A Detailed Water Audit: Case Study of Priyadarshini College of Engineering Campus, Nagpur

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Abstract- Water is used in practically every industry, and as the population and standard of living rise, so does demand. All the world's living things depend on water, but only a relatively limited amount of it is accessible for drinking and other uses. Humans are misusing this useable water that is readily available, and water audit is a method that has been introduced to combat this misusing of water. Reduce water losses and leaks by conducting a water audit, which also provides information on customer water use. Water audits are also performed in phases and include numerous stages. Case studies are highlighted in this to show the overall auditing technique. The study shows that the industry benefits from a systematic approach to water audit.

1. INTRODUCTION

Almost everything we do or do every day involves water. India will soon experience water stress, thus as the year goes on, we must all fight to ensure our water security. To save water and use it effectively, a straightforward action can be taken. The study was focused on the long-standing issue of water scarcity. In order to reduce water usage and frequently save money, water auditing quantifies water flows and quantity in simple or complicated systems. We discovered that water was being consumed After conducting a water audit, it was discovered that losses were higher than they ought to be. Reduced water losses, improved financial results, increased supply system dependability, improved knowledge of the distribution, and effective utilisation of current supplies are the results of this. The amount of water lost from the water network or distribution system as a result of seepage, evaporation, leakage, and other factors like theft, unauthorised, or illegal withdrawals from the systems are quantified by a water audit. A method called a "water audit" is used to discover instances of public money being wasted as a result of water loss and unauthorised connections being preferred to the efficient use of water resources while protecting the environment. Enhances knowledge and documentation through water audit of the distribution system, and better understanding of what is happening to the water after it leaves the source point. It helps in correct diagnosis of the problems faced in order to suggest optimum solutions.

2. IMPORTANCE OF WATER AUDIT

Leakage accounts for a fraction of the total water consumption, as do erroneous metres, possible unauthorised use, and water distributed to customers. A water audit shows where the water is going and how much of it got there. Depending on the information that the system has access to, the water audit's level of detail may change. For a variety of causes, all water systems experience some water loss. The volume of water lost is not well-documented by data. Customers and the system both bear financial responsibility for water loss. Water loss cannot be eliminated by utilities. Since some water loss is inevitable, it is not cost-effective to make every drop that escapes your system disappear. However, a water audit can help manage most of the loss that happens in water systems. Like running any other business, operating a water utility is simple. India has 2.4 percent of the world's land, 4 percent of the world's water resources, and 16 percent of the world's people, respectively. On average, 50% of the rain falls in less than 100 hours and within 15 days, and this water is consumed for 365 days. India currently has 1820 m3 of water per person available year, down from 6000 m3 in 1947. Given the current situation, doing a water audit is an action that must be done both in India and globally. As a result, it serves as a tool for identifying instances of public money being wasted owing to water loss and unauthorised connections being preferred to the efficient use of water resources while protecting the environment.

3. OBJECTIVES OF WATER AUDIT

Finding physical losses from pipe leaks and overflows, losses from metering errors, unauthorised connections, and free water supplies provided by the municipal authorities for public stand posts and parking lots are the goals of a water audit.

4. ADVANTAGES OF WATER-AUDIT

- Water audits give utility managers, directors, and operators options for making decisions. To put it another way, knowing where water is used in your system enables you to deploy resources wisely, including time, labour, and money.
- Managers can effectively cut down on water losses in the system by using water audits.
- By reducing the amount of water utilised near the source, capital investments like a new well, more advanced treatment methods, or extra water rights may even be postponed or avoided.
- Water audits also show which uses of water generate income for the company and which do not. As a result, System staff can boost income by ensuring that all appropriate uses are precisely tracked and billed. This increases the water system's financial capacity, lowers the cost per customer, and improves water resource management.
- Raising awareness among water consumers so that they are aware of the proactive measures the utility is taking to reduce wasted water and make savings for the future.

5. METHODOLOGY OF WATER AUDIT

- Authorised Use and Water Losses are two other categories that apply to this amount of water. Authorised Use + Water Losses = System Input, so to speak. The typical water balance's full vertical height of water is consistent.

5.1. Following identify important relationships just by glancing at the standard water balance:

- Water Losses = Apparent Losses + Real Losses.
- Apparent Losses = Metering Inaccuracies + Unauthorized Use.

5.2. By following five step process outlined below will able to complete these equations,

- Source Evaluation.
- Evaluation of Apparent Losses.
- Evaluation of Real Losses.
- Performance Measurement.

1. source evaluation:

Determining System Input is the first step in completing the conventional water balance. There are numerous sources that can be included in the System Input category. Multiple wells, springs, or bodies of surface water may belong to a system. Intakes. Even though it is only one category, this phase is crucial since the amount of water input needs to be balanced. Keep in mind that outputs and inputs must match in any form of balancing. All subsequent calculations you make will be incorrect if this amount is incorrect. figured out through metering at the source. These meters are frequently referred to as master meters. All water systems place a great deal of importance on master meter readings. The only trustworthy way to know how much water the system is consuming overall is to take an accurate master meter reading; this can be done by looking at installation dates, warranties, maintenance history, or verbal conversations with system staff. The system's compliance with water rights laws, statutory fees (such as the water conservation fee), and payments for any water acquired from other systems are all impacted by these readings. Compared to customer meters, master meters are bigger and more expensive.

2. Evaluate apparent loss:

The components of water losses fall into two categories: apparent losses and real losses. Initially, the definitions of these two terminologies, which are as follows, can be confused. Inaccuracies in water flow monitoring, mistakes in water accounting, and unauthorized use are all examples of apparent water losses. Real Losses, which include leaks and overflows before the point of end use, are the actual physical escape of water from the distribution system. Water that is delivered to an end user, even unauthorized usage, but is not properly metered or recorded, is another way to think about apparent losses. Affirmative losses are sometimes referred to as "paper losses" since they include water that was improperly recorded on paper. Real losses are less expensive for the system than apparent losses. The utility's consumers pay the cost of apparent losses at that rate. Real losses are incurred when the water is produced and pumped through the distribution system. The water audit thus enables comprehension of the actual picture of water losses in the water system.

3. Evaluation of real losses:

Real Losses, which include leaks and overflows before the point of end use, are the actual physical escape of water from the distribution system. A bigger amount of water wasted by Water Audit- A Tool for Assessment is typically due to real losses...

In comparison to apparent losses, utilities. Real water loss has a marginal cost that is based on the cost of production, which includes the costs of extraction, treatment, distribution, operations, and maintenance. The first category of Real Losses is Leakage on Mains. Any actual loss of water in the distribution system—as opposed to storages or service connections—is referred to as a leakage on mains. People who are not familiar with the conventional water balance frequently confuse this category with "water loss" or "unaccounted-for water". On-mains leakage will change over time. Maintaining accurate records of leak locations, repairs, and predicted losses is crucial. The time required to conduct a leak detection survey is greatly influenced by the information you have at your disposal, such as system maps, a list of the pipes and fittings, and a history of repairs. Make sure the data you are paying for will satisfy the requirements of the water audit.

Point	Losses	Pumping (Hrs.)	Total Looses
A	$0.01m^3/hr$	4	14600 litres/year
B	$0.019m^3/hr$	4	27,740 litres/year
			= 42340 litres/year

4. Performance measurement:

Sr. No.	Name of Building	RCC Tank/Syntax	Drinking Water Tank
1)	Mechanical Building	49126 lit	8000 lit
2)	MBA Building	5865 lit	3910 lit
3)	Electrical Building	5865 lit	3910 lit
4)	Aeronautical Building	28315 lit	NA
5)	AI&DS, IoT, Robo	36674 lit	NA
6)	IT Building	14430 lit	6000 lit
7)	Civil Building	28101 lit	8000 lit
	TOTAL Water	216267 lit	32000 lit

6. CONCLUSION

From the Reading we find that, the first three points i.e., Points called A, B, C, F & H has no losses.

But Points called D&G has major losses of 0.01 m3/hr,0.019 m3/hr & 0.019 m3/hr respectively. As we think these numbers are very small but can affect the water demand very heavily.

Losses for points: -

Point D: - The meaning of $0.01m^3/hr$ of discharge is about 10 litres of water is loss in every hour. As we calculated that the average pumping time of pump is 4 hrs., which means 40 litres of water is get loss in a day. And for a year it is approximately about

= 365 x 40

= 14,600 litres/year.

Pont G: - The meaning of $0.019m^3/hr$ of discharge is about 19 litres of water is loss in every hour. As we calculated that the average pumping time of pump is 4 hrs., which means 76 litres of water is get loss in a day. And for a year it is approximately about

= 365 x 76

= 27,740 litres/year.

Point	Losses	Pumping (Hrs.)	Total Looses
D	$0.01m^3/hr$	4	14600 litres/year
G	$0.019m^3/hr$	4	27,740 litres/year
			= 42340 litres/year

On an Average over 42340 litres of water is loss in a year. This loss is for only one pumping time. From the Pump Operator we came to know that he switches on the pump 2-3 times a day, So the numbers are very huge and worrying.

Coming towards the leakages of taps, there are 25 numbers are taps which are leak out of 649 taps from overall college. This means almost 4% of taps are leak in overall college.

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