

Scaling up of Reforms in Water Supply- Maharashtra



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Vision for Urban Water supply & Sanitation in India



“All Indian cities & towns become totally sufficient in potable water supply, sanitized, healthy, liveable and ensure and sustain good public health for all their citizens with a special focus on affordable water supply and sanitation facilities for the urban poor and women.”

Maharashtra

- Population = 11,23,72,972
- Area = 307,731 km²
- 2nd Most populous
- 3rd Largest state by area

Breath of India

One of the
wealthiest
states in India

Contributes- 25% of
the industrial output

23.2% of its GDP in
2010-11

Maharashtra

■ Maharashtra is the world's second most populous “first-level administrative country sub-division”

■ Were it a nation in its own right, Maharashtra would be the world's tenth most populous country ahead of Mexico

Rank ♦	Subdivision ♦	Type ♦	Country ♦	Population ♦	Area km² ♦
1.	 Uttar Pradesh	State	India	199,581,477	240,928
2.	 Maharashtra	State	India	112,372,972	307,713
3.	 Guangdong	Province	China	104,303,132	177,900
4.	 Bihar	State	India	103,804,637	94,163
5.	 Shandong	Province	China	95,793,065	156,700
6.	 Henan	Province	China	94,023,567	167,000
7.	 West Bengal	State	India	91,347,736	88,752
8.	 Andhra Pradesh	State	India	84,665,533	275,045
9.	 Punjab	Province	Pakistan	84,632,500	205,344

Source: wikipedia.org

Maharashtra's Water Wealth

1 BCM = 10^9 m^3

380 rivers, Length=20,000 kilometers

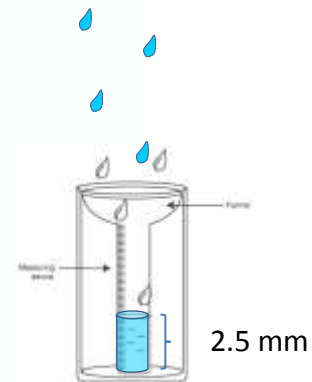
Consumption:
23.9
BCM

Irrigation=20.3, BCM

Drinking water = 2.85 BCM

Industry= 0.8 BCM

- Average rainfall = 1360 mm
- Average rainy days = 55

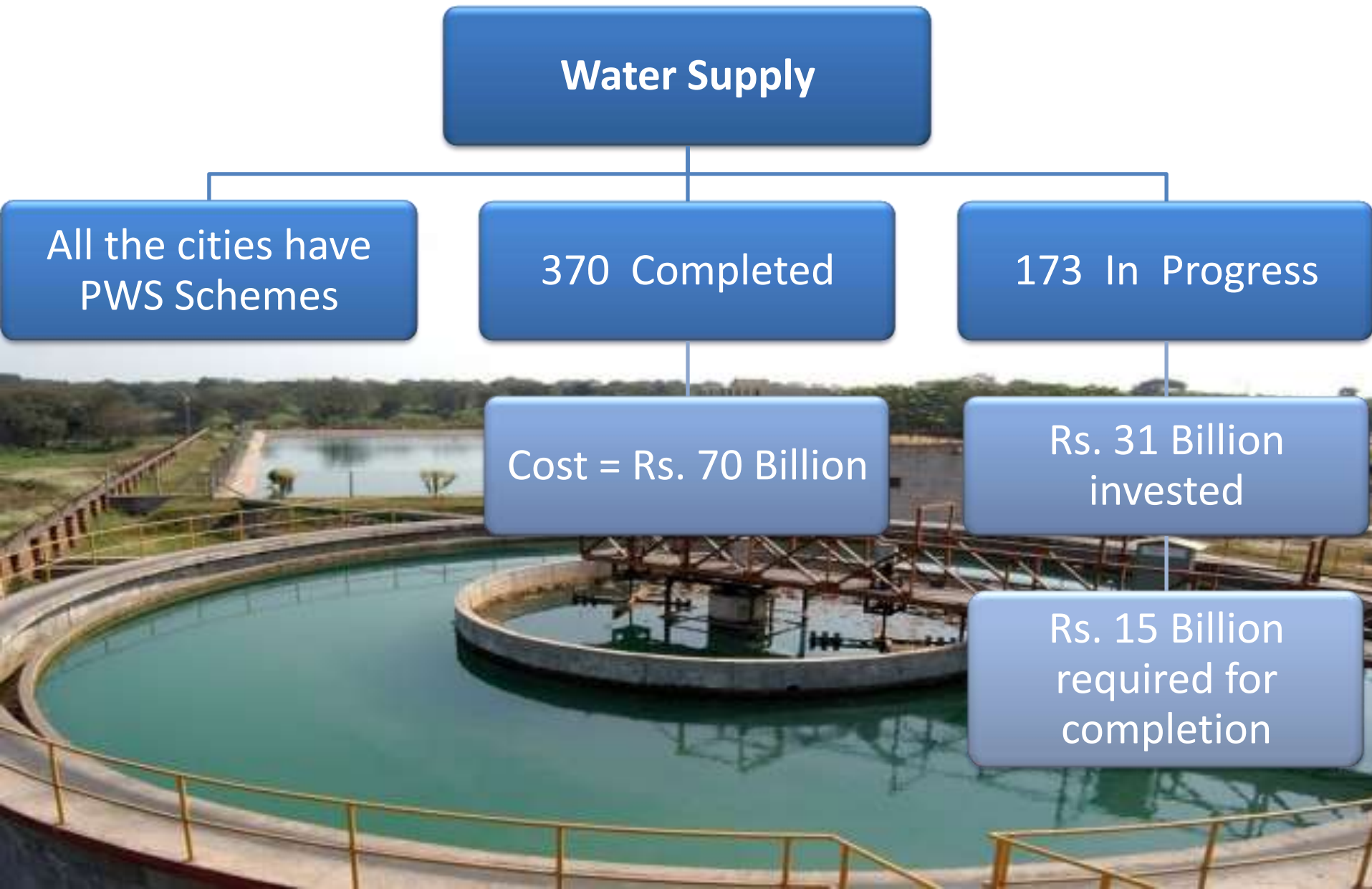


Rain Gauge

rainfall > 2.5 mm

- Gr. Water = 31.5 BCM, withdrawal = 7.3 BCM,
- Evaporation: max: 2475 mm (Nashik), Min: 1478 mm (Konkan)

Status of Urban Water Supply



Status of Urban Sanitation

Sanitation-1

25 cities have
underground
sewerage systems

13 schemes in
progress

The remaining cities
have onsite
treatment system

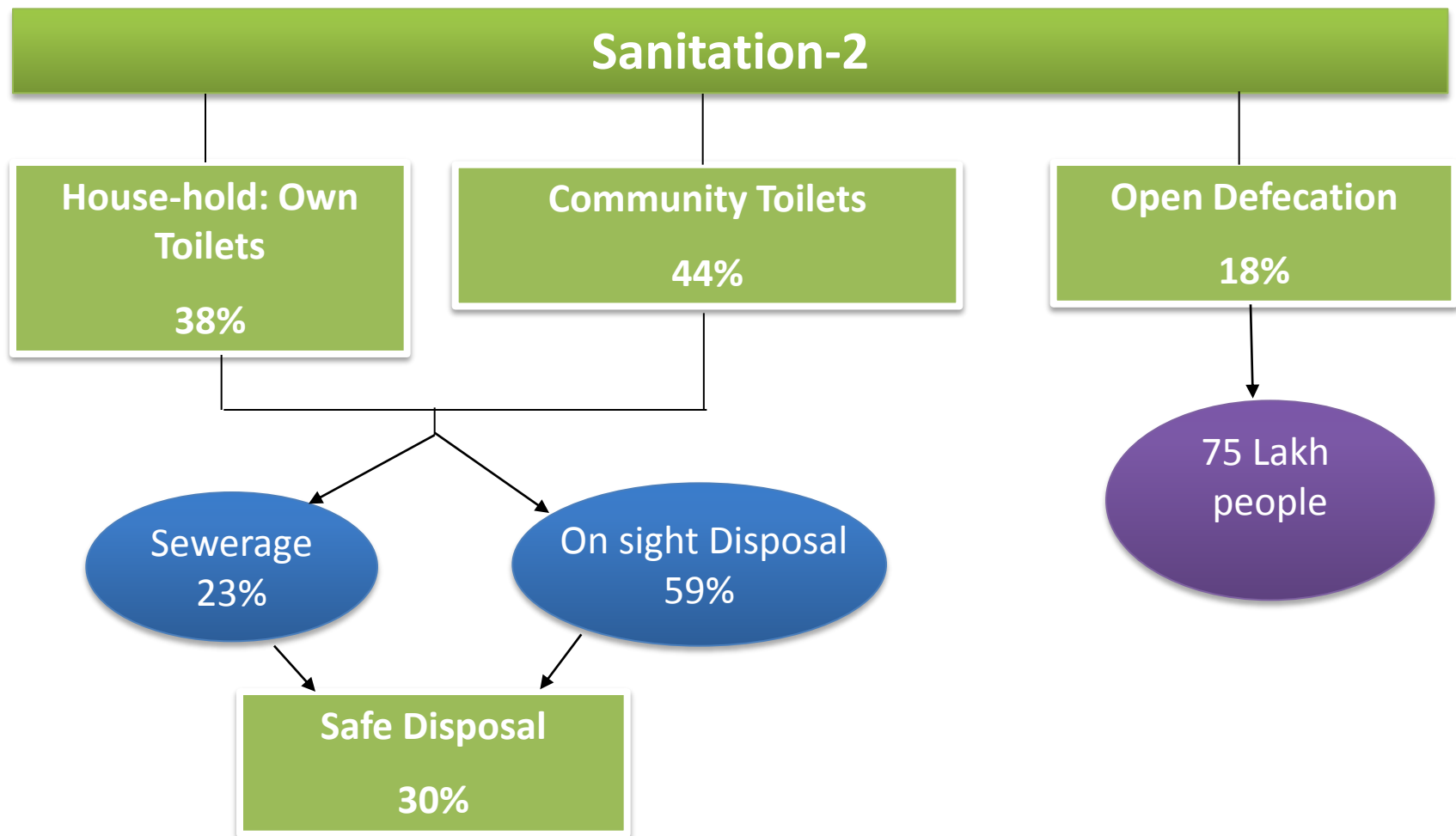
Ground Reality

Sanitation
coverage -
IHHL 62 % in
urban area

Open
Defecation
rampant



Status of Urban Sanitation



Status of Urban Solid Waste Management



Solid Waste
Management

Improved collection
and transportation
systems

Inadequate
treatment and
disposal facilities

Outcome- Urban Water Supply and Sanitation Program

Program	Investment (Rs Crores)	Physical Achievement	Service Standards	ULB's Achievement
Urban Water Supply	7000	379 schemes	24x7 water supply	2 Small towns and some wards in 2 Cities
Sewerage	1000	26 schemes	100% sewerage connected system	None
Toilet Management	60	52000 seats	ODF ULB	None
Solid Waste Management	12th FC Grants	Few Projects	ULB managing Solid Waste scientifically	None

Maharashtra Sujal and Nirmal Abhiyan



Sujal and Nirmal Abhiyan

Areas of Reforms in Urban Cities



Water Supply



Sewerage and Sullage



Toilet Management



Solid Waste Management

Objectives

Performance of the MSNA



Aims

- To improve service delivery in water supply and sanitation sector,
- To discuss impact of MSNA
- Difficulties faced in implementation
- Achieve one of the norm of shifting our country to the galaxy of developed nation.

Ingredients of MSNA



Time Frame of MSNA

- House to House Survey
- Bulk Meter
- Water + Energy Audit
- Hydraulic Model
- Pressure Management
- GIS Mapping
- PPP in OandM
- Computer Billing
- Preparation of city sanitation plan
- Solid waste collection and disposal

2009-12

- 24x7 System
- Metering 100%
- Collection efficiency (100%)
- Sewerage including STP

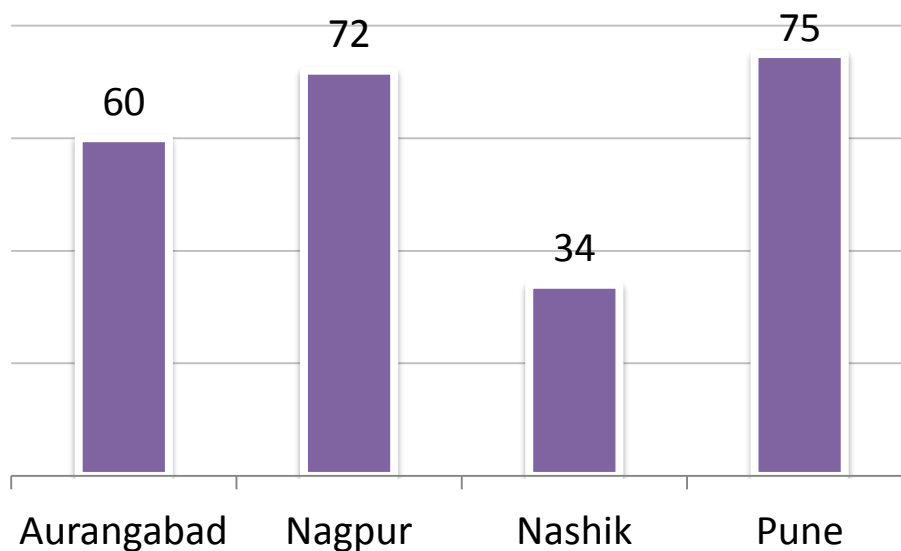
2012-17

2017-25

- 24x7 in pilots
- Sustainable sources
- Metering 80%
- Collection efficiency (80%)
- Sewerage system
- MIS
- Tariff framing
- Solid waste M.
- ODF cities

World-class water supply and sanitation for all 252 cities

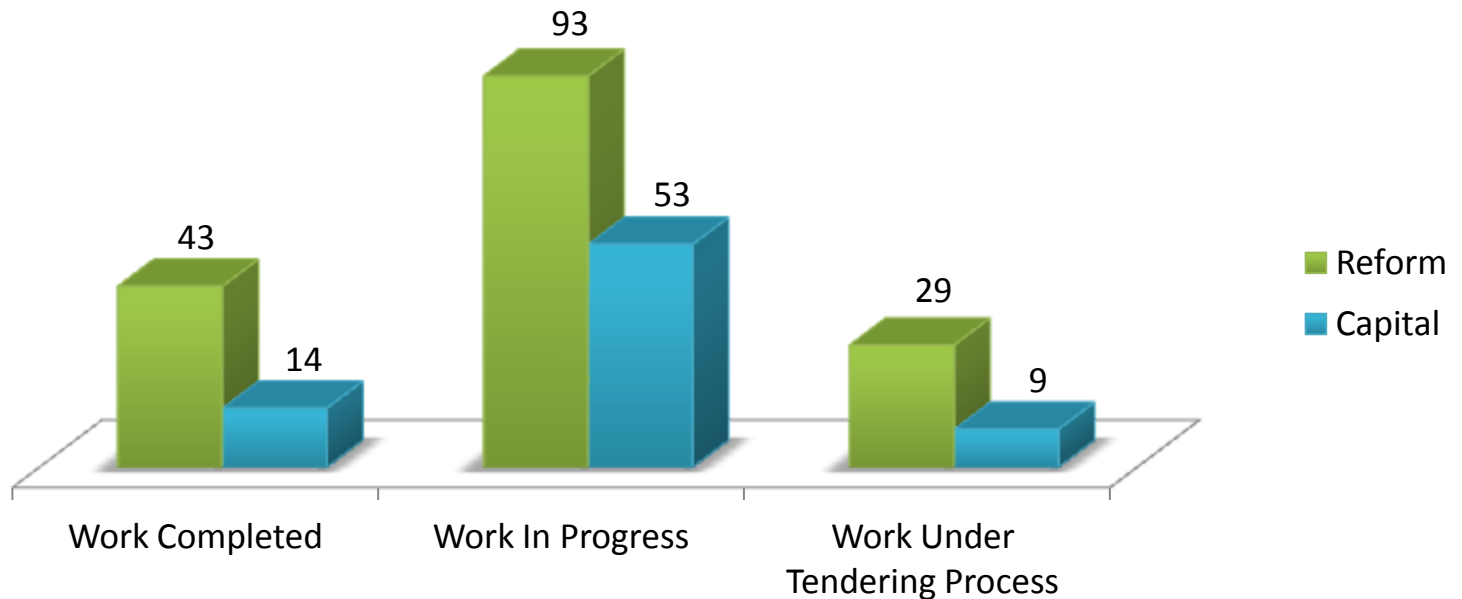
MSNA STATUS



Division	Works sanctioned	Completed Works	Works in progress	Works not started	Tech. sanction awaited
Aurangabad	60	21	32	5	2
Nagpur	72	26	36	9	1
Nashik	34	1	31	2	0
Pune	75	9	47	18	1
Total	241	57	146	34	4

MSNA STATUS

Works	Number
Reform (R)	124
Capital (C)	35
Capital+Reform	82
Total	241



Appreciation of MSNA Program

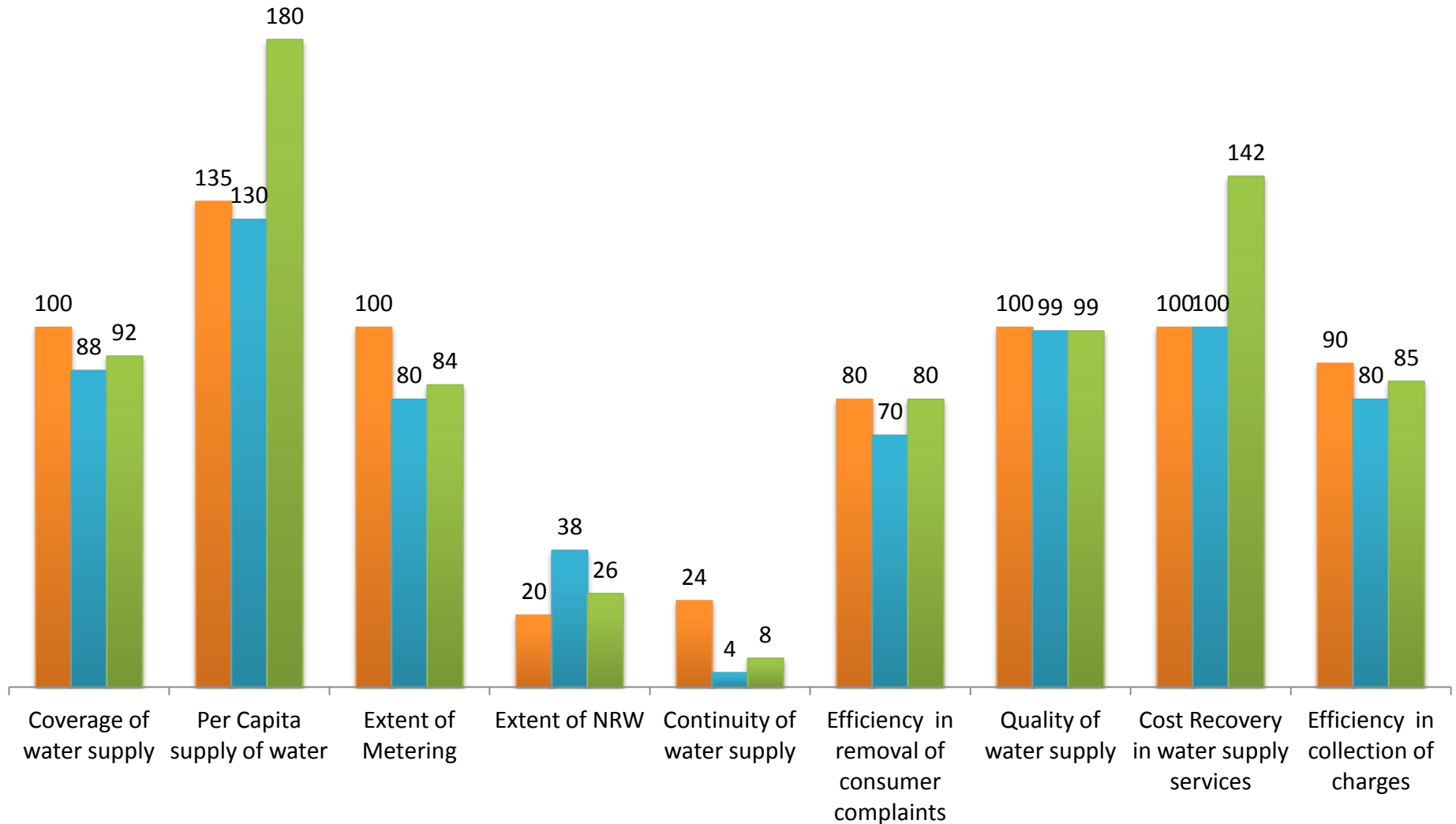
(World Bank)



MSNA Impact

(Badlapur- First city to provide 24x7 water supply in 8 wards)

Standard Before After



Innovative Methods Adopted

Former Member Secretary- Dr Sanjay Dahasahasra Giving Oath to the Staff

Oath...

- I vow that I shall devote myself for improving service delivery of water supply of 7 Lakhs people of Amravati,
- I promise that I shall be a part of the team to create GIS maps, hydraulic model and installation of meters,
- I assure that I shall go to site and find low pressures and identify the leaks,
- I shall educate my people for the initiative

REFORM COMPONENTS

State Level
Committee
Approved
Reform Agenda

Improve
Efficiency and
sustainability of
Water Works of
ULB

Consumer Survey

Water Audit

Energy Audit

Installation of Bulk Meters

Hydraulic Modeling

Pressure Management

GIS Mapping

Computerized Billing and Collection System

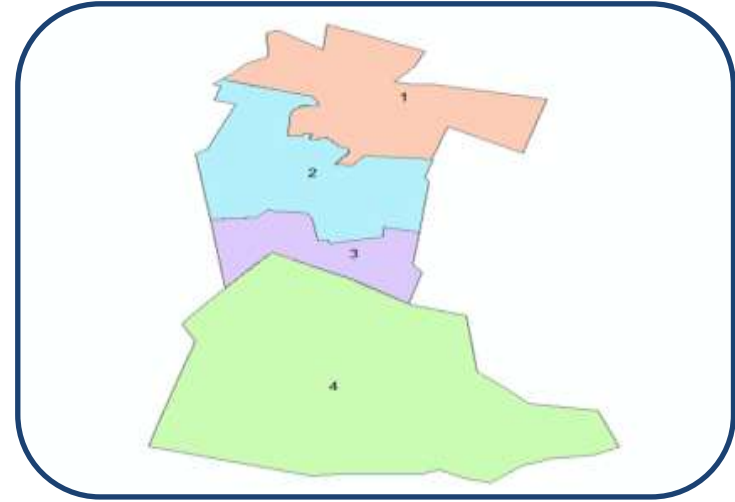
Impact of MSNA

City Limits - Extents



Before

- Old ward boundary Maps
- Improper Demarcation of City Extents
- Hand Drawn – Not to scale maps were available



After

- Ward Boundaries and City Limits are demarcated which are now properly based on GIS and field survey
- GIS based City Maps are prepared

Impact of MSNA

Satellite Image



Before

- Satellite Image was not available
- Old DP Maps were referred
- Minute Details – Street Level Details were not available



After

- Google or Satellite Image with very high Resolution (0.5m) are available
- Image can be used for
 - Development Planning,
 - Property Tax, Sewer,
 - Solid Waste Management

Impact of MSNA

Properties



Before

- Digitized maps were not available
- Properties were not mapped
- Properties were not uniquely identified

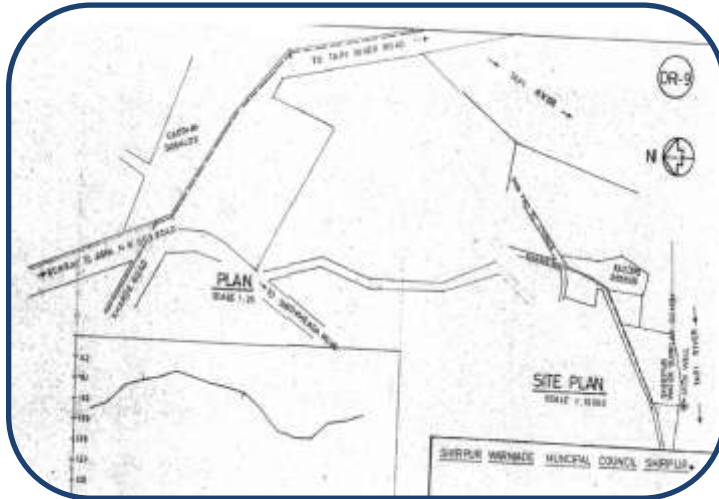


After

- Root level digitized maps are prepared
- Each and every property is mapped on GIS
- Every property is uniquely identified in a GIS based system

Impact of MSNA

Water Network Data



Before

- Water networks maps not available
- Information of elements of water network was not available
- Maps were old, not to scale, hand drawn and in disintegrated manner
- Differences in ground reality and available records



After

- Survey: GIS water network maps prepared
- Updated information of water network is attached to map
- Gaps between ground reality and available records are resolved by physical verification
- Information: at a click on GIS System
- Powerful tool for Asset Management and decision making

Impact of MSNA

Stand-posts



Before



After

- Information: location, number was not available
- Stand-posts were converted to group connection on paper only
- There was no change in ground reality,
- Many stand-posts were without tap.

- Stand-posts: Physically surveyed and mapped on GIS
- Exact information is available
- Helps in policy decision making for conversion of stand-posts to group connection

Proposed Network



-
- An aerial photograph of a residential neighborhood. Yellow lines are drawn on the image, likely representing property boundaries or a specific route. Red lines and dots are also visible, possibly indicating points of interest or specific locations. The image shows houses, streets, and green spaces.

After

- Proposed Network along with Existing Network were mapped on GIS
- Proposed and Existing Network were studied in an integrated manner
- Physical Survey and Field verification of Proposed Network was done

Impact of MSNA

Billing Data (used for CS)



Before

- Available in hard copy format
- Data: old and outdated - redundant
- Differences between ground reality and billing data was observed
- Data was not streamlined properly
- Billing data was not standardize wrt consumer details and connection details



Meter	Min kL	Max kL	Used (L)	# Days	Used (L)/day	% of Total Used	Gas Bill
Apt 01							
Cold	2	2.8	800	196	4.08	0.5373 %	
Hot	22.52	26.02	3500	196	17.86	1.4296 %	

After

- Billing data in soft copy format (both english and marathi) is prepared
- Billing data is updated
- Billing data is streamlined and standardize wrt name and connection
- Each and every customer is uniquely identified

Impact of MSNA

Consumers Mapping



Before

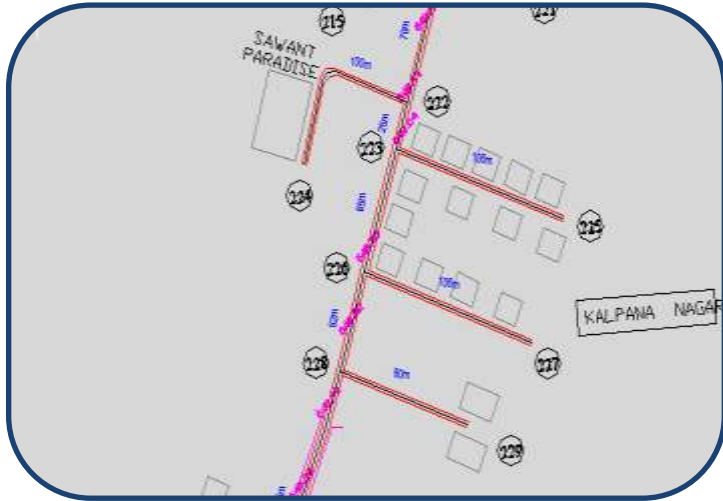


After

- Information : number of connections, temporarily disconnected, permanently disconnected etc was not available
- Information related to the location of consumer was not available
- Consumers are mapped on GIS
- All the connections with details are mapped on GIS
- Consumers with outstanding amount can also be shown on GIS
- Grouped wardwise, zonewise for better revenue collection

Impact of MSNA

Elevation Map



Before



After

- Contour map was not available
- Elevations were derived from old toposheets

- Physical survey was conducted to identify the location and elevation of a point
- 3D Stereo paired images used to generate contours

Impact of MSNA

Leakages



Before

- No information about leakages was available
- Locations were not known

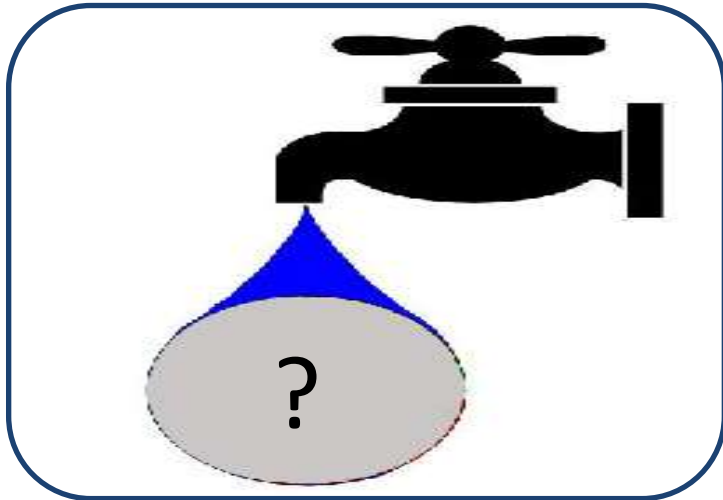


After

- After physical survey, leakages are mapped on GIS along with photograph and location details

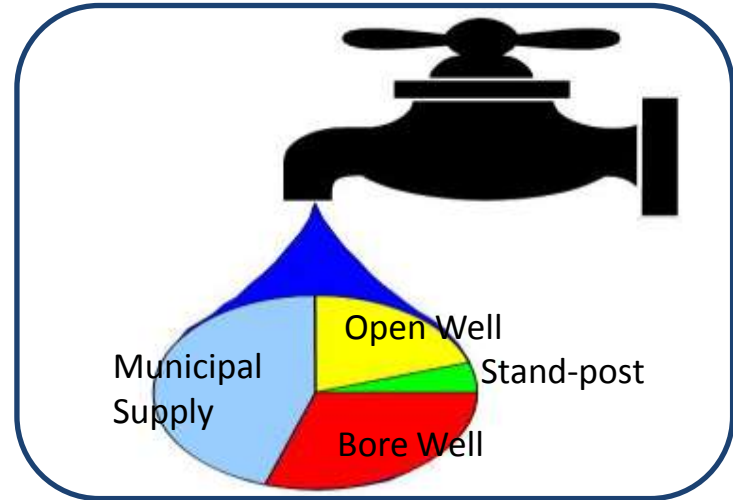
Impact of MSNA

Water Consumption (Municipal Supply, Open Well, Bore Well etc)



Before

- No information was available for water consumption by different beneficiaries



After

- HH and population dependent on municipal supply, open well, bore well, SP etc. is available on GIS system

Impact of MSNA

Consumer Feedback



Before

- No information was available about the perception of the consumer
- Information: water quality, quantity and pressure not available with consumer



After

- Consumer feedback about the service of water supply is available in terms of quality, quantity, supply hours, pressure and satisfaction
- Consumer perception about water supply is known along with statistical data

Impact of MSNA

Meters

Non working meters were replaced
by MJP



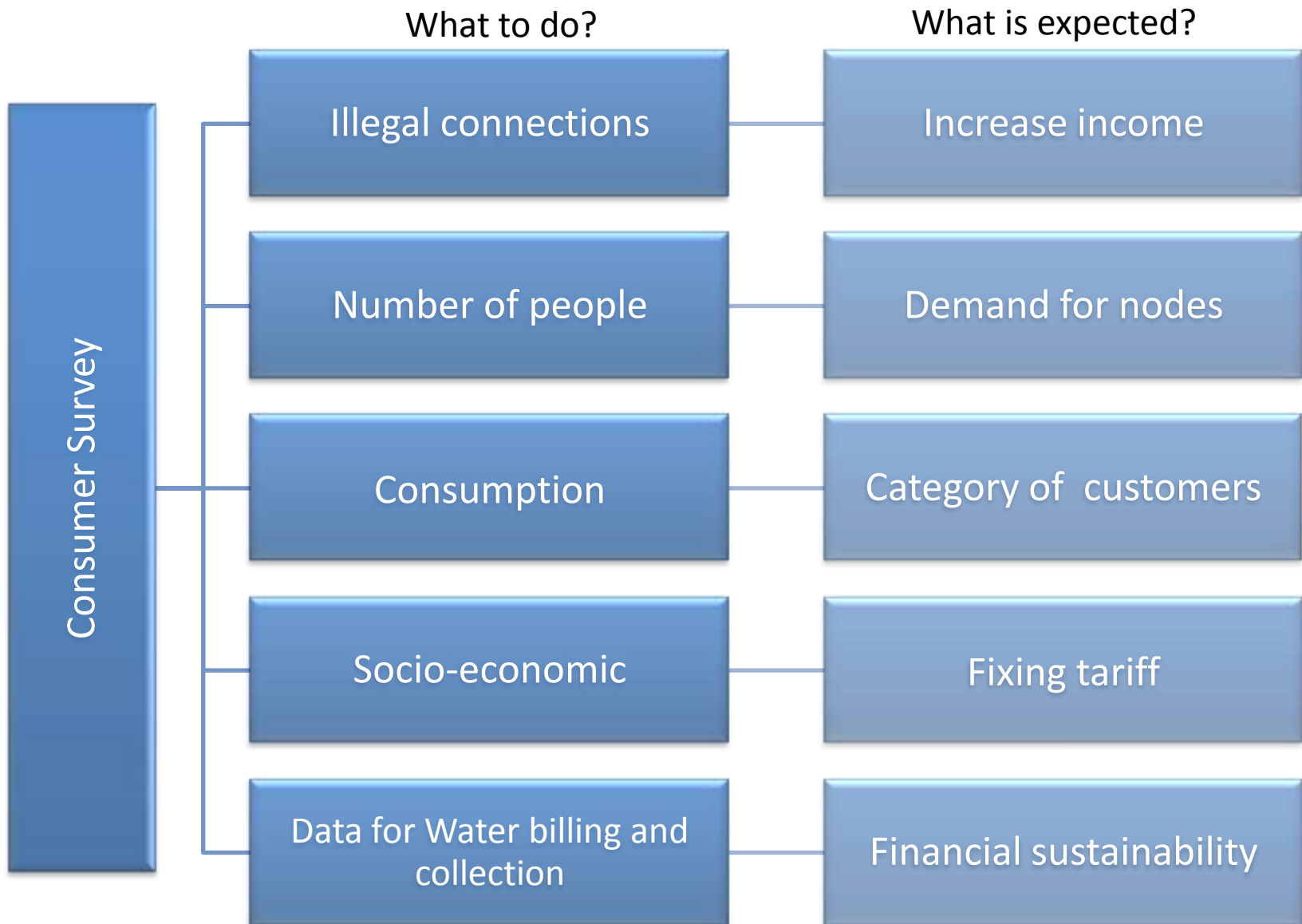
Before



After

Difficulties in MSNA

Consumer Survey

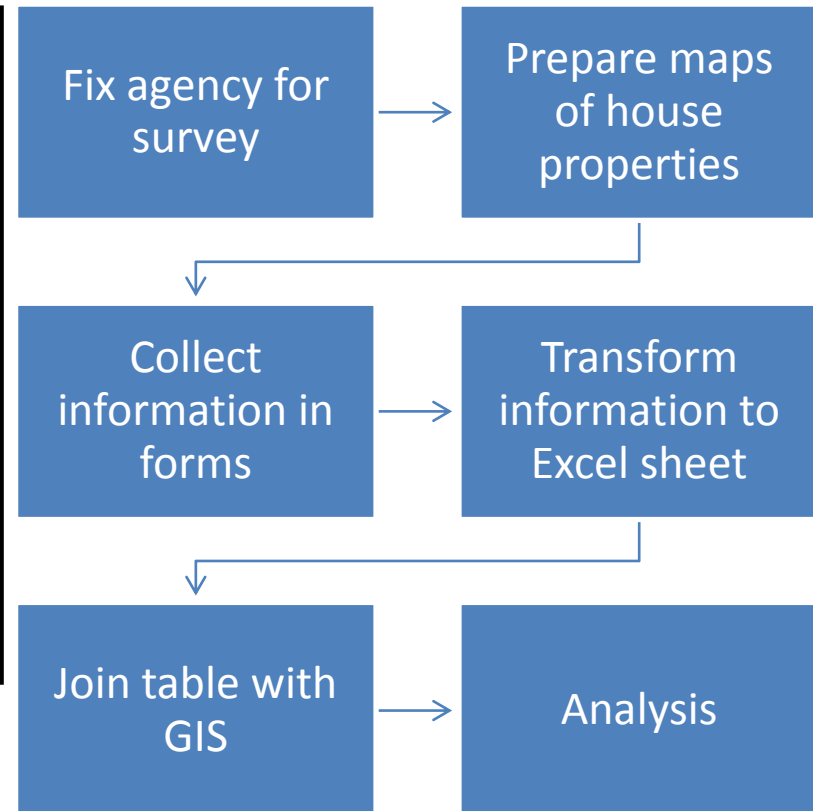


Difficulties in MSNA

Consumer Survey



Illegal connections not properly found
by consultants,





Difficulties in MSNA

Consumer Survey

SN	City	Properties	House-Holds	Total Connecti ons	Illegal Connecti ons	Ill_Conn_ Regulariz ed	Rs Lakhs Saved/Y
1	Amravati	132525	NA	73721	4000	2200	30
2	Ahmadpur	12152	10676	3789	3733	0	0
3	Udgir	12683.0	19580	8390	2304	0	0
4	Yavatmal	53480	NA	26537	1681	1131	12
5	Sillod	7762	9940	3839	1194	412	4.94
6	Nilanga	6391	7819	2575	1165	350	13.98
7	Deulgaon-Raja	6320.0	4963.0	3327	654	0	0
8	Manmad	13882	17606	8389	496	0	0
9	Pachgani	2052	3960	1421	436	0	0
10	Badlapur	58020	50640	15488	400	0	0
11	Basmat	10041	8781	4524	241	0	0
12	Ambarnath	12779	49430	20186	231	0	0
13	Gondia	28595	NA	10189	135	0	0
14	Manwat	5093.0	4582.0	4561	121	0	0
15	Ballarpur	17962.0	17899.0	7126	118	0	0
16	Khamgaon	15887.0	20834.0	7870	116	0	0
17	Hingoli	11056.0	14664.0	5119	114	0	0



Difficulties in MSNA

Consumer Survey

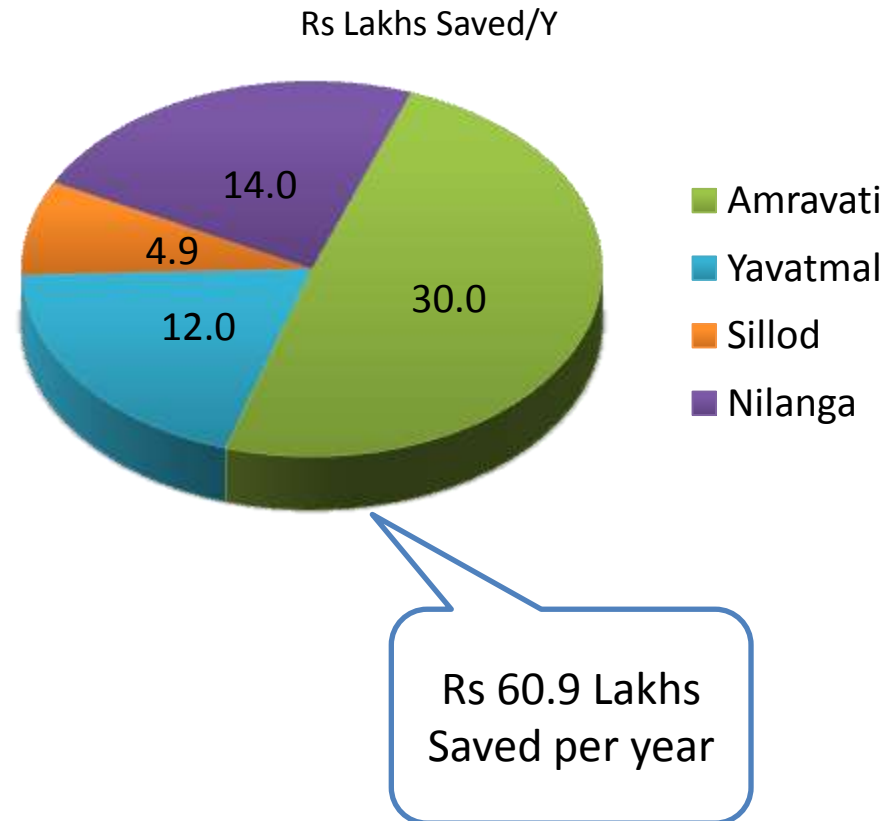
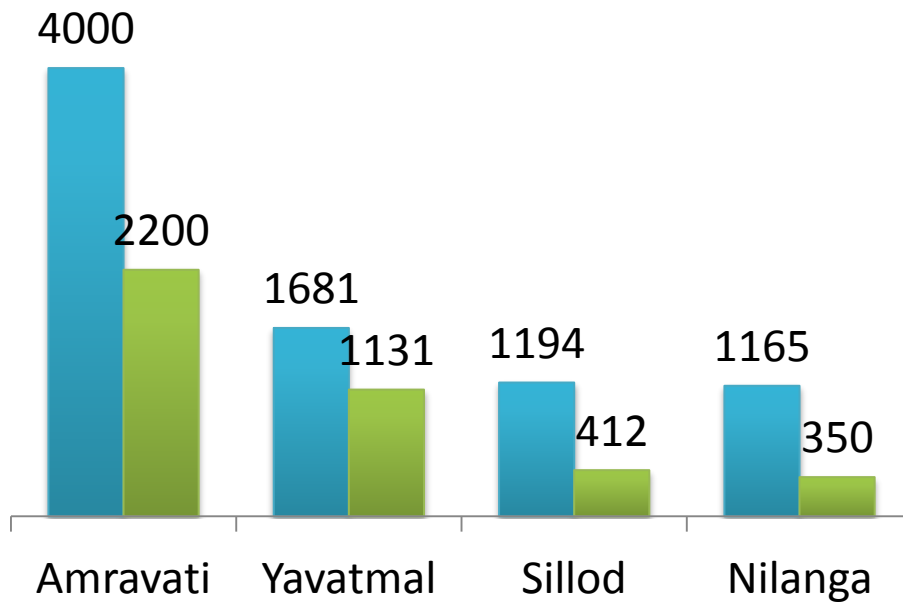
	City	Properties	House-Holds	Total Connections	Illegal Connections	Ill_Conn_Reg ularized	Rs Lakhs Saved/Y
18	Umarkhed	8846.0	7952.0	4546	52	0	0
19	Akot	22033.0	22033.0	7154	25	0	0
20	Deoli	4420.0	4033.0	1918	23	0	0
21	Narkhed	6015.0	5919.0	2694	6	0	0
22	Ramtek	3971	4953	2442	4	0	0
23	Kalmeshwar	3194	4114	3028	1	0	0
24	Anjangaon	9539	10749	7762	0	0	0
25	Chikhaldara	666	549	609	0	0	0
26	Jalgaon Jamod	6415	7452	1922	0	0	0
27	Karanja	11362.0	13303.0	6798	0	0	0
28	Mohapa	1239	1474	1082	0	0	0
29	Mowad	1676	1859	1208	0	0	0
30	Panhala	758	903	631	0	0	0
31	Patur	4156.0	4920.0	1659	0	0	0
32	Tiroda	4796	4500	1789	0	0	0



Difficulties in MSNA

Consumer Survey

■ Illegal Connections
■ Ill_Conn_Regularized



Difficulties in MSNA

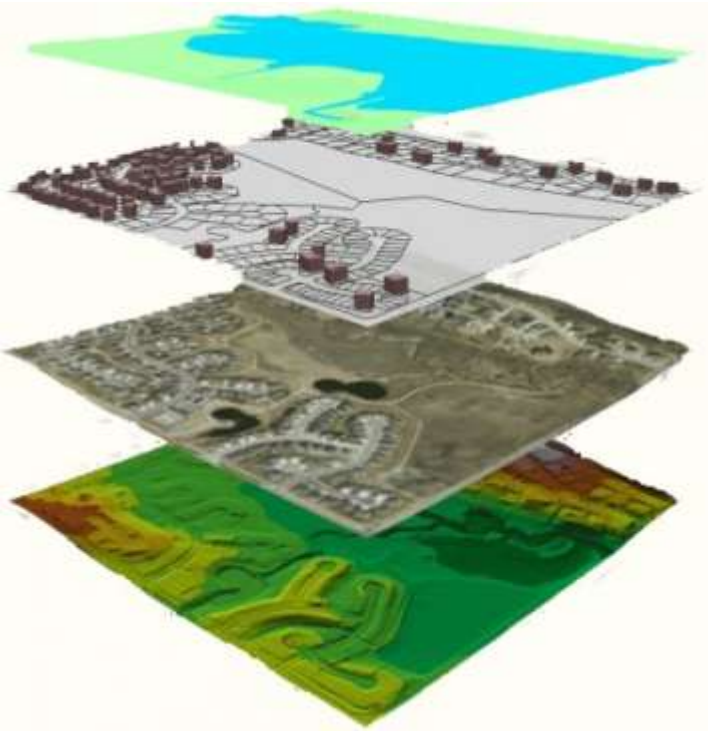
Consumer Survey



- Resistance from religious section
- Difficulty in defining area of
- Non co-operation from the consumers
- Frequent visits to houses that are locked
- Unavailability of the bills for verification
- No accessibility to visual verification of connection
- Surveyors abused and threatened
- Identify legal and unauthorized connections
- Large number of stand-posts with unaccounted water
- Illegal connections not properly found by consultants,

Difficulties in MSNA

GIS



- Unavailability of satellite image,
- Prolonged time for procurement from NRSA,
- Improper and incomplete base data availability
- DP maps/ward boundaries are obsolete
- Hand drawn and inaccurate water network
- Poor asset management - with incomplete information on location, and geography
- Scheme related information: old and not updated,
- Variations observed on ground

Difficulties in MSNA

Hydraulic Modelling

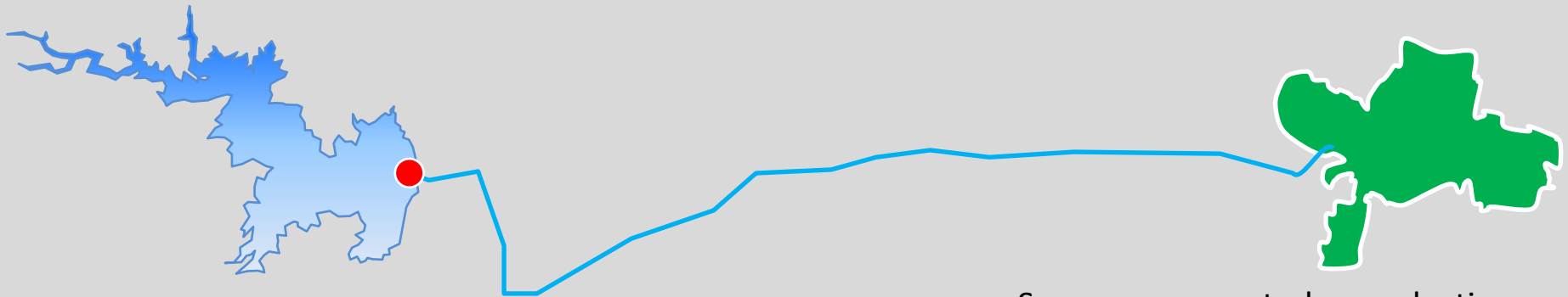
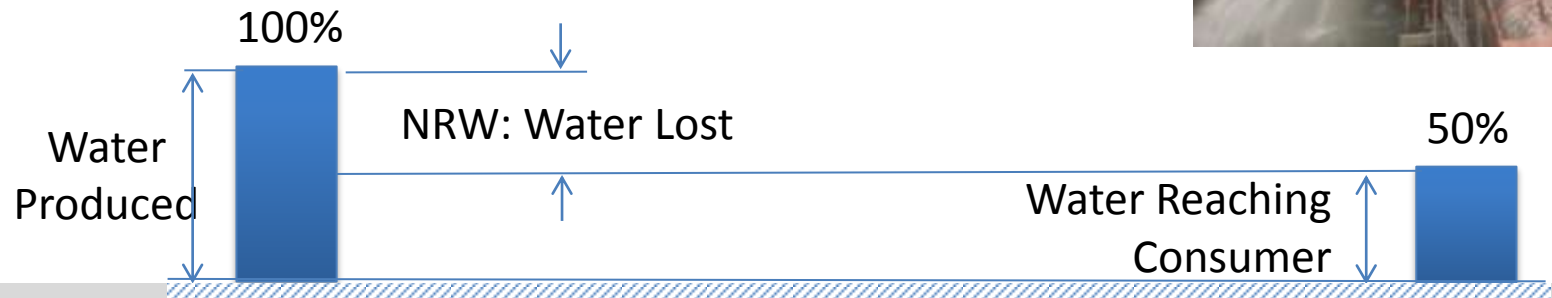
- Drawings manually sketched
- AutoCAD drawings: are non spatial
- No engineer in ULB for taking care of Hyd. M.
- Actual pipelines different from the information available
- Restriction of no. of nodes (population/40) is not correct,
- Engineers: Training and capacity building
- Consultants know only sketching and feeding the data
- Simulation scenarios are not made
- Demand allocation is wrong in many cases
- Operational zones are not created in HM

Difficulties in MSNA

Definition: Non Revenue Water

- NRW - is water that has been produced and is “lost” before it reaches the customer

$$NRW = \frac{\text{Total water produced} - \text{Total water sold} \times 100}{\text{Total water produced}}$$

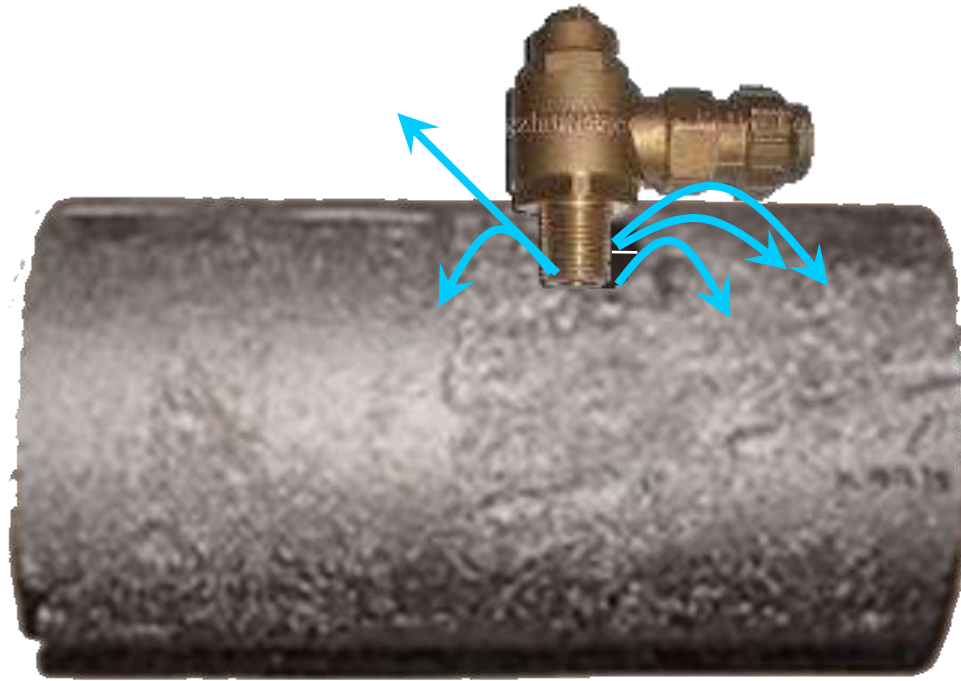


Difficulties in MSNA

- CI pipeline is brittle
- Unskilled Non-Plumber makes irregular shaped hole in CI pipeline,



Difficulties in MSNA



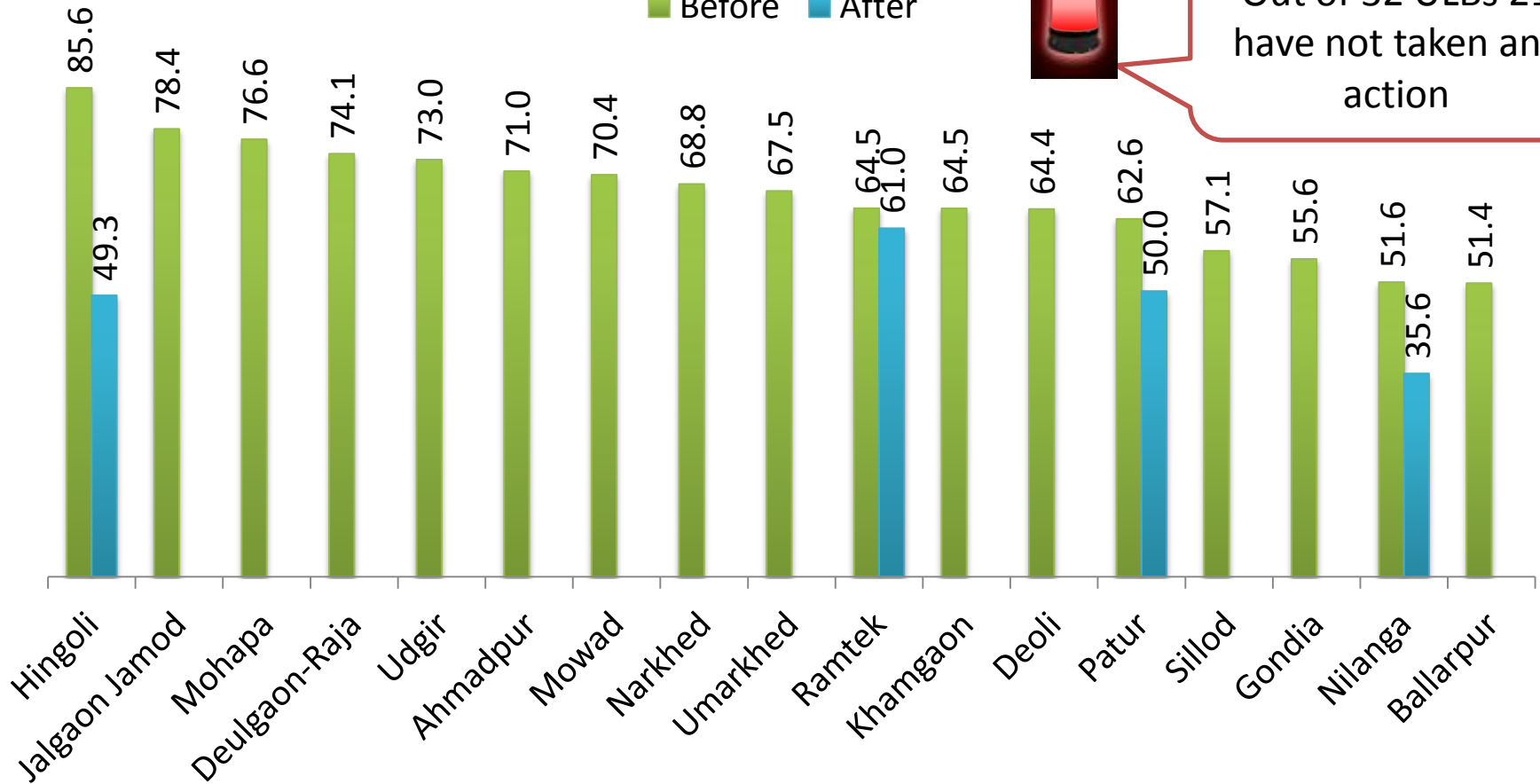
NRW- Actual Performance

NRW (%)

■ Before ■ After

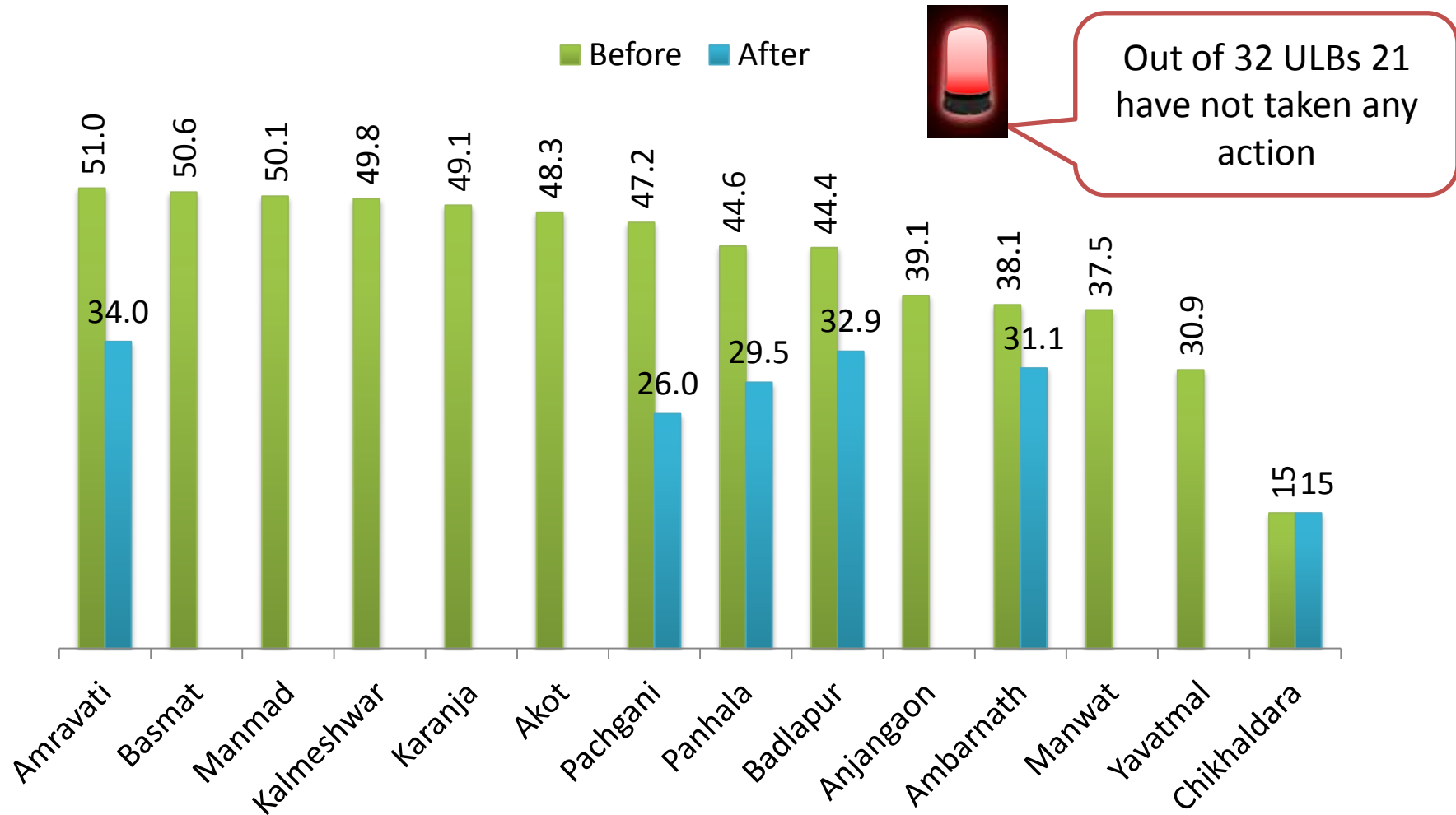


Out of 32 ULBs 21 have not taken any action



NRW- Actual Performance

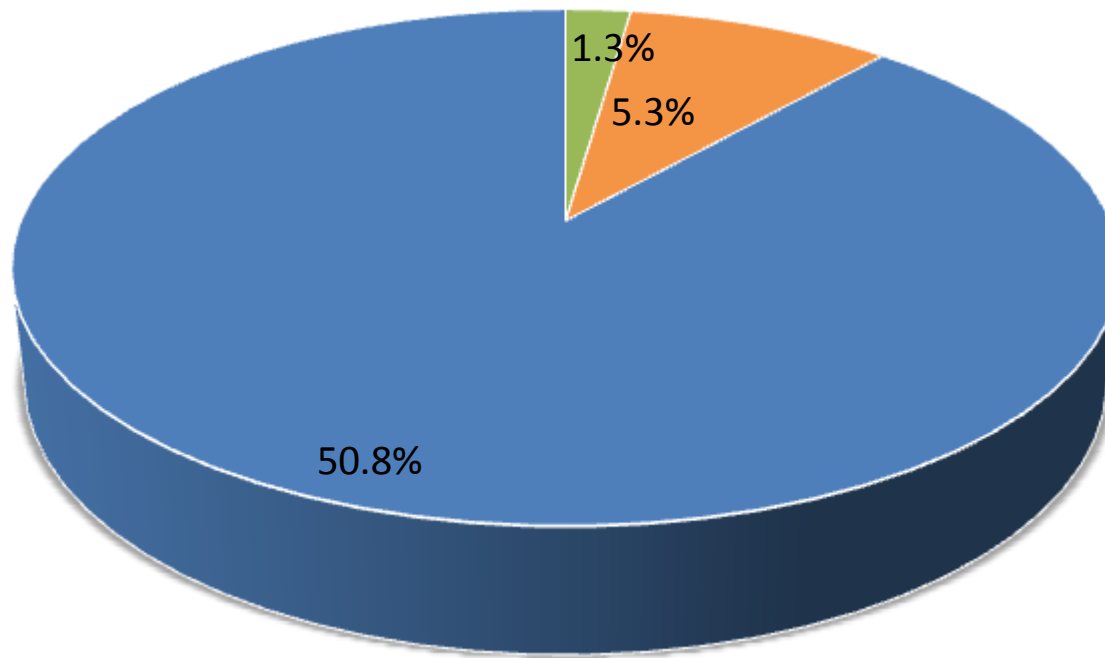
NRW (%)



NRW- Actual Performance

Average of NRW = 57.4%

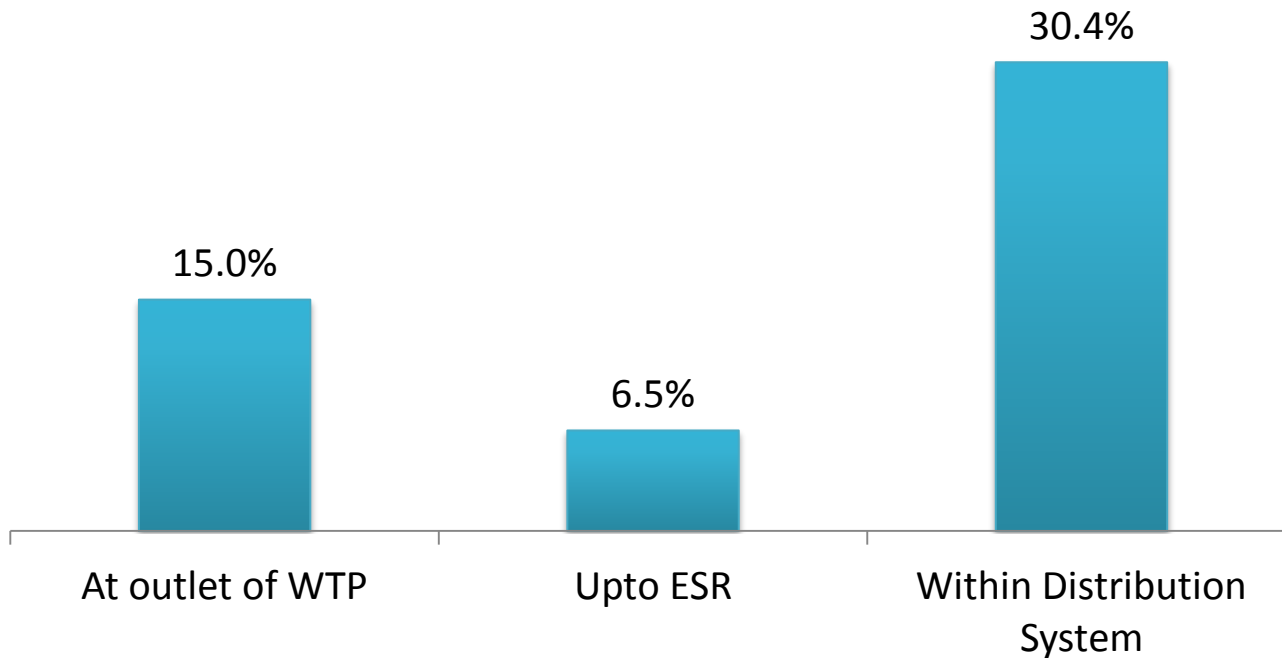
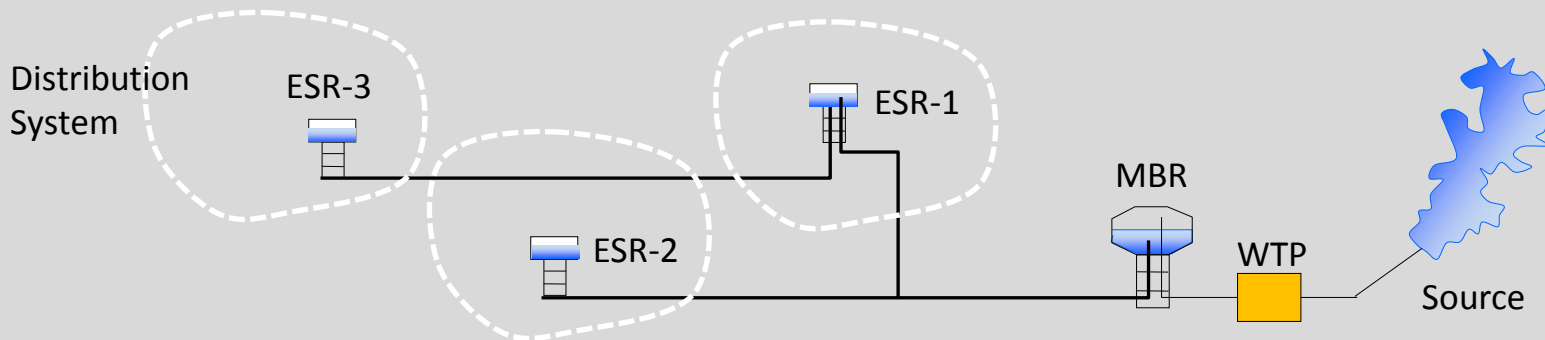
Did you know?
Other surveys shows
low value, between
25 to 30%



■ Authorized_Unbilled ■ Apprant ■ Real

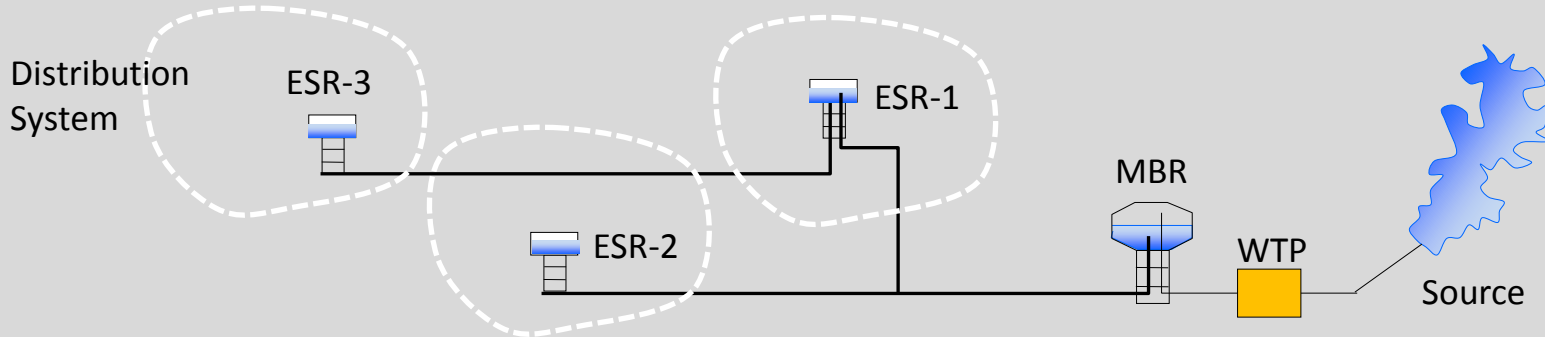
NRW- Actual Performance

Average NRW (%) of 31 Cities



NRW- Actual Performance

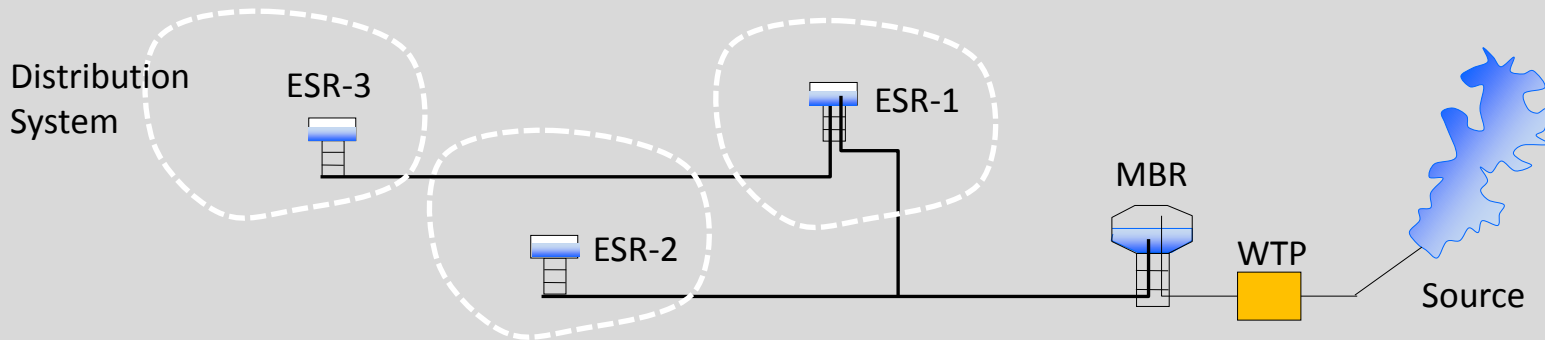
NRW (%)



SN	City	NRW	Apparent	Authorized Unbilled Consumption	Real		
					At outlet of WTP	Up to ESR	Within Distribution System
1	Ahmadpur	71.0	26.2	2.7	25.1	0.8	15.6
2	Akot	48.3	0.2	0.0	0.0	5.9	42.3
3	Ambarnath	38.07	2		3.5	1.5	31.06
4	Amravati	51.0	NA	NA	12.0	3.0	36.0
5	Anjangaon	39.1	0.0	0.0		0.2	39.0
6	Badlapur	44.4	2.0		3.5	1.5	37.4
7	Ballarpur	56.0	0.9	0.0	4.7	7.1	43.4
8	Basmat	50.6	2.6	10.0	11.7	0.5	24.8
9	Chikhaldara	15	2	2			11
10	Deoli	64.4	6.2	2.7	25.4	11.7	18.4

NRW- Actual Performance

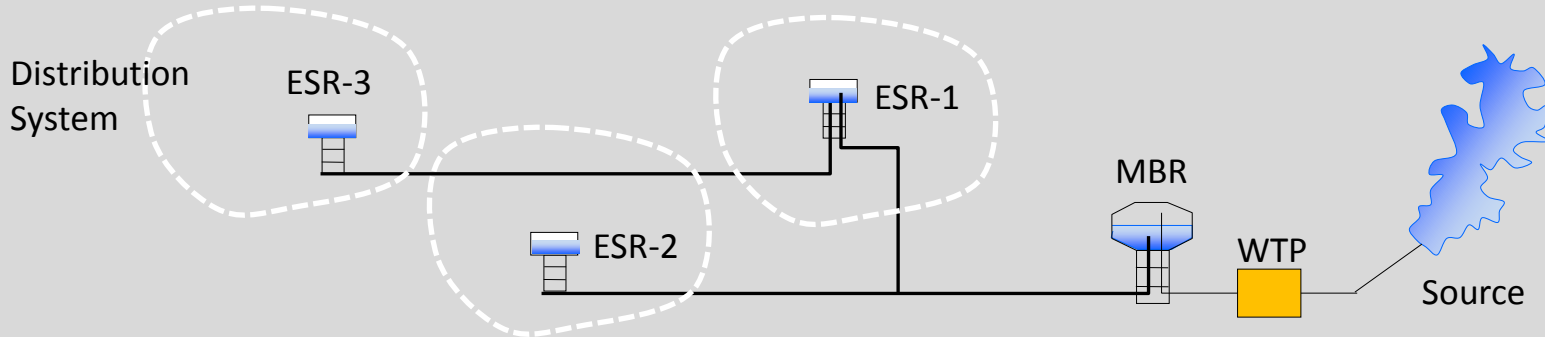
NRW (%)



SN	City	NRW	Apparent	Authorized Unbilled Consumption	Real		
					At outlet of WTP	Up to ESR	Within Distribution
12	Gondia	55.6	0.6	0.4	16.0	3.3	35.8
13	Hingoli	85.6	0.3	0.1	41.3	5.5	38.3
14	Jalgaon Jamod	78.4	0.0	0.4	0.0	37.3	40.6
15	Kalmeshwar	49.8	1.4	2.0	11.2	0.2	35.1
16	Karanja	49.1	8.0	0.0	10.4	11.3	19.4
17	Khamgaon	64.5	1.0	1.6	13.6	1.3	47.0
18	Manmad	50.1	0.7	1.7	11.9	2.3	33.5
19	Manwat	37.5	9.7	1.4	13.0	0.3	12.9
20	Mohapa	76.6	0.0	1.8	41.7	5.7	27.4

NRW- Actual Performance

NRW (%)



SN	City	NRW	Apparent	Authorized Unbilled Consumption	Real		
					At outlet of WTP	Up to ESR	Within Distribution
22	Narkhed	68.8					
23	Nilanga	51.6	14.5	1.6	25.1	0.0	10.4
24	Pachgani	47.2	16.6	0.0	14.0	4.8	11.8
25	Panhala	54.9	8.8	0.0	20.7	13.6	11.8
26	Patur	62.6	3.3	0.0	12.4	3.4	43.5
27	Ramtek	80.1	6.0	3.2	15.6	16.4	38.9
28	Sillod	57.1	4.6	1.1	29.6	2.1	19.7
29	Udgir	73.0	2.9	0.3	7.3	2.8	59.7
30	Umarkhed	67.5	21.6	0.6	0.9	3.4	40.7
31	Yavatmal	30.9				6.8	24.1

Difficulties in MSNA

False Value of Non- Revenue Water



- Gap: actual and on paper
- Therefore, meters are required.
- No taps. No consumer meter, hence can't work out NRW in scientific way



What the average household pays

	2003-04	2007-08	% increase
Anglian Water	£274	£434	58%
Derbyshire Water	£279	£434	56%
Northumbria	£307	£430	41%
Severn-Trent	£313	£420	34%
South West	£315	£410	30%
Southern	£322	£409	26%
Thames	£333	£404	21%
United Utilities	£342	£400	17%
Wessex	£363	£405	11%
Yorkshire	£330	£398	19%
Average	£326	£408	24%

RPI inflation (money cost)

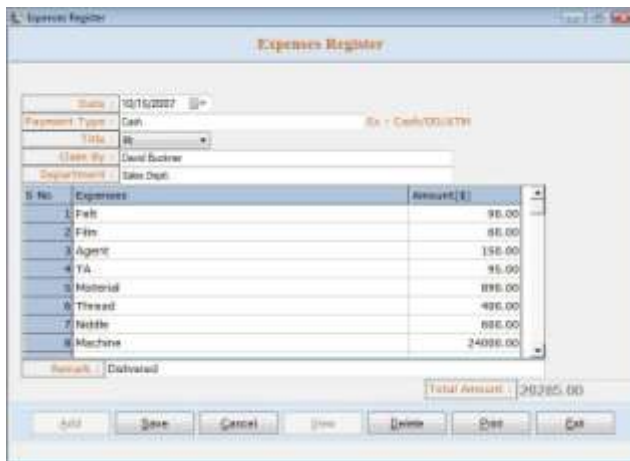
Source: Ofwat. RPI for water and sewerage. Notes: includes Essex & Suffolk Water. Derbyshire Water customers will benefit from £10 government rebate from April 2013. Without this, average bill would be £349. RPI inflation January 2003-December 2012 (source: ONS)

Case	Quantity (m ³)	Rate (rs/m ³)	Total (Rs)
Regular	10.5	12	126
House Lock			300
Difference	14.5		174

- Tariff for house lock is Rs 300/m,
- Family of 5 consumes 10.5 m³/m, bill is Rs 126 /m,
- MJP works out difference in quantity of water consumed in reverse way,
- Water used seems less, gives false NRW, hiding quantity lost due to physical leakages

Difficulties in MSNA

Computerized Billing



The screenshot shows a software window titled 'Expenses Register'. It contains a form with fields for Date (10/15/2007), Payment Type (Cash), Title (RE), Clerk By (David Buckner), and Department (Sales Dept.). Below the form is a table with columns 'S No.', 'Expenses', and 'Amount (\$)'. The table lists eight items: 1. Pelt (98.00), 2. Film (88.00), 3. Agent (158.00), 4. TA (95.00), 5. Material (898.00), 6. Thread (498.00), 7. Needle (898.00), and 8. Machine (24098.00). At the bottom, there is a 'Total Amount' field showing 29385.00 and buttons for Add, Save, Cancel, Print, Delete, and Exit.

S No.	Expenses	Amount (\$)
1.	Pelt	98.00
2.	Film	88.00
3.	Agent	158.00
4.	TA	95.00
5.	Material	898.00
6.	Thread	498.00
7.	Needle	898.00
8.	Machine	24098.00

- No defined consumption pattern
- Most of the data is old
- Discrepancy in the billing data
- Billing data having many redundant records (e.g., Temporarily disconnected, permanent)
- Poor awareness regarding water conservation in people

Difficulties in MSNA

Water Audit

System Input Volume 10.89 MLD	Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption) 1.585 MLD (14.56%)	Billed Authorized consumption 1.57 MLD (14.42%)	Billed Metered Consumption (Including water exported) 1.57 MLD (14.42%)	Revenue Water (Total billed quantity) 1.57 MLD (14.42%)
			Billed Un-metered Consumption NIL	
	Water Losses (System Input Volume - Authorized Consumption) 9.305 (85.44%)	Unbilled Authorized Consumption 0.015 MLD (0.14%)	Unbilled Metered Consumption Nil	Non-Revenue Water (System Input volume - Revenue Water) 9.32 MLD (85.58%)
			Unbilled Un-metered Consumption 0.015 MLD (0.14%)	
		Apparent Losses 0.03 MLD (0.28%)	Un-Authorized Consumption 0.03 MLD (0.28%)	
			Metering Inaccuracies NIL	
			Raw water Transmission 4.25 MLD (39.03%)	
			WTP losses 0.25 MLD (2.30%)	
			Pure water transmission losses 0.46 MLD (4.22%)	
			ESR LOSSES 0.14 MLD (1.29%)	
			Distribution Losses 4.175 MLD (38.32%)	
		Real Losses (Water Losses- Apparent Losses) 9.275 (85.16%)		

- Resistance to the installation of Water Meter
- Tampering and theft of meters
- No Support from consumers
- No support from Council staff
- Un-authorized boosting problems
- Political Interference
- Only 5% of each DMA is metered and then water audited, this does not truly represent NRW in full DMA

Difficulties in MSNA

Energy Audit



- Electricity billing data not available for analysis,
- No previous records registered in log books about the condition of motors, pumps, panels as well as for maintenance and break down,
- Energy audit is made for pumping machinery only, and not holistically- If there is any system fault, it is undetected,
- Energy audit recommendations are not followed

Difficulties in MSNA

Computerized Billing

- Improper and incomplete billing data,
- Available data is available in hard copy only,
- Property tax data and water connection data are maintained in same register,
- No provision for deletion / updation of any record - only addition is possible,
- Exact no. Of properties are unknown,
- Category of connections- legal, illegal, working, disconnected are unknown
- Most of connections are unmetered or flat rate,

Expenses Register

Date: 10/10/2007

Payment Type: Cash

Total: 20285.00

Class By: David Sushma

Department: Sales Dept

S No.	Expenses	Amount
1	Petrol	95.00
2	Film	95.00
3	Agent	150.00
4	TA	95.00
5	Material	895.00
6	Travel	495.00
7	Tackle	895.00
8	Machine	2400.00

Remarks: Delivered

Total Amount: 20285.00

Buttons: Add, Save, Cancel, Print, Delete, Exit

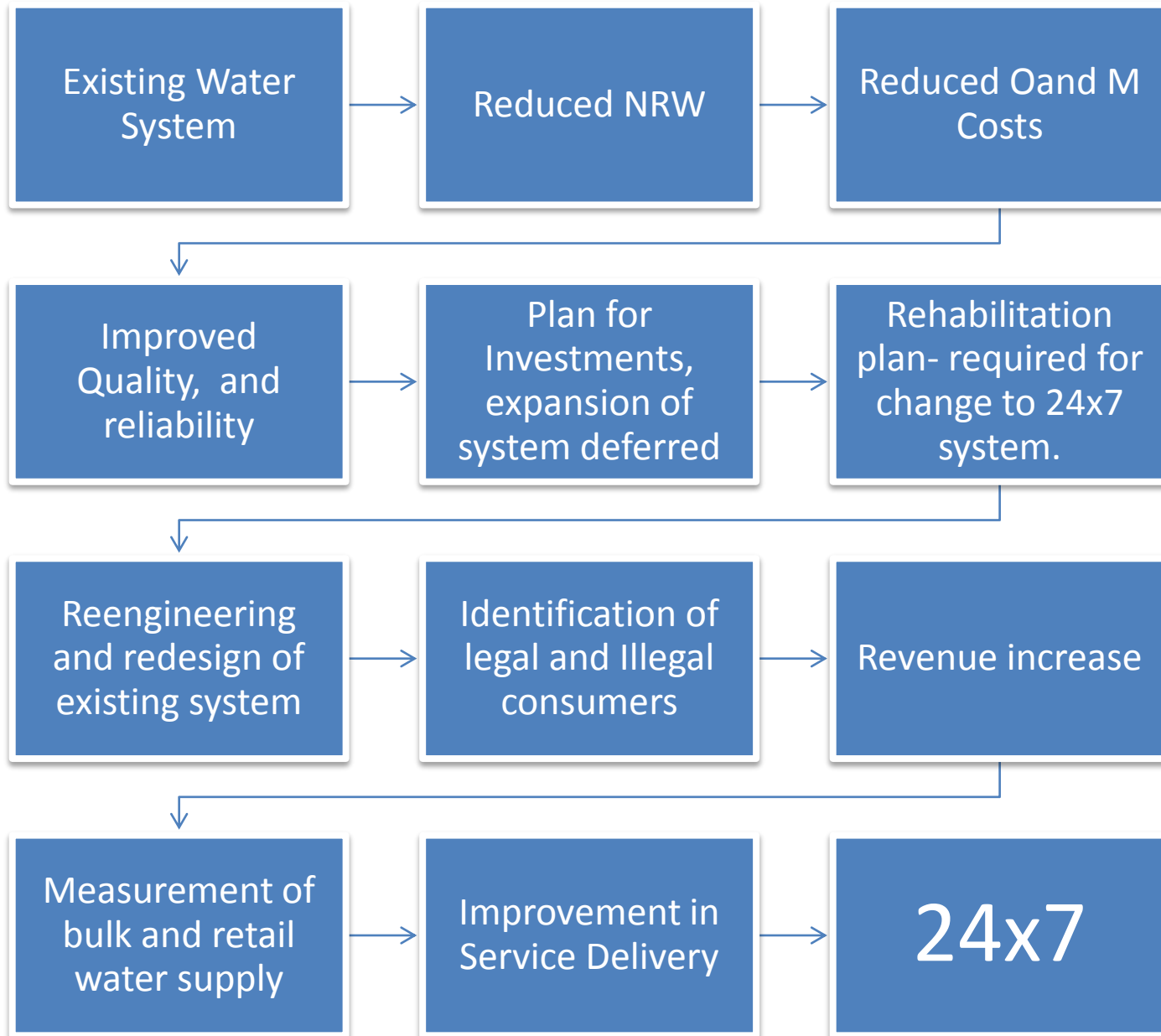
Difficulties in MSNA

Meters



- Meters are installed by MJP but not maintained by ULB,
- Meters malfunction

Conclusions



Thanks....