

Green Audit a Case Study of N. Wadia College, Pune, M.S. India

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Abstract: *The rapid growth of industrialization and urbanization has led to the degradation of the environment all over the world. In such circumstances the initiative of green campus for the institutes need to be adopted for sustainable development. NowrosjeeWadia College, Pune, Maharashtra, is a pioneer institute with NAAC "A" grade (2003-2008), having completed 85 years of its perception. It runs two streams - Arts and Science . The college is located in central Pune city on a beautiful campus of 17 acres.*

Modern Education Society's NowrosjeeWadia College, Pune , M.S. is deeply concerned and unconditionally believes that there is an urgent need to address these fundamental problems and reverse the trends. Being a premier institution of higher learning, the college has initiated 'The Green Campus' program three years back that actively promote the various projects for the environment protection and sustainability. The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Policy adopted by the institution.

Keywords: *Green Audit, Green Campus, Green Policy, water conservation, Eco System*

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I. Introduction

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institute which will lead for sustainable development.

NowrosjeeWadia College, Pune is committed to save environment and work towards a sustainable future. Green audit of the College is inevitable in order to manage environmental problems efficiently. Green audit involves carbon neutrality, tree plantation, rain water harvesting, hazardous waste management, energy conservation and use of renewable resources.

The main buildings of the college are heritage buildings. There is a separate Science building for Chemistry, Botany, Zoology and Geology Departments. There is a separate Art's building, Office building, Post Graduate building, Assembly Hall, Seminar halls, Hostels etc.

Modern Education Society and Nowrosjee Wadia College, Pune is deeply concerned about environmental problems and reverse the trends. Being a premier institution of higher learning, the college has initiated 'The Green Campus' program two years back that actively promote the various projects for the environment protection and sustainability. College has conducted its in house 'Green Audit' in the academic year 2016-17 by taking technical assistance from external experts.

Ellington (1990) is the first scientist that provides comprehensive guide to the use of environmental audits. In 2008 Porter, Simon & Hatchery is the first who clearly mention exactly what is the Green Audit? And after his explanation about the green audit these concept of auditing accepted worldwide. He defined as the concept „Green audit“ as “Environment management system (EMS) that is continuous increase in environment and communication of the results of the EMS activity with organization“s directors.(Ionciu, 2009). In 2008 Adeniji is the first who primarily concerned with environmental audit of the companies to the growing importance of green issues. The components of environmental diversity are analyzed, reported, recorded, identified systematically in Green audit. The environmental practices with in the campus and its implication on the eco-friendly ambience is also analysed in Green audit.

The College organizes tree plantation program annually. The Institute has started practices like vermi composting and solid waste management. As per the syllabus of SPPU, Pune, environment awareness program is a compulsory subject for all second year students. Students and staff members are made aware of pollution caused by use of vehicles.

The college makes special efforts to inspire environmental awareness amongst students with the belief that environmental awareness will lead to sustainable development. For developing ecological consciousness amongst students a wide range of activities such as organizing campaigns, poster exhibitions, street plays, film screenings, field visits, workshops and seminars are undertaken by the college. Efforts are also made to institutionalize some of the environmentally sustainable practices in college.

II. Methodology

The methodology for the green auditing includes different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study cover the following areas to summaries the present status of environment management in the campus

- **Water management**
- **Energy Conservation**
- **Waste management**
- **E-waste management**
- **Green area management**

Objectives of the Study

1. To promote the environmental conservation of the college campus
2. To identify, quantify, describe, framework of environment sustainability
3. To introduce and aware students to real concerns of environment and its Sustainability
4. To make sure that the threats to human health are eradicated
5. To bring out a status report on environmental compliances

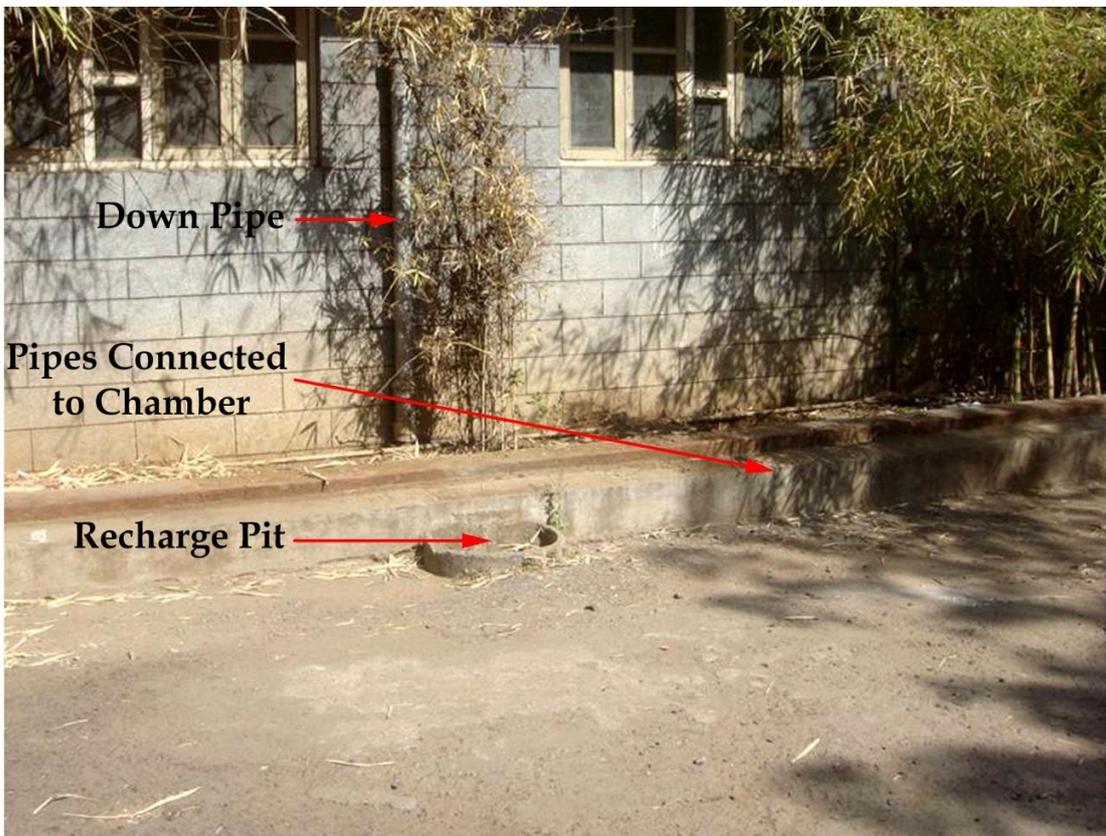
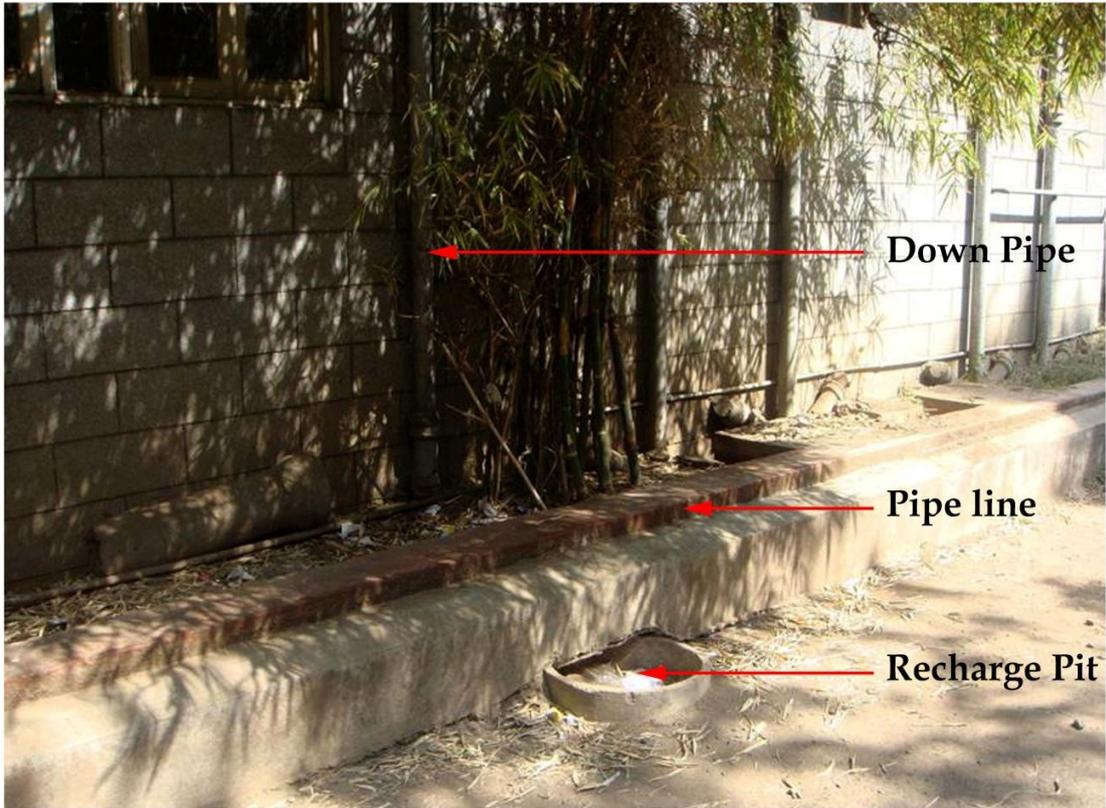
III. Result And Discussion

A :Water Consumption :

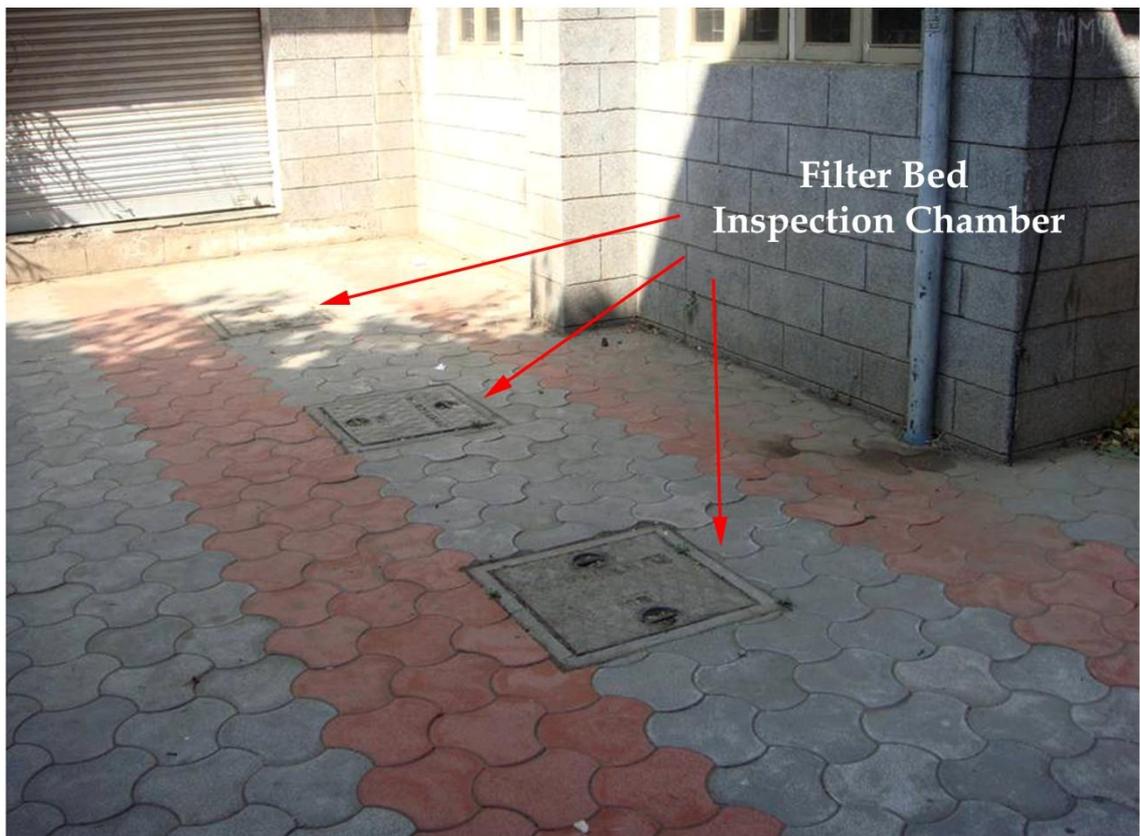
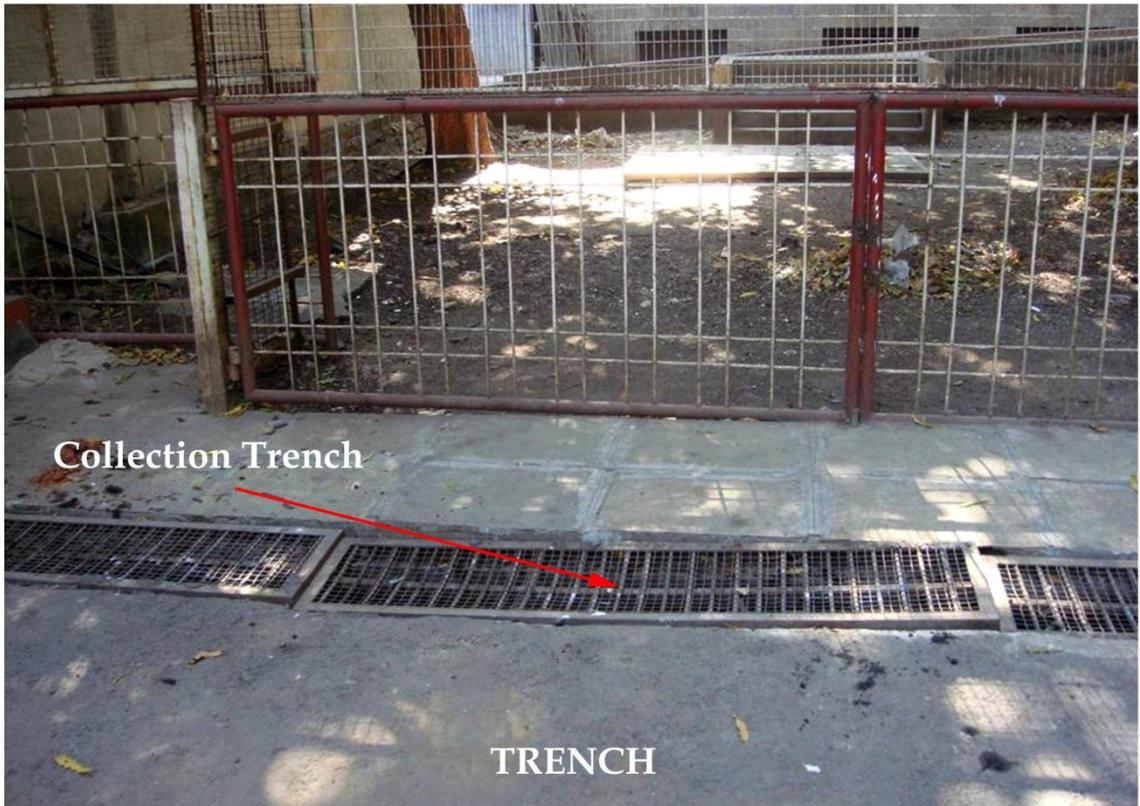
A water audit is an on-site survey and assessment to determine the water use, water sources, irrigation, storm water, appliances and fixtures and hence improving the efficiency of itsuse.

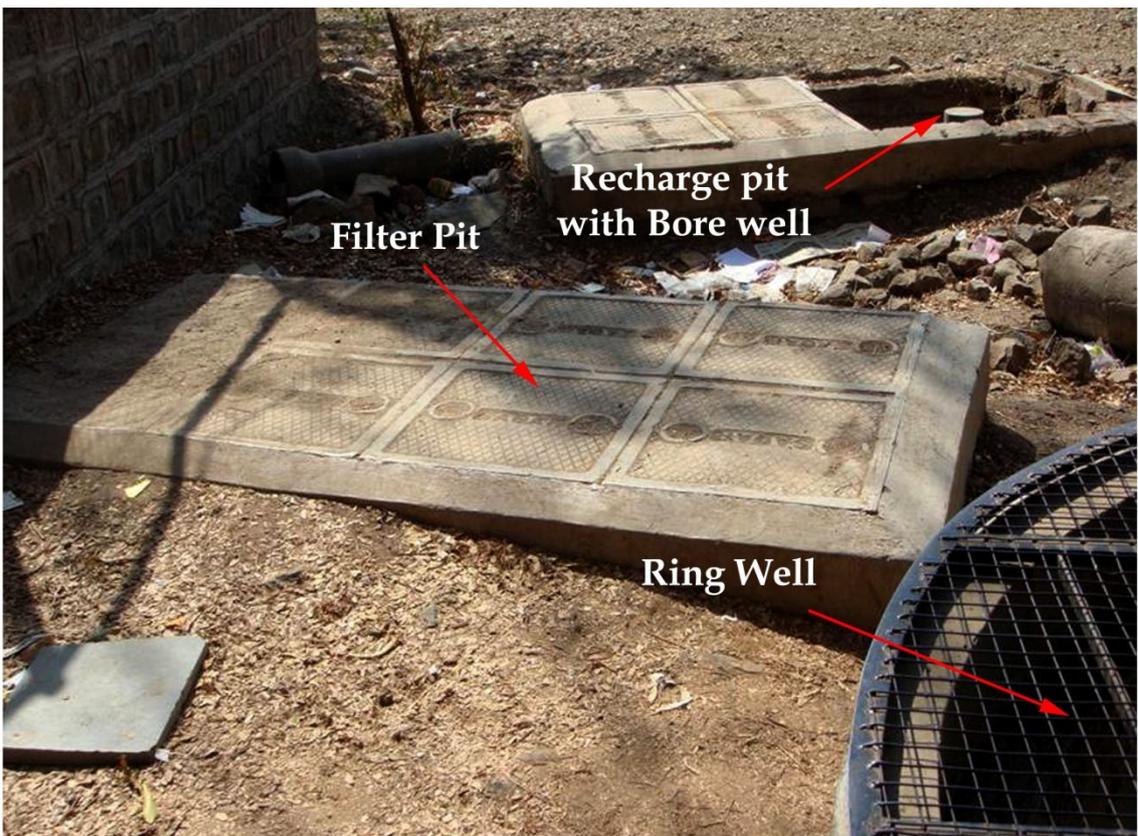


RAIN WATER HARVESTING PROJECT

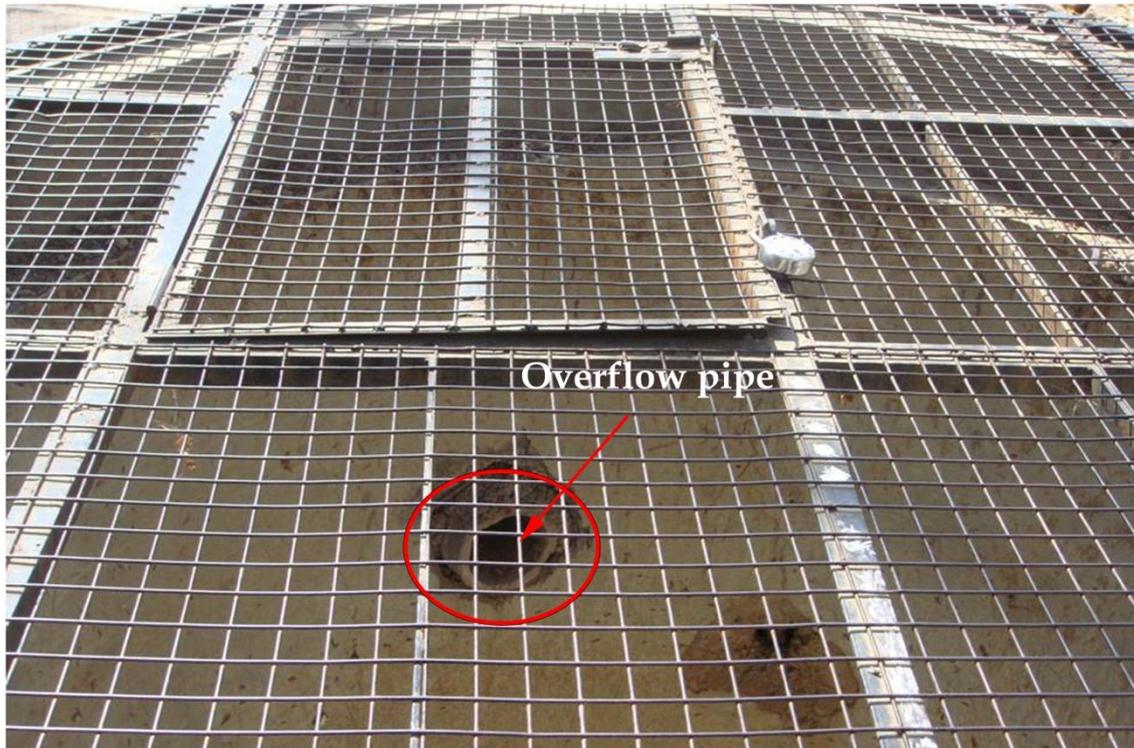






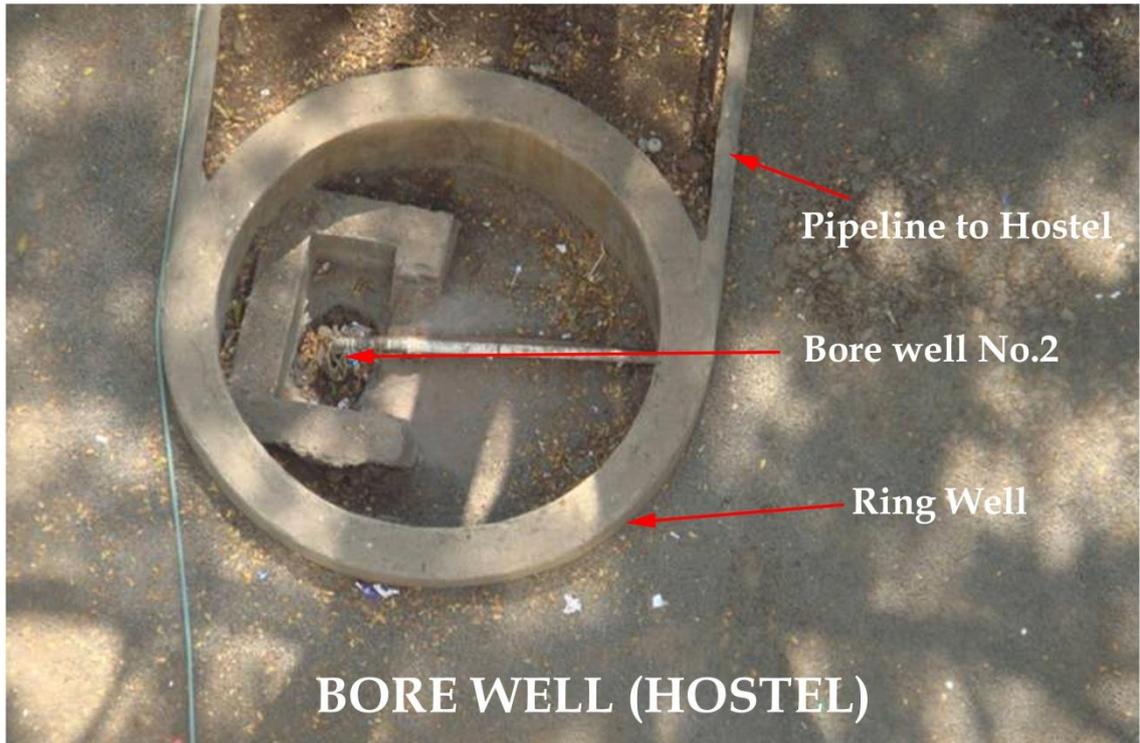


OVERFLOW PIPE IN WELL



RING WELL, FILTER PIT, RECHARGE PIT





RAINWATER HARVESTING (BOY'S HOSTEL)





IV. Observations

The study observed that Well and Pune Municipal cooperation water supply are the two major sources of water. Water is used for drinking purpose, canteen, toilets, laboratory, Hostels and gardening.

During the survey, no loss of water is observed, neither by any leakages, nor by overflow of water from overhead tanks.

College has successfully implemented rain water harvesting project. To minimize the use of Municipal Corporation water resources, rain water harvesting project and waste water recycling plant is installed. Water collected from entire new annex building [catchment area is 890 Sq. mt (9576 Sq. ft.)] is taken to ring well through filter Bed Chamber.

Ring Well – R.C.C. Rings is having diameter of 2 m and Height 2.5 m (An independent booklet has been prepared to explain in detail). Ground water re-charging pit is prepared in the college campus. Arrangement have been made so that storm water flows from playground to fill a pit and filter pit to well. Bore- well of 6 inches diameter and depth of 110 feet is taken in the campus on 04.07.2010. In hostel arrangements has been made of recycling of washrooms. In this way 10890 liters of water available for reuse. Re-use of water tank, provided near boys' hostel.

The college has been implementing an elaborate rain water harvesting project that has saved for the campus a substantial amount of Rs. 17,70,000. The project has involved all the five institutions on the campus as a result of which the water level in the campus has registered a significant growth. As a result barring drinking water requirements, all the campus water requirements are taken care of by this project. It has become a permanent source of water for all the institutions on the campus. The project has thus helped in moving toward the goal of a green campus.

The project has been implemented in the following phases:

Phase I: (MESCOE old building, NowrosjeeWadia cycle stand roof and surfacewater)

Phase II: (Playground, Surface water and the Ness Wadia College)

Phase III: (Engineering Building and Parking)

Phase IV: (Hostel Bath and wash basin water recycling)

Table no. 1: Water available for recycling

Sr.No.	Use	No. Of Persons Using (Per Day/Basin)	Water Required per person (Liters)	No of Units (Basin & Bath Area)	Water Available Liters per day (recycling)
1	Wash basin	3	3	110	990
2	Bath	3	30	110	9900
Total Water Available(Per day)					10890 lit

Table no. 2: Water Requirement Per Day

Water Required per Flush	No. Of Use	No. of Toilets	Total water required per day
10	6	110	6600 lit

V. Recommendations

1. Gardens should be watered by using drip/sprinkler irrigation system to save water.
2. It is recommended that the recycling and reuse of water is necessary.

B : Electricity Consumption :

The Electricity resources can be utilized sustainably by proper monitoring, lighting , appliance, careful use of energy and by using renewable energy sources such as wind, solar energy, CNG gas etc.

a. Observations:

- Electricity Consumption per Year was **1,57428KWH Avg.**
- Electrical Consumption per Month was **13119 KWH Avg.**
- Electrical Consumption per Day was **437.3 KWH**

Recently the college has taken an overview of energy consumption with an objective to save energy and accordingly old wirings and high voltage electrical tube lights were replaced with new efficient materials time to time. For night LED lamps have been installed around the college building. On every floor central switch is provided to control all electrical gazettes. Attendants deployed on every floor have been instructed to switch off lights and fans, whenever it is not required. All faculties and students have been instructed to switch off the light and fans after the practical/class gets over. College giving preference to buy energy saver star rating electric appliances.

Solar panels are sanctioned by S.P. Pune University and will be installed in campus very soon. The college has made efforts to use solar energy wherever possible. In college hostels and facility center, solar water heating system is provided (2 units with a capacity of 5000 LPD).

Centralized water supply system is installed on MESCOE building. Overhead water tank has been constructed from which water is supplied to all building in campus through the gravity.

SOLAR WATER HEATER SYSTEM



b. Recommendations :

1. Installation of LED lamps instead of CFL or normal Tube lights.
2. Use of CNG gas instead of LPG gas in laboratories .

C : Solid wastes

In the present times, the most burning issue is solid waste generation and management . Unscientific handling of solid waste can create threats to everyone. Managing the solid waste within the campus is need of time.

a. Observations:

The survey is deals with the volume, type and current management practice of solid waste generated in the campus.

The total solid waste collected in the campus is 80 Kg/day. Waste generation from tree droppings and garden management is a major solid waste generated in the campus.

Table 3: Source of waste

Sr.No.	Source Of Waste
1.	a. Canteen waste. b. solid waste from tree droppings, Botanical garden and lawn
2.	Plastic waste
3.	Solid Waste from Chemistry, Botany Zoology, Geology , Physics, Geography, Comp. Sci. Electronics and Maths Lab.
4.	Solid waste from Library and Office
5.	Solid waste from Hostels

Characteristic and Disposal Practices of Solid Waste Management

1. The waste is segregated at source by providing separate dust bins for Biodegradable and Plastic waste
2. Segregation of chemical waste generated in chemistry, Botany and zoology lab.
3. Adar Poonawalla Foundation (Clean City Initiative) is giving great contribution in solid waste management

Table 4 : Methods of disposal of waste

Sr. No.	Waste Category	Method of Disposal
1	a. Canteen waste. b. solid waste from tree droppings and Botanical garden	Vermi Composting Organic Manure
2.	Plastic Waste	Through Authorized recycler after segregation
3.	Solid Waste from Lab	Composting Organic Manure



Pune's success in waste management is its ability to persuade, and work with, initiatives such as the Adar Poonawalla Clean City Movement (APCCM)

Vermiculture Composting Culture The institute has started vermi culture composting culture in house during 2010-11 on 30 m² land. The main purpose of this is to reduce disposable waste in the college campus and after complete process of vermin composting it is used as manure in Botanical garden.. The main benefits of the process are to reduce the waste in the environment and save the cast.



D :Waste Management:

The total Number of Computers in the Institute are 441, Printers - 57, Xerox Machines are 06.

1. The E-waste and defective item from computer lab is being stored properly.
2. The institution has decided to contact approved E- waste management and Disposal facility in order to dispose E-waste in scientific manner.
3. Waste / scrap things are segregated and e-waste is handed over to Rag-pickers.
4. Most of the unused electronic equipments are disposed in Buy-back schemes.
5. Proper care is taken for safer disposal of toxic chemicals, biological waste, cultured microorganisms, broken glasses etc.
6. **‘Say No to Plastics’ Campaigns:** Efforts are underway to reduce the use of plastic bags and bottles on campus. Volunteers of EVS, N.S.S. and N.C.C. are working towards a plastic free campus. The campaign is a part of this effort.
7. Department of Botany, EVS and Zoology frequently organized guest lectures on waste management.

b. Recommendations :

1. Minimize the absolute amount of waste that it produces from college staff offices.
2. Make full use of all recycling facilities provided by Pune Municipal corporation and Adar Poonawalla Foundation (Clean City Initiative).
3. Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated
4. Recycle or safely dispose of white goods, computers and electrical appliances

E :Carbon Consumption

This includes the vegetation and sustainability of the campus to ensure that the buildings adhere to green standards. This also helps in ensuring that the Environmental Policy is enacted, enforced and reviewed using various environmental awareness programmes.

a. Observations:

1. Students and Staff members are made totally aware of pollution caused by vehicles.
2. In the college campus almost 90% of students are using public transport like buses and local train.
3. The carbon consumption awareness programme help in carbon emission at individual as well as social level and avoids Air and Noise pollution in the campus due to vehicles or any other activity.
4. There is no industrial area adjoined to College
5. Due to all these factors, the quality of air on the campus is non-pollute

Environment Awareness Program

Environmental awareness program is compulsory subject to all second year students irrespective of faculty. Syllabus covers the following topics .

- a. Air Pollution, its causes, effects & installation of various devices that reduces the air pollution.
- b. Water Pollution its, causes, effects& various methods to prevent it.
- c. Sound Pollution, its causes, effects & installed equipments that reduce it.
- d. Noise Pollution its effects on surroundings.
- e. Biodiversity and its conservation

Various tree plantation programs are being organized during the month of July and August on the college campus. Department of Botany and E.V.S., N.C.C and N.S.S. units of College organized tree plantation programmes annually. This program helps in encouraging eco-friendly environment which provides pure oxygen within the campus. The plantation program includes various types of indigenous species, rare species of ornamental and medicinal wild plant species. College Celebrate 5th June as 'Environment Day' every year.

Biodiversity Audit:

Campus is located in the vicinity of approximately 61 types (species) trees. Periodically the list of trees planted in the garden and campus is prepared. The numbers are allotted to the trees and records are kept. The Botanical names, families and local names are mentioned on boards attached to trees.

Different species of birds were observed during the serve. 15 species of butterfly were recorded.

Biodiversity audit has sensitized the students and staff members about importance of biodiversity and its conservation

List of trees:

Sr. No.	Scientific name	English name	Marathi name	Family
1	<i>Livistonachinensis</i> (Jacq.) R. Br. Ex. Mart	Fan Palm		Arecaceae
2	<i>Podocarpus neriifolius</i> D. Don.	Podocarpous		Podocarpaceae
3	<i>Zamia furfuracea</i> L. f. ex Aiton	Zamia		Zamiaceae
4	<i>Hibiscus rosa-sinensis</i> L.	China Rose	जास्वंद	Malvaceae
5	<i>Pinus roxburghii</i> Sarg.	Pinus		Pinaceae
6	<i>Mangifera indica</i> L.	Mango	अंबा	Anacardiaceae
7	<i>Swietenia mahagoni</i> (L.) Jacq.	West Indian mahogany	महोगनी	Meliaceae
8	<i>Sennasiamea</i> (Lam.) H. S. Irwin & Barneby	Senna	काशीद	Leguminosae
9	<i>Leucaena leucocephala</i> (Lam.) de Wit	White Babool	सुबाभूळ	Leguminosae
10	<i>Ceiba pentandra</i> (L.) Gaertn.	White Silk-Cotton Tree	हिरवासावर	Malvaceae
11	<i>Opuntia ficus-indica</i> (L.) Mill.	cactus pea	फड्यानिवडुंग	Cactaceae
12	<i>Dypsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	Areca Palm		Arecaceae
13	<i>Dracaena draco</i> (L.) L.	Dracaena		Asparagaceae
14	<i>Grevillea robusta</i> A. Cunn. ex R. Br.	Silver oak		Proteaceae
15	<i>Acacia auriculiformis</i> Benth.	Australian acacia	ऑस्ट्रेलियन बाभूळ	Leguminosae
16	<i>Lagerstroemia speciosa</i> (L.) Pers.	Pride of India	तामण	Lythraceae
17	<i>Justicia adhatoda</i> L.	white vasa	अडुळसा	Acanthaceae
18	<i>Ziziphus jujuba</i> Mill.	red date	बोर	Rhamnaceae

19	<i>Plumeriaalba</i> L.		पांढराचाफा	Apocynaceae
20	<i>Plumeriapudica</i> Jacq.	Fiddle leaf plumeria		Apocynaceae
21	<i>Psidiumguajava</i> L.	Guava	पेरू	Myrtaceae
22	<i>Callistemonlanceolatus</i> (Sm.) Sweet	bottlebrush		Myrtaceae
23	<i>Thespesiapopulnea</i> (L.) Sol. ex Corrêa	Indian tulip tree	भेंड	Malvaceae
24	<i>Sterculiafoetida</i> L.	Wild Indian Almond	जंगलीबादाम	Malvaceae
25	<i>Putranjivaroxburghii</i> Wall.	Lucky Bean Tree	जीवनपुत्र	<i>Putranjivaceae</i>
26	<i>Delonixregia</i> (Hook.) Raf.	Flame Tree	गुलमोहर	Leguminosae
27	<i>Thevetianeriifolia</i> Juss. exSteud.	Yellow Oleander	पिवळीकण्हेर	Apocynaceae
28	<i>Sennasopha</i> (L.) Roxb.	SophaSenna	काशवाद	Leguminosae
29	<i>Eucalyptus globulus</i> Labill.	Tasmanian bluegum	निलगिरी	Myrtaceae
30	<i>Tamarindusindica</i> L.	Tamarind	चिंच	Leguminosae
31	<i>Jacaranda mimosifolia</i> D.Don	Blue Jacaranda	नीलमोहर	Bignoniaceae
32	<i>Peltophorumpterocarpum</i> (DC.) K. Heyne	Copperpod	पिलमोहर	Leguminosae
33	<i>Albiziasaman</i> (Jacq.) Merr.	Rain Tree	गुलाबीशिरीष	Leguminosae
34	<i>Bauhinia</i> purplea L.	Purple bauhinia	कांचन	Leguminosae
35	<i>Santalum album</i> L.	Sandalwood	चंदन	Santalaceae
36	<i>Thuja</i> picataDonn ex D.Don	giant cedar	मोरपंखी	Cupressaceae
37	<i>Araucaria angustifolia</i> (Bertol.) Kuntze	Christmas tree		Araucariaceae
38	<i>Euphorbia antiquorum</i> L.	Triangular Spurge	तीनधारीनिवडुंग	Euphorbiaceae
39	<i>Dioscorea</i> bulbiferaL.	Air potato	कडुकरंडा	Dioscoriaceae
40	<i>Moringa</i> oleifera Lam.	Drumstick Tree	शेवगा	Moringaceae
41	<i>Cocos</i> nucifera L.	Coconut	नारळ	Arecaceae
42	<i>Artocarpus</i> heterophyllusLam.	Jackfruit	फणस	Moraceae
43	<i>Combretum</i> indicum (L.) De Filippis	Rangoon Creeper	विलायतीचमेली	Combrataceae
44	<i>Hiptage</i> benghalensis (L.) Kurz			<i>Malpighiaceae</i>

VI. Conclusions

1. The installation of solar panels, paperless work system, Rain water harvesting and vermicomposting, reuse of papers are some of the major initiatives taken by Institute.
2. The waste management has been carried out effectively using eco friendly and scientific techniques.
3. There is concrete research done on environment by the faculty and students.
4. A part of Green Audit carried out in-house by EVS coordinator, faculties and students of EVS, the campus appears pollution free, class rooms and laboratories are well ventilated, natural light is adequate, noise level is under the limit.

Acknowledgement

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I hope, this will boost and help the new generation to take care of Environment and propagate these views for many generations to come.

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