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Study of Ancient Water Storage System on Forts in Nashik District of Maharashtra

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Abstract

India has a rich heritage of water conservation. Wells and *Kunda* in Rajasthan, *Bandharas* and lakes in Maharashtra, *Bandhis* in M.P, *Kuhal* in Himachal, *Eiris* in Tamilnadu, and the most spectacular, *Aahar* and *Piain* in Bihar…..all this add to the techniques of ancient time which were used for irrigation and water supply. Many of them are in working today also, with full proficiency. These traditional systems are the gift of the knowledge, ambience and society of a particular location. These systems are not only supplying water but also holding perfect balance between environment and human beings. All these systems works on the principle of experience, which is their power and essence of fruitfulness![1]

The traditional system doesn't prove to be non-useful. These are different than that of constructed and maintained by the government agencies. Modern water supply systems are costly and may interfere the environment. The water available from those systems is used for farming and other commercial works. Modern techniques posses a negative image in the mind of common man and society. It is also the fact that these systems have made farmers and society, a dependent on Government. Water is a great power of development. If equal, society-oriented, and sensible development is desired, we must recharge these traditional systems and strengthen it. Traditional systems have to be modified with the new scale of time and technology, appropriate repair and maintenance is necessary. Local techniques must be developed to solve these problems.

Keeping above points in mind, a study of water storage system on the forts in Nashik district of Maharashtra State was carried out. To explore the facts and their technical details one exploration campaign was arranged, during which, a large number of remains pertaining to the water supply schemes were studied. These includes open channels, remains of small bunds, water tanks, wells, number of small and big cisterns and reservoirs, and remains of artificial lakes at different contours, etc. Can we use these water bodes for betterment of community? There are thousands of villages in Maharashtra, having topography similar to that of a fort i.e. located on a hillock or mountain and established on downthrow side of a hill. If the fort can yield good and sufficient amount of water, why cant these villages and hamlets? Hence by studying the details of water supply, distribution, collection, storage, one

can find the ways to conserve water at the similar topography. Various details were observed regarding the water storage system and distribution of the same. The details include collection system, conservation system, distribution system, calculations regarding the water supply.

1. INTRODUCTION:

Water …a vital element of life! Since ancient time, water is inspiring living being for their betterment and fulfillment of dreams. Maharashtra is decorated by mountains and hills of Sahayadri. All the past generations (before 100years from now) were administered and disciplined through forts only. All the kingdom of Maharashtra has survived due to these forts and their impregnable construction! The strength of Marathas was their ableboard fort and fortresses. Due to the strong forts , Mughals and other powerful empires have tried hard to get hold of the Deccan plateau. The difficult topography of the land and mountains has helped the local kings to keep their subjects and property untouched by the foreign attack. During the centuries, Maharashtra was subjected to various changes regarding the rulers and administration, at some even of a radical-nature. During its long elegant journey with time, it witnessed the era of grandeur along with the era of frustration. Once it was a booming metropolitan state full with public and private structures, temples, mosques, gardens, bazaars etc. But because of the loss of the Royal patronage it lost its earlier grandeur. The scattered heaps of ruins remind us of the glory of the yester years. However at present, these forts appear like a deserted necropolis. Even the bastions, balekilas, and the palaces are full of graves and tombs.

These forts served their kings loyally and nobly with their strong arms and coats, at the same time, they conserved springs of sweet water at their heart! These springs gave essence of life for those who battled hard for their state and kingdom .Not only life, but also a touch of heal for their lives and soul when the great worriers lost their lives for the Motherland and Culture!

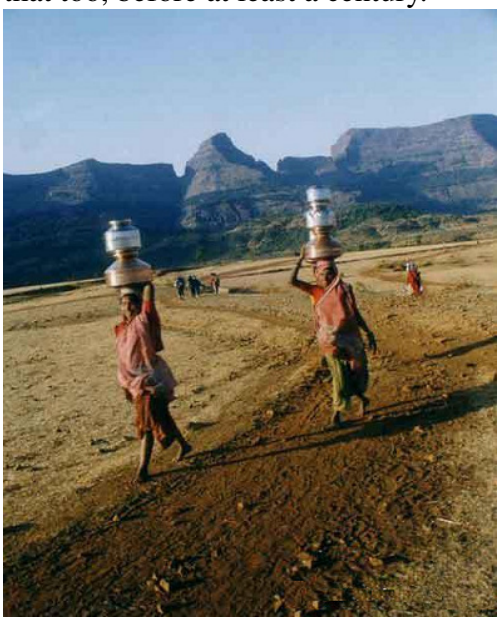
The presented paper is an attempt to explore these springs and water bodies along with their technical facts. Our culture, tradition and a rich heritage teach us lot many new techniques of water conservation and harvesting of rainwater. The need of hour is to have the deep sense of responsibility, a searching vision and an erg to explore these facts.

2. THE OBJECTIVE

Studying the topic of water storage system on forts is a nice experience though living in the 21st century. The challenges laid down by the new era are much difficult. At the same time our heritage and tradition posses right power to face these challenges and to overcome the same. It is said that without firm foundation, one can't even walk. In the same way, neglecting our tradition and heritage, would certainly demoralize our efforts of water conservation in the modern world. When one comes across the sincere and smart efforts done by our forefathers, for the storage and distribution of water, admiringly bows down his head at feet of this supreme intelligence. The hidden potential within these systems is to be explored.

For the sake of Example, in Rajasthan, one can find number of well-like structures covered with an oval shaped lid. Both have been constructed with masonry and neatly

maintained. To way-out curiosity, if one peeps in he would find a large tank full of water! It is a system made for storage of rainwater. A large amount of rainwater present would certainly satisfy the need of people and cattle for next year. This gives an admiring and astonishing experience to know that a society can make the environment at his command and that too, before at least a century.[2]



Maharashtra have a curse of being short of water, though there is a large amount of rain occurring every year in rainy season, for a single drop of water the housewife must walk at a distance of 2 to 5 km daily. A community, having a great heritage of rainwater harvesting, requires walking thousands of meters for even the drinking water. A country where, rain is worshiped as a God, burns for a single drop of water?

These questions arise in mind and then a smart point floats. Can we use these naturally occurring water bodes for betterment of community? **There are thousands of villages having topography similar to that of a fort i.e. located on a hillock or mountain also established on downthrow side of a hill. If the fort can yield good and sufficient amount of water, why cant these villages and hamlets? Hence by studying the details of water supply, distribution, collection, storage, one can find water and conserve the same in the similar topography.** Thinking on the same line, study campaign was carried out in the forts around Nashik. Various details were observed regarding the water storage system and distribution of the same. The details include collection system, conservation system, distribution system, calculations regarding the water supply.

3. BRIEF ON FORTS OF MAHATASHTRA

3.1 History of Maharashtra [3]

A rough timeline of the state of Maharashtra according to the Chief ruler under whose empire the overall region survived, can be drawn as:*Yadavas*(1187-1294), *Khilji*(1295-1320), *Tughlaq*(1320-1343), *Nizamshahi* of Ahmednagar(1490-1635), *Marathas*(1635-1780). In between the Nizamshahi period, Mughals were in power in large part of region. During these ups and downs of grandeur and frustration, the forts were subjected to various constructional changes, as each ruling dynasty had a specific motive behind its possession. For example Yadavas wanted to defend it against their political rivals namely the Hoyasalas and the Kakatiyas. Hence they converted it into a stronghold in its real sense. On the other hand , Muhammad Tughlaq wanted to develop these forts on the lines of an imperial centers as he was impressed by its geographical and strategical location. But soon they discovered that it is very difficult to handle the system of forts through sole administration. Hence they resolved one new technique to rule these forts. It was Watandari –Subhedari method. Which yielded the fruits to *Nizamshahi,* while keeping its roots in the Marathas and their loyal army. According to this method, the ownership was given to an influenced person . This would be the *Watandar* of the fort and the surrounding area of the same. A number of similar

Watandars were produced. This resulted in self fulfillment of the whole area and the biggest advantage to Nizam was the inter-battling spirit of these Watandars, which would keep them as enemies of each others but at the same time they surrender their faith to the King. Hence it was an easy move for the kings.

During the same era, Mughals treated Maharashtra as the entrance to Deccan and derived maximum benefit out of the internal strife. As a result, it was exposed to the Islamic precept for more than three centuries and during this Islamic hiatus the fort and township were subjected to modification for several intervals. Hence to understand the nature of different phases of occupation, it is necessary to analyze the relative history of the fort and the township.

3.2 History Of Nashik Pertaining To Forts

Since a long time, the rich culture of India has acquainted Nashik, the place where lord Rama stayed and a place of Kumbh Mela. The pilgrimage and religious importance grown, the city started gaining its importance and holy image through thousands of minds in India. The city started vivid and vital religious programes (vidhis) obviously, it was (and is) visited by thousands of visitors every now and then. In ancient time, Dharma being the main concern about every issue, to protect the religious places and cities was the main responsibility of the administration and the kings. Hence to safeguard this city and its surroundings a series of forts and fortresses were erected, these forts can be studied for further details.

The city is being located beneath the mountains and hills of Sahayadri. The famous Pandav-caves and Chamar caves are well known for their Buddhist heritage and carvings. They give a chief and elegant proof for the bygone richness of Nashik and villages around. As they thrust command over large area including Nashik, a purpose of keeping watch is also being fulfilled. Construction and erecting period of both caves is same. Though the caves and carvings give relevance to Buddhism and allied panthas, main basic purpose was to keep watch. No armed soldiers were set up on these places. But the nearby fort of Ramshej, was constructed for collection of tax on road and goods. Ramshej holds the way to Gujarath and Baghlan. Hence it is an important place to control the pathway leading to and dispatching from Nashik. On the top of all the three hills, one can find good amount of water. There are underground tanks of different kinds and method of construction in different in each one. Details of the same are given later.

3.3 Water supply On Forts

The history of town-planning and water supply in India commences from the first cycle of Indian urbanization. It is evident from the towns unearthed so far that water supply is one of the significant constituent of town-planning throughout the ages. As far as the Hindu town-planning and water supply are concerned, most of the ancient and medieval towns are situated either on the banks of rivers, lakes or artificial tanks or reservoirs[4]. Hence water was no problem for them. Almost all forts in Sahayadri are the best example of the medieval defense technology. By providing the artificial means of defense, the problem of protection was solved to some extent. However it gave birth to a more serious problem i.e. the problem of water supply, because most of these forts are situated in and around the naturally protected area.

To explore the facts and their technical details one exploration campaign was arranged. During exploration campaign, a large number of remains pertaining to the water supply schemes were seen. These includes open channels, ruminant of small bunds, water tanks, wells, number of small and big cisterns and reservoirs, and remains of artificial lakes at different contours etc. This suggest that various water supply schemes were implemented. The principle objective is to find the links among the remains. Different Kings and their technicians have implemented different schemes according to their knowledge and beliefs. But amongst all, the water collection systems implemented during Islamic Era are the most spectacular one. They have really worked on the topography and maximum benefits out of the rainfall and the groundwater available.

3.4 Water supply in Shivaji Era

Shivaji Era commences from 1630 A.D. to 1681 A.D. When the entire India was under Mughal Empire, the sheer and honest Marathas were struggling in Deccan to keep their culture and heritage alive. It was the part of country which whole-heartedly devoted their lives and prosperity at the feet of their beloved King… Shivaji.

But doing this type of revolution against a great empire needs great power. It needs a true patriotic mind, healing support of peoples and strong arms of soldiers. All this is outcome of clean faith to your country and your mother-land. Adding to all above things, Shivaji was fortunate enough to have a chain of about 300 forts at his command. The forts which can fight for a long time and with loyal heart!. These forts are located at and around the difficult peaks of Sahayadri. Shivaji having known all the nooks and corners of this strong range, derived maximum benefit of these hilly terrain and defeated his enemy with a very few loyal army. During his life time, he repaired, constructed, and rebuilt many of the forts in and around Maharashtra. All the kingdom of Chatrapati was administrated through forts only. Not only for the sake of administration, but also keeping safety point of view, capital of 'Swarajya' was located on fort (Rajgad, and Raigad.1674).

FIG 1: Water reservoir on Raigad

Every fort was an independent town. It was a place where all the needed things were kept ready. Large amount of grocery, armors, goods of day-to-day wants etc. were kept handy. The reason behind doing all was that at any time enemy can have a cruel attack. At and on attack, the fort in charge (Kiledars) used to close all the gates and means of communications. On this front, the fort is a small town surrounded by the enemy. So the inside storage of food, water arms etc. has to be sufficient for the peoples fighting and living for and on the same. For this purpose, they need to have good storage of drinking water also. Water (with good quality and quantity) being the basic need, and has to be fulfilled at any cost. The storage should be sufficient at emergency. (it is known that forts were battled for the period of 8 to 10 months also. So it is obvious that, a good storage is essential). It is true that it is impossible to carry water from bottom of a peak to top by man power or any mechanism. **Hence the total demand water must be fulfilled on the fort itself.**

The means used for satisfying the total water demand were underground water tanks, reservoirs, cisterns, and some artificial lakes. Generally it is found that the stone quarries for the construction of the fort were converted in to the lake. Here, after the stone demand being fulfilled for the construction of the fort and walls, the excavated ground portion was blasted at greater depth. The blasting is so arranged that it would generate crakes which will allow the flow of water. By providing sufficient amounts of underground cracks and channels it was possible to bring groundwater in the lake. Another resource was the storage of rainwater which is available in the rainy season. The arrangement of the cisterns is done in such a way that the surface runoff would automatically be diverted to the cistern and it will recharge the same. But this technique is useful where good rainfall is assured and constructions of such cisterns are economical.

4. GEOLOGICAL ASPECT [5]

Movement of ground water takes place under gravity through rocks which have textures and structures favorable for its movement. Rocks in which water can flow easily are called pervious rocks. These are porous sediments with large pores such as sandstone and conglomerates and nonporous igneous and metamorphic rocks with open interconnected joints along which water can easily flow. Rocks through which water cannot easily flow are called impervious. These are nonporous rocks which are massive i.e. free from joints or jointed nonporous rocks in which joints are not open and interconnected and also fine grained porous rocks like shale which are impervious because their pores are too small to allow free movement of water through it. For making a rock pervious, the mere presence of openings is not enough. Their size and arrangement must be such that continuous through channels are available for the passage of water. The condition most suitable for the storage of ground water is the occurrence of a pervious layer enclosed between two impervious layers, one above and one below. By the folding and faulting of such a set of beds various structures are produced in which water is kept confined in the pervious layer by impervious layers. The commonest of such structures and the most suitable for the formation of a groundwater reservoir is a syncline.

Groundwater often finds a natural outlet under favorable structural conditions and flows out from the ground. If water flows out at a single point it is called as spring, and called as a seepage if there is a general oozing out of water along a line. The commonest of the springs are the contact springs, which issue where the contact of a pervious water bearing layer with an underlying impervious layer is intercepted by a slope. Water percolating in the pervious rock cannot sink further when it meets the impervious rock below, and flows under gravity along the watertight top of the impervious layer until it issues at the surface a contact spring. In the Deccan Trap are contact springs issue on hillsides where laterite or compact jointed basalt is underlain by amygdaloidal basalt. As the streams in the Deccan Trap area are rejuvenated they flow in rocky channels with alluvial terraces at higher levels. Water seeping in to the alluvial flows over the basalt, and appears as a contact spring where the contact between alluvium and basalt is intercepted by the valley slope. The fair weather flow of perennial streams is provided largely by such contact springs. Springs also issue at the contact of weathered sheet jointed basalt with the underlying fresh amygdaloidal basalt.

5. TECHNICAL ASPECT [6]

5.1 Fort of Salher (1581 M)

5.1.1 Introduction: The range running west to east, of the Mausam river is dominated by Salher fort. This is the highest hill fort in Sahayadri . It is steep and well-fortified. The view from the top is one of the finest in the region. There is a huge cave and a water tank a little below the top. This is the second highest peak in the Sahayadri (after Kalsubai). And one of the three peaks above 5000fts. Historically Salher is an important landmark. It witnessed many battles, the chef one being its capture by the Maratha army in 1671. Salher is located in Satana Taluka of Nashik district . Vaghambe is the base village.

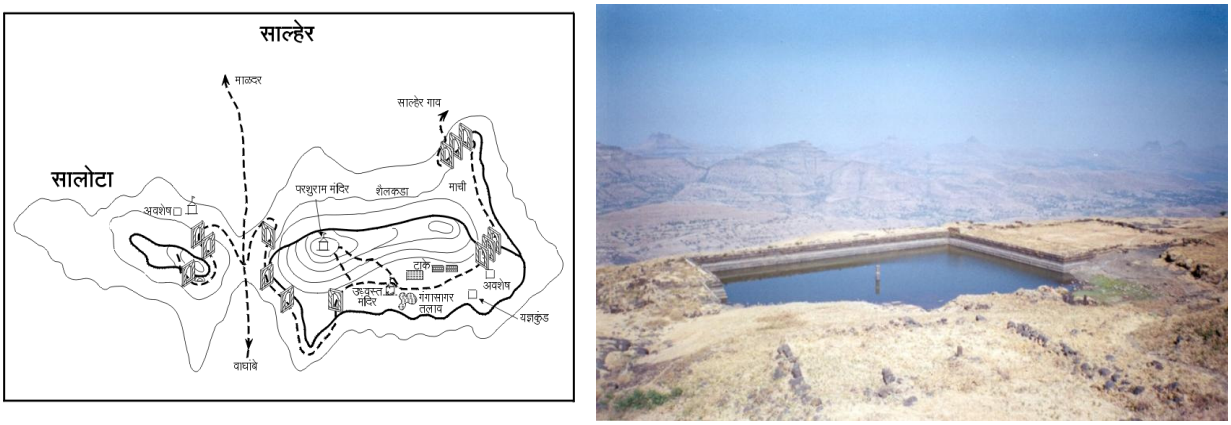


FIG 2: Map of Fort Salher and the water tank in the pictorial view

5.2 Water Collection System: A huge water tank was seen on the fort. Approximate dimentions:30m×20m×5m.). A number of small streams collected in tank gathering water from all over the fort area. A small cistern was also seen. All the water was seem to be stored in the tank itself.

5.3 Geographical Details: The top area of the fort can be divided in two parts. One on them is the topmost part (Appx. Area = 0.5k.m. sq..)and the second one is the are including the lake and caves(2.0 km. sq.) The weathered laterite (Murum) was seen all over the area of the fort and amygdaloidal basalt was seen as the chief rock.

5.4 Calculations: When asked about the past population on the fort and the allied information, the local people said that around 200 people were there of fort when it was used for administration. They also added that there is a floating population of around 500 when there is festival and fair of Lord Parshurama of fort.

Let us assume that the population living on the fort was 300.
Let the daily demand be =150lit /day
Total volume per day = 150×300 = 45,000lit/day
= 45 M^3/day.
Available water in Tank = 3000 M^3.
Sufficient for around 70 day .
No distribution system was seen.

5.2 Fort of Alang (1492M)

5.2.1 General: The fort of Alang is the best example of utilization of Protection due to Geographic conditions and location. It takes a long way to reach up to the top. Three fourth of the fort has to be traversed at least 3 ties at different levels to reach the top. There is a series of water tanks arranged in circular fashion. Alang is located in Igatpuri Tehsil of Nashik district. The base village is Ambewadi which is 20k.m. away from Igatpuri.

5.2.2 Water Collection System: There are several water cisterns in circular shape . The water percolating inside is seen. The temperature of the water is surprisingly cold. Approximate volume of each cistern is about 60cu.meter. Traces of laterite were seen at the top. The remaining rock patch is of compact basalt. The noticing fact is that the cistern founded in the rock yielding good amount of water though the basalt is predominant.

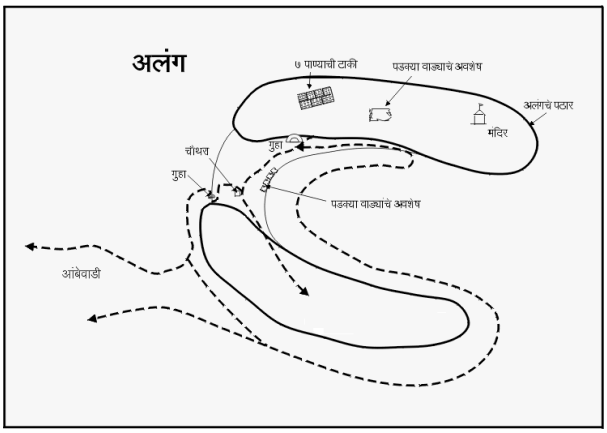
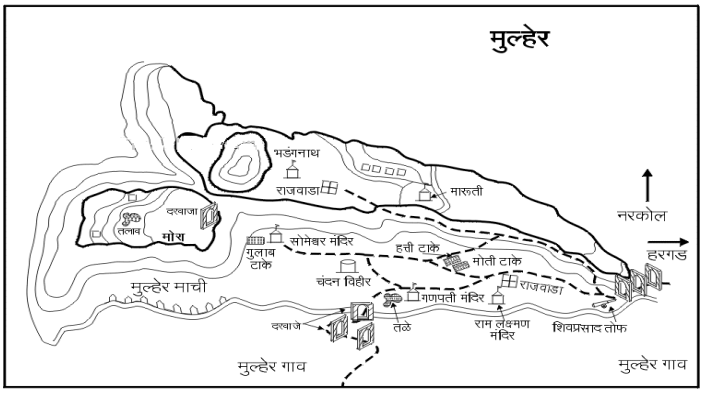


FIG 3: Map of Fort Alang: The series of water tanks

5.2.3 Population and Water supply: The exact population figures are not available. But the people say that there were not much population on this fort. It was the fort built for keeping watch on the area nearby. It is having a series of water tanks located on the north edge of the fort. These series are spectacularly arranged to form inter connectivity and separation at the same time.

5.3 Mulher Fort (1415 M):

5.3.1 Introduction: Mulher was the Capital of Baglan king, Rathore. Being the place of Capital it has to serve a lot of population, resulting in large storage of Water. Mulher is



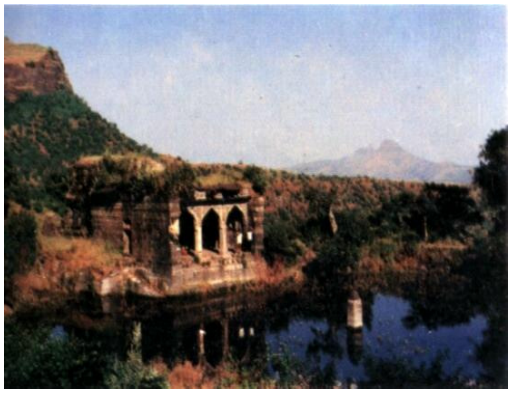


FIG 4: Ganesh Tmple, Mulher

located in the low rainfall area of Nashik District its a part of Satana Tehsil of Nashik District. It's located at around 1415 m from MSL.

5.3.2 Water Collection: The fort water collection system is an excellent example of rainwater collection system and water conservation. The Triangular shaped fort is divided in three parts. The tanks and lake is located at the end of the slopes so that almost all of the water can be collected in the tanks. Three Cisterns, one big lake on the top and a well constructed well can be seen on the top. The lake is having a beautiful temple of lord Ganesh.

5.3.4 Calculations: Looking at the huge water storage on the forts, it can be calculated that it is sufficient for consumption of around 300 people for a period of three months.

5.4 Harihar Fort(1131 M)

5.4.1 General: A unique fort in the Sahayadri built on a triangular prism of rock. Its three faces and two edges are absolutely vertical. The third edge is inclined at an angle of about 70°. A one meter wide rocky staircase is hewn on this edge. At one place, it goes through a hole carved in an overhang. This ascent is a rare route amongst all the forts. On the top there is a small temple and a cave with water. The village at the bottom is Nirgud pada. The

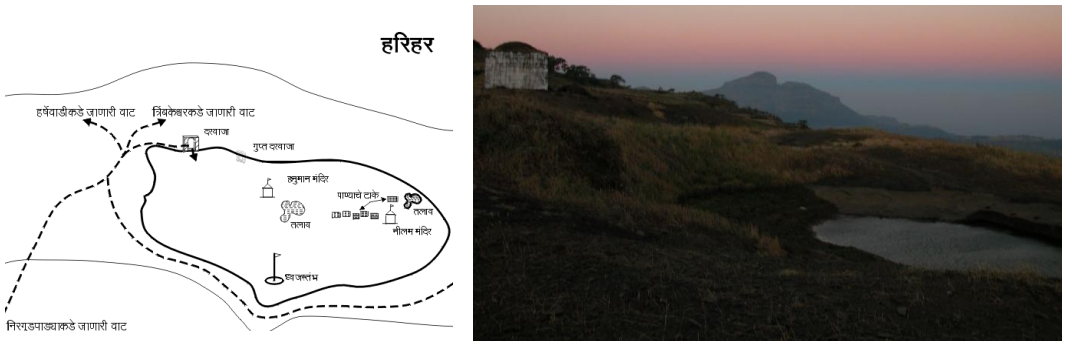


FIG 5: Harihar fort- map and water tanks on top

village is 20 km. from Trimbak. Khodala to Jawhar is 35 k.m. . The fort is in Nashik district.

5.4.2 Collection System: A small lake is seen on the top. There is a temple also which is worshipped regularly by the people in the village. The lake is at the bottom of the vertical rock building the bastion of the fort. The lake gets its water from the spring coming out from the contact of the vertical rock with the ordinary rock laying underside.

5.4.3 Geographical Details: The total area of the fort might be around 2 k.m.sq. The fort can be divided in to two parts which can be described as Top and sub top. Height of the fort from MSL is 1124 meters.

5.4.4 Water Collection: There is not much water available on fort. The main purpose of this fort was to keep a watch on the way towards Konkan dispatching from Nashik. The tanks and the lake constitutes majority of the water storage.

5.5 Ramshej (1007 M)

5.5.1 Introduction: Ramshej is the fort built in between 9^{th} to11^{th} century. The main purpose of the fort was the

collection of tax on the way to Khandesh and Gujrath. Good safety arrangements have been made by making the wall of rock perfectly vertical along the periphery of the fort. The fort gains its important because of its location, as it holds the way dispatching from and arriving to Nashik. A small temple is seen on the top. Beside this temple the cistern is located. The town at the base is Ashewadi. It is 8k.m away from Nashik.

5.5.2 Water collection system: There is a reservoir on the top of the fort. A small cistern (2m×3m×1.5m) is seen on the way towards top. The location of the reservoir and the cistern are on the same vertical line. The cistern has good amount of water even in summer also. It derives the same through the contact springs of the rocks. The water percolating in the cistern can be seen.

5.5.3 Volumetric analysis:

Approximate Volume available in the reservoir = (10×10×15/2) × 2.5 = 1875 M^3**.**

Approximate Volume Drinking water available in the cistern = 2.5×3.5×2 = 17.5 M^3**.**

Roughly estimated for 100 persons = 1875000/(100×150) = 125 days **.**

5.6 Ankai (970 M) -Tankai (857 M)

5.6.1 Introduction*:* These twin hills for a part of the Chandwad range. A prominent fortified entrance is a sign of its strength. Its location is perfect for the command upon Manmad Range. The construction of entrances is an example of peculiar intelligence of civil engineering expertise. The rock is completely eroded on all the sides that it presents perfectly perpendicular walls on all its four faces. There is a big temple, a mosque and a tank on the top. The Balikilla is in good condition. A number of small tanks are seen on the top of both the forts. Height from mean sea level is around 1000 meters. The fort of Ankai can be reached from the railway station of Manmad. It is located 8k.m. away from the town of Manmad. The base village is Ankai.

FIG 6: The huge lakes on fort Ankai-Tankai

5.6.2 Water Storage System: The lake on the top collects its water from the surface runoff occurring during the rainy season. But the water cisterns located derives the same from the groundwater available in the rock. All the tanks were full of water.

5.6.3 Geographical Details: The forts are like tow tables kept beside each other. The top is flat and is like a table plane. Amygdaloidal Basalt is the main prominent rock. A lot of Sills

and Fissures are seen throughout the fort. The area covered is around 10 k.m. sq. in all. There is a small peak at the top of Tankai fort.

5.6.4 Volumetric Analysis*:* It was seen that a large amount of water is available on the fort . The water present in the lake and the cisterns is sufficient to fulfill the demand of a large amount of population. A Fountain was also seen at the balekilla, which was in the destructed state. This shows that there was no problem of water-supply.

5.6.5 Fountain Water Supply: The inlet to the fountain tank were seen which were directed towards the lake outside the balekilla . Hence it can be concluded that the water was brought from the lake and using gravity, the fountain was made.

6. ANALYSIS OF DATA:

System of water supply during the Shivaji Era was almost same throughout his Empire. A certain amount of water was fixed to every person according to his post in the administration. Every person would get that much amount of water only. This water was being carried manually from the lake to individuals. There was a special division in administration which used to look after the work of these carriers only. In local language, these carriers were called as 'Panke'. They were given wedges according to their workload and the person they offer their service. Upon the entire forts considered, no where water distribution system was found. But at some places like Fort of Salher and Fort of Ankai-Tankai, some channels were seen diverging from the places of bathing and domestic washing .Hence it can be said that though water distribution system was not implemented, water disposal system was implemented at some places.

At many places it was seen that both rainwater and groundwater were harvested. The groundwater was tapped through the cisterns which were made in the rock yielding good amount of water. And regarding the rainwater, open tanks were dug or constructed to collect the runoff.

Another important point is that the local Kings and their subordinates were not interested in building the water distribution system for more availability of water. It seems that concept of water availability was much different than that of the concept imparted by Islamic Empires. This might be because of the fact that bathing is given as a prime and luxurious touch in Islamic culture. But that of Marathi culture doesn't treat it as a luxury, but functional utility was given the prime importance. At the same time, Kings of Rajputs used to have their baths as an administration process and given through importance as that of the Darbaars and general meetings.

Hence it can be concluded that demand of water and its use was, to a greater extent, a function of the origin of king and the traditions which they follows .Hence the design of collection systems and distribution of the same used to change according to the Kings an their tradition.

7. CONCLUSION:

Traditional systems doesn't mean that they are old and not useful. These are different than that of constructed and maintained by the government agencies. The modern systems are costly and some times may cause harm to environment. The water available from those systems is used for farming and other commercial works. Modern techniques do posses a

negative image in the mind of common man and society. It is also the truth that these systems have made the farmers and other society , a dependents on Government.

Water is a great power of development. If we want equal, society-oriented, and sensible development, we have to recharge these traditional systems and must strengthen the same. Some of the important points can be summed up as follows:

 # Necessity of Modification: Traditional systems have to be modified with the new scale of time and technology. They were to fulfill the need of less population and hence cannot be enough for today's busted one. Hence appropriate repair and maintenance is necessary.

 # Local technologies: It is the need of time to have new techniques developed in our country only. The logic and techniques developed in western countries are according to their environment and causes harm to ours. Hence local technologies must be developed to solve the problems.

 # Involvement of common man: The most suitable comment for the new and modern aids is that they don't allow the common man to take part in the process, though these systems are made for him! A common farmer may take whole interest when he feels that the system is for him and himself only in the person to look after the same.

 # Finance and Investments: The rural and common man is a poor fellow at this front. Though their experience is a vast sea, they don't have a single drop of money to invest in such type of systems. Hence government and NGOs have to take lead in such matter.

 # Human resources: Development of human resources is a must. It is necessary to develop the whole resources along with the water. Hence the need of time is to train the peoples to participate in governmental administration and activities.

 # Rainwater harvesting: It as felt that, rainwater harvesting is the Mantra for the new millennium . There is no pollution, no transportation cost, less storage cost etc has made this technique an essential one. There is a lot of scope in country like India. One must realize the same and make effort in appropriate direction.

 # Collection of information: The first step of the work is to have some knowledge of current situations. This is the field which can change the primary speed and can govern the post perpetual need of the systems. Collection of recent information and sorting out the same is a must for the forthcoming development.

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