Name of City: BHUSAWAL MUNICIPAL COUNCIL

WATER AUDIT REPORT

2015 - 2016

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Conversions Commonly Used in Water Audit

1 m3 = 1000 ltrs.
1 unit = 1000 ltrs.
1 ML = 1000 units / 1000 m3
1 MM3 = 1000 ML
1 MM3/yr. = 2.74 MLD
1 cusec = 2.446 MLD

1.1 PRESENT BILLING SYSTEM

PCMC is a sole possessor of its water supply scheme and manages its own water supply and distribution, so also the billing system. Billing system is outsourced and is carried out quarterly for residential consumers and monthly for commercial consumers. Method of billing is as per metered consumption for all categories of consumers, such as domestic, non-domestic. The number of consumers are listed below.

Sr. No.	Particular	Connection count
1	Number of registered Individual metered consumers	0
2	Number of registered Bulk (more than one flat count) metered consumers	0
3	Number of registered commercial consumers	177
4	Number of registered public consumers	20210
5	Number of slum connections	500
6	Number of non-slum registered Unmetered consumers	19533

2. WATER AUDIT METHODOLOGY

2.1 GENERAL METHODOLOGY

Water Audit methodology adopted is described as below:
The audit strategy has to be applied to all the components of the existing water supply system progressively so that entire system from WTP to consumers could be covered. It is advisable to divide area into two parts viz. supply side & demand side. The **supply side** essentially consists of treated water transmission and ESR. It can be easily seen that these components can be tackled efficiently, effectively and speedily due to better access. The other part i.e. **Demand side** essentially consists of the distribution network, connections, metering etc which is a voluminous work as compared with that of supply side. The methodology and various tasks of this strategy to be covered are listed below:

2.1.1 SUPPLY SIDE:

- Identify all the system components from WTP to reservoirs on site and update the maps / information available if required.
- Obtain the log book data of treated water supply in order to assess the average daily pumping need over the period of one year.
- Obtain the details pertaining to capacities of sumps and storage reservoirs, condition of existing measuring system such as flow meter and / or level indicator, their inflow & supply hours.
- Carry out flow measurements simultaneously to the extent possible in order to assess the quantum of water released in specified period, preferably a day.
- Assess the difference in the measurements to estimate the losses

2.1.2 DEMAND SIDE:

- Obtaining the list of water supply connections (domestic & non-domestic) in the distribution system. As most of the consumers are metered and billing is done by photo reading, all the billing data is taken for reference.
- Measure the supply of water from the storage reservoirs which is let into the distribution system in order to assess the quantum of water supplied in the whole city.
- Fill up the audit sheet

3. CALCULATION OF NON REVENUE WATER

3.1 TASK-1: SYSTEM INPUT VOLUME:-

3.1.1 WATER INPUT OR PURCHASE FROM IRRIGATION DEPARTMENT: -

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

3.1.2 RAW WATER INTAKE: -

Raw water charges paid to Irrigation Department.

A		B	C	D	E
System Input Volume					
1	Identify and map the sources.				
2	Measure the water from each raw source	**22**			
3	Adjust the figures for total supply.				

System Input Vol. = 22 MLD. TASK-2: Billed Metered Consumption & Billed Un-metered Consumption:-

Average quantity is taken into account for Billing as per consumer data.

A	B	C	D	E
System Input Volume		Billed Authorized Consumption	**Billed Metered Consumption** (Including water exported)	**Revenue Water** (Total billed qty.)
			21	
			Billed Un-metered Consumption	

22		**21**	**21**	

- **Billed Metered Consumption** (including water exported)
- **Billed Un-metered* Consumption**: Ref. Diagram showing Total Water losses observed, For Total Extrapolated Billed Unmetered consumption.

  i.e. **21 MLD for 20210 Connections**

3.2 TASK-3: CALCULATE THE VOLUME OF NON-REVENUE:-

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

A	B	C	D	E
System Input Volume (mld)		Billed Authorized Consumption (mld)	Billed Metered Consumption (Including water exported)	Revenue Water (mld)
			Billed Un-metered Consumption	**18**
22				

Non-Revenue Water = System Input Vol (Col.-A) – Revenue Water (Col-E).

Non-Revenue Water = Col. A – Col. E

= 22 – 18 = 1 MLD

3.3 TASK-4: CALCULATE THE UNBILLED AUTHORIZED CONSUMPTION (METERED & UNMETERED)

i) Public stand post water supply

ii) Tanker water supply

iii) Corporation offices, Schools, Hospitals.

iv) Public Parks & Gardens (old).

v) Public Urinals.

vi) Un-metered unbilled connections.

Un Billed Metered Consumption –connections are flat water tariff, based on tapping size & type of consumer is charged by corporation.

Un Billed Un-metered* Consumption Ref. Diagram showing Total Water losses observed, for Total Extrapolated un- Billed Unmetered consumption. I.e. Consumption from free connections & PSP as per consumer survey)

3.4 TASK-5: CALCULATE AUTHORIZED CONSUMPTION:-

Authorized Consumption = Billed Authorized Consumption (Top of Col b) + Unbilled Authorized Consumption

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="5">System Input Volume

22 MLD</td><td rowspan="2">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)
21 MLD</td><td>Billed Authorized Consumption</td><td>Billed Metered Consumption (Including water exported)</td><td>Revenue Water</td></tr>
<tr><td>20 MLD</td><td>Billed Un-metered Consumption</td><td>20 MLD</td></tr>
<tr><td>Water Losses</td><td rowspan="3">Unbilled Authorized Consumption

1 MLD</td><td>Unbilled Metered Consumption</td><td rowspan="3">Non-Revenue Water (System Input volume – Revenue Water)</td></tr>
<tr><td rowspan="2"></td><td>Unbilled Un-metered Consumption</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td rowspan="2">(System Input Volume – Authorized Consumption)</td><td rowspan="2"></td><td rowspan="2"></td><td>1 MLD</td></tr>
<tr><td></td></tr>
</table>

- Un-Billed Authorized Consumption = 1 ML (*Ref. calculation at Task No. 4)*
- Billed Authorized Consumption = 21 MLD (*Ref. calculation at Task 2)*

Total = 1 MLD

3.5 TASK-6 CALCULATE WATER LOSSES

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="3">System Input Volume

22 MLD</td><td rowspan="2">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)
21 MLD</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (Including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Un-metered Consumption</td></tr>
<tr><td rowspan="2"></td><td>Unbilled Authorized Consumption
—</td><td>Unbilled Metered Consumption</td><td rowspan="2">Non-Revenue Water (System Input volume – Revenue Water)</td></tr>
<tr><td>Unbilled Un-metered Consumption
—</td></tr>
<tr><td></td><td>Water Losses (System Input Volume – Authorized Consumption)
1 MLD</td><td></td><td></td><td></td></tr>
</table>

Water Losses = System Input Volume - Authorized Consumption (Col.B)

= Col. A. – Col. B

= **22 – 21 = 1 MLD**

3.6 TASK-7 CALCULATE THE APPARENT LOSSES:-

Apparent Losses = Un-authorized Consumption + Metering Inaccuracies

3.6.1 UN-AUTHORIZED CONSUMPTION:-

- Estimated illegal consumers
- Estimated water consumption
- The cost of water consumption

3.6.2 METERING INACCURACIES:-

- Raw Water Measurement Losses
- Losses at Pump House
- Measurement Losses in Distribution System

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="2">System Input Volume In

22 MLD</td><td rowspan="5">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)

21 MLD</td><td rowspan="2">Billed Authorized Consumption
20 MLD</td><td>Billed Metered Consumption (Including water exported)
0</td><td rowspan="2">Revenue Water Mld

20 MLD</td></tr>
<tr><td>Billed Un-metered Consumption
20
MLD</td></tr>
<tr><td>Unbilled Authorized Consumption
1 MLD</td><td>Unbilled Metered Consumption
00</td><td rowspan="4">Non-Revenue Water (System Input volume – Revenue Water) Mld

1 MLD</td></tr>
<tr><td></td><td>Unbilled Un-metered Consumption
1 MLD</td></tr>
<tr><td></td><td rowspan="4">Water Losses (System Input Volume – Authorized Consumption)

1 MLD</td><td rowspan="4">Apparent Losses In mld</td><td>Un-authorized Consumption</td></tr>
<tr><td></td><td>In Mld</td></tr>
<tr><td></td><td>Metering Inaccuracies (mld)</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

3.7 TASK-8 CALCULATE REAL LOSSES:-

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

*Unidentified water losses included in Real losses.

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="8">System Input Volume

22 MLD</td><td rowspan="3">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)

20 MLD</td><td rowspan="2">Billed Authorized Consumption 0 MLD</td><td>Billed Metered Consumption (Including water exported)
0</td><td>Revenue Water Mld</td></tr>
<tr><td>Billed Un-metered Consumption
20 MLD</td><td>4 MLD</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
20 MLD</td><td>Unbilled Metered Consumption
0.00</td><td rowspan="5">Non-Revenue Water (System Input volume – Revenue Water)

4 MLD</td></tr>
<tr><td>Unbilled Un-metered Consumption
20 MLD</td></tr>
<tr><td rowspan="3">Water Losses (System Input Volume – Authorized Consumption)

18 MLD</td><td rowspan="2">Apparent Losses

4 MLD</td><td>Un-authorized Consumption
14.01 MLD</td></tr>
<tr><td>Metering Inaccuracies Mld</td></tr>
<tr><td rowspan="2">Real Losses (Water Losses – Apparent Losses)
4 MLD</td><td></td></tr>
<tr><td colspan="3">*Unidentified Water Losses</td></tr>
</table>

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

= 22 – 18

= 4 MLD

3.8 TASK-9 ASSESSMENT OF REAL LOSSES:-

There are following sources of real losses in water system.

i. Leaks at raw water transmission
ii. Evaporation losses
iii. Water treatment losses
iv. Leaks / seepage of reservoirs
v. Overflows of reservoirs
vi. Leaks of distribution mains
vii. Leakages from valves & air valves
viii. Leakages from service connections up to meter
ix. Leakages in consumer premises after the meter (not in scope of water audit)

Measuring & estimating losses from discovered leaks the following methods have 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