

## An Assessment water circulation system in Nashik city, Maharashtra

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### Abstract

Water utility has the major asset of distribution system infrastructure. The world's population will be growing by about 80 million people per year. It is projected to approach 10 billion by 2050. According to Delhi Human Development Report (2013) has been define as "access of water for life is a basic human need and fundamental human right". Nashik is fast growing city due atmospheric condition, condensive environment, growth of industrialization, urbanization and Potential of economic growth. It used for Survey of India toposheets, LISS-IV image for collection and clipping the water bodies in image. In the city water distribution network in hydrologic pressure system. Water resource are mainly two type mainly ground water and surface water, surface water like as- Gangapur Dam, Darana, Kaspyhi, Mukane, Alandi etc. Wells and bore wells are available in city surrounding area. Water distribution system are including water treatment plant, ESR station etc. it is result that Nashik is potential fast growing development of different things. A water distribution system is very good and provides water for each factor.

**KEYWORDS:**Dam, LISS-IV image, SOI toposheets, water utility hydrologic clipping

#### • Introduction:

Water utility has the major asset of distribution system infrastructure (Miner, 2007). The American Water Works Association has defines the water distribution system means "including all water utility components for the distribution of finished or potable water by means of gravity storage feed or pumps though distribution pumping networks to customers or other users, including distribution equalizing storage." (AWWA, 1974) The world's population will be growing by about 80 million people per year. It is projected to approach 10 billion by 2050. Most of more than 50% of population on our planet today live in urban areas (Roser.,2017). In India, in census 1901, 2001 and 2011 population be inherent in in urban centers was 11.4%, 28.53% and 31.16% respectively (Datta and Pranati, 2006; Census,2011,Yadav,2016) According to Delhi Human Development Report (2013) has been define as "access of water for life is a basic human need and fundamental human right".

Pumping stations, distribution storage and distribution piping are including in water distribution system. The distribution network has depends on hydraulic performance components. The interest to designers is both the flows and their pressures throughout the network of water distribution. The water distribution system is two type mainly open channel flow and Pressure pipe flow. In open channel flow the elevation head is the

distance from some datum to the tap of the water and pressure pipe flow the elevation head is the distance from some datum to the center of the pipe (Loucks, & Van Beek, 2017).

The hydraulic performance of each component in the distribution network depends upon the performance of other components, of interest to designers are both the flows and their pressures throughout the network open-channel flows, the elevation head is the distance from some datum to the top of the water surface. For pressure pipe flow, the elevation head is the distance from some datum to the center of the pipe

• **Study area and methodology:**

The Nashik city is located between 20°02'00'' North latitude and 73°50'00'' East Longitude at Northwest part of the Maharashtra, at 529.5 meters above sea level. Nashik city has an area of 259.5 square kilometers. Nashik is located 180 km from Mumbai and 206 km from Pune (Gadakh and Jaybhaye, 2015). Nashik is the administrative headquarter of the Nashik district and Nashik Division. Nashik, which has been referred to as the "Wine Capital of India", is located in the Western Ghats, on the western edge of the Deccan peninsula on the banks of the Godavari. It is claimed to be the fastest growing city in Maharashtra (Gadakh and Jaybhaye, 2016).

• **Methodology:**

1. Database: The data required for the current study includes SOI topographical maps, Satellite Images, Census data and Utility service data details.

• **Table no. 1: Source of data**

Type of Data	Details
Primary Data and Secondary data	Toposheets No. 46H/12, 46 H/16, 47 E/09,47 E/13 Survey Of India, Scale 1:50000
	Satellite Imagery - LISS-IV; IRS-P6 Path: 95 Row:59 National Remote Sensing Centre (NRAC), Hyderabad
	Census Of India NMC Records, Water supply department report

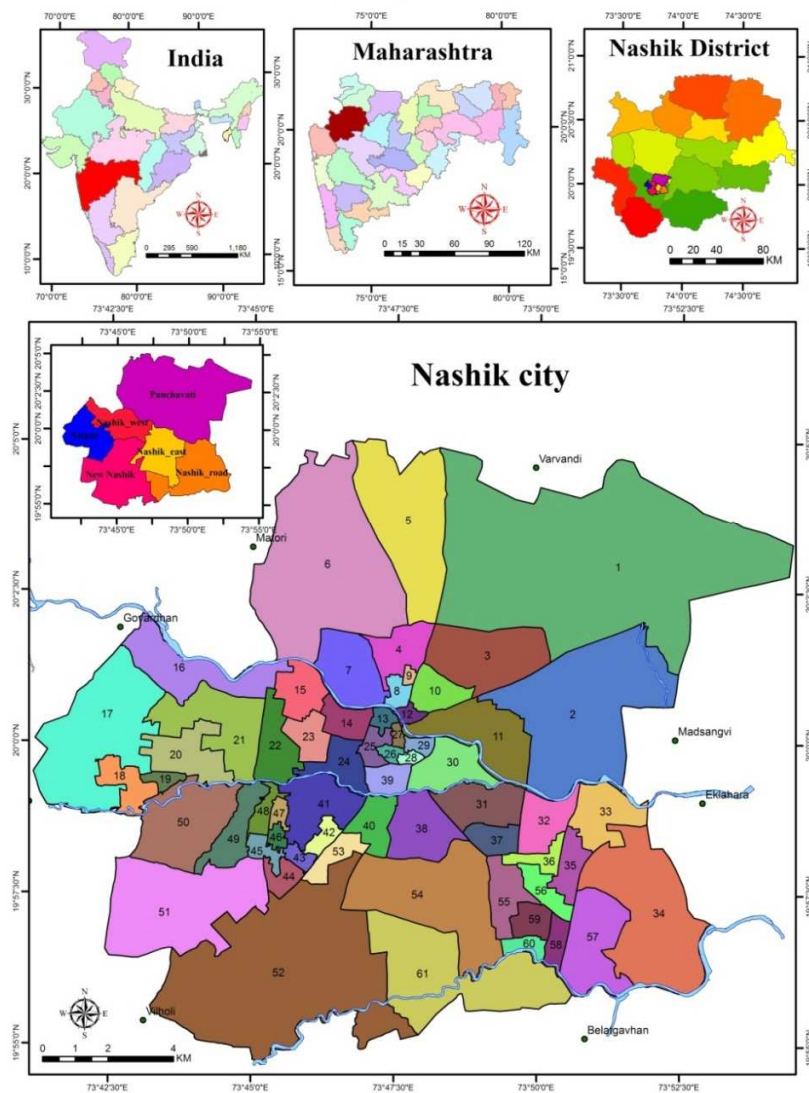
(Gadakh & Jaybhaye, 2014, 2017)

**Following methodology has been adopted**

- ❖ Collection of SOI Topographical map, different satellite data and related attribute data.
- ❖ Georeferencing of SOI topographical maps, remote sensing data and selection of training site for the ground truthing.
- ❖ Application of pre-image processing techniques has been applied for the analysis of satellite data such as radiometric correction, Geometric rectification, Image enhancement, Band extraction, Restoration.

- ❖ Remote sensing techniques and Geographical Information System used for the generation of base map and related data base from toposheets of Survey of India and satellite data.
- ❖ Creation of GIS layers: digitization of administrative boundaries of wards, roads, railway line, contour line, drainage network, from the topographical maps and Google map for the study area using Arc GIS 10.0 software.
- ❖ Fieldwork and ground truthing (GCP using Global Positioning System (GPS) instrument, digital camera etc.

#### Location map of study area



Location map of the Study area (Gadakh& Jaybhaye, 2015, 2016, 2017, 2018)

- **Result and dissuasion**
- **Sources of Water Supply:**

Water supply systems get water from a variety of sources, including surface water (lakes and rivers) and groundwater (Bore wells, Wells, Hand pumps etc.).

**a. Surface Water:**

Godavari River and Dharna River are the main source of surface water in the Nashik city. Darana dam has been constructed in Dharna river in 1934, Gangapur Dam has been constructed in Godavari river in 1963, Kashapi dam on Kashapi river in 1999, Alandi dam in Alandi river in 1983, Mukane Dam on Sandra river in 1995

Following dam has provided water of Nashik urban fringe area:

1. **Kashyapi Dam:** Kashyapi River is tributary of Godavari and its construct is an earth fill dam on near Rajapur in Nashik district. Gangapur Dam has constructed upper side of Nashik. The height of the dam above lowest foundation is 41.75 m while the length is 1,291 m.
2. **Darna Dam:** Darana Dam has constructed on Darana river near Igatpuri, Nashik in Maharashtra state in 1934. It is also called "Gravity Dam. The height of the dam above lowest foundation is 28 meter while the length is 1,634 m. 1,886.1 km<sup>3</sup> of volume content and 226,870.00 km<sup>3</sup> total gross storage capacity. Darana Dam was constructed in 1934 with a storage capacity of 203.43 MCum (7149 mcft) and it is 28 km away from the Nashik City. Nashik Municipal Corporation (NMC) has 528 mcfc (14.98 MCum) quota of water reserved. NMC constructed a pick up weir with sluice gate on Darna river near Chehedi village. It is known as Chehedi Barrage and head work is located at submergence of weir. Water is released from the dam as per demand.
3. **Gautami Godavari Dam:** Gautami Godavari Dam has constructed on U/S side of Gangapur Dam. Gautami tributary of Godavari at near village Beze Tal. Trimbakeshwar, Dist. Nashik. Total Gross storage of Dam is 1879 mcft. Total Length of dam including spillway is 910 m and 59.38 m is height of Dam. Gautami-Godavari dams have not availability of water in during summer.
4. **Alandi Dam:** Alandi Dam has constructed on the Alandi River. This dam is an earth fill dam on in Nashik district in Maharashtra. The height of the dam above lowest foundation is 29.3 m while the length is 1,690 m. The volume content is 2,782 km<sup>3</sup> and total gross storage capacity is 29,600.00 km<sup>3</sup>.
5. **Gangapur Dam:**

Gangapur Dam has constructed on Godavari River. These dam is near the Gangawadi village and around 10 K.M from the Nashik city. These dams has constructed from 1954 to 1963 in soil, it is also call "Earthen Dam". These dam is 357.4 Sq.km of the total catchment area. 3810 m is length of dam and 36.57.m

height of dam.203.76 MCM is live storage in the dam. 102 m is the length of the waste weir. Total 09 radial gate and discharge capacity 810013 Cusecs. On the dam two canals has prepared like as left bank canal is 64Km and Right bank canal is 30 Km. an around 15960 hectare area has irrigated in this dam. Godavari River in first stage lot of material has eroded in deposit of Gangapur dam. Due to the reasons right bank cancel has closed like as increase of residential zone, commercial zone and Industrial area. In 1998 Nashik Municipal Corporation has lying pipelined on Gangapur Dam because purpose of drinking water for all over Nashik city. Left bank canal has used for irrigation purpose for Nashik and surrounding area and also used for Satpur and Ambad MIDC area

**Mukane Dam:**Mukane Dam has constructed on Saundra River near Igatpuri Tehsil Nashik district.It is an earth fill dam.The height of the dam above lowest foundation is 26.93 m is height of lowest foundation of dam while t 1,530 m is length of dam. The volume content is 2,271 km<sup>3</sup> is content of the volume and gross storage capacity is 214,160.00 km<sup>3</sup> is total gross storage capacity.

**b. Ground Water:**

It is additional important ground water source the water supply demand of Nashik city. In the city an around 38 wells and 1435 bore wells. Bore wells depth in Nashik city is of roughly 10 - 13 meters. In summer season ground water levelmeters while after monsoon it becomes around 3-4 meters.

Table No 02: Nashik city: administrative ward wise Ground water resource (bore well and Wells)

Sr.No	Administrative Ward	Water Tankers	Bore well (NMC)		Wells(NMC)		Private Wells As per Survey	
			Hand Pumps	Electric Pump	Without Electric Pump	With Electric Pump	Without Electric Pump	With Electric Pump
1	Nashik East	2	85	84	0	3	-	32
2	Nashik West	1	52	63	0	8	-	12
3	Panchavati	1	154	85	5	10	6	20
4	Nashik Road	1	312	90	0	5	88	3
5	New Nashik	2	236	91	2	2	-	46
6	Satpur	1	131	52	1	2	2	9
	Total	8	970	465	8	30	96	122
	<b>Grand Total</b>		<b>1435</b>		<b>38</b>		<b>218</b>	

Source –WWW.Nashik Municipal Corporation

**Development and growth of water system in Nashik city:**

Nashik is collecting water from Nashik Municipal Corporation, Gangapur Dam and Darana river basin for drinking water. For the city of Nashik, in 1995, the demand for the population of in 2011 was 128 ten million Cubic meter. Water Reservation was approved by the government. Accordingly, the contract was signed by the Nashik Municipal Corporation till 2011. Water Resources Department, Government of Maharashtra As per 24/7/2009, for the city of Nashik by drinking water by 2041, 399.63 ten million Cubic meters increased water reservation is approved.

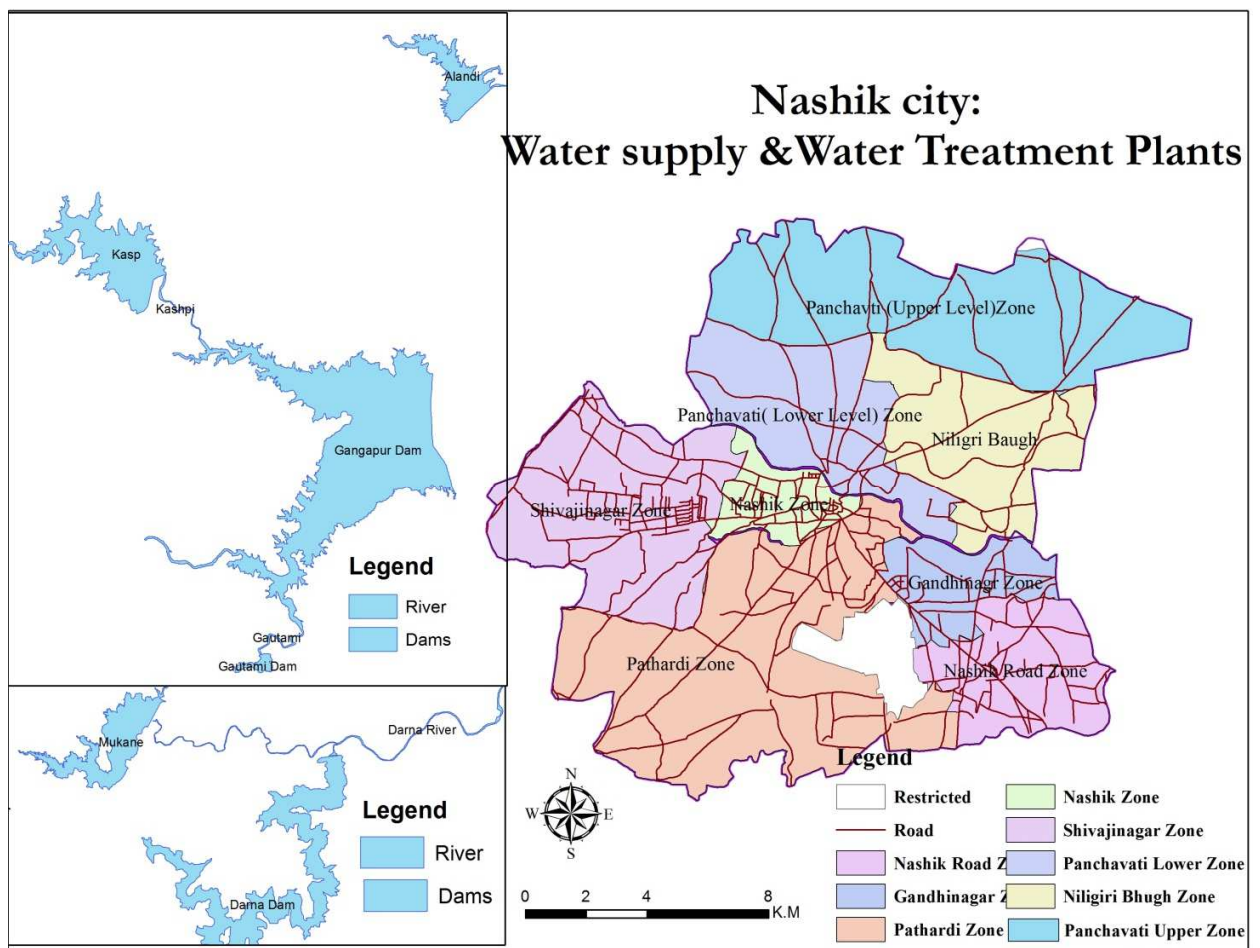


Fig.02 Nashik city: Water supply source and water treatments plants

**Water Supply System:**

Today, water supply schemes of Nashik city, Nashik road, Deolali camp and 23 villages are including. it have been amalgamated into Nashik municipal corporation boundary. In 2001 direct pipeline scheme has accomplished in area. In NMC ambad and Satpur industrial areas which are within NMC are provides water its own water source. Drinking water needs of Satpur town adjoining Satpur Industrial estate were being met by taking

bulk supply of water from MIDC. Nashik city receives piped water from two sources namely Gangapur Dam head works on river Godavari, which supplies almost 1.6 million residents of NMC area and Head works on the river Darana, that pumps about 25 MLD of raw water which serves Nashik Road area.

**Head at Gangapur Dam:** From Gangapur dam raw water has pumped and supplied to Bara Bungalow, Panchavati, Gandhi Nagar, Nashik road water treatment plant and Shivaji Nagar filtration plant. After conventional treatment, chlorinated water is supplied to citizens of Nashik.

**Head works in Mukane Dam on Darna River at Chehadi village, Nashik Road:** From Darna river about 30 MLD of raw water is pumped and supplied to Nashik Road filtration plant. One other source is from Darana dam which is about 28 km from Nashik city is dam was constructed in the year 1934 with storage capacity of 7149 mcft. Presently NMC is having reservation of 350 mcft. in this storage. The NMC has constructing one weir with gates on river Darana near village Chehedi with storage capacity of 144 mcft. There are 6 treatment plants in the city viz. Shivajinagar, Bara Bungalow, Panchavati, Gandhinagar Nashik road, Panchavati (New) Nilgiribaug WTP. These six water treatment plants have total design capacity of 472.5 MLD and currently 395 MLD water is being produced. Water from Gangapur dam head works is pumped through two raw water rising main pipelines. One pipeline carries water to Shivaji Nagar WTP and the treated water is then supplied to CIDCO and Satpur area. Another pipeline takes water to the remaining four WTPs. From the Darna head works, water is pumped and supplied to the Nashik Road WTP.

**Table no 03 Nashik city: Water treatment Plant**

Sr.No	Location	Capacity (MLD)
1.	Shivajinagar	145.50
2.	Bara Bunglow	81.00
3.	Panchavati	71.00
4.	Nashikroad	73.00
5.	Gandhinagar	52.00
6.	Panchavati(new) Nilgiribaug	50.00
<b>Total</b>		<b>472.50</b>

Source: [www.nashikMunicipal corporation](http://www.nashikMunicipal corporation)

- **Treatment Technology:**

Through conventional treatment processes is treated of the raw water like aeration, coagulation, flocculation, sedimentation, rapid gravity sand filtration and disinfection by chlorine. In details all process of raw water Aeration refers it is the process by which air is circulated through, mixed with in water. Coagulation define as in the coagulation process involves adding iron or aluminum salts, like as aluminum sulphate, ferric sulphate, ferric chloride or polymers, to the water. Flocculation refers to A process wherein colloids come out of suspension in the form of floc, either spontaneously or due to the addition of a clarifying agent. Sedimentation the process of allowing particles in suspension in water to settle out of the suspension under the effect of gravity. Filtration refers to any system

or process that is used to filter out particles and pollutants .Chlorination means it is the process of adding chlorine to drinking water to disinfect it and kill germs. There are seven booster pumping stations like as Kalika, Gopalnagar, Dwarka, Budhwar Peth, Patherdi, Chunchale andBorgarh pumping station. After treatment, water is pumped to Elevated Service Reservoirs (ESRs) spread across 6 zones of the city from where water is distributed to end users by gravity through the distribution network. An around NMC Nashik, 99.8% of the total population extensively uses surface water i.e. piped water supply. Only 0.2% is depending on ground water supply which is available in the form of bore well. In the light of increasing water demand, 1202 wells have been procured by NMC. Out of these hand pumps are fitted on 918 wells and 284 power pumps are fitted on bore wells



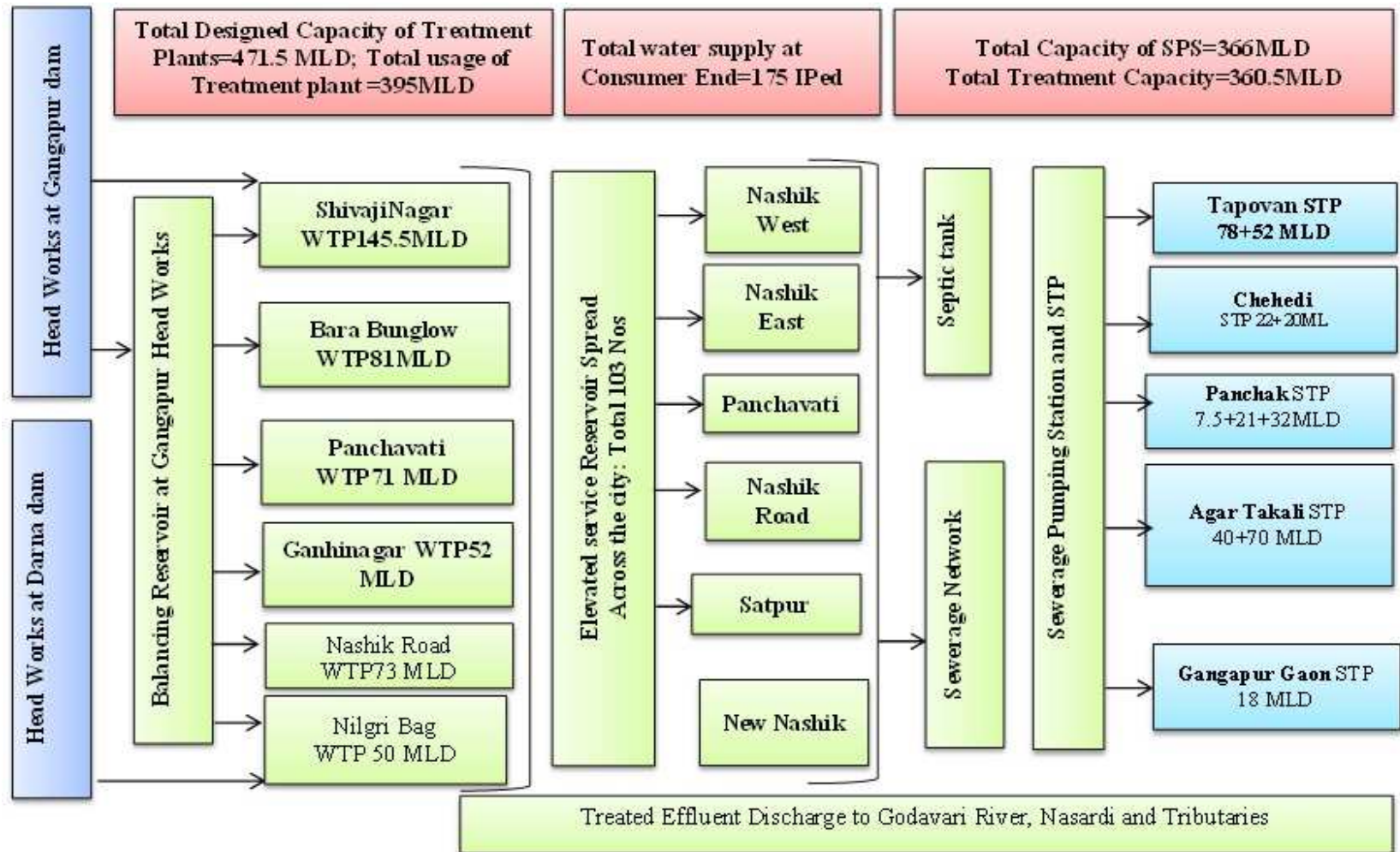


Fig.No04: water supply of the Nashik city Source: *Environmental Status of Godavari River Report*

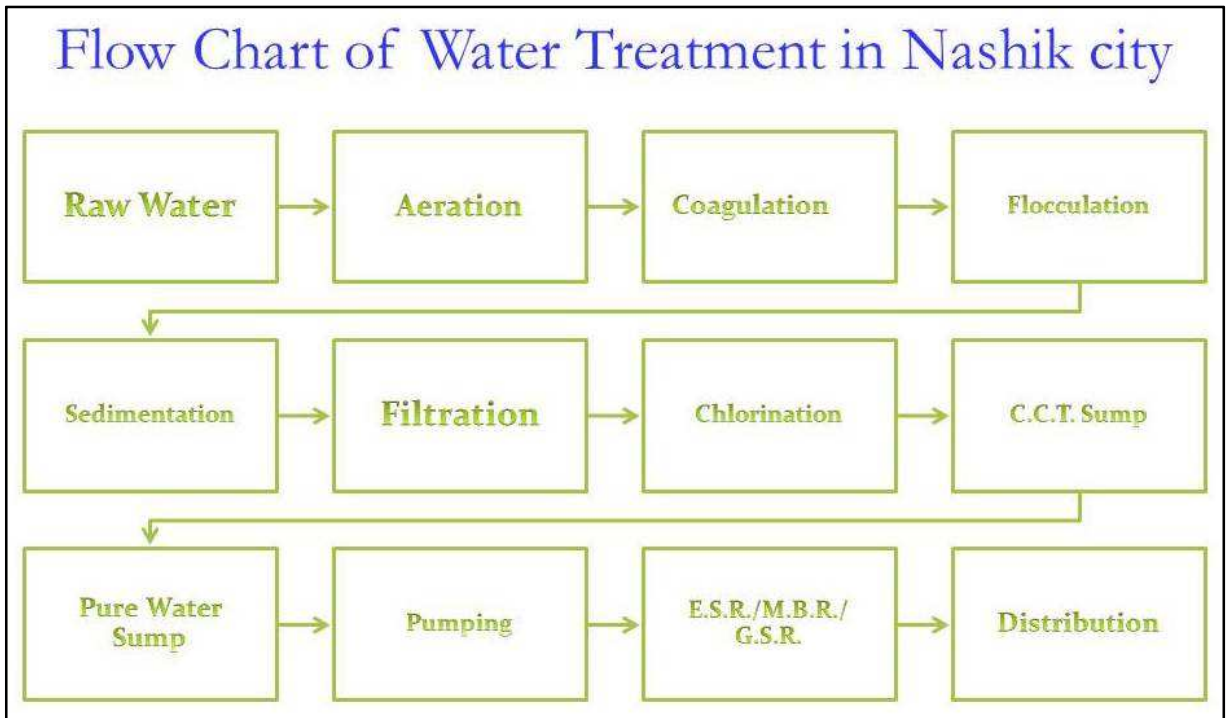
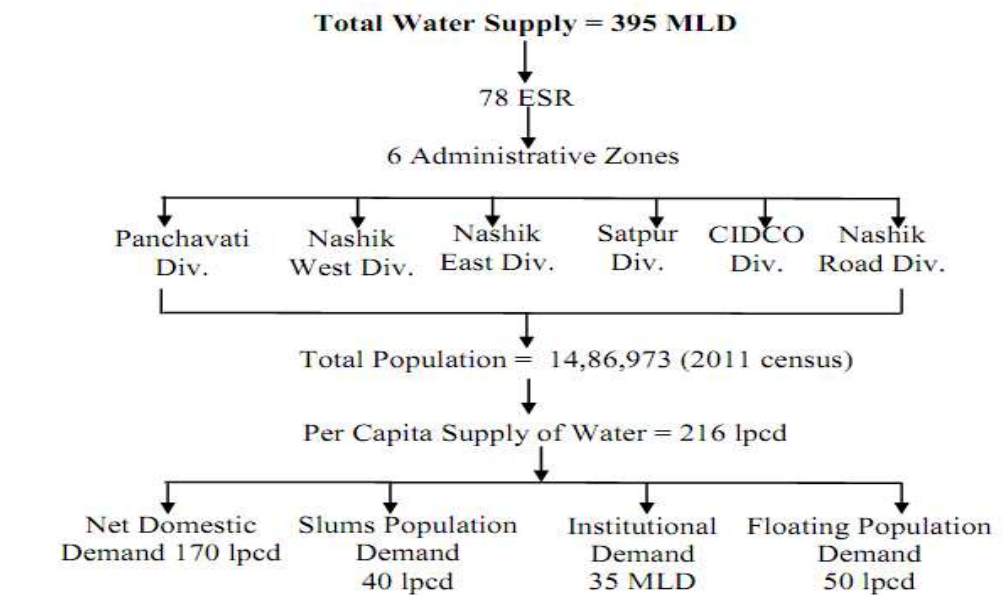


Fig No 04 water treatment in Nashik city corporation

Source : Nashik municipal corporation



Source: CDP/CSP/ESR documents for Nashik city prepared by NMC.

Figure 2.4 : Water Supply in Nashik

**Table No 04, Nashik city: Elevated Service Reservoirs**

Sr.No	Administrative ward	Number of ESRs	Capacity(Lakh liters)
1.	Nashik east	11	196.00
2.	Nashik west	17	240.52
3.	Panchavati	21	331.50
4.	Satpur	14	193.50
5.	Nashik road	14	221.25
6.	New Nashik	26	480.0
<b>Total</b>		<b>103</b>	<b>1662.77</b>

*Source: Water Supply Department, NMC Nashik*

In the Nashik city 2000 km is distribution network coverage that there are 1, 50,000 water connections are provided out of which 95% connections are metered. The piped network is a combination of pipelines ranging from 50 to 450 mm diameter has installed at different points in time. The demography and land use of Nashik has indicates 52% of developed residential area. 18% slum is partially covered through PSPs through the distribution network. Water supply is within a fixed time schedule for every zone and sub zone. The citizens get water every day for a period of 2- 4 Hrs. The gross per capita supply works at 175 lpcd based on the quantity of water taken at the source level, which is higher than the 135-150 lpcd. 10% of the population is not covered by municipal water supply, particularly in some wards on the outskirts of Nashik city or in select slumpockets. The supply is also not extended in some areas few flood prone areas which have a population of about around 2000 population .

- **Conclusion**

- Nashik city gets daily water supply from Gangapur Dam and Chehi Bandhra on the river Darna to provide normal water of 5 to 3 lakh liters per day. It is purified at six water purification centers located in the city and water is distributed in the city through 5 water bodies and about 5 km in length.
- Hydraulic Modelling to cover water supply system for entire Nashik Municipal Corporation limits
- In the city six treatments plants its capacity 472.50 MLD
- The gross per capita supply of water 175 LPCD.
- The Nashik city has total Elevated Service Reservoirs 103 and its capacity 1662.77
- Water resources are more available in city and cities surrounding area near by 40-50 K.M. Radius.

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