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### **TITLE: Dying Wisdom of Medieval Water Management of Aurangabad City**

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#### **Abstract**

In the history of Aurangabad, the system of canals is ancient and memorable, which is introduced by Malik Amber in 1617 A.D. Aurangabad town always faced scarcity of water and there were no big dams or water reservoirs in the vicinity. Owing to hard rock & dry land, it was very difficult to construct the pillars to supply water to the town. This was the great feat of ancient engineering achievement. Malik Amber in 1617 A.D. discovered subterranean water table of mountainous elevated valleys in north of Aurangabad. He practically manipulated and procured a stable perennial water supply for a population of 7 lakh by constructing his unique Wonderful aqueduct by name KHAIR – E- JARI. The old water supply system is the reminiscent of medieval period. The city of Aurangabad was having number of Nahars of pure mineral subterranean drinking water. This practice of construction of such aqueducts continued from the period of Malik Ambar up to the time of Aurangzeb and Asif Jan (1803) for a period of about two centuries. On the high lands around the city from North, East and South wherever the circumstances allowed the engineers of the period brought down Nahars in Aurangabad city. Personalities like Malik Amber Shah Mehmood of Panchakki and shah Ali Nehri are founders, designers and planners of these three famous, wonderful easy and useful aqueduct system of Aurangabad. In order to cope up with growing population despite Ambri Nahar (canal) they dug several canals and they still exist. During the long period of three and half centuries this unique, God gifted old water supply system prevailed and lasted up till now, The inhabitants of Aurangabad were being benefited by this water supply system since three hundred years regularly without any tax. In our paper, the technical details of neher system is discussed in depth.

#### **INTRODUCTION**

In the history of Aurangabad Malik Amber in 1617 A.D introduced memorable system of water supply. Aurangabad city always faced scarcity of water and there were no big dams or water reservoirs in the vicinity. Owing to hard rock and dry land it was very difficult to construct the pillars to supply water to the town. So this was the great feat of medieval engineering achievement. Malik Amber in 1617 AD discovered subterranean water table of mountainous elevated valleys in north of Aurangabad. He practically manipulated and procured a stable perennial water supply for a population of 50000 of people by constructing his unique Wonderful aqueduct by name KHAIR – E- JARI. The old water

supply system is the reminiscent of medieval period. When we enter the town, we find numerous buildings, palaces, tombs, mosque, fortifications around the town, but same time, we see high rectangular or round pillars erected on the roadsides. These high pillars are called “distribution chambers” which clearly indicate the medieval system of supplying water.

The city of Aurangabad was having number of Nahars of pure mineral subterranean drinking water. This practice of construction of such aqueducts continued from the period of Malik Ambar (1617) up to the time of Aurangzeb and Asif Jan (1803) for a period of about two centuries. On the high lands around the city from North, East and South wherever the circumstances allowed the engineers of the period brought down Nahars in Aurangabad city.

Personalities like Malik Amber, Shah Mehmood of Panchakki and shah Ali Nehri are founders, designers and planners of these three famous, wonderful easy and useful aqueduct system of Aurangabad. During the long period of three and half centuries this unique, God gifted old water supply system prevailed and lasted up till now, the inhabitants of Aurangabad were being benefited by this water supply system since three hundred years regularly without any tax.

During the military activities, Malik Ambar discovered the Kham river valley and its large natural basin of about 150 sq. miles over head of a well planned and layout city. Malik Amber has designed the construction of the aqueduct in a very simple appearance and natural way underneath the river bed of Sawangi and Kham river which has got number of man holes over head called Abgir Nali upto Gaimukh. An earthen dam was constructed on the river Kham on the north of Aurangabad city.

### **Planning Designing and Construction of Old water supply system:-**

The old system of water supply was dependent on the canals. If we try to find out the origin of these canals out side the town we will find only huge land fields. At the origin there is neither any construction work nor deposit of water. As the origin of these canals are either in the lap of mountain or in the vicinity of river. Under the principle of gravitational power these canals were dug in the porous levels of land and they flow in the natural way. Geographically the town is surrounded by the mountains from all sides. The town is located in the valley. Hence most of the canals start from the mountainous field and end in the town. The most interesting and absorbing thing is the simplicity and uniqueness of these canals. There is no technical complication but still it is running successfully. Each canal is divided into two parts. First is conduit ( Large pipe or water way ) and the second part is a net of masonry pipes on which they erected rectangular or round pillars some times they are higher in a size and some times smaller. The cross sectional area of these conduits is based on the old engineering hydraulic & design system is an engineering marvel. In order to cope up with growing population despite Ambri- Nahar (canal) they dug several canals such as;

Nahar – e – Palsi, Nahar – e – Nasarullah, Nahar – e - Pan-chakki, Nahar – e - Lal Mahal, Nahar – e – Kiradpura, Nahar – e – Garkheda, Nahar – e – Koila, Nahar – e - Durga – Shab Ali Nahri, Nahar – e – Chausar, Nahar – e - Darga Hazrat Shab Noor Hashmi, Nahar – e – Begampura and Nahar – e – Chavni.

They utilize the local material and the peculiarity of these canals lies in the principle that the water stores and filters into it.

Malik Ambar was the commander of the Nizam Shahi Kings and Subedar of Daultabad: He was dynamic commander and a great engineer His system of water supply is first of its kind and also the last. In the year 1604, Malik Ambar made 'Khadki' present Aurangabad as his head-quarter and named it as Fateh Nagar. He introduced the system of water-supply for the public utility and this well-organised system is known as canal Ambari or Nahar-e-Ambari. In 1653, when Aurangzeb was appointed as the subedar of Deccan he made Fateh Nagar as his capital and named it as Aurangabad. When he became the emperor of the Mughal Empire he declared Aurangabad as the capital of the Mughal Empire. Owing to this reason the population of time grew faster and acute scarcity of water was felt. In order to supply water to the growing population he extended the system of water supply of Ambari and new canals were also dug. It is described that at the peak of Aurangzeb's reign the population of Aurangabad was about two lakhs. Besides nahar-e-Ambari there were 12 (twelve) canals which were sufficient to supply ample water to the town some of them are still functioning properly and rest of them can become permanent source of supplying water after the minor repairs.

### **Nahar-E-Ambari**

Nahar-e-Ambari is a living memorial of Malik Ambar. He constructed this canal in 1029 A.D. and died in 1035. This is the biggest of all canals and still exists. In the northern direction of Aurangabad there is a range of mountains, but the most famous mount is Ju-ban. Adjacent to this mountain the Sangvi town is located. A mile away from this town is the origin of this canal. The total length of this canal is 4450 m. There was no distinct mark on this canal before 400m. But after 400m, Fateh Bhai, administrator of Aurangabad marked on this canal from beginning to the end. He also constructed in his supervision high & strong man holes. Due to these man-holes the cleaning & maintenance of the canal was easy. At the beginning of this site there is a man-hole & at the end of it is Gaye-Mukh. The difference of height these sites are 140 feet from the highest point of the town its starting point is 48.8 m high. So the flow of this canal is based on the natural process of gravity modern engineers think, that it is underground streams of water. At the beginning man-hole was buff with porous bricks so that large quantity of water enter into it & the flow of natural underground streams of water also continues. At the complete length of this canal there are 100 man-holes through these the cleaning of the canal is performed. Savangi river is almost parallel to this canal. On one side of the river is canal Ambri & on the other side which is comparatively higher is Nahar-e-Nasrullah. The floor of the canal is lower at many places, the canal is dug in the porous layers of the ground so that large quantity of water may be supplied by the percolation. The peculiarity of this canal is that the water filters into it and the quantity of water also increases. At the beginning, they confined the natural underground flowing water and diverted into the canal subsequently so that the canal flows permanently.

The canal is in fact an underground stream of water. Its sectional area at the length of the canal is different, sometimes it is broader & sometimes it is narrow. This difference is due to the slope of land. Its shape and cutting is normally rectangular but sometimes it is trapezoidal the average width is 0.75 m and height is from 0.75 m to 4.5 m. The canal is dug very deep under the ground but there is no masonry work on its two

vertical sides. But above the vertical sides an arch of lime & brick is built. Bricks are red in colour and smaller in size. The rise of the arch is not more than 7 to 9 cm. The conduit of this canal is like a tunnel. Above this arch, earth filling is done so at some places the agriculture is also done. Man holes are strong and high rectangular tanks on which are stone coverings are fitted. So that the time needs it can be removed easily and the man could enter into it and clean it. There is a network of masonry pipe from Gay mukh. There is a particular reason because from that point, the land is uneven so it was not possible to supply water by the syphon system. There were two branches of the pipe lines one used to go upto Bara Dari Khurd-e-Kallan and second used to supply water to the remaining population of the town. The clay pipes are circular and its radius is 20 cm at the ends of these pipes are sockets by which they were connected and then they become solid and also the size of the pipe becomes longer. On the line of pipe in the town there are some hollow pillars made up of bricks & lime & they are called Air-tower.

The purpose of the construction of these air-towers was that the air of pipes should be passed because these pipes are weak and they cannot bear the pressure of water secondly each air tower created pressure in water and in order to create velocity in the forward line of pipes so that it could get head of water and maintain balance. These air towers are often circular or rectangular. Out of these some are higher and some are less high for the pressure and head of water. In the solid towers, at the proper distance, there are manholes for the distribution of water. Irrespective of weather, the water was distributed in the different streets through these holes to the taps. Whenever they wanted to close these holes, the lids of wood were fitted. Out of these towers, they are some main (principal) towers & some are branch tower. The branch towers were connected to the common tanks and houses. Each tower has two vertical lines of pipes & they are parallel from pipe the water comes up and falls down from the other pipes and flows faster forward. For common people there were tanks in each street rayal & rich people used the pipe connection and tap water stored water in the tanks of their garden.

The recent water supply system of Aurangabad is a link of this chain. In this recent system the whole length of the canal is kept like the past upto Gayemukh but they some changes e.g. in the town instead of clay-pipe the new system pipes are laid down. This modern system of the net of taps is a part and pareel of Ambari system. Initially there were proposals of constructing a huge dam for the water supply of the town. But this scheme was very expensive and there were no huge sources of water like dam, river and wells in the town. So keeping in view the high expenditure required for this project the director of the water supply Mr.Ahmad Mirza continued Nahar-e-Ambari as a source of water which is completed in the supervision of the chief and Asst. Engineer. After the cleaning and restoration of the Nahar-e-Ambari canal at some distance of Gaye Mukh a setting tank is constructed. First the water stores in this tank and accumulates into clear water chamber and then by the chemical action it is cleaned and then falls down into service reservoir. Distribution reservoir is made inside Delhi Gate. In this reservoir filtered water is deposited and the from here it is distributed in the town cleaning of water is done either by the bleaching powder or chlorine. Although there is no heavy rains in the recent years and while cleaning the canal all the old principles were not followed, with which the ancestors were familiar. However, the Nahar-e-Ambari is being utilised for the supply of water except a few Hanes which are at the highest level. In older times the water was distributed permanently. But in recent times it is done intermittently and

that is two hrs in the morning and two hrs in the evening. From Gaye Mukh to inside city instead of clay pipes the metallic pipes are put so that they could bear the pressure of water. In these pipes the main pipe of R.C.C. is put and others are metallic. Another small distribution of water supply was made little away from the Paithan gate at Kala Chabotra. From this centre the water was supplied to a number of lanes. This Kala chabotra is constructed by Malik Ambar. He uses to check his military from here. This reservoir is at higher level so the pump was used to fill the reservoir. For common people in the various lanes common tap or public stand post were founded. In the hours of rich needy the connection of water was given by the iron pipes.

When we compare our water supply system with the present system, we find a huge difference in indigenous system a single paisa was not spent abroad, but the whole amount was spent at the same place and if is utilized in the vicinity where there was no extra expenditure in filtering, depositing, cleaning or distributing the water. The water supply system of Aurangabad is on a very large scale but for the maintenance hardly little amount is spent and despite the meager spent on this old project, it continues to supply water over 300 years.

### **Nahar-E-Pan Chakki**

Around the town of Aurangabad, Aurangzeb Alamgir constructed fort wall. In the western direction of the town, a river flows along the city wall. At the bank of the river, there is tomb of Baba Shah mastan and Hazrat Baba Shah Musafir Nagshbandi. Both the saints are buried at one place under a tomb. This site is known as Pan-Chakki. In ancient time a flour mill was run by the power of water. For this purpose, the nahar was brought from the distant mountain. The water of this canal falls through a wall which is constructed like a pillar. The water falls into a big tank. This monument is the wonderful specimen of the medieval engineering feat. It dates back to 17<sup>th</sup> century A.D. Rich people contributed in this regard and constructed different part of this monument. In the Panchakki water is brought down from the Kham river, which is about 4 km away from there in a mountain. The total length of this nahar is 4 km. it originates in the bed of kham river. The water is brought through clay pipes by the siphon system. The water ultimately forms an artificial water fall through a wall & stored in a big tank. The flow of this nahar is 1.78 MLD.

### **Nahar-e-Palsi**

The village Palsi is located in the East of Aurangabad. This canal enters through the Roshan Darwaza. There is a river near the village & this canal is dug from this river. This river is the memory of Aurangzab. Water was distributed by this canal to the neighboring lanes. This canal is in ruinous condition needs the attention of the present Govt. If necessary restoration will be done on this canal some area may get ample water though it.

### **Nahare-e-Begumpura**

This nahar is known as Kishan Rao thathe's Nahar. In olden times this nahar was reserved only for Begumpura. Now it supplies water only to Bibi-ka-Magbara. The quantity of in coming water had diminished & so water flows only for six months.

### **Nahar-e-Nasrullah**

This canal was constructed to supply the water to Roshan Bagh (Garden). It is constructed in the memorial of son in law or daughter of Aurangzeb. Formerly Roshan Bagh was watered by this canal but now it is in poor condition. Adjacent to Juban mound this canal starts from Savangi River from the starting point the river 2.5 km away is the site of Nasar ullah nahar, which is little away from Mahadev Kund in the north-east direction of savangi river. The traces indicate that river's trend were confined & transferred into the river. Owing to this reason it flows in every season although the river is located away from Nasrullah Nahar but at some places at the complete length of the canal is parallel. This canal passes from its starting point to Roshan Bagh through twelve small and large streams. The total length of the canal is about 3.6 km. This canal is covered with small arches of bricks and lime 3 m below the ground level. In the total length of this river, near ventilation no. 4 is a big nalla. Where the level of the arch and floor of nalla is similar. On this nalla the canal is broken and water wastage continues. The interior part of the canal is filled with silt. Here the ground dug area is 1.2 \* 0.75 m. The ventilation number is temporary from its point of beginning there is no regular ventilation on this canal. Only a few pits at some places are the vague marks which serve the purpose of the ventilation. The conduit ends at ventilation no. 8. At this man-hole, a tank is made in which at higher is a tap of clay. From here till Roshan Bagh, the clay pipe of 18 cm radius is laid down. In the complete length of the pipe, there are eleven nallas. Syphon of pipes are made at two places at nallas and often build the two ends man-hole like a tank of air tower and these pipes are passed safely through it. On these pipes also two syphon and 17 raw man-hole and at the end is Air tower. From this last Air-tower till the man-hole no. 10 of Nahar-e-Ambari the connection is possible. This pipe between the man-hole & nallas have broken at several places due to old age & no maintenance has been done. The canal and pipe's alignment is not straight, on the contrary, it angle changes. In this canal, two more branch canals meet near man-hole no. 4 the dug are is 1.2 \* 0.75 m.

#### **Nahar-e-Dagah Hazrat Shal Noor Hamvi**

Hazrat Shah Noor Hamvi popularly known as Hamami attained 300 years age. He died during the time of Aurangzeb. This canal was constructed during the time of Aurangzeb for his Darghs. This nahar is in good running condition.

#### **Nahar-e-Dargha Hazrat Shah Ali Nahri**

Hazrat Shah Ali Nahari was the saint during the time of Asif Jha I. He constructed the canal for himself. Hence he is famous as Shah Ali, Nahari, The dates of this birth & Death is not known but the son of Asif Jha I. Nawab Syed Mohammed Khan Zafar Jung Bhadur gave some donation for maintenance of this canal in 1171 Hijri. So it proves that this canal was constructed before 1171 Hijari.

### **CONCLUSION**

The 350 year old water supply system is working effectively without any maintenance, without silting and corrosion. The life of present water supply system is 30 to 50 years and with maintenance. The methods and materials used for neher system is

available locally and constructed by local skilled and unskilled labour. This will help to solve water problem in developing countries.