GREEN AND ENVIRONMENTAL AUDIT REPORT

January 2023

Prepared for

Kisan Veer Mahavidyalaya, Wai

Prepared by

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Proprietor

Submitted on 25th January 2023

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We dare to walk thin green line

Date: 25th January 2023

To,

The Principal

Janata Shikshan Sanstha's

Kisan Veer Mahavidyalya, Wai

Subject: Detailed Green/Environmental and Energy Audit at your College.

Respected Sir,

Based on field visit, Environmental baseline data collection, field study and our discussion, we are pleased to submit herewith Combined Green/Environmental and Energy Audit Report. We are thankful for your timely help and contribution towards making this Report.

Thanking you

Rupali A More

Adya Environmental Services

Proprietor

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AUDITS 1. SOLID WASTE AUDIT

INTRODUCTION

Urbanization and industrialization have resulted in increasing amounts of municipal, industrial and health care waste in the country. Central pollution control board (CPCB) has estimated current quantum of solid waste generation in India to the tune of 48 million tons per annum. Each year everyone in India throws away more than 0.4 tons of waste. Management of such high quantum of waste puts enormous pressure on solid waste management system. Throwing thing away is waste of natural resources and energy which have been used to make the product. Waste has to put somewhere. Most of it is sent to landfill sites or incinerated (burnt), using up land and releasing greenhouse gasses. On an average in India 12% of waste is recycled/composted, 79% is sent to landfill site and 9% is incinerated (burnt)

SOLID WASTE GENERATION

VISUAL ANALYSIS OF MONTHLY SOLID WASTE GENERATION

Garden waste is the main contributor of campus solid waste by volume. Every week near about 45000 to 50000 gm of Garden waste is removed from college campus. Variation in Garden waste quantity is also found due to the seasonal variation. Paper waste also contributes a lot to the solid waste volume.

As an educational institute, college's paper and hard paper waste like cardboard, paper covering, printing paper is also high. It accounts for near about 25% by volume. KVC converts possible amount of its garden waste to manure by composting. Food waste is not included in visual analysis of solid waste for college building. College staff and students bring back their food waste (Tiffin waste) to their home. Food waste from canteen is disposed off with proper care.

SOLID WASTE ACCOUNTING BY WEIGHT

TABLE 1 WEEKLY WASTE OF OFFICES, CLASSROOMS & LIBRARY IN GM APX

Place	Paper	Hard pape	Polythen	Hard Plastic	Glass	Chalks	Metal	Other Organic	E-waste
Library	120	150	3	60	20	NEG	5	NEG	50
Office area	400	200	3	200	40	NEG	20	200	80

Classrooms	200	70	5	600	45	300	20	100	130
Total	720	420	11	860	105	300	45	300	260

TABLE 2 WEEKLY DPT WISE SOLID WASTE GENERATION OF COLLEGE IN GM APX

Departments	Paper	Hard paper	Polythene	Hard Plastic	Glass	Chalks	Metal	Other Organic	E - waste
Chemistry	140	300	3	150	150	40	20	100	40
Zoology	70	70	2	50	50	20	10	50	30
Botany	60	70	2	40	50	20	10	2000	30
BCA	500	50	1	40	30	40	20	50	150
Others	300	200	2	200	30	70	15	100	70
Total	1070	360	10	480	310	190	75	2300	320

TABLE 2 WEEKLY SOLID WASTE OF NON-BUILT-UP OF COLLEGE CAMPUS APX (GM)

Place	Paper	Hard paper	Polythene	Hard Plastic	Glass	Chalks	Garden waste	E-waste
Solid Waste of non built-up area	200	100	-	200	100	NEG	50000 (depends on the	-

Please note

*Computers and Instruments scrap is not included here.
*Plant material waste from botany practical's is included in organic waste.)
*Canteen waste is not included here.
* Waste from residential complexes is not included

TOTAL WEEKLY WASTE GENERATION OF CAMPUS

Here we can see that Garden waste is the main contributor of campus solid waste by weight. Sanitary pads and paper are the third and fourth main contributors. If we differentiate between degradable and biodegradable waste biodegradable waste shows a very large figure compare to Non – degradable waste (glass, electronic, waste, and plastic).

Weekly Biodegradable waste of college is 55-56 kg while non biodegradable waste of campus comparatively small and is 12-13 kg. But these are non-biodegradable substances and disturb natural processes. So College should take steps towards waste reduction, reuse and recycling to make its campus more Eco-friendly.

	Waste Type	Percentage
1	Paper	25 %
2	Hard paper	2 %
3	Garden waste	65 %
4	Hard plastic	3%
5	Polythene	2 %
6	Glass	1 %
7	Electronic waste	2%
8	Miscellaneous	1%

Table Visual analysis of Waste (apprpx)

	Waste Type	Weight (gm)
1	Paper	1990
2	Hard paper	880
3	Polythene	21
4	Hard Plastic	1540
5	E – waste	580
6	Glass	515
7	Chalks	490
8	Garden waste, Organic waste	52600
9	Miscellaneous	200
10	Sanitary pads	10000

Table Waste by weight(apprpx)

KEY STEPS BY COLLEGE TO REDUCE WASTE AT SOURCE WASTE

CHALK WASTE

Chalk waste is an important contributor of College's Solid waste. Chalk dust is also an allergic irritant for many students and teachers. Chalk is mostly made up of limestone or gypsum. College produces 490kg of chalk waste per week. College should start recycling of the chalks. New chalks can be made using chalk molds.

GLASS, PAPER AND HARD PLASTIC

Currently Wai Municipal Council collects this waste from College. On an average 1561g of hard plastic and plastic is weekly disposed off by campus. Approx 2870gm of paper and hard paper waste goes to dustbin every week. On an average 515 gm of glass goes to waste. College staff reuses one side printed paper for their daily office work. College gives remaining paper waste for reuse to other vendors. For other waste separate storage facilities are provided. And it is given to waste recycler after possible reuse of waste.

Waste segregation dustbins

Canteen owner showing segregated waste

College student practicing waste segregation

Municipal council collects this segregated waste for further waste management and treatment

Science laboratories viz Chemistry, Botany, Zoology are the major glass waste producing areas. Amongst them Chemistry laboratory produces larger amount of glass waste. All those three departments give glassware waste for recycling. Plastic waste from those laboratories is cleaned and given to Municipal council for further processing. No radioactive material is used in Chemistry laboratory. Lead is used in very small quantity in the form of PbSo4 salt. It is used for only two chemistry practical. And the concerned practical's are performed in groups. Other non toxic chemical waste of science practical's are flushed out with water. This waste water undergoes neutralization process before disposal.

Glass waste of Science lab

ORGANIC WASTE

Organic waste of this college mainly includes garden waste. Other organic waste is paper, hard paper, cotton waste etc. Weekly on an average approx 45000 to 50000gm of garden waste (depending on season) is removed from college premises plus other organic waste (other than gardening area) which further goes to compost treatment. Garden maintenance is done once in a week. And this waste also goes to compost unit. College takes every possible step like reduce, reuse before giving organic waste for recycle and disposal. Wai Municipal council collects college's degradable and non biodegradable waste.

Biological technique is most appropriate technique for organic and high-moisture wastes. It includes two main processing mechanisms composting and anaerobic digestion/ bio-methanation. Previously college was practicing vermin-composting as well composting to convert garden waste.

USE AND THROW TYPE PENS

Challenge for students and staff:
Ask students to last a whole semester with one pair of refillable pens OR ink pens.

Nowadays many people use 'use and throw' type pens. Nobody goes to refill the pen with ink. This adds more plastic to our dustbin. Same picture can be found at this College campus. 98% of students of KVC use 'use and throw' type pens. This adds near notable quantity of hard plastic to solid waste per year.

ELECTRONIC WASTE

A college gives its E-waste to a vendor company.

SANITARY PADS:

Menstrual Hygiene Management (MHM) is an integral part of the Swachh Bharat Mission Guidelines (SBM-G). The MHM Guideline (Dec 2015) is issued by the Ministry of Drinking Water and Sanitation to support all adolescent girls and women. It outlines what needs to be done by state governments, district administrations, engineers and technical experts in line departments; and school head teachers and teachers.

As the usage of sanitary napkins is increasing, the amount of sanitary waste generated every day is also increasing. It is equally important to address the issue of efficient disposal of this infectious waste. Currently as we see, a major part of this waste is dumped into landfills leading to tremendous land pollution. Sanitary napkins are flushed down the toilet under the name of convenience. All the drains ultimately meet the rivers in the city and thus water pollution increases.

So if we see the chart of UNSAFE to SAFE practices i.e burning and use of small incinerators is comparatively safe option. Currently college is using burning option. It is done at a distant place and under complete observation (till complete burning of the sanitary waste).

RECOMMENDATIONS

KVC College should improve its Waste Management Plan to achieve its goal of Carbon neutral campus.

1. Installation of food waste based Bio-gas plant would a good waste recycling option for Canteen waste.
2. Installing Sanitary napkin incinerator machine can promote better hygiene and waste management.
3. Educate, Empower and guide second year students on their academic environmental awareness coursework/projects. Examples: Chalk recycling project, awareness on 'stopping use of Use and throw pens'. Focus should be given on
    - Awareness and sensitization of all user groups namely teachers, students and support staff.
    - Integrating various environmental friendly practices at college level.
4. According to the 5 R's, four actions should be taken, if possible, prior to 'recycling': refuse, reduce, reuse, repurpose, and then recycle. In the 5R's hierarchy, remember to treat recycling as a last resort after attempting to refuse, reduce, reuse or repurpose. Incorporating this methodology into college will minimize landfill waste. Before disposing of your waste, walk through each of these steps.
5. Refusal to unhealthy fryums and cold drinks will not only minimize the landfill waste but it is one of the prime necessities of the time. Research studies have been found that there is connection between unhealthy snacking at schools and academic performance. Students eating unhealthy foods at snack time had worse academic performance. <u>It is advised to create 'Environmental friendly healthy eating policy' for the college.</u>
    - Take competitions/festivals of zero packaged homemade healthy snack, homemade chocolates.
    - College administration should make room/space for healthy soups, fruit salad, nariyal paani, healthy paratha-chutni, neembu-pani sellers/stalls in campus.

2. WATER AUDIT

INTRODUCTION

A water audit is a systematic review of a site that identifies the quantities and characteristics of all the water uses. The site may vary from a public water utility, facility (institutional or commercial properties like malls, office, schools etc.) or a household. The overall objective of conducting a water audit is to identify opportunities to make system or building water use more efficient.

Water auditing is an ongoing process and rarely stays consistent in a site or system over time. Therefore in order to gauge progress from adopted water conservation and cutbacks, water audit should be performed on a regular basis.

The contemporary approach of typical 'end-of-pipe' treatment of wastewater needs to shift towards decentralized, integrated water management with efforts towards 'zero discharge' or 'positive water balance', thus, reducing the fresh water consumption as well as pollution. This requires comprehensive information about the quantity and quality of water being used (and/or wasted) at different places. The first step towards this is the identification and measurement of the flows, water quality, and losses within different stages through regular water audits. Although there is growing realization in India on water management, there is also a need for sensitization of different sectors on the concept of water audit and its benefits.

Current Water Status of the region

Almost entire district is underlying by Deccan trap basalt. Also the isolated and small parts adjoining the hilly areas have low ground water development potential. Such areas occur in almost entire Mahabaleshwar taluka and part of Madha, Patan , Wai and Man taluka. The major part of the district is occupied by areas with medium ground water development potential.

Depth to water level in Satara district during may 2011 ranges from 0.09 m bgl (Shendri) to 16.2 (Mahabaleshwar) Depth to water level during premonsoon (May 2011) has been 9 depicted in the

following figure. The perusal figure 3 indicates that most prominent range of water level is 5-10 m bgl which is seen almost entire district.

The overall stage of ground water development in the district is 69.5% hence it is necessary to adopt water conservation and artificial recharge techniques to increase sustenance of this precious resource.

Drought areas has been observed in major parts of the district in the entire eastern, north eastern and south eastern parts comprising almost entire Khandala, Phanltan, Khatav, Mhaswad talukas and parts of Koregaon and Karad talukas. Deeper water levels of more than 10 m bgl are also seen in northern part around Mahabaleshwar, Khandala and Wai and in south eastern part of the district in the parts of Man and Khatav talukas. These are the areas where the ground water scarcity is quite common when the rainfall is deficient. The stage of ground water development in 5 talukas (Karad, Khatav, Koregaon, Phaltan and Wai) has already crossed 70%. Most of these talukas fall in rain shadow zone of Western Ghats, where rainfall is low. Hence special attention is required in above mentioned areas and immediate steps like ground water augmentation by artificial recharge practice and water conservation should be adopted before further ground water development is planned in these areas.

WATER SUPPLY OF KVC CAMPUS

The Primary source of college potable water is well water. College fulfills its water demand from two wells. One is located in college campus. While the other (locally known as ‘Kharatanchi vihir) is located at distant place. The water quality of the ‘campus well’ is good and after filtration it is used for drinking purpose. ‘Kharatanchi vihir is used for Irrigation purpose.

College has attached six water filters at different drinking line. The filtered water falls under the limits of potable water. There is no water-meter at water intake.

Based on flow rate measurement the average amount of potable water that is pumped form well water line to the overhead 14 tanks of different capacities is about 35500L. Although on certain days there is a sudden jump & increase in the amount of water which is generally attribute to increase in certain water uses like Gatherings, workshops etc. There is direct water line from Kharat’s well for garden irrigation.

GARDEN IRRIGATION IS DONE THROUGH DRIP IRRIGATION AS WELL AS SURFACE IRRIGATION.

WATER USAGE

To conduct a building water audit water consumption data for all the users were required to be monitored and recorded. Toilet water use including flushing and face/hand washing along with drinking was clubbed under personal water use. In order to collect primary data and to ensure accuracy, a brief questionnaire format was prepared and survey conducted for students.

Non residential water users	Number
Students Senior college	2845
Teaching – Regular Senior college (Grant)	26
Teaching – on Contract Senior college (Non grant)	38
Teaching – C.H.B	28
Non teaching (Grant)	42
Non teaching (Non grant)	28
Canteen employees	6
Total	**2979**

Table Total Non residential water users of the KVC campus 2022-2023

The total personal water use was calculated from flow rates, questionnaire and total water users (occupancy of the building).

WATER CONSUMPTION CALCULATIONS (COLLEGE)

1. POTABLE WATER CONSUMPTION (DAILY)

Total daily water Intake of,

Total Potable and Non potable water intake by KVC College excluding garden irrigation is 42000 lit/day

*Calculated from flow rate and daily water pumping operation to overhead tanks

CALCULATION ON THE BASIS OF QUESTIONNAIRES AND FLOW RATES

i. Daily potable water consumption by staff and students (Nonresidential occupants : 1 × 2979 = 2979 litters/day.

ii. Non potable water use for mopping = 200L

iii. Non potable use by for flushing in toilets = 2979 × 5 = 14895 liters/day

iv. Non potable use by for cleaning in toilets 500 liters/day

v. Water used for hand and face washing = Average time the tap left open × Number of times the hand and face washed) × Average flow rate of taps per second
= 6 seconds × 3 times × 0.12 = 2.16 liters per capita

So, Total non potable water use by staff, and students for hand and face washing = 10724

Total potable and non potable water use by students and staff of college is 2979 + 200 + 14895 + 500+ 6434 = 29298 liters per day

Residential water use	Occupants	**Quantity (L)**
Boys hostel	12	2200
Girls hostel	16	2800
Servants' quarters	2	500
Principals residence	3	500

Table Total Residential water use of the KVC campus 2022-2023

Type of water use	**Quantity(L)**
Canteen	2500
Laboratories	330

Table: Other key water uses of the KVC campus 2022-2023

OVERALL WATER CONSUMPTION

Therefore based on the above recordings, monitoring and calculation, the total potable and non potable water consumption for KVC Campus is 37728 liters/day. Here gardening water requirement is excluded.

	Heads	**Water use (in liters)**
1	Average daily water supply, to the overhead tanks from the underground tank	35500
2	Total calculated water consumption from the water audit	38128
3	Difference between water consumption from overhead tanks and actual water use for various purposes	2628

Table: Total water supply and use at KVC College

DATA COMPARISON AND ANALYSIS

There is a variation in the average amount of water that is pumped to the overhead tanks every day for various purposes and the average water consumption calculation. The average water supply (quantity) was based on time taken to overhead the tanks, flow rates and monitoring. The amount of water based on questionnaire, flow rate and water users is 38128 liters per day while the daily water need to overhead all the tanks is 35500. The calculated water amount is 1.07 times greater than the amount of water which is used pumped in the tanks.

This difference could be attributed to the following facts

- The staff and students present per day in the college were assumed to be 100 % present. In real this percentage varies.
- The observations from questionnaire for personal water use were a representative observations and not a complete study.
- Some students bring water bottles from their homes
- Along with this staff living in nearby areas, they also don't use the college washrooms more than one time . Some of them bring drinking water from home.

WASTE WATER GENERATION BY KVC COLLEGE

Every building generates waste water amounting to almost 80% of total water consumed. The major source of KVC waste water includes grey water from canteen, wash basins, lab basins, and black water from toilets.

ESTIMATION OF WASTE WATER GENERATED BY KVC

Waste water generated = 80% of water used

So, waste water generated by KVC based on water audit

= 80% of 38128 liters per day = **30502 liters/day**

Waste water generated by KVC based on pumped quantity

= 80% of 35500 liters per day = **28400 liters/day**

Out of the total waste water generated by KVC College black water from toilets goes to septic tank and then to drainage.

ISSUE OF CONCERN

MOPPING

About 15 years ago bucket mopping system in India is replaced by wiper mopping system. Nowadays no one uses bucket system at public places. The current one is less time consuming, hygienic and also less exhaustive. But yet the necessary pre requisite (infrastructure) to support this type of mopping is not established in India. Most or almost all the workers who do mopping face the common problem of cleaning the wipers. No single Institute or public place adopted the necessary structure for cleaning the moppers. Workers use the basin taps, toilet taps to clean their moppers. Most of them don't clean it regularly due to difficulties in cleaning. This creates a question of hygiene. Along with difficulties in cleaning, water requirement for washing these moppers is also high as workers wash their wipers under running water. This picture can be seen everywhere in India.

There should be a separate specifically designed system/basins for mopper cleaning.

TOILETS

Water consumption is more for flushing application in any building. College has single flushing system in Toilets.

INSTALLATION OF SEWAGE TREATMENT PLANT

The main goal of sewage water treatment facilities is to protect people, as well as local ecosystems, from contaminants and pathogens found in wastewater. Water treatment facilities were designed to speed up the natural process of purifying water because the natural process can't keep up with the amount of waste society produces.

CONCLUSION AND RECOMMENDATIONS:

1. Plants in the garden area should be watered after 4.30 pm in the evening to reduce evaporation losses. College has drip irrigation system and it has minimized unnecessary water loss.

2. Suitable innovative infrastructure to wash the moppers should be developed. That will minimize water use and will also maintain hygiene, cleanliness in college. At present no single institute has this infrastructure. It can be possible through little innovation, efforts and problem solving approach.

3. College has rooftop rainwater harvesting system. Currently college stores its collected rainwater in water tanks. To store large quantity of harvested rainwater large capacity tanks are needed. KVC also has passive rainwater harvesting structures like contour bunds and field bunds in campus for infiltration of rain water. While farm pond, percolation tank, recharge pit will improve the efficacy of passive rainwater harvesting.

4. It is suggested to check the water quality of well water and fertility status of the campus soil.

Stored rainwater fulfills distilled water demand of Science laboratories

Active rooftop rainwater harvesting structure

Laboratory wastewater neutralization set up

Lab wastewater Neutralization set up

The prime objective of the practice is to control water quality deterioration being created due to experiments performed in institutional laboratories

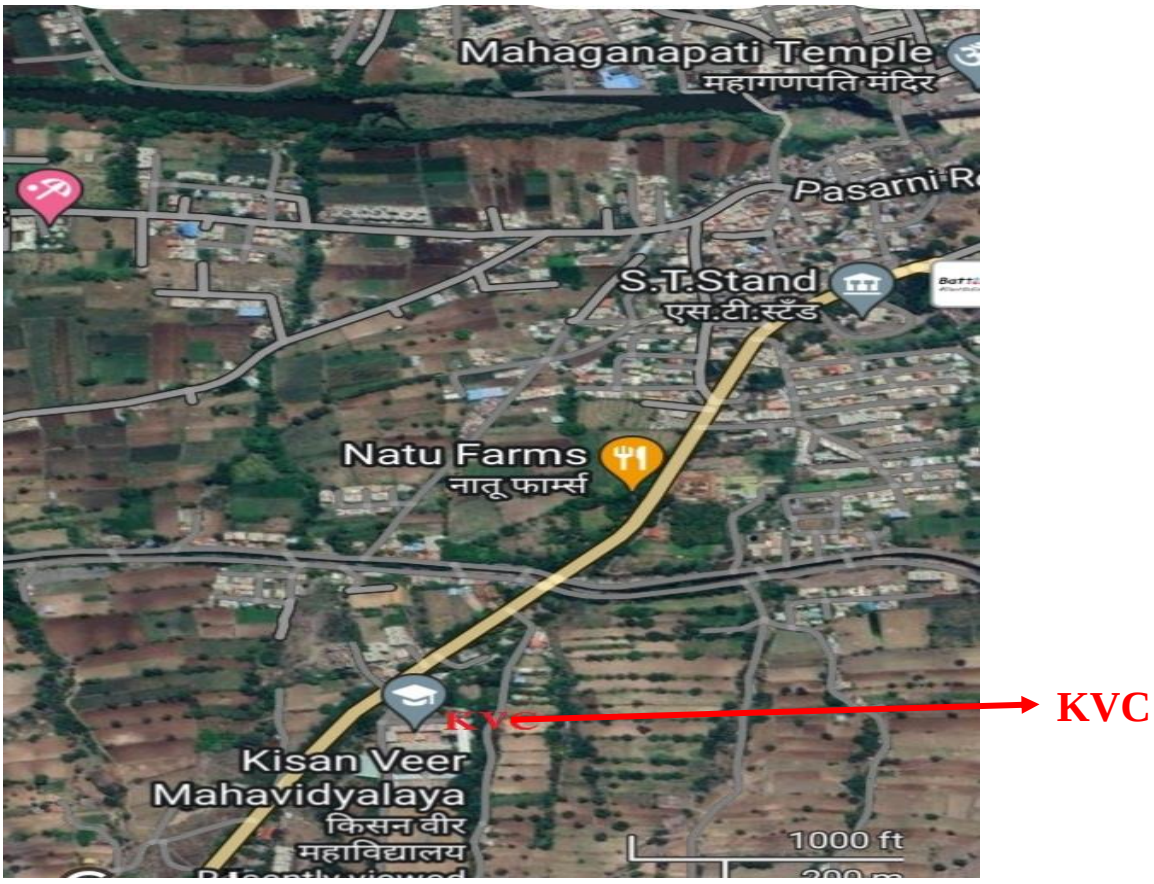
3. NOISE AUDIT

Actual noise monitoring is carried out with the help of sound level meter on various locations shown in figure. We have taken the samples within the free field. The comprehensive study was done inside the campus to calculate the noise level at various important locations such as class room areas, playground, parking area, library location and the data is interpreted for solutions.

Noise level readings (dB) was taken using noise meter

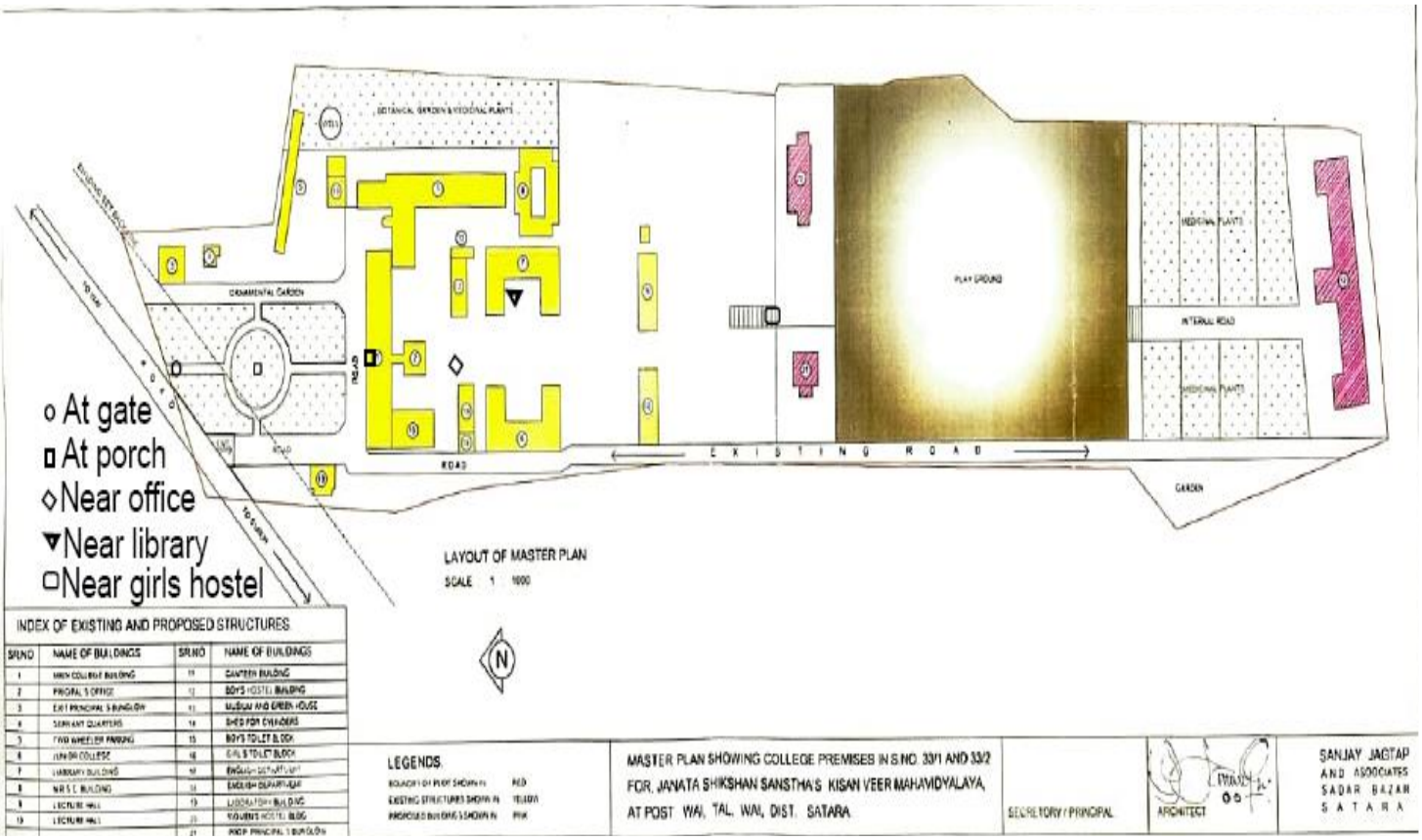
The readings were taken in certain period of interval and specific timings such as mornings, evenings, afternoon.

LOCATION OF KISAN VEER COLLEGE



The location of KVC is situated in less crowdie area of Wai City. College is at a distance of 1km from Main bus stand of Wai and 1.6km from the famous Mahaganpati temple i.e crowdie area of the city. This college is surrounded by vegetation, tree cover, green farms and large campus. They act as buffer zone to outside noise road traffic.

NOISE MONITORING LOCATIONS



OBSERVATIONS

Day and Date: Wednesday and 06/12/2022				
		Noise pollution in dB		
Location. No.	Area	Maximum	Minimum	Average
1	At Main Gate	81	41.9	58.2
2	At Porch	79.3	46.9	58.5
3	Near Office	77.5	36.5	58.4
4	Near Library	69.3	35.9	56.7
5	Near Ladies hostel	78.7	47.5	61.5
Day and Date: Thursday and 07/12/2022				
		Noise pollution in dB		
Location. No.	Area	Maximum	Minimum	Average
1	At Main Gate	80.7	39.6	55.8
2	At Porch	86	35	53.3
3	Near Office	81.6	32.9	49.3
4	Near Library	52.6	9.5	41.5
5	Near Ladies hostel	62.3	27	45.4

Day and Date: Friday and 08/12/2022				
		Noise pollution in dB		
Location No	Area	Maximum	Minimum	Average
1	At Main Gate	76.2	42.3	57.2
2	At Porch	74	46.9	55.5
3	Near Office	71.6	36.5	54.4
4	Near Library	62	35.9	52.3
5	Near Ladies hostel	58	27	43.5

Day and Date: Saturday and 09/12/2022				
		Noise pollution in dB		
Location No	Area	Maximum	Minimum	Average
1	At Main Gate	78.9	47.7	60.3
2	At Porch	80.9	46.4	56
3	Near Office	67.7	43.2	50.1
4	Near Library	73.3	11.5	44.4
5	Near Ladies hostel	66.1	19.8	40.6

Day and Date: Monday and 10/12/2022				
		Noise pollution in dB		
Sr. No.	Area	Maximum	Minimum	Average
1	At Main Gate	70.1	44.2	53.2
2	At Porch	80.7	22.6	51.9
3	Near Office	67.6	41.5	50.9
4	Near Library	81.9	11.5	36.8
5	Near Ladies hostel	54.4	15.6	42.3

Day and Date: Tuesday and 12/12/2022				
		Noise pollution in dB		
Location No	Area	Maximum	Minimum	Average
1	At Main Gate	83.1	42.5	59.1
2	At Porch	74	40.3	54.5
3	Near Office	72.5	34.5	53.9
4	Near Library	63	30.5	40.9
5	Near Ladies hostel	50	15.5	38.2

Day and Date: Wednesday and 13/12/2022				
		Noise pollution in dB		
Location. No.	Area	Maximum	Minimum	Average
1	At Main Gate	74	47	56.8
2	At Porch	74.3	49.1	52.5
3	Near Office	70.5	30.5	50.4
4	Near Library	62.3	30.9	37.7
5	Near Ladies hostel	64	47.5	35.5

Day and Date: Thursday and 14/12/2022				
Location No.	Area	Noise pollution in dB		
		Maximum	Minimum	Average
1	At Main Gate	83.3	43.9	57.1
2	At Porch	78.2	31.1	54.5
3	Near Office	71.2	37.5	56.4
4	Near Library	66.3	31.9	54.7
5	Near Ladies hostel	71.7	28.5	32.5
Day and Date: Friday and 15/12/2022				
Location No	Area	Noise pollution in dB		
		Maximum	Minimum	Average
1	At Main Gate	71	41.9	54.2
2	At Porch	71.3	43.9	55.5
3	Near Office	70.5	36.5	51.4
4	Near Library	62.3	28.9	48.7
5	Near Ladies hostel	58	20.5	28.9

DISCUSSIONS AND RECOMMENDATIONS

As per CPCB guidelines silence zone is referred as areas up to 100 meters around such premises as hospitals, educational institutions and courts. KVC campus is at a wide distance from crowdie and noisy a r e a . Noise levels observations at main gate and porch area exceeds noise levels standards. While the noise level observations near teaching area i.e. location number 3, 4 and 5 almost follows noise level limits of silence zone. Some observation exceeds noise limits but we have taken the samples in free field where there are no reflected sound waves. So this clears that the Noise level decreases towards classroom areas.

Parking area of any educational institute is notable noise producer. Gap between parking area and college building should be covered by three layer canopy of Trees. This acts as good sound barrier. A good sound barrier has a combination of ground cover, shrubs, and trees to block noise.

4. BIODIVERSITY AUDIT

TREES CENSUS AND INVENTORY

The present Tree census and inventory study was done to quantify, to create an inventory and to understand phyto-ecological structure of KVC campus.

OBJECTIVES

1. To make an inventory of trees individuals and tree species in the campus.
2. To undertake phyto-ecological analysis with the help of
    a. Species composition
    b. Abundance

SAMPLING

Since the purpose of the study was to create a detailed inventory of Tree individuals and species, the "Census" was used as a sampling technique. The campus was surveyed and each tree was counted. Within each plot all individual trees were identified, measured, and recorded. The diameters at breast height of the species were measured using a measuring tape.

RESULTS

SPECIES COMPOSITION OF TREES

Species composition shows the different tree species found in the study area. A total of 35 species were recorded belonging to 20 families and 31 genera. Tree inventory shows the different plant species, their families found in the KVC senior college campus. A total of 35 tree individuals (height above 3 meters) species were recorded in the study site.

Dominant families recorded in the study area according to descending order (based on number of species type in each family) are Fabaceae (5), Arecaceae (4), Myrtaceae (4), Moraceae (3), Apocynaceae (3) and Annonaceae (3). All other families have less than 2 individuals

ABUNDANCE A total of 31 genera was recorded in the study site. *Mangifera indica* (Anacardiaceae) having 149 individuals was the most abundant tree species. This was followed by the species *Cocos nucifera (Arecaceae), Plumeria rubra* (Anacardiaceae), *Azadirachta indica* (Meliacaeae), *Polyalthia longifolia, Alstonia scholaris having* 43, 26, 21, 18 and 11individuals each.

DISCUSSION

The canopy of the campus is characterized by mixed species i.e. evergreen as well as deciduous. The most dominant trees in this campus are *Mangifera indica, Cocos nucifera, Plumeria rubra, Azadirachta indica, Polyalthia longifolia and Alstonia scholaris.* The Fabaceae were observed to be the most prevalent family. This may be due their plantation, good survival rate and adaptability.

Out of first six abundant species of the campus five were native species while one is exotic to India
The five native species alone makes up 62 % of total tree number. And out of all 35 tree species 22 species are native to India.

CONCLUSION

1. Fabaceae is the dominant family and *Mangifera indica* is the dominant species of this area.
2. It does not includes Trees of vulnerable or endangered species
3. Considerably more population of few species is one of the reasons for low value of evenness

BIRD DIVERSITY

In nature bird occur in a variety of habitats – from deserts to the tropical rain forests; the short dry to the tall wet grasslands and on the alpine meadows in the high altitudes; from sea level to above 4000 meters above sea level; on rocks, cliffs in caves and mud banks; along fresh water estuaries, seas and shores. They also occur on man modified lands such as agricultural fields, airfields, along roadsides and hedgerows and gardens, among human habitations and dwellings.

KVC College comes under habitat of man modified lands. 10 bird species were recorded from the campus.

C DAY AND TIME OF BIRD CENSUS

Date 23rd December 2022, Time of the observations – 7..00 am to 10.30am

Common Name	Scientific Name	College campus
Kingfisher	*Ceyx azureus*	2
Swift	*Apus apus*	4
Myna	*Acridotheres tristis*	**3**
Sun bird	*Arachnothera sp*	**3**
Grey hornbill	*Ocyceros birostris*	**2**
Red vented bulbul	*Picnonotus cafer*	**5**
House Crow	*Corvus splendens*	**3**
Common Myna	*Acridotheres tristis*	**4**
Black drongo	*Dicrurus macrocercus*	**1**
Green bee eater	*Ardea cinerea*	**2**

Table List of birds reported at KVC campus

METHODOLOGY

Direct count method was used to count the birds of campus.. The area was divided to record the number of birds in each part. The divisions were clearly demarcated by landmarks so they can be used subsequently for the same purpose. The observations included the species/common name of the bird, number of individuals observed.

BUTTERFLY DIVERSITY

India hosts 1501 species of butterflies (Gaonkar 1996), of which peninsular India hosts 350 and the Western Ghats, 331. Remaining species are mostly forest dwellers and may not be found in the urban area. There is no literature available onbutterflies of Wai

OBSERVATIONS

Common name	***Scientific name***	**Family**	**Abundance**
Tailed jay	*Grapheme Agamemnon*	Papilionidae	Commom
Common Mormon	*Papilio polytes*	Papilionidae	Common
Plain Tiger	*Danaus chrysippus*	Nymphalidae	Common
Common grass yellow	*Eurema hecabe*	Pieridae	Common
Common mormon	*Papilio polytes*	Papilionidae	Commom

Table Butterflies reported at KVC college campus

MAMMAL DIVERSITY

The mammals commonly seen on campus – Greater Bandicoot Rat (*Bandicota indica*), House Rat (*Rattus rattus*), Indian hare (*lepus nigricollis*), three stripped squirrel, Deer, Cat, Dog, Bats.

REPTILES OF THE CAMPUS

Pheretima posthuma, and earthworm of *Lumbricus* genus is found in the campus. Lizard of species *Hemidactylus frenatus* is found on the building walls of the campus. Rarely Oriental garden lizard can be seen on the trees of the campus. Asian snake-eyed skink (*Ablepharus pannonicus*) is found in the campus. These skinks are mostly spotted in the summer season at cooler places of the campus garden.

5. Carbon accounting 5A. Carbon Sequestration Potential

Introduction

Increasing levels of carbon dioxide in the atmosphere are of growing concern globally and locally, and urban forests have a role to play in the battle against climate change. Urban forests can reduce atmospheric carbon directly and indirectly. As long as trees are growing, they remove CO_2 from the air in a process called carbon sequestration, transforming CO_2 into carbon and making use of it to build living matter - leaves, stems, trunk, roots, etc. The Biomass carbon sequestration potential was measured for KVC campus.

Total biomass assessment

The assessment of above ground and belowground biomass of KVC campus was carried out within whole campus

Biomass carbon = (aboveground biomass carbon + belowground biomass carbon)

Conclusion

Total 6 tons of carbon is locked in by the trees of KVC campus

5B. Vehicular emissions

The emissions inventory is the foundation upon which the regulatory strategy can be formulated. There are many emission sources that contribute to the urban air pollution such as point sources, non-point or area sources, motor vehicles, non-road mobile and natural. Magnitude of contribution from each of the sources depends upon the individual emission rates and the activity level.

The on-road vehicle emission inventory can be summarized as the product of an emission rate (e.g., gram/km) and an associated vehicle activity (e.g., km/day).

The observations used in calculating vehicular emissions are visual observations of the i.e December 2022. On an average around 156 two wheelers were used daily by KVC students and staff. While 5-6 four wheelers were daily parked in the campus.

Based on the past vehicle observations and with the help of emission factors given for Indian vehicles total emissions by KVC campus are calculated here.

Pollutants	Emissions Factor	Avg Number of Vehicle/ day	Emissions (gm/km)	Average Travel (km)	Total Emissions per day
CO	1.4	156	218.4	15	3276
HC	0.7	156	109.2	15	1638
NOx	0.3	156	46.8	15	702
PM	0.05	156	7.8	15	825
CO2	33.83	156	5277	15	79162

Table Total emissions by two wheelers

If we consider CO2 emissions only, we can see that 79162 gm/day of CO2 is emitted by two wheelers of KVC campus. So the CO2 emitted by two wheelers per year is,

79162 * 240= 18998928 gm/year = 18.99 **tones/year**

Pollutants	Emissions Factor	Avg Number of Vehicle day	Emissions (gm/km)	Average Travel (km)	Total Emissions per day
CO	4.3	5	21	50	1050
HC	2.05	5	10.25	50	512
NOx	0.11	5	0.55	50	27.5
PM	0.08	5	0.4	50	20
CO2	72.50	5	362.5	50	18125

Table Total emissions by Four wheelers

Emission factors by four wheelers are higher than two wheelers. So the emissions per vehicles are also high as compared to two wheelers. If we consider CO2 emissions only, we can see that 18125gm of CO2 is emitted by two wheelers of KVC campus. So the CO2 emitted by four wheelers per year is,

18125* 240 = 4350000gm/year = **4.3 tones/year**

Total Emissions by KVC vehicles per year = 2W + 4W = 18.99 + 4.3 = 23.29 tones/year

From above figure it can be analyzed that though the number of 4W are less as compared to 2W, they do major contribution in total CO2 emissions of the campus

CARBON DIOXIDE EMISSIONS AND ITS ASSIMILATION BY CAMPUS TREES

In green audit college has also assessed carbon sequestration by campus trees. Study shows that 0.4 tones of carbon is sequestered by campus plants. And carbon flux shows that campus plants have capacity to absorb/sequester around 6 tons of carbon this year. This capacity gets increased by every year.

If we quantify CO2 flux to carbon dioxide,

6 tones of Carbon = 6000 kg of carbon

ENERGY AUDIT REPORT

January 2023

Prepared for

Kisan Veer Mahavidyalaya, Wai

Adya Environmental Services

Proprietor

Prepared by

Adya Environmental services, Baramati

Submitted on 25th January 2023

Audit

ENERGY SCENE

Primary source of energy at KVC is electricity. Electricity is used for all electrical appliances like lighting, fan, pumps, computer and lab instruments. Also water is used for drinking, domestic & gardening purpose.

ENERGY: SOURCES & UTILIZATION

Primary energy / natural resources utilized at the service center are electricity & water. These sources are consumed for the generation of motive power and water for drinking, washing & domestic usage, gardening respectively. The source of electrical power for the service center is from MSEDCL grid

Objectives

- Collect historical data to analyze background activities
- Collect & analyze monthly billing data & energy consumption data for the period of one year.

LEVEL OF AWARENESS

College should organize different training programs for general awareness. Trainings on energy conservation are not found on records. It should be ensured that everyone knows the operating energy conservation parameters

The electricity bill consists of following parts

- Demand charges
- Unit charges
- Time of Day Charges
- Other charges, which cannot be controlled
- Load factor is an indicator to assess if the billed maximum demand charges can be reduced. The monthly load factor is calculated as follows:

Maximum demand should be monitored regularly so as to reduce non-critical loads when set maximum demand is reached. And also need to reduce contract demand in such way that to avoid excess demand charge by considering future load.

OBSERVATIONS

Monthly Electricity Consumption of College campus: 2021-2022

Sr. No.	**Consumer Number**	**Average monthly Units Consumed (kWh)**
1	193010029085	486
2	193010001873	440
3	088000835686	315
4	193018827061	326
5	193018826316	290
6	193010000133	1780
7	193011955676	583
8	193018810924	576

Electricity bill analysis

Sr. No.	Parameter	Value	Unit
1	Avg. Unit Consumption (Electricity bill)	184	Units/day
2	Avg. Unit Consumption (Electricity audit)	156	Units/day

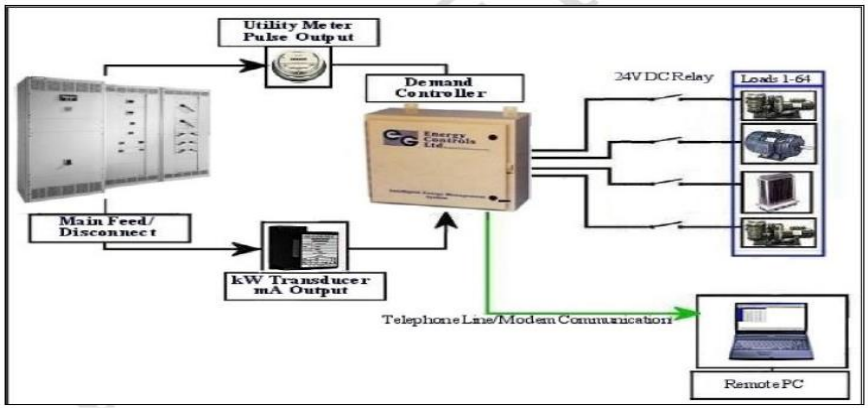
WATER

For water quantification there is no any metering system available at building section.

Water flow meter has to be installed at all major water line for recording consumption of water.

Maximum Demand Controller

- High-tension (HT) consumers have to pay a maximum demand charge in addition to the usual charge for the number of units consumed. This charge is usually based on the highest amount of power used during some period (say 30 minutes) during the metering month.
- The maximum demand charge often represents a large proportion of the total bill and may be based on only one isolated 30 minute episode of high power use. Considerable savings can be realized by monitoring power use and turning off or reducing non-essential loads during such periods of high power use.



Power Factor Incentive & Penalty

- Whenever the average power factor over a billing cycle or a month, whichever is lower, of a High Tension consumer is below 90%, Penal charges shall be levied to the consumer at the rate of 2 % (two %) of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.) for first 1 % (one percentage point) fall in the power factor below 90%, beyond which the penal charges shall be levied at the rate of 1 % (one %) for each percentage point fall in the power factor below 89%. Such penalty will however not be applicable to Railways for Power Factor up to 72%.
- Whenever the average power factor is more than 0.95, an incentive will be given to High Tension industrial (HTP-I, HTP-II & HT- SEASONAL), and HTP-III & HTP-IV consumers, irrespective of status of TOD meter installation.

- The said incentive will be at the rate of 1% of the amount of the monthly energy bill (excluding Regulatory Liability Charges, Demand Charges, FOCA, Electricity Duty) for every 1% improvement in the average power factor above 0.95.
- For power factor of 0.99, the effective incentive will amount to 5% reduction in the energy bill and for unity power factor; the effective incentive will amount to 7% reduction in the energy bill.
- Power factor will be computed, by the method of kWh / KVAh & rounded off to two decimal points as per the existing practice.

SHARE OF NON-CONVENTIONAL ENERGY RESOURCES

Solar water heater system is being used for Boys hostel, Girls hostel and Principals residence.

RECOMMENDATIONS

1. Average daily Unit use as per Electricity bill is 1.17 % lower than the use calculated from Energy audit. This difference could be attributed to the following facts.
   i) Holidays and half days are not considered in the Energy audit calculation.
   ii) This difference may be due to location of the College building. College has good natural ventilation and light. This makes KVC campus, a functional, habitable and environmentally sustainable habitat.
2. College should do water pumping in the hours of 4am to 6 am OR 10pm to 12pm to minimize its unit charges.
3. College should increase the share of Non conventional sources of Energy.
4. College should organize training programs for general awareness on energy conservation.

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