nov. 2004
3	Time	13:44
4	Measurement Method	Bucket Filling Method
5	Leak Detection Team Members	1. Rajendra Jagtap 2. Arun Kumar Shah 3. Diman Biswas 4. Ravi Aloni 5. Manish Doye

FLOW READING DETAILS.			
SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	4	25.00	6.250
2	5	25.00	5.000
3	5	25.00	5.000
Average Flow in LPS			5.417

Life of Leakage	20	Years
-----------------	----	-------

Supply Hours 24 Hrs.

Total Vol. of Water lost per Day 468000 Lits/day

Total Vol. of Water lost per Day 0.468 MLD

Total Vol. of Water lost per Annum 170820000 Lits/Annum

Total Unit of Water lost per Annum 170820 Units/annum

Cost of Water per Unit 5.55 Rs. / Unit

Cost of Leakage per Annum	948051	Rs. / Annum
----------------------------------	--------	-------------

Pl. Note: Nearby Residential and Commercial, area are using this water for daily use.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE		
SR. NO.	DETAILS	DESCRIPTION
1	Type of Leakage	Loha Pulliya
2	Location	Lead Joint Leakage at Wanjan Nagar ESR Feeder
3	Pipe Dia.	0.45 m
4	Pipe Material	AC Pipe

DETAILS OF SURVEY		
SR. NO.	DETAILS	DESCRIPTION
1	Name of Agency	Dinesh Rathi & Associates, Nagpur
2	Date of Testing	27th Nov. 2004
3	Time	13:44
4	Leak Detection Team Members	Bucket Filling Method 1. Rajendra Jagtap 2. Arun Kumar Shah 3. Ravi Aloni 4. Manish Doye

FLOW READING DETAILS		
Time of Flow	24	hrs.
No. of Pipes	1	Nos.
Dia. D	0.45	m
Radius R	0.225	m
Water Depth From Top edge of Pipe	0.425	m

To Calculate è

Dim A 0.025 m

Dim B 0.2 m

è 0.476 radians

Wetted Area A = $R^2(\text{è} - (\sin(2\text{è})) / 2) = 0.003 \text{ m}^2$

Velocity

Length of Pipe (L)	4.65 m
--------------------	--------

Time in secs (T)	5 sec
------------------	-------

Velocity V = L / T 0.93 m/s

Flow rate Q = $A \times V$ 0.00323 m³/Sec

Total Vol. of water lost per 279304 Lits/day

Total Vol. of water lost per 0.2793 MLD

Total Vol. of Lost per 101946112 Lit / Annum

Total Unit. of Lost per 101946 Unit / Annum

Cost of Water per Unit 5.55 Rs./Unit

Cost of Leakage per Annu 565801 Rs./Annum



LEAK DETECTION PLAN

LEAK DETECTION TEST		DESCRIPTION	
		Opp. Arun Automobile [Ghat Road]	
DETAILS OF LEAKAGE		Air Valve	
Sr. No.	DETAILS	716.10 mm	
1	Location	100 mm	
2	Type of leakage		
3	Main Pipe Dia.		
4	Air Valve Size	DESCRIPTION	
		Dinesh Rathi & Associates, Nagpur	
DETAILS OF SURVEY		27th Nov. 2004	
Sr. No.	DETAILS	13:44	
1	Name of Agency	Bucket Filling Method	
2	Date of Testing	1. Rajendra Jagtap	
3	Time	2. Arun Kumar Shah	
4	Measurement Method	3. Diman Biswas	
5	Leak Detection Team Members	4. Ravi Aloni	
		5. Manish Doye	
			
FLOW READING DETAILS.			
Sr. No.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	142	20.00	0.141
2	141	20.00	0.142
3	141	20.00	0.142
Average Flow in LPS			0.142
Life of Leakage		1	Years
Supply Hours		24	Hrs.
Total Vol. of Water lost per Day		12269	Lits/day
Total Vol. of Water lost per Annum		4478112	Lits/Annum
Total Unit of Water lost per Annum		4478	Units/annum
Cost of Water per Unit		5.55	Rs. / Unit
Cost of Leakage per Annum		24854	Rs. / Annum

PI. Note: Nearby Residential and Commercial, area are using this water for daily use.

LEAK DETECTION PLAN

LEAK DETECTION TEST

DETAILS OF LEAKAGE

SR. NO.	DETAILS
1	Location
2	Type of leakage

DESCRIPTION

Murgiwala Valve [Near Tukdoji Putla]

Leakage

DESCRIPTION

Dinesh Rathi & Associates, Nagpur

DETAILS OF SURVEY

SR. NO.	DETAILS
1	Name of Agency
2	Date of Testing
3	Time
4	Measurement Method
5	Leak Detection Team Members

09th Feb. 2005

17:15

Bucket Filling Method

1. Rajendra Jagtap

2. Arun Kumar Shah

3. Diman Biswas

4. Ravi Aloni

FLOW READING DETAILS.

SR. NO.	Time in Sec.	Loss of water due to leakage	FLOW LPS
1	30	20.00	0.667
2	30	20.00	0.667
3	30	20.00	0.667
Average Flow in LPS			0.667



Life of Leakage	3	Years
-----------------	---	-------

Supply Hours	5	Hrs.
--------------	---	------

Total Vol. of Water lost per Day	12000	Lits/day
----------------------------------	-------	----------

Total Vol. of Water lost per Day	0.012	MLD
----------------------------------	-------	-----

Total Vol. of Water lost per Annum	4380000	Lits/Annum
------------------------------------	---------	------------

Total Unit of Water lost per Annum	4380	Units/annum
------------------------------------	------	-------------

Cost of Water per Unit	5.55	Rs. / Unit
------------------------	------	------------

Cost of Leakage per Annum	24309	Rs. / Annum
---------------------------	-------	-------------

Pl. Note: Nearby Residential and Commercial, area are using this water for daily use.

WATER AUDIT, LEAK DETECTION PLAN SEEPAGE WATER AT FORT GSR

ESR Fort GSR 1 Date 01-01-2004

Reading taken by
1) Anurag Mate

Time min	Interval in sec	Reading one M	Reading two M	Water Ht M	Level rise M	Side of Section M	Side of Section M	ESR filled cap M ³	Deductions for columns			No	V M ³	Net capacity M ³	ESR total cap M ³	Flow per sec M ³ /Sec	Flow per min M ³ /Min	Flow per hour M ³ /Hr
									B mm	D mm	A M ²							
12.20pm	Start	5.700	2.250	3.450	0.000	37.800	25.025	0.000	220	220	0.048	87	0.00	0.00	0.00	0	0	0
12.25pm	300	5.700	2.120	3.580	0.130	37.800	25.025	122.973	220	220	0.048	87	0.55	122.43	122.425	0.408	24.485	1469.105
12.30pm	300	5.700	1.940	3.760	0.180	37.800	25.025	170.270	220	220	0.048	87	0.8	169.51	291.938	0.565	33.902	2034.146
12.35pm	300	5.700	1.780	3.920	0.160	37.800	25.025	151.351	220	220	0.048	87	0.67	150.68	442.615	0.502	30.135	1808.130
12.40pm	300	5.700	1.600	4.100	0.180	37.800	25.025	170.270	220	220	0.048	87	0.76	169.51	612.127	0.565	33.902	2034.146
12.45pm	300	5.700	1.450	4.250	0.150	37.800	25.025	141.892	220	220	0.048	87	0.63	141.26	753.387	0.471	28.252	1695.122
12.50pm	300	5.700	1.300	4.400	0.150	37.800	25.025	141.892	220	220	0.048	87	0.63	141.26	894.647	0.471	28.252	1695.122
12.55pm	300	5.700	1.150	4.550	0.150	37.800	25.025	141.892	220	220	0.048	87	0.63	141.26	1035.908	0.471	28.252	1695.122
1.00pm	300	5.700	0.980	4.720	0.170	37.800	25.025	160.811	220	220	0.048	87	0.72	160.09	1196.002	0.534	32.019	1921.138
1.05pm	300	5.700	0.800	4.900	0.180	37.800	25.025	170.270	220	220	0.048	87	0.76	169.51	1365.515	0.565	33.902	2034.146
1.10pm	300	5.700	0.600	5.100	0.200	37.800	25.025	189.189	220	220	0.048	87	0.84	188.35	1553.861	0.628	37.669	2260.162
1.15pm	300	5.700	0.500	5.200	0.100	37.800	25.025	94.595	220	220	0.048	87	0.42	94.17	1648.035	0.314	18.835	1130.081
1.20pm	300	5.700	0.370	5.330	0.130	37.800	25.025	122.973	220	220	0.048	87	0.55	122.43	1770.460	0.408	24.485	1469.105
1.25pm	300	5.700	0.360	5.340	0.010	37.800	25.025	9.459	220	220	0.048	87	0.04	9.42	1779.878	0.031	1.883	113.008
1.35pm	600	5.700	0.370	5.330	0.010	37.800	25.025	9.459	220	220	0.048	87	0.04	9.42	1789.295	0.016	0.942	56.504
1.45pm	600	5.700	0.380	5.320	0.010	37.800	25.025	9.459	220	220	0.048	87	0.04	9.42	1798.712	0.016	0.942	56.504
1.55pm	600	5.700	0.380	5.320	0.000	37.800	25.025	0.000	220	220	0.048	87	0.00	0.00	1798.712	0.000	0.000	0.000
2.05pm	600	5.700	0.390	5.310	0.010	37.800	25.025	9.459	220	220	0.048	87	0.04	9.42	1808.130	0.016	0.942	56.504
2.15pm	600	5.700	0.380	5.320	-0.010	37.800	25.025	-9.459	220	220	0.048	87	-0.04	0.00	1808.130	0.000	0.000	0.000
2.25pm	600	5.700	0.380	5.320	0.000	37.800	25.025	0.000	220	220	0.048	87	0.00	0.00	1808.130	0.000	0.000	0.000
2.35pm	600	5.700	0.390	5.310	0.010	37.800	25.025	9.459	220	220	0.048	87	0.04	9.42	1817.547	0.016	0.942	56.504
2.45pm	600	5.700	0.390	5.310	0.000	37.800	25.025	0.000	220	220	0.048	87	0.00	0.00	1817.547	0.000	0.000	0.000
	8100													1525.61				

Note :- The inlet was open full & outlet closed

Level rise during an hour =

1.880 Mtr

Flow per hour =

1770.46 Cum/hr

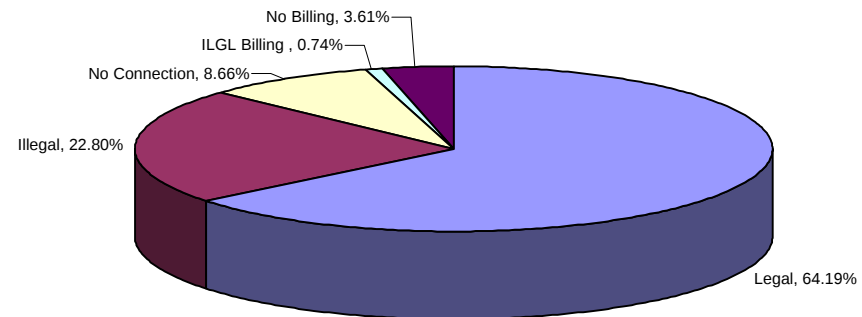
Leak detection	Level dropped during an hour	Outflow due to tank leakage	Av. Days of Over flow for year	Loss of water per year Cum/year	Loss of water per Day Cum/Day	Loss of water in MLD (Annual Average)
	0.040 m	37.67 Cum / Hr	60	54243.89	148.61	0.1486

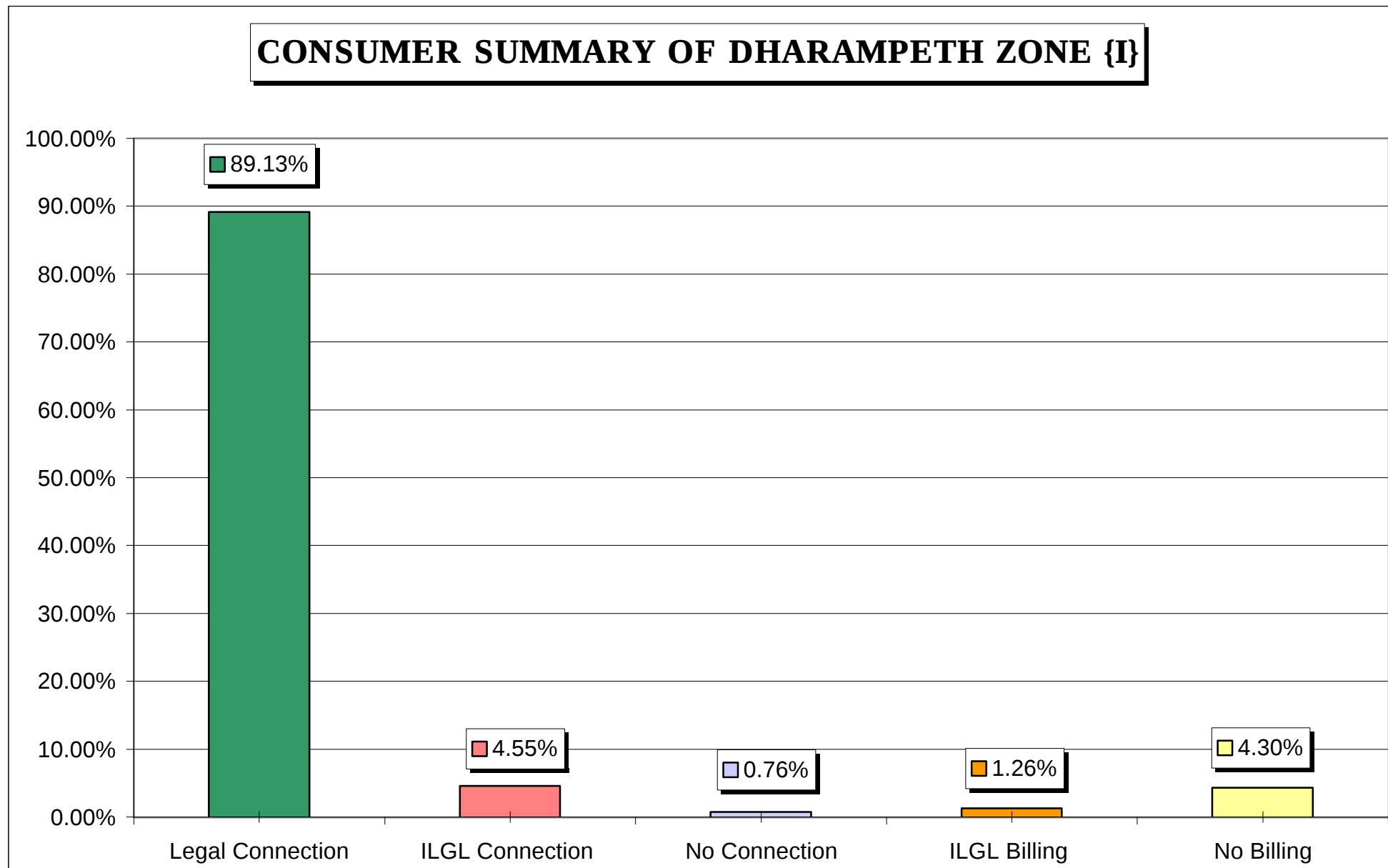
Annexure-3
(144 Test Zone Consumer Survey)

Annexure-3
SUMMARY OF CONSUMER SURVEY FOR WATER AUDIT, LEAK DETECTION WORK

Sr. No.	Zone	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Pipe Length
									1/2"	2"	3"	4"	5"	6"	8"	10"	
1	Dharampeth	6325	1187	1058	54	9	15	51	0	2445	734	4303	156	1405	0	0	9043
2	Laxmi Nagar	7151	1251	1194	19	29	1	8	0	597	576	5933	0	2558	0	0	9664
3	Hanuman Nag	3467	784	620	98	20	9	37	0	238	1802	4375	0	79	0	0	6494
4	Dhantoli	5241	898	818	60	7	0	13	0	694	2724	2648	0	626	0	0	6692
5	Nehru Nagar	9194	1829	1236	480	8	20	85	0	1568	214	16447	0	2562	903	0	21694
6	Gandhinagar (Sokta Bhavan)	5555	1162	880	143	100	0	39	0	871	1799	2934	341	535	581	0	7061
7	Satranjipua	5668	975	370	356	214	1	34	0	388	763	3096	0	634	0	0	4881
8	Lakadganj	5231	974	508	150	197	16	103	171	0	0	4182	0	562	58	0	4973
9	Ashi Nagar	12075	2380	612	1307	404	7	50	0	2197	0	10596	0	2337	1044	0	16174
10	Mangalwari	2622	466	346	48	43	19	10	0	1094	322	1422	0	382	0	0	3220
Total		62529	11906	7642	2715	1031	88	430	171	10092	8934	55936	497	11680	2586	0	89896
TOTAL PERCENTAGE OF CONSUMER SUMMARY				64.19%	22.80%	8.66%	0.74%	3.61%									

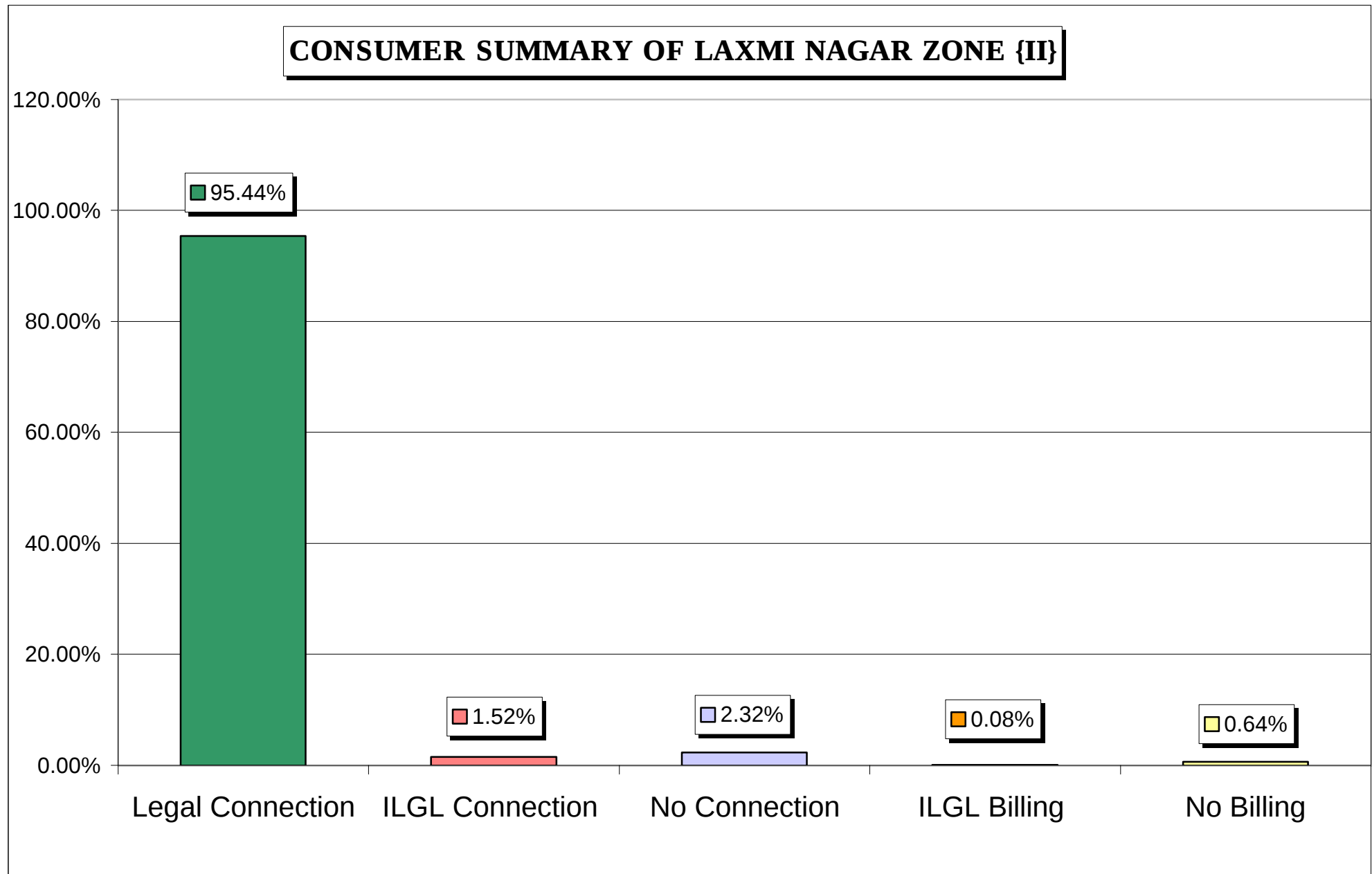
CONSUMER SUMMARY FOR SELECTED 144 TEST ZONES





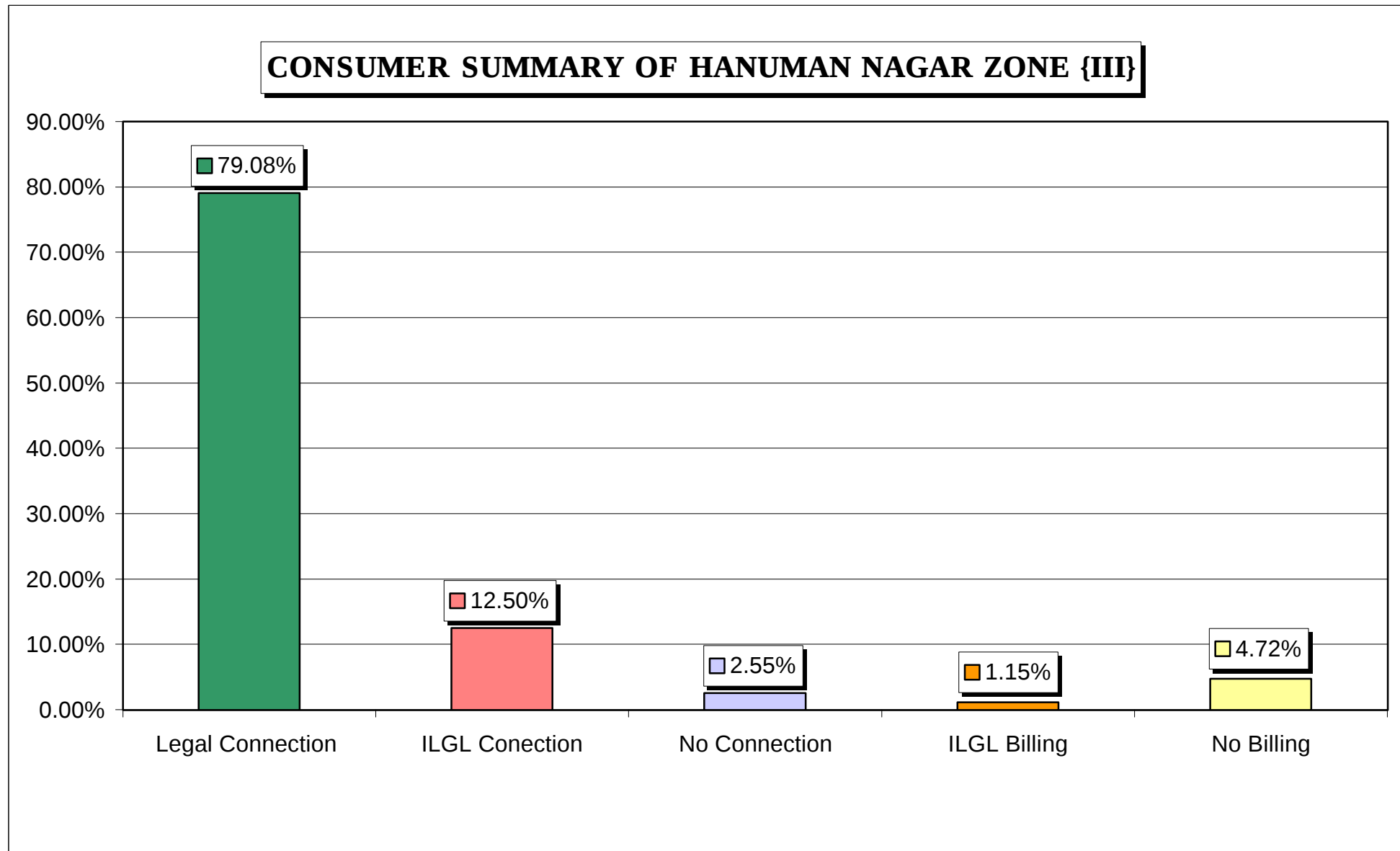
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
1	Dharampeth	HIG	Bajiprabhu Nagar	Ram Nagar	365	80	65				15				1096		690			1786	
			Ambazari Layout	Ram Nagar	486	63	63								813					813	
			Friends Colony	Gittikhadan	452	102	101			1					517		283			800	
			Tilak Nagar	Ram Nagar / Rifle Line	1275	204	204						920	410			174			1504	
		MIG	Gajanan Nagar	Seminary Hills	109	38	27			7		4				455					455
			Giripeth	Ram Nagar	814	106	106							266		183		258			707
		LIG	Manohar Vihar	Seminary Hills	511	130	130									465					465
			Trust Layout	Ram Nagar	369	80	70	4	1		5		67	173	117						357
			Ambedkar Nagar	Ram Nagar / Rifle Line	816	151	138	7	1		5		551	151		156					858
		SLUM	Surendra Garh	Seminary Hills	560	108	80	14			14					227					227
			Vishwas Nagar	Seminary Hills	321	63	36	21				6		122		59					181
			Seva Nagar	Ram Nagar	172	46	28	4				14				371					371
			Kachipura- 2	Ram Nagar / Rifle Line	75	16	10	4				2		519							519
Sub Total					6325	1187	1058	54	9	15	51	0	2445	734	4303	156	1405	0	0	9043	
Percentage							89.13%	4.55%	0.76%	1.26%	4.30%										



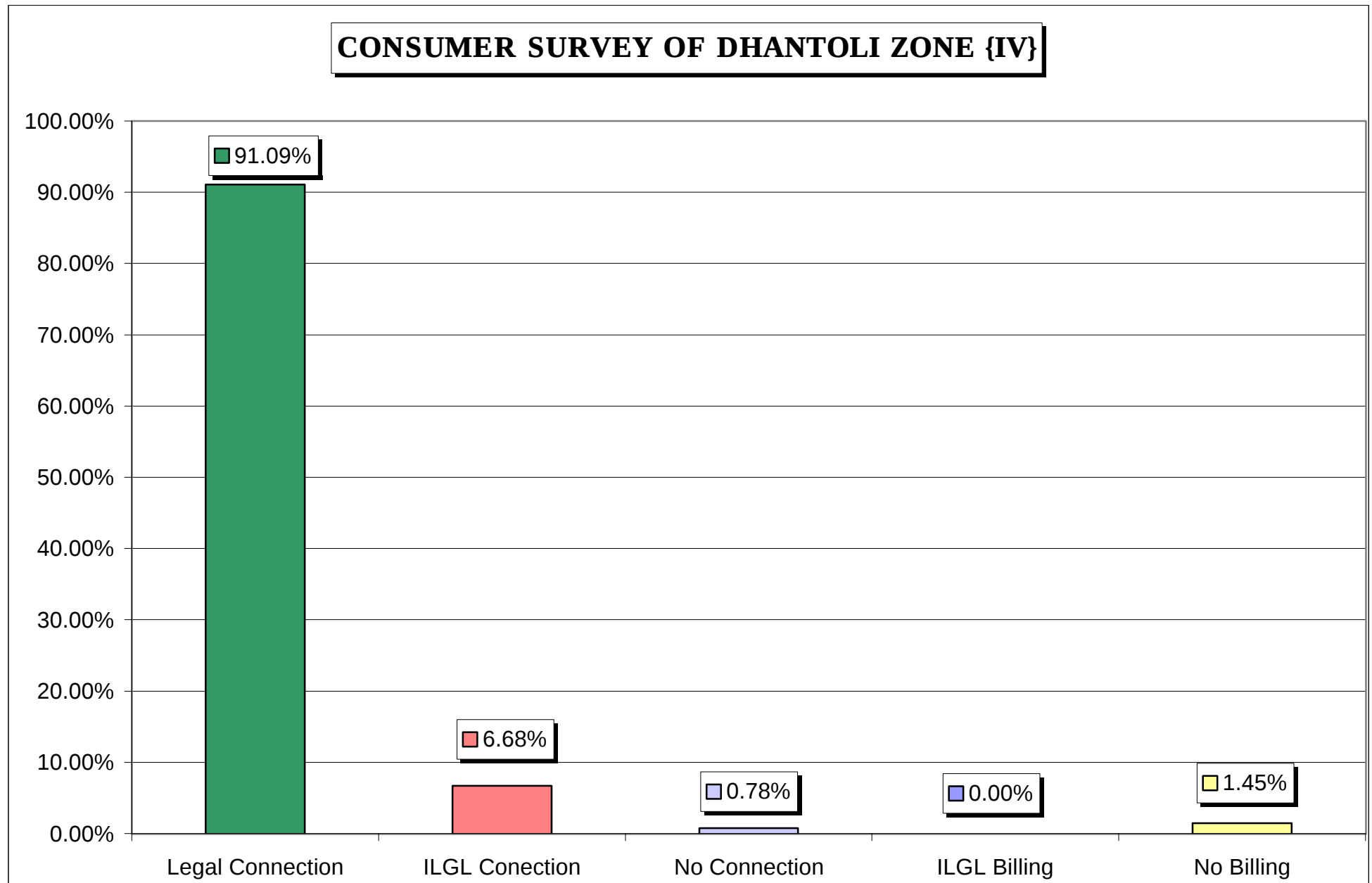
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
2	Laxmi Nagar	HIG	Nelco Society	Gayatri Nagar	454	38	35				3				240		250			490	
			Friend Society	Laxmi Nagar Old	171	36	36							186	538					724	
			Congress Nagar	Dhantoli	710	94	93				1		47		127		476			650	
		MIG	Prasad Nagar	Takliseem	472	74	74									753					753
			Guddhe Layout	Laxmi Nagar New	159	31	31									387					387
			Vijay Nagar	Gayatri Nagar	235	46	46						365		12		365				742
			NIT Layout Gittikhadan	Laxmi Nagar New	574	100	100														0
			Milind Nagar	Khamla	427	52	52									421					421
			Adhyapak Nagar	Takliseem	413	86	86									244		409			653
		LIG	Kamgar Nagar	Gayatri Nagar	422	83	80	1				2				397		210			607
			Dhangarpura	Laxmi Nagar	251	37	37									275		462			737
			Savitri Vihar	Laxmi Nagar New	862	200	199	1								482		264			746
		SLUM	Laxmi Nagar	Laxmi Nagar Old	264	51	48	3						80		256					336
			Bhamptee Village	Laxmi Nagar New	225	45	27	1	16	1				105	179						284
			Tukdoji Nagar	Gayatri Nagar	569	111	90	8	13							291					291
			Takliseem	Takliseem	247	45	42	3							211	189					400
			Takiya	Dhantoli	293	48	45	2				1				325					325
		HIG/MIG	Panchdeep Nagar	Khamla	284	48	48									701					701
			Nagbhoomi Layout	Khamla	119	26	25					1				295		122			417
Sub Total					7151	1251	1194	19	29	1	8	0	597	576	5933	0	2558	0	0	9664	
Percentage							95.44%	1.52%	2.32%	0.08%	0.64%										



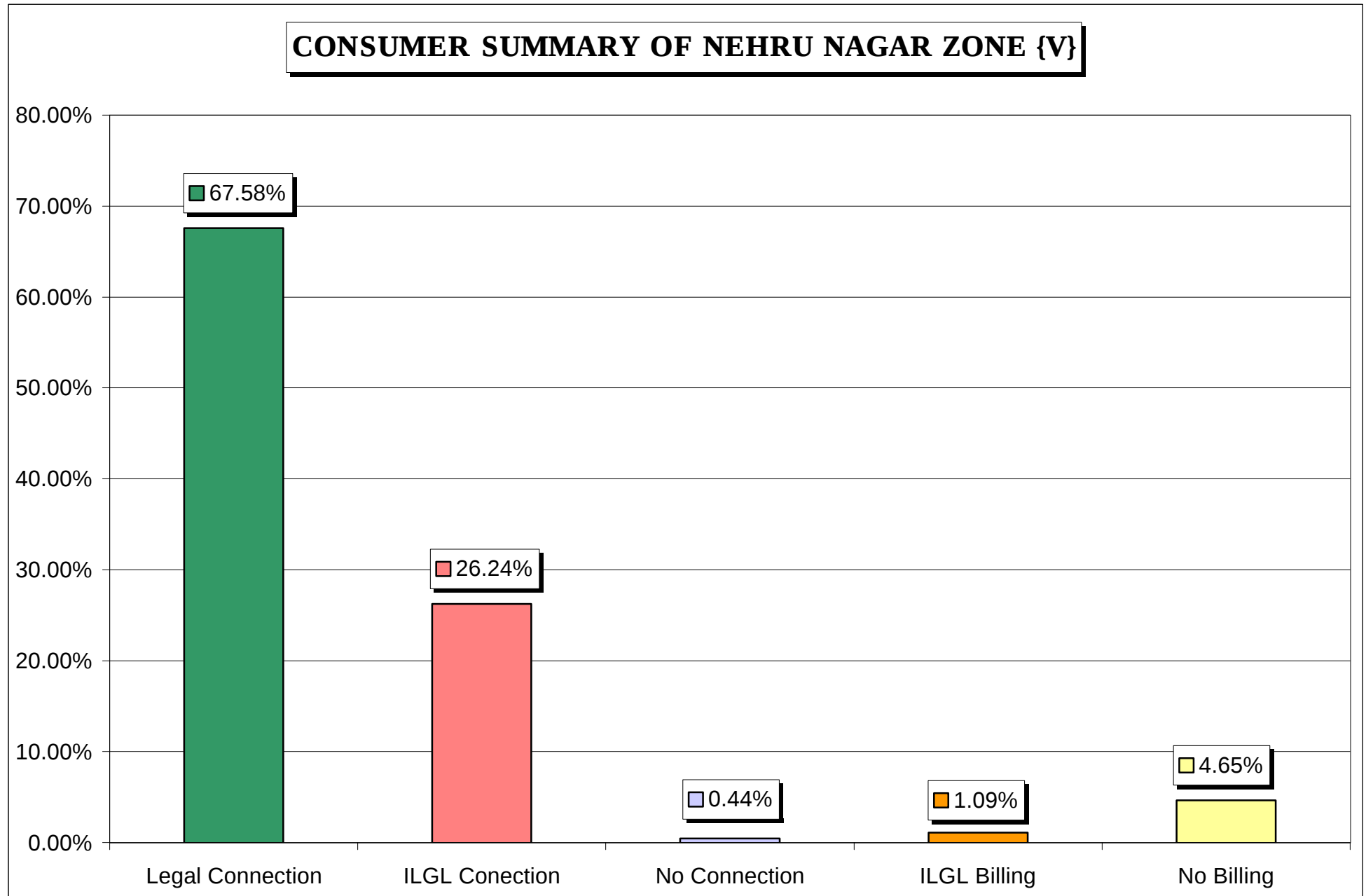
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connect ion	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe
												1/2"	2"	3"	4"	5"	6"	8"	10"	
3	Hanuman Nagar	HIG	Banerjee Layout	Omkar Nagar	494	89	87	1			1			704						704
		MIG	Mahatma Fule Nagar	Omkar Nagar	296	66	55	3	2		6				694					694
		LIG	Bajrang Nagar	Wanjari Nagar Old	156	25	20	3			2				453					453
			Shivraj Nagar	Wanjari Nagar Old	264	51	49			1	1			981						981
			Vinkar Colony	Omkar Nagar	780	171	145	24			2				1116					1116
		SLUM	Chandramani Nagar	Wanjari Nagar Old	12	77	67	9			1		158	117			79			354
			Bhim Nagar	Omkar Nagar	442	87	47	16	15	1	8		80		387					467
			Sanjay Gandhi Nagar	Hudkeshwar	571	135	77	40	1	7	10				716					716
		HIG/MIG	Kukade Layout	Wanjari Nagar Old	278	41	40	1							363					363
		MIG/LIG	Shiv Shakti Nagar	Hudkeshwar	174	42	33	1	2		6				646					646
Sub Total					3467	784	620	98	20	9	37	0	238	1802	4375	0	79	0	0	6494
Percentage							79.08%	12.50%	2.55%	1.15%	4.72%									



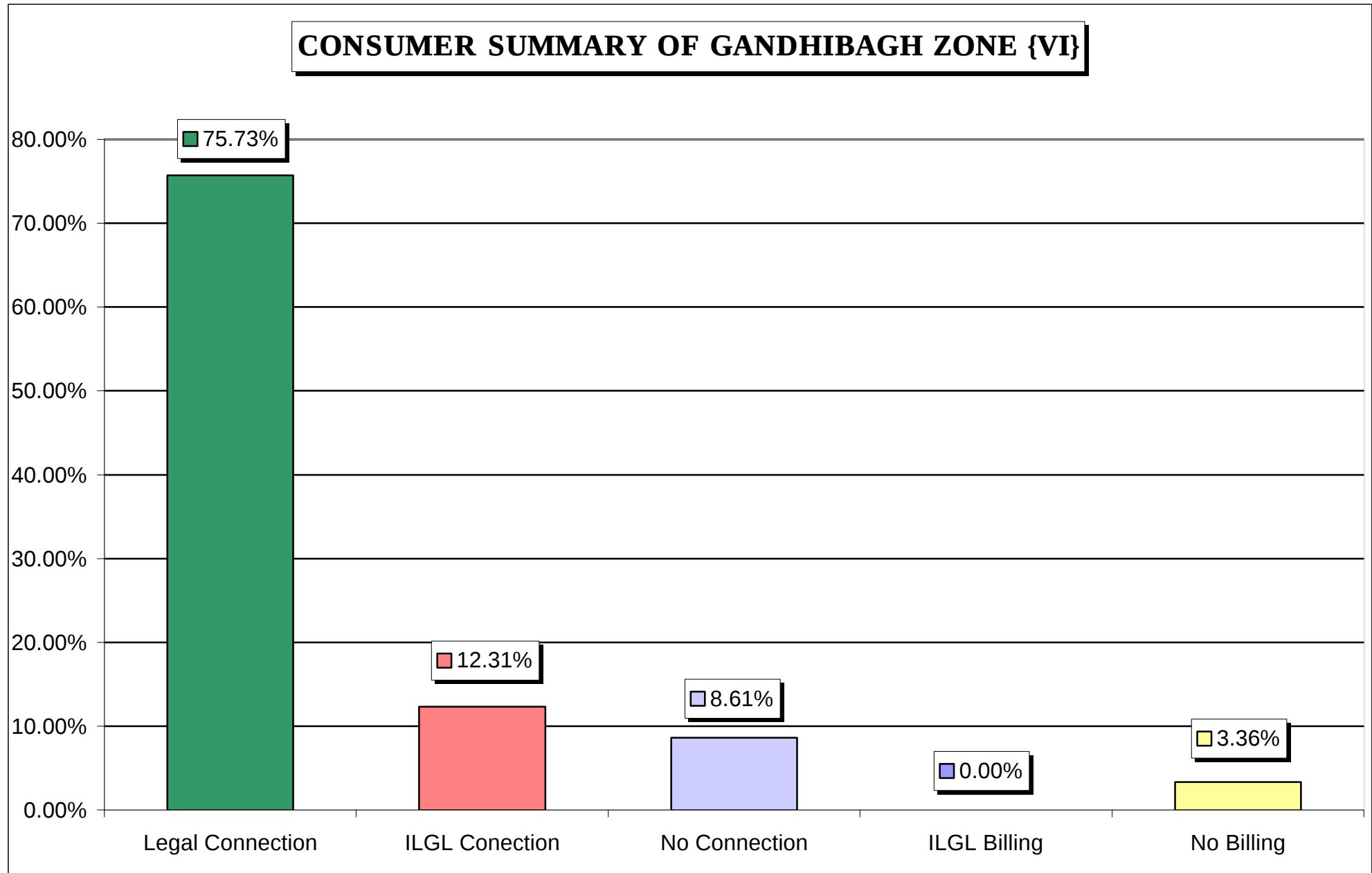
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
4	Dhantoli	MIG	Trikoni Maidan	Wanjari Nagar Old	464	82	82						164	162	587					913	
		LIG	Somwari Quarter	Reshim Bagh	277	58	48	6			4					205					205
			Vakilpeth	Wanjari Nagar Old	254	51	44	3	1		3				90	336					426
			Rajabaksha	Direct Tapping	825	110	102	1	3		4				65	490		300			855
			Ganeshpeth	Direct Tapping	231	47	47								109		230			339	
			PTS Colony	Direct Tapping	1021	207	200	7						143	1116	90				1349	
			SLUM	Juni Shukrawari	Reshim Bagh	202	39	39								139					
		Siraspeth		Wanjari Nagar Old																	0
		Kurnel Bagh		Direct Tapping	186	36	36							214							214
		Rambagh		Direct Tapping	303	59	18	41							156						156
		Vakilpeth		Direct Tapping	125	26	25	1								293		96			389
		HIG/MIG	Reshimbagh	Reshim Bagh	392	64	62	1			1		173	275	201						649
			Hanuman Nagar	Wanjari Nagar Old	961	119	115		3		1			721	337						1058
Sub Total					5241	898	818	60	7	0	13	0	694	2724	2648	0	626	0	0	6692	
Percentage							91.09%	6.68%	0.78%	0.00%	1.45%										



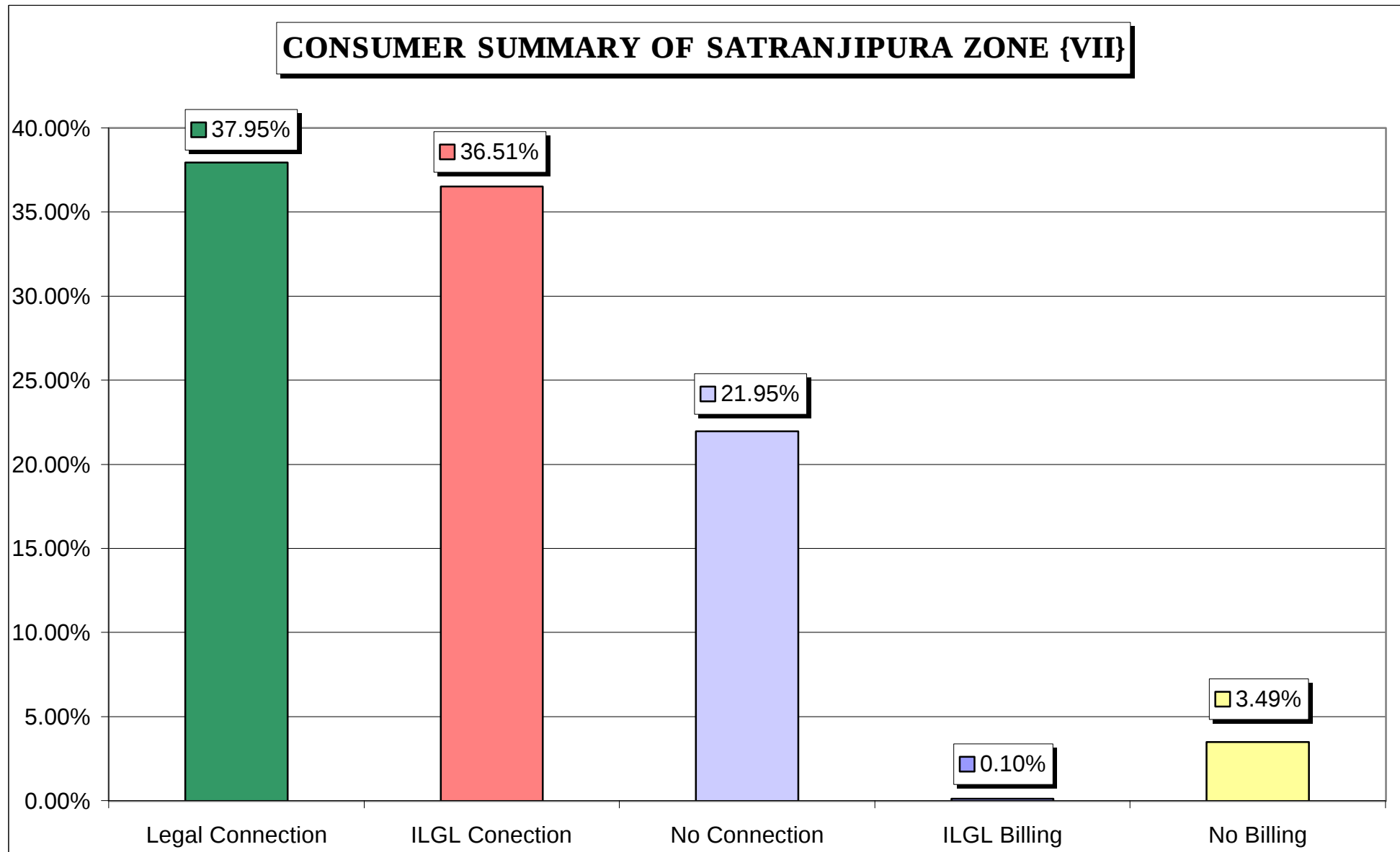
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
5	Nehru Nagar	HIG	Surve Nagar	Sakkardara	656	124	100		7		17				848		464	275		1587	
			Sanmarg Nagar	Hudkeshwar	211	45	38				7				35		285			320	
			Pragati Colony	Dighori	287	66	66								1129		50			1179	
			Gurudeo Nagar	Nandanvan	703	150	136	9		1	4				2357					2357	
			MHADA Colony	Nandanvan	113	28	28								115		210			325	
		MIG	Ayodhya Nagar,Ram Mandir	Sakkardara	213	40	31			2	7					398					398
			Ayodhya Nagar,Thakur Chakki	Sakkardara	148	26	21	5					205		115					320	
			New Malgi	Hudkeshwar	1530	307	281	12		14					2771		708			3479	
			Old Malgi	Hudkeshwar	685	165	147	7			11				2827		364	226		3417	
			Sai Nagar	Dighori	138	31	10	21							312		268			580	
			Telephone Nagar	Dighori	151	35	30				5		336							336	
			Shakti Mata Nagar	Nandanvan	273	56	36				20				669		40			709	
			Shri Krishna Nagar	Nandanvan	257	48	44	1			3				830					830	
		LIG	Rajiv Gandhi Nagar	Sakkardara	438	98	26	72						544						544	
			Raghuji Nagar	Sakkardara	396	92	85	4			3				831		173			1004	
			Adarsh Nagar	Dighori	251	56	53	1		2					575					575	
			Auliya Nagar	Nandanvan	318	52	0	51			1				832					832	
		SLUM	Dighori Village	Dighori	416	94	87	1		1	5		483		480			402		1365	
			Hasan Bagh Slum	Nandanvan	1459	252	0	252							1131					1131	
			Nandanvan Slum	Nandanvan	222	44	0	44							192					192	
		HIG/MIG	Dattatrya Nagar	Sakkardara	329	20	17		1		2			214						214	
Sub Total					9194	1829	1236	480	8	20	85	0	1568	214	16447	0	2562	903	0	21694	
Percentage							67.58%	26.24%	0.44%	1.09%	4.65%										



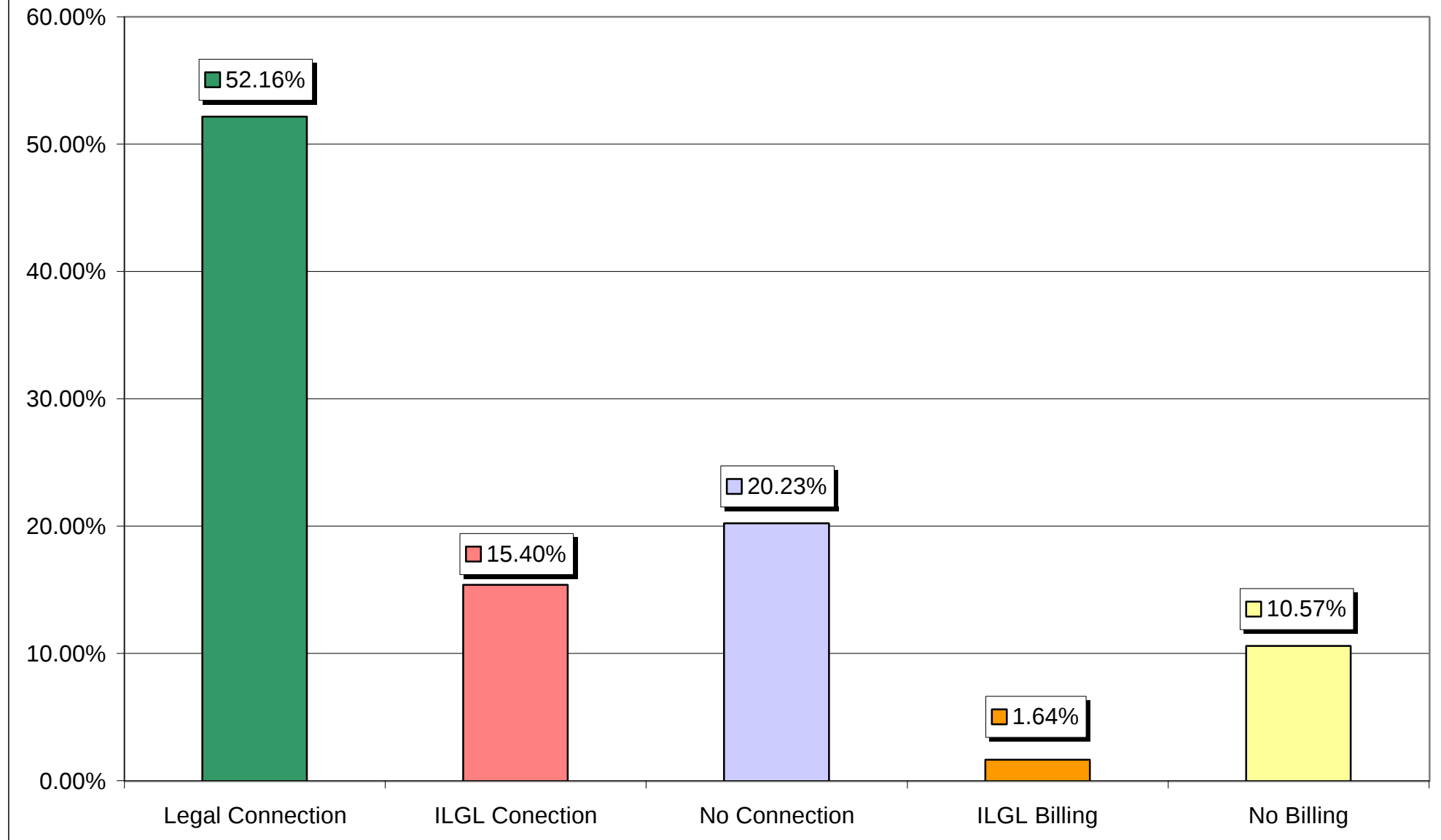
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
6	Gandhibagh	HIG	Queta Colony	Lakadganj	944	128	127	1						716		215				931	
		MIG	Hansapuri	Bhoipura		126	107				19		122	215	151			244		732	
		LIG	Ganjipeth	Sitabuldi Fort	117	17	7	2	8						102					102	
		SLUM	Bhoipura	Bhoipura	318	54	24	13	15		2				305						305
			Chitnavis Pura	Sitabuldi Fort	828	152	64	75	13					69	357			166		592	
			Namak Factory	Bhoipura		103	91				12		95	56	384					535	
			Killa Mahal	Kill Mahal	505	69	52	10	7			19	201	208					428		
			Satranjipura	Lakadganj	259	40	25	3	12					208					208		
		HIG/MIG	Mahal	Sitabuldi Fort	444	73	63	4	6				168	86	92					346	
		MIG/LIG	Gandhi Grain Market	Lakadganj	399	101	88	1	7		5			411			445			856	
			Adarsh Nagar	Lakadganj	1741	299	232	34	32		1		467	45	1127	126	90	171		2026	
Sub Total					5555	1162	880	143	100	0	39	0	871	1799	2934	341	535	581	0	7061	
Percentage							75.73%	12.31%	8.61%	0.00%	3.36%										



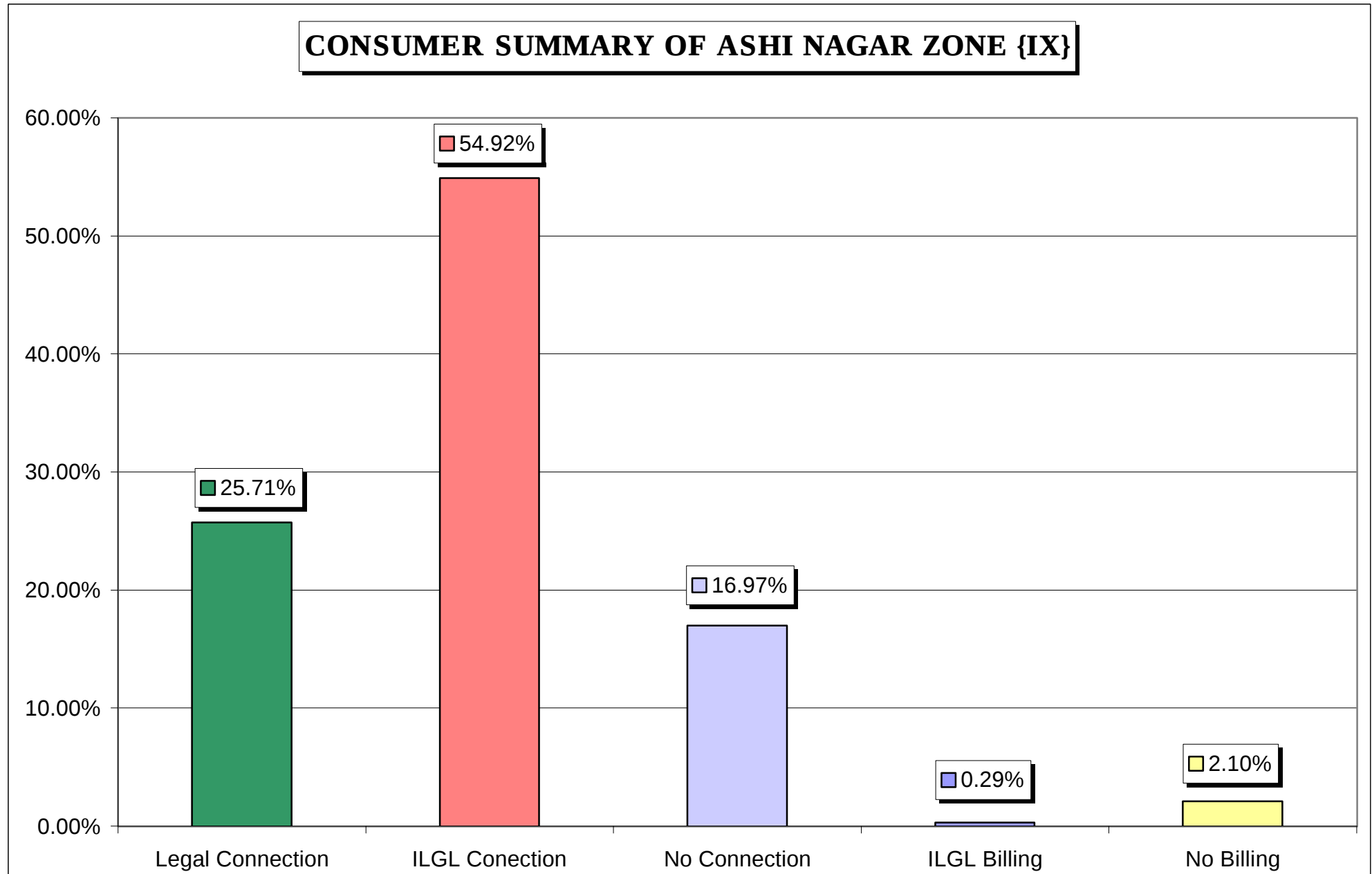
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
7	Satranjipura	HIG	Loha Oli	Governer House	107	28	18		10						142					142	
			Kashmiri Galli	Indora Tapping	406	52	45	2	4		1		101		322					423	
		MIG	Timki	Governer House	143	26	14	7	4	1					111					111	
			Nawa Nakasha	Indora Tapping	370	52	9	41	2						175					175	
			Tulsi Nagar	Kalmana Tapping	190	40	39		1											0	
		LIG	Ladpura	Indora Tapping	367	61	19	28	14					243		237					480
			Vinkar Colony	Indora Tapping	383	64	49	14			1				445						445
			Vinoba Bhawe Nagar	Subhan Nagar	397	87	20	51	10		6					540					540
		SLUM	Timki	Governer House	306	43	2	41						44		411					455
			Parwarpura	Governer House	252	41	39		2							274		150			424
			Kundanlal Gupta Slum	Kalmana Tapping	701	118	2	107	9							260		132			392
			Rajiv Gandhi Nagar	Kalmana Tapping	1204	203	1	54	123		25					64					64
			Bangde Layout	Kalmana Tapping	188	36	15	2	18		1					135					135
		MIG/LIG	Barse Nagar	Indora Tapping	191	33	7	9	17							318					318
			Shanti Nagar	Kalmana Tapping	463	91	91									425		352			777
Sub Total					5668	975	370	356	214	1	34	0	388	763	3096	0	634	0	0	4881	
Percentage							37.95%	36.51%	21.95%	0.10%	3.49%										

CONSUMER SUMMARY OF LAKADGANJ ZONE {VIII}

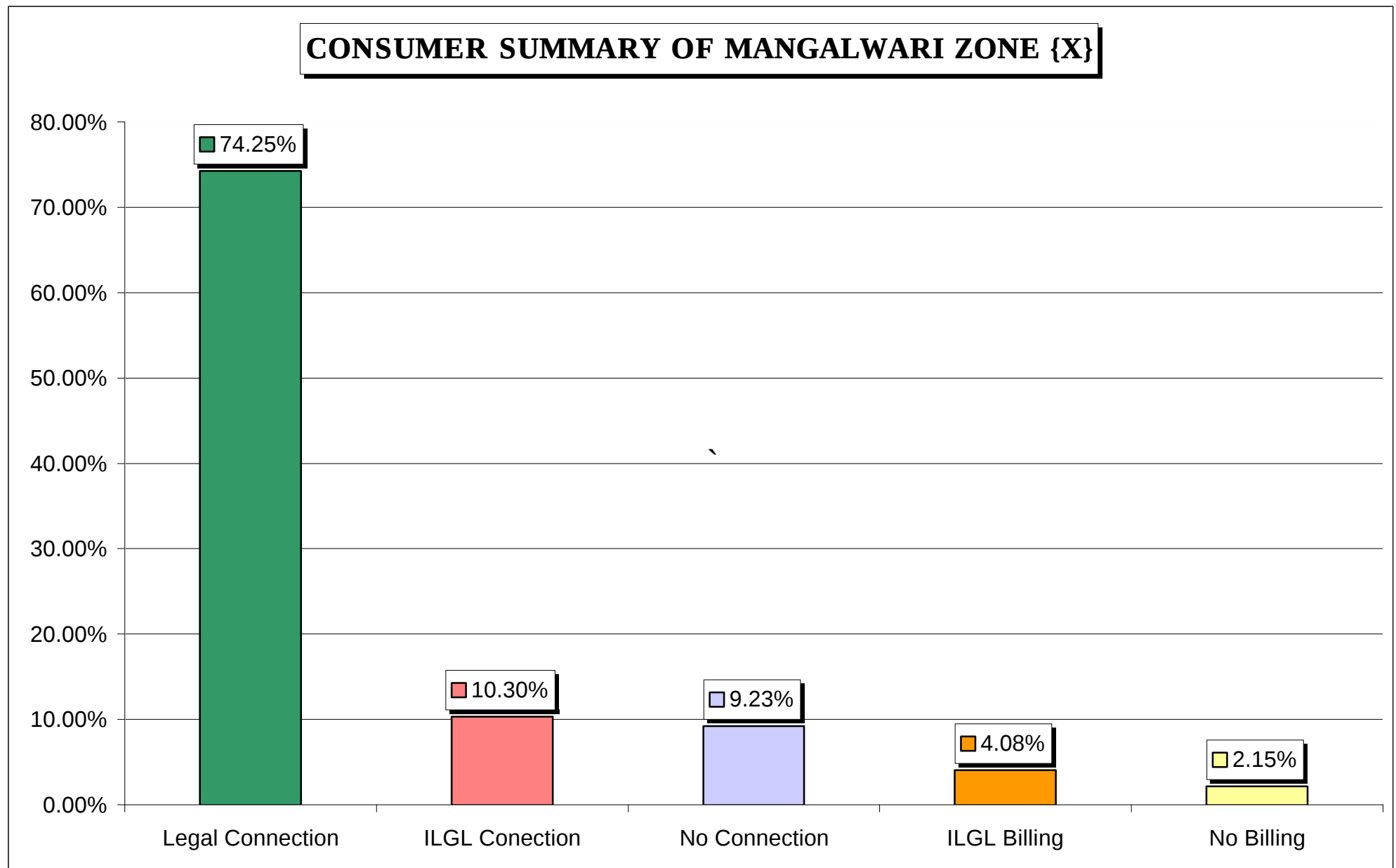
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe
												1/2"	2"	3"	4"	5"	6"	8"	10"	
8	Lakadganj	HIG	Deshpande Layout	Bharatwadi	392	80	66		11		3				194					194
			H. B. Town	Subhan Nagar	406	40	13		17		10				227					227
			Jalaram Nagar	Mini Mata Nagar	220	27	21	1	3		2				353		101			454
		MIG	Trimurti Nagar	Bharatwadi	413	89	63	4	17		5				468					468
			Gangabagh Pardi	Subhan Nagar	439	94	55	15	13		11				411					411
			Shikshak Nagar	Mini Mata Nagar	127	27	15		9		3				224					224
		LIG	Deshpande Layout	Bharatwadi	321	59	37	3	16		3				192					192
			Vinobha Bhawe Nagar	Subhan Nagar	792	147	87	16	31	2	11				601		138			739
			Janki Nagar	Mini Mata Nagar	340	74	59	1	12		2	171			132		246			549
		SLUM	Prajapati Nagar	Bharatwadi	550	96	45	36		14	1				752			58		810
			Bhandewadi Slum	Subhan Nagar	748	152	46	58	29		19				435					435
			Punjoram Wadi	Mini Mata Nagar	483	89	1	16	39		33				193		77			270
Sub Total					5231	974	508	150	197	16	103	171	0	0	4182	0	562	58	0	4973
Percentage							52.16%	15.40%	20.23%	1.64%	10.57%									



CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe	
												1/2"	2"	3"	4"	5"	6"	8"	10"		
9	Ashi Nagar	HIG	Yashodeep Nagar	Binaki	204	45	36	4	2		3				426					426	
			New Thaware Nagar	Jaripatka	457	102	70	19	3	1	9		495		115		214	307		1131	
		MIG	Bhole Nagar	Binaki	284	50	8	26	2			14		74		238					312
			Boudha Nagar, Ind	Indora Tapping	210	56	47	6			3				255					255	
			Boudha Nagar, Zone Office	Indora Tapping	299	44	23	20	1						252					252	
			Siddarth Nagar	Indora Tapping	82	18	14	4							146					146	
		LIG	Yogi Arvind Nagar	Binaki	2440	454	5	438	10	1					2930					2930	
			Jaripatka, Chaodhari Sq.	Bezanbagh	370	73	58	6	5		4				52		273			325	
			Sant Lahanuji Nagar	Jaripatka	196	39	9	24	4		2				315					315	
			Kabeer Nagar	Nari	1149	271	103	138	23	2	5				1392		258			1650	
		SLUM	Rani Durgawati Nagar	Binaki	246	58	52	1	3	1	1				452					452	
			Devi Nagar	Indora Tapping	289	58	48	8	2						337		192			529	
			Hemu Colony	Bezanbagh	456	67	56	2	8		1				336					336	
			Pilli Nadi	Uppalwadi	1194	261			261						191					191	
			Wanjara Village	Uppalwadi	557	92	8	72	12				1237							1237	
			Maya Nagar	Jaripatka	372	71	28	39	3	1			120		110					230	
			Nara Village	Uppalwadi											87		1285			1372	
			Nari Basti	Nari									271		16			399		686	
		MIG/LIG	Chawk's Colony	Indora Tapping	474	104	17	83				4				312		115			427
			Sugat Nagar	Jaripatka	227	44	20	12	9			3				180					180
			Kamgar Nagar	Nari	2569	473	10	405	56	1	1				2454			338		2792	
Sub Total					12075	2380	612	1307	404	7	50	0	2197	0	10596	0	2337	1044	0	16174	
Percentage							25.71%	54.92%	16.97%	0.29%	2.10%										



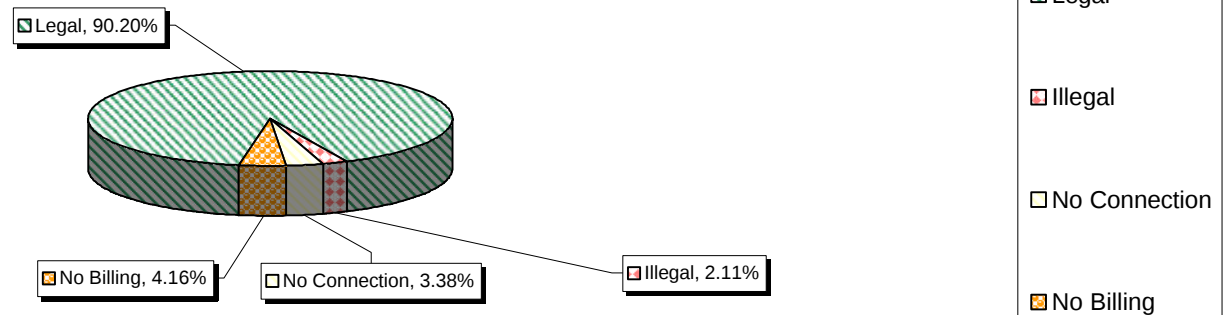
CONSUMER SUMMARY OF SELECTED TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	ILGL Billing	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe
												1/2"	2"	3"	4"	5"	6"	8"	10"	
10	Mangalwari	MIG	Geeta Nagar	Gittikhadan	379	56	43	2	7		4		283		73					356
			Mohan Nagar	Governer House	258	53	53								214					214
			MHADA Colony	Governer House	150	31	31								200					200
		LIG	Patel Nagar	Gittikhadan	354	61	56	5					284		384					668
		SLUM	Borgaon Slum	Governer House	142	30	23	2		4	1		53		162					215
			New Basti Slum	Governer House	295	46	24	19	3						223					223
		HIG/MIG	Byramji Town	Governer House	160	29	23		2		4		186				382			568
		MIG/LIG	Shiela Nagar	Gittikhadan	402	64	49	1	13		1			322						322
			Shri Krishna Nagar	Governer House	482	96	44	19	18	15			288		166					454
Sub Total					2622	466	346	48	43	19	10	0	1094	322	1422	0	382	0	0	3220
Percentage							74.25%	10.30%	9.23%	4.08%	2.15%									

CONSUMER SUMMARY OF SELECTED HIG TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Total Population	No. of Consumer	Legal	Illegal	No Connection	No Billing	Length of Pipe Lines in Meter							Total Length of Pipe
								1/2"	2"	3"	4"	5"	6"	8"	
1	Dharampeth	2578	449	433	0	0	15	0	920	410	2426	0	1147	0	4903
2	Laxmi Nagar	1738	242	237	0	0	5	0	47	186	1901	0	848	0	2982
3	Hanuman Nagar	772	130	127	2	0	1	0	0	704	363	0	0	0	1067
4	Dhantoli	1353	183	177	1	3	2	0	173	996	538	0	0	0	1707
5	Nehru Nagar	2299	433	385	9	8	30	0	0	214	4484	0	1009	275	5982
6	Gandhibag (Sokta Bhavan)	1388	201	190	5	6	0	0	168	802	92	215	0	0	1277
7	Satranjipura	513	80	63	2	14	1	0	101	0	464	0	0	0	565
8	Lakadganj	1018	147	100	1	31	15	0	0	0	774	0	101	0	875
9	Ashi Nagar	661	147	106	23	5	12	0	495	0	541	0	214	307	1557
10	Mangalwari	160	29	23	0	2	4	0	186	0	0	0	382	0	568
Total		12480	2041	1841	43	69	85	0	2090	3312	11583	215	3701	582	21483
Percentage				90.20%	2.11%	3.38%	4.16%								

CONSUMER SUMMARY OF HIG TEST ZONE



CONSUMER SUMMARY OF SELECTED HIG TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

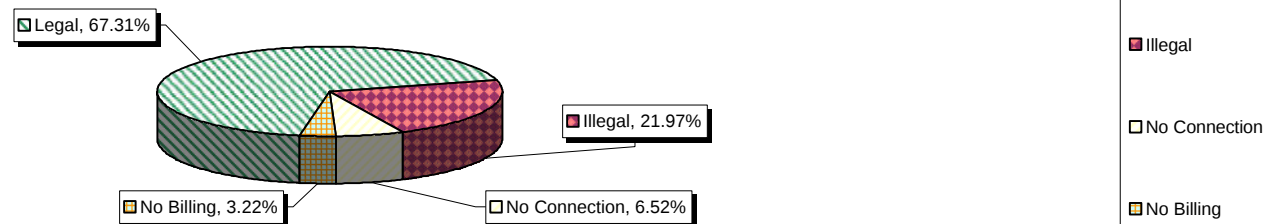
Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connect ion	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe
											1/2"	2"	3"	4"	5"	6"	8"	10"	
1	Dharampeth	HIG	Bajiprabhu Nagar	Ram Nagar	365	80	65	0	0	15	0	0	0	1096	0	690	0	0	1786
			Ambazari Layout	Ram Nagar	486	63	63	0	0	0	0	0	0	813	0	0	0	0	813
			Friends Colony	Gittikhadan	452	102	101	0	0	0	0	0	0	517	0	283	0	0	800
			Tilak Nagar	Ram Nagar / Rifle Line	1275	204	204	0	0	0	0	920	410	0	0	174	0	0	1504
Sub Total					2578	449	433	0	0	15	0	920	410	2426	0	1147	0	0	4903
2	Laxmi Nagar	HIG	Nelco Society	Gayatri Nagar	454	38	35	0	0	3	0	0	0	240	0	250	0	0	490
			Friend Society	Laxmi Nagar Old	171	36	36	0	0	0	0	0	186	538	0	0	0	0	724
			Congress Nagar	Dhantoli	710	94	93	0	0	1	0	47	0	127	0	476	0	0	650
			Panchdeep Nagar	Khamla	284	48	48	0	0	0	0	0	0	701	0	0	0	0	701
			Nagbhoomi Layout	Khamla	119	26	25	0	0	1	0	0	0	295	0	122	0	0	417
Sub Total					1738	242	237	0	0	5	0	47	186	1901	0	848	0	0	2982
3	Hanuman Nagar	HIG	Banerjee Layout	Omkar Nagar	494	89	87	1	0	1	0	0	704	0	0	0	0	0	704
			Kukade Layout	Wanjari Nagar Old	278	41	40	1	0	0	0	0	0	363	0	0	0	0	363
Sub Total					772	130	127	2	0	1	0	0	704	363	0	0	0	0	1067
4	Dhantoli	HIG	Reshimbagh	Reshim Bagh	392	64	62	1	0	1	0	173	275	201	0	0	0	0	649
			Hanuman Nagar	Wanjari Nagar Old	961	119	115	0	3	1	0	0	721	337	0	0	0	0	1058
Sub Total					1353	183	177	1	3	2	0	173	996	538	0	0	0	0	1707

5	Nehru Nagar	HIG	Surve Nagar	Sakkardara	656	124	100	0	7	17	0	0	0	848	0	464	275	0	1587
			Sanmarg Nagar	Hudkeshwar	211	45	38	0	0	7	0	0	0	35	0	285	0	0	320
			Pragati Colony	Dighori	287	66	66	0	0	0	0	0	0	1129	0	50	0	0	1179
			Gurudeo Nagar	Nandanvan	703	150	136	9	0	4	0	0	0	2357	0	0	0	0	2357
			MHADA Colony	Nandanvan	113	28	28	0	0	0	0	0	0	115	0	210	0	0	325
			Dattatrya Nagar	Sakkardara	329	20	17	0	1	2	0	0	214	0	0	0	0	0	214
Sub Total					2299	433	385	9	8	30	0	0	214	4484	0	1009	275	0	5982
6	Gandhibagh	HIG	Queta Colony	Lakadganj	944	128	127	1	0	0	0	0	716	0	215	0	0	0	931
			Mahal	Sitabuldi Fort	444	73	63	4	6	0	0	168	86	92	0	0	0	0	346
Sub Total					1388	201	190	5	6	0	0	168	802	92	215	0	0	0	1277
7	Satranjipura	HIG	Loha Oli	Governer House	107	28	18	0	10	0	0	0	0	142	0	0	0	0	142
			Kashmiri Galli	Indora Tapping	406	52	45	2	4	1	0	101	0	322	0	0	0	0	423
Sub Total					513	80	63	2	14	1	0	101	0	464	0	0	0	0	565
8	Lakadganj	HIG	Deshpande Layout	Bharatwadi	392	80	66	0	11	3	0	0	0	194	0	0	0	0	194
			H. B. Town	Subhan Nagar	406	40	13	0	17	10	0	0	0	227	0	0	0	0	227
			Jalaram Nagar	Mini Mata Nagar	220	27	21	1	3	2	0	0	0	353	0	101	0	0	454
Sub Total					1018	147	100	1	31	15	0	0	0	774	0	101	0	0	875
9	Ashi Nagar	HIG	Yashodeep Nagar	Binaki	204	45	36	4	2	3	0	0	0	426	0	0	0	0	426
			New Thaware Nagar	Jaripatka	457	102	70	19	3	9	0	495	0	115	0	214	307	0	1131
Sub Total					661	147	106	23	5	12	0	495	0	541	0	214	307	0	1557
10	Mangalwari	HIG	Byramji Town	Governer House	160	29	23	0	2	4	0	186	0	0	0	382	0	0	568
Sub Total					160	29	23	0	2	4	0	186	0	0	0	382	0	0	568

CONSUMER SUMMARY OF SELECTED MIG TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Total Population	No. of Consumer	Legal	Illegal	No Connection	No Billing	Length of Pipe Lines in Meter							Total Length of Pipe
								1/2"	2"	3"	4"	5"	6"	8"	
1	Dharampeth	923	144	133	0	7	4	0	266	0	638	0	258	0	1162
2	Laxmi Nagar	2280	389	389	0	0	0	0	365	0	1817	0	774	0	2956
3	Hanuman Nagar	470	108	88	4	4	12	0	0	0	1340	0	0	0	1340
4	Dhantoli	464	82	82	0	0	0	0	164	162	587	0	0	0	913
5	Nehru Nagar	2714	569	490	45	0	18	0	205	0	6423	0	1340	226	8194
6	Gandhibag (Sokta Bhavan)	2140	526	427	35	39	25	0	589	671	1278	126	535	415	3614
7	Satranjipura	1357	242	160	57	24	0	0	0	318	711	0	352	0	1381
8	Lakadganj	979	210	133	19	39	19	0	0	0	1103	0	0	0	1103
9	Ashi Nagar	4145	789	139	556	68	25	0	74	0	3837	0	115	338	4364
10	Mangalwari	1671	300	220	22	38	5	0	571	322	653	0	0	0	1546
Total		17143	3359	2261	738	219	108	0	2234	1473	18387	126	3374	979	26573
Percentage				67.31%	21.97%	6.52%	3.22%								

CONSUMER SUMMARY OF MIG TEST ZONE



CONSUMER SUMMARY OF SELECTED MIG TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Population	No. of Consumer	Legal	Illegal	No Connection	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe
											1/2"	2"	3"	4"	5"	6"	8"	10"	
1	Dharampeth	MIG	Gajanan Nagar	Seminary Hills	109	38	27	0	7	4	0	0	0	455	0	0	0	0	455
			Giripeth	Ram Nagar	814	106	106	0	0	0	0	266	0	183	0	258	0	0	707
Sub Total					923	144	133	0	7	4	0	266	0	638	0	258	0	0	1162
2	Laxmi Nagar	MIG	Prasad Nagar	Takliseem	472	74	74	0	0	0	0	0	0	753	0	0	0	0	753
			Guddhe Layout	Laxmi Nagar New	159	31	31	0	0	0	0	0	0	387	0	0	0	0	387
			Vijay Nagar	Gayatri Nagar	235	46	46	0	0	0	0	365	0	12	0	365	0	0	742
			NIT Layout Gittikhadan	Laxmi Nagar New	574	100	100	0	0	0	0	0	0	0	0	0	0	0	0
			Milind Nagar	Khamla	427	52	52	0	0	0	0	0	0	421	0	0	0	0	421
			Adhyapak Nagar	Takliseem	413	86	86	0	0	0	0	0	0	244	0	409	0	0	653
Sub Total					2280	389	389	0	0	0	0	365	0	1817	0	774	0	0	2956
3	Hanuman Nagar	MIG	Mahatma Fule Nagar	Omkar Nagar	296	66	55	3	2	6	0	0	0	694	0	0	0	0	694
			Shiv Shakti Nagar	Hudkeshwar	174	42	33	1	2	6	0	0	0	646	0	0	0	0	646
Sub Total					470	108	88	4	4	12	0	0	0	1340	0	0	0	0	1340
4	Dhantoli	MIG	Trikoni Maidan	Wanjari Nagar Old	464	82	82	0	0	0	0	164	162	587	0	0	0	0	913
Sub Total					464	82	82	0	0	0	0	164	162	587	0	0	0	0	913

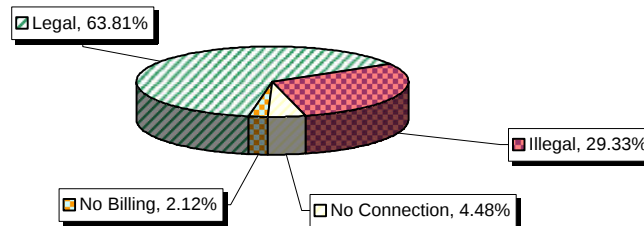
5	Nehru Nagar	MIG	Ayodhya Nagar,Ram	Sakkardara	213	40	31	0	0	7	0	0	0	398	0	0	0	0	398	
			Ayodhya Nagar,Thakur	Sakkardara	148	26	21	5	0	0	0	0	205	0	115	0	0	0	0	320
			New Malgi	Hudkeshwar	1530	307	281	12	0	0	0	0	0	0	2771	0	708	0	0	3479
			Old Malgi	Hudkeshwar	685	165	147	7	0	11	0	0	0	0	2827	0	364	226	0	3417
			Sai Nagar	Dighori	138	31	10	21	0	0	0	0	0	0	312	0	268	0	0	580
			Telephone Nagar	Dighori	151	35	30	0	0	5	0	336	0	0	0	0	0	0	0	336
			Shakti Mata Nagar	Nandanvan	273	56	36	0	0	20	0	0	0	0	669	0	40	0	0	709
			Shri Krishna Nagar	Nandanvan	257	48	44	1	0	3	0	0	0	0	830	0	0	0	0	830
			Sub Total					2714	569	490	45	0	18	0	205	0	6423	0	1340	226
6	Gandhibag (Sokta Bhavan)	MIG	Hansapuri	Bhoipura	0	126	107	0	0	19	0	122	215	151	0	0	244	0	732	
			Gandhi Grain Market	Lakadganj	399	101	88	1	7	5	0	0	411	0	0	445	0	0	856	
			Adarsh Nagar	Lakadganj	1741	299	232	34	32	1	0	467	45	1127	126	90	171	0	2026	
Sub Total					2140	526	427	35	39	25	0	589	671	1278	126	535	415	0	3614	
7	Satranjipura	MIG	Timki	Governer House	143	26	14	7	4	0	0	0	0	111	0	0	0	0	111	
			Nawa Nakasha	Indora Tapping	370	52	9	41	2	0	0	0	0	175	0	0	0	0	175	
			Tulsi Nagar	Indora Tapping	190	40	39	0	1	0	0	0	0	0	0	0	0	0	0	
			Barse Nagar	Indora Tapping	191	33	7	9	17	0	0	0	318	0	0	0	0	0	318	
			Shanti Nagar	Kalmana Tapping	463	91	91	0	0	0	0	0	0	0	425	0	352	0	0	777
Sub Total					1357	242	160	57	24	0	0	0	318	711	0	352	0	0	1381	
8	Lakadganj	MIG	Trimurti Nagar	Bharatwadi	413	89	63	4	17	5	0	0	0	468	0	0	0	0	468	
			Gangabagh Pardi	Subhan Nagar	439	94	55	15	13	11	0	0	0	411	0	0	0	0	411	
			Shikshak Nagar	Mini Mata Nagar	127	27	15	0	9	3	0	0	0	224	0	0	0	0	224	
Sub Total					979	210	133	19	39	19	0	0	0	1103	0	0	0	0	1103	

9	Ashi Nagar	MIG	Bhole Nagar	Binaki	284	50	8	26	2	14	0	74	0	238	0	0	0	0	312
			Boudha Nagar, Ind	Indora Tapp	210	56	47	6	0	3	0	0	0	255	0	0	0	0	255
			Boudha Nagar, Zone Office	Indora Tapp	299	44	23	20	1	0	0	0	0	252	0	0	0	0	252
			Siddarth Nagar	Indora Tapp	82	18	14	4	0	0	0	0	0	146	0	0	0	0	146
			Chawk's Colony	Indora Tapp	474	104	17	83	0	4	0	0	0	312	0	115	0	0	427
			Sugat Nagar	Jaripatka	227	44	20	12	9	3	0	0	0	180	0	0	0	0	180
			Kamgar Nagar	Nari	2569	473	10	405	56	1	0	0	0	2454	0	0	338	0	2792
			Sub Total					4145	789	139	556	68	25	0	74	0	3837	0	115
10	Mangalwari	MIG	Geeta Nagar	Gittikhadan	379	56	43	2	7	4	0	283	0	73	0	0	0	0	356
			Mohan Nagar	Governer House	258	53	53	0	0	0	0	0	0	214	0	0	0	0	214
			MHADA Colony	Governer House	150	31	31	0	0	0	0	0	0	200	0	0	0	0	200
			Shiela Nagar	Gittikhadan	402	64	49	1	13	1	0	0	322	0	0	0	0	0	322
			Shri Krishna Nagar	Governer House	482	96	44	19	18	0	0	288	0	166	0	0	0	0	454
			Sub Total					1671	300	220	22	38	5	0	571	322	653	0	0

CONSUMER SUMMARY OF SELECTED LIG TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Total Population	No. of Consumer	Legal	Illegal	No Connection	No Billing	Length of Pipe Lines in Meter							Total Length of Pipe
								1/2"	2"	3"	4"	5"	6"	8"	
1	Dharampeth	1696	361	338	11	2	10	0	618	324	582	156	0	0	1680
2	Laxmi Nagar	1535	320	316	2	0	2	0	0	0	1154	0	936	0	2090
3	Hanuman Nagar	1200	247	214	27	0	5	0	0	981	1569	0	0	0	2550
4	Dhantoli	2608	473	441	17	4	11	0	143	1271	1230	0	530	0	3174
5	Nehru Nagar	1403	298	164	128	0	4	0	544	0	2238	0	173	0	2955
6	Gandhibag (Sokta Bhavan)	117	17	7	2	8	0	0	0	0	102	0	0	0	102
7	Satranjipura	1147	212	88	93	24	7	0	243	445	777	0	0	0	1465
8	Lakadganj	1453	280	183	20	59	16	171	0	0	925	0	384	0	1480
9	Ashi Nagar	4155	837	175	606	42	11	0	0	0	4689	0	531	0	5220
10	Mangalwari	354	61	56	5	0	0	0	284	0	384	0	0	0	668
Total		15668	3106	1982	911	139	66	171	1832	3021	13650	156	2554	0	21384
Percentage				63.81%	29.33%	4.48%	2.12%								

CONSUMER SUMMARY OF LIG TEST ZONE



- ☒ Legal
- ☒ Illegal
- ☐ No Connection
- ☒ No Billing

CONSUMER SUMMARY OF SELECTED LIG TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

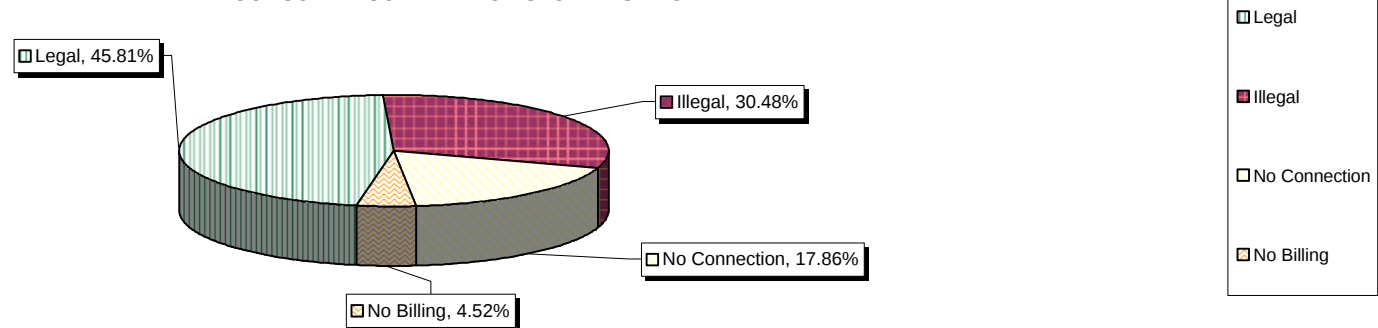
Sr. No.	Zone	Category	Test Zone	ESR Command Area	Total Populati on	No. of Consumer	Legal	Illegal	No Connecti on	No Billing	Length of Pipe Lines in Meter								Total Length of Pipe
											1/2"	2"	3"	4"	5"	6"	8"	10"	
1	Dharampeth	LIG	Manohar Vihar	Seminary Hills	511	130	130	0	0	0	0	0	0	465	0	0	0	0	465
			Trust Layout	Ram Nagar	369	80	70	4	1	5	0	67	173	117	0	0	0	0	357
			Ambedkar Nagar	Ram Nagar / Rifle Line	816	151	138	7	1	5	0	551	151	0	156	0	0	0	858
Sub Total					1696	361	338	11	2	10	0	618	324	582	156	0	0	0	1680
2	Laxmi Nagar	LIG	Kamgar Nagar	Gayatri Nagar	422	83	80	1	0	2	0	0	0	397	0	210	0	0	607
			Dhangarpura	Gayatri Nagar	251	37	37	0	0	0	0	0	0	275	0	462	0	0	737
			Savitri Vihar	Laxmi Nagar New	862	200	199	1	0	0	0	0	0	482	0	264	0	0	746
Sub Total					1535	320	316	2	0	2	0	0	0	1154	0	936	0	0	2090
3	Hanuman Nagar	LIG	Bajrang Nagar	Wanjari Nagar Old	156	25	20	3	0	2	0	0	0	453	0	0	0	0	453
			Shivraj Nagar	Wanjari Nagar Old	264	51	49	0	0	1	0	0	981	0	0	0	0	0	981
			Vinkar Colony	Omkar Nagar	780	171	145	24	0	2	0	0	0	1116	0	0	0	0	1116
Sub Total					1200	247	214	27	0	5	0	0	981	1569	0	0	0	0	2550
4	Dhantoli	LIG	Somwari Quarter	Reshim Bagh	277	58	48	6	0	4	0	0	0	205	0	0	0	0	205
			Vakilpeth	Wanjari Nagar Old	254	51	44	3	1	3	0	0	90	336	0	0	0	0	426
			Rajabaksha	Direct Tapping	825	110	102	1	3	4	0	0	65	490	0	300	0	0	855
			Ganeshpeth	Direct Tapping	231	47	47	0	0	0	0	0	0	109	0	230	0	0	339
			PTS Colony	Direct Tapping	1021	207	200	7	0	0	0	143	1116	90	0	0	0	0	1349
Sub Total					2608	473	441	17	4	11	0	143	1271	1230	0	530	0	0	3174

5	Nehru Nagar	LIG	Rajiv Gandhi Nagar	Sakkardara	438	98	26	72	0	0	0	544	0	0	0	0	0	544	
			Raghuji Nagar	Sakkardara	396	92	85	4	0	3	0	0	0	831	0	173	0	0	1004
			Adarsh Nagar	Dighori	251	56	53	1	0	0	0	0	0	575	0	0	0	0	575
			Auliya Nagar	Nandanvan	318	52	0	51	0	1	0	0	0	832	0	0	0	0	832
Sub Total					1403	298	164	128	0	4	0	544	0	2238	0	173	0	0	2955
6	Gandhibag (Sokta Bhavan)	LIG	Ganjipeth	Sitabuldi Fort	117	17	7	2	8	0	0	0	0	102	0	0	0	0	102
Sub Total					117	17	7	2	8	0	0	0	0	102	0	0	0	0	102
7	Satranjipura	LIG	Ladpura	Indora Tapping	367	61	19	28	14	0	0	243	0	237	0	0	0	0	480
			Vinkar Colony	Indora Tapping	383	64	49	14	0	1	0	0	445	0	0	0	0	0	445
			Vinoba Bhave Nagar	Subhan Nagar	397	87	20	51	10	6	0	0	0	540	0	0	0	0	540
Sub Total					1147	212	88	93	24	7	0	243	445	777	0	0	0	0	1465
8	Lakadganj	LIG	Deshpande Layout	Bharatwadi	321	59	37	3	16	3	0	0	0	192	0	0	0	0	192
			Vinobha Bhave Nagar	Subhan Nagar	792	147	87	16	31	11	0	0	0	601	0	138	0	0	739
			Janki Nagar	Mini Mata Nagar	340	74	59	1	12	2	171	0	0	132	0	246	0	0	549
Sub Total					1453	280	183	20	59	16	171	0	0	925	0	384	0	0	1480
9	Ashi Nagar	LIG	Yogi Arvind Nagar	Binaki	2440	454	5	438	10	0	0	0	0	2930	0	0	0	0	2930
			Jaripatka, Chaudhari Sq.	Bezanbagh	370	73	58	6	5	4	0	0	0	52	0	273	0	0	325
			Sant Lahanuji Nagar	Jaripatka	196	39	9	24	4	2	0	0	0	315	0	0	0	0	315
			Kabeer Nagar	Nari	1149	271	103	138	23	5	0	0	0	1392	0	258	0	0	1650
Sub Total					4155	837	175	606	42	11	0	0	0	4689	0	531	0	0	5220
10	Mangalwari	LIG	Patel Nagar	Gittikhadan	354	61	56	5	0	0	0	284	0	384	0	0	0	0	668
Sub Total					354	61	56	5	0	0	0	284	0	384	0	0	0	0	668

CONSUMER SUMMARY OF SELECTED SLUM TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	No. of Consumer	Legal	Illegal	No Connection	No Billing	Percentage of Illegal	Length of Pipe Lines in Meter								Total Length of Pipe
								1/2"	2"	3"	4"	5"	6"	8"	10"	
1	Dharampeth	233	154	43	0	22	18.45	641	0	657	0	0	0	0	1298	1298
2	Laxmi Nagar	300	252	17	29	1	5.67	185	390	1061	0	0	0	0	1636	1636
3	Hanuman Nagar	299	191	65	16	19	21.74	0	238	117	1103	0	79	0	0	1537
4	Dhantoli	160	118	42	0	0	26.25	0	214	295	293	0	96	0	0	898
5	Nehru Nagar	390	87	297	0	5	76.15	0	483	0	1803	0	0	402	0	2688
6	Gandhibag (Sokta Bhavan)	477	329	91	36	21	19.08	0	122	1000	915	215	0	410	0	2662
7	Satranjipura	441	59	204	152	26	46.26	0	44	0	1144	0	282	0	0	1470
8	Lakadganj	337	92	110	68	53	32.64	0	0	0	1380	0	77	58	0	1515
9	Ashi Nagar	607	192	122	289	2	20.10	0	1628	87	1442	1285	192	399	1372	6405
10	Mangalwari	76	47	21	3	1	27.63	0	53	0	385	0	0	0	0	438
Total		3320	1521	1012	593	150	30.48	826	3172	3217	8465	1500	726	1269	4306	20547
Perceatnge			45.81%	30.48%	17.86%	4.52%										

CONSUMER SUMMARY OF SLUM TEST ZONE



CONSUMER SUMMARY OF SELECTED SLUM TEST ZONES FOR WATER AUDIT, LEAK DETECTION PLAN

Sr. No.	Zone	Category	Test Zone	ESR Command Area	No. of Consumer	Legal	Illegal	No Connecti on	No Billing	(% age) of Illegal	Length of Pipe Lines in Meter								Total Length of Pipe
											1/2"	2"	3"	4"	5"	6"	8"	10"	
1	Dharampeth	SLUM	Surendra Garh	Seminary Hills	108	80	14	0	0	12.96	0	0	0	227	0	0	0	0	227
			Vishwas Nagar	Seminary Hills	63	36	21	0	6	33.33	0	122	0	59	0	0	0	0	181
			Seva Nagar	Ram Nagar	46	28	4	0	14	8.70	0	0	0	371	0	0	0	0	371
			Kachipura- 2	Ram Nagar / Rifle Line	16	10	4	0	2	25.00	0	519	0	0	0	0	0	0	519
Sub Total					233	154	43	0	22	18.45	0	641	0	657	0	0	0	0	1298
2	Laxmi Nagar	SLUM	Laxmi Nagar	Laxmi Nagar	51	48	3	0	0	5.88	0	80	0	256	0	0	0	0	336
			Bhamptee Villag	Laxmi Nagar	45	27	1	16	0	2.22	0	105	179	0	0	0	0	0	284
			Tukdoji Nagar	Gayatri Nagar	111	90	8	13	0	7.21	0	0	0	291	0	0	0	0	291
			Takliseem	Takliseem	45	42	3	0	0	6.67	0	0	211	189	0	0	0	0	400
			Takiya	Dhantoli	48	45	2	0	1	4.17	0	0	0	325	0	0	0	0	325
Sub Total					300	252	17	29	1	5.67	0	185	390	1061	0	0	0	0	1636
3	Hanuman Nagar	SLUM	Chandramani Nagar	Wanjari Nagar	77	67	9	0	1	11.69	0	158	117	0	0	79	0	0	354
			Bhim Nagar	Omkar Nagar	87	47	16	15	8	18.39	0	80	0	387	0	0	0	0	467
			Sanjay Gandhi Nagar	Hudkeshwar	135	77	40	1	10	29.63	0	0	0	716	0	0	0	0	716
Sub Total					299	191	65	16	19	21.74	0	238	117	1103	0	79	0	0	1537
4	Dhantoli	SLUM	Juni Shukrawar	Reshim Bagh	39	39	0	0	0	0.00	0	0	139	0	0	0	0	0	139
			Siraspeth	Wanjari Nagar Old														0	
			Kurnel Bagh	Direct Tappin	36	36	0	0	0	0.00	0	214	0	0	0	0	0	0	214
			Rambagh	Direct Tappin	59	18	41	0	0	69.49	0	0	156	0	0	0	0	0	156
			Vakilpeth	Direct Tappin	26	25	1	0	0	3.85	0	0	0	293	0	96	0	0	389
Sub Total					160	118	42	0	0	26.25	0	214	295	293	0	96	0	0	898

5	Nehru Nagar	SLUM	Dighori Village	Dighori	94	87	1	0	5	1.06	0	483	0	480	0	0	402	0	1365
			Hasan Bagh Sl	Nandanvan	252	0	252	0	0	100.00	0	0	0	1131	0	0	0	0	1131
			Nandanvan Slu	Nandanvan	44	0	44	0	0	100.00	0	0	0	192	0	0	0	0	192
			Sub Total		390	87	297	0	5	76.15	0	483	0	1803	0	0	402	0	2688
6	Gandhibag (Sokta Bhavan)	SLUM	Bhoipura	Boipura	128	127	1	0	0	0.78	0	0	716	0	215	0	0	0	931
			Chitnavispura	Sitabuldi Fort	126	107	0	0	19		0	122	215	151	0	0	244	0	732
			Namak Factory	Boipura	17	7	2	8	0	11.76	0	0	0	102	0	0	0	0	102
			Killa Mahal	Kill Mahal	54	24	13	15	2	24.07	0	0	0	305	0	0	0	0	305
			Satranjipura	Lakadganj	152	64	75	13	0	49.34	0	0	69	357	0	0	166	0	592
			Sub Total		477	329	91	36	21	19.08	0	122	1000	915	215	0	410	0	2662
7	Satranjipura	SLUM	Timki	Governer Hou	43	2	41	0	0	95.35	0	44	0	411	0	0	0	0	455
			Parwarpura	Governer Hou	41	39	0	2	0	0.00	0	0	0	274	0	150	0	0	424
			Kundanlal Gupta Slum	Kalmana Tap	118	2	107	9	0	90.68	0	0	0	260	0	132	0	0	392
			Rajiv Gandhi Nagar	Kalmana Tap	203	1	54	123	25	26.60	0	0	0	64	0	0	0	0	64
			Bangade Layout	Kalmana Tap	36	15	2	18	1	5.56	0	0	0	135	0	0	0	0	135
			Sub Total		441	59	204	152	26	46.26	0	44	0	1144	0	282	0	0	1470
8	Lakadganj	SLUM	Prajapati Nagar	Bharatwadi	96	45	36	0	1	37.50	0	0	0	752	0	0	58	0	810
			Bhandewadi Slu	Subhan Naga	152	46	58	29	19	38.16	0	0	0	435	0	0	0	0	435
			Punjoram Wad	Mini Mata Na	89	1	16	39	33	17.98	0	0	0	193	0	77	0	0	270
			Sub Total		337	92	110	68	53	32.64	0	0	0	1380	0	77	58	0	1515

9	Ashi Nagar	SLUM	Rani Durgawati	Binaki	58	52	1	3	1	1.72	0	0	0	452	0	0	0	0	452
			Devi Nagar	Indora Tappin	58	48	8	2	0	13.79	0	0	0	337	0	192	0	0	529
			Hemu Colony	Bezanbagh	67	56	2	8	1	2.99	0	0	0	336	0	0	0	0	336
			Pilli Nadi	Uppalwadi	261	0	0	261	0	0.00	0	0	0	191	0	0	0	0	191
			Wanjra Village	Uppalwadi	92	8	72	12	0	78.26	0	1237	0	0	0	0	0	0	1237
			Maya Nagar	Jaripatka	71	28	39	3	0	54.93	0	120	0	110	0	0	0	0	230
			Nara Village	Uppalwadi	0	0	0	0	0	0	0	0	87	0	1285	0	0	1372	2744
			Nari Basti	Nari	0	0	0	0	0		0	271	0	16	0	0	399	0	686
			Sub Total		607	192	122	289	2	20.10	0	1628	87	1442	1285	192	399	1372	6405
10	Mangalwari	SLUM	Borgaon Slum	Governer Hou	30	23	2	0	1	6.67	0	53	0	162	0	0	0	0	215
			New Basti Slum	Governer Hou	46	24	19	3	0	41.30	0	0	0	223	0	0	0	0	223
			Sub Total		76	47	21	3	1	27.63	0	53	0	385	0	0	0	0	438

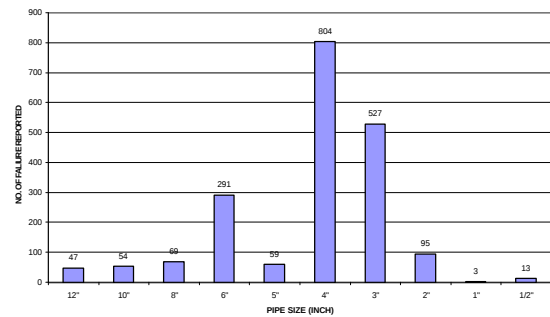
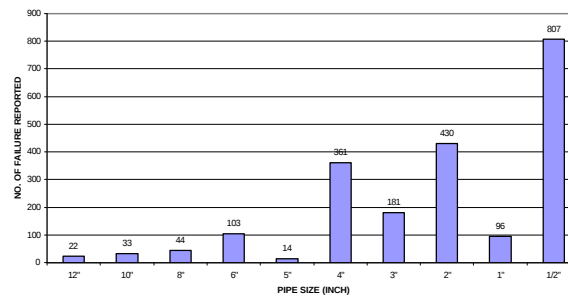
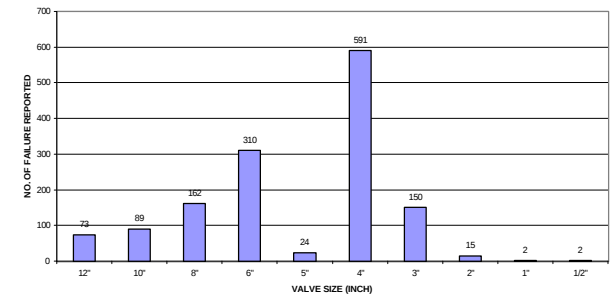
Annexure-4
(Analysis of Maintenance Record)

ANNEXURE-4

SUMMARY SHEET

ANALYSIS OF MAINTENANCE RECORD

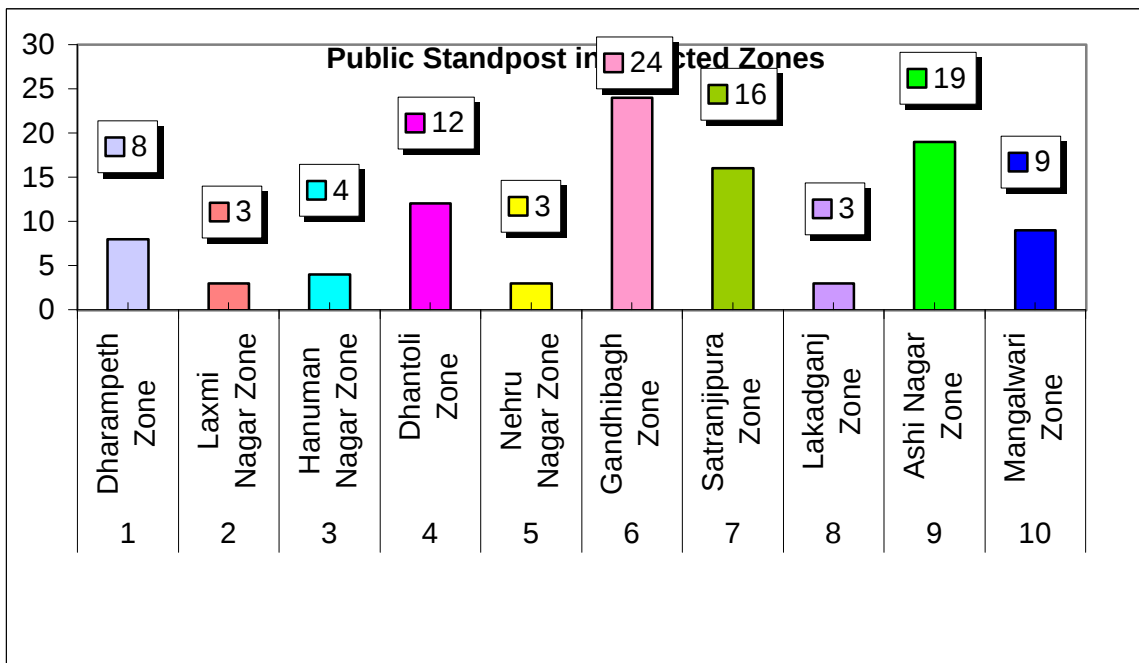
Zones	Types of Maintenance																											Grand Total						
	Joint										Total	Pipe										Total	Valve										Total	
	12"	10"	8"	6"	5"	4"	3"	2"	1"	1/2"		12"	10"	8"	6"	5"	4"	3"	2"	1"	1/2"		12"	10"	8"	6"	5"		4"	3"	2"	1"		1/2"
Dharampeth	2	3	2	22	0	48	70	9	0	0	156	2	1	2	18	0	37	29	71	25	95	280	13	15	8	41	1	51	14	0	0	0	143	579
Laxmi Nagar	10	19	12	53	5	148	60	3	0	3	313	3	4	2	6	1	27	14	17	6	147	227	7	19	13	51	0	74	8	5	1	1	179	719
Hanuman Nagar	2	4	17	50	5	160	54	14	0	0	306	1	0	8	11	1	55	23	26	2	0	127	3	10	22	31	0	32	6	0	0	0	104	537
Dhantoli	4	7	3	55	33	191	150	16	0	0	459	1	3	3	9	4	34	25	85	5	279	448	7	15	17	43	16	105	12	0	0	0	215	1122
Nehru Nagar	12	8	8	33	0	98	58	18	0	0	235	8	9	8	8	0	64	25	33	0	23	178	14	8	9	18	0	79	34	0	0	0	162	575
Gandhibagh	7	2	10	35	15	79	77	7	0	0	232	4	10	3	21	3	49	23	89	12	57	271	7	7	31	24	5	65	34	1	1	0	175	678
Satranjipura	6	9	8	27	1	46	33	28	3	10	171	3	2	11	14	5	69	31	108	46	206	495	10	8	52	87	2	155	38	9	0	1	362	1028
Total	47	54	69	291	59	804	527	95	3	13	1962	22	33	44	103	14	361	181	430	96	807	2091	73	89	162	310	24	591	150	15	2	2	1418	5471

JOINT FAILURE
(Year 2003-2004)PIPE FAILURE
(Year 2003-2004)VALVE FAILURE
(Year 2003-2004)

Annexure-5
(Details of Public Stand Post)

ANNEXURE - 5**DETAILS OF PUBLIC STAND POST [PWR] IN SELECTED TEST ZONE**

Zone No.	Zone	Nos. of Stand Post
1	Dharampeth Zone	8
2	Laxmi Nagar Zone	3
3	Hanuman Nagar Zone	4
4	Dhantoli Zone	12
5	Nehru Nagar Zone	3
6	Gandhibagh Zone	24
7	Satranjipura Zone	16
8	Lakadganj Zone	3
9	Ashi Nagar Zone	19
10	Mangalwari Zone	9
Total Numbers of StandPost		101



Annexure-6
(Average Flow Rate at Public Stand Post)

Annexure-6

AVERAGE FLOW RATE AT PUBLIC STAND POST

Sr.No.	Zone No.	Zone Name	Av. Flow Rate LPS	Av. Velocity M/SEC	Av. Supply Hours
1	I	Dharampeth Zone	0.229	1.294	10
2	II	Laxmi Nagar Zone	0.189	1.068	2
3	III	Hanuman Nagar Zone	0.164	0.928	2
4	IV	Dhantoli Zone	0.285	1.615	6
5	V	Nehru Nagar Zone	0.076	0.430	2
6	VI	Gandhibagh Zone	0.147	0.552	5
7	VII	Satranjipura Zone	0.213	1.208	2
8	VIII	Lakadganj Zone	0.282	0.820	2
9	IX	Ashi Nagar Zone	0.311	1.762	14
10	X	Mangalwari Zone	0.168	0.951	4
Total			0.220	1.063	5

Pl. Note:

1. The Kachipura slum is getting water for 24 Hrs.
2. The Test zone of Ashinagar Zone is on Kanhan Rising Main and hence the flow rate and supply hours are more

Annexure-7
(Average Flow Rate at Consumer End)

Annexure-7**AVERAGE FLOW RATE AT CONSUMER END**

Sr. No.	Zone No.	Zone Name	No. of Test Zone	No. of Consumer	Av. Flow Rate LPS	Av. Velocity M/SEC	Av. Supply Hours
1	I	Dharampeth Zone	11	22	0.204	1.154	7
2	II	Laxmi Nagar Zone	4	7	0.167	0.947	3
3	III	Hanuman Nagar Zone	3	6	0.104	0.590	2
4	IV	Dhantoli Zone	9	17	0.207	1.171	4
5	V	Nehru Nagar Zone	4	8	0.076	0.430	2
6	VI	Gandhibagh Zone	4	8	0.196	0.971	4
7	VII	Satranjipura Zone	8	15	0.152	0.860	3
8	VIII	Lakadganj Zone	6	10	0.184	0.781	2
9	IX	Ashi Nagar Zone	4	8	0.206	1.168	3
10	X	Mangalwari Zone	7	14	0.154	0.870	3
Total			60	115	0.165	0.894	3

Annexure-8
(Water Tariff Structure)

राज्य सरकार, अहमदाबाद : दिनांक २००२/१५८/२००२/सि.सं. (घो.), दिनांक २८ नोव्हेंबर, २००२ रोजी प्रोत्साहित

परगुडी आपराडाडी नाटयस्तरे विभागाबिस्तुन नुरयता ठेपान्या पाण्दये घर (जन्मे/१०,००० सौंदर्य)

अ.क्र.	वापरण्या प्रकार	१.३.२००० पासून	१.९.२००१ पासून	१.३.२००२ पासून	१.३.२००३ पासून
१	२	३	४	५	६
१.	घरगुती वापर नदीवर धरण बांधले असल्यास जलासायतून	००.५०	१.००	१.५५	१.३०
२.	क्रांतीवातून (प्रवाहाने वापर उपसा पध्दतीने) अ) मापदंडाप्रमाणे साठवण तलाव असल्यास ब) मापदंडाप्रमाणे साठवण तलाव नसल्यास	१.२० १.८०	२.५० ३.५०	३.०० ४.००	३.२५ ५.००
३.	घरणासाठी नदीतून अ) मापदंडाप्रमाणे साठवण तलाव असल्यास ब) मापदंडाप्रमाणे साठवण तलाव नसल्यास	००.९५ १.८०	२.०० ३.५०	२.२५ ४.००	२.५० ५.००
४.	वापरणाऱ्या संस्थेने घरण स्वतःपणे बांधले असल्यास / पाणी वापरण्या प्रमाणानुसार घरणाच्या बांधकामाचा खर्च दिला असल्यास	००.३५	००.७५	१.००	१.१५
५.	नदीवर पाणी उचलण्याच्या जागीच्या वरून बाजूस कोठेही घरण बांधले नसल्यास नदीतून	००.३५	००.७५	१.००	१.१५

टीप :- १) धरभुली पाणी बाणरावे वर हे सर्व सहाय गोठ्यात आनवधाका, काढाळ, पाडे, वाड्यां, पंगिर परिनाद, गजगजगाळिल्ले, केलेमोड मोड अशा वेगवेगळे भागू
संपादित. तसेच ज्योतिषिक साधनांचे प्रभावी यथाहस्तांना ४५००० किंवा त्याचे ५५००० लिखित यांच्याकडून घेऊन यावर लेखने बंधविण्याच्या उद्देशाने पुस्तकेत्या
अर्थीन सहान पिण्याच्या मागील पूर्वजांकडूनही धरभुली पाणी बाणरावे वर लागू राहतील.
२) रक्ताचा क्रमांक ७, ८ व ९ मधील धर हे ज्योतीच्या राज्य एकमेत पूर्णांकित केलेले आहेत.
३) दिनांक २४/१०/२००९ रोजी निर्धारित केलेल्या शासन जादेसाठीची येील परिशिष्ट ३ मध्ये कोणताही बदल झालेला नाही.