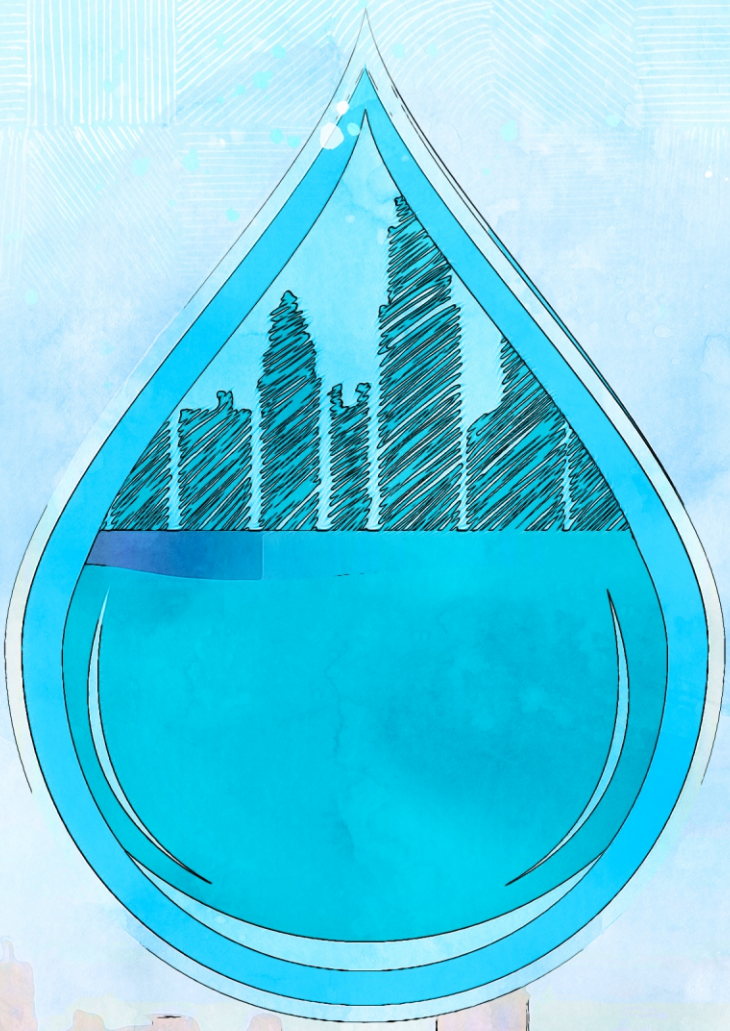
Moving towards Water Sustainability

for Aurangabad City



Research Study

2022-23

Regional Centre for Urban & Environmental Studies
All India Institute of Local Self-Government, Mumbai
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Preface

Water, as all of knows is inevitable for the sustenance of living being on the Earth. It is essential for the stability of every country on the Earth, and without water security there cannot be a national security. It is essential for achieving larger sense of security, sustainability, development and human well-being. UN-water supports the inclusion of water security in the post-2015 development agenda as part of the Sustainable Development Goals.

With changing climate and its variability, there is fluctuations in rainfall and temperature, which will create short rainy seasons and long dry seasons. These shifts have a sever impacts on lives and livelihoods. Changes in water supply, leads to more human suffering, increased risk of instability, conflict, and migration. Achieving water security needs protection of our vulnerable systems and resources, mitigating water related impacts such floods, hazards, droughts. Also, safeguarding access to water, functions, services and manage water in an integrated and equitable manner.

Drinking water supply system is crucial infrastructure for public health and living. Need of the hour is to provide safe drinking water to people in order to make our cities healthier. Provision of drinking water is the sole responsibility of urban local bodies in all cities in India. However, whether this service is available, reliable and efficient needs to be assessed, over a time period, in order to bring in efficiency and efficiency in the entire system.

For the purpose of the study, two types of data were collected – secondary and primary. The secondary data from the government offices, research study reports, journal papers were collected in the areas of Water. The data was collected for the current status, however in case of non-availability of current data set, previous years data set is being used for analysis purpose. The primary data was collected with the help of questionnaire interview. The respondents were randomly selected due to the nature of data. The questionnaire had quantitative as well as qualitative questions to do the same.

The study was carried out for Aurangabad city in the State of Maharashtra, which is governed by Aurangabad Municipal Corporation (AMC). Following the data collection including secondary information and primary survey, a holistic and micro-level analysis was done. After analysis, the study revealed interesting and important results that was used for policy recommendations to the respective urban local bodies to follow. Furthermore, the same recommendations may be used to prepare Action Plans for other urban local bodies as well.

Acknowledgement

I take this opportunity to put on record our deep appreciation for the Ministry of Housing & Urban Affairs (MoHUA), Government of India (GoI) for providing us an opportunity to working on this study.

I also take this opportunity to express my gratitude towards Shri. Ranjit Chavan, President, All India Institute of Local Self Government for providing valuable guidance and support to complete this report. I also express my sincere thanks to Dr. Jairaj Phatak, IAS (Retd.), Director General, All India Institute of Local Self Government for his continued support in completing this report.

This Research Study was undertaken by JNEC, MGM University, Aurangabad with RCUES, AIILSG, Mumbai. I truly appreciate the sincere efforts of Dr. V.S.Pradhan, HOD, Department of Civil Engineering, JNEC, Aurangabad and her team in completing this report and coming up with recommendations for the urban local bodies as a part of their strategies to increase efficiency of operation in piped water supply for Aurangabad.

I am thankful to the RCUES's Research team for their continued support in completion of this research study report.

Director
RCUES, AIILSG, Mumbai

Table of Content

Preface i

1. BACKGROUND 1

2. BRIEF ABOUT AURANGABAD CITY 2

3. STATUS OF WATER SUPPLY – AURANGABAD CITY 4

3.1 Historical Development of Surface Water Supply Infrastructure 4

3.2 Current Situation of Surface Water Supply Infrastructure 5

3.2.1 Quantity 5

3.2.2 Distribution 6

3.2.3 Water Treatment 8

3.2.4 Water Metering 11

3.2.5 Household Survey 11

Summary of Responses 11

4. AUGMENTATION OF WATER SUPPLY SCHEME 16

5. ANAYLYSIS OF CURRENT SITUTATION 18

5.1 Service Level Benchmark (SLB) 18

5.2 Assessment of Existing Situation 22

5.2.1 Access & Coverage 22

5.2.2 Service Levels & Quality 22

5.2.3 Efficiency in Service Operation 23

5.2.4 Financial Management 24

6. RECOMMENDATIONS & SUGGESTIONS 25

Table of Abbreviations

AMC:	Aurangabad Municipal Corporation
AURIC:	Aurangabad Industrial City
CIDCO:	City and Industrial Development Corporation
CPHEEO:	Central Public Health and Environmental Engineering Organization
ESR:	Elevated Storage Reservoir
GOI:	Government of India
GSR:	Ground Storage Reservoir
JNEC:	Jawaharlal Nehru Engineering College
LPCD:	Liters per Capita per Day
MGM:	Mahatma Gandhi Mission
MHADA:	Maharashtra Housing Development Corporation
MIDC:	Maharashtra Industrial Development Corporation
MLD:	Million Liters per Day
MoHUA:	The Ministry of Housing and Urban Affairs
NRW:	Non-Revenue Water
O&M:	Operation & Maintenance
PAS:	Performance Assessment System
PMU:	Project Management Unit
SLB:	Service Level Benchmark
SWM:	Solid Waste Management
ULB:	Urban Local Body
UNESCO:	The United Nations Educational, Scientific and Cultural Organization
UN:	United Nations

Table of Tables

Table 1: Area Details of Aurangabad Municipal Corporation 3
Table 2: Details of Historical Development of Water Supply Schemes - Aurangabad 4
Table 4: Details of Tanker Water Supply 6
Table 5: Service Level Benchmark 18
Table 6: Status of AMC as per PAS report 20

Table of Figures

Figure 1: Image of India, Maharashtra along with Google Image of Aurangabad City 2
Figure 2: Location map of Aurangabad city, Pharola WTP and Harshul lake 5
Figure 3: Location of Harshul Lake and Aurangabad city 6
Figure 4: Location of Pharola WTP 8
Figure 5: Process flow diagram of Pharola WTP 8
Figure 6: Images of Pharola WTP 9
Figure 9: Superimposed map of Aurangabad Water Supply 10
Figure 10: Water Supply – Access & Coverage 20
Figure 11: Service Level & Quality 21
Figure 12: Efficiency in Service Operations 21
Figure 13: Financial Sustainability 22

1. BACKGROUND

Water is inevitable for sustenance of living being on the Earth. It fuels every aspect of life and essential for basic health and hygiene. It drives most important sectors such as agriculture, industrial, energy etc. It is an important condition for all life on planet and also enabling and/or limiting factor for any social and technological development. It is essential for the stability of every country on the earth, and without water security there cannot be a national security.

With climate change and variability, there is fluctuations in rainfall and temperature, which creates short rainy seasons and longer dry seasons. These shifts have a sever impacts on lives and livelihoods. Changes in water supply, leads to more human suffering, increased risk of instability, conflict, and migration.

Water is central to achieving a larger sense of security, sustainability, development and human well-being. UN-water supports the inclusion of water security in the post-2015 development agenda as part of the Sustainable Development Goals.

As per Working definition of UN-Water, 2013**, *"Water Security is the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability"* [(3)].**

Achieving water security needs protection of our vulnerable systems and resources, mitigating water related impacts such floods, hazards, droughts. Also, safeguarding access to water, functions, services and manage water in an integrated and equitable manner. Drinking water supply system is crucial infrastructure for public health and living.

With this backdrop, the present study is going to assess water security from the perspective of surface water resource supply and its management for Aurangabad city.

2. BRIEF ABOUT AURANGABAD CITY

Aurangabad city is in the Central Maharashtra Region and it is a capital of Marathwada region. The city has a rich medieval history and the city was founded in 1610 by Malik Ambar, which was eventually named as Fatehnagar. After the death of Malik Ambar, Aurangzeb has ruled it and renamed it as an Aurangabad. In 1724, Aurangabad was ruled by Nizam-Ul-Mulk, and later the capital of the Nizam was shifted to Hyderabad. During the British period, Aurangabad was remained under the princely state of Hyderabad. The city was a part of Bombay state after independence and later in the year of 1960 it was included in the newly formed State of Maharashtra.

The city is having semi-arid climate with annual mean temperature range from 17 to 33 ^{0}C. Most of the rainfall occurs in the monsoon season from June to September. Average annual recorded rainfall is 710 mm. The entire area is covered under Deccan trap, which influences storage of water.

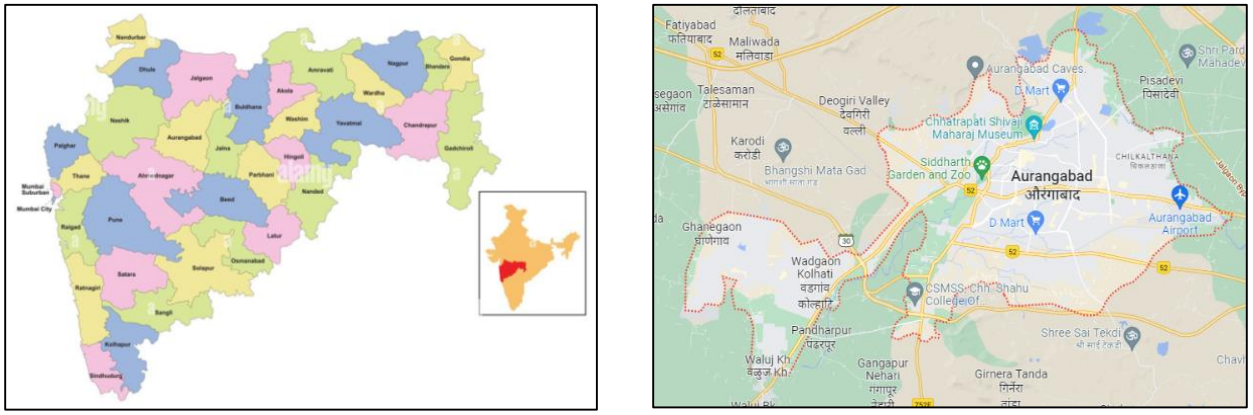


Figure 1: Image of India, Maharashtra along with Google Image of Aurangabad City

The city is a famous tourist hub due to many historical monuments including Ajanta & Ellora caves, which is a famous UNESCO World Heritage Sites. Other than that, it has other tourists' attraction includes, Aurangabad caves, Bibi ka Maqbara, Panchakki, Salim Ali Lake, Grishneshwar temple. Other than tourist attractions, city also houses several Gates, there are total 52 Gates in the city, of historical and architecture perspective. Aurangabad is also being called as "CITY OF GATES".

Aurangabad started to industrialize in the late 19th century, with city's first cotton mill opened in 1889. City and surrounding area houses number of pharmaceuticals, manufacturing, seeds, plastic processing, aluminum processing, agriculture, biotech, and automotive industries. There are famous industrial areas; The Shendra, Chikalthana, Waluj MIDC with various major multinational groups. City is also a major Himroo silk, Paithani silk and Cotton production center. In 2019, the Aurangabad Industrial City (AURIC) became the first greenfield industrial smart city of India under the country's flagship Smart Cities Mission.

Other than tourist hub, industrial hub, Aurangabad is one of the major educational hubs for students of Marathwada region. Many government and private colleges of various streams such as engineering, law, arts, science, designing, hotel management are present in Aurangabad.

The process of development and urbanization has increased substantially due to large scale industrial development, which has resulted into migration. People from different areas of Marathwada region migrated to Aurangabad in search of work. In 1982, Maharashtra Housing Development Corporation (MHADA), a para-statal organization was established for providing housing to lower and medium income groups. The city population has increased by 69% during the year of 1961 and 1971. There was a rapid decadal growth of population between 1971-81 at 82% and 96.7% in 1981-91. The city was being identified as a fastest growing city in Asia during 1980's. As per 2001 census, the population of Aurangabad city (includes Aurangabad city area, CIDCO area and Cantonment area) was 9.02 lakh, spread over an area of 137.40 sq.km. As per the latest census information of 2011, city population has reached up to 14.22 lakh, covering an area of 139 sq.km. City is part of Flagship programme – Delhi Mumbai Industrial Corridor, of Central Government in which area near Shendara – Bidkin is going to be developed under Special Economic Zones.

The Municipal Council of Aurangabad was established in 1936 and it attained a status of Municipal Corporation in 1982, due to inclusion of 18 peripheral villages, making total area of 139 Sq.Km. The details of Municipal Limit extension is given in the table below:

Table 1: Area Details of Aurangabad Municipal Corporation

Sr. No.	Year	Area (sq.km.)
1	1969	54.39
2	1982	138.5
3	2006	142

At present the city is divided into 115 electoral wards, and divided into 6 zones. Each ward is represented by a corporator. Aurangabad Municipal Corporation (AMC) is the responsible authority for providing basic amenities like drinking water, drainage facility, roads, street lights, health care facilities, and primary education facilities.

3. STATUS OF WATER SUPPLY – AURANGABAD CITY

The city is famous for its water supply schemes of historical importance. During earlier times, the city received its water supply from wells, springs, which is related to small underground masonry pipes. These systems were efficient and sufficient to supply water throughout the year. The city still depends on some of these sources and are still in working conditions. This system is called as *"Nahar-E-Ambari",* named after Mallik Ambar. The system of Nahar-E-Ambari was continued to supply water to the city till 1954 in adequate quantities, along with small dug wells and tanks in the peripheral parts of the Aurangabad city. In 1954, the first public water supply scheme was initiated by the State Government for Aurangabad, wherein water was sourced from Harshul tank, and subsequently two more schemes based on Jayakwadi Dam were built. Old Jayakwadi scheme was built in the year of 1975-76, while new Jayakwadi scheme was built in the year 1991. Details of the same is represented in the below table well as following section of the report.

Table 2: Details of Historical Development of Water Supply Schemes - Aurangabad

Sr. No.	Year	Details of the scheme	Quantity of Water Supplied
1	1620	Nahar-E-Ambari	2 MLD
2	1954	Harshul Water Supply	4 -5 MLD
3	1975-76	Old Jayakwadi Water Supply	28 MLD
4	1991	New Jayakwadi Water Supply	100 MLD
5	2022	Jayakwadi Water Supply	127 MLD

3.1 Historical Development of Surface Water Supply Infrastructure

1. Harshul Lake Uddhwa Water Supply Scheme (1954) – Under this scheme, only 4 to 5 MLD water was supplied. The scheme also has a 10 MLD capacity water treatment plant having ground tanks at Delhi Gate and Kranti Chowk along with main gravity walls. However, at the end of summer, less water was available. Water supply through this scheme stopped since April 2018, due to dam failure.

2. Jayakwadi Old & Booster Water Supply Scheme (1975-76 & 1984) - A separate scheme of 28 MLD capacity for the city was commissioned in 1975-76 from Jayakwadi Dam. The population was 1.70 lakhs during that time. The scheme comprised of different components;

- A water treatment plant at Pharola (56 MLD)
- A tank at Nakshatra Wadi
- All 700 mm diameter – (impure citation channel – 26.6 Km long), (pure citation channel - 13.96 Km long and (gravity channel - 09 Km long).

3. Jayakwadi New Water Supply Scheme (1991) - As the population of the city has increased to 5,92,000 in the year 1991, a new plan was required in order to meet the growing demand of the population. The

Maharashtra Life Authority implemented a separate plan of 100 MLD capacity for the city in 1991-92. Under this scheme, following infrastructure was constructed:

- A well at Jayakwadi
- A water treatment plant at Pharola – 100 MLD capacity
- A tank at Nakshatra Wadi
- A 219 mm diameter impure citation channel (26.6 Km long), a pure citation channel (14.32 Km long) and a 1400 mm diameter steel gravity channel (9 Km long)

3.2 Current Situation of Surface Water Supply Infrastructure

3.2.1 Quantity:

The city is divided into 6 water supply zones, which caters existing 15 lakh population. Water lifting requirement from Jayakwadi reservoir is 240 MLD. However, the maximum lifting capacity for the city is 135 MLD, against 240 MLD. The Jayakwadi dam is located at 60 Km away from Aurangabad city. Existing net water supply to the city is 127 MLD, against the demand of 202.5 MLD (considering the CPHEEO standard of 135 LPCD for metro cities). Major reasons of insufficient water supply include; physical losses of water through bulk and retail distribution network, supply to enroute users (The existing pipeline carries water in bulk, and it passes through different habitations, villages, and industrial areas, which takes water from the pipeline either legally or illegally), limited treatment as well as distribution capacity.

Figure 2: Location map of Aurangabad city, Pharola WTP and Harshul Lake

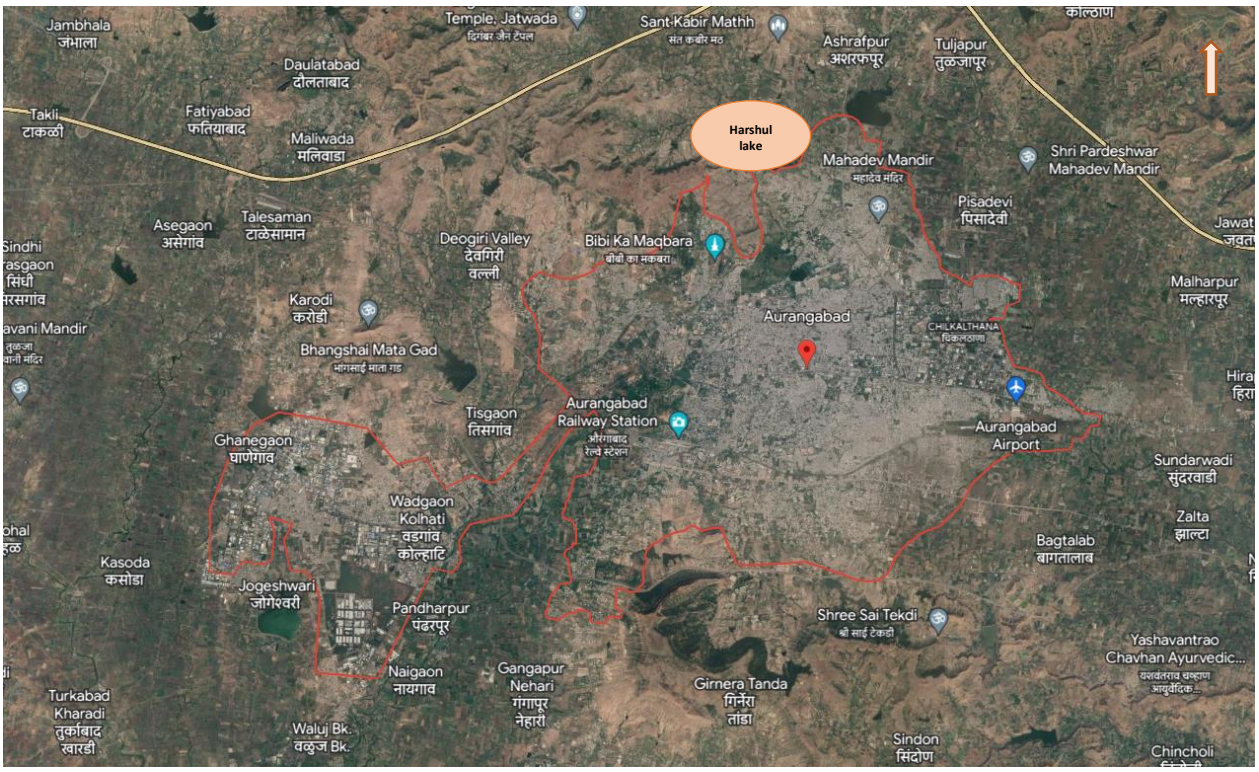


Figure 3: Location of Harshul Lake and Aurangabad city

3.2.2 Distribution:

Presently, total 1020 Km length of distribution pipes are there covering the city. The distribution network/pipe is made up of various materials having different diameters. This network is very old. About 65% of water pipes in the distribution system is made up of AC, RCC, PVC & GI materials. Due to this it is observed that physical losses are much more than acceptable limit, also rusting, erosion of pipelines is there; leading to failure in meeting the required pressure and discharge standards. This leads to unequal distribution of water across the city, leading to application of booster pumps and direct tapping from main water supply lines, and creating further distortions.

There is total 59 water tanks/reservoirs in the city, of which 13 are ground reservoirs (GSR) (having capacity of 15.40 MLD). Remaining 46 are Elevated Storage Reservoirs (ESR), having capacity of 51.58 MLD.

Water distribution has not kept pace with the physical expansion of the city, which has resulted into lack of piped water supply in newly added areas as well in unauthorized settlements. In areas where there is an absence of piped distribution system, water is supplied to citizens through paid tankers. It is supplied from a total of 4 tanker filling stations in the city, which distributes approximately 3 MLD water. Details of tanker filling stations is presented in table 4.

Table 3: Details of Tanker Water Supply

Sr. No.	Tanker filling stations	Total tankers	Daily average rounds	Remark
1	N-7 Jalakumbh - 19	19	90 to 100	Total 400 turns done by tankers, which makes 3 MLD water to be distributed through tankers.
2	N-5 Jalakumbh - 42	42	190 to 200	
3	Kotla Jalakumbh - 16	16	60 to 65	
4	Nkshatrawadi Pump House - 06	06	22 to 25	

Wells & Hand Pumps:

Other than piped water supply network, there are total 305 open wells, of which 206 are private wells and 99 municipal/public wells. Open wells whose water is usable/potable are used to supply water to citizens. Electric pumps have been installed at 55 wells in the city.

There is total 1533 hand pumps in the city, of which 1551 are within the municipal corporation limits. Employees have been appointed to maintain the said hand pumps and the hand pumps are being maintained as per requirement. There are a total of 73 fracking wells with electric pumps installed in the cities.

Duration:

Due inadequacy in water supply and demand, the city started supplying piped water every 1 day since 2001. Every 2 days since 2012, and every 3 days since 2018.

Operation & Maintenance:

Leakages and related issues in the distribution pipeline is addressed during regular maintenance schedule of Municipal Corporation. However due to old infrastructure, leakage rate is increasing steadily.

The topology of Aurangabad city water utility is dead end, and intermittent system. This type of system is very chief and easy but pressure and water quality is not adequate. Initially all ESR in city received water by gravity, however due to increase in demand and odd even terrain of Aurangabad city, there is pumping also, and still there is problem in distribution.

Problems/Issues:

- The water supply scheme was commissioned in the year 1975 and 1991, due to which there are issues of; welding cracks, wall damage, pumping machinery damage, old electrical equipment's, which results into frequent repairing and maintenance.
- The Municipal Corporation does not have sufficient number of engineers and skilled staff to take care of operation and maintenance effectively.
- There is a wide gap between water demand and supply.

- Piecemeal and improper planning to augment water supply and it has not kept pace with physical expansion of the city.

3.2.3 Water Treatment:

Water before go out for distribution is being treated at Pharola Water Treatment Plant. Capacity of the plant to treat water is 56 MLD (1975) & 100 MLD (1992).

Figure 4: Location of Pharola WTP

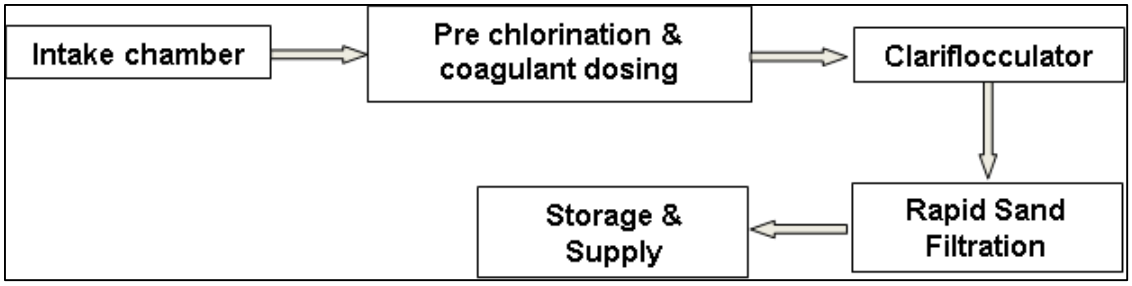


Figure 5: Process flow diagram of Pharola WTP

Figure 6: Images of Pharola WTP

The water treatment plant is treating water through primary and secondary treatment processes.

1. **Intake chamber:** Water from the source is being collected and stored in intake chamber.
2. **Pre chlorination & Coagulant Dosing:** Perchlorination is a process that involves adding chlorine to the collection system of industrial plants and other industrial settings, mainly for corrosion and odor control. At times, it is also applied for the purpose of disinfection and for the removal of oil particles. It is also used in water treatment to control aquatic growth as well as taste, and as an aid in settling and coagulation.
3. **Clariflocculator:** Clariflocculator is a combined flocculator and clarifier in which floc formation and its subsequent removal by sedimentation occur. It has two concentric tanks where the inner tank serves as a flocculation basin and the outer tank serves as a clarifier.
4. **Rapid Sand Filtration:** Rapid sand filtration is a purely physical drinking water purification method. Rapid sand filters (RSF) provide rapid and efficient removal of relatively large suspended particles.

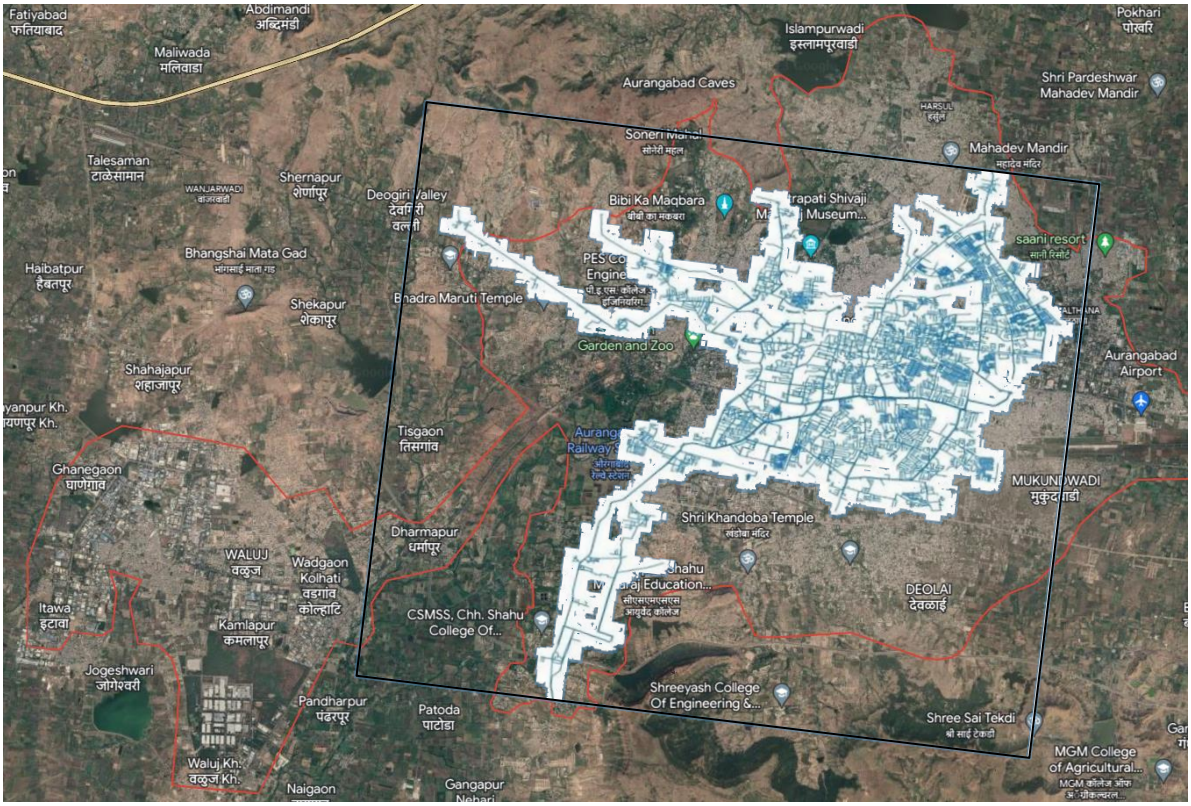


Figure 7: Superimposed map of Aurangabad Water Supply

3.2.4 Water Metering:

There is an absence of water metering system in the city.

3.2.5 Household Survey

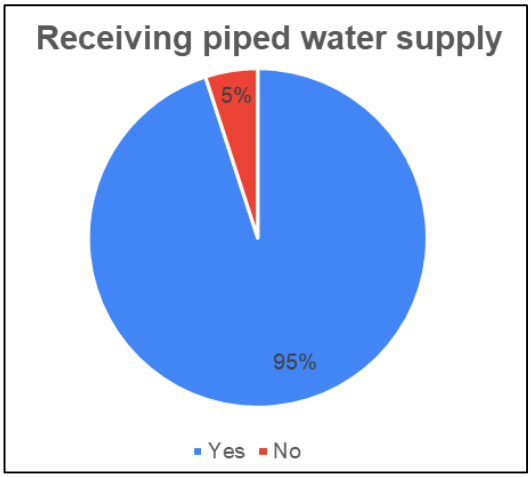
Household survey was carried out in order to tap people's perspective on the existing water supply system. A detailed questionnaire was prepared and a survey was conducted on a random sampling basis and total 50 households were surveyed in order to get an overview of existing situation.

Summary of Responses

Analysis of the responses received is carried out in order to understand the current situation.

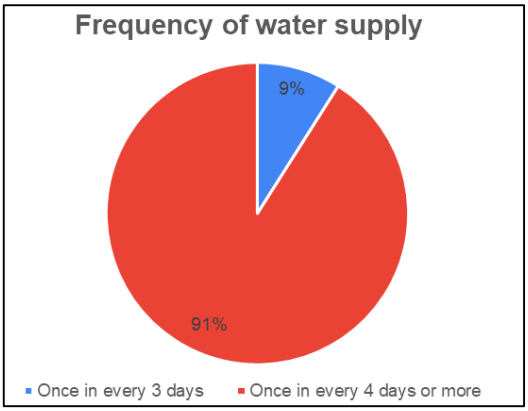
1. Receiving Piped Water Supply

Of total surveyed respondents, 95 percent told that they receive the municipal supply.



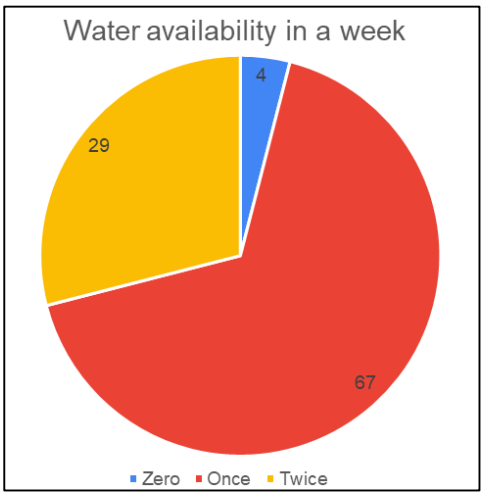
2. Frequency of Municipal Water Supply

As more than 90 percent of the respondents mentioned they receive water supply once in every 4 days or more.



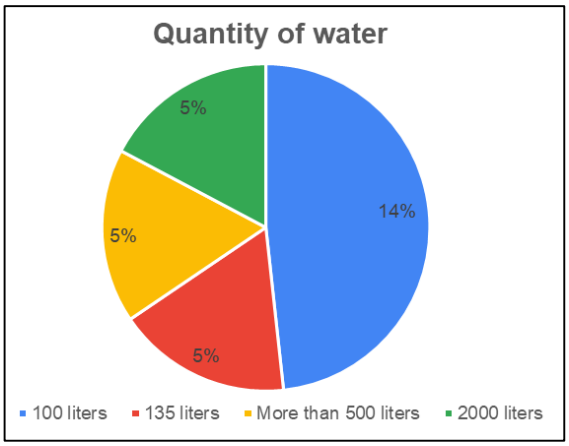
3. Water availability in a Week

63 percent of respondents gets water one time in a week, which is a quite concerning and 27 percent gets water twice in a week.



4. Quantity of water

Most of the respondents said that they get approximately 100 liters per day water, which is lower than the standard of 135 liters per capita.

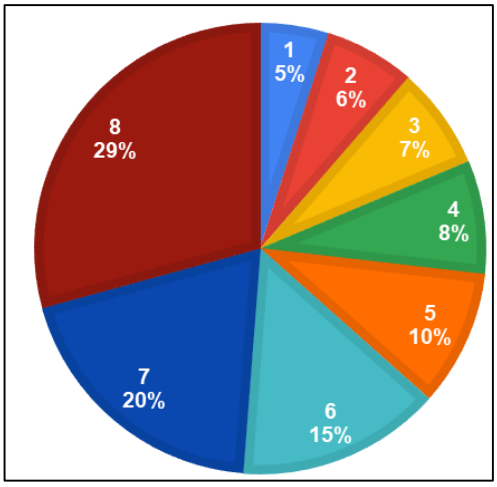


5. Duration of Water Supply – Summer

Around 29 percent respondents said that they receive water for sixty minutes whenever they get water, while 20 percent respondents mentioned that they receive water for 45 minutes.

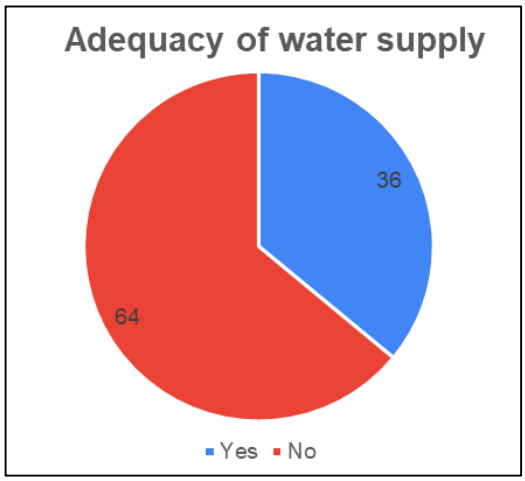
6. Water Storage

All the respondents mentioned that they have to store water due to irregular supply of water on a weekly basis.



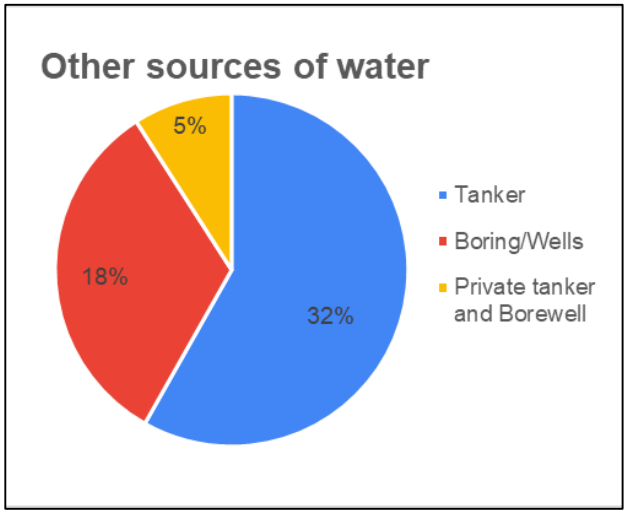
7. Adequacy of Water supply

64 Percent respondents said that quantity of water which is being supplied in inadequate to meet their daily needs.



8. Other Sources of Water

Due to inadequacy of piped water supply, people have to rely on other sources such as tanker water and bore wells. 32 percent respondents said that they are using tanker water in case of need or to meet their demands. 18 percent respondents mentioned that they rely on boring/wells to fulfill their requirements.



9. Number of Borewells

50 percent respondents mentioned they have one bore well at the household level.

10.Quality of Piped Water Supply

55 percent respondents that water quality of piped supply is good, 40 percent responded that its average and only 5 percent responded that its poor.

11.Water Treatment

In order to understand further on quality of water being supplied, the question of treating water once it reaches at household is being asked. It has come out of the survey that 64 percent respondents are not using any kind of treatment for the piped water supply.

12.Water Quality

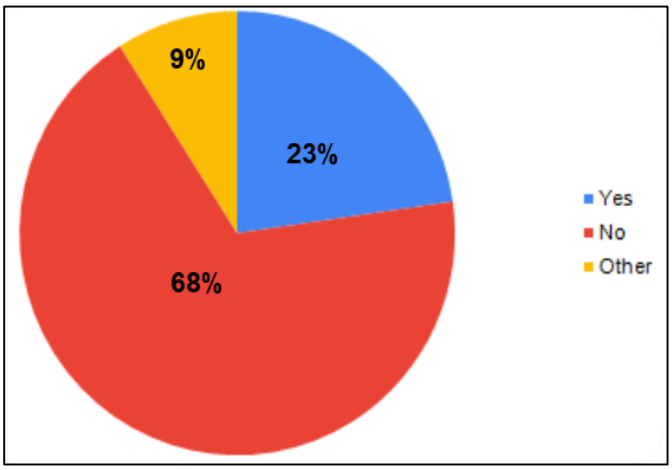
86 percent respondents mentioned that they are not facing any health issues related to piped water supply. 5 percent have reported to suspended impurities and excessive residual chlorine.

13.Paying Water Tax

95 percent respondents said that they are paying water tax. However, the amount of water tax varied from Rs. 2000 annually to Rs. 10000.

14.Complaint Redressal

59 percent respondents said that they go to corporation office, 22 percent reported not going for any complaint redressal. 68 percent said that their complaints are not being registered, while 23 percent reported that their complaints are being registered.



15.Concerns related to Municipal Water Supply

When asked about their concerns related to municipal water supply, varied responses came from the respondents. Most of the concerns are related water suppl infrastructure (old infrastructure), uneven and improper distribution, regularity of water supply, and timing of water supply.

16.Respondent's Suggestions

Following suggestions are being received from the respondents to enhance scenario of piped water supply.

- Duration of water supply should be reduced.
- Make water supply on a daily basis.
- Definite water supply time.

4. AUGMENTATION OF WATER SUPPLY SCHEME

Municipal Corporation has prepared the concept plan and estimates of the entire scheme from Jayakwadi origin to distribution system at a war level of Rs 1680.50 crore in the year 2019. The augmented water supply scheme is designed for the year 2052 for future population of 3317342. Chief Engineer, Maharashtra Life Authority, Aurangabad on 3/8/2019 granted technical approval to the detailed project report of Aurangabad City Water Supply Scheme at a cost of Rs.1680.50 crore net and Rs.1747.72 crore gross.

The project proposal has received administrative approval under Maharashtra Suvarna Jayanti Nagrotthan Abhiyan costing Rs.1680.50 crore. No. 258/33 Date 13/09/2019. As per the condition of administrative approval, the implementing agency of the said project will be Maharashtra Life Authority and the said work will be done on full deposit basis. The financial distribution of the project is as follows:

Details	Cost (Cr.)
Sanctioned cost of the scheme	1680.50
Allowable subsidy through the State Government (70% of the project)	1176.35
Participation of Urban Local Self-Government (30% of the project)	504.15

The scheme envisaged to provide 604.83 million liters of water in the final phase of the project. It has also included newly incorporated Satara Deolai within the municipal limits of the scheme. Details of the scheme is given in table 4.

Sr. No.	Extension Name	Description
1	Canal	Length 400 mt.
2	Jack wells and pump houses	70 mt. by 25 mt.
3	Jodbandhara	600 mt. long and 12 mt. wide
4	bridges	600 mt. long and 12 mt. wide
5	Impure water intake channel	39.54 Km, 2500 mm outer diameter and 25 mm thickness, up to Nakshatrawadi
6	Water Purification Centre-Existing, below Nakshatrawadi Hill	392 MLD
7	Pure water extraction channels	500 mt., 1932 mm outer diameter, up to 632 m level and 600 m, 1528 mm outer diameter, up to 664 m level
8	Balance water bodies	11.27 MLD, at 664 mt. level and 5 MLD at 632 m level
9	Pure water transmission channels	Steel length 39.053 km and DI length 84.47 km
10	High water tank and ground water tank	49 and 4
11	Distribution system	1911.05 Km

For the effective implementation of the project as per the condition of administrative approval, there will be a joint Project Manager Unit (PMU) of the officials of Maharashtra Life Authority and Aurangabad Municipal Corporation, which will have an officer of the rank of Superintendent Engineer of Maharashtra Life Authority.

The PMU is going to implement the project effectively and within the time limit by maintaining coordination between the organizations. A Project Management Unit (PMU) is established by the Municipal Corporation by including - City Engineer, Executive Engineer (Water Supply), Chief Accounts Officer, Tax Assessor and Collector and Deputy Engineer, Jayakwadi Construction.

A tender of Rs.1308 crore has been conducted for this project under phase one through Maharashtra Life Authority Board and for this work Megha Engineers Private Limited Hyderabad, Nagarjuna Construction Company (NCC) Hyderabad and GVPR. Engineers Limited Hyderabad has received three tenders. Lowest Rate GVPR After accepting the tender of Engineers Limited Hyderabad at a rate of 9.90% higher than the budgeted rate, work orders have been issued to the concerned on 4/2/2021 through the Maharashtra Life Authority.

As per the letter dated 16/09/2020 of the Joint Secretary, Urban Development Department, the participation of the Municipal Corporation is Rs. 504.15 crore as per the letter dated 16/09/2020 as well as the amount of Rs. 129.52 crore as per the increased tender received, the total amount is Rs. 633.67 crore. Accordingly, the Municipal Corporation has made the necessary submission to the Government through letter No. 337 dated 18/9/2020.

At present, construction of water bodies has started at six places in the city. It is very necessary to complete the said project within the prescribed period and after that abundant water supply to the city will be available.

5. ANAYLYSIS OF CURRENT SITUTATION

In order to understand the current situation of water supply and its security, baseline data is being collected. However, understanding its efficiency, effectiveness, and sustainability it is needed to carry out its assessment and analysis. This section of the report describes the assessment of current situation and comparing it with service level benchmarks.

5.1 Service Level Benchmark (SLB)

Benchmarking is a recognized as an important mechanism for performance management and accountability in service delivery. It involves the measuring and monitoring of service provider performance on a systematic and continuous basis. Sustained benchmarking can help utilities to identify performance gaps and introduce improvements through the sharing of information and best practices, ultimately resulting in better services to people. Recognizing its importance, the Ministry of Urban Development (MoHUA), Government of India (GOI), has launched the Service Level Benchmarking (SLB) initiative covering water supply, wastewater, solid waste management (SWM) and storm water drainage. Ministry of Urban Development (MoHUA), GOI, has also published a handbook of Service Level Benchmarking. It seeks to a identify a minimum set of standard performance parameters for the water and sanitation sector that are commonly understood and used by all stakeholders across the country; a define a common minimum framework for monitoring and reporting on these indicators; and a set out guidelines on how to operationalize this framework in a phased manner. This helps in understanding the situation and bring in accountability of different stakeholders for better performance. For water supply sector, following benchmark is there with respect to different indicators.

Table 4: Service Level Benchmark

Sr. No.	Indicator	Benchmark	Definition
1	Coverage of water supply connections	100%	Total number of households in the service area that are connected to the water supply network with direct service connections, as a percentage of the total number of households in that service area. Service area implies a specific jurisdiction in which service is required to be provided.
2	Per capita water supply	135 lpcd	Total water supplied to consumers expressed by population served per day.
3	Extent of metering of water connections	100%	The total number of functional metered water connections expressed as a percentage of the total number of water supply connections. Public stand-post connections should also be included.

4	Extent of Non-Revenue Water (NRW)	20%	The total number of functional metered water connections expressed as a percentage of the total number of water supply connections. Public stand-post connections should also be included.
5	Continuity of water supply	24 hrs	Continuity of supply is measured as the average number of hours of pressurized water supply per day. Water pressure should be equal to or more than a head of 7 meter (m) at the ferrule point/ meter point for the connection (7 m head corresponds to the ability to supply to a single-storied building).
6	Quality of water supplied	100%	The percentage of water samples that meet or exceed the specified potable water standards, as defined by the Central Public Health and Environmental Engineering Organization (CPHEEO). The sampling regimen should meet standards and norms laid down.
7	Efficiency in redressal of customer complaints	80%	The total number of water supply-related complaints redressed within 24 hours of receipt of complaint, as a percentage of the total number of water supply- related complaints received in the given time period.
8	Cost recovery in water supply services	100%	The total operating revenues expressed as a percentage of the total operating expenses incurred in the corresponding time period. Only income and expenditure of the revenue account must be considered, and income and expenditure from the capital account should be excluded.
9	Efficiency in collection of water supply related charges	90%	Efficiency in collection is defined as current year revenues collected, expressed as a percentage of the total operating revenues, for the corresponding time period.

Source: Handbook of Service Level Benchmarking, Ministry of Urban Development, Government of India, https://cpheeo.gov.in/upload/uploadfiles/files/Handbook.pdf

MoHUA supported pilot implementation in 28 cities over 2009-10. The State of Maharashtra is one of the major states, wherein SLBs are effectively implemented. The Performance Assessment Report Urban Water & Sanitation Sector, Maharashtra Databook (2012-16) was published by Performance Assessment System (PAS) and CEPT university. The handbook has highlighted status of Municipal Corporations, Class A Municipalities, Class B Municipalities. Following table highlights the status of Aurangabad Municipal

Corporation with respect to Performance Indicators for the year from 2012-2016. Also the updated information for the year 2020-21 is also being noted here.

Table 5: Status of AMC as per PAS report [6]

Details	2012	2013	2014	2015	2016	2021
Total water produced (MLD)	158	158	158	0	158	
Surface water sources (MLD)	156	156	156	0	156	150
Installed storage capacity (MLD)	168	168	168	0	168	168
Area covered by water supply network (Sq.km.)	95	95	95	0	95	95
Total water supply connections (1000s)	107.4	111	114.5	0	127.3	186
Days of supply per month	16	13	10	0	10	6

Source: Performance Assessment Report of Urban Water Supply and Sanitation Sector, Maharashtra Databook (2012-16).

https://www.pas.org.in/web/ceptpas/knowyourcity?p_p_id=Knowyourcity_WAR_Portal&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_count=1&actionVal=Retrieve&SkipAccessChecking=false

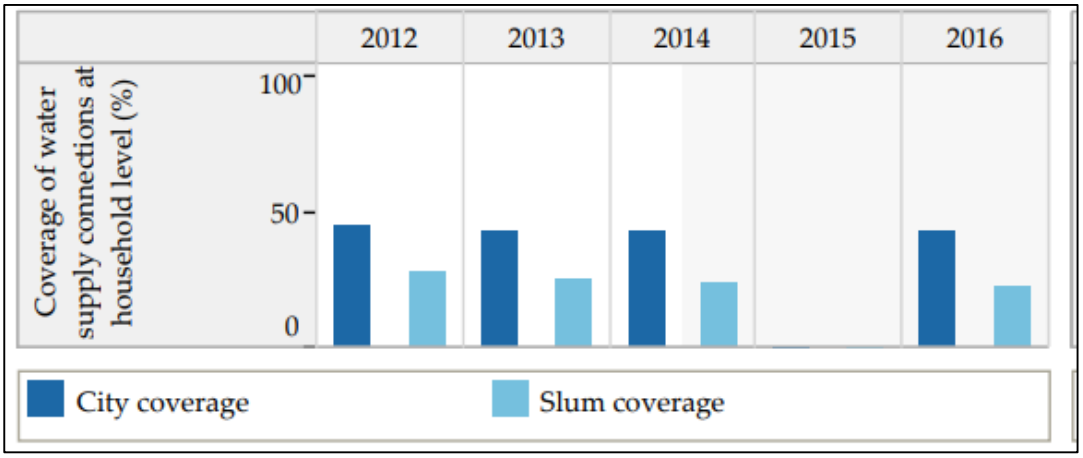


Figure 8: Water Supply – Access & Coverage

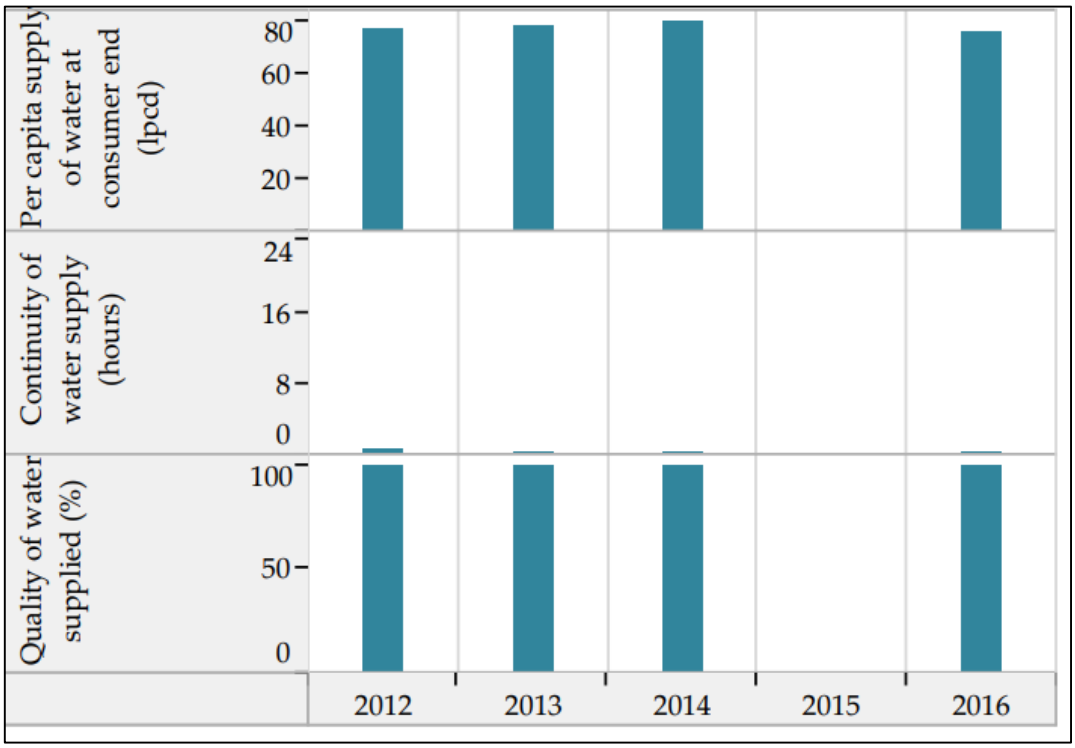


Figure 9: Service Level & Quality

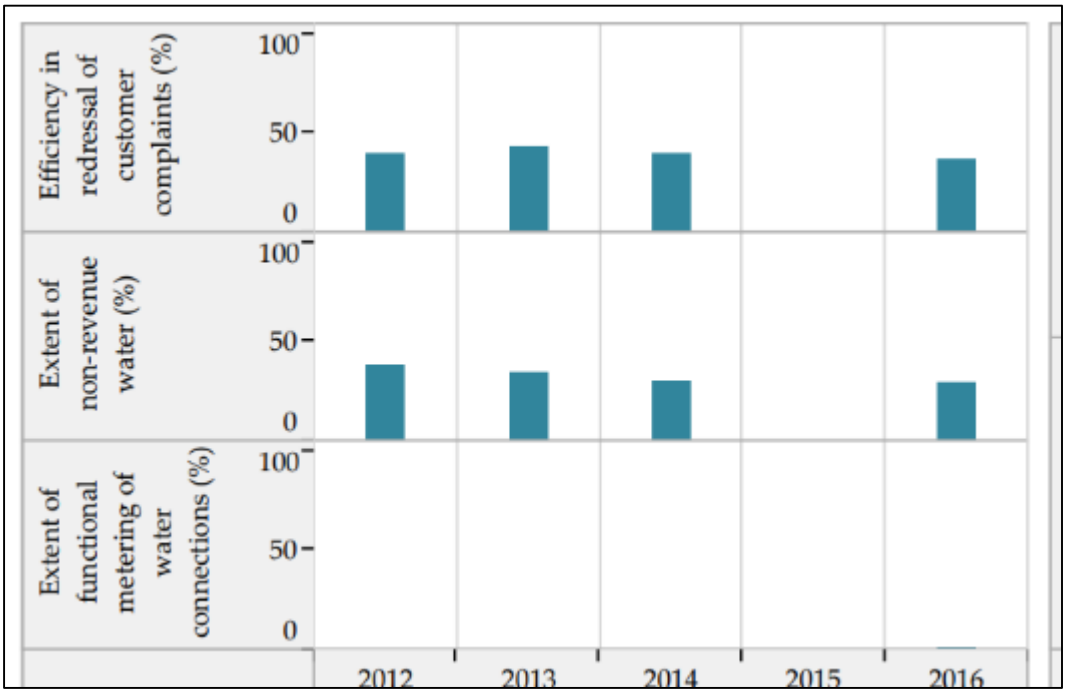


Figure 10: Efficiency in Service Operations

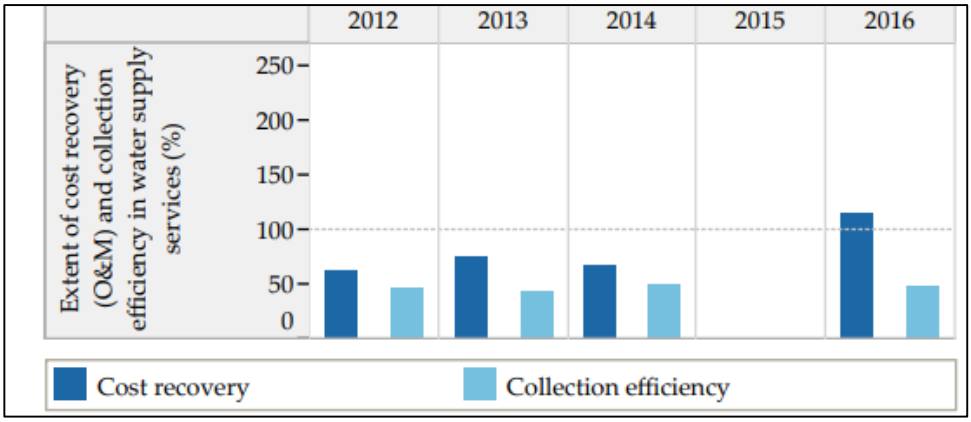


Figure 11: Financial Sustainability

Analysis of present situation with respect to existing data set is being carried out considering PAS performance indicators.

5.2 Assessment of Existing Situation

5.2.1 Access & Coverage

1. Coverage of Water Supply Connections

Coverage of water supply connections indicates the extent of the households connected by tap water supply at household level. It is an important indicator to measure the extent of service delivery of ULBs/ Aurangabad Municipal Corporation.

Indicator	Benchmark	Existing
Coverage of Water Supply Connections	100%	34%
	Gap	66%

Note: In the absence of recent data on water supply connections, study has used past record of year 2016 in order to find out the gap.

Other scenario assumed that, there is 20 percent increase in water supply connections. That makes up to 54% coverage, however still the gap prevails around 60%.

5.2.2 Service Levels & Quality

1. Per Capita Supply of Water

Per capita supply is 135 lpcd, as per CPHEEO norms for water supply for all cities.

Indicator	Benchmark	Existing
Per capita Water Supply	135 lpcd	135 lpcd
		100%

2. Continuity of Water Supply

This indicator captures the number of hours of supply at the end user end. It is one of the key aspects of Service delivery. The city performs poor in relation to this indicator, wherein water is being supplied one time in 3 days, which is nowhere matching with the 24 hours water supply benchmark.

Indicator	Benchmark	Existing
Continuity of Water Supply	24 hours	3 days = 72 hours
	Gap	**67%**

3. Quality of Water Supplied

Water quality is an important parameter for maintaining health of people, hence it is an important indicator from service quality perspective. The water quality meets with the potable drinking water standards of Central Public Health and Environmental Engineering Organization (CPHEEO).

In the absence of existing data set, the study has used the inferences from the preliminary survey, 55 percent respondents stated that its good. The same data set is used for making comparison with benchmark.

Indicator	Benchmark	Existing
Quality of Water Supplied	100% -	55% - Good
	Gap	45%

5.2.3 Efficiency in Service Operation

1. Extent of Non-Revenue Water

This captures the quantum of water losses occurring through physical losses, unauthorized consumption. It also indicates the extent of revenue losses incurred by the ULB.

Indicator	Benchmark	Existing
Extent of Non-Revenue Water	20%	Data not available

2. Extent of Metering Connections

This indicator captures the extent to which the connections that are metered and functional. Functional metering of connection is important aspect in understanding the accuracy of consumption quantities in each city. Water meters are important from the perspective of conserving water, volumetric pricing, detecting water wastage, regular supply. As per the benchmark, 100% metering is to be required to bring efficiency in service operations.

Indicator	Benchmark	Existing
Extent of Functional Metering Connections	100%	0%
	Gap	**100%**

As seen from the table above, Aurangabad does not have a meter connection, which indicates absence of monitoring mechanism on water usages, its wastage and regular supply.

3. Efficiency in collection of Water Supply related Charges

This indicator captures the extent of collection of revenues that are billed by the ULB. It is an important factor in its cost recovery efforts of ULB.

Indicator	Benchmark	Existing
Efficiency in collection of water supply related charges	90%	Information NA
	Gap	**90%**

4. Efficiency in Redressal of Customer Complaints

This indicator captures the number of complaints made by consumers that have been redressed by the ULB. The total number of water supply-related complaints redressed within 24 hours of receipt of complaint, as a percentage of the total number of water supply- related complaints received in the given time period. It is an important indicator and a direct assessment of customer satisfaction levels. This data is being captured through primary survey, in the absence of secondary dataset/ information. Around 60% respondents responded to that their complaints are being registered at AMC office.

Indicator	Benchmark	Existing
Efficiency in redressal of customer complaints	80%	60%
	Gap	**20%**

5.2.4 Financial Management

1. Cost Recovery (O&M) in Water Supply Services

This indicator captures the revenue (taxes, user charges, fees) recovered by the ULB against the expenses incurred. This is the percentage of total operating revenues from water supply related charges to total operating expenses on water supply.

Indicator	Benchmark	Existing
Cost Recovery (O&M)		Data not available

6. RECOMMENDATIONS & SUGGESTIONS

After analyzing the current situation related to piped water supply in Aurangabad city, following major gaps are observed.

OBSERVATIONS:

1. **Quantity of water supply:** People are not getting enough water (i.e. 135 lpcd) in order to meet their daily demands.
2. **Continuity of water supply:** Water is not being supplied on a day-to-day basis. Supply is intermittent and irregular. People get water once or twice in a week specially during summer season. This makes situation worse.
3. **Duration of water supply:** Whenever water comes, it comes for a very short duration of time, 1 or 2 hrs. maximum, due to which people have to store water.
4. **Poor state of water distribution system:** Existing water supply pipelines are made up of AC, RCC, PVC & GI materials. Due to this it is observed that physical losses are much more than acceptable limit, also rusting, erosion of pipelines is there. Other related infrastructure of water distribution system is not efficient enough (storage tanks, pressure pumps).
5. Illegal connections, absence of water metering system and more wastage of water are prevailing issues.
6. Due to lack of data availability, related to financial information (water supply charges and recovery), study was not able to identify the gaps. However, based on primary survey it can be inferred that recovery is a challenge.

SUGGESTIONS TO IMPROVE PIPED WATER SUPPLY:

Though as mentioned under section 4 of the report, there is water supply augmentation plan for the city, however, the city needs to address the following aspects in order to improve water security for its citizens.

1. **Continuous Supply of Water:** Conversion of intermittent supply to continuous water supply is the need of the hour for the city. This can be done by 100% consumer metering and by demand management through enforcing of tariff. Water can be saved by arresting the leakages in the system.
2. **GIS Mapping:** Using GIS based system is the need of the hour, in order to bring in more effectiveness and efficiency in the system. GIS mapping of all the existing, proposed infrastructure is required.
3. **User end Metering:** Distributing water with 100% user end metering is the need of the hour. Consumer metering is necessary. Policy level changes is needed in order to address this.
4. **Infrastructure Improvement:** Overall infrastructure improvement in the context of efficiency is needed to avoid wastages, leakages etc.
5. **Carrying out Water Audit / City Water Balance:** Water audit/city water balance is needed to be done for integrated resource management.
6. **Strengthening Water Supply Infrastructure:** Existing water supply infrastructure needs enhancement and improvement in order to bring efficiency in delivery of water service.
7. **User end Metering:** Distributing water with 100% user end metering is the need of the hour. Consumer metering is necessary. Policy level changes is needed in order to address this.\
8. **User end Metering:** Distributing water with 100% user end metering is the need of the hour. Consumer metering is necessary. Policy level changes is needed in order to address this.
9. **GIS Mapping:** Using GIS based system is the need of the hour, in order to bring in more effectiveness and efficiency in the system. GIS mapping of all the existing, proposed infrastructure is required. GIS mapping also helps in tracking illegal connections.
10. **Infrastructure Improvement:** Overall infrastructure improvement in the context of efficiency is needed to avoid wastages, leakages etc.
11. **Carrying out Water Audit / City Water Balance:** Water audit/city water balance is needed to be done for integrated resource management.
12. **Preparing for City for Climate Resilience:** It is the need of the hour to prepare cities for climate resilience from water security perspective.
13. **Land based water demand estimation:** Water demand estimation and forecasting has become an important component in planning and managing effective water resources. Forecasting or predicting the amount of water to be supplied is a very crucial element for estimating design and operational demand. Instead of focusing on standard water demand calculations, it is important to relook into the estimation, based on land use and keep a pace with development.

ANNEXURE: I

HOUSEHOLD SURVEY FORM

Moving towards Water Sustainability for Aurangabad

Consultation/Discussion Questions for People of Aurangabad City

1. **HOUSEHOLD DETAIL:**

Name of household	
House no/Flat no:	
Area/ Ward no:	
Water zone:	
Total number of people in the house:	

2. **WATER QUANTITY:**

Whether you get municipal water supply?	Yes
	No
Frequency of Municipal Water Supply?	Daily
	Once in every 2 days
	Once in every 3 days
	Once in every 4 days or more
How many days in a week you get water? (During Summer/Winter and Monsoon)	
Quantity of water you get on a daily basis (number of bucks/baskets etc.)	
Duration of water supply on a daily basis during summer	
Duration of water supply on a daily basis during winter	
Duration of water supply on a daily basis during monsoon	
Do you store water? And How much quantity?	Yes/No
Whether water supplied to you is being sufficient for the family?	Yes
	No
If no, then what is the other source of water?	
How many numbers of bore wells are there in the house?	
How much quantity is being extracted from the other source?	

3. **WATER QUALITY:**

Drinking water quality, you get is:	Excellent
	Good
	Average
	Poor
Do you treat or add any material to purify water after it reaches to your tap?	
Do you have RO/MF/UV?	
Any health issues related to water supplied by AMC?	

4. **WATER TAX:**

Do you pay water tax?	Yes
	No
How much water tax you pay annually?	

5. **WATER SUPPLY MANAGEMENT:**

For any complaint related to water, where do you go?	
Whether your complaint is been registered or not?	
Any concerns you have related to municipal water supply.	

6. **REMARKS/SUGGESTIONS:**

_____
_____
_____

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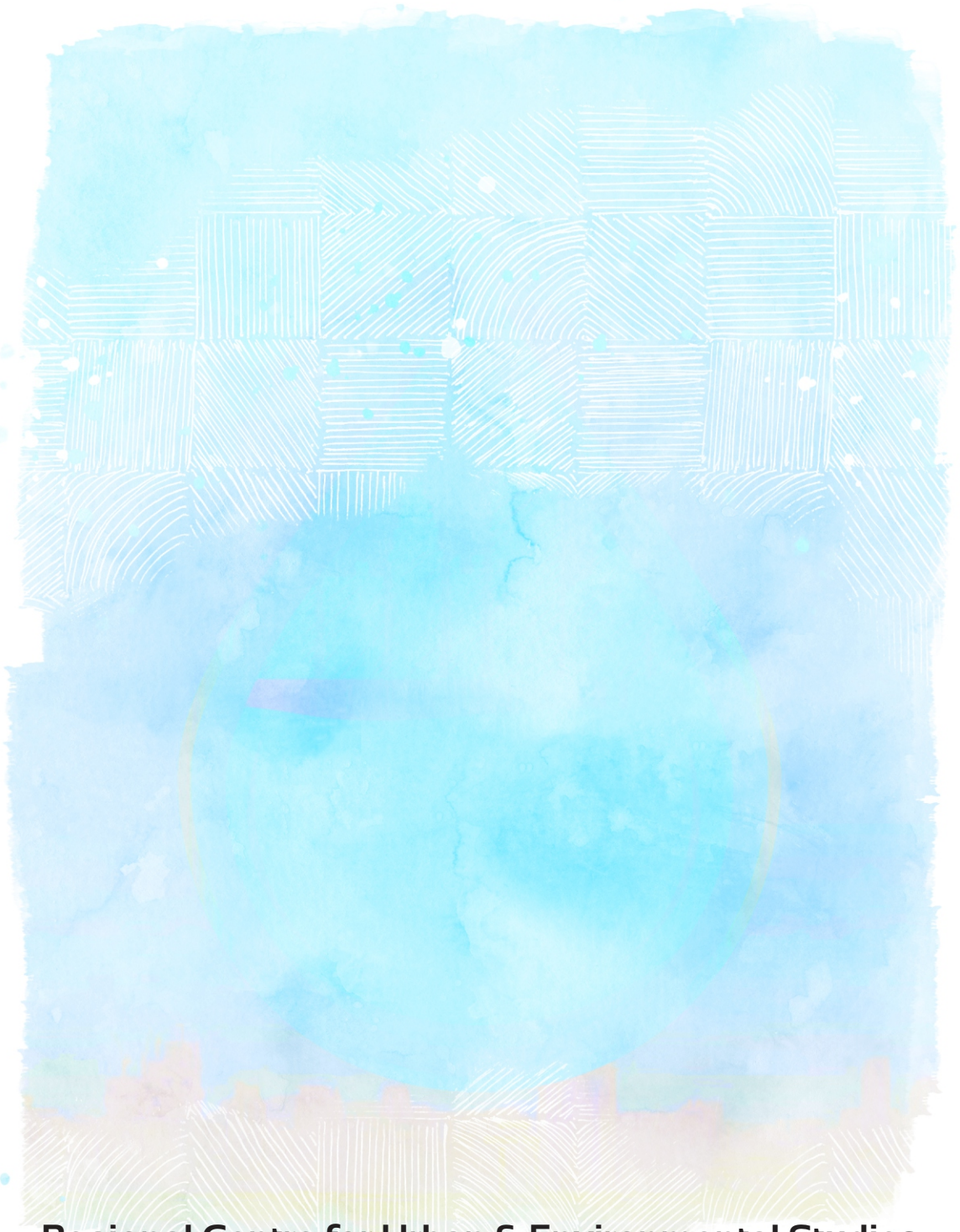
All primary information is collected through stakeholder consultations and discussions.



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