Water Distribution & Conservation

Audit Report, 2019-20

Shri Ram College

Muzaffarnagar

Shri Ram Colleges, Muzaffarnagar

Water Distribution & Conservation Audit Committee

External Auditors

S.No.	Name	Department/Dept
1.	Er. S K Kulshreshtha	(Rtd) Xen, Jal Nigam, Bareilly
2.	Er. Arjun Singh	Head, Deptt of Civil Engg, SRGC
3.	Er. Sangeet Grover	Managing Partner, SRT

Internal Auditors

S.No.	Name	Department/Dept
1.	Dr Rishabh Bhardwaj	Head, Deptt of Chemistry, SRC
2.	Dr Bushra Aquil	Head, Deptt of Agriculture, SRC
3.	Mr Pranjul Kulshreshtha	Manager, Maintenance, SRC

Water Distribution & Conservation Audit

at

Shri Ram College, Muzaffarnagar

Certificate of Audit

Certified that we have conducted water Distribution & Conservation Audit in premises of Shri Ram College, Muzaffarnagar from 2nd April 2020 to 25th April 2020. The college is executing the best practices of water management and its saving.

It may further conserve the water resources for which the audit team has prescribed certain suggestions.

Dated: 30 April 2020
Place : Muzaffarnagar

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Retd. Xen, Jal Nigam
Bareilly

(Er. Arjun Singh)
Head,Deptt of Civil Engg
Shri Ram Group of Colleges,
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Water Distribution & Conservation Audit

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Water Distribution & Conservation Audit

Preface

Water is a precious natural national resource which is becoming increase day by day. With continuous growth in country's population, per capita availability of utilizable water is going down, whereas with ever-rising standard of living of people, all around rapid industrialization and urbanization, demand of fresh water is going up continuously. Unabated discharge of industrial effluents into water bodies is further aggravating the situation of scarcity of water of acceptable quality. Inspite of the fact that fresh water is rapidly becoming scarce it is continued to be used wastefully.

At the global level, about 60-70 percent of total annual water consumption is in irrigation sector. In India water use for irrigation is about 83 percent of current level of total water utilization. Thus apparently there is ample scope of water saving in irrigation sector. Similar is the case with drinkable water resources.

Water audit is an effective management tool for minimizing losses, optimizing various uses and thus enabling considerable conservation of water not in irrigation sector alone but in other sectors of water use such as domestic, power and industrial as well.

In educational institution like Shri Ram College which is extending over several acres land with lawns, gadens, grooves, green houses and farming besides drinking, toilet water, floor cleaning for more than 3500 students auding of water consumption becomes imperative. I hope "General Guidelines for Water Audit & Water Conservation" brought out by the **Shri Ram College, Muzaffarnagar** will serve as a useful reference for undertaking water saving measures in all sectors of water use and facilitate State Governments to formulate their own region-specific, project-specific, system-specific or service-specific guidelines.

I sincerely acknowledge the contribution of Er S K Kulshreshtha for leading the team, Er Arjun Singh for coordination and Er Sangeet Grover for auding equipments and technologies. The efforts of the entire team has been commendable and appreciable.

(Dr Aditya Gautam)
Principal

Water Distribution & Conservation Audit

INTRODUCTION

Availability of natural resources, particularly land and water, for people of India is inequitable at global level. Presently, with 2.4 per cent of land and 4 per cent of water resources, India has to support 16 per cent of world's population and 15 per cent of livestock.

India gets an average precipitation of 4000 billion cubic meters (BCM) per annum. Precipitation is highly unevenly distributed with respect to time and space, over the country. As much as 75% of total average annual precipitation occurs in 4 months of monsoon period. Even during the monsoon months, about 50% of total annual rainfall takes place only in 15 days and in less than 100 hrs. As far as spatial unevenness is concerned, the average rainfall in Meghalaya is 10900 mm, whereas, in Rajasthan it is as low as 100 mm against the national average annual rainfall of 1100 mm. On the other hand demand for fresh water is increasing with every passing day. It is not only due to rapid population growth alone, but also on account of many other factors such as rise in per capita water demand arising out of continuous upward movement of living standards, increased reliance on irrigated agriculture, massive urbanization and industrialization etc.

As per the present indication, population of the country may stabilize by the year 2050 at around 1.6 billion. The available utilizable water resource of the country is considered insufficient to meet all future needs. Under such a situation, in order to face the challenge of water deficit, apart from accelerating pace of development of available utilizable water resources, all out efforts, on the part of people from every walk of life, would need to be made to conserve every drop of water and improve efficiency in all areas of water use.

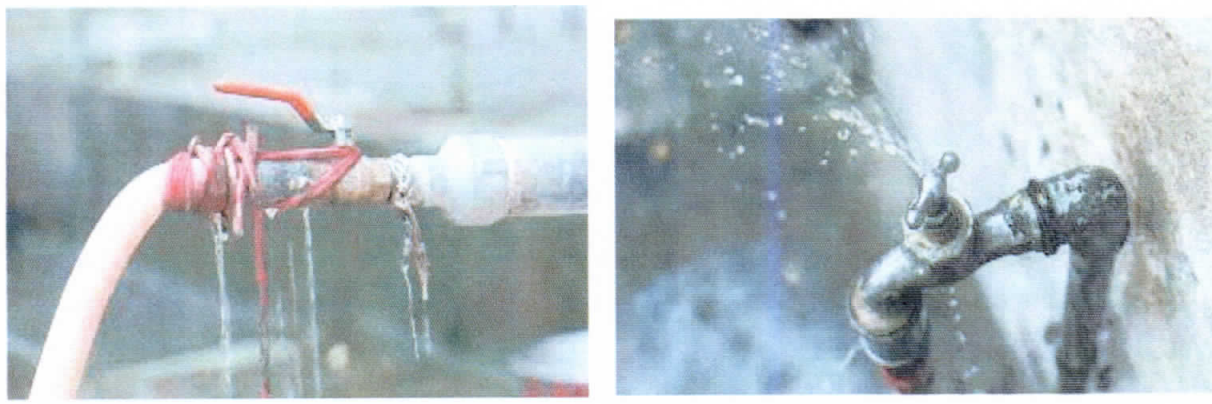
With a view to improving performance of irrigation projects and to increase productivity per drop of water, "Performance Evaluation Studies of Irrigation Projects" have been taken up in the country since the seventies. Central Water Commission started such exercise since the 8th plan period. So far (till the end of Ninth Five Year Plan) performance evaluation studies of 110 major and medium irrigation projects from various regions / states of the country have been successfully accomplished by the Central Water Commission (CWC), State Governments, Central Board of Irrigation and Power (CBIP) and Ministry of Water Resources (MOWR), Govt. of India. Ten irrigation projects have been identified for undertaking post project evaluation studies in the tenth five year plan by Central Water Commission. Besides performance evaluation of irrigation projects, benchmarking of irrigation systems has also been taken up since 2002. Benchmarking may provide an effective 2

tool for measurement of relative performance of irrigation projects and suggest ameliorative measures for performance improvement.

1.1) Water Audit

Water audit determines the amount of water lost from a distribution system due to leakage and other reasons such as theft, unauthorized or illegal withdrawals from the systems and the cost of such losses to the utility. Comprehensive water audit gives a detailed profile of the distribution system and water users, thereby facilitating easier and effective management of the resources with improved reliability. It helps in correct diagnosis of the problems faced in order to suggest optimum solutions. It is also an effective tool for realistic understanding and assessment of the present performance level and efficiency of the service and the adaptability of the system for future expansion & rectification of faults during modernization.

Elements of water audit include a record of the amount of water produced (total water supply), water delivered to metered users, water delivered to unmetered users, water loss and suggested measures to address water loss (through leakages and other unaccounted for water losses).



Water leakage, wastages and unaccounted of water losses

1.1.1) Benefits of Water Audit

Water audit improves the knowledge and documentation of the distribution system, problem and risk areas and a better understanding of what is happening to the water after it leaves the source point. Leak detection programs help in minimizing leakages and tackling small problems before they become major ones. These programs lead to

(a) reduced water losses,

(b) improved financial performance,

(c) improved reliability of supply system,

(d) enhanced knowledge of the distribution system,

(e) efficient use of existing supplies,

(f) better safeguard to public health and property,

(g) improved public relations,

(h) reduced legal liability, and

(i) reduced disruption, thereby improving level of service to customers

2) Water for irrigation technology purpose

2.1 Water Demand

In irrigation sector, water demand is region specific depending upon the type of soil, cropping pattern/practices, climatic condition, etc. Irrigation water demand also depends upon the type of infrastructure, conveyance system, water application technique etc. **In Shri Ram College** uses a drip, sprinkles and fogging technology in Gardens and Loan. Among various methods available for working out irrigation water demand, Modified Penman Method is considered the most suitable and is recommended for assessing crop water demand.

2.2 Irrigation Efficiencies

2.2.1 Field Application Efficiency

On application of water to fields, a part of it gets evaporated, another part goes as losses (run off, percolation loss, etc) and the remaining is used by the crops to meet evapotranspiration needs. Actual quantity of irrigation water required to be released at field head is called Field Irrigation Requirement (FIR). Field application efficiency (Ef) takes into consideration above losses in application of irrigation water and may be defined as ratio of Net Irrigation Requirement (NIR) over Field Irrigation Requirement (FIR) i.e. Ef =NIR/FIR

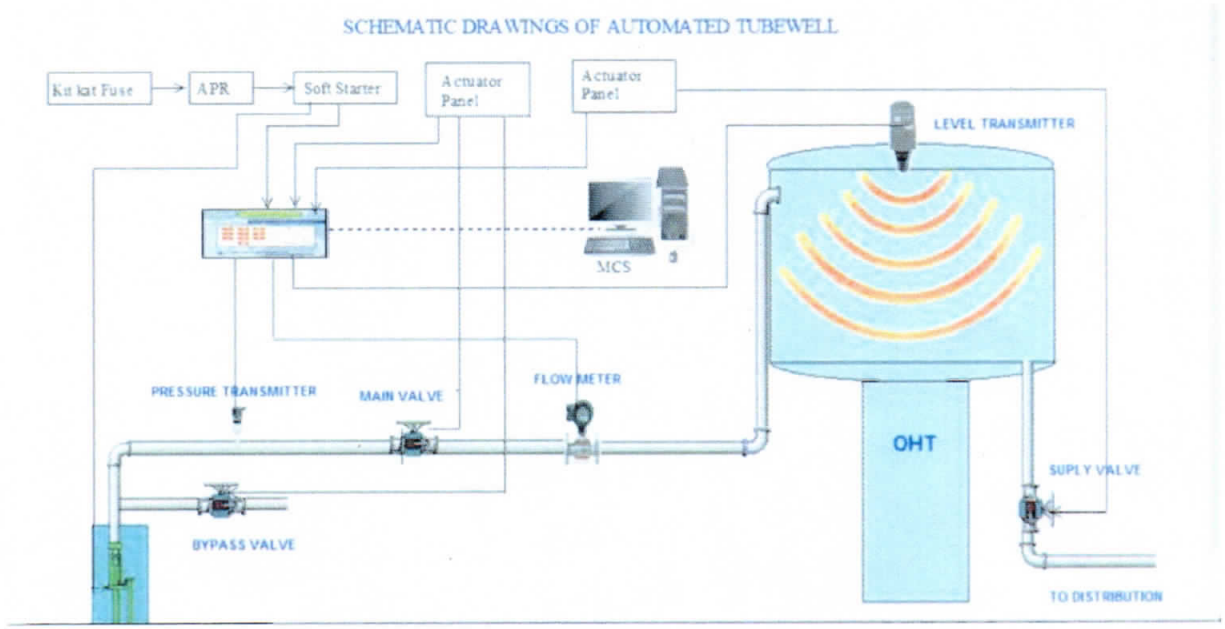
Scada Based Water Flow Control Panel

2.2.2 Pump Safety / Preventer

Today overvoltage, over current, overload, over temperature, and under voltage are the most commonly occurred problems in protection circuits of induction motor. We usually design Protection circuits with components such as timers, contactors and current relays. In order to reduce the mechanical components usage we prefer to use Personal Computer (PC) and REAL TERMINAL UNIT (RTU). In this method Induction motors current, voltage, Speed, temperature values and fault occurred history are monitored in PC with an Alarm Message during fault occurrence. **Shri Ram College** using RTU-based protection methods are costs less, provides higher accuracy with safe mode of operation when compared with the other protection systems.

Objective

- Far superior repeatability.
- To reduced machine downtime.
- To reduced fault and increased accuracy
- Producing good quality product.
- To increase industrial profit
- Operating time is reduced.
- To increasing the production rate.



2.2.3 Drip Irrigation in Flower Beds

Drip irrigation is sometimes called trickle irrigation and involves dripping water onto the soil at very low rates (2-20 liters/hour) from a system of small diameter plastic pipes fitted with outlets called emitters or drippers. Water is applied close to plants so that only part of the soil in which the roots grow is wetted, unlike surface and sprinkler irrigation, which involves wetting the whole soil profile. With drip irrigation water, applications are more frequent (usually every 1-3 days) than with other methods and this provides a very favourable high moisture level in the soil in which plants can flourish.

Drip Irrigation in Flower Beds

Mister Irrigation in Rose Beds

2.2.4 Mister for Rose Beds

For Rose Cultivation Showers of Water should not exceed the height of plants. It is because if water drops on petals of flowers will be decomposed. Therefore, misters with height of 45 cms are provided with mister. The mister takes encircling showers to provide water all around the plant. This method saves water also.

2.2.5 Sprinklers in Green House

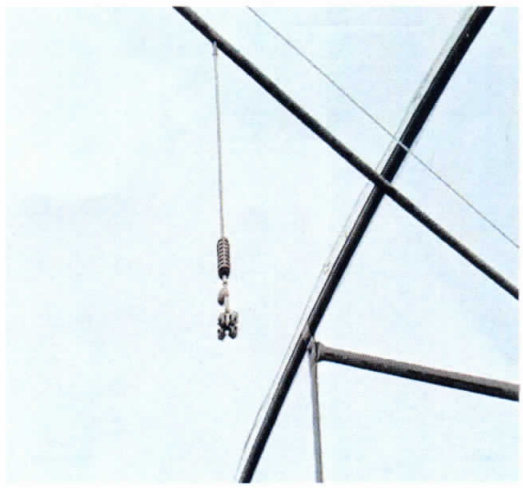
Sprinkler irrigation systems apply irrigation water to the plants. In some greenhouse and shade structures, plumbing is mounted overhead. Overhead installation does have the advantage that the plumbing is protected from mechanical damage by vehicles and persons. Installations can also have supply lines buried in the soil below the crop or mounted to the infrastructure. Movable sprinkler systems are also in use in various parts. Crops for which it is undesirable to wet the foliage (e.g., some ornamental crops) can be irrigated with micro sprinklers to the base of the plants. One positive feature of sprinkler irrigation from above is that it supplies water to most of the top of the root zone with relatively low investment and low maintenance costs. Each sprinkler head type has a particular circular water distribution pattern; multiple sprinkler heads with short distances between emitters can be used to create a more uniform distribution pattern, but inherently sprinkler systems have uneven water distribution. For some crops, wetting of the foliage introduces a higher risk of plant disease development.

Sprinklers in Green House

2.2.6 Foggers for Protected Cultivation

Micro irrigation system is the best for watering plants in a Polyhouse. Micro sprinklers or drip irrigation equipments can be used. Basically the watering system should ensure that water does not fall on the leaves or flowers as it leads to disease and scorching problems. In micro sprinkler system,

water under high pressure is forced through nozzles arranged on a supporting stand at about 1 feet height. This facilitates watering at the base level of the plants.



Fogging Mist in Green House

Problem Definition

Protection of a press machine against possible problems, such as

1) Over current,

2) Overload

3) Over temperature

4) Over voltage

• Occurring in the course of its operation is very important.

• IMs can be protected using some components, such as timers, contactors, voltage and current relay

2.2.7 Filters and Vanchury for centralized water distribution

Irrigation water used for growing vegetables in urban areas in many low-income countries is contaminated with untreated wastewater. Many wastewater treatment methods are economically prohibitive and continued use of such irrigation water pose health risks for vegetable consumers and farmers. As part of a larger study on possible interventions for health risk reduction, the potential of simple interventions was explored. Column slow sand filters with three levels of sand depths (0.5 m, 0.75 m and 1 m) and fabric filters made of nylon, cotton and netting were assessed. More than 600 water samples were analyzed for helminth eggs and thermotolerant coliforms. Flow rates were also measured. From slow sand filters, 71-96% of helminths and 2 log units (from 7 to 5 log units) of thermotolerant coliforms were removed. Sand depths had no significant influence in the removal.

Lower removal rates were achieved by fabric filters, with an average removal of 12-62% for helminth eggs and 1 log unit for thermotolerant coliforms. Nylon filters had higher removal rates especially for helminth eggs (58%). Average flow rates for sand filters were 3 m per day and fabric filters had steady flows of about 1.5 liters per second, but flow reduced with time in cotton filters. The simple filters tested improved the microbial quality of irrigation water and could easily be used in combination with other interventions to further reduce health risks. The unit cost of the filters tested also appear acceptable to farmers and some incentives like better prices will motivate many farmers to invest in such simple interventions.

Filters and vanchury for centralized water Distribution

3. Water for Domestic Purpose

Domestic water is a basic need for human as well as livestock. The main objective of domestic water supply system is to provide safe and clean water in adequate quantity at reasonable cost. For sustainability, the planning may be required at national level as a whole for policies and subsequently at state or region or at community levels. Lot of waste water is generated specially in urban areas. It is estimated that return flow from urban and rural uses is about 50% of supplies and pollute the very fresh water resources. It is expected that 85 percent of the return flow would go the surface water source and balance 15 percent to ground water source. There are considerable losses in the distribution system on account of leakages due to networks being old and poor maintenance in addition to lack of efforts towards conservation.

3.1 Per Capita Water Requirement

The quantity of water required for domestic purposes depends mainly on habits, social status, climatic conditions and customs of the people. The per capita water requirement in urban areas is more than

that in the rural areas. As per yardstick of the Union Ministry of Urban Development & Poverty Alleviation, water requirement for domestic purposes in urban areas is 40 liters per capita per day (lpcd) in case of supply through public stand posts and 70 lpcd in the case of supply through house service connections, where no sewerage system is existing or 8 contemplated. Where sewerage system is existing or contemplated, water supply would be 135 lpcd in the urban areas. In the case of metropolitan cities having population of more than 1 million, the domestic water supply would be 150 lpcd. Over and above the aforesaid demand, 15% losses may be allowed for determining the quantity of raw water required.

3.2 Water Audit

In domestic water supply, water audit is considered very important, since treatment of water to bring it to drinking water standard costs a lot of money to the supplier. Water audit helps in determining the amount of water lost from a distribution system due to leakages etc. Water audit compares the amount of water supplied with the amount billed and accounts for the water loss.

3.2.1 Water Measurement

For the purpose of water audit, bulk metering system should be devised zone-wise, including group-consumer-wise in a system or a subsystem. This will facilitate identification of the reaches where actually the wastage of water is taking place. One can determine average daily water use by using one of the following two methods.

(a) Metered Water: In the case of metered water use, per capita per day consumption is to be obtained by dividing water usage by the number of days in the billing period and also by the number of residents of household.

(b) Unmetered Water: If water use is not metered, one must determine water use for each fixture. Flow rates for showers and faucets can be determined by using a container and stop watch to measure the amount of water discharged through the fittings in a minute. Toilet use per flush can be approximated by the capacity of the flushing tank.

3.3 Water Losses and Follow up

There are two types of losses, real and apparent losses. Real loss includes water lost through leakages in distribution systems, service connections, and storage tanks (including overflow). Apparent loss includes meter and record inaccuracies and unauthorized water uses such as theft and

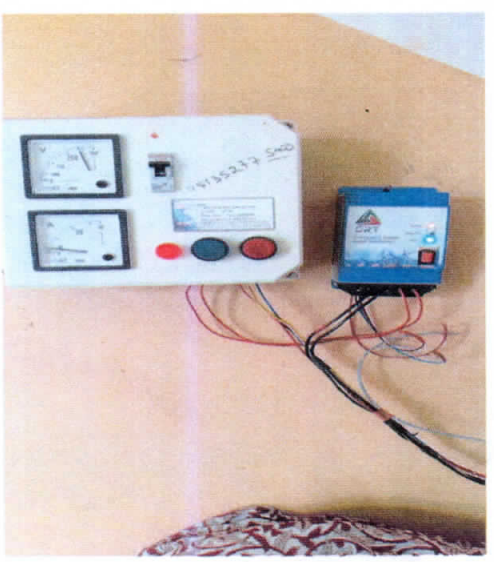
unauthorized connections. Unauthorized/Unmetered uses can be considered a special type of water loss and they can also represent lost revenue and therefore they should be estimated carefully.

4. Action Plan for Water Conservation in SRGC

4.1 water level controller to avoid over flow

Water is very precious for the living beings and scarcity of the same is gradually increasing. Most of the cities in the county and that of the world are facing this problem. This is one of the motivations for the current work and to deploy techniques in order to save water and help the environment which in turn ensures water for the future. Hence, it is of utmost importance to preserve and save water. In many houses there exists unnecessary wastage of water due to overflow from overhead tanks etc. Automatic Water Level Controller can provide a solution to this problem. Present work does not use any microcontrollers etc. The operation of water level controller is based on the fact that water conducts electricity. As the water level rises or fall the sensing probes and circuits of the controller detect the same. These signals are used to switch ON or switch OFF the pump motor as per requirements. This system is used to automate the process of water pumping to over-head tank storage and has the facility to select the level of water to pump. This system is running in **Shri Ram College Muzaffarnagar** preventing water and electricity on every motor.

Automatic Pump Controller



Automatic Water Level Controller

4.2 Rainwater harvesting

Rainwater harvesting (RWH) is **the collection and storage of rain**, rather than allowing it to run off. Rainwater is collected from a roof-like surface and redirected to a tank, cistern, deep pit (well, shaft, or borehole), aquifer, or a reservoir with percolation, so that it seeps down and restores the ground water. **Shri Ram College** is very conscious to conserve the water. We use every technology to save the water.

Water Storing In Tank

Level Measuring In Reservoir

4.3 Ground Water Protection

Ground water resources are getting polluted at an alarming pace due to lack of proper wastewater and sewerage disposal system in urban areas. The application of excessive fertilizers in agriculture sector and disposal of hazardous effluents from the industries are putting great strain on availability of fresh water. **Shri Ram College** brings a technology of Japan to protect ground water and to reuse the waste water.

Recycle The Waste Water

Water Treatment Plant

4.4 Uses of Drip, Sprinklers and Foggers in Garden and Loans

Important action points towards water conservation in the irrigation sector are as follows:

1. Performance improvement of irrigation system and water utilization;
2. Proper and timely system maintenance;
3. Rehabilitation and restoration of damaged /and silted canal systems to enable them to carry designed discharge;
4. Selective lining of canal and distribution systems, on technoeconomic consideration, to reduce seepage losses;
5. Restoration / provision of appropriate control structures in the canal system with efficient and reliable mechanism;
6. Conjunctive use of surface and ground water to be resorted to, specially in the areas where there is threat to water logging;
7. Adopting drip and sprinkler systems of irrigation for crops, where such systems are suitable;
8. Adopting low cost innovative water saving technology;
9. Renovation and modernization of existing irrigation systems;
10. Preparation of a realistic and scientific system operation plan keeping in view the availability of water and crop water requirements;
11. Execution of operation plan with reliable and adequate water measuring structures.
12. Revision of cropping pattern in the event of change in water availability;
13. Utilisation of return flow of irrigation water through appropriate planning;
14. Imparting trainings to farmers about consequences of using excess water for irrigation;
15. Rationalization of water rate to make the system self-sustainable;
16. Formation of Water Users Associations and transfer of management to them;
17. Promoting multiple use of water;
18. Introducing night irrigation practice to minimize evaporation loss;

19. Assuring timely and optimum irrigation for minimizing water loss and water-logging;

Sprinklers & Foggers

4.5 Uses of Sensors Operative automatic taps in SRC

Sensor taps save much more water than regular taps. Sensor taps provide the minimal levels of water consumption because they switch off automatically, like when you are soaping or foaming your hands. Hence this can lead to a cut down of water wastage by up to 70%.

Sensor Based Automatic Water Tap

5. PROFIT – LOSS ACCOUNT OF WATER

It is observed that the college authorities, management, staff and students are quite conscious in using water resources. The management has provided all advance irrigation means like drip, foggers, sprinkles and misters to save as high as 66 percent of water with comparison to open field irrigation. Similarly, a pipe line network for all lawns and gardens is provided instead of open ditches, this is saving as much as 42 percent of water. In toilets low capacity cisterns are provided with

pressure discharge mechanism to save 39 percent of water. Similarly, sucking pumps were provided for floor cleaning instead of washing the floors.

Water is being recycle for rough uses in kitchen to save 28 percent water. At all important places wash hand basins are provided with sensor driven automatic taps to save 24 percent water.

It is observed that very good practices are followed to save the water. The overall figure of saving comes to 34.86 percent.

Typical Use of Water and its saving

1.	Drinking water	24 %
2.	Cooking and other kitchen uses	28%
3.	Washing clothes	10%
4.	Toilets Flushing and House Cleaning	39%
5.	Lawns and Gardens	42%
6.	Farming	66%

6. AWARENESS PROGRAMS FOR WATER CONSERVATION

Water conservation is a key challenge, which requires public participation. Mass awareness on the need for water conservation and providing common tips to effectively participate in this important mission is need of the time. The simple information on typical use of water for domestic purpose and how to save water under this sector, as given below, may help in creating awareness.

Recommended Saving of Water in Hostel

What we do generally	What we are doing in SRC	Saving of water
Bathing with Shower 100liter	Bathing with Bucket 18 liter	82 liter
Bathing with running water 40liter	Bathing with Bucket 18 liter	22 liter
Using old style flush in Latrines 20 liter	Using new style flush 6 liter	14 liter
Shaving with running water 10 liter	Shaving by taking water in mug 1 liter	9 Liter
Brushing teeth with running water 10 liter	Brushing teeth by taking water in mug 1 liter	9 Liter
Washing clothes with running water 116 liter	Washing clothes with bucket 36 liter	80 liter
Washing hands with running tap 10 liter.	Washing hands with mug 0.5 liter	9.5 liter

6.1 Tips in Shri Ram College for Conserving Water for Domestic and Municipal Use

- Timely Detection and repair of all leaks;
- Turning off water tap while brushing teeth;
- Use of mug rather than running water for shaving;
- Avoiding / minimising use of shower/bath tub in bathroom;
- Turning off faucets while soaping and rinsing clothes;
- Avoiding use of extra detergent in washing clothes;
- Using automatic washing machine only when it is fully loaded;
- Avoiding use of running water while hand-washing;
- Avoiding use of running water for releasing ice tray ahead of time from freezer;
- Using smaller drinking glasses to avoid wastage;
- Using over flow stop valve in the overhead tanks to check over flow of water;
- Turning off the main valve of water while going outdoor; • Avoiding use of hose for washing f loors; Use of broom may be preferred;

- Minimizing water used in cooling equipment by following manufacturer's recommendations;
- Watering of lawn or garden during the coolest part of the day (early morning or late evening hours) when temperature and wind speed are the lowest. This reduces losses from evaporation.
- Avoiding use of excess fertilizers for lawns in view of the fact that application of fertilizer increases the requirement of water in addition to polluting the groundwater.
- Planting of native and/or drought tolerant grasses, ground covers, shrubs and trees. Once established, they do not need to be watered as frequently and they usually survive a dry period without much watering.
- Grouping of plants based on water needs while planting them;
- Turning off water tap a little before watering time so as to use full water available in hose;
- Avoiding over watering of lawns. A good rain eliminates the need for watering for more than a week.
- Setting sprinklers to water the lawn or garden only, not the street or sidewalk;
- Avoiding installation or use of ornamental water features unless they recycle the water and avoiding running them during drought or hot weather;
- Installation of high-pressure, low-volume nozzles on spray washers;
- Replacement of high-volume hoses with high-pressure, low-volume cleaning systems;
- Equipping spring loaded shutoff nozzles on hoses;
- Installation of float-controlled valve on the make-up line, closing filling line during operation, provision of surge tanks for each system to avoid overflow;
- Adjusting flow in sprays and other lines to meet minimum requirements;
- Washing vehicles less often, or using commercial car wash that recycles water;

Shri **Rajendra Singh** "Jal Purush" Magsaysay awardee addressing on Seminar on Water & Environment: Issue, Challenges & Solutions in Auditorium of Shri Ram College, Muzaffarnagar

It is concluded that Shri Ram College, Muzaffarnagar is observing best practices of water saving. All the stake holders are well aware of the importance of water resources. The college authorities regularly running campaign and awareness drive to save water. They have invested considerably for advanced technologies of water saving.