



TRIPURA STATE POLLUTION CONTROL BOARD

(A Statutory Organisation Under Government of Tripura)
Department of Science Technology & Environment

No. F.19 (72)/TSPCB/WQME/1247

February 08, 2022

To,
The Principal in charge
Netaji Subhash Mahavidyalaya,
Gomati Tripura

Sub: Environmental Status of Netaji Subhash Mahavidyalaya, Gomati Tripura - reg

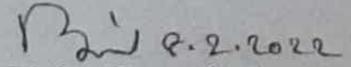
Sir,

With reference to your letter No. F.01/IQAC/NSM/UDP/21/986, dated 02/12/2021, regarding the subject cited above. The Environmental Monitoring conducted on 29.12.2021 inside the campus of Netaji Subhas Mahavidyalaya, Gomati Tripura revealed that **the Environmental status in respect of water, air and noise of the college is decent and the campus is free from any kind of major pollutants.**

Please find enclosed Environmental Status of water, air and noise of Netaji Subhash Mahavidyalaya, Udaipur, Gomati Tripura.

Encl: As stated

Yours faithfully


(Dr. Bishu Karmakar)
Member Secretary

**Environmental status in respect of water, air and noise at Netaji
Subhash Mahavidyalaya, Gomati Tripura**

1. Objectives

Tripura State Pollution Control Board conducted a pollution monitoring programme regarding Air, Water and Noise quality at Netaji Subhash Mahavidyalaya, Gomati Tripura to be a part of Environmental Audit of the college. Objectives of the monitoring programme are as follows-

- i) To study the drinking water quality status
- ii) To conduct ambient Air Quality Monitoring
- iii) To conduct ambient noise Monitoring

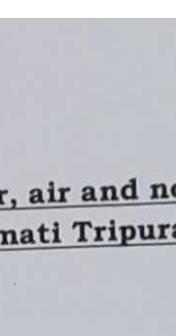
2. Water quality monitoring

In order to assess the drinking water quality in Netaji Subhash Mahavidyalaya, Gomati Tripura one drinking water sample was collected from a water purifier of the college in a pre-cleaned one litre polythene bottle for the analysis of different physical & chemical parameters. The analysis was carried out in the laboratory of Tripura State Pollution Control Board using the standard methods given in APHA, 2012 (*American Public Health Association*).

2. 1. Results

The data Table of the water sample at Netaji Subhash Mahavidyalaya, Gomati Tripura is shown in *Table-1*.

Table: 1: Analytical Result of Drinking Water Samples Collected from Netaji Subhash Mahavidyalaya, Gomati Tripura.



Sl. No	Parameters	S-1	Standards (BIS, 2012)	
			Acceptable limit	Permissible limit
1.	pH	6.6	6.5-8.5	6.5-8.5
2.	Conductivity ($\mu\text{S}/\text{cm}$)	149	-	-
3.	Turbidity (NTU)	3.1	5	1
4.	Total Dissolved Solids (mg/l)	75	200	600
5.	Total Hardness (mg/l)	25.6	200	600
6.	Calcium (mg/L)	5.8	75	200
7.	Magnesium (mg/L)	3.1	30	100
8.	Chlorides (mg/l)	13.2	250	1000
9.	Iron (mg/L)	0.29	0.3	0.3
10.	Arsenic (mg/L)	BDL	0.01	0.05

*BDL= Below Detectable limit

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2.2. Observation

From the result table, it has been observed that, the analysed values of the said drinking water sample are within the prescribed standards limit of BIS, 2012 (*Bureau of Indian Standards*).

2.3. Conclusion

The quality of water used in the Campus of Netaji Subhash Mahavidyalaya, Gomati Tripura is good for drinking purposes.

3. Air quality monitoring

To conduct the air quality monitoring, the station has been set up in the roof of the commerce building at the college premises. Logistic considerations as easy accessibility, security, availability of reliable power supply etc. were examined before finalizing the locations.

3.1. Duration and frequency of monitoring

The air quality monitoring was carried out for 24 hour schedule at the monitoring station.

3.2. Sampling & analytical techniques

The sampling procedures for measurement of PM-2.5, PM-10, NO₂ and SO₂ were according to the internationally accepted standard technique through use of Respirable Dust Sampler (RDS) with gaseous sampling attachments and PM-2.5 Sampler manufactured by M/s Environtech Instruments PVT. LTD., New Delhi has been used for sampling purposes.

3.3. Results

The detailed monitoring results of Particulate Matter (PM-10 & PM-2.5), Sulphur Dioxide (SO₂) and Oxides of Nitrogen (NO₂) are presented in *Table-2*.

Table-2: Ambient Air Quality Monitoring results of NetajiSubhashMahavidyalaya, Gomati Tripura.



Pollutants	Time weighted Average	S-1	Standards (CPCB, 2009)
Particulate matter (PM ₁₀), µg/m ³	24 Hours	72.2	100
Particulate matter (PM _{2.5}), µg/m ³	24 Hours	46	60
Sulphur Dioxide (SO ₂), µg/m ³	24 Hours	2.11	80
Nitrogen Dioxide (NO ₂), µg/m ³	24 Hours	8.08	80

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3.4. Observation

From the result table it is observed that ambient value of PM-10, PM-2.5, SO₂ and NO₂ of air within the Netaji Subhash Mahavidyalaya, Gomati Tripura are within the prescribed standard limit of CPCB (Central Pollution Control Board, 2009).

3.5. Conclusion

On the basis of air quality data it has been concluded that the quality of air within the campus of Netaji Subhash Mahavidyalaya, Gomati Tripura is good.

4. Noise monitoring

The present study is carried out to assess the equivalent noise level (Leq) around the college campus both in the day time and night time.

4.1. Methods of measurement

Sound Level Meters (SLM) SL-4001 was used for monitoring of noise levels. The noise levels were monitored at least for 30 minutes at each location during monitoring.

4.2. Results

The data table of noise levels of different locations of Netaji Subhash Mahavidyalaya, Gomati Tripura are shown in *Table-3*.

Table-3: Noise Levels in dB(A) at Different Locations of Netaji Subhash Mahavidyalaya, Gomati Tripura.

Sl No.	Locations (NetajiSubhasMahavidyalaya, Gomati, Tripura)	Day Time (6.00 a.m to 10.00 p.m)	Night Time (10.00 pm to 6.00 a.m)	Standard (Day time) Silent Zone	Standard (Day time) Silent Zone
		LeqdB(A)	LeqdB(A)		
1.	Near Administrative Building	55.2	38.5	50	40
2.	Academic building	56.8	39.2		
3.	Infront of Main Gate of the college	59.7	39.9		

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4.3. Observations

The noise monitoring was carried out at the 3 (three) locations in the college campus covering the administrative block, academic building and in front of main gate during day time and night time. The summarized results of noise level are given in **Table-3**. From the measured noise level data it was found that the ambient noise level inside the college campus of Netaji Subhash Mahavidyalaya, Gomati Tripura during day time is slightly high but within the prescribed standard limit of CPCB for silent/sensitive zone during night time.

5. Overall conclusions

The Environmental Monitoring inside the campus of Netaji Subhash Mahavidyalaya, Gomati Tripura revealed that the Environmental status in respect of water, air and noise of the college is decent and the campus is free from any kind of major pollutants.

6. Recommendation

1. To maintain the good environment, more green belt has to be developed in the college campus by planting valuable trees especially medicinal plants, and seasonal blooming trees etc which helps to increase the beautification of the campus and also will attract more birds.
2. More emphasis should be given on solar energy as alternative energy source in the college campus.
3. More emphasis should be given on rain water harvesting

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GREEN AUDIT REPORT

2020- 2021



NETAJI SUBHASH MAHAVIDYALAYA,
GOMATI DISTRICT, UDAIPUR, TRIPURA

INTERNAL QUALITY ASSURANCE CELL (IQAC)

Prepared by College Audit Team

The Audit Team

Following Faculty members of the college functioned as the Internal audit team for the “Green Audit” purpose which is performed under the initiative of the IQAC of the college.

Sl No	Audit Coordinator	Sri Debashis Roy Chowdhury Assistant Professor, Department of Chemistry
1.	Land Use Analysis	Smt. Mampi Sarkar Assistant Professor, Department of Geography
2.	Water Audit	Dr. Basu Maan Daas Assistant Professor, Department of Chemistry
3.	Waste Audit	Dr. Parthasarathi Debray, Assistant Professor,, Department of Human Physiology
4.	Energy Audit	Sri Prankrishna Debnath, Department of Physics
5.	Green Campus/ Biodiversity Audit (Flora & Fauna) Green Campus	Dr. Dipti Das Associate Professor, Department of Botany Sri Prasenjit Debbarma Assistant Professor, Depart of Botany Dr. Nupur Datta Assistant Professor, Department of Zoology
6.	Carbon Foot Print Analysis	Dr. Biplab Ghosh Assistant Professor, Department of Chemistry, NSM

Acknowledgements

We would like to convey our sincere gratitude to all the departments, students, teaching and nonteaching staff for their kind cooperation during green audit survey.

We would also like to convey our sincere gratitude to the Tripura State Electricity Corporation Ltd. for their support and active role in providing relevant information regarding energy audit.

We would also like to express our greatest appreciation to the Tripura Renewable Energy Development Agency (TREDA) for their support to provide various information regarding rooftop solar power plant of the college.

Sincere thanks to all for providing us necessary amenities and assistance during the audit and making the audit a successful one.

Finally we would like to convey our heartfelt gratitude to the respected Principal of the institution for his unwavering support and kind cooperation to complete the green audit report. We appreciate his attitude towards environment issues and its protection.

Convener

Green Audit Team, NSM

2020-21

Audit Key Steps

Planning & Preliminary Committee	<i>April 2019</i>
Green audit committee reconstituted focusing on biodiversity, energy and environmental auditing	<i>November 2020</i>
Draft report completed and submitted to college authority	<i>November 2021</i>
College Authority response received	<i>December 2021</i>
Final report completed and presented	<i>December 2021</i>

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1. Executive Summary

Eco campus is a concept implemented in many educational institutions, all over the world to make them sustainable in term of their mass resource utilization and waste discharge in to the environment. Waste minimization plans for the educational institute are now mandatory to maintain the cleanliness of the campus. To find out the environmental performance of the educational institutions and to analyze the possible solutions for converting the educational campus as eco-campus Green Auditing of institution is essential.

This is the first attempt to conduct green auditing of the college campus. In accordance with the Green Campus Evaluation Plan, as suggested by the Internal Quality Assessment Cell (IQAC) of the college, N S Mahavidyalaya, Udaipur, Gomati District, Tripura planned for conducting a green audit of the college in April, 2019. It was delayed due to the COVID 19 lock-down. Ultimately Green Audit was performed by the college internal audit team.

This audit was mainly focused on greening indicators such as water, waste, biodiversity, energy and carbon foot print. Environment audit was done by Tripura State Pollution Control Board. In order to meet its objectives, this audit combined physical inspection with a review of relevant documentation and interviews with various stakeholders. Collected data were grouped, tabulated and analyzed. Finally a report pertaining water, waste, biodiversity, energy and carbon foot print management audit focusing on strength, weakness and recommendations on the green issue of campus are documented. However, information regarding the environment audit of the institution conducted by Tripura State Pollution Control Board has been reported separately.

The baseline data will be a useful tool for campus greening, resource management, waste optimization, energy efficiency and a document for implementation of sustainable development of the college.

The audit procedure has tried to meet the standard scientific methods. To reach the final decision by the audit team, sufficient and appropriate audit

procedures were completed and valid evidences were gathered to support the final conclusions drawn in this report. The conclusions are based on a comparison of the situations or the exact circumstances that existed at the time of the audit.

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Dr. Biplab Ghosh, Assistant Professor (Carbon Foot Print)

2. Introduction

The Sustainable Development Goals (SDGs), launched by the United Nations in 2015, represent an action plan for the planet and society to thrive by 2030. The SDGs provide a window of opportunity for creating multidimensional operational approaches for climate change adaptation. They address poverty, hunger and climate change, among other issues central to human progress and sustainable development, such as gender equality, clean water & sanitation, and responsible consumption and production.

As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more predominant nowadays. If self-enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self-enquiry is a natural and necessary outgrowth of quality of an educational institution. Thus it is imperative that the college evaluate its own contributions toward a sustainable future.

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 institutes which will lead to sustainable development and at the same time reduce a sizable amount of atmospheric carbon-di-oxide from the environment.

2. 1. Objectives

The college has been putting efforts to keep the campus environment clean since its inception. But the auditing of this non-scholastic effort of the college has not been done before.

Therefore, the broad purpose of the present green audit is to identify, quantify, describe and prioritize framework of green campus for the institution which will lead to sustainable development and at the same time make campus '**carbon neutral**'.

The specific objectives are:

1. To map the land use –land cover analysis of the college.
2. To quantify the liquid and solid waste generation and management of the college.
3. To assess water use and conservation strategies of the college.
4. To document the floral and faunal diversity or biodiversity of the college.
5. To estimate the Energy requirements & consumption of the college.
6. To assess the carbon foot print of the college.
7. To introduce the students to real concerns of environment and its sustainability.
8. To impart environment management plans to the college.
9. Providing a database for corrective actions and future plans.
10. To identify the gap areas and suggest recommendations to improve the Green Campus status of the NS Mahavidyalaya, Udaipur.

About NS Mahavidyalaya

Netaji Subhash Mahavidyalaya (NSM) is situated at the Udaipur Sub-Division of the Gomati District of Tripura. It is approximately 50 kilometers away from the Agartala, the capital city of Tripura, Agartala. It is a co-educational college affiliated to the Tripura University. The College received recognition from the University Grants Commission (UGC) under 2(f) and 12(B) as Netaji Subhash Mahavidyalaya on 31st March 2004.

Udaipur was the Capital of Tripura under the royal regime of the Manikya dynasty. The capital was shifted to Old Agartala by King Krishna Manikya in the eighteenth century, and then to the present day Agartala in the nineteenth Century. Three famous shrines of Tripura - Tripura Sundari temple, Bhubaneswari temple and Mahadev temple - are situated at Udaipur. The prodigious and Nobel laureate poet Rabindranath Tagore wrote his famous humanist play Bisarjan at the backdrop

of Bhubaneswari Mandir of Udaipur. Tripura Sundari temple integrates Tripura in to the cultural map of India by making this mandir or temple one of the 51 Pithas of Shakti. This town is also known as 'a town of lakes' because of the presence of large and beautiful water bodies, called dighis in local language; the lakes Dhani Sagar, Amar Sagar, Jagannath Dighi and Mahadeb Dighi are located in and around the town. Udaipur is the second largest town of Tripura on the bank of river Gumati. It has a canopy of lush green foliage making the town a visitor's paradise. Not unnaturally, therefore, it is one of the most frequented tourists' destinations of the State. The town experiences moderate temperature throughout the year.

NS Mahavidyalaya started his journey with a total no of 35 students and offered degree courses in six subjects from humanities namely, Bengali, English, Sanskrit, Economics, History and Political Science and in general pass courses. More subjects had been introduced afterwards. At present subjects offered in humanities are Bengali, English, Sanskrit, Kokborok, Political Science, History, Education and philosophy; subjects offered in the Science stream are Physics, Chemistry, Mathematics, Botany, Human Physiology, and Zoology, and the subjects offered in the intermediate group are Mathematics, Economics, Psychology, Geography and Physical Education. The academic administration of the college is supervised by the Directorate of Higher Education under the Government of Tripura. The academic curricula and examinations are regulated by Tripura University.

Vision Statement

The vision of N. S. Mahavidyalaya is to provide inclusive education to the students; it aims to inculcate human values, professionalism and scientific attitude among all sections of learners including scheduled tribes, scheduled castes, other backward communities and religious minorities with special focus to female students.

Mission

: The mission statements of the College are as follows:

- To provide ample scope for multifaceted development among the local youths irrespective of religion, race, caste and gender.

- To ensure quality higher education for its students.
- To provide and promote inclusive education for all.
- To develop academic programmes based on local/regional/national/ global needs.
- To encourage and practice student-centric learning for self-development and skill development among students.
- To nurture social awareness and responsibilities among its students.

NAAC Grading in Assessments

NAAC Accreditation First cycle (2014) : B Grade, point 2.02

Infrastructure

Students and faculty strength, College physical infrastructures are presented in Table 2.1, 2.2, 2.3 and Fig. 2.1, 2.2, 2.3 and 2.4.



Fig. 2.1. Main Building of the NS Mahavidyalaya

Table. 2.1. The student and faculty strength of the N.S. Mahavidyalaya (2020-21)

Particulars	Male	Female	Total
No of Students	2420	1886	4306
No of Permanent Faculty	19	33	52
No of Guest Teachers	20	13	33
No of permanent Non-Teaching staff	9	21	30
No of Outsourcing staff	4	4	8

Table. 2.2. Physical Structure of NS Mahavidyalaya

Administrative, Library, Class room, Laboratories	2 Three storey and 1 two storey Building
Canteen and Cycle/Scooter stand	1 Two-storey Building
Indoor facility Sports Training Center	1 One-srorey building
Students Council, NSS, NCC, Boys common Room	1 Two-storey Building
Alumni Room	1
Guard Rest Room	1
ST Boys Hostel	1 Two-storey Building
Vermi Unit	1

Fig. 2.3. Infrastructure of NS Mahavidyalaya

Departments	19
Laboratories (Sciences, Geography and Psychology), Computer lab	9
English Language lab	1
Computer Lab	1
Seminar Hall	01
Conference Hall/Professors common Room	01

Libraries	1 main library and departmental library
Canteens	1
Indoor Facility Training center	1
Students Council	1
NSS Room	1
NCC Room	1
Boys Common Room	1
Girls Common Room	1
ST Boys Hostel	1
Office room	1
Academic section	1
cash section	1
stipend section	1
Enquiry desk	1
Distance Study center (TU)	1
IGNU study center	1
IQAC room	1
store room	1
Alumni Room	1
Guard Rest Room	1
Playground	1
Iron Removal Plant	1
Solar system for renewable energy	1



Fig. 2.2. Physical Science building



Fig. 2.3. Bio science Building and Indoor facility Training center



Fig. 2.4. Playground of the NSM



Fig. 2.5. College canteen and cycle/bike stand

3. Methodology

Green Audit is a process of systematic identification, quantification, recording, reporting and analysis of components of environmental issues.

3.1. Target areas of Green Auditing and Management

Green audit forms part of a resource management process. Although they are individual events, the real value of green auditing is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy and water; minimize waste generation or pollution and also economic efficiency. All these indicators are assessed in the process of 'Green Auditing of this educational institute'. Target areas included in this green auditing of the NS Mahavidyalaya are land, water, waste, green campus, energy and carbon footprint. The Audit report is presented under the following sub-headings.

1. Land use analysis
2. Auditing for Water Management
3. Auditing for Waste Management
4. Auditing for Green Campus Management & Biodiversity
5. Auditing for Energy Management
6. Auditing for Carbon Footprint

Auditing for Water Management

Water is a natural resource; all living organisms depend on water. While freely available in many natural environments, in human settlements drinkable water is less readily available. Groundwater depletion and water contamination are taking place at an alarming rate. Hence it is essential to examine the quality and usage of

water in the college. Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse.

Auditing for Waste Management

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health. Pollution from waste is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems.

Solid waste can be divided into three categories: bio-degradable, non-biodegradable and hazardous waste.

Bio-degradable wastes include food wastes, canteen waste, wastes from toilets etc. Non-biodegradable wastes include plastic, tins and glass bottles etc.

Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol. Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively.

Special attention should be given to the handling and management of hazardous waste generated in the college. Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology.

Non-biodegradable waste can be utilized through recycling and reuse. Thus the minimization of solid waste is essential to a sustainable college.

Auditing for Green Campus Management & Biodiversity

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 21.7 kg of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen released by the trees

of the campus is good for the people in the campus. So while you are busy studying and working on earning those good grades, all the trees in campus are also working hard to make the air cleaner for you.

Auditing for Energy Management

Energy conservation is an important aspect of campus sustainability which is also linked with carbon foot print of the campus. Energy auditing deals with the conservation and methods to reduce its consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examine its energy use practices.

Auditing for Carbon Footprint

Burning of fossil fuels (such as petrol) has an impact on the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon-emission. So, carbon foot print analyses amount of carbon emission of the campus and their mitigation to check whether campus is carbon neutral or not.

3.2. Audit plan

The Green Audit of the NS Mahavidyalaya was performed by three stages:

- The Pre-audit stage
- Audit stage
- Post Audit Stage

The Pre Audit Stage

In the pre-audit stage, meetings provide an opportunity to support the capacity and objectives of the audit and enable discussions on the feasibility associated with the audit.

During April 2019, the planning of audit processes was discussed in the pre-audit meeting. The audit team was also selected in this meeting with involvement of Faculty members of the college. The audit protocol and audit plan were discussed in advance.

The authority of the college conveyed commitment towards the green auditing during the pre-audit meeting. Authority was ready to encourage all green activities. It was decided to promote all activities that are environment friendly such as awareness programs on the environment, planting more trees on the campus, etc., after the green auditing. The management of the college was willing to formulate policies based on green auditing report

The Audit Stage

The Audit Stage encompasses of the team selection and the field works performed. Different students group were made. Green auditing in NS Mahavidyalaya began with the assessment of the status of the green cover of the Institution followed by waste management practices; water and energy use and conservation strategies etc. The team monitored different facilities at the college, determined the types of different appliances and their utilities (lights, taps, toilets, fridges, etc.) as well as measuring the usage per item (Watts indicated on the appliance or measuring water from a tap) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and students were interviewed to get details of usage, frequency or general characteristics of certain appliances.

Data collection was done in the sectors such as Energy, Waste, water, Greening

& bio-diversity and Carbon footprint. College records and documents were verified several times to clarify the data received through survey and discussions.

The Post Audit Stage

The post-audit stage ensures formulation of draft findings and placing it before the authority for final response. Since the audit is done, it was important to ensure college Authority (Principal) approval for the draft. After getting draft approval, the audit team went for final report formulation.

3.3. Data collection

Data collection to conduct the Green Audit of the college was performed through the following methods:

Onsite Visit

Field visit was conducted by the Green Audit Team. The key focus of the visit was on assessing the status of the green cover of the Institution, their waste management practices and energy conservation strategies etc.

Group Discussion

The Group discussions, focusing on the various aspects of green audit, were held with the different sections of the stakeholders of the college. The discussion was focused on identifying the attitudes and awareness towards environmental issues.

Energy, waste management and Carbon foot print

With the help of students group, the audit team assessed the energy consumption pattern and waste generation, disposal and treatment facilities of the college. The data collection was made by a survey with a self-made questionnaire.

3.3. Survey Forms

Surveys are made with self-made forms by Audit team, which are as follows:

1. Water audit survey Forms

SL NO	PARAMETERS	Response	Remarks
1	Source of water		
2	No of Wells/Ponds/Lakes		
3	No of motors used		
4	Horse power – Motor		
5	Number of water tanks		
6	Capacity of tank		
7	Quantity of water pumped every day		
8	Any water wastage/why?		
9	Water usage for gardening		
10	Waste water sources		
11	Use of waste water		
12	Faith of waste water from labs		
13	Whether waste water from labs mixed with ground water		
14	Any treatment for lab water		
15	Whether any green chemistry method practiced in labs		
16	No of water coolers		
17	Rain water harvest available?		
18	No of units and amount of water harvested		
19	Any leaky taps		
20	Amount of water lost per day		
21	Any water management plan used?		
22	Any water saving techniques followed ?		
23	Are there any signs of messages inside the college campus reminding peoples to turn off the water taps or water supply?		

2. Waste audit survey forms

Total strength of students, teachers, and Non-teaching staffs

No of Students		
No of Teachers		
No of Non-teaching staffs		
Male		
Female		
Grand Total		

Approximate quantity of waste generated per day in College (in kg)

. Office /class room/lab/canteen	
Particulars	Amount
Non-Bio degradable (plastic waste)	
Biodegradable (paper waste)	
Biodegradable (Food waste)	

How the waste generated in the college is managed?

Composting/ Vermicomposting		
Is there any recycling mechanism		
Any waste management methods used?		

3. Energy audit survey form

Room No. / name	Electrical device/ items	Number	Power	usage time (hr/day)

4. Carbon foot print analysis survey report of the students of NSM

1.	Students reach college by walking	
2.	Students reach college by cycling	
3.	Students using public transportation	
4.	Students reach college by two wheelers	
	Students reach college by Four wheelers	
	Average distance travelled by two wheelers	
	Average quantity of fuel use in two wheelers	
	Average distance travelled by four wheelers	
	Average quantity of fuel use in four wheelers	
5.	Faculty/staff reach college by walking	
6	Faculty/staff reach college by cycling	
7.	Faculty/staff using public transportation	
8.	Faculty/staff reach college by two wheelers	
	Faculty/staff reach college by Four wheelers	
	Average distance travelled by two wheelers	
	Average quantity of fuel use in two wheelers	
	Average distance travelled by four wheelers	
	Average quantity of fuel use in two wheelers	
9.	Number of LPG cylinders used in canteen/labs per month	
10.	Use of any other fuels	
11.	Average Electricity consumption per month)	
12.	Total Garbage generation as below (per day)	
	Plastic Waste (per day)	
	Paper waste (per day))	
	Food waste (per day)	
13.	Any solar plant and its capacity:	
14.	Is there any resource optimization?	
15.	Is there any waste management system?	
16.	Is there any energy efficiency?	

4. Results

In results section auditing report of water, waste, flora-fauna, energy, carbon-foot print and their managements are described in different subsections.

4.1. Land use analysis

The term 'Land use' and 'land cover' are often used together. Therefore it is important to define them clearly. The 'land use' represents the present and future planned human activities on a territory, characterized as residential, industrial, commercial, agricultural, forestry and leisure. On the other hand; 'land cover' represents the physical and biological cover of the Earth's surface including classes as build-up areas, forests, agricultural areas, wetlands, (semi-) natural areas, water bodies.

Viewing the earth from space, it is now very crucial to monitor man's activities on natural resource. In situations of rapid changes in land use, observations of the Earth from space give the information of human activities and utilization of the landscape. Remote sensing and GIS techniques are now providing new tools for advanced land use mapping and planning. The collection of remotely sensed data facilitates the synoptic analyses of earth system, functions, patterning, and change in the local, regional as well as at global scales over time. Satellite imagery particularly is a valuable tool for generating land use map.

4.1.1 Methodology for land-use land-cover mapping

The Land use land cover analysis were performed by a group of students under the supervision of Smt. Mampi Sarkar, Assistant Professor and HOD (In-charge), Department of Geography, NS Mahavidyalaya. The students who carried out the analysis have geography as general subject and their names are mentioned below.

- Sourav Debnath,
- Kuldip Sarkar
- Partha Das
- Partha Das

To prepare land use land- cover map two types of data were used such as field survey data and the data from Google earth by digitizing various layers. Land use-land cover map of the study was prepared using the above two types of data with the help of QGIS 3.16 Hannover software.

Land use-land cover map has been developed through the following steps:

1. Acquisition of data was done through field and digitization of various layers of land use-land cover map on Google earth.
2. Data manipulation and analysis and linking the spatial data with the attribute data for creation of topology was carried out using GIS software.
3. After digitizing all the layers of various land use & land cover, KMZ file was exported and it was imported to QGIS 3.16 Hannover software for creation of map layout. Thus, the creation of GIS output in the form of map showing various land use-land cover have been actualized.

An attempt has been made in this study for land use- land cover analysis of Netaji Subhash Mahavidyalaya, Udaipur, Gomati, Tripura with a view to detect the land consumption in the built-up land area and vegetation coverage using GIS techniques.

Land cover classification

An attempt has been made in this study for land use land cover analysis of Netaji Subhash Mahavidyalaya, Udaipur, Gomati, Tripura with a view to detect the land consumption in the built-up land area and vegetation coverage using GIS techniques.

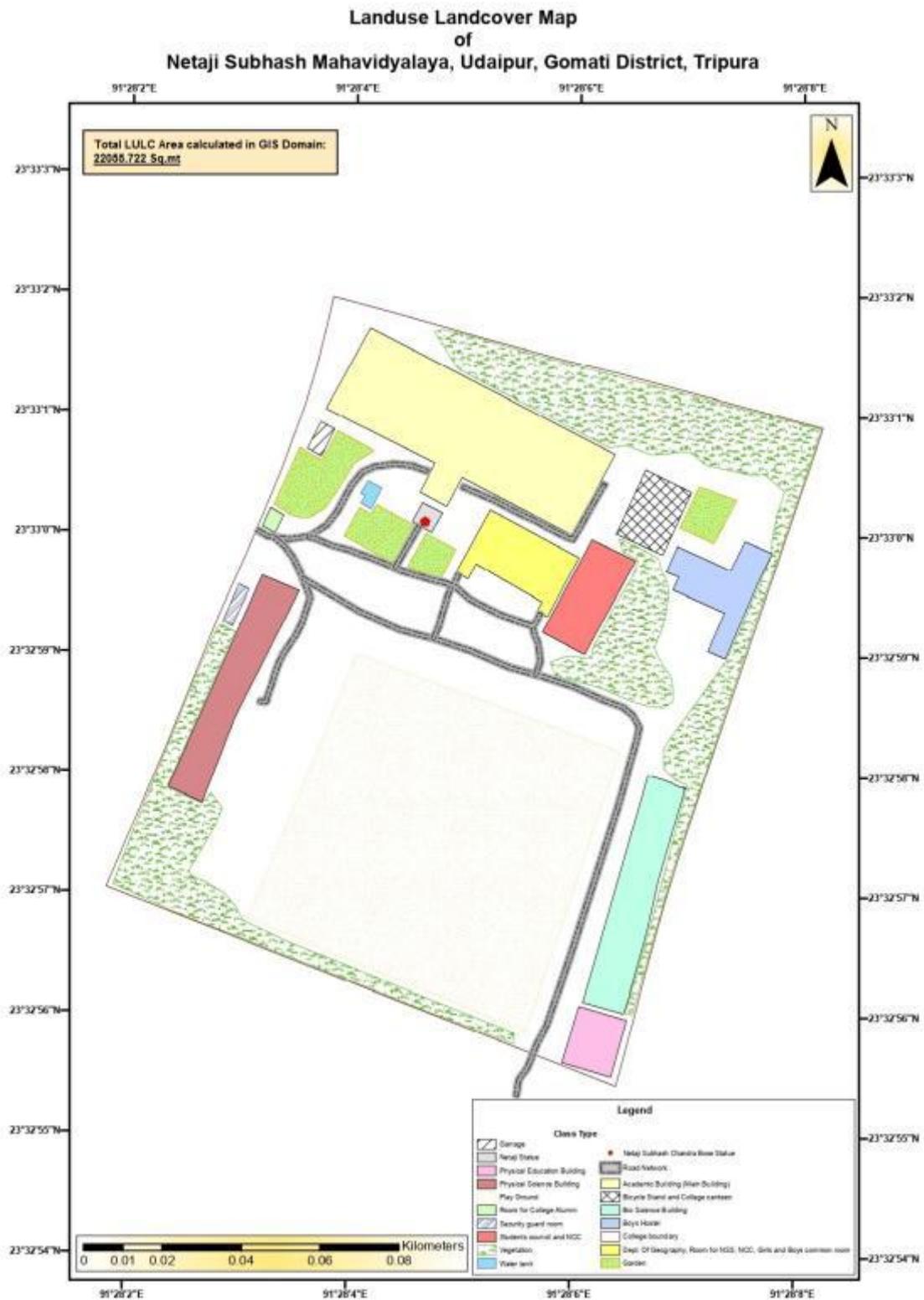


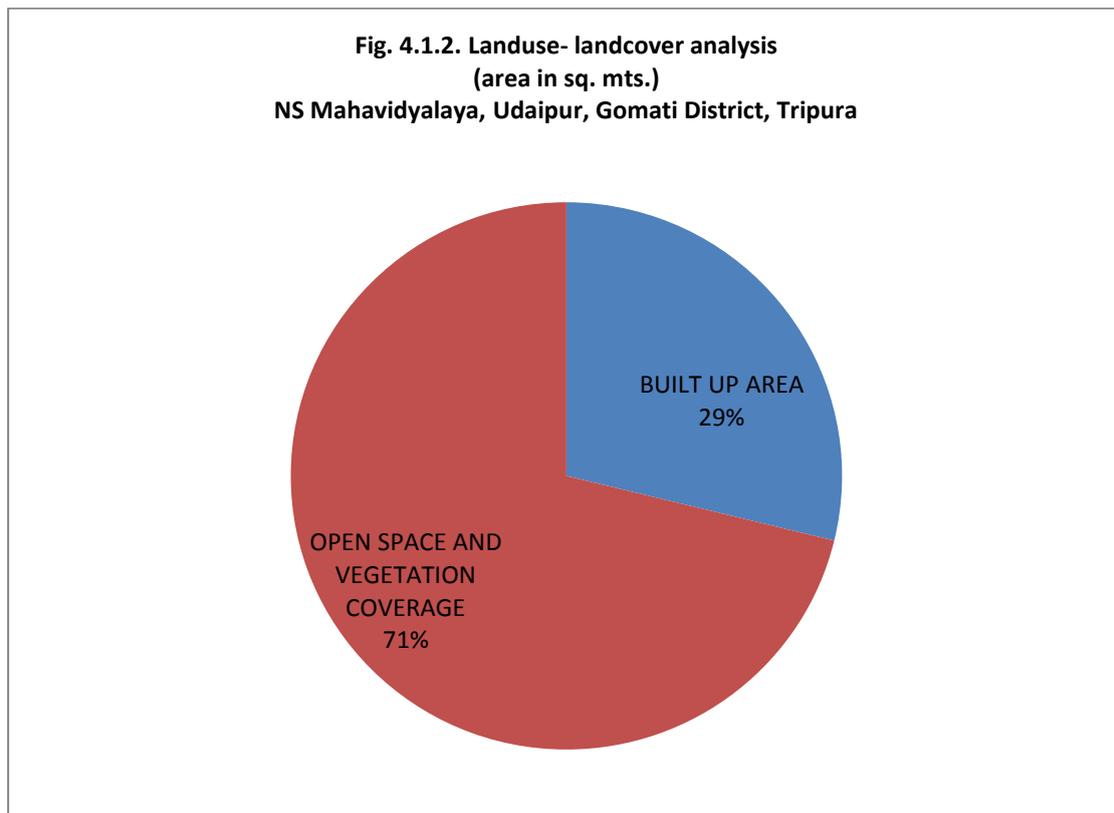
Fig.4.1.1. Land use-land cover analysis of NS Mahavidyalaya, Udaipur .

4.1.2. Results

Land use and land cover data of NS mahavidyalaya, Udaipur, Gomati District, Tripura are presented in Table 4.1.2.

Table 4.1.1. Land use land cover data of NS mahavidyalaya, Udaipur, Gomati District, Tripura

Categories of land use	Area (sq metres)
Built up area	5384.329
Open space and vegetation coverage	13311.671
total area	18696



The total area of NS Mahavidyalaya, Udaipur, Gomati District, Tripura is 18696 sq. meters (area calculated in GIS domain is 22055.722 sq. meters) out of which the built up area is 29% (i.e. 5384.329 sq. meters) and open space & vegetation coverage is 71% (i.e. 13311.671 sq. meters).

The built up area of 29% (i.e. 5384.329 sq. meters) consists of the following regions of NS Mahavidyalaya, Udaipur as follows:

1. The North and North Eastern part of Netaji Subhash Mahavidyalaya is densely built up having main faculty Building (Academic building) with administrative block and. Arts building, boys' hostel, buildings of NSS, NCC, Students Council, Canteen and scooter stand building, room for college alumni and garage and the statue of Netaji Subhash Chandra Bose.
2. The south and south-eastern region is sparsely built up having the buildings for the Bio Science departments and the Physical Education department.
3. Whereas, in the south-western part of this college having Physical science department and room for gate keepers and night guards.
4. Most of the southern region of this college is covered by the playground.

4.1.3. Observations

NS Mahavidyalaya, Udaipur, Gomati, Tripura, has an eco-friendly environment. It has a long legacy of healthy environmental practices including periodic plantation. Its land use is such that about 71 % of the total area is occupied by open land and vegetation coverage that generate a better and sustainable campus environment. Being situated along the NH8 of Tripura and endowed with other facilities, the college attracts maximum number of students' enrolment in comparison to others colleges of this state.

4.2. Auditing for Water Management

4.2.1. Results

Results of water auditing are tabulated in Table 4.2.1.

The source of water is ground water. A total of 25000 L of water is pumped out every day.

Table 4.2.1. Profiles of water audit

SL NO	PARAMETERS	Response	Remarks
1	Source of water	Ground water (through IRP)	
2	No of Wells/ponds/lakes	Nil	
3	No of motors used	1	
4	Horse power – Motor	10 HP	
5	Number of water tanks	plastic Tank 17, reservoir 2	
6	Capacity of tank	1000L -17 12000L (approx.) -2 reservoir	
7	Quantity of water pumped every day	25000 L	
8	Any water wastage/why?	apparently nil	Broken Taps get repaired regularly. Water and waste related complaint register is maintained by office and supervised by Swachhata Action Plan Committee (SAP) regularly.
9	Water usage for gardening	approx. 500 L/day	
10	Waste water sources	Lab, canteen,	

		Bathroom	
11	Use of waste water	Partially used for gardening	
12	Fate of wastewater from labs	After dilution waste water is disposed in the soak pit	
13	Any wastewater treatment for lab water	No	
14	Whether any green chemistry method practiced in labs	Few Organic and inorganic synthesis has been done by Green method (as per curriculum in Department of Chemistry)	
15	Rain water harvest available?	yes, in the physical science and bio science building	
16	No of units and amount of water harvested	02	
17	Any leaky taps	Few, if leaked, repaired regularly	
18	Amount of water lost per day	Monitored Regularly	
20	Any water management plan used?	Water management audit conducted	
21	Any water saving techniques followed?	Initiative taken the reuse of waste water for farming	
23	Are there any signs of messages inside the college campus reminding peoples to turn off the water taps or water supply?	Yes. Posters and awareness programme	

4.2.2. Observations

Following observations are made from the water auditing:

1. Source of water in the campus is ground water.
2. Ground water has been purified by the Iron Removal plant.



Fig. 4.2.1. Iron removal plat

3. Rainwater harvesting system has been adopted only for laboratory purposes, but it is not adequate.
4. Wastage of water is mainly done by damaged Taps. But in the college there is a systematic repair mechanism by the college authority and it is supervised by Swacchata Action Plan Committee (SAP Committee). Some water is consumed for drinking water needs of inhabitants of surrounding localities.



Fig. 4.2.2. Water filter in campus

5. Campaigning against misuse of water by using posters, display on Smart TV, etc are noticed. Students are aware about the need of the conservation of water.
6. Recycling of water is noticed. But it needs more scientific and practical approach. Generation of awareness regarding the recycling of water is necessary.

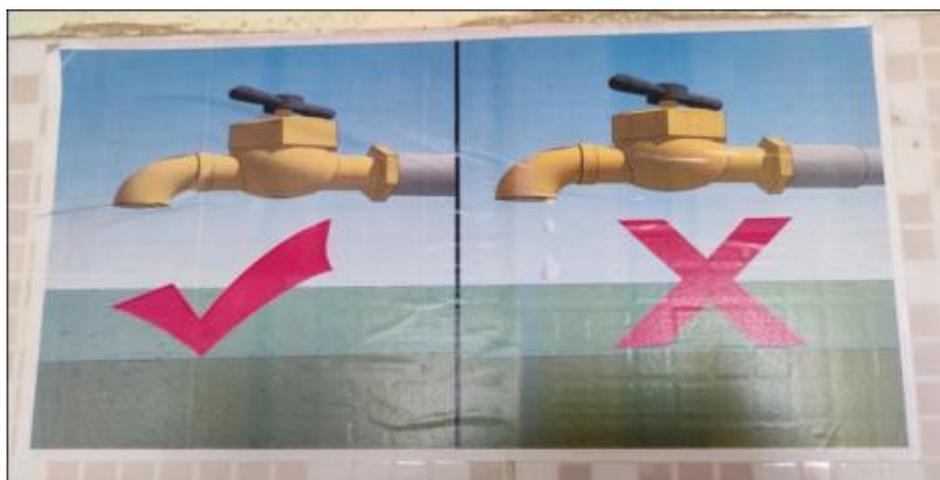


Fig. 4.2.4. Awareness poster

4.3. Auditing for Waste Management

Waste management is important for an ecofriendly campus. In a college different types of wastes are generated, and their collection and management are very challenging. The following data provide the details of the waste generated and the disposal method adopted by the college.

4.3.1. Results

Survey data of auditing of waste managements is tabulated 4.3.1-4.3.5.

Table. 4.3.1. Total No of stakeholders

No of Students	4306
No of Teachers (including guest)	85
No of Non-teaching staffs	38
Grand Total	4429
Male	2472
Female	1957

Table 4.3.2. Approximate quantity of different waste generated per day (in kg)

. Office	
Particulars	Amount
Non-Bio degradable (plastic)	0.05 kg/day
Biodegradable (paper waste)	0.2kg/day
Biodegradable (Food waste)	nil

. Class room	
Particulars	Amount
Non-Bio degradable (plastic)	0.05 kg/day
Biodegradable (paper waste)	0.3 kg/day
Biodegradable (Food waste)	nil

Laboratories	
Particulars	Amount
Non-Bio degradable (plastic waste)	0.1 kg/day
Biodegradable (paper waste)	0.1 kg/day
Biodegradable (Food waste)	nil

Canteen	
Particulars	Amount
Non-Bio degradable (plastic waste)	0.2 kg/day
Biodegradable (paper waste)	0.2 kg/day
Biodegradable (Food waste)	2 kg/day

Hostel	
Particulars	Amount
Non-Bio degradable (plastic waste)	0.1 kg/day
Biodegradable (paper waste)	0.2 kg/day
Biodegradable (Food waste)	5 kg/day

Total waste generated	
Particulars	Amount
Non-Bio degradable (plastic)	0.5 kg/day
Biodegradable (paper waste)	1.0 kg/day
Bio degradable (Food waste)	7 kg/day

Table 4.3.4. How the waste generated in the college is managed?

A)Composting/ Vermicomposting	Yes	College has vermin-compost unit which is under supervision of Department of Zoology and Swacchata Action Plan Committee (SAP).
B)Recycling	yes	

Table 4.3.5. Different types of waste generated in the college and their management

Types of waste	Particulars	Disposal method
Plastic waste	Plastic containers, wrappers, plastic bag, Pen, Refill, Plastic water bottles and other.	Separated through Blue and Green dustbins and disposed of with the help of Udaipur Municipal Council.
Solid wastes	Paper waste, Damaged furniture, paper utensils like glass plates, food wastes	Both side of paper are printed and used for rough work/writing etc.,
Chemical wastes	Laboratory waste	diluted with water and disposed in soak pit.
Waste water	lavatory and canteen use	Soak pits for lavatory waste and canteen waste water is reused for gardening
Glass waste	Broken glass wares from the labs	Disposed in glass pit.
E-Waste	Computers, electrical and electronic parts	<ul style="list-style-type: none"> • E-Waste materials are kept in a separate store-room with a dead stock register. •UPS batteries are recharged/repaired/exchanged by the suppliers. • The cartridge of laser printers is refilled outside the college Campus.

4.3.2. Observations

Following observations are made from the auditing of waste management practices:

1. **Waste segregation:** Waste segregation system has been maintained through Blue and Green Dustbins where non-degradable and degradable wastes are separated respectively. Degradable wastes are used for composting and non-degradable wastes are segregated and disposed through Udaipur Municipal Corporation (UMC). However, continuous monitoring and campaigning regarding this are required.
2. **Display/Poster for waste management:** Different posters and displays on Smart TV are highlighted to generate awareness among students about the disposal of wastes and their management.
3. **Optimization of paper use** is seen by using paper on both sides at office.
4. Answer scripts, projects and different documents are kept as per the University rules.
5. Concept of e-waste management is present but not adequate.
6. **Laboratory waste:** Laboratory wastes are diluted with water and disposed to soak pit.

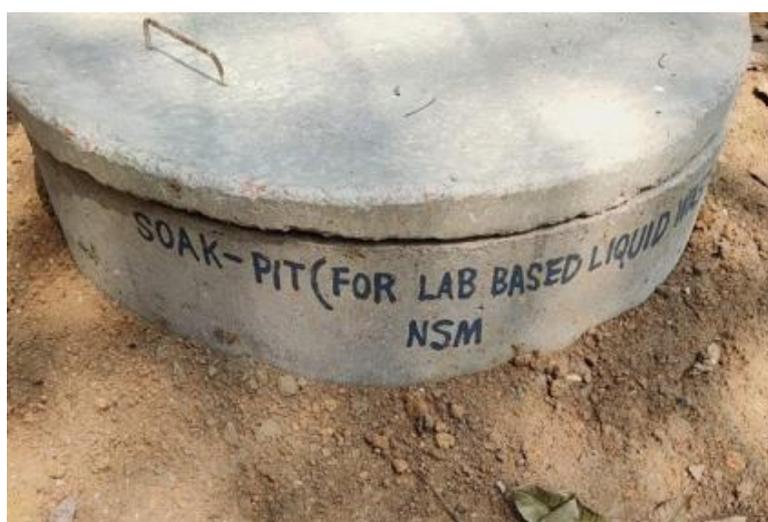


Fig 4.3.1. Soak for laboratory waste

7. Canteen biodegradable wastes are kept in a specific pit for compost making.
8. Vermicomposting unit, which is under the department of Zoology, NSM. Udaipur and Sacchata Action plan Committee (SAP) is active.
9. Although NS Mahavidyalaya has a 'Plastic free campus', but it needs more strict monitoring and more awareness regarding this practice. Plastic free campus awareness posters are spotted. It is also displayed on smart TV.
10. **Swacchata Action Plan Committee (SAP):** College has SAP committee which also monitors waste and water management in the college.
11. Workshops/Hands on Training Programme organized on Compost making by which students are made aware about waste management and livelihood generation.



Fig. 4.3.2. Workshop on Vermicomposting

12. Best Practices about waste management which are followed:
 - i. **Cleaning Activities:** NSS unit of the college organizes awareness programme and direct activities on cleaning and waste management. There are regular and special camp activities of NSS where waste management practices are seen. NCC

units (Boys and Girls) are also taking part in the cleaning and waste management activities.



Fig. 4.3.3 NSS and NCC units of the college doing cleaning and waste management activity

ii. **Vermicomposting** : There is a vermicomposting unit for waste management and livelihood generation run by Department of Zoology and Swachhata Action Plan Committee (SAP) of NSM.



Fig 4.3.4.. Vermicomposting unit of the college

iii. In the college there is a 'Compost Making Students' group that actually works to maintain Vermicomposting Unit of the college under the supervision of Department of Zoology and SAP Committee.

4.4. Auditing for Green campus & Biodiversity

These are divided into Floral and Faunal Diversity.

4.4.1. Floral Diversity

To complete analysis the of flora at the NS Mahavidyalaya campus, multiple field visits were carried out by Dr. Dipti Das, Associate Professor & HOD, Sri Prasenjit Debbarma, Assistant Professor, Department of Botany and 6th Semester Honours students during the period of January to mid of March' 2021 and a comprehensive list of the floral species present in the campus was prepared on the basis of this study. The floral diversity of different species is listed in the Table 4.4.1.1.

Table. 4.4.1.1. Table: Summary of recorded flora of Netaji Subhash Mahavidyalaya Campus

Sl No	Scientific name	Family	Local name	Habit
1	<i>Acacia mangium</i> Willd.	Fabaceae	Acacia	Tree
2	<i>Acalypha indica</i> L.	Euphorbiaceae	Mukta jhuri	Herb
3	<i>Achyranthes aspera</i> L.	Amaranthaceae	Apang	Herb
4	<i>Acmella paniculata</i> (Wall . ex DC.) R. K. Jansen	Asteraceae	Dantashure	Herb
5	<i>Ageratum houstonianum</i> Mill	Asteraceae		Herb
6	<i>Aglaonema costatum</i> N.E. Br	Araeaceae		Herb
7	<i>Albizia lebbek</i> (L.) Benth.	Fabaceae	Siris	Tree
8	<i>Alstonia scholaris</i> (L.) R Br.	Apocynaceae	Chhatim	Tree
9	<i>Alternanthera sessilis</i> (L.) R. Br. ex DC.	Amaranthaceae	-	Herb
10	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Kanta note	Herb
11	<i>Annona squamosa</i> L.	Annonaceae	Atta fol	Small tree
12	<i>Araucaria columnaris</i> (G.Forst.) Hook.	Araucariaceae	Christmas tree	Tree
13	<i>Astraea lobata</i> (L.) Klotzsch	Euphorbiaceae		Herb

14	<i>Axonopus compressus</i> (Sw.) P. Beauv	Poaceae		Herb
15	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Neem	Tree
16	<i>Blumea lacera</i> (Brum.t.)DC	Asteraceae	_	Herb
17	<i>Boerhavia repens</i> L.	Nyctaginaceae	Punarnava	Herb
18	<i>Bryophyllum pinnatum</i> (Lam.)Ken	Crassulaceae	Pathar kuchi	Herb
19	<i>Calotropis gigantea</i> (L.) W.T.Aiton	Apocynaceae	Akanda	Shrub
20	<i>Canna indica</i> L.	Cannaceae	Kalaboti	Herb
21	<i>Carica papaya</i> L.	Caricaceae	pepe	Tree
22	<i>Casuarina eqisetifolia</i> L.	Casuarinaceae	Belati- jhau	Tree
23	<i>Catharanthus roseus</i> (L) G.Don	Apocynaceae	Nayantara	Herb
24	<i>Centella asiatica</i> (L.)Urb.	Apiaceae	Thankuni	Herb
25	<i>Chlorophytum comosum</i> (Thunb.) jacques	Asparagaceae	Pata bahar	Herb
26	<i>Chrysopogon aciculatus</i> (Retz.)Trin.	Poaceae	Chorkata	Grass
27	<i>Citrus limon</i> (L.) Burm . f.	Rutaceae	labu	Shrub
28	<i>Cleome rutidosperma</i> DC.	Cleomaceac	Beguni hurhure	Herb
29	<i>Clerodendrum infortunatum</i> L.	Lamiaceae	Bhat	Shrub
30	<i>Clitoria ternatea</i> L.	Fabaceae	Aparajita	Climber
31	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceac	Telekucha	Climber
32	<i>Coffea arabica</i> L.	Rubiaceae	coffee	Shrub
33	<i>Colocasia esculenta</i> (L.) Schott	Araceac	Kachu	Herb
34	<i>Crotalaria pallida</i> Aiton	Fabaceae	Bonatashi	Shrub
35	<i>Croton bonplandianus</i> Baill	Euphorbiaceae	Ban tulsi	Herb
36	<i>Crysanthemum indica</i> L.	Asteraceae	Chandramillika	Herb
37	<i>Cuphea hyssopifolia</i> kunth	Lythraceac		Shrub
38	<i>Cycas revoluta</i> Thumb.	Cycadaceae	Cycas	Tree
39	<i>Cycas rumphii</i> Miq	cycadaceae	Cycas	Shrub
40	<i>Cynodom dactylon</i> (L.) pers.	Poaceae	Durba	Herbs

41	<i>Delonix regia</i> (Bojen.ex hook) Raf	Fabaceae	Radhachura	Tree
42	<i>Dentella repens</i> (L) J.R Forstand G.	Rubiaceae		Herb
43	<i>Grona triflora</i> (L.) H.Ohashi & K.Ohashi	Fabaceae	Kudaliya	Herb
44	<i>Eclipta prostrata</i> (L.)L.	Asteraceae	Keshut	Herb
45	<i>Epipremnum aureum</i> (linden & Andre) G.S. Bunting	Araeaceae	Money plant	Herb
46	<i>Euphorbia milii</i> Des Moul	Euphorbiaceac		Herb
47	<i>Evolvulus nummularius</i> (L.) L.	Convolvulaceae	Sankhapuspi	Herb
48	<i>Ficus hispida</i> L.f.	Moraceae	Dumur	Shrub or small Tree
49	<i>Ficus rumphi</i> Blume.	Moraceae	Bot	Tree
50	<i>Gardenia jasminoides</i> J.Ellis	Rubiaceae	Gandhoraj	Shrub
51	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae	Bon jamir	Herb
52	<i>Grewia nervosa</i> (lour)G. Panigrahi.	Malvaceae	Pichla	Tree
53	<i>Holarrhena pubescens</i> Wall. ex G.Don	Apocynaceae	kurchi	Tree
54	<i>Impatiens balsamina</i> L.	Balsaminaceae	Dopati	Herb
55	<i>Imperata cylindrica</i> (L.) P. Beauv	Poaceae	Ulu chan	Herb
56	<i>Jasminum sambac</i> (L.) Aiton	Oleaceae	Beli	Shrub
57	<i>Kalanchoe blossfeldiana</i> poelln.	Crassulaceae	Pathor kuchi	Herb
58	<i>Lantana camara</i> L.	Verbenaceae	Chotra	Shrub
59	<i>Leucas aspera</i> (willd.)Link	Lamiaceae	Swetadrone	Herb
60	<i>Magnolioa champaca</i> (L). Baill. Ex pierre	Magnoliaceae	Chapa	Tree
61	<i>Mecardonia procumbens</i> (Mill.) Small	Plantaginaceae		Herb
62	<i>Mikania micrantha</i> Kunth	Asteraceae	Refugilata	Climber
63	<i>Mimosa pudica</i> L.	Mimosaceae	Lajjabati	Herb
64	<i>Mimosops elangi</i> L.	Sapotaceae	Bakul	Tree

65	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Karipata	Small tree
66	<i>Nelsonia canescens</i> (Lam.) Spreng	Acanthaceae		Herb
67	<i>Ocimum basilicum</i> L.	Lamiaceae	Babui tulsi	Herb
68	<i>Oldenlandia corymbosa</i> L.	Rubiaceae	Khetpapra	Herb
69	<i>Oxalis corniculata</i> L.	Oxalidaceae	Amrul	Harb
70	<i>Pennisetum polystachion</i> (L.) Schult.	Poaceae		Herb
71	<i>Phaulopsis dorsiflora</i> (Retz.) Santapau	Acanthaceae		Herb
72	<i>Phoenix sylvestris</i> (L.) Roxb.	Arecaceae	Khajur	Tree
73	<i>Phyllanthus urinaria</i> L.	Phyllanthaceae		Herb
74	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Amlaki	Shrub
75	<i>Platyclusus orientalis</i> (L.) Franco	Cupressaceae	Jhao gach	Tree
76	<i>Plumeria rubra</i> L.	Apocynaceae	Kathgulap	Small tree
77	<i>Monoon longifolium</i> (Sonn.) B.Xue & R.M.K.Saunders	Annonaceae	Debdaru	Tree
78	<i>Portulaca umbraticola</i> Kunth	Portulacaceae	Notash ful	Herb
79	<i>Psidium guajava</i> L.	Myrtaceae	Peyara,Gayam	Small tree
80	<i>Richardia brasiliensis</i> Gomes.	Rubiaceae		Herb
81	<i>Ricinus communis</i> L.	Euphorbiaceae	Reri	Shrub
82	<i>Rorippa indica</i> (L.) Hiern	Brassicaceae	Bon sarisha	Herb
83	<i>Rungia pectinata</i> (L.) Nees	Acanthaceae	Pindi	Herb
84	<i>Scoparia dulcis</i> L.	Plantaginaceae		Herb
85	<i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby	Leguminosae	Minjiri	Tree
86	<i>Senna occidentalis</i> (L.)Link	Leguminosae	Kalkasunda	Under Shurb
87	<i>Sida cordata</i> (Burm.f.) Bross . Waalk	Malvaceae		Herb
88	<i>Sida cordifolia</i> L.	Malvaceae	Berela	Herb
89	<i>Sida rhombifolia</i> L.	Malvaceae	Svetbarela	Herb

90	<i>Solanum nigrum</i> L.	Solanaceae	Kakmachhi	shrub
91	<i>Solanum torvum</i> Sw.	Solanaceae	Ban bagun	Shrub
92	<i>Spermacoce alata</i> Aubl.	Rubiaceae		Herb
93	<i>Streblus asper</i> Lour	Moraceae	Sheora	Tree
94	<i>Syngonium podophyllum</i> Schott	Araeaceae	Patabahar	Herb
95	<i>Syzygium cumini</i> (L) Skeels	Myrtaceae	Jam	Tree
96	<i>Tabernaemontana divaricata</i> (L.) R. Br. Ex roem &Schult	Apocynaceae	Tagor	Shrub
97	<i>Terminalia arjuna</i> (Roxb ex Dc) wight & Arn	Combretaceae	Arjun	Tree
98	<i>Thunbergia grandiflora</i> (Roxb. Ex Rottler) Roxb.	Acanthaceae		Climber
99	<i>Tradescantia spathacea</i> Sw.	commelinaceae	Rhoeo	Herb
100	<i>Tradescantia zebrina</i> hont. Ex Bosse	Commelinaceae	Patabahar	Herb
101	<i>Trema orientalis</i> (L.) Blume	Cannabaceae	Bon naiccha	Tree
102	<i>Turnera ulmifolia</i> L.	Passifloraceae		Under shrub
103	<i>Urena lobata</i> L.	Malvaceae	Banokra	Herb
104	<i>Vernonia cinerea</i> (L.) Less.	Asteraceae		Herb
105	<i>Zephyranthes rosea</i> Lindl.	Amaryllidaceae	Rain lily	Herb
106	<i>Ziziphus jujuba</i> var <i>spinosa</i> (Bunge)hu ex H.F. chow	Rhamnaceae	Bolboroi	Tree
107	<i>Ziziphus muritiana</i> Lam	Rhamnaceae	Gulboroi	Tree
108	<i>Zornia gibbosa</i> Span	Fabaceae		Herb



Fig. 4.4.1.1. *Albegia labbeck*

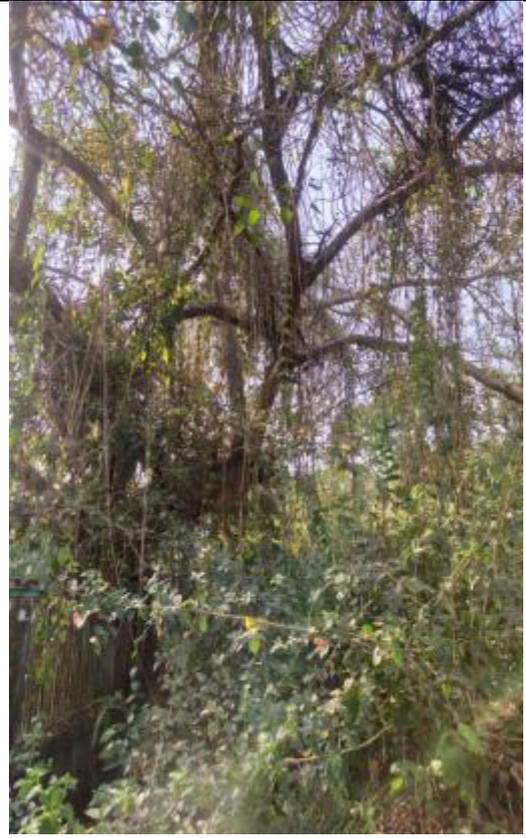


Fig. 4.4.1.2. *Ficus rumphi*



Fig. 4.4.1.3. *Polyalthia longifolia*

4.4.1.1 Routine Green Practices

1. Every year the college celebrates Vanmahotsav initiated by NSS unit of the college.



4.4.4. Vanmohatsav at NSM

2. In the college there is a committee on 'Awareness Programme on Science, environment and climate change issues' sponsored by Department of Science, Environment and Technology, Govt. of Tripura.
3. 'Plantation and Adoption Programme 2021' was initiated as a part of the observance of 'World day to Combat Desertification and Drought--17th June'.



Fig. 4.4.5. Adoption and Plantation Programme

4.4.2. Faunal Diversity

A survey was conducted to portray the faunal diversity of NS Mahavidyalaya. The survey was conducted by Dr. Nupur Datta, Assistant Professor & HOD-in-charge, Department of Zoology, NSM along with the following group of students.

- Aditya Karmakar , 3rd Semester
- Arup Datta , 3rd Semester
- Subharanjan Choudhury, 3rd Semester
- Sukanta Biswas, 3rd Semester
- Arghadeep Das, 3rd Semester

Survey was undertaken during the end of August, 2021 at various times of the day since different species remain active at different times of the day. Species rich sites includes Physical science department, ST Boys' hostel, Bioscience building premises, etc, were given special consideration. Photos were taken using Samsung Galaxy M31 phone and external macro lens. The survey is important to know about the species richness of Fauna and flora (since plants serve as hosts for most of the insects) of the college premises. Moreover it'll provide further scope for scientific studies concerned with recording and conservation of Species.

During this survey several types of organisms are spotted in the college campus. List of the organisms found in the area tabulated in Table. 4.4.2.1

Table: 4.4.2.1. Faunal Diversity of NS Mahavidyalaya

sl no	Type of organism	Scientific name/ common name
1.	INSECTS	<p>Butterflies: Total 31 Nos Of Species. J.lemonias, P.pansy, J.iphita, J.atlites, G.doson, P.demoleus, P.polytes, T. japetus, E.hypermnestra, L. salsala, N. hylus, D. chrysippus, L. Martha, etc.</p> <p>Moths: N. punctana, G. obeditalis etc.</p> <p>Dragonflies: A. brevipennis, C. coromandelianum, C. servilia etc.</p> <p>Ants: Family:Micropezidae, Ichneumonidae, etc.</p> <p>Grasshoppers: O. viridulus, green grasshoppers etc</p> <p>Musca: Common flies</p> <p>Mosquitoes: Common sp. Of mosquitoes</p> <p>Honeybees: Common honey bees, A. sp.</p> <p>Beetles: Choleopteran beetles, pentatomidae.</p>
2.	ARACHNIDS	<p>Spiders: Pardosa sp., P. petrsi, A. tenuipes, M. bivittatus, Oxyopes sp., H. venatoria, Argiope sp., Nephila kuhlii etc.</p>
3.	MOLLUSCS	<p>Land Snail Family: Helicarionidae</p>
4.	AMPHIBIA	<p>Toads D. melanostictus, B. stictus, tree frogs etc.</p>
5.	REPTILIA	<p>Lizards H. sp, C. versicolor, etc.</p> <p>Gecko G. sp.,</p>
6.	BIRDS	<p>Different Types Of Birds e.g. Cinereous Tit, parrot, sparrow, pegion, common myna, woodpackers, brown shrike, Asian barred owlet etc</p>
7.	MAMMALS	<p>Squirrels F. palmarum.</p> <p>Rats B. bengalensis.</p>



Fig 4.4.2.1. *Elymnias hypermnestra*



Fig 4.4.1.2 *Aethriamanta brevipennis*



Fig 4.4.2.3. *Asarkina* sp



Fig. 4.4.2.4. *Toxorhynchites* cf. *splendens*



Fig 4.4.2.5. *Crossopriza* sp



Fig 4.4.2.6. *Telicota colon*

4.5. Auditing for Energy management

Energy is consumed in the NS Mahavidyalaya to run different simple appliances like bulbs, tubes, fans, pumps etc. as well as sophisticated applications like computers, printers, photocopiers, instruments of science laboratories such as Physics, Chemistry, Botany, Zoology, Human Physiology.

Data collection for energy audit of the N S Mahavidyalaya was done by the audit team under the leadership of Sri Prankrishna Debnath, Assistant Professor, Department of Physics with the help of group of students of physical sciences from April to September, 2021. This audit was performed to evaluate the energy efficiency of the campus.

4.5. 1. Results

All regular Electrical appliances data were collected by the audit team such as, number, approximate power, average operation, monthly use etc. Daily operational data were collected from the end users. All the information regarding electrical appliances is tabulated in Table 4.5.1

Table 4.5.1 Profiles of regular use electrical appliances and their consumption

SI No	Electrical appliances/ instruments	Number	Approx Power (W)/unit	Total Power to be consumed (W)	kW	Average Operation (hour/day)	kWh	Monthly operation (days)	Total consumption/ month
1	CFL	49	14	686	0.686	8	5.488	22	120.736
2	Tube light	394	40	15760	15.76	5	78.8	22	1733.6
3	led bulb	50	09	450	0.45	8	3.6	30	108
3	led tube	10	20	200	0.2	8	1.6	22	35.2

4	fan	377	60	25020	25.02	6	150.1	22	3302.64
5	Table fan	06	55	330	0.33	4	1.32	22	29.04
6	Stand fan	03	55	165	0.16	4	0.64	20	12.8
7	Projector	04	280	1120	1.12	1	1.12	22	24.64
8	Audio amplifier	02	460	920	0.92	0.33	0.30	22	6.6
9	Computer	50(CRT)	100	5000	5.0	4	20.0	20	400
		24(LCD)	60	1440	1.44	4	5.76	20	115.2
10	Laptops	16	45	720	0.72	4	2.88	20	57.6
11	Printers	12	40	480	0.48	1	0.48	20	9.6
12	Photostat machine	05	700	3500	3.5	2	7	15	105
13	Refrigerator	07	110	196	0.196	24	4.72	30	141.75
14	Exhaust fan	12	45	540	0.54	4	2.16	25	54
15	Halogen	02	100	200	0.2	4	0.8	25	20
16	Smart tv	07	38	266	0.26	1	0.26	20	5.2
17.	Motor (10HP)	1	7460	7460	7.460	2.5	18.65	30	559.275
Total									6699.335

Table.4.5.2. Details of power connection of Tripura State Electricity Corporation

Sl No	Consumer No	Connected load
1	100410506281	20 kW
2	100410506282	20 kW
3	100410506338	20 kW
4	100410506407	60 kW
5	100410506438	6 kW

Table 4.5.3. Monthly power consumption statistics

Sl No.	Month	Electric Consumption Unit (KWh)
1	Apr 2021	846
2	May 2021	170
3	June 2021	79
4	July 2021	659
5	Aug 2021	2520
6	Sept 2021	1929
Consumed in 06 months		6203 kWh
average electric energy consumed per Month (considering 6 months value mentioned above)		1033.83 kWh
average electric energy consumed per month (considering August and September/ 2021 consumption)		2224 kWh*

*August and September, 2021 consumptions average have been considered as college activity (classes) were restricted during April to July/ 2021 due to COVID -19 situation.

Table. 4.5.4 Monthly Power requirement, consumption and renewable energy statistics of NS Mahavidyalaya, Udaipur

Total monthly Power requirement by all electric appliances	6699.35 kWh
Actual average monthly electric consumption	2224 kWh
Capacity of Solar power plant	5 KWp
Solar average generation (kWh/kW)	4 kWh
average monthly generation	600 kWh
to be mitigated by renewable energy(solar)	1680kWh

4.5.3. Observation

Data generated in energy audit are useful for understanding the energy distribution and utilization of college. The summary of observation and recommendations are:

1. The college needs average maximum 6699.35 kWh of electricity in a month. But it has been shown that only average monthly power consumption is found to have 2224 kWh (Table 4.5.3), which is less than power need when all the electrical appliances works maximally as derived by the audit team.
2. The causes of less consumption of power than required are:
 - I. Less electric light are required in day time as bright sunlight enters into the class room.
 - II. No air conditioning equipment are being used in the college.
 - III. College is having Solar power plant and also solar street lighting systems.
 - IV. “Energy efficiency” concepts are found among students.



Fig. 4.5.1. Solar Street lights around Netaji’s Statue in the campus

3. In the college there is a committee on ‘**Awareness Programm on Science, environment and climate change issues**’ sponsored by the Department of Science, Environment and Technology; Govt. of Tripura.

4.6. Carbon Foot Print

A carbon footprint is the amount of greenhouse gases—primarily carbon dioxide—released into the atmosphere by a particular human activity. Global Warming Potential (GWP) is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. A carbon footprint can be a broad measure and is usually measured as tons of CO₂ emitted per year.

In India, the concept of 'carbon neutral campuses' is gaining momentum. Green audit, energy audit actually part of this. The amount of Green House Gases (GHG) emissions, mainly the quantity of CO₂ produced by the campus as a result of its operations and carbon sequestration is measured. Based on this, the total carbon footprint is estimated. Measures are recommended to bring down the carbon footprint of the campus and to make it a carbon neutral campus.

The major objectives of the audit are:

1. To make students and teachers aware of carbon footprint.
2. To create awareness about carbon mitigation and its plan to reduce carbon footprint based on the data generated.

Auditing regarding carbon foot print was performed under the supervision of Dr. Biplab Ghosh, Assistant Professor, Department of Chemistry with group of 5th semester physical sciences students.

The methodology for carbon footprint calculations are still evolving and it is emerging as an important tool for green house management. In the present study carbon emission data from the campus is estimated under three categories viz.

- a. **Energy**
- b. **Waste produced**
- c. **Transportation**

In the college Energy and waste audit was performed and listed in section 4.3. and 4.5. Regarding transportation, a survey was made.

A survey by self-made questionnaire was performed regarding modes of transportation used by the students to reach college. Besides, regular vehicle count was also done by the college security guards during the month of August, 2021. **Approximately 50 percent of students participated in survey.** From the survey approximate measure of distance covered by bike/scooty and amount of fossil fuels use (like petrol) was calculated approximately. Only students were considered for carbon foot print auditing.

Carbon Mitigation

Carbon foot print or carbon emission can be reduced by the following ways:

- Carbon sequestration by plants (plantation)
- By using renewable energy like solar energy
- Resource optimization (optimal use of resources such as fuel etc)
- Waste minimization and management (recycling, composting etc.)
- Energy efficiency

4.6.1. Observations

1. Most of the students are using public transport (75.4% students) and only a few no of students are using two wheelers (7.9%).
2. Total garbage generation is found to be 8.5kg /day including plastic, paper and food waste. Among these plastic, paper and food wastes are 0.5 Kg/day, 1kg/day and 7 kg/day respectively.
3. Waste management's systems are seen e.g. vermicomposting unit.

Table 4.6.1. Carbon foot print analysis survey report of the students of NSM

1.	Students reach college by walking	13.6%
2.	Students reach college by cycling	2.76%
3.	Students using public transportation	75.74%
4.	Students reach college by two wheelers	7.9%
	Students reach college by Four wheelers	nil
	Average distance travelled by two wheelers	16.57 km*
	Average quantity of fuel use in two wheelers	0.33 lit petrol
	Average distance travelled by four wheelers	nil
	Average quantity of fuel use in four wheelers	nil
5.	Faculty/staff reach college by walking	5.5%
6	Faculty/staff reach college by cycling	nil
7.	Faculty/staff using public transportation	71.11%
8.	Faculty/staff reach college by two wheelers	16.66%
	Faculty/staff reach college by Four wheelers	6.66%
	Average distance travelled by two wheelers	11.33 km
	Average quantity of fuel use in two wheelers	0.25 lit
	Average distance travelled by four wheelers	73 km
	Average quantity of fuel use in two wheelers	1.5 liter petrol & 1kg CNG
9.	Number of LPG cylinders used in canteen/labs per month	10 Nos
10.	Use of any other fuels	nil
11.	Average Electricity consumption per month)	2224 KWh
12.	Total Garbage generation as below (per day)	8.5 kg
	Plastic Waste (per day)	0.5 kg
	Paper waste (per day))	1 kg
	Food waste (per day)	7 kg
13.	Any solar plant and its capacity:	yes, 5 KWp
14.	Is there any resource optimization?	not specific
15.	Is there any waste management system?	yes (Documents given in insention..4.2. in waste auditing)
16.	Is there any energy efficiency?	yes (details given in section 4.5. in energy auditing)

* Students residence within 15 km periphery from the college has been considered and found 96 students reach college by bike/scooty.

4. Solar Power plant of 5kWp capacity has been installed in 2021.

The details statistics are given in the Table 4.6.12. It is observed that the average generation is 4.0 kWh per kW of solar power plant installed. So, it may be estimated that in 2021 the total generation of solar energy will be around 0.480 mWh of electricity

Table. 4.6.1. Solar power plant statistics

Mitigateddc through Solar Power Plant Installed April 2021	
Capacity of Solar power plant	5 kWp
Solar average generation (kWh/kW)	4 kWh
Total generation (8 months)	0.480 h



Fig 4.6.1 Solar Plant of the NSM

5. A committee on 'Awareness Program on Science, environment and climate change issues' sponsored by the Tripura Climate Change cell, Department of Science, Environment and Technology, organizes different programs such as

- I. 'World day to combat desertification and draught-17th June' observation
- II. 'World Ozone day-16th September' observation.
- III. Poster Competition on World Ozone day through Google form.



Fig. 4.6.3. World Ozone day observation

5. Summary and Recommendations

5.1. Summary of the report

Green audit has been performed in the college first time for the year 2020-21 by the internal audit team, although planning was initiated from 2019 onward by IQAC of the college. It was delayed for the COVID -19 lockdown. Internal audit team was made by the IQAC of the college involving the faculty members of different departments. Different students groups were also made for helping or making aware of the students regarding green audit.

Therefore, the broad purpose of the present green audit is to identify, quantify, describe and prioritize framework of green campus for the institution which will lead to sustainable development and at the same time make campus 'carbon neutral'.

To fulfill the above broad objectives auditing was performed over the following criteria:

1. Land use analysis
2. Auditing for Water Management
3. Auditing for Waste Management
4. Auditing for Green Campus Management & Biodiversity
5. Auditing for Energy Management
6. Auditing for Carbon Footprint

In order to meet its objectives, this audit combined physical inspection with a review of relevant documentation and interviews with various stakeholders.

The main findings of the audit show that, in general, all the departments and students are aware about the need for environmental protection at a general level. It was also observed that a number of best practices such as planting trees in the campus, vermicomposting, safe laboratory waste disposal to ensure a proper waste management technique, etc. are followed in the campus. Awareness Program on Science, environment and climate change issues are well practiced. Energy

consumption is less than expected. Infrastructure of renewable energy is just developed, although not adequate. Campus is fully dependent on ground water. Although, rainwater harvesting initiatives has been taken.

Students are mostly using public transport (75.4% students) and only less no of students are using two wheelers (7.9%). However, more specific emphasis should be given on resource optimization such as optimal use of fuel etc.

So, to make 'carbon neutral campus', the institution need more plantation, more use of renewable energy (solar power), minimization of waste & recycling, and energy efficient practices.

However, on detailed review, it was observed that, the green policy of the campus is still in nascent stage and needs further nurture. In addition, certain processes could benefit from further review in order to improve their efficiency, fairness and consistency.

5.2. Recommendations

Following recommendations are made by the green audit of the campus for the year 2020-21.

6.1. General recommendations

General recommendations are:

1. Maximize Renewable energy generation and consumption by developing infrastructure for the purpose.
2. Waste minimization is required.
3. More awareness about resource optimization.
4. Ultimately more plantations are required to make carbon neutral environment.

6.2. Criteria wise recommendations

Besides general recommendations criteria wise recommendation are given as applicable.

Water Management	<ul style="list-style-type: none"> i. More preventive measure should be taken for stopping misuse of water. ii. Push water taps should be installed. iii. Automatic sensor tap can be installed iv. More rainwater harvesting mechanisms to be installed. v. Water wastage during lifting of water through the water pump should be controlled. vi. Use of ST Boys' hostel underground water reservoir should be monitored and during rainy day these tanks can be filled up with rain water by installing proper harvesting structures. vii. Recycling of waste water practice should be followed more precisely.
Waste Management	<ul style="list-style-type: none"> i. More awareness could be generated for a plastic free campus. ii. Promotion of reusable serving plates in college canteen iii. Use of biodegradable serving materials like wooden spoons, etc., should be promoted in College canteen. iv. Promotion of e-waste management awareness is required. v. Leaf litter of the campus can be converted into compost vi. Sanitary Napkin incinerators should be installed. vii. The students could be encouraged to take

	back the food waste as per the zero waste strategy of the college. It will also help in reducing the consumption of water in washing.
Green campus management	<p>i. In order to increase the carbon sequestration, to bring carbon emission to zero and to enhance the greenery of the campus, it is recommended to plant more trees inside the campus.</p> <p>ii. Those tree which sequestrates more CO₂, should be selected for plantation.</p>
Energy management	<p>Following recommendations have been made for more power saving</p> <ol style="list-style-type: none"> I. Replace CFL, Tube lights by LED Bulb and LED Tube to save power. II. More powerful solar plants should be installed (at least 15-20 kWp solar plant). III. More solar street light should be installed. IV. Need for efficient use of solar power generated by the 5Kwp solar plants installed. V. Master switch should be installed for the class rooms. VI. It has been noticed that among the electrical appliances water pump is maximally used. So, more water conservation measures should be taken to reduce pump use or indirectly less energy use. VII. Effective plans should be made to use solar energy for cooking in canteen and Hostel to avoid LPG use. VIII. Regular energy efficiency programs and activity for the students and staff members

	are required.
Carbon Foot Print	<p>To make NSM Carbon emission neutral following measures could be taken.</p> <ol style="list-style-type: none"> I. More plantations and maintenance of plantation are required. II. Need more generation and use of renewable energy. Although college have 5kWp solar plant., higher capacity solar plant is required to mitigate carbon emission. III. More efficient Waste minimization and management is required, although composting mechanism is applied nicely in the campus. IV. More efficient Recycling of the waste is required, although few steps have been taken. V. Specific Energy efficiency steps are required. However few steps such as campaigning etc. have been taken. VI. Although students are mostly using public transport (75.4% students) and only less no of students are using two wheelers (7.9%). However, more specific emphasis should be given on resource optimization such as optimal use of fuel etc. VII. However, Carbon foot print audit was done without calculating carbon foot print in terms of carbon emission and mitigation to check carbon neutral campus. So, need specific carbon foot print analysis in future.

6.0 Declaration

I agree with all the recommendation and observation mentioned in this report.

Original signed by

Principal
NS Mahavidyalaya
Udaipur



6.0 Declaration

I agree with all the recommendation and observation mentioned in this report.

Original signed by

Sudhan Debnath
31-12-21

Principal

NS Mahavidyalaya

Udaipur

(Dr. Sudhan Debnath)
Principal-In-Charge
Head of Office
N. S. Mahavidyalaya
Udaipur, Gomati, Tripura.