TECHNICAL REPORT OF

SOIL AND WATER AUDIT

Submitted to

T. K. MADHAVA MEMORIAL COLLEGE

ALAPPUZHA - 690 513, KERALA, INDIA

Date of Audit :03.01.2020

Submitted by

Regd. No. 114 / 2017

NATURE SCIENCE FOUNDATION

(A Unique Research and Development Centre for Society Improvement)

ISO 9001:2015 and 14001:2015Certified and Ministry of MSME Registered Organization

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1. Introduction

Soil and water are inequitable natural resources of India at global level. Soil are naturally occurring loose covering on the earth's surface. Weathering altered the rock particles of soil into mixtures of mineral and organic constituents (Bridges, 1997). Soil is rich in microorganisms such as bacteria, fungi, actinomycetes, algae, protozoa and nematodes. The microorganism of the soil helps in enzymatic degradation of organic matter, energy storage and conversion of nutrients in available form in their biomass (Jenkinson and Ladd, 1991). The chemical and physical property of soil makes it a rich medium for the plant growth. Water the other natural resource constituting with 97% of salt water and 3% of fresh water (Alley *et al*., 1999). The use of water is inevitable in our daily needs. Water is used in agriculture, industrial, household, recreational and environmental activities. The natural source of fresh water are surface water and ground water. Ground water is used as primary source of domestic drinking water. Artificial sources of fresh water are treated wastewater and desalinated seawater.

Soil and water are natural resources of the organization that has to be structured, planned and developed from the point of entry to end users the stakeholders in such a way with contamination free soil and water, sustainable use of land and water and suitable measures for their conservation. Soil and water Audit is a tool to improve the quality of the land and water to provide a healthy environment for the stakeholder directly and indirectly of the campus. It creates awareness on environmental ethics, resolves environmental issues and offers solutions to various social and economic needs (APHA, 2017). It strengthens the concept of "Jal Jeevan Mission" and "Sustainable Land Management" among stakeholders of India for the protection of natural ecosystems for future prospects.

Soil and water audit procedures includes the definition of soil and water audit, methodology on how to conduct soil and water audit at Educational Institutions and Industrial sectors as per the checklist of Environment Management Systems and International Standards on ISO 14001:2015, Jal Jeevan Mission, Swachh Bharath Scheme under Clean India Mission to understand the principles and importance of various audits in the context of the organization and risk assessment at 360˚. Soil and water audit helps the educational institutions/ industries to maintain eco-friendly environment, assures personal hygiene to various stakeholders and supports the nation; on the whole for the noble cause of environmental protection and nature conservation which in turn enhances the quality of life of all living beings (Arora, 2017).

Most of the soil in India are well drained, deep, fairly loamy, slightly acidic to alkaline and lime-free soils and they are ideal for variety of plant cultivation (Arora and Sekhon, 2015). The Indian soils are mainly derived from gneissic rock containing large amount of mica with good behaviour of water holding capacity with abundance of micro and macro elements. Some of the soils are characterized by clay loam type, classified as latosols with good organic matter contents along with sufficient amount of nitrogen, potassium and phosphorous contents all tea soils are distinctly acidic, rich in nitrogen content and (Mishra, 2020).

2. Role of Educational Institutions in India

Educational institutions are playing important role in a nation's growth and development which starts from maintenance of green campus without harming the environment. A clean and healthy environment in an Organization determine effective learning skills and offers a conducive learning environment to the students. Educational institutions are insisted by both Central and State Governments to offer eco-friendly atmosphere to the stakeholders. In addition, all the Educational institutions are asked to save the environment for future generations and to resolve the environmental problems (accumulating solid wastes and wastewaters/effluents and their careless disposal, enormous utility of plastics, uneconomical consumption of water, irresponsible in water harvesting and storage procedures, etc.) through Environmental Education. Implementing Swachh Bharath Abhiyan Scheme launched by the Indian Government thro' the Educational institutions plays a major role in terms of giving neat and clean environment to tribal, rural and urban people across the country, besides the regular and conventional activities carried out by NSS, NCC/Student Force, Nature club, Eco club, Science club, Fine Arts club, Flora and Fauna club, Youth Red cross unit, etc. Seminar, Conference, Workshop, training and awareness programmes on Biodiversity conservation education, environmental awareness programmes, etc. may be conducted periodically by the Management and Administrative people of an Organization to the stakeholders.

Soil and Water audit in the campus is a systematic method whereby an organization's environmental performance is checked against its environmental strategies and compliances of the Government guidelines. This audit process is definitely useful for the Educational institutions to maintain the campus neatly and can give pure atmosphere to the students and staff members including Management people. It is like an official examination of the environmental effects on an organization's campus as per the Government guidelines. The audit report may be useful to improve the organization's campus significantly by following the recommendations and suggestions given in the report. The green campus audit processes are being undertaken by World / Indian Green Building Council (IGBC), Green Building Code and Green Ratings Systems (GBCRS), Green Rating for Integrated Habitat Assessment (GRIHA), Conideration of Indian Industry GreenCo Rating System (CII-GreenCo) and Associated Chambers of Commerce and Industry of India (ASSOCHAM) along with ISO EMS 14001:2015 criteria and the concept of Swachh Bharath Abhiyan under Clean India Mission.

3. Environment Friendly Campus to maintain Soil health and Water quality

As stated earlier, Organization is liable to provide an eco-friendly atmosphere along with good drinking water facility to all the stakeholders (students and staff members). Manuring the cultivated plants/grown within the campus may applied with organic manure, cow dung, farmyard manure and vermicompost instead of using chemical fertilizers. All non-compostable and single-use disposable plastic items, plastic utensils, plastic straws and stirrers should be avoided. Demonstration/awareness programme on establishing plastic-free environment and utility of oganic alternatives for all incoming and current students, staff and faculty should be organised. Reduction of use of papers alternated with e-services, e-circulars, etc. and proper disposal of wastes, recycling and suitable waste management system should be considered to establish environment friendly campus.

4. Aims and Objectives of Soil and Water Audit

- To maintain periodic records on physico-chemical and biological parameters of soil and water in the organization campus.
- To maintain contamination free with safe soil and water for the stakeholders which in turn useful for maintaining the environment and personal hygiene.
- To identify and provide baseline information to assess threat and risk to the ecosystem with respect to safe soil and water due to Organization development.
- To recognise and resolve different environmental threats of the Organization without creating any soil and water pollution.
- To ensure proper utilization of resources available in the surrounding areas towards future prosperity of the humanity as bioresources like water and soil are considered to be very important.
- To fix a couple of norms for disposal of all varieties of wastes for pollution free soil and water as per the Green and Environment Policy.
- To assess the proper utilization of water from the entry to the consumers and discharge the wastewater as per the guidelines of Central and State Government Pollution Boards.

5. Importance of Soil and Water Auditing

The Management of the Organization (Auditee) should be exposed their inherent commitment towards making Healthy environment through the soil and water auditing and ready to encourage/follow all types of activities to enhancement the quality of soil and water. They should promote activities such as conduct of environment awareness programmes, Sprinkler system for irrigation system for effective water management and to maintain soil moisture, rainwater harvesting to restore the groundwater, use of biofertilizers and avoidance of chemical fertilizers and agrochemicals to enhance the soil quality etc., prior to and after the soil and water auditing. The administrative authorities should formulate ‘Jal Jeevan mission’ and “Sustainable Land management” principles based on technical report of soil and water auditing. A clean and healthy environment will enhance an effective teaching/learning process and creates a favourable learning green environment to the scholars. They should create the awareness on the importance of sustainability of soil and water through environmental education among the student members and research scholars. Soil and water audit is the most effective, ecological approach to manage environmental complications.

Soil and Water audit may be beneficial to the campus in improving the activities of sustainable land and water which in turn useful to save the planet for future generation. Soil and Water audit is a kind of professional care and a simple indigenized system about the environment monitoring in terms quality enhancement of soil and water which is a duty of each and every individual who are the part of economical, financial, social, and environmental factors. It is necessary to conduct soil and water audit frequently at least

once in three years in campus because students and staff members should aware of the soil and water audit and its beneficial effects in order to save planet by means of 'Jal Jeevan mission' and "Sustainable Land Management" which in turn support the institution to set environmental models ('icon') for the community. Soil and water audit is a professional and useful measure for an Organization to determine how and where they are retaining the campus eco-friendly manner. It can also be used to implement the alleviation measures at win-win situation for the stakeholders and the planet. It provides an opportunity to the stakeholders for the development of ownership, personal and social responsibility.

6. Benefits of the Soil and Water Auditing

There are several benefits on conduct of water and soil audit by the Organization which may be definitely useful to improve the campus significantly based on the audit report. It covers both qualitative and quantitative measurements including physical, biochemical and microbiological observations of the presence of streams and springs, number of bore wells, open wells, water channels and etc. in the campus. It has to be checked for decrease in green cover, any key alteration in the soil species as indicators of soil contamination. Installation of water saving devices like automatic system and water meter and efforts taken towards water leakage, leak detection and repair, water pumping works towards water conservation are playing important role. Vermicomposting or any similar process may be carried out inside the campus to preserve soil health. The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, NCC/Student Force and NSS bodies may be involved in providing awareness programmes to educate stakeholders the importance sustainable water and land use. The following are the major benefits of the water and soil auditing.

Soil and water audit is a proven technology for providing pure atmosphere without any soil and water pollution and supplying safe drinking water to the stakeholders worldwide since long time. UV light as a biological and chemical technology methods is most effective method to give safe water to the stakeholders which does not create any new chemical byproducts, does not change the flavour or odour of the water and also does not remove any beneficial minerals. Its effectiveness depends upon many factors and it is very important to design the water purifier scientifically so as to deliver the safe & purified water. Turbidity, particulate matter, and natural organic matter are the most significant water quality parameters having the greatest effect on biological disinfection capability. Water temperature and pH have an insignificant effect on water quality and disinfection capability by increasing levels of turbidity, particulate matter, and natural organic matter absorb more unwater materials present in the water. There is concern of adverse health effects to the consumer as a result of mercury exposure from UV lamp breakage during operation including reverse osmosis system of water purification. It is very convenient, instant and easy to operate is some of other important advantages.

Water borne disease has been a concern to human being ever since its cause had discovered and the most appropriate treatment process adopted is microbial disinfection. Disinfection is necessary to destroy pathogenic (disease causing) bacteria and other harmful microorganisms that are present in water due to contamination. Over several years, water heating (hot water) and ultraviolet (UV) disinfection as biological technology have been developed into a viable technology for drinking water disinfection. Biological disinfection systems inactivate protozoa, fungi, bacteria and viruses. Through all-embracing research and meticulous field experiences, biological disinfection has proven to be safe, reliable, and inexpensive and accepted this as a world ide technology for drinking water disinfection. The following benefits are taken into account while soil and water audit is undertaken at an organization as one of the best practices followed.

- Internal audit procedure for soil and water analysis will be implemented periodically in the organisation followed by analysis of soil profile in terms of testing various soil parameters should be carried out in the campus as well.

- Soil fertility analysis in terms of enumerating various beneficial and harmful microorganisms preferred in the campus followed by analysis of soil organic matter, ratio of gravel, clay and sand particles, water holding capacity and above the ground biomass.

- Observation of any streams /springs present inside the campus and record of any decline in water quality and water quantity in recent times and record of any decrease in green cover area in the campus along with key alteration in the soil species.

- Finding out any change in the water use /l and used pattern followed in recent times due to either the vertical growth or the horizontal development of the organization followed by observation of soil erosion, acidification, contaminations, land scape management and associated issues inside the campus.

- Number of bore wells, open wells, water reservoirs & channels, water supply, check dam and etc. are sufficient in the campus and finding out any water logging problem arise inside the campus during the heavy rainfall and water saving opportunities and measures taken by the management.

- Observation of any loss of soil and water biodiversity inside the campus including awareness programmes on soil and water conservation and formulation of sustainability goals for sustainable land use and rain harvesting system in the campus.

- Number of taps and faucets, toilets, showers, rest rooms, etc. in sufficient numbers in the campus coinciding with the human population and efforts taken towards water leakage, leak detection & repairs, water pumping works towards water conservation.

- Availability of sprinkler and drip systems for irrigation methods for effective water management including Installation of water saving devices like automatic system, water meter, etc. and sewage treatment plant availability and its uses including gardening fir efficient irrigation and lawn care practices, water wise landscaping, etc.

- Vermicomposting or any similar process carried out inside the campus for soil health preservation and organizing programmes to educate stakeholders the importance of

sustainable land use and water conservation through Cells, Clubs, Forums, Chapters, Associations and etc.

- Investment carried out for sustainable land use and its conservation including Action plan devised to restore the degraded land. Campus comes under seismic zone and protective zone under Government Acts and Statues.

- Detection of *Escherichia coli*, Coliform bacteria and Faecal Coliform in water samples collected from different places in the campus.

7. About the Organization

7.1. T. K. Madhava Memorial College

T. K. Madhava Memorial College was founded by the great Indian freedom fighter and social reformer, Sri. T. K. Madhavan, who was born and brought up in a prominent Ezhava family in Kathikappally Taluk. With the inspiration of grand spiritual vision of Sree Narayana guru, Sri, T. K. Madhavan dedicated his life to the cause of the oppressed people. In the year 1964, the college is noted as a temple of learning established through the efforts of Karthikappally, Karunagappally and Mavelikkara SNDP Unions. About 14 Sree Narayana Colleges were established throughout the length and breadth of Kerala that resembles the living monuments of the great guru. During this last few decades, the institution has concurred a niche for itself among the illustrious cluster of institutions during this last 4 decades.

The institution has been a pioneering institution of higher education in Alappuzha district after being named by the freedom fighter and social reformer T. K. Madhavan. In maintaining the quality of education, the institution is in forefront and also reinforcing the rural people of backward and marginalized community. Alumni and faculty of the institution with regard to political, literacy, cultural, scientific and entrepreneurial firmaments have made appreciable contributions, since its inception. This also includes the lead contributions of poet and the lyricist Anil Panachooran, renowned Malayalam actor Ashokan, Pro Vice Chancellor of Sree Narayanaguru Open College Prof (Dr.) S. V. Sudheer to the institution.

Mission and Vision

T. K. Madhava Memorial College, upholding the ideology of the great saint & social reformer, Sree Narayana Guru, ***'Enlightenment through Education'***, envisages accessible, transformative and quality education, to equip students with knowledge and skills in their chosen stream, inculcate values, provide opportunities for students to realize their full potential and thus shape them into responsible citizens. Their mission is to prepare young minds to imbibe knowledge, skills and sensitivity. Igniting the scientific and rational thinking among youth and elevating them socially and economically backward community through quality and inclusive education. The institution makes sure gender equality and transformative education and also imparts quality education in science, humanities and commerce by integrating traditional and innovative teaching and learning practices.

For instilling the philosophy and vision of the quintessential leader, T. K. Madhavan, created a platform for students for exploring their creative potential and nurturing the spirit of critical thinking. T. K. Madhava memorial college foster conceptual understanding and outcome based education at par with New Education Policy. The institution also equips students and teachers with the skills needed to adapt better to the changing global scenario. Students are been encouraged in value-based, integrated and scholastic thinking practice for transforming towards a liberated society. T. K. M. memorial college is following the core values in the form of STEER system which comprises of Skill & Strength, Truth & Trust, Equality & Ethics, Endurance & Empowerment, Research & Renovation

7.2. About Nature Science Foundation (NSF)

NSF is an ISO 9001:2015 & 14001:2015certified and registered with Ministry of Micro, Small and Medium Enterprise (MSME), Government of India Organization functioning energetically towards the noble cause of nature conservation and environmental protection. NSF is managed by a board of trustees of NSF Public Charitable Trust under the TN Societies registration Act 1975 (TN Act 27 of 1975) on 29th November, 2017 at Peelamedu, Coimbatore- 641 004, Tamil Nadu, India with Certificate of Registration No. 114 / 2017. In addition, NSF has 12A, 80G and Form 10AC certificates for income tax exemption and implanting various Government schemes. The main motto of the NSF is to "Save the Nature to Save the Future" and "Go Green to Save the Planet". NSF Branch Offices are also functioning effectively at Gorakhpur, Uttar Pradesh and Faridabad, Haryana, India to adopt the 'Go Green Concept' in a big way. NSF family is wide spread across India with over 115 state-wise Lead auditors to conduct Green and Environment Audits.

NSF is functioning strenuously to conduct different awareness programmes and implement various schemes to public and school / college students towards the noble cause of nature protection. Some of the programmes are also being organized for the benefit of tribal communities to create the supply chain for biodiversity conservation studies. The objectives along with vision and mission are illustrated to promote educational and environmental awareness programmes through social activities for enhancing the quality of life and to conserve nature from environmental pollutants using traditional and modern technologies for sustainable land management. NSF is educating the tribal community children through social service and towards the upliftment of tribes as a whole and make them as entrepreneurs.International Eco Club Student Chapter (IECSC) has been established for Student volunteers and faculty members are encouraged to conduct National and International events, Student Technical Symposium, Distinguished lecture programme, Environment day celebration, Ozone day celebration, Project model exhibition, Awareness programmes on Environmental pollution, Biodiversity and Natural resources conservation and etc. with the financial support of the Foundation. NSF is being released 'Magazine' and 'Newsletter' biannually to share the information about Environmental awareness programmes on biodiversity conservation, seminar on soil conservation, water management and solid waste management, restoration and afforestation programmes in Western Ghats of southern India.In order to encourage the students, members of faculty, academicians, scientists, entrepreneurs and industrial experts those who are involving in nature protection and biodiversity conservation studies across the world, NSF tributes the deserved meritorious candidates with various awards and honours such as 'Best Faculty Award', 'Best Women Faculty', 'Best Scientist Award', 'Best Student Award', 'Best Research

Scholar Award', 'Best Social Worker Award', 'Young Scientist Award', 'Life-Time Achievement Award' and 'Fellow of NSF'. These award and honours will be given to the deserved meritorious candidates during the 'Annual Meet and Award Distribution Ceremony' which will be conducted every year during the first week of January.NSF has introduced various types of Audits such as 'Eco Audit', 'Green Audit', 'Energy Audit', 'Hygienic Audit' Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-Waste Management Audit, Academic & Administrative Audits including ISO certification process to Academic Institutions, R&D Organizations and Industries towards the accreditation process as well as maintaining a hygienic eco-friendly environment to the stakeholders in their campus. All audits will be conducted as per the Checklist prepared by the NSF ISO Criteria and in compliance with Government Law and Environmental Legislations including World / Indian Green Building Council and the concept of Swachh Bharath Abhiyan under Clean India Mission. Green campus and Environment Policy, Purchase Policy, Energy Policy, MoU, International Eco Club student Chapter. Audit Certificates will be given to get the maximum mark weightage from NAAC. Audit processes are being conducted through the certified Auditors as per the following

Audit	**Certified Auditors**	**Certified Auditors**
Green Audit	IGBC - Indian Green Building Council GBCRS - Green Building Code and Green Ratings Systems GRIHA – Green Rating for Integrated Habitat Assessment	Mrs. S. Rajalakshmi Dr. R. Mary Josephine Dr. B. Mythili Gnanamangai Er. Ashutosh Kumar Srivastava Er. N. Shanmugapriyan
Energy Audit	BEE - Bureau of Energy Efficiency LEED - Leadership in Energy and Environmental Design CII-GreenCo – GreenCo Rating System Felicitator	Er. D. Dinesh kumar Er. N. Shanmugapriyan Dr. N. Balasubramaniam Dr. P. Thirumoorthi Dr. G. Murugananth
Environment Audit	IGBC -Indian Green Building Council ASSOCHAM - Associated Chambers of Commerce and Industry of India FSRS – Fire Safety & Rescue Services	Mrs. S. Rajalakshmi Dr. A. Geetha Karthi Dr. R. Mary Josephine Dr. B. Mythili Gnanamangai Er. Ashutosh Kumar Srivastava Er. N. Shanmugapriyan
Hygiene Audit	FSMS – Food Safety Management System & Occupational Safety & Health (ISO 22000:2018) SBICM - Swatch Bharath under India Clean Mission	Mrs. Gaanaappriya Mohan Er. Ashutosh Kumar Srivastava Dr. R, Sudhakaran Dr. N. Saranya
Waste Management Audits	Water & Soil Audit, Plastic Waste Management Audit, Biomedical Waste Audit, Solid Waste Management Audit, E-	Mrs. Gaanaappriya Mohan Er. Ashutosh Kumar Srivastava Dr. R, Sudhakaran Er. N. Shanmugapriyan

	Waste Management Audit as per the Checklist of NSF	
Academic & Administrative Audits	Academic & Administrative Audits as per the NAAC Criteria and ISO implantation procedure	Dr. B. Anirudhan Dr. B. Shreeram
ISO Certification	QMS (9001:2015), EMS (14001: 2015), OHS (45001: 2018), ISMS (27001:2018), FSMS (22000: 2018), QMSMD (13485: 2016), EnMS (50001: 2018)	Er. Ashutosh Kumar Srivastava Mrs. S. Rajalakshmi Dr. A. Geetha Karthi Mrs. Gaanaappriya Mohan Dr. R. Mary Josephine

8. Audit Details

Date / Day of Audit : **03.01.2020**
Venue of Audit : **T.K. Madhava Memorial College, Kerala**
Audited by : **Nature Science Foundation,**
Coimbatore, Tamil Nadu, India.
Audit type : **Soil & Water Audit**
Name of Auditing Chairman : **Mrs. S. Rajalakshmi Jayaseelan,**
Chairman of NSF & ISO QMS, EMS, OHSMS, EnMS Auditor.
Name of IGBC AP Auditor : **Dr. B. Mythili Gnanamangai,**
Vice Chairman of NSF, Indian Green Building Council Accredited Professional.
Name of Lead Eco Auditor : **Er. Ashutosh Kumar Srivastava,**
Associated Chambers of Commerce and Industry, New Delhi.
Name of Subject Expert-I : **Mr. B.S.C. Naveen Kumar,**
Senior Faculty, Mahatma Gandhi National Council of Rural Education, Ministry of Higher Education, Hyderabad.
Name of Subject Expert-II : **Er. D. Dinesh Kumar,**
Certified Lead Auditor, IGBC, ASSOCHEM, GRIHA & LEED
Name of the Energy Auditor : **Dr. N. Balasubramanian,**
Certified Bureau of Energy Efficiency Auditors of NSF.
Name of the Eco Auditor : **Er. S. Srinivash,**
Tamil Nadu Fire and Rescue Services, Coimbatore.
Name of Eco & Green Officer : **Ms. M. Nithya,**
Environment, Energy & Green Council Programme Officer, NSF.

9. Procedures followed in Soil and Water Auditing

Soil and Water audit is a structured process of documenting the credentials in terms available water and land resources, water distribution network, conveyance system from raw water source to treatment plant, from treatment plant to treated water storage system, treated water storage system to distribution networks, individual users, measures undertaken in reducing the environmental pollution and soil erosion, implementation and maintenance of vermicomposting to enrich the soil quality and conservation of water by rainwater harvesting. It is a kind of a professional tool for assessing the soil and water of the campus. Soil and water audit projects the best environmental practices and initiatives taken in the organisation at the prescribed site of audit that brings added value to the organisation in maintaining the eco-friendly campus to the stakeholders. First step of the audit is ensuring that the organisation has a central role in maintaining the health and hygiene of the campus, in order to validate the same.

Soil and water audit has been conducted as per the checklist of Nature Science Foundation, Coimbatore, Tamil Nadu, India (www.nsfonline.org.in) through the authenticated Professionals for people qualified to investigate and evaluate the campus for validating the best environmental practices (Staniskis and Katiliute, 2016, SCSR, 2018). Professional team of ISO Environment Management Audit (14001:2015), Indian Green Building Council Accredited Professionals, Experts of soil and water Lead Auditors and Botanists / Zoologists / Biotechnologists were selected to conduct the soil and water audit process.

During the audit, the sources of water and the type of soil within the campus were recorded and samples were collected for the analysis. The operation of the water irrigation system, trip and sprinkler irrigation methods and use of recycled water for irrigation purpose or any other purpose in the campus area were noted. The number of water wells, bore wells and water reservoir facilities in the campus were also noted as per the Audit Manual .

Attempts made to check the maintenance of record of physico chemical and biological parameters of soil and water were noted. Biodiversity conservation education, projects, awareness programmes, etc., through Indian Biodiversity Act and Ministry of Environment, Forests and Climate Change, Government of India and the conduct of outreach programmes for dissemination of Green campus motto were recorded (Venkataraman, 2009). Conduct of outreach programmes for dissemination of Green campus motto to the students and staff members including public domain and signing of MoU with Government and Non-Governmental Organizations to ensure activities on sustainable land and water for future generation were noted (Lauder *et al*., 2015; Brindusa *et al*., 2007). Technology driven solutions initiated by the soil and water organization can also be disseminated and documented successively for propagating the attitude of the soil and water campus in wider masses.

Projects, Dissertations and Thesis are the academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches towards the sustainability of land and water. These should be disseminated through presentations and publications in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. These efforts taken by the students and staff were deliberated while conducting the soil and water audit. Soil and water audit processes are taking place as per the following flow-chart starting from the receipt of application forms from the auditee (organization) and ending upon the submission of final

report to the concerned organization (Leal Filho *et al*., 2015). During the audit process, the best sustainable soil and water practices followed and new initiatives undertaken in the organisation to reduce the environmental pollution and steps taken for nature conservation that brings added value to the organisation in maintaining the eco-friendly campus were assessed In addition, supporting activities of the scholars and staff with regard to "Vision and Mission" of the sustainable soil and water activities of the Organization is also evaluated.

9.1. Onsite Soil and Water Audit activities

1. Opening meeting is the first step between the audit team and auditee along the Management Representatives where the purpose of the audit, procedures to be adopted for the conduct of the audit, verification of the documents and the time schedules were discussed, in brief.

2. Followed by opening meeting, onsite inspection will be conducted which is the second step in the audit where the Audit team members visited different sites in the campus and required photographs were taken then and there for preparing the audit report.

3. During the onsite phase of visit, it is vivid how the various facilities made by the campus Management to the stakeholders ensuring a safe and hygienic soil and water.

4. It is observed how the environment is protected in the campus and by what means an eco-friendly atmosphere is being given to the stakeholders.

5. The assessment reveals the strengths and weaknesses of the Auditee's Management controls and risks associated with their failure in providing uncontaminated soil and water resources facilities.

6. Collecting audit proofs *ie*, data collection and information from the auditee as per the audit protocol were carried out.

7. An exit meeting was conducted to describe the findings of the audit with Management Representatives and staff members along with the audit team in brief.

9.2. Pre-Audit stage activities

A pre-audit meeting (opening meeting) is conducted with Management and Administrative people along with staff coordinators of soil and water audit process, wherein, audit protocol and audit plan were discussed in brief. The purpose of this meeting is to provide a chance to emphasize the scope and objectives of the audit and discussions held on the feasibilities associated with the audit (Marrone *et al*., 2018). Pre-audit stage activities are an essential prerequisite for the soil and water audit to meet the auditee and to gather information about the campus and required documents were collected directly from the Organization before the start of the audit processes (Fachrudin *et al*., 2019). Audit team was selected by the Nature Science Foundation as per the checklist comprised of Lead Auditor of ISO (EMS 14001:2015), Botanist, Agriculture and Horticulture Scientists from Conventional and Technical Universities across India, Accredited Professionals from Indian Green Building Council, Hyderabad and Associated Chambers of Commerce and Industry of India, New Delhi.

9.3. Target Areas of Soil and Water Auditing

Soil and water audit is nothing but a professional tool to assess the purity of soil and water in the educational institutions and give a value addition to the campus and considered as a resource management process. Soil and water audit mainly concentrate on the efficient use of soil and water; minimize waste generation or pollution and also improve the economic efficiency. Soil and water audit process may be undertaken at frequent intervals and their results can demonstrate improvement or change over time. Soil and water audit focuses on the reduce the loss of water, reduce the wastes to landfill and enhance energy use conservation to integrate environmental considerations into all contracts and services considered to have significant environmental impacts (Choy and Karudan, 2016).

There are several target listed in the soil and water audit process in which a few are taken into consideration as per the Indian scenario is concerned. They are water use efficiency, sewage waste management and reuse methods, soil erosion control, (León-Fernández and Domínguez-Vilches, 2015) drinking water quality supply, Biogas plant, rain harvesting system, water reservoirs, percolation pond, water irrigation, implementation of Government schemes, conduction of awareness programmes management, safety and health infrastructure facilities for stakeholder's wellbeing (Nunes *et al*., 2018).

Table 1. Source and uses of water in the campus:

S.No	Parameters	Quantity Used
1.	No of bore wells	2 Nos
2.	No of the motors used	1 Nos.
3.	Capacity of water tank	2500 - 4000 lit
4.	Amount of Water used in Girls Hostel	900 - 1200 lit/day
5.	Amount of Water used in Boys Hostel	8500 - 1000 lit/day
6.	Resident Staff quarter	2000 - 2500 lit/day
7.	Administrative block	800-1000 lit/day
8.	Construction work	750 - 900 lit/day
9.	Canteen	450 – 950 lit/day
10.	Urinals and Toilets	250 - 400 lit/day
11.	Departments	750 - 950 lit/day
12.	Gardens	250 - 600 lit/day
13.	Laboratories	150 - 250 lit/day
14.	Vehicles washings	150 - 200 lit/day

10. Quantitative Measurements

10.1. Assessment of Soil and Water Quality

10.1.1. Assessment of Physico-chemical Property of Water

Water quality are assessed by measuring the physicochemical parameters and biological parameters. The water samples are collected from source which include ground water, tap water, RO water, waste water and treated waste water. The water samples were collected in sterile glass bottles and transported immediately to the laboratory for analysis of physico-chemical and biological parameters by following the method of APHA (1998). The samples were stored in room temperature for further analysis. Different parameters were examined to find out their suitability for irrigation and even for drinking purposes using Indian Standards as reference (Indian ISI Water, 2002). The physical appearance and colour of the drinking water samples were noted by naked eyes. The taste of drinking water was

investigated by sensation perceived in the mouth on contact. Similarly, the odour of the water was sniffed as described by Arceivala (1998). The pH and conductivity of drinking water samples were measured by dipping the pH electrodes into the water samples and readings were noted by using a pH meter (Systronics, AL113) and digital conductivity meter (Elico, ADI51L); respectively. Drinking water samples were thoroughly shaken and wait until air bubbles disappeared. 10 ml of the samples were poured into the turbidity meter cuvette and read the turbidity using a digital nephlometric turbidity meter (Elico, Tu1020). Hundred ml of the drinking water samples were filtered through a glass fibre filter paper (200 µm size). The filtrate was evaporated on a tared porecelain dish. The porcelain dish was preheated at 105^0 C and then at 550 ^{0} C, cooled and brought to constant weight. The dish was kept at 105^0 C for about 1 hr, cooled and weighed subsequently. The increase in weight denoted the total dissolved solids content in the water samples. Following the method of APHA the chemical constituent of the sample including Nitrate, chloride, sulphate, fluoride and iron were detected spectrophotometerically.

10.1.2. Assessment of Soil edaphic parameters analysis

The soil samples were collected from different places at a depth of 0–25 cm from the campus. The sampling was carried out using the clean soil auger. The dry soil samples collected were entirely placed in clean, labelled polyethylene bags and then transported to the laboratory for further analysis after air drying under room temperature. The soil samples were grinded using mortar and pestle to reduce the particle size and then sieved through a 2 mm mesh to obtain acceptable and homogeneous samples. The samples were stored at room temperature until the physicochemical analysis was performed (Parajuli and Duffy, 2013). Various soil edaphic parameters like soil pH, electrical conductivity (Ec), total organic matter (OM) as carbon content (Walkley and Black, 1984), available nitrogen (AOAC, 1990), available phosphorous (Jackson, 1973), exchangeable potassium (Murphy and Riley, 1962), calcium, magnesium and sodium (Bhargava and Raghupathi, 2001) were estimated as per the protocols mentioned.

10.1.3. Assessment of Microbial contamination in the water

Indicative bacterial species such as coliform bacteria, faecal coliform and Escherichia coli present in water samples collected from different sources was analysed by following three methods such as presumptive, confirmed and completed tests. Determination of water pollution indicative bacteria was carried out by following serial dilution techniques and most probable number (MPN) method (Cappuccino and Sherman, 1992; Dubey and Maheshwari, 2002). All the microbial analysis works were carried out under aseptic condition. From each serial dilution, 1ml of the samples was taken and transferred to test tubes containing 5ml Lauryl trptose broth. The tubes were then incubated at 37ºC for 24-48 hrs. The tubes showing colour change from purple/violet to yellow were taken as positive. The number of positive tubes at each dilution was used with the MPN tables to give number of bacteria present in the original sample. The positive tubes

Figure 2

Figure 2

Figure 1. Solution of MacConkey Broth Purple, Figure 2. Solution of Brilliant green lactose bile broth

were streaked onto Eosin Blue Agar plates, using a sterile loop and incubated at 37^{o}C for 24 hours. The isolated colonies were subjected to observe green metallic in reflected light with dark purple centers by transmitted light. Identification of water pollution indicative bacteria by Presumptive test was carried out by taking a series of test tubes containing double strength lactose broth in which different concentration of water samples was dispensed. All the tubes were incubated at 37°C for 24 hours for gas production. Production of gas was hereby confirmed the presence of coliforms in the water sample. Characterization and morphological identification of water pollution indicative bacteria were made by referring "Bergey's Manual of Determinative Bacteriology" (William and Wilkins, 1994).

10.1.4. Enumeration of Bacteria, Fungi and Actinomycetes in water samples

The sterile Petri plates containing nutrient agar (NA), potato dextrose agar (PDA) and casein nitrate agar (CAN) Similarly, for the enumeration of *Escherichia coli* (*E. coli*) were taken for the enumeration of bacteria, fungi and actinomycetes; respectively in air to assess the number aero-flora (IMTECH, 1998). These plates were exposed for 2-3 minutes at specific places where the number of microorganisms as microflora in the air were to be enumerated. The exposed Petri plates were incubated under room temperature for 24-96 hours. Similarly, one ml of water samples was transferred to the petriplates containing the basal medium and then incubated under the controlled environments.

The number of bacterial colonies grown in the Petri plates containing nutrient agar medium within 24-48 hrs of incubation period were counted using a Colony counter. In the case of fungal growth, the Petri plates containing potato dextrose agar medium were observed after 72-96 hrs of incubation. The colony of actinomycetes were recorded in between the incubation period of 48-72 hrs. The bacterial colonies exhibited different shape, size, colour and texture on morphology. Fungal colonies were identified based on visual characteristics such as colony morphology, elevation, colony margin, aerial mycelium and colony colour. Actinomycetes showed a good sporulation with compact and dense, chalk-like dry colonies with powdery mass, different colour variations from pale pink to white colour on the Petri plates and shown a branched filamentous mycelium in their cell / filament morphology similar to fungal characters in terms of colony growth (Holt, 1989; IMTECH, 1998).

11. Soil and Water Audit Observations

It covers both qualitative and quantitative measurements including physical observation of the presence of streams and springs, number of bore wells, open wells in the campus. Checked for decrease in green cover, any key alteration in the soil species as indicators of soil contamination. Installation of water saving devices like automatic system and water meter and efforts taken towards water leakage, leak detection and repair, water pumping works towards water conservation. Vermicomposting or any similar process may be carried out inside the campus for soil health preservation. The various Clubs, Forums, Cells, Associations and Student / Staff Chapters such as Eco club, Nature club, Science club, Fine Arts club, Flora and Fauna club, Youth Red Cross, NCC/Student Force and NSS bodies may be involved in providing programmes to educate stakeholders the importance sustainable water and land use.

12. Qualitative Measurements of Soil and Water Auditing

The results on various quantitative measurements were made for which soil and water samples were collected from various places of the Organization campus as per the protocols and guidelines mentioned above.

Table 2. Qualitative Measurements of Soil and Water Auditing

S.No	Requirements and checklists of the audit	Conformity		
		Yes	No	NA
1	Have an internal audit procedure for soil analysis been at implemented in the organisation	✓		
2	Whether soil profile analysis carried out in the campus?	✓		
3	Whether soil fertility analysis preferred in the campus?		✓	
4	Whether soil organic matter and above the ground biomass analysed?	✓		
5	Whether any streams /springs presence observed inside the campus		✓	
6	Does any decline in water quality and water quantity observed in recent times.		✓	
7	Whether any decrease in green cover observed in the campus?		✓	
8	Whether any key alteration in the soil species observed?	✓		
9	Whether any change in the water use / land used pattern followed in recent times?	✓		
10	Does soil erosion and associated issues observe inside the campus?		✓	
11	Does soil acidification and associated issues observe inside the campus?		✓	
12	Does soil contaminations and associated issues observe inside the campus?		✓	
13	Number of bore wells, open wells, water reservoirs, Water supply, check dam and etc. are sufficient in the campus	✓		
14	Whether any water logging problem arise inside the campus ?		✓	
15	Whether any loss of soil and water biodiversity observed inside in the campus		✓	
16	Whether any programmes launched recently on soil and water conservation?	✓		
17	Whether any sustainability goals formulated for sustainable land use & rain harvesting system in the campus?		✓	
18	Number of taps and faucets, toilets, showers, rest rooms, etc. in sufficient numbers in the campus coinciding with the human population	✓		
19	Efforts taken towards water leakage, leak detection & repairs, water pumping works towards water conservation	✓		
20	Sprinkler system if available for irrigation system for effective water management		✓	
21	Water contamination and related issues including water logging during heavy rains	✓		
22	Installation of water saving devices like automatic system, water meter, etc.**	✓		

23	Sewage treatment plant availability and its uses including gardening for efficient irrigation and lawn care practices, water wise landscaping, etc.		✓	
24	Whether vermicomposting or any similar process carried out inside the campus for soil health preservation?		✓	
25	Does any programmes conducted to educate stakeholders the importance of sustainable land use?	✓		
26	Whether any investment carried out for sustainable land use and its conservation?	✓		
27	Whether any action plan devised to restore the degraded land?	✓		
28	Whether campus comes under seismic zone and protective zone under Govt. act? **	✓		
29	Whether vermicomposting or any similar process carried out inside the campus for soil health preservation?		✓	
30	Detection of *Escherichia coli*, Coliform bacteria and Faecal Coliform in water	✓		

* Applicable for industrial sectors

13. Assessment of Soil and Water quality

13.1. Assessment of Physico-chemical property of Water of Campus

According to CAWST, 2013, pH is an operational water quality parameter and is important when disinfecting water with chlorine. EC is unusually high levels may suggest chemical contamination. Turbidity could be an indication of surface runoff and may interfere with water treatment. Bacteria and viruses can attach to suspended particles and cause health risks. High turbidity decreases water acceptability. Fluroide is a naturally occurring form of the element fluorine, which is sometimes found in groundwater at levels that exceed safe levels. Too much fluoride can cause pitting and staining of tooth enamel. Long term exposure to high levels could lead to bone issues in adults. Nitrate and nitrite could occur due to the fertilisation of nearby farm fields or sanitation facilities located too close to the well. In most cases, these compounds aren't a serious health risk. They are harmful to infants, however, causing blue baby syndrome, which can be fatal. Chlorine 5mg/L is the health based guideline. Chlorine is often used for water treatment.

The physicochemical constituents of Bore well water samples of the campus including pH, conductivity, colour and odour, chloride sulphate fluoride and iron below the maximum limit of Indian standards of Drinking water quality (Table 3). Whereas total dissolved solids, hardness, turbidity and alkalinity were observed to be above the maximum limit of Indian standards of drinking water quality. Hence the direct consumption of bore well water is not recommended for drinking purposes. The high value of total dissolved solids, hardness, turbidity and alkalinity of bore well water is reduced on adopting reverse osmosis technology. Physico-chemical constituents are all observed to be below the maximum limit of Indian standards of drinking water quality. Hence the bore well water treated by RO is recommended for drinking purposes.

Table 3. Analysis of Physico-chemical parameters of water samples collected at different sources of the Campus.

S.No.	Parameters	Bore well water	RO water	Recycling Water	Standard (IS 10500: 2012)
1.	pH	7.2	6.4	7.2	6.2 to 8.1
2.	Conductivity	1678	-	1214	1000 to 1500
	(micromhos/cm)				
3.	Colour (Hazen unit)	-	-	-	-
4.	Colour & Odour	Agreeable	Agreeable	Agreeable	Agreeable
5.	Taste	-	-	-	-
6.	Total dissolved Solids*	396	334	479	500-550
	mg/L				
7.	Hardness* mg/L	330	BDL [DL:1]	206	200
8.	BOD*	272	252	248	200-300
9.	COD*	87	66	92	50-100
10.	Dissolved oxygen*	355	415	325	300-500
11.	Dissolved CO2*	114	127	135	100-200
12.	Turbidity (NTU)	1.20	0.70	0.18	1
13.	Alkalinity* mg/L	215	220	372	200-300
14.	Salinity*	142	153	156	100-200
15.	Acidity*	56	44	66	50-100
16.	Nitrate* mg/L	2.86	BDL [DL:1]	1.15	1.00-3.00
17.	Chloride* mg/L	138	152	123	100-200
18.	Sulphate* mg/L	130	120	123	100-150
19.	Fluoride* mg/L	BDL	BDL [DL:	BDL [DL:	1.0-2.0
		[D.L:0.1]	0.1]	0.1]	
20.	Iron* mg/L	0.16	BDL	0.09	0.10-0.57
			[DL:0.05]		

13.2. Recycling of Wastewaters at T. K. Madhava Memorial College

Wastewater recyclers are important features in any Organization or Industry. Once for all the implementation should follow the proper guidelines for wastewater treatment system discharge standards as per Central Pollution Control Board (CPCB). The main feature of these discharge standards is the treated water should not be harmful to the biodiversity, resources and the environment. If an industry or Organization has the wastewater treatment plan, proper records on the analysis of water input and output parameters including the running time of the wastewater treatment plant; its operation cost, its maintenance and the reuse records of the treated water should be well accounted. A typical wastewater treatment system should be based on the waste characterization and the treatment of wastes which can be modified so as to fit into the motto of treating the wastewater which in turn to release of safe water (Senior and Brightman, 2015).

The T. K. Madhava Memorial College Campus has a very good wastewater treatment facility covering primary, secondary and tertiary water treatments for elimination of excess phosphorus, potassium, zinc, chromium and nitrogen contents along with harmful pathogens and the degradation of inorganic wastes. The wastewaters are treated with both chemical and biological treatment methods using activated-sludge, UV light and

chlorination. There is a proper connectivity and channels for the discharge of wastewaters from various departments, canteens, cafeteria and hostels to wastewater treatment plants. The wastewaters are purified considerably and reused for gardening as water reclamation. In addition, there is a Reverse Osmosis (RO) water unit to get RO water. The RO treated water is periodically tested for the physico-chemical properties for which Registers containing data relevant to water analysis are being maintained. There is a periodical test to check the physico-chemical properties of wastewaters such as pH, biological oxygen demand, chemical oxygen demand, dissolved oxygen and carbon-di- oxide and total soluble solids before reuse for gardening.

13.3. Assessment of Physico-chemical property of Soil samples collected from of the Organization Campus

Soil physic-chemical properties influence the behaviour of soil and hence, knowledge of soil property is important. Soil testing is the only way to determine the available nutrient status in soil and the only way we can develop specific fertilizer recommendations. Soil properties that are sensitive to changes can be used as indicators to improve soil quality. Analysis of soil is carried out for the studies of various parameters like total organic carbon, available nitrogen (N), phosphorus (P_2O_5) and potassium [K_2O], pH, electrical conductivity, soil texture, bulk density, chloride, fluoride and % moisture content. The fertility of the soil depends on the concentration of N, P, K, organic and inorganic materials, conductivity. The physicochemical properties such as moisture content, Nitrogen, phosphorus and organic matter required for the growth of plant. Potassium is used for flowering purpose, it is also required for building of protein, photosynthesis, fruit quality and reduction of diseases and phosphate is used for growth of roots in plants. The soil profile and soil edaphic parameters of the campus observed to be low in the essential nutrients which are needed for the plant growth. The soil fertility has to be enhanced by adapting vermicomposting and proper irrigation facility.

Soil samples were collected from different places of T. K. Madhava Memorial College campus and then subjected to analyse for their fundamental soil edaphic parameters such as pH, Electrical conductivity (Ec), Total organic carbon, Total nitrogen, Available Phosphorous, Exchangeable Potassium, Total ferric and ferrous ion concentration, Manganese, Magnesium, Zinc, Copper with the help of Tamil Nadu Agricultural College Soil and Water Analysis centre, Coimbatore, Tamil Nadu (AOAC, 1990). The results indicated that pH and Ec recorded values were 7.70 and 0.14 dSm^{-1}; respectively. The soil macro-elements like the amount of total Organic Carbon, Nitrogen, Phosphorous and Potassium were found to be 4.5%, 4.5%, 6.0 and 4.5 kg/acre. The micro-elements like total ferric and ferrous ion concentration, Manganese, Magnesium, Zinc and Copper recorded were 2.9, 2.2, 0.59 and 0.51 ppm. The soil sample analysis report revealed that all the values are within the prescribed according to the Southern Indian Soil health analysis report.

The fundamental characteristics of soil samples are very important because soil health determines the number of plant and microbial diversities in terms of the number of Genera and species diversity and richness. Besides, the population density as well as diversity determines the human population intervention, anthropogenic sources, municipal sewage disposal, solid / garbage waste disposal, industries activities and use of large number of vehicles and agrochemicals which will pollute the soil health. The availability of macro and micro-elements of soils determine the number of beneficial microorganisms such as nitrogen fixing, potassium solubilizing and phosphorous mobilizing microorganisms such as bacteria, fungi and actinomycetes. The soil nutrients are being considered as an essential element for enhancing the profuse growth of various plant species and microbial organisms.

Table 4. Soil Profile and Soil Edaphic Parameters of the Organization Campus

S.No	Description	Results / Observations
I. Physical parameters of soils		
1.	pH	8.2
2.	Electrical Conductivity	655µmhos/cm
3.	Water holding capacity	53-60%
4.	Sand: Gravel: Clay Ratio	19:10:36
5.	Moisture Content	38%
6.	Dry matter Content	55%
II. Macro Nutrients estimations of soils		
7.	Organic carbon	0.51 %
8.	Nitrogen	5.39 %
9.	Potassium	BDL [DL:10]
10.	Phosphorous	BDL [DL:10]
III. Micro Nutrients estimations of soils		
11.	Calcium	14 mg/kg
12.	Magnesium	BDL [DL:10]
13.	Sodium	125 mg/kg
14.	Manganese	158 mg/kg
15.	Zinc	132mg/kg
16.	Ferric	154 mg/kg

13.4. Assessment of Microbial Contamination of Soil and Water samples

Water is considered a vehicle for the propagation and dissemination of human associated bacteria. Safe drinking water is a fundamental human right and if contaminated with opportunistic pathogenic environmental bacteria, it may have health implications for consumers. Human health should therefore be protected by preventing microbial contamination of water that is intended for consumption. These unprotected water sources can be contaminated with microbes through rainfall run-off and agricultural inputs, mixing with sewage effluents and faeces from wild life, which render them unacceptable for human consumption. They are some of the Faecal coliforms, *Aeromonas* and *Pseudomonas*, are used as indicators of faecal contamination in water and the presence of these pathogens may have severe health implications on consumers especially those that are immunocompromised (Suma George *et al*., 2014). Presence of Faecal coliforms in the water samples can be measured by MPN index. MPN index can be performed by conducting multiple tube fermentation test.

Drinking water from RO water plant and Bore well water samples were collected from T. K. Madhava Memorial College campus and then subjected to analyse for their fundamental physico-chemical properties such as pH, Conductivity (Ec), Turbidity, Total Dissolved Solids (TDS), Bicarbonate (HCO_3), Chloride (Cl), Sulphate (SO_4), Calcium, (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Percentage of Magnesium (Mg) and Calcium (Ca) ratio with the help of Tamil Nadu Agricultural College Soil and Water Analysis centre, Coimbatore, Tamil Nadu (AOAC, 1990). The results indicated that pH and Ec recorded values were 6.3 and 0.65 dSm^{-1}; respectively. Similarly, the amount of HCO_3, Cl and SO_4 in water samples were 3.2, 7.0 and 1.2 mg/lit and Ca content was 3.0, Mg was

2.4, Na was 2.4 and K was 0.3 mg/lit and the ratio Mg:Ca contents in water samples were found to be in the range of 0.6-0.8 mg/lit. The total turbidity and TSS recorded were 1.17 and 2.54 NTU (Nephelometric Turbidity Unit) and 325-537 mg/lit; respectively. The water sample analysis report revealed that all the values are within the prescribed according to Central Pollution Control Board, India upon drinking water specification (IS: 10500, 1991). The fundamental characteristics of drinking water are very important because of large number of human population intervention, anthropogenic sources, municipal sewage disposal, solid / garbage waste disposal, industries activities and use of large number of vehicles and agrochemicals which will pollute the soil and water quality.

The water samples collected from different places in T. K. Madhava Memorial College Campus were measured by taking five numbers of 0.5 ml in 10 ml double strength MacConkey broth, five numbers of 1ml of water in 5ml of single strength MacConkey broth and five numbers of 0.1 ml of water in 5 ml of single strength MacConkey broth. From the result it is confirmed that water sample I is showed the presence of Faecal coliforms, whereas water sample II and III showed the absence of Faecal coliforms.

Table 5. MPN index of water samples of TKKM Campus

S.No	Source of water	Combination of positives	MPN index/100ml	Interpretation
1.	Water Sample I	5-5-5	235	Unsatisfactory
2.	Water Sample II	0-0-0	<1.5	Satisfactory
3.	Water Sample III	0-0-0	<1.5	Satisfactory

Table 6. Number of Microbial colonies in Soil and Water samples at different locations of the Organization Campus.

S.No.	Name of the Place	Number of Microbial colonies (cfu) *			
		Bacterial colonies	Fungal colonies	Actinomycete colonies	Total colonies /
1.	**Water Sample I**	**1**	**1**	**2**	**5**
	(Tap water)				
2.	Water Sample II	NIL	NIL	NIL	NIL
	(Drinking water)				
3.	Water Sample III	1	1	NIL	2
	(Open well water)				
4.	Soil Sample I	6	3	2	13
	(Open land)				
5.	Soil Sample II	NIL	1	2	4
	(Gardening)				
6.	Soil Sample III	4	1	1	7
	(Vegetation)				

Soil microorganisms can be grouped into bacteria, actinomycetes, fungi, algae, protozoa, and nematodes. They are responsible for the majority of enzymatic processes in soil and store energy and nutrients in their biomass (Jenkinson and Ladd, 1981). Soil microorganisms are responsible of soil fertility and quality (Bünemann *et al*., 2018), are strongly affected both by the type of soil management and irrigation. Chemical indicators can be measured by monitoring soil pH, salinity, organic matter content, cation and anion exchange capacity, nutrient cycling, and the presence of toxic or radioactive elements, while biological indicators may include measures of the presence of macro- and microorganisms, as well as their activities and by products. During the audit in the campus, the soil and water samples were analysed for the presence of pathogenic microorganisms such as bacteria, fungi and actinomycetes. It is found that the number of microbial colonies is found to be very less which in turn proved the purity of soil and water available in the campus

14. Rainwater Harvesting System and Percolation Pond for Water storage

Rainwater harvesting system is a traditional old practice not only in drought prone areas and also in areas having seasonal rainfall. The Indian traditional rainwater harvesting is being practiced in various parts of the country to improve the ground water status. Now the threatening features of the lower ground level of water has created a revamp of newly featured rainwater harvesting systems. Indian traditional rainwater harvesting systems are constructed based on three modes either direct pumped, indirect pumped or by gravity alone in the campus. In addition, lakes, bonds, water channels and any other water reservoir methods are considered as the rainwater harvesting system. The campus should have adopted any of the above said modes of rainwater harvesting or any new methods that has the benefit of conserving the water resource as well. A small square shaped pit containing gravels and sands constructed near the building for rainwater harvesting and connected with pipes from the roof of the building to pit. During the audit, there was a well-developed rain harvesting system-water channels connected with a square shaped pit observed with the Campus. Rainwater harvesting structures and recharge wells is at the initial stage

15. Operation of Water irrigation, Drip and Sprinkler Irrigation systems

In order to conserve water, sprinkler irrigation is the best method to use on soils that have steep slopes, undulating or irregular topography and on soils that are too shallow to level. It is difficult, however, to sprinkle irrigate if water intake rate of soils is less than 4mm/hr. Drip irrigation method is a more recent type of pressurized irrigation method which is widely practiced in the developed countries and is being introduced in arid and semi-arid zones where water scarcity is major problem, compared to the sprinkler irrigation method, the drip methods operate on much lower line pressure, thus providing or saving in energy requirement. A recent approach is mixing of fertiliser with the irrigation water which is then delivered to the crops/plants through drip irrigation and has been termed as fertigation. This is an efficient method of delivering fertiliser and water to the plant with minimum wastage. A register is maintained to note down the timing of watering the plants and quantity of water poured every time was observed during the audit in the Campus. Irrigation system are initial stage in the campus.

16. Use of Biofertilizers, Organic and Green Manures in the Campus

Natural or eco-friendly methods should be used to grow plants vigorously in the campus which could reduce the environmental pollution. Use of biofertilizers, organic manures (cow dung, vermicompost and plant wastes and litters) and green manures to grow healthy plants in the medicinal plant garden, kitchen garden and terrace garden should be ensured to keep the campus organic. The plant waste such as fallen leaves, stems, fruits, nuts, seeds and other plant parts should be used to make green manures. A concrete or ground level green manure production unit and vermicomposting units will help to convert all the plant and animal based wastes into green/organic manures. This will be a healthy way of solid litter waste management in the campus. Minimal use of chemical fertilizers as part of integrated nutrient management system is acceptable but nil use of chemical fertilizers is highly appreciable and also helps to keep the campus more of an organic ecosystem. The soil, air, water and sunlight are the four major natural resources any campus gets. Proper use and conservation of these resources are mandatory in green campus audit sites. The available resources and their utilization should be accounted for from time to time. Management of the right way of utilization of these resources with the vision of sustainability should be carried out by framing a committee led by the Head of the Institution concerned. Biofertilizers such as Nitrogen fixing bacteria, Potassium and Phosphorus solubilizing bacteria, Potassium mobilizing fungi (VAM), farm yard manure, dried cow dung manure, vermicompost manures and biofungicides and biopesticides are extensively used in the Campus to cultivate plants. Agrochemicals, chemical fertilizers (urea, murate of potash, sulphate of potash, rock phosphate, etc.), pesticides and fungicides are not used. These practices are very well appreciated because air, water and soil pollution due to use of agrochemicals is eradicated which in turn to improve the soil health significantly.

17. Conduct of Outreach programmes

Professional implementation of all the Eco plans in the campus should be done through the Eco clubs, Nature clubs, Science clubs, Youth Red cross units, Fine Arts clubs, Women cell, Associations, Forums, SSL, NCC (National Cadet Corps) and NSS (National Service Scheme). All the students, members of staff and employers should be mandatory members of the club and should do tree planting and maintenance of greenery in the campus periodically. Conducting frequent seminars, conferences, workshops, awareness rallies, etc. on topics relevant to the environment is necessary to educate and create awareness among the students and staff members. In addition, student's associations, cells, clubs and forums should be the first hand receivers of all the new plans proposed by the Government such as Swachh Bharath Abhiyan and Jal Shakti Abhiyan under Clean India Mission and implement the same in the campus. The Campus has well developed NCC/Student Force, NSS, Swatch Bharath Abhiyan under Clean India Mission. These bodies are actively involved in tree planting programmes and cleaning the surrounding areas of tribal, rural and urban peoples near Kerala.

The College is conducting a large number of activities to conserve the nature and to teach about the importance of environment to rural, tribal and urban people towards the conservation of soil and water resources.

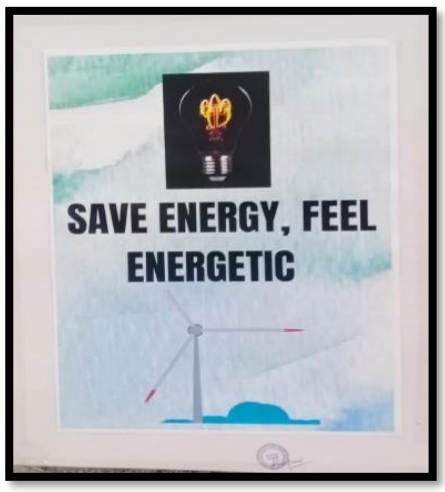
Awareness programmes on the green campus initiatives and dissemination of green motto and pledges are accounted in a sustainable manner towards water and soil biodiversity. Its benefits and self-sustainability are being projected for wider centric on earth and Ecology conservation. Innovative practices that add up credentials in implementing the green campus which needs to be promoted in the awareness programme to the students and staff members including public domain. Technology driven solutions initiated by the green campus organization are periodically disseminated and documented successively for propagating the attitude of the green campus in wider masses.

The College has taken sufficient attempts to disseminate the green campus motto and green pledge such as ‘Don’t cut trees’, ‘Don’t use plastic bags’, ‘Don’t waste waters’, ‘Plastic Free Zones’ and ‘Preserve the Natural Resources’ and etc. among the students and staff members in the campus. The College is implemented the Government schemes (Swatch Bharath Abhiyan under Clean India Mission) to give pure and safe water to rural people and teach the importance of cleanliness of toilets and restrooms to people living in and around Kerala . These activities are very important in view of the instantaneous vicinity to undertake progressive programmes and conducted Participatory rural appraisal programmes. It is involving the socioeconomic position of the inhabitants, natural resources, traditional knowledge systems, cropping patterns, etc. of the rural and tribal people. The Management is also focusing on the development of women, youth, children and dalits and to identify the extension and training needs of the target group through the Nature club and NSS volunteers towards water and soil biodiversity conservation.

The College helps to develop social commitment and to expose the students to get sensitized to social realities and to build a link between the student community and the wider community. It enhances the social interaction, inter-personal communication skills and develop emotional maturity of students. It also helps students in total and integrated personality development. The Management facilitates to prepare the students for future life, by developing qualities such as cooperation, team spirit, leadership, discipline and development of creative talents including to boost the self-confidence of students.

18. Academic credentials: Projects, Dissertations and Thesis work

Project, Dissertation and Thesis works are academic effort credentials that always fosters the innovative ideas on thinking and implementation of new innovative approaches. Applied research work of the faculties, staff and student members should be implemented within the campus owing to the credential of the research. Those works indicating the significance of empowering the sustainability of soil and water can be implemented or adopted in other organizations. If the innovation is capable of developing into entrepreneurship, then it is highly appreciable.



The Report of projects and dissertations which are productive in methodologies should be disseminated through presentation and publication in social media, books, magazines and journals so as to spread the innovative ideas and methods to the broad public. The faculty members and students from various subject domains are doing extensive project work related to nature conservation, environmental pollution, soil and water analysis.

19. Best practices followed in the campus

1. It is observed that the Management is maintaining more than 75 % of the green cover area after building construction as per the guidelines of World Green Building Council to provide a healthy environment and eco-friendly atmosphere to the stakeholders.

2. The Management is established which provide pure atmosphere to the stakeholders under natural environment, topology, landscape and soil erosion. The campus is established without disturbing the natural vegetation along with the artificially created topography like pedestrian pathways and parking areas in the campus.

3. The College has established rainwater harvesting models, percolation pond, water channels to recharge the bore wells by collecting rainwaters from the building roofs, open areas and playgrounds including unexplored areas which are channelized to flow of rainwaters to increase the ground water level.

4. Appropriate dustbins and eco-friendly covers are made available in all the places across the campus to control the spread of wastes and contaminants from one place to another place and without harming the soil fertility status.

5. The results on soil parameters analysis showed that the Management is maintaining the campus in a sustainable manner without polluting the soil and harming environment which in turn is not affecting the water quality.

6. Similarly, the results on water physico-chemical analysis indicated that the Management in giving more importance to drinking water quality to the stakeholders which is directly correlated with the report of soil analysis.

20. Recommendations and Suggestions

- Drinking water obtained from rivers and ground water of tube wells, hand pumps and bore wells should be chlorinated before supplying to the stakeholders which will improve the quality of water by eliminating the harmful microorganisms.

- The College initiated rainwater harvesting models, percolation pond, water channels to recharge the bore wells by collecting rainwaters from the building roofs, open areas and playgrounds including unexplored areas which are channelized to flow of rainwaters to increase the ground water level.

- The Quality Policy of the Organization regarding water use and savings opportunities may be developed generously towards the water consumption and calculate the per capita water consumption per person per day.

- Installation of water saving devices like automatic system and water meter in order to conserve water may be implemented as water saving measures.

- Availability of sewage treatment plant and channelling of treated water to irrigation and even for drinking purposes may be taken into consideration.

- Attempts should be made to create awareness among students and staffs about the scarcity of water resources and water pollution by conducting conferences, seminars and training programmes periodically.

- In order to maintain the soil health and fertility for long time in the Organization campus, soil samples may be collected from different locations periodically and check the soil edaphic parameters covering micro and macro elements

- Eco club student chapters, forums, cells, associations, clubs, etc. may be established to among the students from which a large number of programmes on nature conservation and environmental protection may be conducted to address the importance of soil and water resources to rural, tribal and urban people.

- It is recommended to develop 'Green Campus Policy', 'Energy and Environment Policy' and 'Purchase Policy' for not allowing the non-degradable plastic covers during the purchasing of goods with respect to nature conservation and environmental protection which in turn to save the soil and water resources.

21. Conclusion

T. K. Madhava Memorial College has made significant progressive contributions with respect to teaching learning, research and consultancy, innovation and transfer of technology, community service and value education, *in toto*. The Campus is a well-established self-supporting College in India which imparts quality education to rural, tribal and urban people across the Nation. This Organization is excellent in terms of academic activities and providing an eco-friendly atmosphere to the stakeholders. The Organization has taken enormous efforts to maintain health and hygiene of the students, research scholars, staff members and parents in a sustainable manner which reflects the importance of the environment and stakeholders. It is conducting a large number of activities for the benefit of rural and tribal community people without disturbing the natural environment, topology, landscape management and vegetation. The Campus is maintaining the purity of soil and water by proper checking of their physico-chemical and biological parameters. The installation of a rainwater harvesting system, percolation ponds and drip irrigation system to conserve rainwater and ground water are noteworthy in the campus. The Organization has created medicinal, herbal and ornamental gardens at small scale level for establishing a massive reforestation / afforestation planting programme in which a large number of trees and shrubs species were planted together for providing an eco-friendly atmosphere to the stakeholders in a sustainable manner.

22. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Principal, NAAC and IQAC Coordinators of T. K. Madhava Memorial College for providing necessary facilities and co-operation extends during the soil and water audit. This helped us in making the audit a magnificent success journey of the NSF. Further, we hope that the concept of establishing and maintenance of sustainability of soil and water proposed by the Management will create Clean and Green Environment and this will be taken care of by upcoming generation and propagate further in coming days.

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UDYAM
REGISTRATION CERTIFICATE

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NAME OF ENTERPRISE	M/S NATURE SCIENCE FOUNDATION
TYPE OF ENTERPRISE *	MICRO
MAJOR ACTIVITY	SERVICES
SOCIAL CATEGORY OF ENTREPRENEUR	GENERAL

NAME OF UNIT(S)

S.No.	Name of Unit(s)
1	Green Campus, Energy and Environment Management Audits

OFFICAL ADDRESS OF ENTERPRISE

Flat/Door/Block No.	LIG-IL2669	Name of Premises/ Building	GANDHIMAA NAGAR
Village/Town	Gandhimaanagar S.O	Block	LIG-II
Road/Street/Lane	Peelamedu	City	Coimbatore South
State	TAMIL NADU	District	COIMBATORE , Pin 641004
Mobile	9566777255	Email:	chairmannsf@gmail.com

DATE OF INCORPORATION / REGISTRATION OF ENTERPRISE	28/11/2017
DATE OF COMMENCEMENT OF PRODUCTION/BUSINESS	12/03/2020

NATIONAL INDUSTRY CLASSIFICATION CODE(S)

SNo.	NIC 2 Digit	NIC 4 Digit	NIC 5 Digit	Activity
1	69 - Legal and accounting activities	6920 - Accounting, bookkeeping and auditing activities; tax consultancy	69201 - Accounting, bookkeeping and auditing activities	Services
2	85 - Education	8542 - Cultural education	85420 - Cultural education	Services
3	85 - Education	8549 - Other education n.e.c.	85499 - Other educational services n.e.c.	Services

DATE OF UDYAM REGISTRATION	26/02/2022

* In case of graduation (upward/reverse) of status of an enterprise, the benefit of the Government Schemes will be availed as per the provisions of Notification No. S.O. 2119(E) dated 26.06.2020 issued by the M/o MSME.

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PROCEEDINGS OF THE COMMISSIONER OF INCOMETAX (EXEMPTIONS),
III FLOOR, ANNEXE BLDG, NO.121, MAHATMA GANDHI SALAI, CHENNAI-34

Present : G.M.DOSS, I.R.S
Commissioner of Income Tax (Exemptions)

** URNo. AACTN7857J/05/18-19/T-1105 Dated:03/09/2018

Sub: Registration u/s. 12AA of the Income tax Act 1961 - in the case of

"Nature Science Foundation"
LIG-II, 2669, Gandhimaa Nagar, Peelamedu, Coimbatore – 641 004.

Ref : Application in form 10 A filed on 28/03/2018

ORDER UNDER SECTION 12AA OF THE INCOME TAX ACT 1961.

1. The above **Trust/~~Society/Association/ Company/ others/~~**, bearing **PAN AACTN7857J** was constituted by **Trust Deed / ~~Memorandum of Association~~** dated **29/11/2017** registered with **Sub-Registrar's Office/ ~~Registrar of Societies~~**/~~Registrar of Companies/others~~ on **29/11/2017.**

2. ~~The Trust Deed / Memorandum of Association has subsequently been amended / modified / altered by a Codicil / Supplementary Deed / Amendment Deed / Alteration to Memorandum of Association/others dated XX/XX duly registered on XX/XX.~~

3. The above **TRUST** filed an application seeking Registration u/s 12 AA of the Income tax Act, 1961.

4. On going through the objects of the **TRUST** and its proposed activities as enumerated in the **Trust Deed / ~~Memorandum of Association,~~ I** am satisfied about the genuineness of the **TRUST** as on date.

5. The application has been entered at **Sl.No.1105** maintained in this office. The above **Trust** is accordingly registered as a **PUBLIC CHARITABLE TRUST** u/s 12 AA of the Income Tax Act, 1961 with effect from **29/11/2017**.

6. It is hereby clarified that the Registration so given to the **Trust/~~Institution~~** is not absolute. Subsequently, if it is found that the activities of the **Trust/~~Institution~~** are not genuine or are not being carried out in accordance with the objects and clauses of the **Trust Deed / ~~Memorandum of Association~~** submitted at the time of registration or modified with the approval of the **Commissioner of Income-tax (Exemptions), Chennai** or there is a violation of the provisions of Section – 13, **the** Registration so granted shall be cancelled as provided u/s 12 AA (3) or 12AA(4) of the Income Tax Act. Further, this approval is also subject to the **Trust/Society/Association/Company/ ~~Others~~/** complying to the provisions of the proviso to sec 2(15) of the Income Tax Act 1961**.**

7. **Granting of Registration u/s 12AA** does not confer any automatic exemption of income from taxation. The **Trust/~~Institution~~** should conform to the parameters laid down in Sections 11, 12, 13 and 115 BBC of the I.T. Act, 1961, to claim exemption of its income on year to year basis before the Assessing Officer.

** This Unique Registration No. URNo. **AACTN7857J/05/18-19/T-1105 Should be mentioned in all your future correspondence.**

Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income-tax(Exemptions), Chennai.

Copy to:
1. **The Assessee.**
2. **The ACIT(Exemptions), Coimbatore Circle.**
3. **Office Copy.**

//CERTIFIED TRUE COPY//

(N SRINIVASA RAO)
Asst. Commissioner of Income-tax (H.Qrs)(Exemptions),
Chennai.

F.2984

GOVERNMENT OF INDIA
INCOMETAX DEPARTMENT
OFFICE OF THE COMMISSIONER OF INCOME TAX (EXEMPTIONS)
Aayakar Bhawan, Annexe III Floor, 121 M.G. Road, Chennai 600 034

URNo. AACTN7857J/05/18-19/T-1105/80G Date: 10.04.2019

Name of the Trust ~~/Society /Company/Institution~~	:	NATURE SCIENCE FOUNDATION
Address	:	LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU, COIMBATORE - 641 004
PAN	:	AACTN7857J
Date of Application	:	12.11.2018

Received
E. Ponnuraj 17/07/19
17/07/2019

APPROVAL UNDER SECTION 80G(5)(vi) OF THE INCOME TAX ACT, 1961

The aforesaid Trust ~~/Society/Company/Institution~~ has been registered u/s.12AA of the Income Tax Act with effect from **29.11.2017** vide **AACTN7857J/05/18-19/T-1105** dated **03.09.2018.** It is certified that donation made to **NATURE SCIENCE FOUNDATION** at **LIG II 2669, GANDHIMAA NAGAR, PEELAMEDU,COIMBATORE - 641 004** shall qualify for deduction u/s 80G(5)(vi) of the Income Tax Act, 1961, subject to the fulfillment of conditions laid down in clauses [i] to [v] of sub-section (5) of section 80G of the I.T Act, 1961.

2. This approval shall be valid in perpetuity with effect from **A.Y. 2019-20** unless specifically withdrawn. **The details and validity of the certificate is available @ office.incometaxindia.gov.in**

3. The Return of Income along with the Income & Expenditure Account, Receipts and Payments Account and Balance Sheet should be submitted annually **to** the Assessing Officer having jurisdiction over the case.

4. No change in the Trust Deed/~~Memorandum of Association~~ shall be effected without the prior approval of the undersigned i.e. **Commissioner of Income Tax (Exemptions), Chennai**.

5. Every receipt issued to a donor shall bear the **Unique Registration Number** i.e. **URNo. AACTN7857J/05/18-19/T-1105/80G** and date of this order i.e. **10.04.2019.**

6. Under the provisions of section 80G(5)(i)(a), the institution/fund registered u/s.12A, u/s.12AA(1)(b) or approved u/s.10(23C), 10(23C)(vi)(via), etc., shall have to maintain separate books of accounts in respect of any business activity carried on and shall intimate this office within one month about commencement of such activity.

Sd/-
(G.M.DOSS, I.R.S)
Commissioner of Income Tax (Exemptions)
Chennai.

Copy to:
1. The applicant
2. Guard File
3. The DCIT(Exemptions) Coimbatore Circle.

//Certified True Copy//

(N. SRINIVASA RAO)
Assistant Commissioner of Income-tax (H.qrs)
(Exemptions), Chennai.

FORM NO. 10AC

(See rule 17A/11AA/2C)

Order for registration

1	PAN	AACTN7857J
2	Name	NATURE SCIENCE FOUNDATION
2a	Address	
	Flat/Door/Building	LIG-II, 2669
	Name of premises/Building/Village	GANDHIMAA NAGAR
	Road/Street/Post Office	Coimbatore South
	Area/Locality	COIMBATORE
	Town/City/District	Gandhimaanagar S.O
	State	Tamil Nadu
	Country	INDIA
	Pin Code/Zip Code	641004
3	Document Identification Number	AACTN7857JE2021501
4	Application Number	739995830271021
5	Unique Registration Number	AACTN7857JE20215
6	Section/sub-section/clause/sub-clause/proviso in which registration is being granted	01-Sub clause (i) of clause (ac) of sub -section (1) of section 12A
7	Date of registration	03-11-2021
8	Assessment year or years for which the trust or institution is registered	From AY 2022-23 to AY 2026-2027
9	Order for registration:	
	a. After considering the application of the applicant and the material available on record, the applicant is hereby granted registration with effect from the assessment year mentioned at serial no 8 above subject to the conditions mentioned in row number 10.	
	b. The taxability, or otherwise, of the income of the applicant would be separately considered as per the provisions of the Income Tax Act, 1961.	
	c. This order is liable to be withdrawn by the prescribed authority if it is subsequently found that the activities of the applicant are not genuine or if they are not carried out in accordance with all or any of the conditions subject to which it is granted, if it is found that the applicant has obtained the registration by fraud or misrepresentation of facts or it is found that the assessee has violated any condition prescribed in the Income Tax Act, 1961.	
10	Conditions subject to which registration is being granted	
	The registration is granted subject to the following conditions:-	

	o. This certificate cannot be used as a basis for claiming non-deduction of tax at source in respect of investments etc. relating to the Trust/ Institution.	
	p. All the Public Money so received including for Corpus or any contribution shall be routed through a Bank Account whose number shall be communicated to Office of the Jurisdictional Commissioner of Income Tax.	
	q. The applicant shall comply with the provisions of the Income Tax Act, 1961 read with the Income Tax Rules, 1962.	
	r. The registration and the Unique registration number has been instantly granted and if, at any point of time, it is noticed that form for registration has not been duly filled in by not providing, fully or partly, or by providing false or incorrect information or documents required to be provided under sub-rule (1) or (2) of rule 17A or by not complying with the requirements of sub- rule (3) or (4) of the said rule, the registration and Unique Registration Number (URN), shall be cancelled and the registration and URN shall be deemed to have never been granted or issued.	
	Name and Designation of the Registration Granting Authority	Principal Commissioner of Income Tax/ Commissioner of Income Tax (Digitally signed)

Digitally Signed by SIBICHEN K MATHEW
Date: 2021.11.03 15:52:36 IST

Certificates of Certified Lead Auditors of Soil and Water Audit

1. ISO Environment Management System (14001:2015) of Mrs. S. Rajalakshmi, Chairman of NSF.
2. ISO Environment Management System (14001:2015 TUV NORD) of Dr. A. Geethakarthi, NSF Environment Auditor.
3. Indian Green Building Council (IGBC AP) Accredited Professional of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
4. Associated Chambers of Commerce and Industry of India (ASSOCHAM) of Dr. B. Mythili Gnanamangai, Vice-Chairman of NSF.
5. Lead Auditor in 'Food Safety Management System (ISO 22000:2005)' of Mrs. Gaanappriya Mohan, NSF Hygiene Auditor.
6. 'Personal Safety and Occupational Health' of Institute of Health Safety & Environment Council of Mrs. Gaanappriya Mohan, NSF Hygiene Auditor.
7. Bureau of Energy Efficiency (BEE) and National Productivity Council of Er. N. Dineshkumar, Energy Auditor of NSF.

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SYSTEMS AND SOLUTIONS PRIVATE LIMITED

Certificate No: **IRS/FSM/2016/04/03/02 of 07**

Certificate of Successful Completion

This is to certify that

GAANAPPRIYA MOHAN

has attended and successfully completed the

Food Safety Management System
Lead Auditor Training Course
(ISO 22000:2005)

Delivered by IRCLASS
Date: 25/04/2016 – 29/04/2016.
at Delhi, India.

Shashi Nath Mishra
Associate Vice President

IRS Course Accreditation No. **LF1619 104**
Participant's ~~Driving Licence~~ / PAN card No. / ~~Passport No~~ / ~~Any Other~~: BLCPG6705J.

IRS/TRG/LAC/FSM/SC/Rev.09.

Date of Issue: **20/05/16.**

NABET

QSA INTERNATIONAL
RAB
PERSONNEL & TRAINING CERTIFICATION

Course accredited with National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI).
IRS Head Office: 52A, Adi Shankaracharya Marg, Opp. Powai Lake, Powai, Mumbai-400 072, India, Telephone: 91-22-30519400.

iHSE COUNCIL

Institute of Health Safety & Environment Council

Certifies that

GAANAPPRIYA MOHAN

has successfully passed an assessment in

Applied Principles Of Workplace Safety Compliance

[Course Ref# 50139\1]

Date of Assessment	3 JUNE 2019
Date of Award	10 JUNE 2019
Certificate Number	APWSC/2019/10219
Centre Name	Green World Safety And Security Consultancies L.L.C

Course Director

The CPD Standards Office
CPD PROVIDER 50139

Accredited cpd Course

An institution that has been independently assessed by QRO and in compliance with the requirement of ISO 29993:2017 Learning Services Outside Formal Learning Services Requirements

IGBC

Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

B Mythili Gnanamangai

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

V Suresh
Chairmar
Indian Green Building Council

Gurmit Singh Arora
Vice-Chairman
Indian Green Building Council

210122

17 April 2021

GEM Certificate

ASSOCHAM

Celebrating 101 Years

ASSOCHAM hereby certifies that

Dr. B. Mythili Gnanamangai

has successfully passed the

Green and Eco-friendly Movement Certified Professional Test (GEM CP)

with

"Excellent Performance"

on

16 July, 2021

He/she is now eligible to execute the GEM Sustainability Certification Projects.
ASSOCHAM feels proud to award the GEM Certified Professional title to him/her.

Pankaj R. Dharkar
Chairman, GEM

GEM CP 20/649

Deepak Sood
Secretary General, ASSOCHAM

BUREAU OF ENERGY EFFICIENCY

Examination Registration No. : EA-14056 Serial Number: 9176

Certificate Registration No. : 9176

Certificate For Certified Energy Manager

This is to certify that Mr./Mrs./Ms. Dinesh Kumar D Son/Daughter of Mr./Mrs. R M Dhanasekaran who has passed the National Examination for certification of energy manager held in the month of October 2011 is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewable subject to attending the prescribed refresher training course once in every five years.

His /Her name has been entered in the Register of certified energy manager at Serial Number 9176 being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr./Mrs./Ms. Dinesh Kumar D is deemed to have qualified for appointment or designation as energy manager under clause (*l*) of Section 14 of the Energy Conservation Act, 2001 (Act No.52 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this 7th day of February, 2013

Digitally Signed: RAKESH KUMAR RAI
Sun Mar 01 10:58:55 IST 2020
Secretary, BEE New Delhi

Secretary
Bureau of Energy Efficiency
New Delhi

Dates of attending the refresher course	Secretary's Signature	Dates of attending the refresher course	Secretary's Signature
22.12.2019			

Regn. No. EA-7391

Certificate No. 5093

National Productivity Council

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. N.Balasubramaniam

son / daughter of Mr. M.Nanjukuttigounder

has passed the National Certification Examination for Energy Auditors held in December - 2009, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 11th February 2010

Controller of Examination

ENERGY IS LIFE

BEE

CONSERVE IT

ऊर्जा दक्षता ब्यूरो

BUREAU OF ENERGY EFFICIENCY

विद्युत मंत्रालय, भारत सरकार

MINISTRY OF POWER, GOVERNMENT OF INDIA

प्रमाणित किया जाता है कि

श्री/श्रीमती दिनेश कुमार ने ऊर्जा संरक्षण भवन निर्माण संहिता के लिए 7 दिसंबर '16 से 8 दिसंबर '16 तक ~~एमएनआईटी~~ / ~~सीईपीटी~~ /आईआईआईटी द्वारा आयोजित मास्टर ट्रेनर सर्टिफिकेट कार्यक्रम को सफलता पूर्वक सम्पन्न कर लिया है।

This is to certify that

Shri/Smt. Dinesh Kumar has successfully completed the Master Trainer Certificate Programme conducted by ~~MNIT~~ / ~~CEPT~~ / IIIT from 7 December '16 to 8 December '16 for the Energy Conservation Building Code.

नई दिल्ली, 07 JUL 2017

New Delhi,

महानिदेशक

Director General

LEED AP BD+C

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

DINESH KUMAR D

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED® green building program.

10531234-AP-BD+C
CREDENTIAL ID

26 DEC 2016
ISSUED

25 DEC 2022
VALID THROUGH

Mahesh Ramanujam

MAHESH RAMANUJAM
PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL
PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Dinesh Kumar Dhanasekaran

has qualified as a **GRIHA** Certified Professional For V. 2015

Date of issue: 19th June 2020

Note : This certification is valid only for GRIHA version 2015.

Chief Executive Officer
GRIHA Council