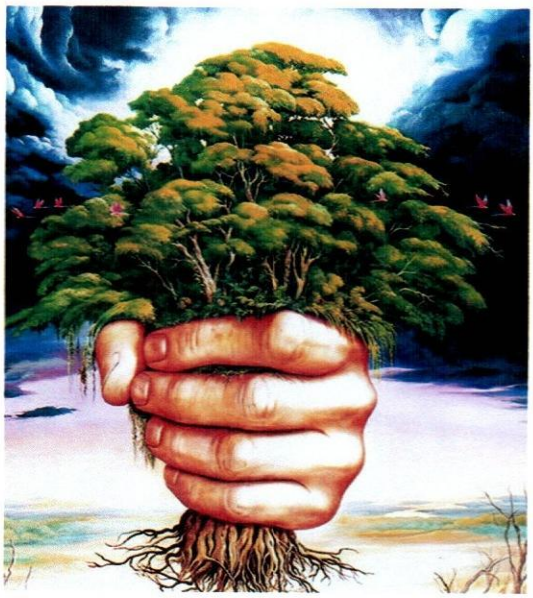
Green Audit Report

2021

LALIT CHANDRA BHARALI COLLEGE

MALIGAON, GUWAHATI, ASSAM



Green Audit Report,2021

Lalit Chandra Bharali College

Maligaon, Guwahati- 781011

The Audit Team:

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CERTIFICATE

This is to certify that the present green audit report of Lalit Chandra Bharali College, Maligaon, Guwahati-11 was prepared during the period July-September, 2021. The audit team assessed the water, soil and air quality, water consumption and management, waste management, carbon foot print, green campus and green agenda in curriculum and practises and the policies and efforts of the college to maintain an eco-friendly campus.

20.9.2021

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Preface

Conservation of the environment, realisation of the importance of environmental protection, consequences of pollution and depletion of flora and fauna and sustainable development are important insights of present-day research, teaching and all forms of scholarly ventures. The Lalit Chandra Bharali College, located in the heart of the city of Guwahati in its pursuit of environmental quality study and efforts at environmental protection has made an institutional self-enquiry of the campus. The present report is the outcome of this enquiry process. In the absence of any standard model for green audit in the state, the committee brainstormed and designed their own methodology and related tools for the same. Survey on the basis of a pre-tested and well-structured questionnaire, on site visit and focussed group discussion with the stakeholders of the institution composed the methodology of the present study. The part which involved measurements of quality for energy audit, the task was entrusted upon a professional body, viz. Thunderbolt Energy Consultancy, Maharashtra

Wesincerely hope that all the stakeholders of the College will give due attention to the cause of the environment. The audit teamhas made various short term and long-term suggestions for better environmental management in the campus which perhaps will receive due attention of the stakeholders.

Dr.Mridul Kr. Borthakur **Dr. Pranab Bujarbarua**

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Executive Summary

Green audit is a practise implemented across institutions, all over the world, both educational and otherwise to make them environmentally sustainable with their mass resource utilization and waste discharge in to the environment. In the context of educational institutions, it becomes even more pertinent as we deal with students who are the future generations.

The green audit of L.C.B. College, Maligaon, Guwahati was initiated with forming of an internal audit team with the faculty members Dr.Nilima Goswami Sarma, Dr.Jublee Goswami, Mrs. Kunjalata Brahma Bathari. Thereafter, two external members Dr.Mridul Kumar Borthakur, Department of Zoology, B. Borooah College with specialisation in Ecology and wildlife biology and Dr. Pranab Bujarbarua, Department of Botany, Handique Girls' College with specialisation in higher plant Ecology were duly appointed to the audit team. The present audit report was prepared during the period July-September, 2021.

The audit team designed their own methodology and related tools for the Green Audit. Survey, on site visit and focussed group discussion with the stakeholders of the institution composed the methodology of the present study. The part which involved measurements of quality for energy audit, the task was entrusted upon a professional body, viz. Thunderbolt Energy Consultancy, Maharashtra.

The audit team assessed the quality of water, soil and air of the campus, water consumption and management practises adopted, waste management policies adopted, carbon foot print, green campus and green agenda in curriculum and practises and the policies and efforts of the college to maintain an eco-friendly campus. In the context of waste management, the audit team considered only the solid waste including E-waste management.

Overall Recommendations

1. The audit team recommends that initiatives be taken to increase the green cover in the campus. Inside the boundary of the college, some fruit bearing plants may be planted. Moreover a few beds of indigenous medicinal and aromatic herbs may also be created as demonstration plots with information on their use.
2. The college may take initiative for plantation in the degraded areas of the two adjoining hills. This may help in restoring the greenery of the degraded hills.
3. Since the open area in the college campus is too less, every department may take initiative to grow as many potted plants in their respective departments (wherever possible).
4. The audit team recommends that bird watching camp, butterfly photography and similar activities be initiated under expert guidance to raise the awareness of students about their surroundings.
5. The college may observe world water day, world ozone day and such other events to raise the awareness of stakeholders on various environmental issues. Green clubs, eco clubs and such associations involving students and staff may be initiated.
6. The audit team recommends that leaking water taps be repaired at the earliest. College may put up signs and posters to save water. Students must be given projects on water saving ideas and the best ideas may be rewarded.
7. The audit recommends that the harvested rainwater of the collegemay be purified in a customised sand-coal filter and put to use for handwashing or gardening purpose.
8. The college campus and canteen may reduce the use of plastics and may also promote a plastic free zone in the college.
9. Recyclable wastes may be segregated at source and stored.
10. Compostable solid waste (kitchen and garden) may be converted into compost and may be used in the garden or sold out as a resource generation scheme. The college may initiate measures for the same.
11. Efforts to minimise the use of paper should be made.

12. The college should never use open fires to dispose of wastes
13. Proper methods of disposing electronic goods should always be practised.
14. The college may create awareness on what is e-waste among students.
15. Stakeholders must never throw e-waste in the trash. The institution may contact approved E- waste management and disposal facility in order to dispose E-waste in scientific manner.
16. Stakeholders may start using cloud technology to minimise the use of hard disks and pen drives.
17. The audit team recommends that the staff may reduce private vehicle use and develop car-pooling culture or promote use of public transport. The students may be discouraged to use two wheelers.
18. Awareness programs on carbon emissions and noise pollution may be conducted to increase mass awareness among stakeholders.
19. More energy efficient cooking method may be adopted to reduce LPG consumption. Use of generators too often may be discouraged.

Pre-Audit Stage

Background:

Green audit is the tool of management system used methodologically for protection and conservation of the environment. It is also used for the sustenance of the environment. The audit suggests different standard parameters, methods and projects for environmental protection. It can be adopted by any industry, organization, institute and even by housing complex. The green audit is useful to detect and monitor sources of environment pollution and it emphasizes on management of all types of wastes, monitoring of energy consumption, monitoring of quality and quantity of water, monitoring of hazards, safety of stakeholders and even the management of disasters.

Green audit is the need of the present times when the world is challenged with environmental threats and constant pressure of sustenance of the ecosystems. The concept of a green audit mainly focuses on the efficient use of energy and water; minimize waste generation or pollution and also enhancing the economic efficiency of resource use and recording, identification, reporting and quantification of the floral and faunal diversity.

As per the National Environment Policy 2006, Government of India has made green audit mandatory to each industry. It has been recognized that the maintenance of the healthy environment is not the responsibility of the state alone. It is the responsibility of every citizen and thus a spirit of partnership is to be realized through the environment management of the country. The process of environmental audit was formalised by the Supreme Audit Institution (SAI) according to the guidelines given in Manual of Standard Orders (MSO) issued by Authority of the Controller and Auditor General of India 2002.

By realizing the need of responsibility towards environment, NAAC, an autonomous body under UGC has added the concept of environmental audit in accreditation methodologies of universities and colleges. Any responsible educational institution focuses its activities towards the reduction of emissions, procures a cost effective and secure supply of energy, encourages

and enhance energy and water conservation, promotes environment-friendly action plan, reduce wastes, and integrates environmental considerations into all its contracts and services.

Here an attempt is being made to assess the environmental quality in and around L.C.B. college campus thereby preparing a comprehensive environmental audit of the college campus. The prime thrust areas included during the auditing are air quality, water, energy, waste, green campus and carbon foot print. Effort is also being made to formulate management strategies for optimum utilization of various resources.

Objectives of green audit:

The objectives of the present green audit are to assess the environmental quality of the L.C.B. college campus and its adjoining areas and formulate the management strategies and to nurture environment friendly management of the institution.The specific objectives of the environmental audit are:

1. To assess the quality of the air, water and soil in the L.C.B. college campus
2. To monitor the energy consumption pattern of the college
3. To study the water consumption and management pattern of the college
4. To quantify the waste generation (solid and e-waste) and the management plans initiated for the same in the College campus.
5. To assess the carbon foot print of the college
6. To recommend future environment management plans for the college
7. To create a database for initiating corrective actions and future plans.
8. To assess whether the curriculum of the institution include environmentaleducation and practises.

The study will thus try to recognize the initiatives taken by the organization towards environment. It is also expected to provide baseline information to enable the institution to evaluate and manage environmental change, threat and risk thereby to recognize, diagnose and resolve the environmental problems.

Dimensions of Audit Adopted:

(a) Audit of Water, soil and air quality:

Water, soil and air are important natural resources as all living organisms depend on them for sustenance of life. While freely available in many natural environments, in human settlements drinkable water is less readily available. Present pollution poses great threats to the quality of air, water and soil. Hence, it is essential to examine the quality of the same as decided upon by the audit team.

(b) Auditing for water consumption and water management:

Groundwater depletion and water contamination are taking place at an alarming rate. Hence, it is essential to examine the 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. The concerned audit team investigates into the relevant methods that can be adopted and implemented to balance the demand and supply of water.

(c) Audit for energy management:

Energy conservation is an important aspect of campus sustainability. 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. However, the energy audit was done by a professional body, viz. Thunderbolt Energy Consultancy, Maharashtrafor a scientific and well addressed audit and therefore escapes the scope of the present audit team.

(d) Auditing for solid waste management:

Boulding, an environmental economist of repute had rightly compared the earth to a space ship. The earth has to sustain the resources and restrict its waste also within itself. Thus, the present notion of ***reduce, recycling and reuse*** in waste emission and management holds

immense importance. Waste may be solid, liquid and gaseous. In the perspective of the college the first two holds relevant. However, there is no laboratory generation of hazardous liquid waste as observed by the audit team. Liquid waste from toilets and kitchen were observed to be drained out from the college campus. The college authority has provisioned for a drainage system that has benefitted the surrounding locality also as observed by the audit team. Thus, the audit team makes an effort to assess the nature, quantum of solid waste including E-waste generated and the various policies adopted for waste management by the college.

(e) Auditing for green campus:

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits. In one year, a single mature tree will absorb up to 48 pounds 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 stakeholders are busy studying and working and earning good career prospects, all the trees in campus are also working hard to make the air cleaner. Besides, floral and faunal biodiversity loss is a great threat of the modern times primarily because of human activities. The audit team assesses the available floral and faunal biodiversity of the institution and tries to sort out ways to improve the same.

(f) Auditing for green agenda in curriculum and academic practices:

Mass awareness on issues pertaining to the environment is of great importance. The audit team tried to analyse whether the college makes an attempt for the same to create awareness among the ultimate stakeholders of the college, i.e., the students. The parameters for this dimension include environmental education in the curriculum and extra-curricular activities aiming at making students aware of environment issues.

(g) Auditing for carbon footprint:

Carbon emissions from human activities also poses great threat to the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Vehicular emission is one of the major sources of carbon emission by the stake holders of the college. So, the audit team tries to assess the method of transportation that is practiced by the college staff.

Methodology:

The methodology adopted to conduct the present Green Audit of the Institution had the following components:

1. **Primary study**: For assessing the water and energy consumption, solid waste management, carbon foot print, biodiversity of the campus, primary data was collected through pre- structured questionnaires prepared for the purpose and through documentation of the various installations, their management (water, power, etc.) and biodiversity as well.

   During questionnaire survey, information pertaining to water consumption and management, waste management and carbon foot print etc. were gathered involving all the stakeholders of the institution i.e., teaching, non-teaching staffs, the managementand the students.

   For analysis of water quality and physico-chemical properties of soil three different places of the campus were selected randomly. Accordingly, samples were collected at the surface level. Water and soil samples thus collected were preserved and analysed in the Departments of Zoology and Chemistry of B. Borooah College, Guwahati following standard protocols.

2. **Group Discussions**: The Focussed Group discussions were organised with various stake holders of the college i.e.,theteaching and non-teaching staff, students and the management focusing on various aspects of Green Audit. The discussion was focused on identifying the attitudes and awareness towards environmental issues at the institutional and local level.

Data Analysis:

The data gathered by the audit team on the various parameters identified for the present audit were analysed in detail using standard procedures. The analysis is presented in the forthcoming pages of the report for the benefit of all the stakeholders of the institution. The audit team further made some observations and recommendation on the basis of the analysis.

Aspects of Audit

(i) Auditing water, soil and air quality:

The primary source of water in the College is ground water and is pumped through three deep tube wells. Water thus collected is filtered before use for various purposes. The results of various physio-chemical parameters of water quality are presented in the Table 1. The major parameters analysed include dissolved oxygen, free carbon oxide, alkalinity, chloride, hardness, pH, total dissolved solids, arsenic and fluoride.The findings of water sample analysis show the water is unpolluted and it is neutral. Since the water is ground water, the total dissolved solids are found to be 142 ppm. Moreover, other parameters also conform to the norms of permissible standards of drinking water prescribed by different Govt agencies.

Table1: Results of water quality analysis

Sl. No.	Parameters	Results
1	Dissolved Oxygen (mg/litre)	5.80
2	Free Carbon dioxide (mg/litre)	Nil
3	pH	7.1
4	Total hardness (ppm)	32.5
5	Alkalinity (mg/litre)	78
6	Chloride (mg/litre)	48
7	Total dissolved Solids (ppm)	142
8	Arsenic	Nil
9	Fluoride(ppm)	0.71

The soil of the college is sandy loamy in texture and neutral in nature. Moreover, the total organic carbon is found to be very less. The results of soil sample analysis are presented in the Table 2. Apart from the present study, soil samples of the campus were also analysed for their grain size(i.e. percentage of gravel, sand, slit and clay), physical properties (parentage of moisture content, specific gravity, bulk density, dry density, void ratio), shear parameter, consistency and consolidation parameters before the commencement of construction of a multi-storied building in the campus. The findings of the study are attached as Annexure I (Ref. Soil analysis report by Elite Engineers, Fatashil Ambari, Guwahati). The analysis of these reports revealed the feasibility of construction of multi-storied building in the campus.

Table 2: Results of soil sample analysis

Sl. No.	Parameters	Results
1	Total organic carbon (%)	0.58
2	pH	7.12
3	Phosphate (mg/kg)	0.25

Information of different air quality parameters were collected from the Pollution Control Board of Assam. The Assam Pollution Control Board has a station for collecting pollution data in Santipur area of Guwahati which is within one-kilometre arial distance from the L.C.B. college campus. Data recorded by the station of the pollution Control Board, Assam in the month of July, 2021 is given below (Mean of the one-month data) in Table 3. (Annexure: II)

Table 3:Air quality parameters

Sl. No.	Parameters	Results
1	Sulphur Dioxide (SO_2), $\mu g/m^3$	6
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	15
3	Particulate Matter (PM_{10} $\mu g/m^{3)}$	79

The concentration of particulate pollutants (PM10) was higher but it is within permissible limits as per CPCB.

(ii) Auditing for water consumption and water management:

There is growing concern over the depletion of groundwater and its contamination. It is therefore necessary to find out the usage of water in the college. Water auditing is conducted with an aim to examinevarious water installationsthat facilitates raw water intake in the campus. It also tried to look into the water treatment facilities and reuse of water. The audit team tried to recommend some measures so that the demand and supply of water could be maintained.

The following observations were made in the context of water auditing.

Water sources and installations:

The ground water is the prime source through which the college meets its water requirement. The college has three deep tube well which pump about 10000 litres of water daily to fill 6 overhead tanks (4 in the college and 2 in the hostel building) which together can store over 9000 litres of water.These overhead storage tanks are used to supply water inurinals, toilets, bathrooms and hand wash facilities of the campus as well as the hostels. Besides, this water is also used in the canteen and hostel for cooking, cleaning, drinking etc. For construction activities in the campus underground water is used. The college has rainwater harvesting plant that can store upto10,000 litresof water which facilitates the water requirements for construction and watering the garden and potted plants. The following information parameters are indicative of water consumption

i. Number of water tanks: 6 (4in the college and 2 in the hostel campus)
ii. Capacity of water storage: 9500 litres (5500 litresin the college and 4000 litres in the hostel)
iii. Quantity of water pumped daily: 10000 litres (one time only)
iv. No. of leaky taps: 3
v. Water used for gardening: 200 litres(Approx.)

The audit team observed that the wastage of water in the college is primarily due to

- leaving the water taps open after use,
- leakages from taps and
- over use of water

Recommendations:

The audit team recommended the following measures for better management of water:

1. All leaking taps to be repaired at the earliest.
2. Although the college campus has rainwater harvesting facility, but the audit team recommends that a more scientificapproachbe adopted so that the stored water in the harvesting tank do not become a breeding ground of mosquitoes. This water could be used for hand washing purpose at the entry point of the college after purification and filtration besides gardening.
3. The audit team suggests installingsome permanent signboards for general awareness on water conservation in different locations of the campus.
4. Students may be encouraged to come up with project ideas on water conservation and provisions should be made to reward the best ideas.

(iii) Auditing energy management:

Energy Audit provides a "bench-mark" for **managing energy in** any organization and also provides the basis for planning a more effective use of energy throughout the organization.It is important that any responsible institution examine its energy use practices Auditing for energy consumption and its management is an important aspect of campus sustainability. The energy audit of the college campus was done by an external agency viz. Thunderbolt Energy Consultancy, Maharashtra. The detail energy audit report is separately available.

(iv) Auditing solid waste management:

Wastes are any disposed matter that holds zero utility to the owner;as a result, the owner abandons the matter. Waste may be solid, liquid or gaseous. Waste disposal should necessarily include a survey of the nature and quantum of waste generated and an effective environment friendly policy needs to be formulated so that monitoring and disposal of wastes can be done in a scientific way. The present audit tries to find out the sources of waste generation and its management and disposal.

Waste disposal in an institutional campus like L.C.B. College is a major issue of concern as it is a land locked college as a result of which availability of land for dumping and disposal of waste is the major concern for the college.

The college has around 2000 stake holders that include students, management, teaching and non-teaching members, that leads to the generation of a quantum of solid wasteper day. The sources of solid waste in the college are classrooms, laboratories, staff rooms, office, library, canteen, toilets, grounds and the hostel. Solid waste generation in the college & hostel campus is primarily biodegradable, non-biodegradable, hazardous and E-waste and besides there are liquid waste.

For solid waste it is important to segregate the waste into different categories viz. bio-degradable (including kitchen waste), non-biodegradable hazardous and E-waste at source. The solid waste generated in the college and hostel campus primarily includes biodegradable, non-biodegradable, E-waste and hazardous waste.As assessment of the solid waste generation in the campus revealed following information.

1. Waste generation sites of the campus: Class rooms, canteen, office, library, hostel, hostel kitchen, construction sites, common spaces, laboratories and toilets.

2. The nature of waste generated are biodegradable (includes leaf litter, kitchen and canteen waste, waste papers),non-biodegradable (single use plastic, unused pens, glass waste and construction debris), E-waste (computer accessories, cartridge, battery etc) and also hazardous waste (sanitary napkins).

3. The quantum and nature of solid waste generated on an average per day are discussed as under:

Point of waste generation	Biodegradable	Non-biodegradable	Hazardous (Excluding e-waste)
Office	<1kg	<1kg	-
College Canteen	2-10 kg	2-10kg	-
Hostel	Above 10 kg	2-10kg	-
Classrooms	<1kg	<1kg	-
Toilets			<1kg

Audit observation:

The wastes generated in the college are segregated at source. The biodegradable green wastes are collected separately and the other wastes (non-biodegradable and wet garbage) are disposed through Municipal garbage collector. Moreover, the college authority has installed blue dustbins for dry waste and green dustbins for wet waste in different locations of the campus. Apart from these, the waste papers and newspapers are disposed through vendors for recycling.

The ongoing construction activities in the campus resulted in huge generation of construction debris. This debris is disposed by contractors in authorized landfill sites.

The audit team examined all the prevailing waste disposal measures of the institution and recommended the following measures for better waste management.

1. Canteen may serve beverages in refillable glass/metal utensils instead of single use cans/bottles or disposables.
2. The team recommends to reduce the use of plastic;measures may be taken to make the college plastic free campus.
3. Recyclable wastes may be segregated at source and stored.
4. Green wastes (kitchen and garden) may be converted into compost and may be used in the garden or sold out as a resource generation scheme. The college may initiate measures for set up of small vermicomposting unit in the campus as well as in the hostel.

5. Efforts may be taken to minimise the use of paper. Both side printing may be encouraged wherever possible.
6. Open fires to dispose of wastes may be avoided.
7. Electronic items, computer accessories should be disposed through authorised vendors as these may contain some toxic material.
8. Sanitary napkins may be disposed in the toilet itself by installing incinerator in the toilet. This would be helpful to minimise the health hazard.

(v) Auditing for E- Waste Management

The college has large numbers of computers, printers and a couple of xerox machines with full pledged laboratory build up in the Computer Science department, Electronics department, Statistics, Economics and Mathematics departments. The E-waste and defective items from these computer labs are being stored properly. E-waste is stocked up and not dumped with other waste.

Recommendations:

The audit team makes the following recommendation the following for better E-waste management:

1. The college may put out charts, graphics or photographs in prime locations of the college to make students aware about 'E-waste'. This would enable all stakeholders to recognise these wastes.
2. Stakeholders must never throw e-waste in the trash.
3. The institution may contact approved E- waste management and disposal facility in order to dispose E-waste in scientific manner.
4. Stakeholders may start using cloud technology to minimise the use of hard drives and pen drives.

(vi) Auditing for green campus:

The L.C..B college is situated in the heart of Guwahati city. It geographically lies at 26°9′35″ N latitude and91°42′40″ E longitude. The college is located at a natural habitat surrounded by two hills i.e. Adingiri and Nilachal hills. The institution is situated in the foot of the Adingiri hills. The famous Nilachal hills where the pilgrimage site Kamakhya is located is very near to the college. The Adingiri hills is rich in terms of biodiversity. A natural drainage system is flowing on the South West side of the college through which water of the adjoining areas are drained off. The college campus is small having 1.86 acre of land and is a land locked college. As a result, the green cover of the campus is meagre. However, many avian faunae and butterfly species are observed in different seasons due to the natural green surroundings.

The floristic diversity in the campus is too scanty. The plants species available in the campus includes primarily tree species *Polyalthia longifolia* (Debdaru), *Micheliachampaca* (Sopa) and *Mimusopselengi* (Bokul) and sapling of *Azadirachta indica*(Neem). Besides, there are other plants which are having ornamental and medicinal value. These plants are planted in the earthen pots and found to be in luxurious growth. The potted plants recorded in the college are *Ixora acuminata, Agapanthus sp., Aloe vera, Vinca rosea, Dracaena sp., Tradescantia sp., Schefflera sp. And Phoenix sp.*, etc.

Among the avian species, 20 bird species are recorded in the college campus which includes some resident birds, common birds and winter migratory birds. Eleven species of butterflies have been recorded in the college campus. One common primate species is sighted in and around the college campus i.e. Rhesus macaque (*Macaca mulatta*). The plants in the campus and nearby areas of the college play an important ecological role within the campus and also the adjoining areas. These are also food plants and roosting sites of a number of bird and mammalian species. Moreover, these have also contributed in the aesthetic beauty to the area.

List of avian species recorded in the College campus

Serial No.	Common Name	Scientific Name
1	Black Kite	*Milvus migrans*
2	Black Drongo	*Dicrurusmacrocercus*
3	Indian Jungle Crow	*Corvus culminatus*
4	Black Hooded Oriole	*Oriolusxanthornus*
5	Common Myna	*Acridotheres tristis*
6	Homing Pigeon	*Columba livia domestica*
7	Spotted Dove	*Spilopelia chinensis*
8	Pond Heron	*Ardeolagrayii*
9	Oriental Magpie Robin	*Copsychussaularis*
10	White Throated Kingfisher	*Halcyon smyrnensis*
11	House Sparrow	*Passer domesticus*
12	House crow	*Corvus splendens*
13	Red Vented Bulbul	*Pycnonotuscafer*
14	Purple Sunbird	*Cinnyris asiaticus*
15	Eurasian Tree Sparrow	*Passer montanus*
16	Black rumped woodpecker	*Dinopiumjavanense*
17	Cattle Egret	*Bubulcus ibis*
17	Asian Pied Starling	*Gracupica contra*
19	Blue Throated Barbet	*Megalaima asiatica*
20	White wagtail	*Motacilla alba*

List of butterflies recorded in the College campus

Serial No.	Common Name	Scientific Name
1	Black veined Albatros	*Appiasolferna*
2	Common crow	*Eupolea core*
3	Lemon Pansy	*Junonialemonias*
4	Common Mormon	*Papiliopolytes*
5	Red Helen	*Papiliohelenus*
6	Lime(Swallowtail)	*Papiliodemoleus*
7	One Spot grass yellow	*Euremaandersonii*
8	Indian cabbage white	*Appiascanidia*
9	Common mime	*Papilioclytia*
10	Chocolate demon	*Ancistroidesnigrita*
11	Small branded swift	*Pelopidas mathias*

Recommendations

The audit team recommended for increasing the green cover in the campus. Inside the boundary some fruit bearing plants may be planted.This would be helpful to attract more avian fauna. Moreover a few beds of indigenous medicinal and aromatic herbs may also be created as demonstration plots with information on their use. The college may take initiative for plantation in the degraded areas of the two adjoining hills. This may help in restoring the greenery of the degraded hills. Since the open area in the college campus is too less, every department may take initiative to grow as many potted plants in their respective departments (wherever possible).

Other green initiatives may include timely disposal of wastes from the campus. The college may inculcate the habit of plastic (single use) free campus amongst its stakeholders. All possible measures may be taken to make the institution office as 'paperless.

The college may celebration of important days like World Environment Day, Biodiversity Day with great importance to generate awareness among the students.

Bird watching camp, butterfly photography and such other activities may be initiated under expert guidance to raise the awareness of students about their surroundings.

(vii) Auditing for green agenda in curriculum and academic practices:

The ultimate objective of any green initiative is to make the masses aware of the environmental hazards and the need to conserve and protect the environment. With this idea in the backdrop the audit team tried to evaluate whether the curriculum of teaching in the college directly imparts knowledge on the environment. Also, the team tried to see what green practices in extracurricular activities exists in the institution and what national or global events are observed by the institution to make the stakeholders alert and aware of their duties for the cause of the environment.

The audit team observed that students are imparted education in various aspects like environmental pollution, sustainable development, biodiversity lossstrategies towards conservation. Environmental studies form a mandatory part of the regular curriculum and

students are also given assignments and projects as a part of the curriculum on various environmental issues.

The audit team noted that the college adopts various initiatives like lecture programs, poster making, art competitions, extempore speech and the like targeting the students to raise alertness and awareness towards environmental issues. The World environment day is regularly observed with such activities. Tree plantations and gifting saplings on important events form part of the regular green practises of the college.

Recommendations:

The audit team makes the following recommendation for better environment friendly education

1. The college may observe world water day, world ozone day and such other events to raise the awareness of stakeholders on various environmental issues.
2. Green clubs, eco clubs and such associations involving students and staff may be initiated.

(viii) Auditing for carbon footprint:

Carbon emissions from human activities pose great threat to the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone.

Burning of fossil fuels has an impact on the environment through the emission of greenhouse gases into the atmosphere. Vehicular emission is one of the major sources of carbon emission by the stake holders of the college. The carbon emission takes place through vehicle and by the generator set installed in the campus. During audit it is observed that majority of the stakeholders of the college i.e., students, teaching and non-teaching staffs are using individual or public transport to reach the college. None of these stakeholder was found to use the bicycle for transportation. The following were observed in the context of carbon foot print auditing in the college:

1. Number of private cars used by the staff of the college: 16
2. Number of bi-cycles used by the staff of the college: Nil
3. No: of two wheelers used by the staff of the college: 6
4. Average distance travelled by staff with cars: 20 km
5. Average quantity of fuel used by staff with cars: 1.5 Ltr
6. Average distance travelled by staff with two wheelers: 6 km
7. Average quantity of fuel used by staff with two wheelers: ½ Ltr
8. No. of staff using public transport: 16
9. No. of generators used per day: 1
10. No. of LPG cylinders used in canteen and hostels: 6-7 per month

Recommendations:

The audit team makes the following recommendation the following for alertness of the staff to contribute their bit to reduce carbon emissions:

1. Initiatives may be taken to use public transport as much as possible.
2. The staff members with individual cars may initiate car-pooling on a regular basis.
3. The use of two wheelers by students may be discouraged.
4. Awareness programs on carbon emissions and noise pollution may be conducted to generate mass awareness among stakeholders.
5. More energy efficient cooking method may be adopted to reduce LPG consumption.

Conclusion:

Green audit forms part of a resource management process. Although they are individual events, the real value of green audits lies in the fact that it should be carried out at defined intervals and the results can illustrate improvement or change over time. Academic institutes do take part in restoring the environment, still there is scope for the further improvement.

All effort has been made to prepare a comprehensive environmental audit of L.C. Bharali College, Guwahati. The stakeholders of the college should try to find out the various short falls in the various dimensions of an environmentally responsible practises and accordingly various measures may be initiated.

The audit tried to identify the impact of various activities of the institution on environment and to suggest the best protocols for sustainable development organization and environment. Necessary recommendations are also put forth to secure the environment and cut down the threats posed to human health, disposal of all types of harmful wastes, reduce energy consumption thereby to give preference to the most energy efficient and environmentally sound appliances, to minimize the consumption of water and monitor its quality.

Annexure I

ELITE ENGINEERS

Fatashil Ambari, Guwahati-25
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LABORATORY TEST RESULTS

Bore hole no.: **BH1**

Sample collected		Grain size analysis				Physical properties					Shear parameter			Consistency & consolidation parameters			
D/S Depth in m	U/S Depth in m	% of gravel	% of sand	% of silt	% of clay	% of moisture content	Bulk-density gm/cc	Dry-density gm/cc	Specific gravity	Void-ratio	Name of test	Cohesion in kg/cm2	Φ in deg	Liquid-Limit in %	Plastic-Limit in %	Plasticity-Index in %	Compression index, C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.5		0	2	32	66									37.41	21.74	15.67	0.11
	2.00					24.68	1.96	1.57	2.59	0.65	UCT	0.68	0				
3.0		0	4	31	65									37.24	21.72	15.52	0.11
	2.00					23.96	1.96	1.58	2.59	0.64	UCT	0.70	0				
4.5																	
6.00		0	5	30	65									37.14	21.71	15.43	0.13
	6.50					25.86	1.92	1.53	2.59	0.70	UCT	0.42	0				
7.50		0	3	31	66									38.57	21.86	16.71	0.09
	8.00					22.74	2.00	1.63	2.58	0.58	UCT	0.98	0				
9.00																	
10.50		0	4	31	65									37.46	21.75	15.71	0.08
	11.00					20.96	2.04	1.69	2.58	0.53	UCT	1.05	0				
12.00		0	12	32	56									32.57	21.26	11.31	
13.50		0	70	16	14	20.36	1.96	1.63	2.66	0.63	DST	0.06	30			NP	
15.00																	

D/S : Disturbed Sample U/S : Undisturbed Sample

Elite Engineers Guwahati-25 Date

LABORATORY TEST RESULTS

Bore hole no.: **BH2**

Sample collected		Grain size analysis				Physical properties					Shear parameter			Consistency & consolidation parameters			
D/S	U/S	% of gravel	% of sand	% of silt	% of clay	% of moisture content	Bulk-density gm/cc	Dry-density gm/cc	Specific-gravity	Void-ratio	Name of test	Cohesion in kg/cm2	Φ in deg	Liquid-Limit in %	Plastic-Limit in %	Plasticity-Index in %	Compression index, Cc
Depth in m	Depth in m																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.5																	
3.0																	
4.5																	
6.00	5.00	0	4	31	65	23.58	1.96	1.59	2.59	0.63	UCT	0.80	0	37.48	21.75	15.73	0.11
7.50	8.00	0	2	31	67	22.63	1.96	1.60	2.58	0.61	UCT	0.84	0	39.14	21.91	17.23	0.10
9.00		0	4	30	66									37.98	21.80	16.18	
10.50	11.00	0	3	31	66	21.63	2.00	1.64	2.58	0.57	UCT	1.02	0	38.59	21.86	16.73	0.09
12.00		0	67	18	15	20.57	1.96	1.63	2.66	0.64	DST	0.07	28			NP	
13.50		0	69	17	14											NP	
15.00		0	73	15	12	19.87	1.97	1.64	2.66	0.62	DST	0.05	30			NP	

D/S : Disturbed Sample U/S : Undisturbed Sample

Elite Engineers Date

ELITE ENGINEERS

Fatashil Ambari, Guwahati-25
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LABORATORY TEST RESULTS

Bore hole no.: **BH3**

Sample collected		Grain size analysis				Physical properties					Shear parameter			Consistency & consolidation parameters			
D/S	U/S	% of gravel	% of sand	% of silt	% of clay	% of moisture content	Bulk-density gm/cc	Dry-density gm/cc	Specific-gravity	Void-ratio	Name of test	Cohesion in kg/cm2	Φ in deg	Liquid-Limit in %	Plastic-Limit in %	Plasticity-Index in %	Compression index, Cc
Depth in m	Depth in m																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.5																	
3.0																	
4.5		0	3	31	66									38.14	21.81	16.33	0.12
	5.00					25.71	1.94	1.54	2.59	0.68	UCT	0.56	0				
6.00																	
7.50		0	3	32	65									37.48	21.75	15.73	0.11
	8.00					23.46	1.96	1.59	2.58	0.63	UCT	0.90	0				
9.00																	
10.50		0	5	30	65									37.26	21.73	15.53	0.08
	11.00					20.58	2.02	1.68	2.58	0.54	UCT	1.04	0				
12.00		0	65	21	14											NP	
13.50		0	70	18	12	20.37	1.98	1.64	2.66	0.62	DST	0.06	30				
15.00																	

D/S : Disturbed Sample U/S : Undisturbed Sample

Elite Engineers * Fatashil Ambari, Guwahati-25 * Date

LABORATORY TEST RESULTS

Bore hole no.: **BH4**

Sample collected		Grain size analysis				Physical properties					Shear parameter			Consistency & consolidation parameters			
D/S Depth in m	U/S Depth in m	% of gravel	% of sand	% of silt	% of clay	% of moisture content	Bulk-density gm/cc	Dry-density gm/cc	Specific-gravity	Void-ratio	Name of test	Cohesion in kg/cm2	Φ in deg	Liquid-Limit in %	Plastic-Limit in %	Plasticity-Index in %	Compression index, Cc
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.5																	
3.0																	
4.5		0	0	30	70									40.26	22.03	18.23	
	5.00					SAMPLE LOST											
6.00																	

D/S : Disturbed Sample U/S : Undisturbed Sample

Annexure II

State Name: Assam

City Name: Guwahati

Station location: Santipur, Gwahati

Sampling Date	SO2	NO2	PM10
02/07/2021	6.75	15.75	40.5
05/07/2021	5.75	14.75	55
07/07/2021	6	14.5	64.5
09/07/2021	5.5	13.75	83.5
12/07/2021	6.25	14.5	82
14/07/2021	6	14	81.5
16/07/2021	5.75	14.5	86.5
19/07/2021	5.25	14	88
23/07/2021	6	15.25	87.5
26/07/2021	5.5	14.75	97.5
28/07/2021	6	15	96
30/07/2021	6	15.25	80
Mean	6	15	79

Annexure-III

Survey Forms

Questionnaire for Water Consumption and Management Survey

1. Source of water: .....
2. No. Of motors used to pump water: .....
3. Horse power of motor: .....
4. Charges for water paid :(if any, like municipality charges) .....
5. No. of tanks to store water: .....
6. Capacity of tank: .....
7. Quantity of water pumped everyday: .....
8. Water used for gardening: .....
9. Whether any treatment for waste water is established: Y? N(Please tick)
10. Is rain water harvesting available: Y/N (Please tick)
11. If yes, capacity of harvest water: .....
12. If yes, are there provisions for ground water restoring from rain water harvested? : Y/N (Please tick)
13. No. Of water coolers: .....
14. Whether any water management plan is practised: Y?N (tick)
15. Observations/ Remarks:

Questionnaire for survey on green agenda in curriculum and academic practices

1. Whether the following are part of the syllabus:
   a. Environmental Degradation:

   b. Sustainable development:

   c. Conservation of the environment:

2. What efforts are made by the college for creating student awareness in environmental education: .....
3. What days and events on environmental awareness are observed in the college?
   .....
   .....

4. Are there any green clubs or student organisations for raising environmental awareness?
   .....

5. Suggestions/
   Remarks.....
   .....

Questionnaire for audit of solid waste management

1. What types of waste are generated in the college and college hostel? (Please write Y for yes, N for No)

   a. Dry leaves
   b. Bio-degradable waste
   c. E-waste
   d. Sanitary napkins
   e. Glass
   f. Plastic waste
   g. Others (please Specify)

2. Approximate quantity of waste generated per day (in kg) (Please put whichever Applicable) a)< 1kg b) 2-10kg c) >10 kg:

Point of waste generation	Biodegradable	Non-biodegradable	Hazardous	Others (please specify)
Office				
College Canteen				
Hostel				
Classrooms				

3. How is the waste generated managed?

a) Composting/ Vermicomposting Y/N
b) Recycling: Y/N
c) Reuse: Y/N
d) Others: Please specify

4. Any other waste generation methods designed by the college (Please specify)

   .....

   .....

Questionnaire for Study on carbon footprint

1. How many people in the staff use private car to travel?.....

2. Quantity of fuel used per day and average distance travelled per day by the staff with private car? .....

3. How many people in the staff use public transport every day to travel?.....

4. How many people in the staff use two wheelers to travel? .....

5. Quantity of fuel used per day and average distance travelled per day by the staff with two wheelers? .....

6. How many people in the staff use bicycles for travel? .....

7. How many people in the staff car pool? If yes, how frequently:
.....

8. No. of LPG cylinders used in canteen/Hostel/ Labs per month:.....

9. Any other fuel consumption in the college campus? (Please specify) .....

10. Suggestions for reduce of fuel .....