INTERNATIONAL JOURNAL OF ENVIRONMENT
Volume-3, Issue-1, Dec-Feb 2013/14 ISSN 2091-2854
Received:24 December *Revised:9 January* *Accepted: 21 January*

WATER MANAGEMENT IN MOUNTAINOUS JARDHAR VILLAGE, CHAMBA BLOCK, UTTARAKHAND, INDIA

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Abstract

An attempt has been carried out to assess water management practices adopted by Jardhar villagers in Chamba block of Uttrakhand. The rain water during rainy season got collected in *chahals* (mountainous tanks) on top of mountains. The rain water which got collected in these structures percolates through mountains and forms number of small streams which were perennial in nature. The water from these streams were received in a small metal tank at the end of stream in the mountain and through a steel pipe this collected water was diverted and collected into a cement tank at an elevated location at the entrance of the village. From this elevated water reservoir water was distributed at various locations in the village through public stand posts. The sustainable utilization of water in this mountainous area paved way for availability of water throughout the year and thus can sustain the population in such a topographic region. This traditional water management in Jardhar village has set an example of water management which can be adopted in such terrains throughout the world.

Keywords: Water management, Jardhar village, Chamba

Introduction

Water is an essential commodity of human being. To meet demand and supply of water in a society more efficiently sustainable water management is the need of hour. Water management in plains and in mountainous area needs different approach. Water is elixir of life. It is essential for all aspects of our livelihood, from basic drinking-water to food production and health, from energy production to industrial development, from sustainable management of natural resources to conservation of the environment. Water is becoming scarce in many areas and regions of the planet. The latest data from the World Water Council's Report on sustaining water (1996) show clearly how alarming the situation is: "In 1950, only 12 countries with 20 million people - faced water shortages; by 1990 it was 26 countries with 300 million people; by 2050 it is projected to be as many as 65 countries with 7 billion people, or about 60 percent of the world's population, mainly in the developing countries". The report calls for immediate and effective action in order to maintain freshwater availability in the coming century. As documented in the recently published report on freshwater management (Liniger *et al*., 1998), mountains play a crucial role in the supply of freshwater to humankind, in both mountains and lowlands.

Only a tiny fraction of the water which covers the earth is of use to humanity: 97% is salt water, filling the oceans and seas. Of the reminder, 99% is out of reach-frozen up in icecaps and glaciers, or buried deep underground. We depend on what is left- in rivers, lakes and accessible aquifers- to quench our thirst, wash away our wastes, water our crops, and, increasingly, to power our industries (UNEP, 1990).

Mountains—the water tower of the world—are threatened by major global forces. Climate change is predicted to modify the quantities of water available and shift its seasonality. Even greater challenges will come from the dynamics of human behaviour. Population growth is one obvious threat to sufficient water supply, but equally important are changing norms and evolving activities (Wiegandt, 2008).

Water woes of the people residing in hilly regions are not new. Be it summer or monsoon, their plight has remained the same for past many decades. They are depending on the water supplied by the tankers trucks in the summer and in the monsoon, they depend on the collected rain water (Times of India, 2013). In mountain areas the routes to water sources are often long and difficult. Communities must carry heavy loads across steep paths and ravines commodity resulting in serious injuries.

Water management in mountainous region requires a holistic approach to be adopted. An attempt has been carried out to understand the traditional water management in mountainous Jardhar village which is situated at an altitude of 1500 m above mean sea level.

Study Area

Jardhar village (Latitude N $30^0$19'53.3" E $78^0$21'30.8", Longitude N $30^0$20'46.0" E $78^0$20'8.0") is situated in the picturesque valley of Chamba block of Tehri Ghadwal district of Uttarakhand state of India. It is situated at an altitude of about 1440 m above mean sea level. The village is situated approximately 20 km from the district headquarter Chamba. The geographical area of the village is 437.273 ha. The agriculturally cultivable land in the village was 185.495 ha. Irrigated area was 27.825 ha and non-irrigated area was 142.150 ha. As per 2001 census Jardhar village comprises of 15 hamlets with 282 families staying in 9 wards spread over 9 km stretch. Some wards were situated in close proximity while other was far away from each other. On one side of the village is the pine forest and village grassland. On the higher ridges was dense reserved forest comprising primarily of oak and rhododendron trees. The forests of Jardhar village broadly fall under the Himalayan moist temperate forests category. Dominating species in the forest were oak, rhododendron, kaphal and chullu (Kalpavriksha, 2008). Cutting across boundaries of administrative blocks people refer to this entire region as Hemvalghati. The name comes from the river Hemval, which originates from the Surkhanda peak in the Garhwal Himalayas and merges with the Ganges at Shivpuri, about 16 kms upstream of the town of Rishikesh (Malhotra, 2004). The Jardhar village was situated at an altitude of 1440 m above mean sea level (amsl). The average annual rainfall in the region was 785.84 millimeters (30.94 inches). At this mountainous place there were no lakes, ponds or other water bodies near the vicinity of village to be depend upon as a source of potable water.

Water collection

During rainy season, the rainfall in the Himalayan region is very high. Due to hilly region all rainwater flows down from this mountainous region and met rivers and streams in plain region. During non-rainy season scarcity of water was an important issue that has to be faced. To overcome this problem and to ensure availability of water throughout the year; large tanks (*chahals*) were constructed on top of mountains dense forest which were located adjacent to the village. These *chahals* were large tank structure which collects rainwater and hold it for longer duration of time. These water tanks were situated in dense forest were no significant anthropogenic activities were present. The rainwater which got collected in these tanks percolates through mountains and forms different large and small streams which were perennial in nature (Figure 1). Such types of streams were distributed throughout mountain chains.

At the end of stream in mountain (at an altitude of 1520 m amsl) a water receiving device was placed (Figure 2). This water receiving device was made up of metal and was approximately 1 feet length x 1 feet breadth x 1 depth of dimension. It was a box like structure and had a lid with handle to open it for inspection. In this box there were two openings; one for inlet, for entry of stream water and another was outlet, for exit of stream water. At this exit point, a fine mesh made of metal was placed for collecting and removing any suspended particulates which may had come with stream water from mountain. The exit point from this box was connected to a metal pipe which runs through from this water collection point to an elevated water storage reservoir which was located at the entrance of the village.

Water transportation

The water which got collected from this metal box was transported through a metal pipe network (Figure 3). The metal pipes were made up of steel and were laid from stream to reinforced cement concrete (RCC) elevated water storage reservoir at the entrance of the village. The pipes were laid down through deep forest, farms and village boundary. The pipes were laid down just below ground surface so as to reduce any contamination from deep soil and at the same time to check and repair leakages, if any.

Water storage

The water from stream after collection in metal box was transported through steel pipes into an RCC elevated water storage reservoir which was located at the entrance of the village (1507 m). This site for this reservoir was selected, as it was the highest elevated point of the village. This reservoir was made up of RCC structure and was approximately of dimension of 5 feet length X 5 feet breadth X 2.5 feet height (Figure 4). This reservoir was a closed type structure and had no openings in it. The water from stream got continuously being collected in this reservoir. An outlet was made to this reservoir which was made of metal pipe. This metal pipe was laid up to the village at different locations. This elevated water storage reservoir which was located at an elevated location (1507 m) created a gravitational force through which water was distributed at various locations in the village. This method of distribution of water doesn’t required any electricity and hence eco-friendly.

Water distribution

The water from this elevated water storage reservoir was distributed in various parts of the village through a metal pipe distribution network (Figure 5, 6 and 7). A network of metal pipe was placed at various locations in the village. Throughout the village public stand posts were made available which acts as a water distribution point. The locations of public stand posts were selected such that it will cater to the needs of maximum households of the village. The stand post at prominent locations in the village had a small RCC tank constructed to them which ensures all round availability of water to households. At each water distribution point, 2-3 water spouts were made available to users.

Wastewater

Wastewater which was generated after using this fresh water was collected and laid down through a drain to the nearby area thus it doesn't pollute water source (stand post) and keeps the surrounding area in hygienic condition.

Water quality

The water which was distributed to the villagers was without any treatment. Perhaps there may be hardly any source of pollution which may get entered into this water thus it can be concluded that stream water was in its pristine condition. To ensure the quality of water to be in pure state villagers had taken every precaution from source to distribution end that entry of pollutants will be minimum. The water quality initiative includes:

At *chahal* no significant anthropogenic activities were there. Due to this fragile environmental conditions prevailed at that site which ensured water was in pristine condition. At the point of collection of water from stream in the metal box, a metallic lid cover was placed over it and further to ensure that no wild animals to damage or pollute it a heavy stone was placed over it (Figure 2). Inside this metal box a metal mesh was placed so as to trap any suspended material which may get entered into this. From this metal box metal pipe network carry this stream water to an RCC elevated water storage reservoir situated at the entrance of the village. These pipes were placed just below ground surface so as to check any leakages and breakages and to avoid entry of contaminates which may get entered otherwise if these pipes were placed deep inside soil layer. Thus contaminations were avoided.

The RCC elevated water storage tank was situated at the entrance of the village. The site of this tank was in an isolated location and at elevated position. Thus ensures that no human beings and wild animals will cause any destruction to it. This elevated water storage tank was made of RCC and covered from all locations. Thus, there was hardly any possibility of entry of pollutants into it (Figure 4). These precautions had ensured quality of water in its pristine state.

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Figure 1. Natural stream in mountain as a source of drinking water, Figure 2. Water collection device from stream. In the background natural stream in mountain, Figure 3. Water transportation through metal pipe from water source to distribution point, Figure 4. Elevated RCC water storage reservoir at the entrance of the village, Figure 5. Public stand post in the village and in the background metal pipe carrying water from the elevated storage tank to the stand post, Figure 6. Public stand post in the village with cement concrete storage reservoir, Figure 7. A villager is drinking water directly from public stand post, Figure 8. Public stand post and wastwater collection platform with drain outlet

At the distribution point, wastewater generated from public stand post was collected through a drain and disposed of in nearby area (Figure 8), thus to ensure that water source will not get contaminated.

Stream water was available mostly throughout the year. This stream was the only source of drinking water to the villagers. In case of non-availability of water or drying up of this source villagers were forced to go downhill to 2-3 km to fetch water from *gadhera* (natural water stream at downhill). The water which was collected and distributed to the villagers was without any kind of physico-chemical treatment.

Effective utilization of hilly terrain

From Table 1, it can be observed that water source (stream) was situated at an elevated location of 1520 m in mountain from where water was collected and transported through a metal pipe to an RCC elevated water storage reservoir (1507 m) situated at the entrance of the village. This reservoir stores water from stream which subsequently distributed through gravitational force to villagers through different stand posts. Thus, utilization of electricity was not required from source to various distribution points. All these activities were carried out by taking advantage of hilly terrain and slope of the village. The different distribution points in the village were located at various locations which were at lower altitude as compared with source and elevated water storage reservoir. Thus water was distributed under gravitational force.

Table 1. Altitudinal particulars for water source and distribution network

Location	Latitude and Longitude	Altitude (m)
Water source-Stream in mountain	$30^0$20’42.0” N, $78^0$20’04.0” E	1520 m
Water storage in RCC elevated water storage tank	$30^0$20’41.6” N, $78^0$20’18.9” E	1507 m
Village entrance point	$30^0$20’43.6” N, $78^0$20’18.8” E	1498 m
Public stand post at *Panchyat* house	$30^0$20’46.7” N, $78^0$20’24.6” E	1440 m
Public stand post at scheduled caste locality	$30^0$20’42.3” N, $78^0$20’35.4” E	1433 m

Conclusion

Water is an essential commodity for human being. The availability of water varies with respect to topography of area. In mountainous region scenario of water availability and water management is different as compared with plain terrain. Water management in mountainous areas needs a holistic approach to be adopted. Efficient water collection, transportation, storage, distribution, quality assurance, availability throughout the year and wastewater handling are key drivers for effective water management.

The technique adopted by Jardhar villagers for effective management of water is a comprehensive one. It encompasses diverse points ranging from water source to wastewater discharge. This water management technique is a sustainable method as there was no interference with nature, no pollution of air, water and soil as such and at the same time it caters to the needs of individuals throughout the year. This water management at Jardhar village can be an ideal example for villages situated at mountainous ranges throughout the world.

Villagers, in spite of mountainous terrain where availability of water was scarce as compared with plain terrain, had utilized this terrain very efficiently from collection of water, transportation, storage, distribution and wastewater outlet. This shows the effective adaptation of sustainable innovation in adverse conditions which ensured water supply throughout the year with pristine condition with the harmony of nature.

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