

Research Article

Water audit for residential area-Surat City

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Abstract

Water is the basic requirement of human as well as living stock. As the population is increasing the demand for water is also increasing. The water taken from the river is not suitable for drinking without treatment as it contains various minerals which are harmful to human's health, so treatment is required. The treatment of water cost much amount, so it is not appropriate to use water haphazardly. Thus, water audit is process to calculate the water used which is treated so exact use of water is known and through analysis during water audit in domestic the usage of water is known. The place where water is used in excess or waste of water is known. From this audit and analysis, the long-term and short-term plan can be made for the conservation of water and awareness and steps to be taken by people to use water judiciously can be specified.

Keywords: Water audit, domestic, optimization of water loss.

1. Introduction

Water, it is the life of human, not only human but plants and livestock also. Ancient people started residing on the bank of river, because every human needs water from the birth till death. Human can live without food for several days but not without water. From the morning we wake up, we need water for brushing, cooking, faucets, bath, gardening, drinking etc. the water is not only used in residential building but is also used in various industries such as steel, cotton, paper, sugarcane, pulp etc. in various forms. Water is also used to produce electricity and for farming. Food can't be grown without water. The water covers 71.4% of water on the earth; from that 96% is saline water which is found in ocean and seas. While other is fresh water which is found in underground water, ice and snow, river, lake, pond etc. thus, water is useful to life in various forms and as the population is increasing the demand for water is also increasing. Water taken directly from the river contains various metals and wastes so it is needed to treat the water and then use. In treating the water some amount of water is lost till it reaches the consumer. Thus water audit is one of the step from which the non-use of water, loss of water in leakage or any other form can be known and steps can be taken to rectify this losses.

1.1 About the study area (Surat)

Surat is a city which is situated on the bank of river Tapti, also the Arabian sea is 16 km from center of Surat city. it is a city which has large industry situated

in its premises like ONGC, Reliance, L&T, SHELL, ESSAR, Kribhco etc. It is also called Diamond city as here there is large business of diamond, also there are large textile market here, and it is called the Manchester of India. Due to large business and industries the people from various countries and state migrates here. The population of Surat was 2876374 in 1991 and according to census of 2011 the population of Surat city is 4466826, thus in 1 decade the population has raise to almost 1.7 per cent. So as the population has increases the amount of water required to people has also increase. The source of water is only rain and underground water and the rain water is stored in river for use on season other than monsoon, on river Tapti also the Ukai dam has been build to serve the people of Surat. But as the population is increasing rapidly it is required to conserve water and use is judiciously without wasting it. So water audit is one of the step by which we can know the loss of water, unaccountant for water etc.

The main aim for is to find the amount of water used by the people and the quality of water in city. If the amount of water used is excesses than the prescribed amount or the standard amount than the steps can be taken to optimize use of water also if the quality of water is degraded the steps should be taken to treat water properly before supply to people.

2. Literature

As the population is increasing the need of water also increases. Every city has its own water supply in which the water is taken from the source, treated to the

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desire quality and then transfer to the people by the pipes buried in the ground. In this process there is water loss. So water audit is one of technique in which the water loss used is known from the total water and from that the loss in water is known. For water audit it is necessary to know the pipe fitted for the transmission of water. The data from the inflow and the outflow is known and the loss is calculated. The worksheet is made in which the data are entered and the data are compiled in the software from which the water loss is known. The map of the city should be prepared to know the position of pipe. When the losses are detected the steps should be taken to reduce those losses. The water loss due to leakage in pipes is known as apparent loss. The loss due to unaccountant water, inaccuracy in metering is termed as real loss. After knowing all losses and amount of loss the steps should be taken considering the long-term and short-term plan according to the financial condition. As in finance the transaction of money is accounted, similarly water audit is to calculate the flow of water used from the treatment plant to people. (AWWA et al, 2016)

Water audit helps us to know the leakage in the supply; the water used by unauthorized users, theft etc. thus helps to take rectification steps for the faults. It also helps to know the present situation and can help to create efficient performance, reliability, economic benefit and pure and safe water in near future. For the water audit it is necessary to know the total water taken from the source, the water outflow from treatment plant, the water loss in distributaries from water treatment plant to the water storage, loss in pumping from storage, loss in pipe in distribution system to reach the domestic, water used in homes and out from the sewerage. Government spends lots of money for the water treatment to bring to safe and drinkable standard, so it is not acceptable for water loss after spending so much of money. So for domestic water audit, it is necessary to know how much amount of water is transmitted and from that how much amount of water is used. The unwanted and excess use can be determined. The water supplied to the rural areas is 70 lpcd, in urban areas 135 lpcd and areas of population more than 1 million the water supply is 150 lpcd. The water is more wasted in urban areas than rural areas. The quality of water should be determined regularly so according to it the treatment plant can be designed. Also the period is chosen, it is mostly of one year so that all the season are covered. The spreadsheet or comfortable sheet should be prepared in which all the data are recorded. The present pattern of supply should be known so effective work can be done and future plans can be made. It is necessary to know how much water is lost, in which area it is more affected, the way to reduce this water loss, economy to rectify this loss and the time period to reduce this loss. The leakage detection program should be undertaken before the small leakage becomes large. Also the steps to reduce the leakage losses and unwanted use should be determined. (Ministry of water resource, GOI et al 2005).

3. Water audit in Surat city

Water audit is the account for the use of water that is supplied to the domestic. For that the water input is needed to be known and the outflow of water is needed to be known also the quality of water is needed to be known. For this the period is to be decided for how many days it should be undertaken. As in different season the use of water is different. As in rainy season, the water for gardening, cooling etc. is not required, in winter the use of water is less as it is little used in drinking etc. purposes, while in summer the water use is maximum. For whole city it is difficult to check the water usage in each and every house. So the sample houses are selected in which the readings for the water audit are undertaken. In city there are all kinds of house such as building, bungalow, etc. so accordingly the selection should be done.

A person knows more about his house than anywhere else, so here the house of the person working on this project is considered and also these houses are of different type.

*Study area 1:*Raman Park apartment, Nirmala park society, Katargam Surat

Study area 2: Lekhadiya Sheri, Saiyedpura , Surat

Study area 3: Behind Gabani Kidney Hospital, station to Laldarwaja, Surat

Study area 4: Rajdeep Society, Ved Road, Surat.

Study area 5: Abhinav flats, honey park road, adajan, Surat.

The data are taken for the above study area, in which study area 1, 3 and 5 are multi-storey building and the study area 2 and 4 are bungalow type. The 10 days reading were taken continuously from 29th August 2016 to 7th October 2016; this period is rainy season in India. The average readings were as follows:

Study areas	Average lpcd of 1 day
1	152.0
2	155.0
3	147.0
4	139.0
5	139.4
Average of all	146.5

Here the water supply is by the house connection underground pipes and outflow is through the sewerage pipes. The water comes at every area for two hours per day. The time of water coming from SMC varies from area to area it can be morning from 8:00-10:00 or night 8:00-10:00 decided by the SMC. The water supplied by house connection by SMC is 135 lpcd. But from the above data we get that the water use is more in all the study area. In study area 1 the water used is 17 liter more than the supplied. Similarly in all other study ares like in 2,3,4and 5 it is 12,4,4.4 and 11.5 respectively.. From the above data the water used for the Surat city is judge and calculated and it is as follows.

Water Volume Into the System (100 %) 980 MLD	Volume to costumer (60 %) 608 MLD	Billed water and Service (57 %) 559 MLD	Metered water (15 %)146 MLD	Revenue water (57 %)559 MLD	
			Unmetered water (74 %)413		
		Unbilled water and service (5 %) 49 MLD	Metered But free (5 %)49 MLD	Non-revenue water (43 %) 421 MLD	
			Unmetered but free (0 %)0 MLD		
	Loss water (40 %) 372 MLD	Losses to customer (14 %) 136 MLD	Stolen water (14 %)136 MLD		
			Unmetering and Unbilling (0 %)0 MLD		
	Losses out of system (24 %) 236 MLD		Leakage from reservoir (5 %)49 MLD		
			Leakage on trunk pipes (10 %)93 MLD		
Leakage in branch pipes (10 %)94 MLD					

As we can see the above table only the 57% of water is billed and from that only 15% of water is metered water. In Surat, only 15% houses have water-meters, other houses only pay the water tax according to the decided tax. The other leakage and other calculation are as above table. Here we are concern with domestic use of water, from the table 1, we can see that the water use in house is greater than 135 lpcd, which is much greater than standard; this is not acceptable as government spends lots of money on treatment of water and there is haphazard use of water in city.

1.2 On analysis it has been observed the reasons for water loss.

1. The people keep the water tape on continuously while bathing, brushing, washing clothes and utensils, gardening etc.
2. For drinking people take more amount of water then required and then through the extra amount of water. Also similar happens while booming and cleaning house.
3. For hot water, there is only one tape for hot and cold water so the people switch to hot water and allow the cool water to flow off till the hot water comes.
4. The people switched on the pump for the water to reach in tanks and move away and when the water overflows from the tank it is wasted and the person come at his adjustable time and switches off, till than much of water is wasted.
5. When there is hot the people sprinkle the amount of water on road and terrace to make the atmosphere cool.
6. Due to leakage in pipes and poor plumbing system.

From above it is seen that the main reason is due to lack of awareness to use water judiciously. The people do not pay for the water they use, so they do not value water.

3.2 The following steps can be taken for conservative use of water.

1. Through bulk metering, water meter should be installed at each and every home so that people

value water and so not use it haphazardly. As water is the basic need of human, the people should not be charged so much for water as the poor can't pay for water so only nominal charges should be kept such that people have value of water and use it judiciously.

2. The PI program should be undertaken by the government for accuracy and real time data.
3. The awareness should be spread among people through different mediums for conservation of water, so they use and take the water as per required and do not use water wastefully.
4. The rain water harvesting should be done so that rain water is not flowed off and it can be used. Also the water used in house should be filtered and reused for that the method given in US 0595132 patent should be used.
5. The sprinkle type method should be adopted for gardening.
6. For quick hot water in tape the method given in patent no. US 08359053 should be installed.
7. The leakage in the house should be repaired before it becomes larger leakage through leakage detection program, so the water is not wasted. Also the tap installed should be such that they not leak and it is also able to close properly.

Conclusions

From the water audit, the metered water, unmetered water, theft water, unaccount water, leakage etc. is known. The quality of water supply is also known. Through analysis of water use during water audit the water use in domestic is known and from that where the wasteful and excess use of water is present is found. Steps can be taken to optimize water loss is studied and from that it is found that water meter in every home is invariable and it is required to increase the awareness among the people for conservative use of water. Thus, water audit is one of the effective steps for the account of water use from the water distributed and through it the effective steps can be taken to conserve water and use it judiciously.

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