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ENVIRONMENT AUDIT FOR MKSSS CAMPUS

1. Introduction

Unpredictable climate change is the most urgent and pressing problem faced by the world today. Our activities are causing greenhouse gas emissions which is the major cause of global warming. (IPCC 2006). The IPCC report of 2021 shows that GHG emissions from human activities have led to approximately 1.1°C of warming since 1850-1900, and on an average over the next 20 years, it is anticipated that the global temperature would rise by 1.5°C or more. At the COP26 summit in Glasgow in November 2021, India has declared to cut its total projected carbon emission by 1 billion tonnes by 2030, reduce the carbon intensity of the nation's economy by less than 45% by the end of the decade and net-zero carbon emissions by 2070 (MOEFCC,2022)). To fulfil our commitment towards reducing emissions, all organizations, big and small must promote sustainability, including trying to account for and reduce GHG emissions. When compared to other sectors, the environmental effects related to educational institutions are comparatively small, but the education sector has a prospect to play a positive role in global change. Educational institutions can set a positive example by incorporating sustainability into their operations and providing hands-on learning opportunities for tomorrow's citizens and climate leaders. Future decision-makers can also acquire the skills necessary to address ecological, social, and economic issues in communities through the curriculum. Several millions of students graduate each year and educational institutions must prepare them for a changing climate as their future life would be subjected to an increasingly variable climate and frequent and unprecedented climate extremes. As per All India Survey on Higher Education (AISHE) 2020-2021 report, around 4.13 crore students are enrolled in higher education institutes in India. All the students, if educated on sustainable development and sustainable practices, would prepare future professionals to be responsible citizens in a more sustainable society (Filho et., al., 2015). Educational institutes can incorporate sustainability, not only in theory, but in practice in everyday campus life. Universities around the world are committing to carbon neutrality by preparing and implementing climate action plans.

Maharshi Karve Stree Shikshan Samstha, founded in Pune by Maharshi Karve in 1896, has a great legacy of empowering women through education since last 125 years. MKSSS, in its quest to set up a benchmark for a more environment conscious society, has implemented various projects to reduce its impact on the environment. As an educational institution, MKSSS has an important role to play through influencing and inspiring the students and the society in general to strive to create a better environment. It seeks to set example for others by adopting sustainable practices in its operations and lead them. MKSSS has committed to Carbon Neutrality in Scope 1 and Scope 2 emissions by 2050 and this study is aimed at formulating an environment policy to achieve the ambitious goal of the institution.

Objectives:

1. To identify and evaluate the various sources of greenhouse gas emissions.
2. To assess current energy and water consumption and management.
3. To identify various sources of waste generation and understand the current waste management system.
4. To prepare a baseline data of greenhouse gas emissions, energy consumption, water consumption, and waste production.
5. To determine the timeline to reach net zero carbon, net zero water, and net zero waste campus.

1.2 Scope and Limitations

The study includes the operational activities of the educational and residential facilities for the students on the campus. The calendar year 2022, with total number of 220 working days, was considered for the calculation of baseline data. Baseline calculations for eight educational institutions and five hostels were calculated separately and the rest of the common facilities were clubbed together. The financial arrangements for the implementation of the environment policy are not discussed in this study.

Project Area

The study area constitutes the Karvenagar educational premises of Maharshi Karve Stree Shikshan Samstha. The premises are spread over on about 24 acres of land with more than 25 buildings housing various colleges, schools, administrative facilities, and student accommodation.

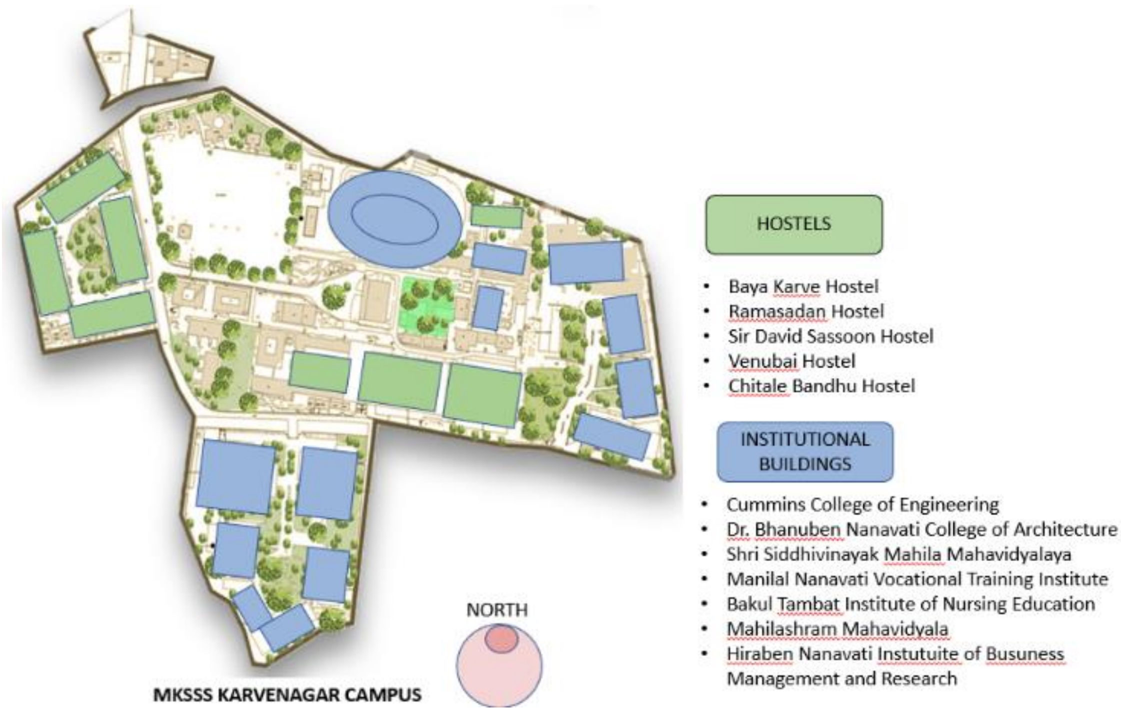

Figure 5.1: Site plan of project area

The study followed the guidelines and principles put forth in “The Greenhouse Gas Protocol” developed by ‘World Business council for sustainable Development’ and ‘World Resources Institute’. The GHG protocol is most widely used and accepted methodology for calculating greenhouse gas emissions. This method requires emissions to be reported against three different “scopes” described below.

Scope 1: Direct emissions from sources that are owned or controlled by company.

Scope 2: Indirect emissions associated with the generation or purchased electricity that were consumed by company.

Scope 3: All other indirect emissions because of the activities of a company that occur from sources neither owned nor controlled by the company.

Emissions covered under scope 1 and scope 2 are mandatory for reporting, while scope 3 emissions can be reported on a voluntary basis.

Setting Organizational boundaries.

Eight educational institutions and five hostel blocks within the campus were considered for detail calculations of greenhouse gas emissions while other smaller units and common services were combined for the purpose of calculations.

Setting Operational boundaries.

Calendar year 2022, with total number of 220 working days, was considered for the GHG emissions calculations. Onsite fuel consumption, electricity consumption, daily commuting of staff and students, educational trips, field trips and trips for official purposes were considered for calculating the travel emissions and waste created due to operational activities of the individual institutions was considered for emissions due to waste. Stationary used by students for individual work was not considered in this study.

Activity boundaries

The activities are listed as per the scopes of emissions.

Scope 1: Direct GHG Emissions - Scope 1 emissions on the campus include emissions due to consumption of:

- LPG for cooking.
- Diesel for electricity generators.
- Fuel by owned vehicles.

Scope 2: Electricity Indirect GHG Emissions - Scope 2 emissions on the campus are from purchased electricity consumed by:

- Educational Institutions
- Hostels
- Bakery
- Miscellaneous units and common services and campus lighting

Scope 3: Other Indirect GHG Emissions - Scope 3 emissions include emissions due to:

- Daily commute of students, staff, and faculty
- Academic tours, Industrial site visits etc.

- Waste disposal
- Purchases (stationery and IT)

GHG Emission Inventory

The emission inventory survey calculated for calendar year of 2022 is as follows:

1. LPG: The consumption details of LPG in all the canteens, bakery, and mess.
2. Diesel: The consumption details of diesel for backup-generator.
3. Details of distance travelled by students using an Institution owned bus and distance travelled by the delivery vehicle.
4. Electricity: Details of consumption of purchased electricity units.
5. Transportation: The daily commute details included details of mode of transportation, weekly frequency of travel and distance travelled by occupants. The transportation details for academic tours and travel included mode of transportation, distance travelled and number of travellers.
6. Waste disposal: Details of quantities of various types of waste generated and their management.
7. Purchases: Quantities of stationary items like paper, files, pens, markers etc and quantities of IT items like desktops, laptops, and printers.

4.5 Requisite activity data.

Table 5.1: Required activity data.

Scope	Emission sources	Data required
Scope 1	LPG	Total number of cylinders used
Scope 1	Diesel for backup generator	Total quantity of diesel used
Scope 1	Institution owned vehicles	Total distance travelled by total number of students
Scope 2	Purchased electricity	total units consumed
Scope 3	Academic tours	Mode of transportation, distance travelled and number of travellers
Scope 3	Daily commuting	Mode of transportation, distance travelled and number of travellers
Scope 3	Papers, notebooks, registers, etc.	Quantities consumed
Scope 3	Selective IT purchases	Number of items purchased
Scope 3	Waste disposal	Quantities of waste disposed

GHG Emission factors

A coefficient known as an emission factor (EF) quantifies the rate at which a specific activity emits greenhouse gases (GHGs) into the atmosphere. The most common unit of measurement for GHG emissions is CO2e (CO2 equivalents), which is weight expressed in kilogrammes or metric tonnes. This measure compares the warming effect of a certain amount of a GHG to CO2 over a 100-year period. In other words, for a given amount of any GHG, CO2e is the amount of CO2 that, 100 years after release, would warm the atmosphere by the same amount as the GHG in question. (https://www.climatiq.io/docs/guides/what-is-an-emission-factor)

Greenhouse Gas (GHG) Emissions Factors were sourced from IPCC, India GHG program, C-balance, UNFCC, and DEFRA as tabulated below.

Table 5.2: Emission factors

Emission inventory	Emission factor	Source
LPG	0.003 tco2/lit	ipcc; INDIA GHG PROGRAM; Government of India Ministry of Power Central Electricity Authority; C-BALANCE; UNFCCC; defra; https://www.dell.com/en-us/dt/corporate/social-impact/advancing-sustainability/climate-action/product-carbon-footprints.htm#tab0=0
Diesel	0.003 tco2/lit	
Scooter	0.0387 kg co2/km	
Three wheeler (Diesel)	0.1322 kg co2/km	
Medium car (diesel)	0.126 kg co2/km	
Public transport(bus)	0.015161 kg CO2/pax-km.	
Train	0.00795 kg co2/pax-km	
Air travel	0.121 kg co2/pax-km	
Electricity	0.96 kgco2/kwh	
Plastic	5.09 kg co2 eq/tonn	
Papers	2.58 kgco2eq/tonn	
metal	19.5 kg co2eq /tonn	
Cardboard	2.62 kg co2 eq/tonn	
Desktop	621 kg co2 eq. /no	
Laptop	691 kg co2 eq. /no	https://8billiontrees.com/carbon-offsets-credits/carbon-footprint-of-a-laptop/
Printer	474 kg co2 eq. /no	

Greenhouse gas emissions are calculated by multiplying the activity data by an appropriate emission factor.

Calculations of GHG emissions of the educational institutions

There are various educational institutes in the campus offering curriculum in multiple disciplines, including Engineering, Architecture, Vocational training, Business Management, Nursing training and Arts, Commerce and Science graduation and post-graduation courses. Total GHG emissions under scope 1, scope 2 and scope 3 for eight major institutions was calculated individually.

6.1. Cummins College of Engineering for Women

6.1.1 Scope 1 Emissions: Scope 1 emissions include direct emissions due to LPG usage for cooking food in the canteens. The data about total number of cylinders utilised per month in the canteen was collected from the canteen manager to calculate the scope 1 emissions as tabulated below.

Table 6.1: Scope-1 emissions.

LPG / cylinder kg	LPG consumption for 1year (284 cylinders) Kg	Emission factor (tCO2eq/kg)	Total emission for year 2022 (tCO2eq)
19	5396	0.003	16.188

6.1.2 Scope 2 Emissions: Scope 2 emissions include indirect emissions due to consumption of purchased electricity in the institution. The quantity of total units of purchased electricity was acquired from the monthly electricity bills to derive the scope 2 emissions.

Table 6.2: Scope-2 emissions.

Scope - 2 Emissions			
Electricity usage for 2022		Emission factor	Emissions
Month	kwh	tco2 eq./kwh	tco2 eq.
Jan	18766	0.96	18.015
Feb	23257	0.96	22.327
mar	25234	0.96	24.225
April	27011	0.96	25.931
May	28911	0.96	27.755
June	18971	0.96	18.212
July	20574	0.96	19.751
Aug	23976	0.96	23.017
Sept	24435	0.96	23.458
Oct	18969	0.96	18.210
Nov	38300	0.96	36.768
Dec	59135	0.96	56.770
Total			314.437

6.1.3. Scope 3 Emissions: Scope 3 includes other indirect emissions due activities like transportation, waste disposal and purchases. Daily commuting of students and staff and academic tours and administrative travels is considered for calculation emissions due to transportation.

6.1.3.1. Emissions due to daily commuting of occupants - Online survey was conducted seeking information about the mode of transportation used for daily commuting, distance travelled each day and number of commuting days per week. Distance travelled annually by each commuter was multiplied by the emission factor for the mode of transport he/she used to get his/her annual emission due to daily commuting.

Table 6.3: Total scope-3 emissions due to daily commute.

Emissions due to daily commuting	
Car	101.2
Two-wheeler	72.34
Rickshaw	10.51
Public transport	26.23
Total Emissions	230.79 t co2 eq.

The survey report implied that 51% of occupants either walk or use cycle, 30% use two-wheeler, 14% use public transport, 4% use car and 1% use rickshaw for daily commuting. 85% of the emissions due to daily commuting are contributed by users of personal vehicles. The hostels within the campus and the residential facilities within walking distance in the neighbourhood, efficiently fulfil the requirement of outstation students, thereby controlling the emissions due to daily commuting.

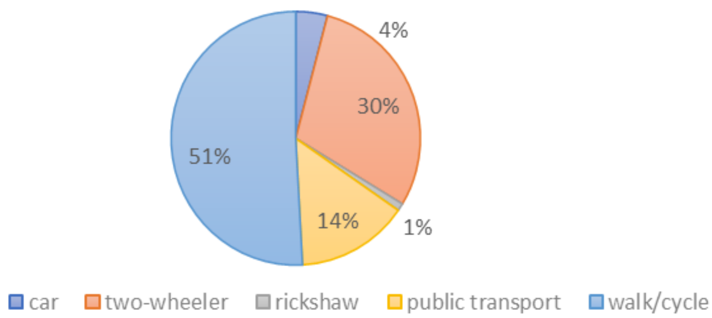

Fig 6.1: Percentage of different modes of transport.

6.1.3.2 Emissions due to industrial visits – Industrial visits are arranged for students as a part of curriculum to gain practical knowledge. A bus is hired for these travels. A total of four industrial visits were arranged in year 2022. The emissions due to these visits are tabulated below.

Table 6.4: Scope-3 emissions due to industrial visits

Destinations	Mode of Transport	Total distance km	No of students	Emission factor	Emissions
Phaltan	Bus	226.000	140	0.015161	0.480
Bhor	Bus	110.000	14	0.015161	0.023
Satara	Bus	226.000	46	0.015161	0.158
Mahad	Bus	262.000	60	0.015161	0.238
Total Emissions t co2 eq.					0.899

6.1.3.3. Emissions due to waste disposal – The waste generated due to the institutional activities include organic and inorganic waste. Organic waste generated is in the form of food waste and vegetable waste from the canteens, which is either used for the biogas plant in the campus or composted in compost pits within the campus. Inorganic or dry waste in the form of paper, carboard, plastic etc. is collected and segregated at a central place in the campus. Recyclable waste is separated and given for recycling and the rest is handed over to the municipal waste colleting agency. E-waste is collected separately and handed over to authorized recycling agency. Metal and wood waste is collected separately and given away for recycling. Bio- hazardous waste in the form of sanitary napkins is collected separately and disposed off in an incinerator in a hygienic way.

Table 6.5: Emissions due to waste disposal

Scope -3 Emissions due to waste disposal					
Type of waste	Annual	Recycled	Disposed	Emission factor	GHG Emissions
	kg	kg	kg	kg co2 eq/kg	Tco2 eq
Organic waste	11000	11000	0		
Paper waste	1100	825	275	1.0418	0.286
Plastic waste	440	0	440	0.0089	0.004
Sanitary waste	880	0	880	2.883	2.537
Demolition waste	50940	25470	25470	0.00124	0.032
metal waste	5329	3000	2329	0.0089	0.021
wood waste	1000	0	1000	0.828	0.828
Desktop		100			
Total					2.827

6.1.3.4. Emissions due to Purchases – The regularly used stationary items like paper, notebooks, pens, markers, files, folders stapler pins etc and selective IT items like desktops, laptops and printers were considered for the calculation of emissions due to purchases.

Table 6.6: Emissions due to purchases of stationery and IT items

Total emissions due to purchases					
material	weight per no/box	nos.	total weight	emission factor	total emission
	kg		kg	kg co2 eq./kg	t co2 eq.
paper rims	2.34	500	1170	2.58	3.019
notebooks/registers	0.15	150	22.5	2.58	0.058
cardboard files	0.1	1000	100	2.62	0.262
plastic folders	0.02	500	10	5.09	0.051
plastic pens/markers	0.2	12	2.4	5.09	0.012
metal pins	0.2	20	4	19.5	0.078
laptop		3		691	2.073
desktop		167		621	103.707
Total					109.260

6.1.3.5. Total scope -3: The emissions due to transportation, waste disposal and purchases add to 343.78 tco2 eq.

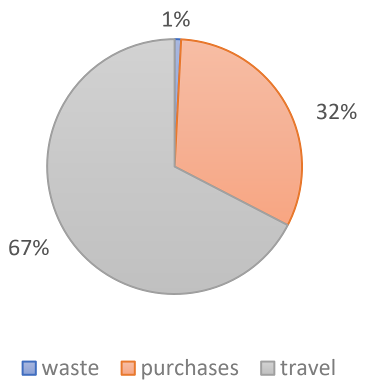

Figure 6.2: Contribution of all sources of scope-3 emissions.

Amongst the scope 3 emissions, highest emissions are due to transportation, contributing to 67%. Whereas emissions due to purchases contribute to 32% and emissions due to waste contribute to 1% of the total scope 3 emissions.

6.1.4. Total GHG emissions: Emissions under all three scopes add up to 677.679 tco2 eq.

Table 6.7: Total GHG emissions.

Total emissions	
Scope -1	16.188
Scope -2	314.438
Scope -3	343.779
	674.405

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Scope1 emissions contribute to 2%, scope 2 emissions contribute to 47% and scope 3 emissions contribute to 51% of the total emissions.

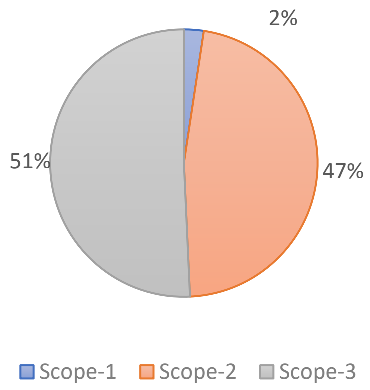

Fig 6.3: Composition of all three scopes of emissions.

6.1.5. Calculating GHG emissions per student – Each institution has its unique operating requirement as per the curriculum it offers. Institutions imparting professional courses require more facilities in the form of computer and instrumentation laboratories, conference, and seminar halls etc and hence consume more energy as compared to non-professional courses. Although there is variation in consumption of resources in the institutions, calculating emissions per student may provide a common ground for comparisons within the campus or with other assessment standards. Calculating emissions per student may also help in understanding the current position of the institution with respect to global standards.

Table 6.8: GHG emissions/student.

Total No. of Students	Total GHG emissions	GHG emissions per student
2052	674.405 t co2 eq.	0.329 t co2 eq.

6.2. Calculating GHG emissions of other Educational Institutions in the campus.

Greenhouse gas emissions for the following educational institutions in the campus were calculated using the same method.

- Dr. Bhanuben Nanavati College of Architecture for Women.
- Shri. Siddhivinayak Mahila Mahavidyalaya.
- Shri Manilal Nanavati Vocational Training Institute for Women (MNVTI)
- Smt. Bakul Tambat Institute of Nursing Education (BTINE)
- Smt. Hiraben Nanavati Institute of Management and Research for Women (HNIMRW)
- K B Joshi Institute of Information Technology, BCA College (KBJ)
- Mahilashram Highschool. (SCHOOL)

6.3. Summary of Greenhouse gas emissions of educational institutions in the campus

Table 6.9: Total GHG emissions of educational institutions.

Annual GHG emissions of the educational institutions							
Institutions	No. of students	Scope-1	Scope-2	scope 1+2	Scope-3	Total Emissions	Emissions /student
Siddhivinayak	2150	11.685	50.779	62.464	203.729	266.193	0.124
MNVTE	350	0.000	83.494	83.494	72.885	156.379	0.447
BTINE	650	25.800	10.212	36.012	64.585	100.597	0.155
BNCA	1120	14.193	146.179	160.372	337.408	497.780	0.444
SCHOOL	4650	4.822	44.866	49.688	268.714	318.402	0.068
K B JOSHI IT	650	0	39.587	39.587	37.548	77.135	0.119
CUMMINS	2052	16.188	314.437	330.625	343.779	674.404	0.329
HNIMRW	180	0.480	129.787	130.267	27.203	157.470	0.875
	11802	73.168	819.341	892.509	1355.85	2248.360	0.191

The total Scope 1 emissions of all the eight institutions together are 73.168 tco2 eq., the total scope 2 emissions are 819.341 tco2 eq., and total scope 3 emissions are 1355.85 tco2 eq. The total GHG emissions of the educational institutions add up to 2248.36 tco2 eq.

Scope -1 emissions contribute to 4%, scope -2 emissions contribute 41% and scope 3 emissions are responsible for 55% of the total emissions.

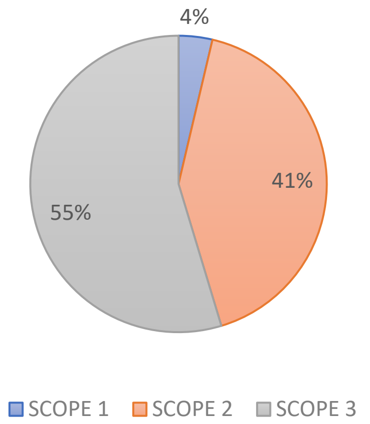

Figure 6.4: All three scopes of emissions of educational institutions

6.3.1. Contribution of each institution in the total emissions

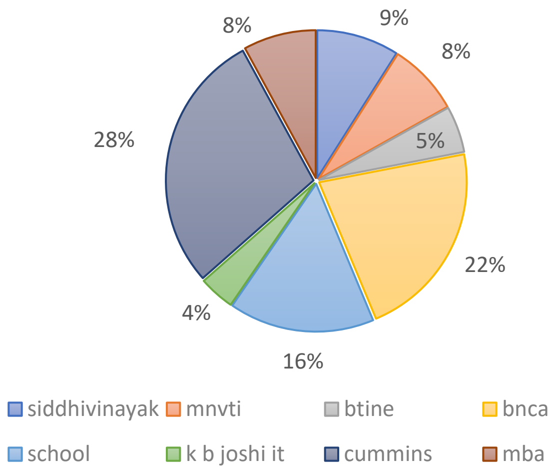

Figure 6.5: Contribution of each institution in the total emissions

School with highest number of students is contributing only 16% and Siddhivinayak college with second highest student strength is contributing only 5% to the total emissions of the institutions, whereas Cummins college contributes to 28% and BNCA contributes to 22% of the total emissions of the educational institutions.

6.3.2. Calculating GHG emissions per student.

Calculations of GHG emissions per student are carried out and represented graphically below.

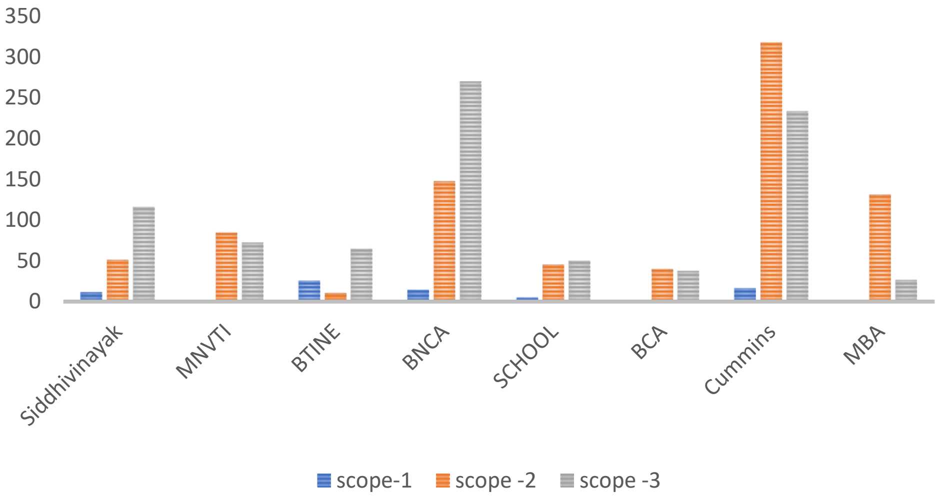

Figure 6.6: Total emissions per student of each institution under all 3 scopes

Although the collective analysis is giving the general idea about emissions per student of each institution, a comparative analysis of scope wise emissions per student would provide detail which would be useful for strategy formation.

6.3.2.1. Scope 1 emissions per student - Scope-1 emissions per student are highest in BTINE owing to the daily travelling of students to the various hospitals in the city by institution owned bus.

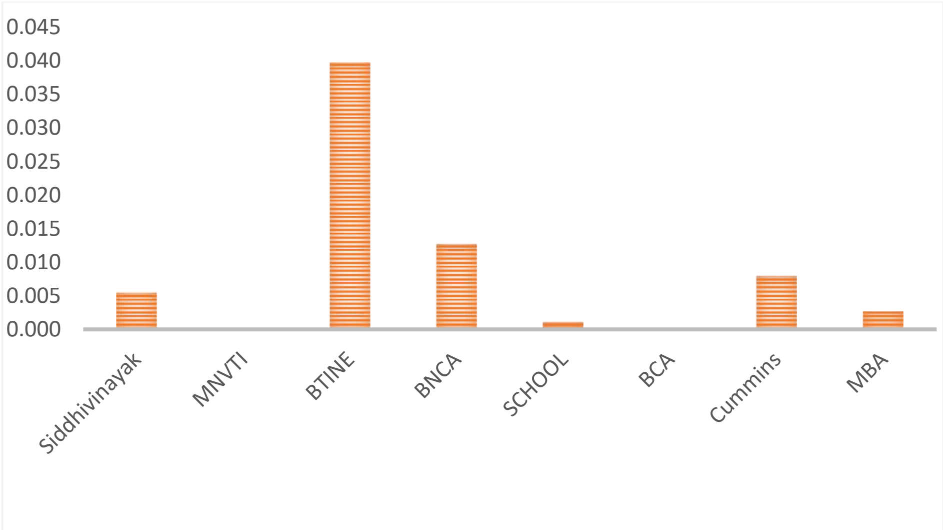

Figure 6.7: Scope-1 emissions per student of each institution

6.3.2.2 Scope 2 emissions per student - Scope-2 emissions per student are highest in HNIMRW as the institute has more air-conditioned spaces as compared to other institutions.

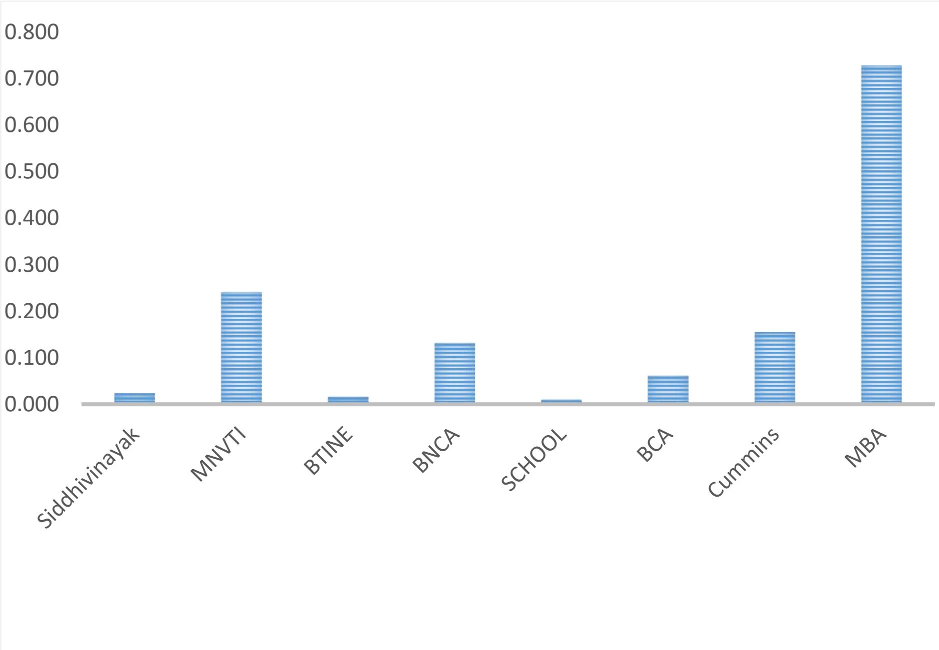

Figure 6.8: Scope-2 emissions per student of each institution.

6.3.2.3 Scope 3 emissions per student - Scope-3 emissions per student are highest in BNCA corresponding to the national and international study tours and use of personal vehicles by 51% of occupants for daily commuting.

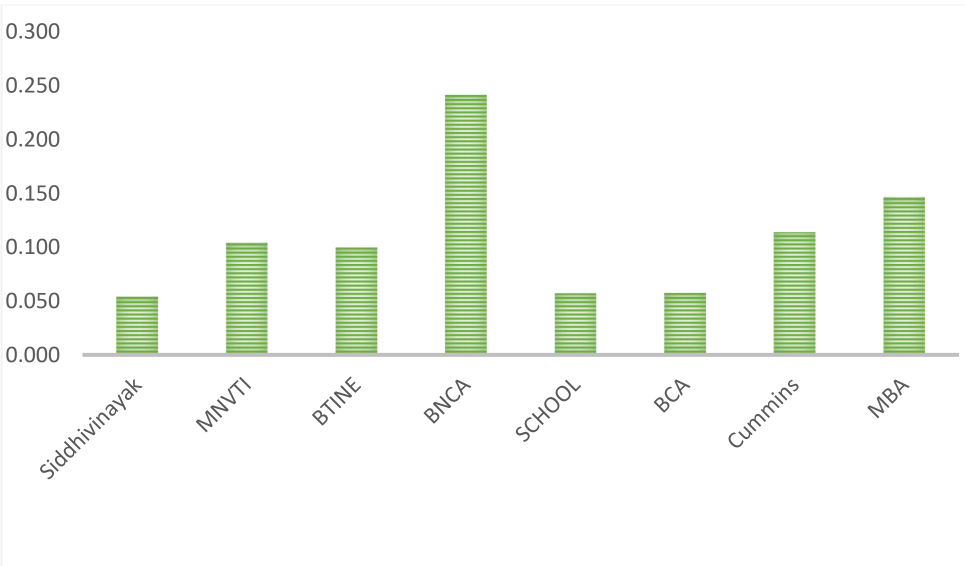

Figure 6.9: Scope-3 emissions per student of each institution.

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5. Calculations of GHG emissions of the hostels in the campus

There are five hostels in the campus which offer residential facilities for girls from schools to colleges. Each one is managed separately and has different accommodation capacities and facilities.

7.1. Baya Karve Hostel

The hostel currently accommodates 900 students and provides all the required facilities for the students.

7.1.1. Scope 1 Emissions: Scope 1 emissions include direct emissions due to LPG usage for cooking food in the hostel mess. The data about total number of cylinders utilised per month in the mess was collected from the mess manager to calculate the scope 1 emissions as tabulated below.

Table 7.1: Scope-1 emissions.

LPG / cylinder kg	LPG consumption for 1year (344 cylinders) Kg	Emission factor tCO2eq/kg	Total emission for year 2022 tCO2eq
19	6536	0.003	19.608

7.1.2. Scope 2 Emissions: Scope 2 emissions include indirect emissions due to consumption of purchased electricity in the hostel. The quantity of total units of purchased electricity was acquired from the monthly electricity bills to derive the scope 2 emissions.

Table 7.2: Scope-2 emissions.

Scope 2 emissions due to purchased electricity				
Units consumed			Emission factor	emissions
	kwh	mwh	tco2 eq/mwh	tco2 eq
Jan	11920	11.92	0.96	11.443
Feb	11560	11.56	0.96	11.098
mar	39000	39	0.96	37.440
April	28800	28.8	0.96	27.648
May	43280	43.28	0.96	41.549
June	20160	20.16	0.96	19.354
July	22120	22.12	0.96	21.235
Aug	20280	20.28	0.96	19.469
Sept	15760	15.76	0.96	15.130
Oct	19800	19.8	0.96	19.008
Nov	20200	20.2	0.96	19.392
Dec	26920	26.92	0.96	25.843
	279800	279.8	0.96	268.608

7.1.3 Scope 3 Emissions: Emissions due to waste disposal – The waste generated in the hostel include organic and inorganic waste. Organic waste generated is in the form of food waste and vegetable waste from the mess, which is either used for the biogas plant in the campus or composted in compost pits within the campus. Inorganic or dry waste in the form of paper, carboard, plastic etc. is collected and segregated at a central place in the campus. Recyclable waste is separated and given for recycling and the rest is handed over to the municipal waste colleting agency. Bio- hazardous waste in the form of sanitary napkins is collected separately and disposed of in an incinerator in a hygienic way.

Table 7.3: Scope-3 emissions due to waste disposal

Emissions due to waste disposal	
waste	emissions
Paper waste	1.146
plastic waste	0.005
Demolition waste	0.046
metal waste	0.000
ply/wood waste	0.124
Sanitary waste	5.074
Total	6.395

7.1.4. Total greenhouse gas emissions: The scope 1 emissions are 19.609 t co2 eq., scope 2 emissions are 271.406 tco2 eq. and scope 3 emissions are 6.395 tco2 eq., totalling the total GHG emissions to 297.483 tco2 eq.

Table 7.4: Total GHG emissions.

Total emissions	
Scope -1	19.608
Scope -2	268.607
Scope -3	6.395
	294.611

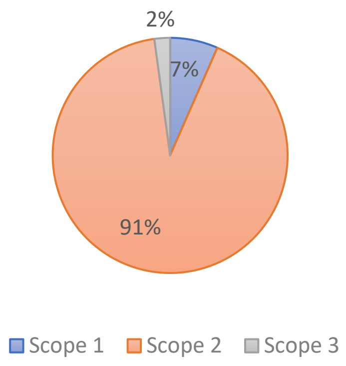

Figure 7.1: Share of all scopes in total GHG emissions.

Scope 2 emissions are highest contributing 91% to the total emissions, Scope 1 emissions contribute 7% whereas scope 3 emissions are limited to only 2% of the total emissions.

7.1.5. Calculating emissions per student

Table 7.5: GHG emissions per student.

Total No. of Students	Total GHG emissions	GHG emissions per student
900	294.611 t co2 eq.	0.327 t co2 eq.

7.2. Calculations of GHG emissions of all the hostels in the campus

Greenhouse gas emissions were calculated for the following hostels similarly.

- Ramasadan Hostel
- Sir David Sasoon Hostel
- Venubai Hostel
- Chitale Bandhu Hostel

7.3. Summary of Greenhouse gas emissions of the hostels in the campus: The total scope 1 emissions of all hostels are 82.67 tco2 eq., total scope 2 emissions are 603.804 tco2 eq. and scope 3 emissions are 20.866 tco2 eq., totalling GHG emissions to 703.336 tco2 eq.

Table 7.6: Total GHG emissions of the hostels.

Annual GHG emissions						
Hostel	No. of students	Scope-1	Scope-2	Scope-3	TOTAL	Emissions/ student
Baya Karve	900	19.608	268.608	6.395	294.611	0.327
Ramasadan	1400	35.738	263.122	7.265	306.124	0.219
Sassoon	700	17.727	40.880	4.267	62.873	0.090
Venubai	300	6.669	10.376	2.133	19.178	0.064
Chitale	104	2.924	20.819	0.807	24.549	0.236
Total	3404	82.666	603.804	20.866	707.336	0.208

7.3.1. Contribution of each hostel in the total emissions

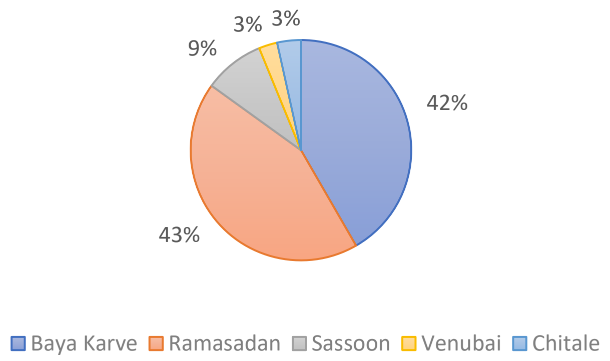

Figure 7.2: Share of each hostel in the total emissions.

Ramasadan hostel contributes to 43%, Baya Karve hostel contributes to 42%, Sassoon hostel contributes 9%. Venubai hostel contribute 3% and Chitale Bandhu hostel contributes 3% to the total emissions of the hostels in the campus.

7.3.2. Calculation of emissions per student in the hostels.

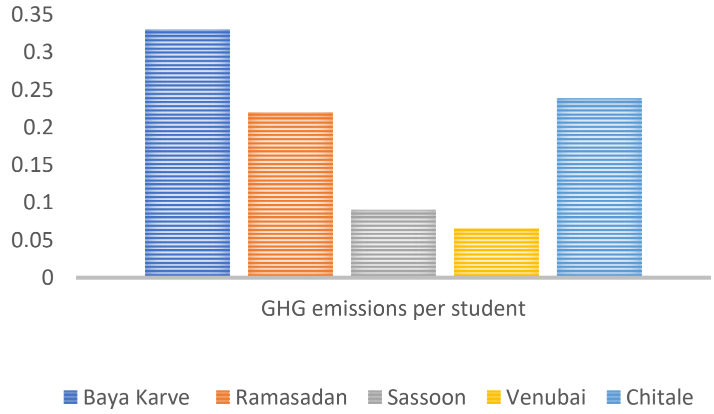

Figure 7.3: Emissions per student in each hostel.

8. Campus Summary of GHG Emissions, Energy consumption, Waste management and Water consumption

The campus houses other small units and ancillary facilities for the institutions including administrative office, estate management office, central store etc. Greenhouse gas emissions of these facilities are calculated collectively for ease of compilation.

8.1. GHG emissions of Common facilities and other small units.

Table 8.1: Total GHG emissions due to common facilities and services in the campus.

Total Emissions	
Sampada bakery	82.505
Common services	50.27
street lights	9.06
Other miscellaneous units	37.135
Total	178.97

8.2. Summary of GHG emissions of the campus

The total greenhouse gas emissions of the campus are 3135 tco2 eq.

Table 8.2: Total GHG emissions of the campus.

TOTAL CAMPUS EMISSIONS			
Educational Institutions	Hostels	Other Units	Total
2248.37	707.336	178.97	3135

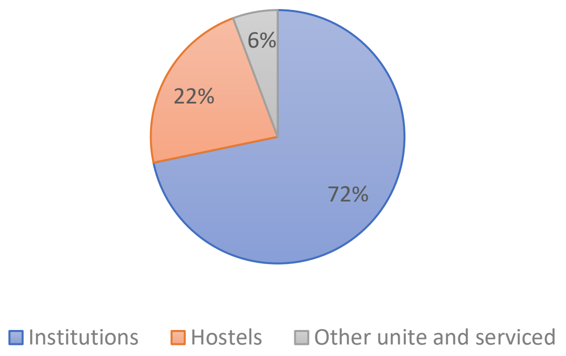

Figure 8.1: Total GHG emissions of the campus.

The educational institutions are responsible for 72% of the total emissions, hostels contribute 22% and the other units and services cause 6% of the total GHG emissions in the campus.

8.2.1. Scope wise summary of GHG emissions of the entire campus

Table 8.3: Total GHG emissions of the campus under all 3 scopes of emissions

TOTAL CAMPUS EMISSIONS			
Scope -1	Scope 2	Scope 3	TOTAL
169.53	1516.71	1448.76	3135.00

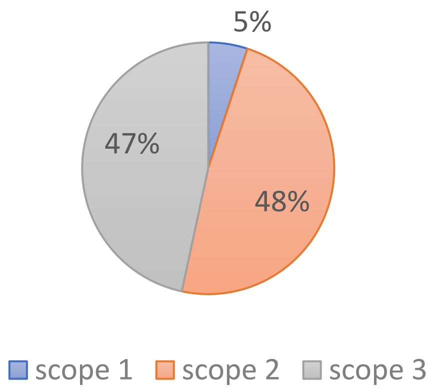

Figure 8.2: Share of all three scopes of emissions in total emissions.

Scope 1 emissions are responsible for 5%, scope 2 emissions are responsible for 47% and scope 3 emissions are causing 48% of the total greenhouse gas emissions.

8.3. Summary of energy consumption

The parent institute receives a single combined electricity bill for the entire campus including all buildings and facilities. The total energy consumption is derived from the collective common bill. The total annual units of purchased electricity are 1579.348 mwh and the resultant scope 2 emissions are 1516.174 tco2 eq.

Table 8.4: Total energy consumption and scope 2 emissions of the campus

Electricity consumption				
Purchased units			Emission factor	Total emissions
	kwh	mwh	tco2eq/mwh	tco2 eq.
Jan	86671	86.671	0.96	83.204
Feb	84427	84.427	0.96	81.050
mar	144171	144.171	0.96	138.404
April	153242	153.242	0.96	147.112
May	153242	153.242	0.96	147.112
June	147553	147.553	0.96	141.651
July	154613	154.613	0.96	148.428
Aug	140483	140.483	0.96	134.864
Sept	146140	146.14	0.96	140.294
Oct	117610	117.61	0.96	112.906
Nov	114816	114.816	0.96	110.223
Dec	136380	136.38	0.96	130.925
	1579348	1579.348	0.96	1516.174

8.4. Summary of waste generation and management in the campus.

Waste management is done efficiently in the campus. Organic and dry waste is segregated at the source and organic waste either goes to biogas plant or compost pits located within the campus. The biogas plant takes in all the food waste and produces 25kg biogas daily. Dry waste is collected and sorted daily at a central place in the campus to segregate plastic, paper, cardboard, and other types. Segregated waste is sent for recycling and the remaining dry waste is handed over to the municipal waste collecting agency. E-waste, metal and wood/plywood waste is collected separately and given to authorized recycling agencies. Bio-hazardous waste of sanitary napkins is collected separately and hygienically disposed in an incinerator inside the campus. Some part of the construction debris is used in other campuses of MKSSS or is sent for disposal.

Table 8.5: Emissions due to waste disposal.

Type of waste	Annual	Recycled	Disposed	Emission factor	Total Emission
	kg	kg	kg		tco2eq
Food	108900	108900	0		
Vegetable/dry leaves	117465	117465	0	0.58	22.710
Dry branches/twigs	25000	25000	0	0.58	4.833
Sanitory waste	4620	4620	0	2.883	13.319
Furniture/wood	3000	2000	1000	0.828	0.828
Metal	1000	500	500	0.001	0.001
Glass	180	150	30	0.009	0.000
Cardboard	800	700	100	1.041	0.104
Paper	18480	14784	3696	1.041	3.848
Plastic	7920	3960	3960	0.008	0.032
Construction waste	226400	113200	113200	1.24	140.368
Total					158.500

8.5. Water consumption

The campus gets freshwater supply from the municipal corporation and the borewells within the campus. The water from both the sources is filtered in a filtration tank before supplying to the individual buildings. A water audit of the campus was carried out in 2017 to understand the water consumption of the campus.

Table 8.6: Water consumption in the campus

Daily water consumption as per water audit (2017)				
Water supply per day	water for irrigation	Total sewage generated (@85%)	Wastewater treatment plant capacity	Untreated sewage being discharged in sewer lines
805100 lit	60,230 lit	684335 lit	2,00,000 lit	684335 lit

(Source: MKSSS water audit report 2017)

8.5.1 Wastewater Treatment Plant

As per the recommendations of the water audit, a wastewater treatment plant was installed near Ramasadan hostel which efficiently treats and recycles 2,00,000 lit. of grey water, thereby reducing the demand for fresh water. The treated water is used for flushing purposes in the hostels and for irrigation.

8.5.2 Rainwater Harvesting System

Rainwater from the roof tops of the buildings in the campus is efficiently harvested and used to recharge groundwater with the help of eight recharge pits. The ground water fulfills all the water requirements of the campus in summer season when the municipal water supplies are insufficient.

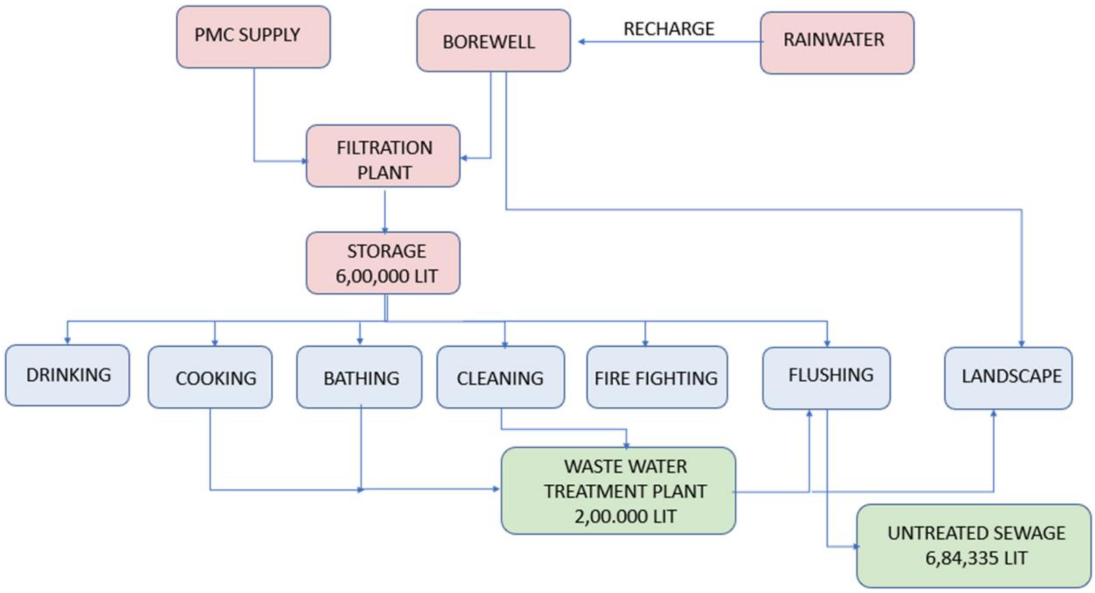

Figure 8.3: Water balance

9. Accounting for offsets in GHG emissions, Carbon sequestration and reporting net GHG emissions

MKSSS has implemented multiple projects in the campus to reduce its impact on the environment which include biogas plant, solar photovoltaic systems, solar water heating systems, compost pits and rainwater harvesting systems. These projects have helped to reduce some of the emissions in the campus.

9.1. Biogas plant- The biogas plant in the campus produces 25kg of biogas daily. Considering production on 300 days, the total biogas produced annually is 7500 kg. The biogas thus produced reduces the requirement of LPG thereby reducing emissions.

Table 9.1: Total GHG emissions offset achieved with the production of biogas.

Days	Quantity	Emission Factor	Biogas emissions	Equivalent LPG emissions	Total emissions offset
300	7500	0.001	7.5	22.5	15.00 t co2 eq.

9.2. Solar Power Generation - MKSSS has installed roof top solar photovoltaic systems of total capacity 618kwp in the campus. Power generated is used within the campus and excess is exported to the grid. A central net meter records the generation and the import and export of the solar power in the campus. The solar power reduces the demand for purchased electricity thereby achieving reduction in Scope 2 emissions.

Table 9.2: Total GHG emissions offset achieved with the generation of solar energy.

Solar Photovoltaic systems				
Plant capacity	Units generated annually	Emission factor of purchased electricity	Equivalent emissions from purchased electricity	Total emissions offset (t co2 eq.)
618 kwp	401.86 mwh	0.96	389.80	385.785

9.3. Solar water heating system- MKSSS has installed solar water heating systems with hot water tanks of capacity 89250 lit in total. The demand for purchased electricity is reduced and reduction in scope 2 emissions is achieved.

Table 9.3: Total GHG emissions offset achieved with solar water heating system.

Solar water heaters			
Total solar hot water lit	Electricity demand for water heating per day kwh	Annual electricity saved mwh	Emission offset tco2 eq
89250	3113.338	934.001	896.64

9.4. Waste management – Organic waste generated in the campus is totally recycled in the biogas plant and the compost pits. Dry waste is segregated and handed over for recycling. The efficient waste management of organic waste and recycling of dry waste results in reducing emissions due to waste disposal.

Table 9.4: Total GHG emissions offset achieved with waste management.

Type of waste	Annual	Recycled	Landfill	Emission factor	Total Emission	emission offset
	kg	kg	kg		tco2eq	
Food	108900	108900	0	0.063		68.607
Vegetables/leaves	117465	117465	0	0.58	22.710	45.420
Dry branches/twigs	25000	25000	0	0.58	4.833	9.667
Sanitary napkins	4620	4620	0	2.883	13.319	0
Furniture/wood	3000	2000	1000	0.828	0.828	1.656
Metal	1000	500	500	0.001	0.001	0.001
Glass	180	150	30	0.009	0.000	0.001
Cardboard	800	700	100	1.041	0.104	0.7287
Paper	18480	14784	3696	1.041	3.848	15.390
Plastic	7920	3960	3960	0.008	0.032	0.032
Debris	226400	113200	113200	1.24	140.368	140.368
Total					158.500	281.870

9.5. Total offsets in emissions due to all the existing projects

Table 9.5: Total offsets in emissions

Total offset in emissions (tco2 eq.)	
Offset in Scope -1 emissions - Biogas	15
Offset in Scope 2 emissions- Solar PV	385.785
Offset in Scope 2 emissions- Solar water heaters	896.64
Offset in Scope 3 emiisions - waste management	281.87
Total	1581.21

9.6. Carbon sequestration

There are 685 trees in the campus and carbon sequestered by them was calculated using the following process:

1. Determine the total (green) weight of the tree.
2. Determine the dry weight of the tree.
3. Determine the weight of carbon in the tree.
4. Determine the weight of carbon dioxide sequestered in the tree

5. Determine the weight of CO_2 sequestered in the tree per year

(Source: www.ecomatcher.com)

Carbon sequestered in the campus trees during accounting 1 year (t co2 eq.): 155.21.

(Source: M. Arch Thesis)

9.7 Reporting net greenhouse gas emissions

Net GHG emissions of the campus are calculated by subtracting the carbon sequestered in the campus tress from the total scope1 and scope 2 emissions. The net scope 1 and scope 2 emissions for the calendar year of 2022 are 1530.49 tco2 eq.

Table 9.6: Net greenhouse gas emissions of the campus.

Net greenhouse gas emissions in the campus (tco2 eq.)			
Total Scope 1 and Scope 2 emissions	Carbon sequestered in trees	Net Scope 1 and Scope 2 emissions	Scope 3 emissions
1685.70	155.21	1530.49	1377.76

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WATER AUDIT FOR
DR. BHANUBEN NANAVATI COLLEGE OF ARCHITECTURE
FOR WOMEN, PUNE

INTENT:

To enhance water use efficiency and minimise the use of potable water.

COMPLIANCE OPTIONS:

Use water efficient plumbing fixtures whose flow rates meet the baseline criteria, individually or in aggregate. The baseline criteria is as under:

Fixture Type	Maximum Flow Rate/ Consumption	Duration	Estimated daily uses per person*
Water Closets	6.0 LPF	1 flush	1 for male; 3 for females
Faucets / taps**	8.0 LPM	0.25 min	4
Urinals	4.0 LPF	1 flush	2 for males

Source: Uniform Plumbing Code- India, 2008

Existing Plumbing Fixtures							
Ground floor (Admin)							
Fixture Type	Duration per Use (in minutes)	Daily Uses (per person/ day)	Total Number of Occupants	Baseline		Existing	
				Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)	Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)
W.C.	1 Flush	1	12	6	72	**8.0**	**96**
W. C.	1 Flush	3	31	6	558	**8.0**	**744**
Health Faucet/taps*	0.25	4	44	8	352	**9.0**	**396**
Urinals	1 Flush	2	12	4	48	**5.0**	**120**
Daily volume from flush fixtures (Black water) litres					**678**		**960**
Daily volume from flow fixtures (Grey water) litres					**352**		**396**
First floor Students (CAID + B.Arch)							
Fixture Type	Duration per Use (in minutes)	Daily Uses (per person/ day)	Total Number of Occupants	Baseline		Existing	
				Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)	Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)
Water Closets	1 Flush	3	300	6	5,400	**7.0**	**6300**
Health Faucet/taps*	0.25	4	300	8	2,400	**9.0**	**2700**
Daily volume from flush fixtures (Black water)				**(Liters)**	**5,400**		**6,300**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**2,400**		**2,700**
First floor Faculty (teaching + visiting faculty)							
Fixture Type	Duration per Use (in minutes)	Daily Uses (per person/ day)	Total Number of Occupants	Baseline		Existing	
				Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)	Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)
W. C.(western)	1 Flush	1	8	6	48	**7.0**	**56**
W. C.(western)	1 Flush	3	22	6	396	**7.0**	**462**
Health Faucet/taps*	0.25	4	30	8	240	**9.0**	**270**
Urinals	1 Flush	2	8	4	64	**5.0**	**80**
Daily volume from flush fixtures (Black water)				**(Liters)**	**508**		**598**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**240**		**270**
Second , third,fourth floor Students (B.Arch + M.Arch)							
Fixture Type	Duration per Use (in minutes)	Daily Uses (per person/ day)	Total Number of Occupants	Baseline		Existing	
				Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)	Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)
Water Closets	1 Flush	3	740	6	13,320	**4.5**	**9990**
Health Faucet/taps*	0.25	4	740	8	5,920	**9.0**	**6660**
Daily volume from flush fixtures (Black water)				**(Liters)**	**13,320**		**9,990**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**5,920**		**6,660**
Faculty (teaching + visiting faculty)							
Fixture Type	Duration per Use (in minutes)	Daily Uses (per person/ day)	Total Number of Occupants	Baseline		Existing	
				Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)	Flow Rate / Capacity (in LPF/ LPM)	Total Daily Water Use (liters)
W.C.	1 Flush	1	18	6	108	**6.0**	**108**
W.C.	1 Flush	3	110	6	1,980	**4.5**	**1485**
Health Faucet/taps*	0.25	4	128	8	1,024	**9.0**	**1152**
Urinals	1 Flush	2	18	4	144	**5.0**	**180**
Daily volume from flush fixtures (Black water)				**(Liters)**	**2,232**		**1,773**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**1,024**		**1,152**

TOTAL BLACK AND GREY WATER GRNERATED IN 220 WORKING DAYS		
Description	**Baseline**	**Existing**
Annual volume of Black water from flush fixtures	48,70,360	43,16,620
Annual volume of grey water from flush fixtures	21,85,920	24,59,160
Annual volume from flush & flow fixtures (Black & Grey water)	**70,56,280**	**67,75,780**

PROPOSED PLUMBING FIXTURES

SR.NO.	MODEL NO		TYPE	STREAM	GREEN PRO	CERTIFICATION
1	F6010101		WITH CENSOR	AERATED STREAM	GREEN PRO	GRIHA CERTIFIED
2	F6010102		WITH CENSOR	AERATED STREAM	GREEN PRO	GRIHA CERTIFIED
3	F6010103		WITH CENSOR	AERATED STREAM	GREEN PRO	
4	F6010107		WITH CENSOR	AERATED STREAM		
5	F1015101		PILLAR COCK	WITH AERATOR	GREEN PRO	GRIHA CERTIFIED
6	F1015102		PILLAR COCK EXTENDED	WITH AERATOR	GREEN PRO	GRIHA CERTIFIED
7	F1015452		PILLAR COCK EXTENDED	WITH AERATOR	GREEN PRO	GRIHA CERTIFIED
8	F1018101		PILLAR COCK	WITH AERATOR	GREEN PRO	
9	F1099101		PILLAR COCK	WITH AERATOR	GREEN PRO	
10	F1017101		PILLAR COCK	WITH AERATOR	GREEN PRO	
11	F1012101		PILLAR COCK	WITH AERATOR	GREEN PRO	
12	F1013101		PILLAR COCK	WITH AERATOR	GREEN PRO	
13	F2013101		PILLAR COCK	WITH AERATOR	GREEN PRO	
14	F1003101		PILLAR COCK	WITH AERA	GREEN PRO	

Faucets with smart water-saving aerators

Taking forward the water saving concept, faucets manufactured at Cera are awarded a number of certifications such as WEP-I, GRIHA and GreenPro.

All the CERA faucets are fitted with aerator, which mixes air with water & gives splash-free gentle flow. Also we offer different water saving aerators which can save more than 50% water in every usage.

PROPOSED PLUMBING FIXTURES

PROPOSED CISTERN AND FLUSH VALVE FOR GROUND AND FIRST FLOOR

MODEL NO	TYPE	CERTIFICATE
F8010301	EXPOSED TYPE	GREEN PRO

MODEL NO	TYPE	
B1020106	TWIN FLUSH	WATER SAVING

Water usage with Proposed Plumbing Fixtures							
Ground floor (Admin)							
Fixture Type	**Duration per Use (in minutes)**	**Daily Uses (per person/ day)**	**Total Number of Occupants**	**Baseline**		**Proposed**	
				Flow Rate / Capacity (in LPF/ LPM)	**Total Daily Water Use (liters)**	**Flow Rate / Capacity (in LPF/ LPM)**	**Total Daily Water Use (liters)**
W.C.	1 Flush	1	12	6	72	**6.0**	**72**
W. C.	1 Flush	3	31	6	558	**4.5**	**418.5**
Health Faucet/taps*	0.25	4	44	8	352	**5.0**	**220**
Urinals	1 Flush	2	12	4	48	**5.0**	**120**
Daily volume from flush fixtures (Black water) litres					**678**		**611**
Daily volume from flow fixtures (Grey water) litres					**352**		**220**
First floor Students (CAID + B.Arch)							
Fixture Type	**Duration per Use (in minutes)**	**Daily Uses (per person/ day)**	**Total Number of Occupants**	**Baseline**		**Proposed**	
				Flow Rate / Capacity (in LPF/ LPM)	**Total Daily Water Use (liters)**	**Flow Rate / Capacity (in LPF/ LPM)**	**Total Daily Water Use (liters)**
Water Closets	1 Flush	3	300	6	5,400	**4.5**	**4050**
Health Faucet/taps*	0.25	4	300	8	2,400	**5.0**	**1500**
Daily volume from flush fixtures (Black water)				**(Liters)**	**5,400**		**4,050**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**2,400**		**1,500**
First floor Faculty (teaching + visiting faculty)							
Fixture Type	**Duration per Use (in minutes)**	**Daily Uses (per person/ day)**	**Total Number of Occupants**	**Baseline**		**Proposed**	
				Flow Rate / Capacity (in LPF/ LPM)	**Total Daily Water Use (liters)**	**Flow Rate / Capacity (in LPF/ LPM)**	**Total Daily Water Use (liters)**
W. C.(western)	1 Flush	1	8	6	48	**6.0**	**48**
W. C.(western)	1 Flush	3	22	6	396	**4.5**	**297**
Health Faucet/taps*	0.25	4	30	8	240	**5.0**	**150**
Urinals	1 Flush	2	8	4	64	**5.0**	**80**
Daily volume from flush fixtures (Black water)				**(Liters)**	**508**		**425**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**240**		**150**
Second , third,fourth floor Students (B.Arch + M.Arch)							
Fixture Type	**Duration per Use (in minutes)**	**Daily Uses (per person/ day)**	**Total Number of Occupants**	**Baseline**		**Proposed**	
				Flow Rate / Capacity (in LPF/ LPM)	**Total Daily Water Use (liters)**	**Flow Rate / Capacity (in LPF/ LPM)**	**Total Daily Water Use (liters)**
Water Closets	1 Flush	3	740	6	13,320	**4.5**	**9990**
Health Faucet/taps*	0.25	4	740	8	5,920	**5.0**	**3700**
Daily volume from flush fixtures (Black water)				**(Liters)**	**13,320**		**9,990**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**5,920**		**3,700**
Faculty (teaching + visiting faculty)							
Fixture Type	**Duration per Use (in minutes)**	**Daily Uses (per person/ day)**	**Total Number of Occupants**	**Baseline**		**Proposed**	
				Flow Rate / Capacity (in LPF/ LPM)	**Total Daily Water Use (liters)**	**Flow Rate / Capacity (in LPF/ LPM)**	**Total Daily Water Use (liters)**
W.C.	1 Flush	1	18	6	108	**6.0**	**108**
W.C.	1 Flush	3	110	6	1,980	**4.5**	**1485**
Health Faucet/taps*	0.25	4	128	8	1,024	**5.0**	**640**
Urinals	1 Flush	2	18	4	144	**5.0**	**180**
Daily volume from flush fixtures (Black water)				**(Liters)**	**2,232**		**1,773**
Daily volume from flow fixtures (Grey water)				**(Liters)**	**1,024**		**640**

TOTAL BLACK AND GREY WATER GRNERATED IN 220 WORKING DAYS		
Description	**Baseline**	**Proposed**
Annual volume of Black water from flush fixtures	48,70,360	37,06,670
Annual volume of grey water from flush fixtures	21,85,920	13,66,200
Annual volume from flush & flow fixtures (Black & Grey water)	**70,56,280**	**50,72,870**

WATER SAVED BY USING AERATORS, TWIN FLUSH CISTERNS AND TWIN FLUSH VALVES - 1502910 LIT., WHICH IS 28% OF BASELINE

INTENT:

To enhance water use efficiency and minimise the use of potable water.

COMPLIANCE OPTIONS:

Use water efficient plumbing fixtures whose flow rates less than the baseline criteria, individually or in aggregate. The baseline criteria is as under:

Fixture Type	Maximum Flow Rate/ Consumption	Duration	Estimated daily uses per person*
Water Closets	6.0 LPF	1 flush	1 for male; 3 for females
Faucets / taps**	8.0 LPM	0.25 min	4
Urinals	4.0 LPF	1 flush	2 for males

Source: Uniform Plumbing Code- India, 2008

TOTAL BLACK AND GREY WATER GENERATED IN 220 WORKING DAYS (LITRES)			
Description	**Baseline**	**Existing**	**Proposed**
Annual volume of Black water from flush fixtures	48,70,360	43,16,620	37,06,670
Annual volume of grey water from flush fixtures	21,85,920	24,59,160	13,66,200
Annual volume from flush & flow fixtures (Black & Grey water)	**70,56,280**	**67,75,780**	**50,72,870**

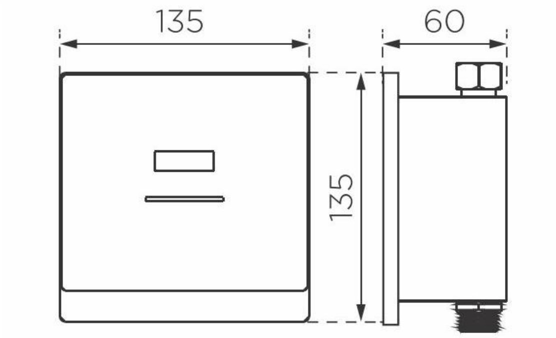
WATER SAVED BY USING AERATORS, TWIN FLUSH CISTERNS AND TWIN FLUSH VALVES - 1502910 LIT., WHICH IS 28% OF BASELINE

ACHEIVABLE POINTS

Percentage of potable water savings over baseline	Points
20%	2
30%	4
40%	6

Recommendations for urinal flushing system:

This credit can be achieved if we provide Timed flush system to achieve baseline criteria. In this system Groups of up to ten or more urinals will be connected to single overhead cistern, which contains the timing mechanism.
A constant drip- feed of water slowly fills the cistern until a tipping point is reached. When the valve opens all the urinals in the group are flushed. This system does not require any action from its users. It is wasteful of water when toilets are used irregularly.



Specifications

KEY FEATURES

Operation	Pre & Post Self Flush
Mount type	Wall Mount - Recessed
Sensor Type	Infra-Red Sensor
Water Pressure	0.05-0.7 MPa
Dia of Inlet/outlet Pipe	Dn 15 (G1/2")
Sensing Range	40-60 cm
Dual Operation	Electrical + Battery
Battery Operated	4 x AA Duracell Battery (not included)

Pressure	1 Bar	2 Bar	3 Bar
Water Discharge (per use in litres)	0.22 L	0.33 L	0.40 L

Recommendations for water closet flushing system:

This credit can be achieved if we replace existing piston flushing cistern with Dual flushing system. The main feature of this system is that it has two buttons for releasing water, One button is for 3 litres output is designed for liquid waste and larger 6 litre output is design for solid waste.

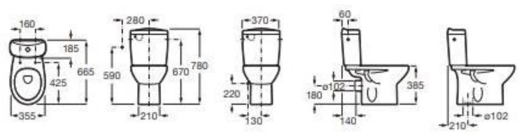
VICTORIA

Dual flush 6/3L WC cistern

DIMENSIONS
Length 385 mm.
Width 180 mm.
Height 430 mm.

COLOURS AND FINISHES
46 White

TECHNICAL DRAWINGS



Roca

Recommendations for taps and health faucet:

This credit can be achieved if we provide aerators to taps. Need Aerators to taps to control LPM.

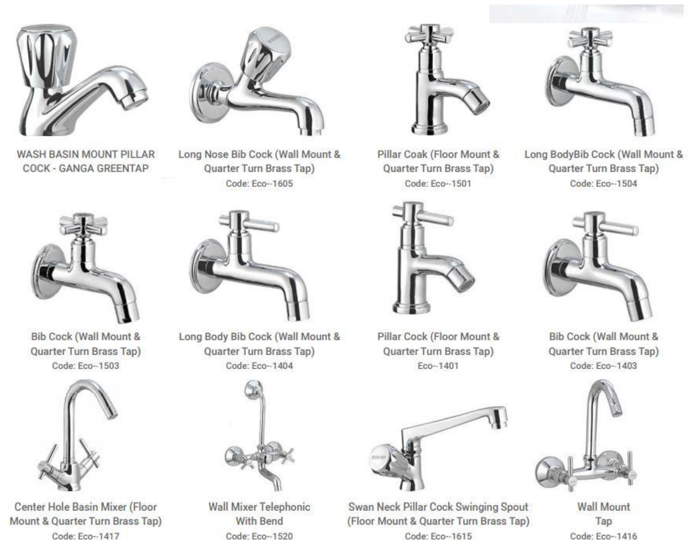
Water efficiency is reducing water wastage by measuring the amount of water required for a particular purpose and the amount of water used or delivered by plumbing fixtures. Water efficiency differs from water conservation in that it focuses on reducing waste, not restricting use. It also emphasizes the influence consumers can have in water efficiency by making small behavioral changes to reduce water wastage and by choosing more water efficient products.

Reduce the flow of water

· Modify the equipment or installing water saving devices.
· Replace existing equipment with more water efficient equipment.
· Change to a waterless process.

Possible savings of water at home with Eco365® water efficient Taps					
Activity	Water usage by tap with standard Aerator(flow rate: 12 L/M)	Water usage by tap with Eco365 Tap(Flow rate: 3 L/M)	Water saved in Litres	Water saved %	Water saved annually by family of 4 with Eco365 Taps
Washing of hand Run time: 45 sec	9 L	2.25 L	6.75 L	75%	39420 (365 days x 4times x 6.75L x 4 members)
Brushing of teeth Run time: 1 min	12 L	3 L	9 L	75%	13140 (365 days x 1 times x 9L x 4 members)
Washing utensils Run time: 10 min	120 L	30 L	90 L	75%	32850 (365 days x 90 Litres)
Runtime & Times of usage could vary case to case basis, Consider ± 10%			Total water saved annually (in litres)		85410

ECO365® Sustainable Living



INTENT:

Recharge the local aquifer or capture rain water to reduce potable water consumption.

COMPLIANCE OPTIONS:

Have rainwater harvesting systems in place, to capture atleast 25% of run-off volumes from roof and non- roof areas. The harvesting system have to cater atleast 1 day of normal rainfall* occurred in the last 5 years.

There are 2 existing pits for rainwater harvesting, which collect water from roof area.

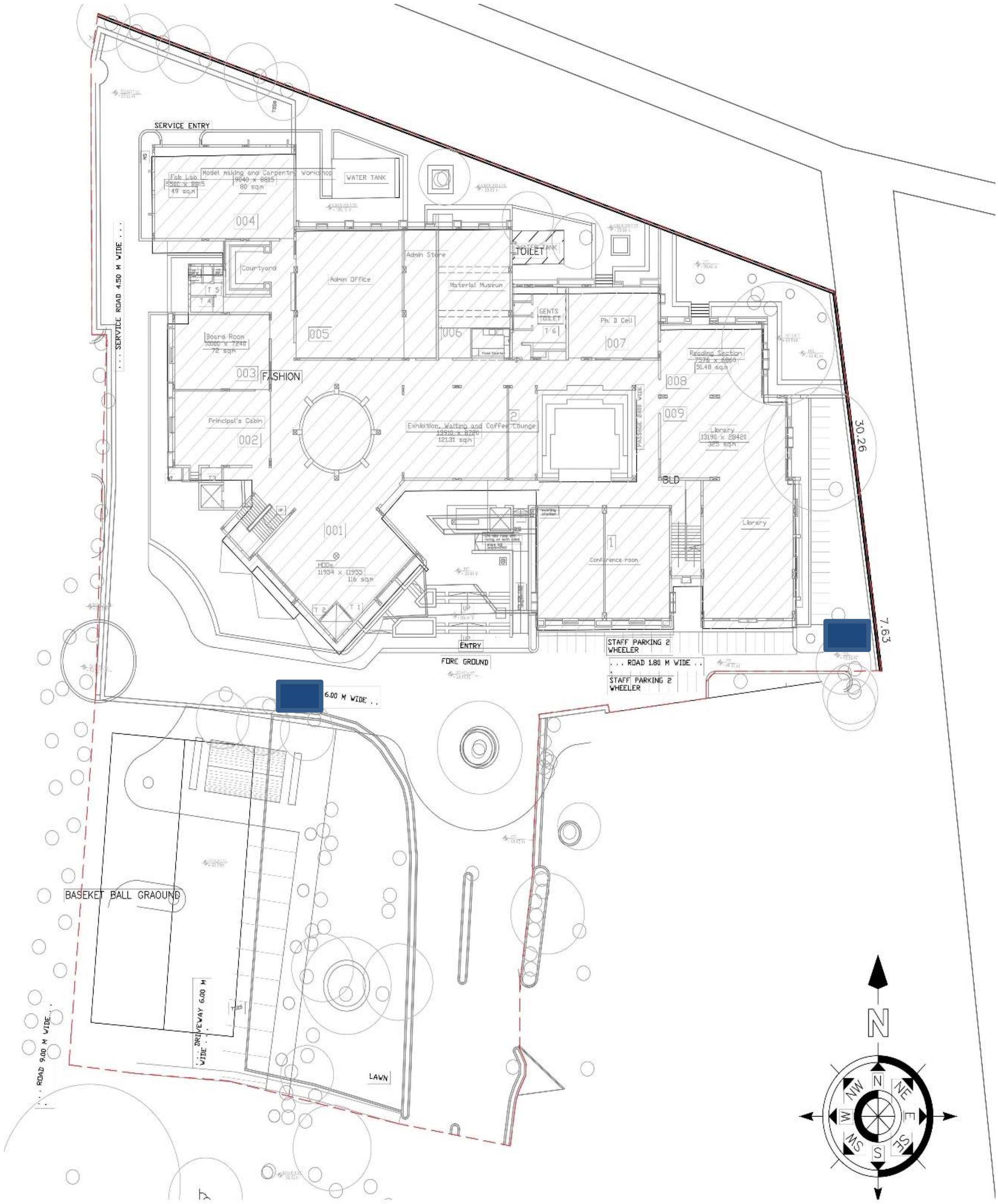
S.No.	Surface Type	Run-off Coefficient	Area (sq.m)	Impervious Area(sq.m)
1	Roof	0.95	1838	1746.1
2	Cemented road	0.95	1338.83	1271.9
3	Concrete Pavers	0.95	701.35	666.3
4	Vegetation	0.1	112.1	11.2
Total impervious area				3,695

Rainfall data	In mm	Normal Rainfall
Jul-16	223.3	7.20
Jul-17	194.3	6.25
Jul-18	175.0	5.65
Jul-19	376.9	12.16
Jul-20	184.0	5.94
Average		7.4

Percentage of Rainwater harvested onsite from roof & non - roof areas	
25% - 2 Points	6.84
50% - 4 Points	13.67

For Day Rainfall	0.0074 m
Total Impervious Area	3,695 sq.m
Total runoff volume	**27.35 cu.m**

Existing rainwater harvesting pit capacity	**3 cu.m**
Existing rainwater harvesting pit	**6 cu.m**



- Existing pit

refer Indian Metrological Department data at http://www.imd.gov.in

INTENT:

Treat waste water generated on site so as to make it available for reuse or safe disposal and hence avoid polluting the receiving streams

COMPLIANCE OPTIONS:

Have on-site treatment systems to treat 100% of waste water generated in the building / campus, to the quality standards suitable for reuse as prescribed by Central (or) State Pollution Control Board (CPCB), as applicable.

SUGGESTIONS:

No Waste Water Treatment system is currently present on the site.
Hence this credit is not applicable.

- **30769** Litres of flushing water (Black + grey) is daily generated in the building.
- Sewage Treatment plant can be suggested for on site waste water treatment.
- Suggested size of Sewage treatment tank according to capacity is 5.27m x 3.5m x 3m

Total domestic (raw) water demand =	**30769**	Litres
Estimated Sewage is 90 % of TWD		
Estimate Sewerage Generated =	27692	Litres
Capacity of S.T.P =	55.38	Cu.m
STP Capacity should be two times of sewage Generated		
Space Requirement For 55.38 Cum STP		
Let Assume Total Depth is 3.3m [Free Board 300 MM (Standard Depth) Liquid Depth L = 3.0 Meter]		
Area of STP =	18.46	m
Lets Assume Width of STP is 3.5m		
Length of STP =	5.27	m
Size of STP is 5.27x3.5x3.3		

Type of Sewage Treatment Plant suggested

Mixed Bed Bio Reactor (MBBR system)

INTENT:

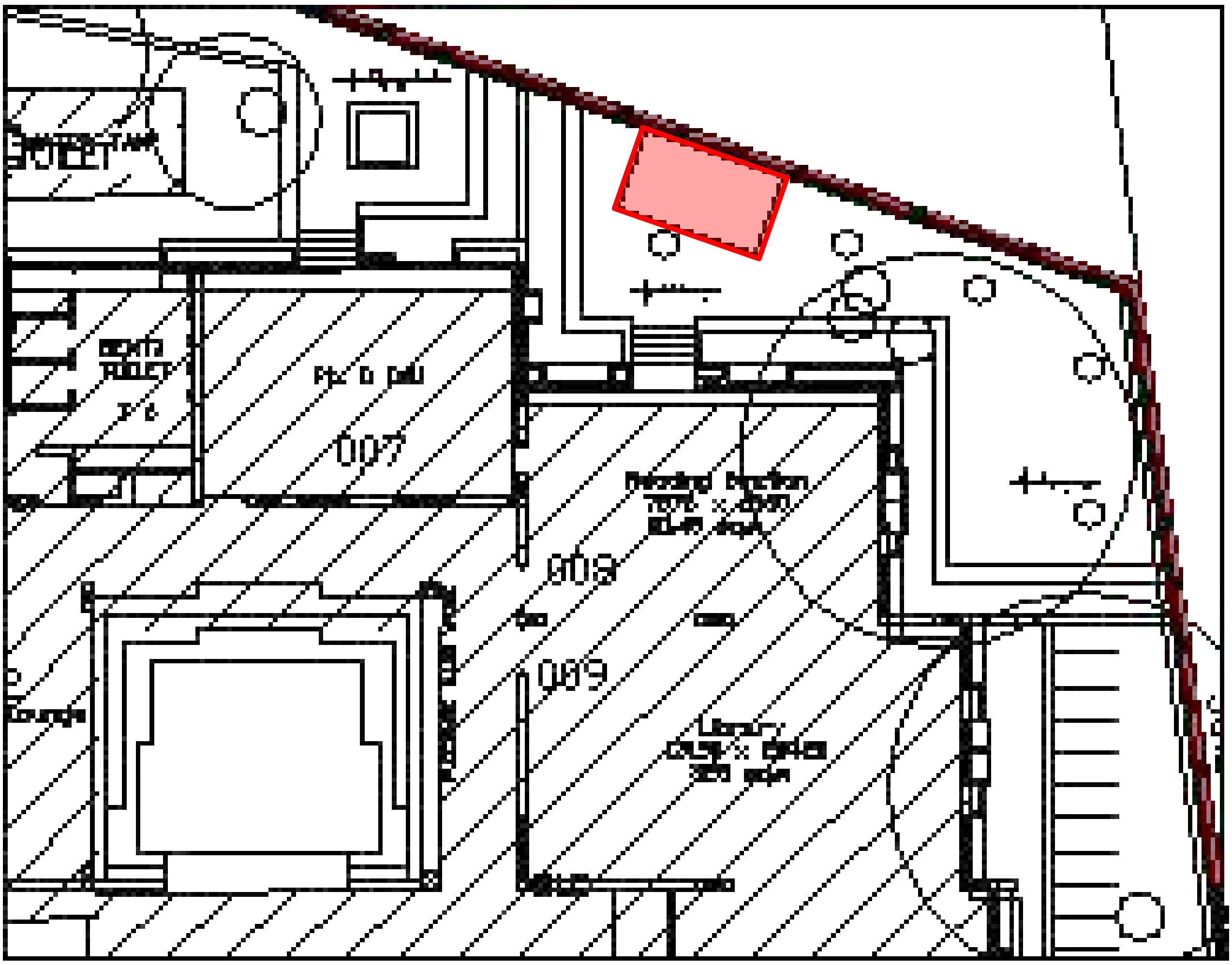
Treat waste water generated on site so as to make it available for reuse or safe disposal and hence avoid polluting the receiving streams

COMPLIANCE OPTIONS:

Have on-site treatment systems to treat 100% of waste water generated in the building / campus, to the quality standards suitable for reuse as prescribed by Central (or) State Pollution Control Board (CPCB), as applicable.

SUGGESTIONS:

Proposed Location of Sewage Treatment Plant for the College campus



Proposed Location of Sewage Treatment plant on site

INTENT:

Treat waste water generated on site so as to make it available for reuse or safe disposal and hence avoid polluting the receiving streams

COMPLIANCE OPTIONS:

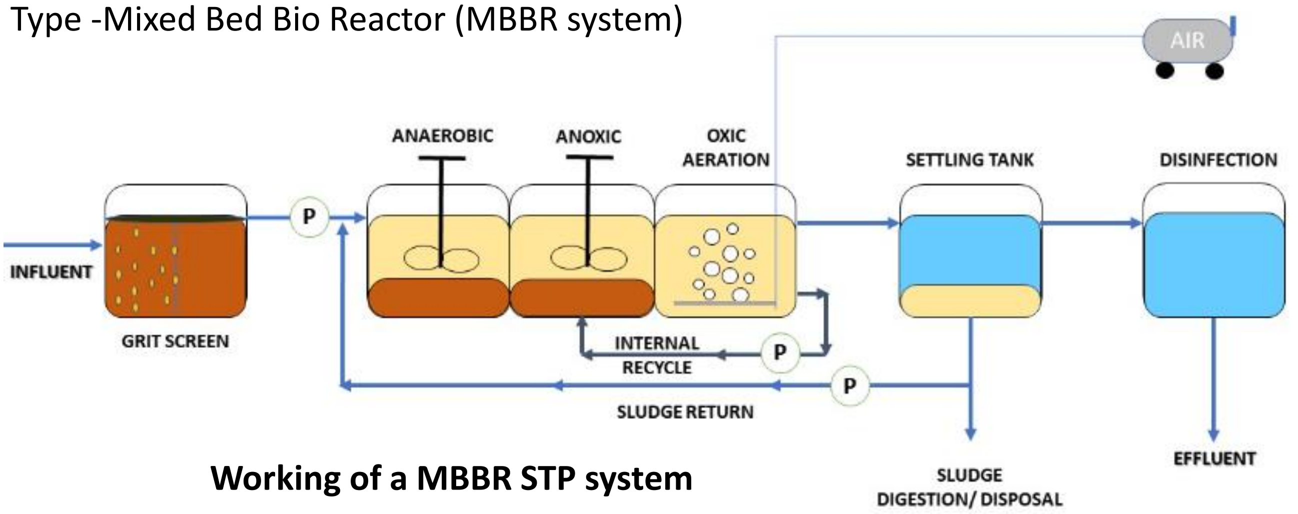
Have on-site treatment systems to treat 100% of waste water generated in the building / campus, to the quality standards suitable for reuse as prescribed by Central (or) State Pollution Control Board (CPCB), as applicable.

SUGGESTIONS:

Sewage Treatment Plant

Capacity Required – 50 KLD

Type -Mixed Bed Bio Reactor (MBBR system)



Working of a MBBR STP system

Product Specification

Capacity (KLD/MLD)	50 KLD
Treatment Technology	Mixed Bed Bio Reactor(MBBR)
Feed Flow Rate	0 - 50 m3/day
Installation Type	Prefabricated
Automation Grade	Automatic
Material Of Construction	Mild Steel
Treatment Stages	Preliminary Treatment, Primary Treatment, Secondary Treatment
Air Blower Count	1 Blower
Air Blower Power	0.25 KW
Control Module	Available
Water Pump Power	1 kW

Prefabricated Packaged Sewage Treatment Plant

₹ 3.50 Lakh

Sold By - Hydropure Consultants, Pune, Maharashtra

Capacity (KLD/MLD): 50 KLD

Treatment Technology: Mixed Bed Bio Reactor(MBBR)

Feed Flow Rate: 0 - 50 m3/day

Installation Type: Prefabricated

Key Highlights-

- No Noise Operation
- Less operational dependencies
- Easy Installation
- Advanced biological contact oxidation process
- Less space required
- Low Costing

INTENT:

Use treated waste water thereby reducing dependence on potable water.

COMPLIANCE OPTIONS:

Demonstrate that the treated waste water from waste water treatment plant is being reused for irrigation/ cooling water make-up/ flushing water requirements. Points are awarded as under:

Percentage of Treated Water Reused	Points
75%	2
100%	4

SUGGESTIONS:

No Waste Water Treatment system is currently present on the site, So No waste water reuse is been done. Hence this credit is not applicable.

- Suggested Sewage treatment tank for Waste Water Treatment – *as per WE Credit 3*

Treated Water Reuse		
Total Waste Water Generated(Input to STP)	30,769	Litres
Total treated Waste Water (Output from STP)	23,384	Litres
Landscape Requirement		

INTENT:

Ensure continuous monitoring of water consumption, both on supply and demand side, to identify improvement opportunities in potable water efficiency.

COMPLIANCE OPTIONS:

Demonstrate water monitoring for the following, as applicable:

- Water consumption through bore well
- Municipal water supply
- Water consumption of each tenant in multi- tenant spaces (as applicable)
- Water purchased from external sources like tankers
- Water consumption/ supply for flushing
- Water consumption/ supply for irrigation requirements
- Any other major consumers of water consumption

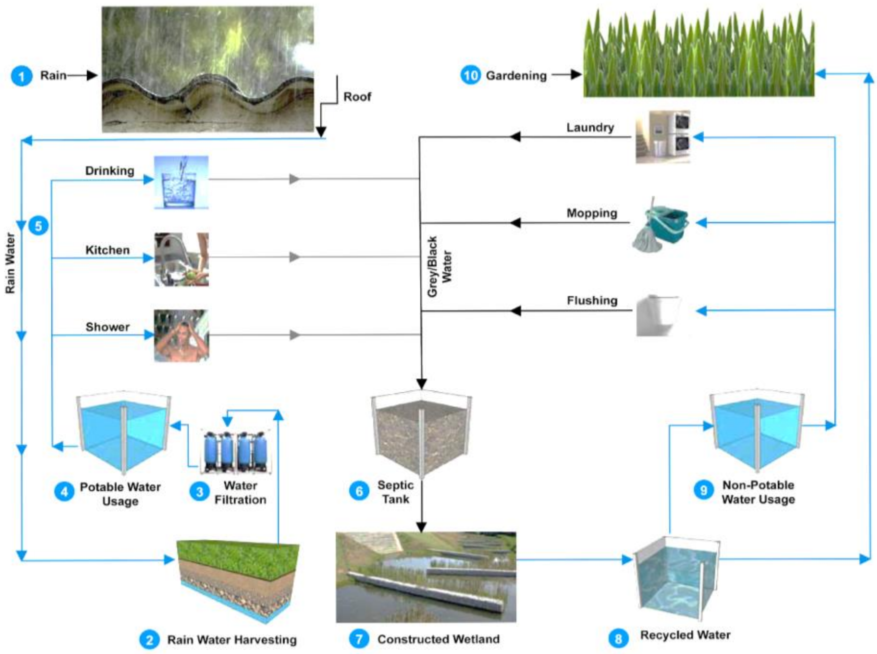
SUGGESTIONS:

No water meter has been installed in the building. Hence this credit is not applicable.

To obtain this credit, it is necessary to install a water meter at -

1. Water consumption through bore well
2. Municipal water supply
3. Daily Water consumption
4. Supply for flushing water
5. Supply for irrigation requirements

- Water Meter at Municipal water supply for potable water and near flushing systems for non potable water.
- Integrated intelligent water energy metering systems can be used



Efficient Water management system can be adopted