

# CASE STUDY ON CII GODREJ GREEN BUSINESS CENTER

DESIGN STUDIO - 2

SUBMITTED BY  
BHANU PALLAVI  
RAMYA GEETIKA  
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GROUP HOUSING



GITAM SCHOOL OF ARCHITECTURE

**INTRODUCTION****CII-GREEN BUSINESS CENTRE**

Location – Hyderabad, Telangana

Promoter – Confederation of Indian Industry (CII)

Site Area- 4.5 Acres;

Built up area – 20,000 SF

Architect – Ar. Karan Grover, KGA

Landscape Architect – Prof. M. Shaheer

MEP Consultant – Dr. P.C. Jain & Mr. Ashish Rakheja, AECOM India

Commissioning Authority – C R Narayana Rao Architects & Engineers

Civil Contractor – Consolidated Construction Limited

The CII – Sohrabji Godrej Green Business Centre in Hyderabad is the first LEED Platinum rated building in India. It offers advisory services to the industry in the areas of: green buildings, energy efficiency, water management, environmental management, renewable energy, green business incubation, and climate change activities.

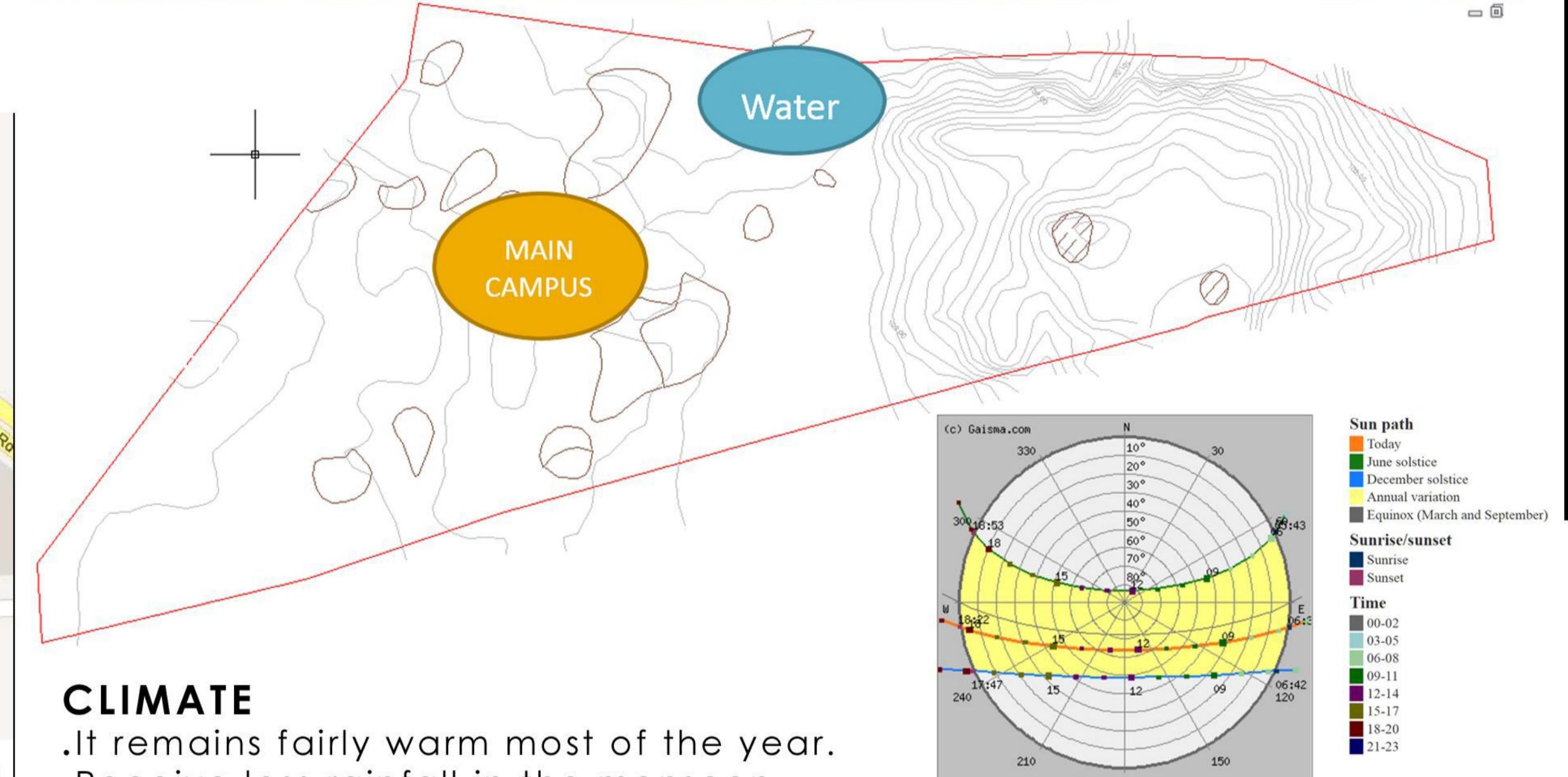
**Key Green Features –**

Renewable Energy: Solar PV systems

Indoor Air Quality: Air Quality Monitoring, high efficiency HVAC system, high performance glass system using wind towers.

Roof gardens and Rain water harvesting etc.

The extensive landscape is home to 600 varieties of trees, most of which are native and adaptive to local climatic conditions.

**SITE ZONING AND LOCATION****CLIMATE RESPONSE DESIGN****THE FIRST LEED PLATINUM RATED BUILDING IN INDIA – CII GODREJ GBC****CLIMATE**

.It remains fairly warm most of the year.

.Receive less rainfall in the monsoon.

.Temperatures come down in the months of December and January and the nights become quite cool in and around the Hyderabad city.

.During the summer months, the mercury goes as high as 42° C while in winters the minimum temperature may come down to as low as 12° C.

**TEMPERATURE**

During the summer months, temperature goes as high as 42° C while in winters the minimum temperature may come down to as low as 12° C.

**Humidity** in the morning is very high exceeding 80 per cent from July to September.

In the dry months of March, April and May, humidity is generally low with an average of 25 to 30 per cent and decreases to 20 per cent at individual stations.

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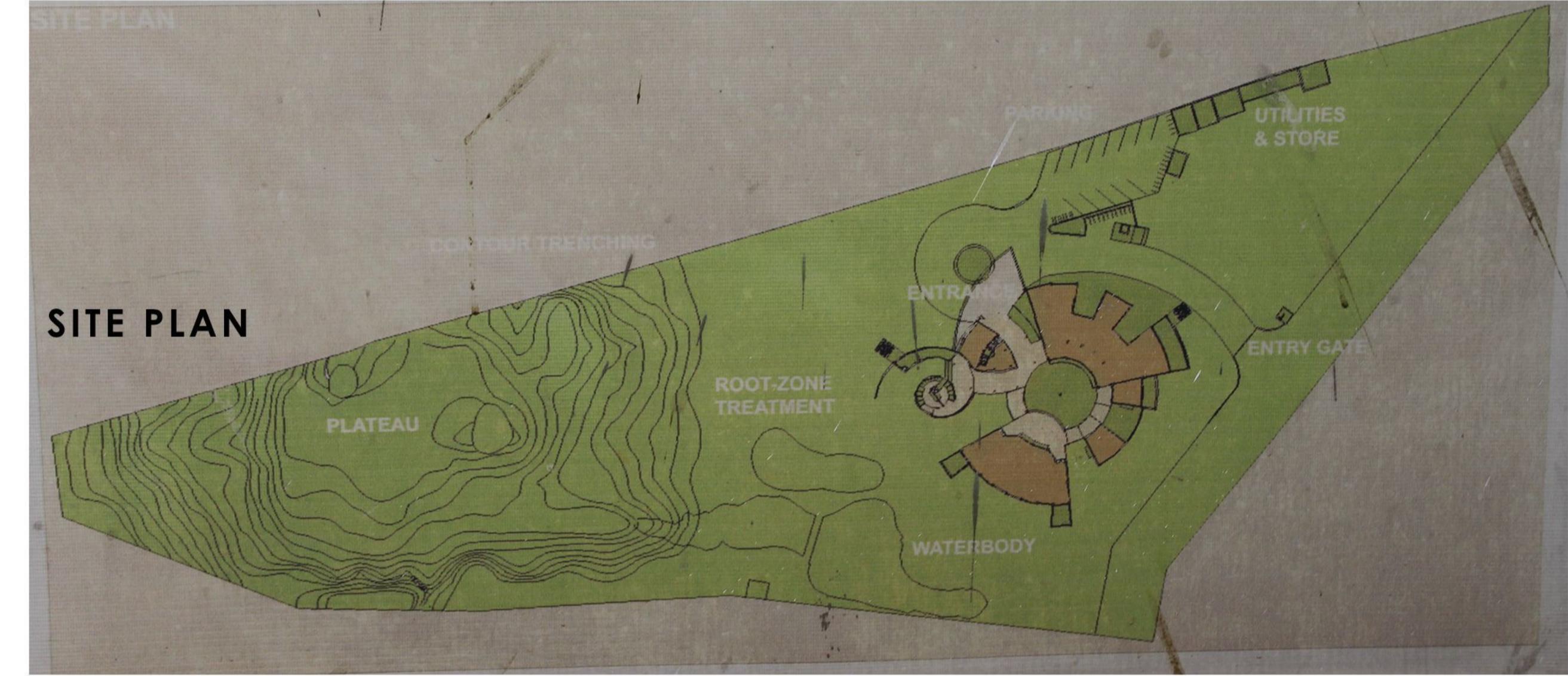
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## SITE SELECTION AND SITE PRESERVATION

### SITE SELECTION AND PLANNING

Site should be selected for the project considering the safety of occupants and should not disturb the ecosystem. Project is located in the Hi-Tech City of Hyderabad and has all the basic amenities nearby. Public Transport is very easily available at the distance of 100m from the location. Use of cycles and battery operated vehicles (non-fossil fuel vehicles) is promoted and there is a battery charging facility available at the site. A different parking is available for the people using cycles and battery operated vehicles.



### SITE PRESERVATION

More than 70% of the existing landscape and contour was retained on the surface. Site Preservation is very important to minimise the site damage and associated negative environmental impacts.



EXISTING TREES CONTOURS AND PLATEAU ARE PRESERVED

## EROSION & SEDIMENTATION CONTROL MEASURES

Prevention of soil erosion is achieved by contour trenching, planting of vegetation. The valuable topsoil has been retained. Impervious surfaces are kept to a minimum, so as to prevent erosion by water run-off.

Sedimentation chambers and grass swales ensure that the storm water run-off does not carry away the soil beyond the site limits.



### SOIL EROSION CONTROL AND PRESERVATION

Honeycomb trays are placed in the areas where loose soil is present or there are more chance of soil erosion. They trap the top layer of soil inside them preventing soil erosion and allowing them to be covered by turf.

Top layer of soil was stacked and stored at the time of construction and was again used for the growth of vegetation.



THE EXISTING ROCKS ARE LEFT PRESERVED ON SITE

Water is diverted to sediment basins to control the sedimentation and hence reduce erosion.



WATER DIVERTED TO SEDIMENT BASINS



### PRESERVATION AND TRANSPLANTATION OF TREES

Most of the natural vegetation was tried to preserve and many new species are now planted at the site. There are more than 160 species of vegetation available on site. Use of native species is promoted as they have more adaptability to the climate and have less water requirement.



RETAINED NATURAL LANDSCAPE

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**RENEWABLE ENERGY**

20% of the building energy requirements are catered to by solar photovoltaics. Placed appropriately on the roof facing South and West to capture maximum heat gain. The solar PV has an installed capacity of 23.5 kW.



Solar panels on the terrace



Solar & wind hybrid system



Superfan in the work space

**SUPER FAN**

Traditional fans are replaced with remote operated superfan which claims to saves more than 50% energy.

**JAALI WALL**

Jaali wall allows diffused light and filtered cool breeze into the complex. This keeps the space cool without much use of A/C cooler etc.,

**MEASURABLE RESULTS****ENERGY SAVINGS**

55% reduction, with ASHRAE 90.1 as the baseline

120,000 kWh / year

**REDUCTION IN CO<sub>2</sub> EMISSIONS**

~ 100 tons / year  
(building is functional since January 2004)

**WATER SAVINGS**

35% reduction in potable water consumption

**ENVELOPE THERMAL TRANSFER VALUE**

U-value of double glazing: 1.70 Watt/m<sup>2</sup> °K

U-value of solid wall: 0.57 Watt/m<sup>2</sup> °K

U-value of roof: 0.294 Watt/m<sup>2</sup> °K

**AIR CONDITIONING SYSTEM EFFICIENCY**

0.8 kW/ton (water-cooled scroll chiller system with CoP: 4.23 at ARI condition)

Installed two 25 TR chillers

**ENERGY EFFICIENCY INDEX (EEI)**

84 kWh/m<sup>2</sup>/year

**WIND TOWER**

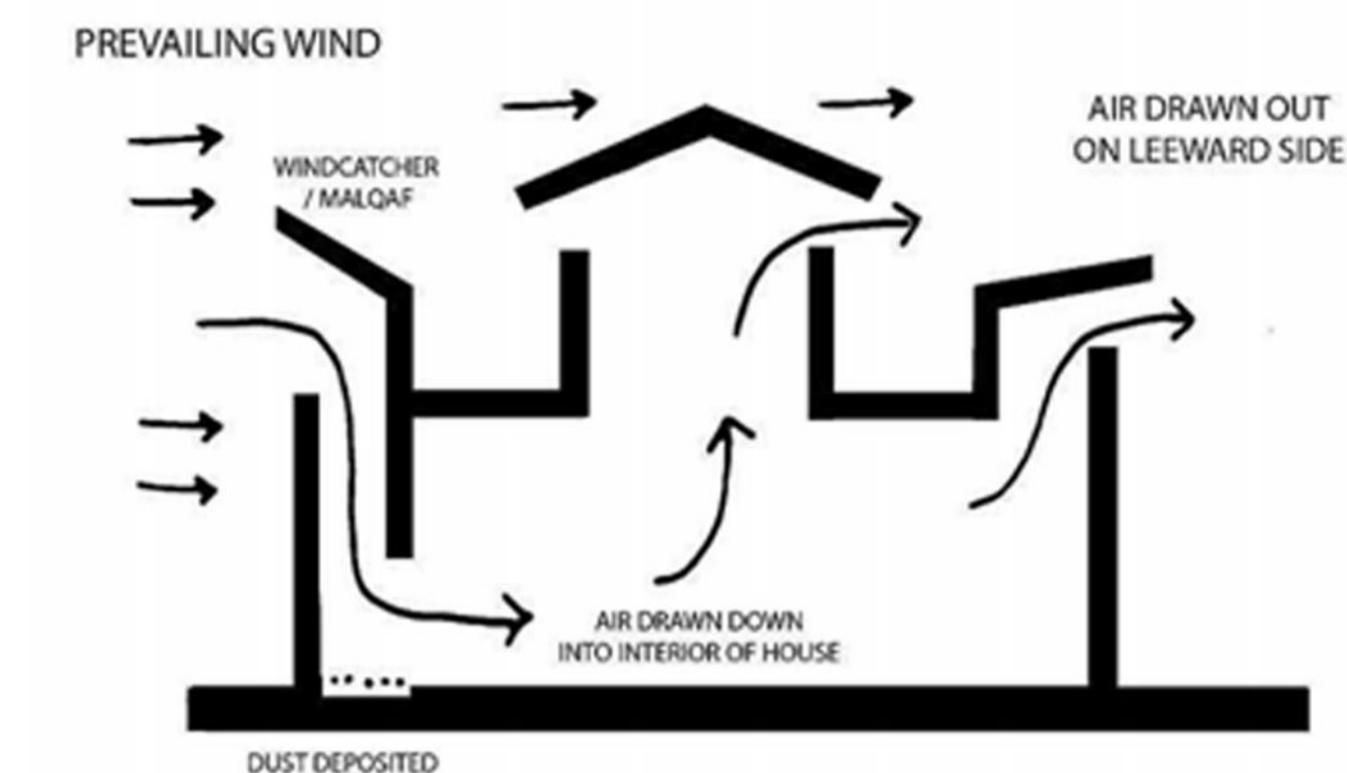
Energy savings are achieved by the GBCs two wind towers. Air, cooled by upto 8C, is supplied to the AHUs, substantially reducing the load on the air conditioning system.



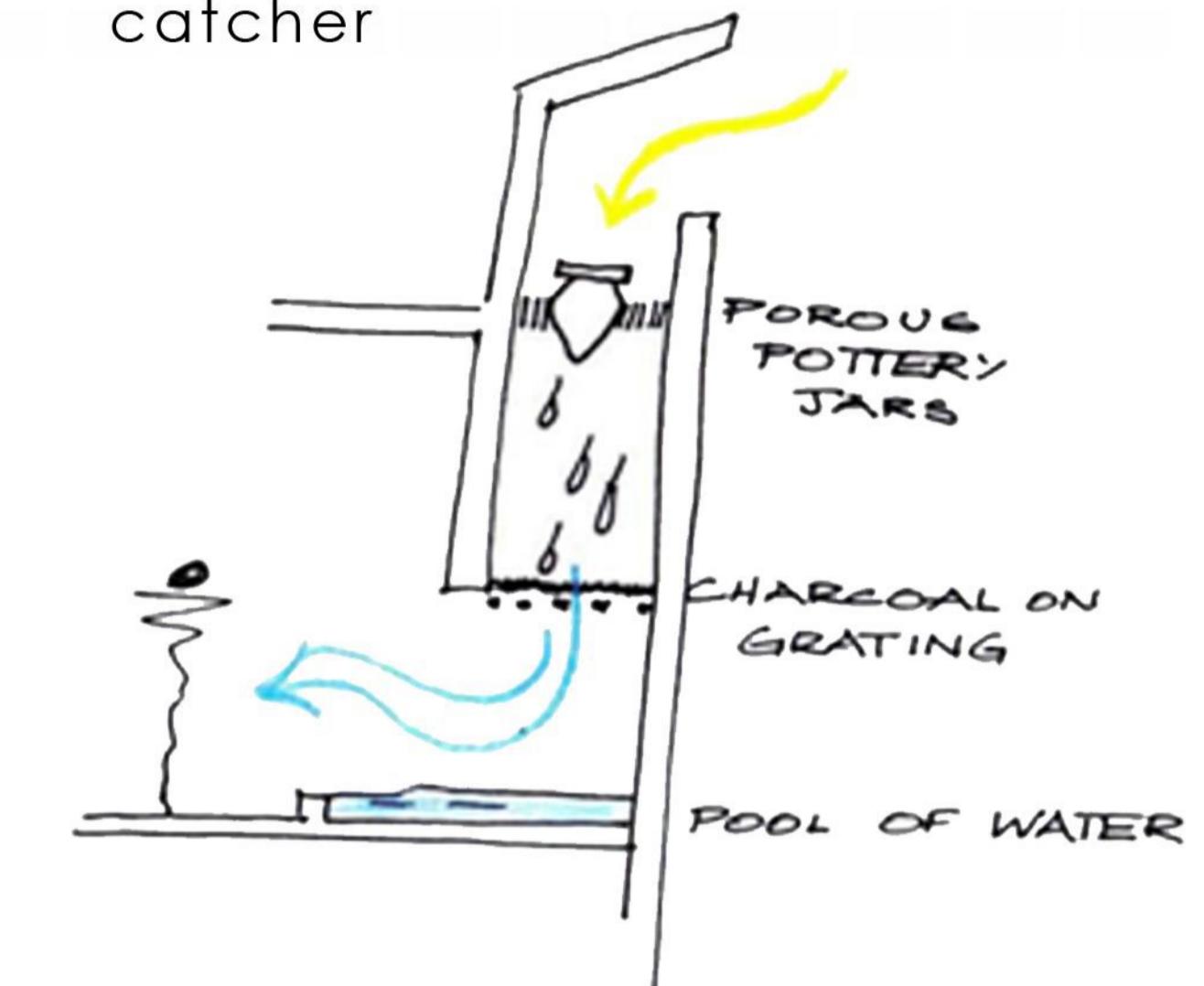
Wind catcher at CII Godrej



Exhaust fan at the bottom of the wind catcher



Working concept of a wind catcher



Design of a traditional wind catcher used in Persia

**WORKING OF A WIND CATCHER**

The design of the wind catcher was influenced by the ones used in Persia, where in the incoming breeze is cooled when it passes over a pot dripping cool water.

**WIND CATCHER IN CII GODREJ**

The wind catcher which has slits on all 4 sides catches the wind. The tower is fitted with a sprinkler & water pipe. The tower has been constructed with fly ash bricks as they retain water or moisture. As the wind moves downward within the shaft, it cools down due to the effect of the continuous sprinkling of water. This air is then sent to the AHU units. Since the wind is pre cooled, it reduces the load and energy demand on the HVAC system.

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**ENERGY EFFICIENCY**

Extensive energy simulation exercises were undertaken to orient the building in such a way that minimizes the heat ingress while allowing natural daylight to penetrate abundantly. The building incorporates several world-class energy and environment friendly features, including solar PV systems, indoor air quality monitoring, a high efficiency HVAC system, a passive cooling system using wind towers, high performance glass, aesthetic roof gardens, rain water harvesting, root zone treatment system, etc. The extensive landscape is also home to varieties of trees, most of which are native and adaptive to local climatic conditions.

**ENERGY EFFICIENCY THROUGH BUILDING ENVELOPE****GREEN ROOF**

55% of roof area is covered by a green roof. This reduces heat gain into the building through the roof. As roof is the component of the building envelope which gets maximum heat gain increasing the dependence on air conditioners, a green roof reduces the load on these units.



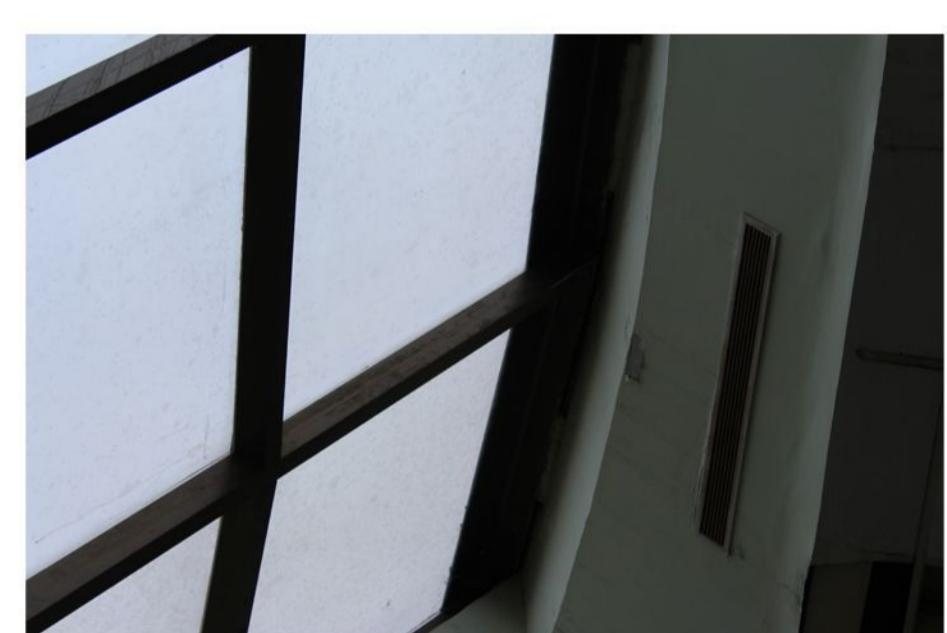
View showing features which lead to energy efficiency

**AERATED CONCRETE BRICKS FOR WALLS**

The use of aerated concrete blocks for facades reduces the load on air-conditioning by 15-20%. These bricks have better insulation properties when compared to conventional kiln burnt bricks.

**HIGH PERFORMANCE GLAZING**

High performance glass has been used to provide north lighting. This glass allows light while restricting heat to pass through. They eliminate the dependence on artificial lighting systems thus reducing energy consumption.

**FENESTRATIONS**

Double-glazed units with argon gas filling between the glass panes enhance the thermal properties. They reduce heat gain while allowing light to enter the building.



Open space for daylight and high performing glass



Day lighting windows separated from view windows, provide abundant day-lighting

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**BATTERY OPERATED VEHICLES**  
Use of battery operated vehicles is encouraged within the compex.

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# LANDSCAPE

## GROUND COVER

Unify groups of plants into a composition

Creates edges

Lead the eye to focal points, building entries

Can create lines of visual character overlapping with paving

Beneficial in stabilizing slopes, preventing erosion

providing privacy and security

by protecting the landscape indirectly wthey are even protecting the other organisms dependent on these plants.



Bioswales



Natural mulching used to protect the top soil from erosion

## TYPES OF LANDSCAPES IN CII

- > Butterfly gardens
- > Medicinal garden
- > Fruits garden
- > Vegetable garden
- > Naturally existing plants and tress protected as a forest .
- > More than 100 varities of butterfly species vist this garden .
- > They even provide living for honey-bees.
- > Many varities of birds visit these gardens daily.



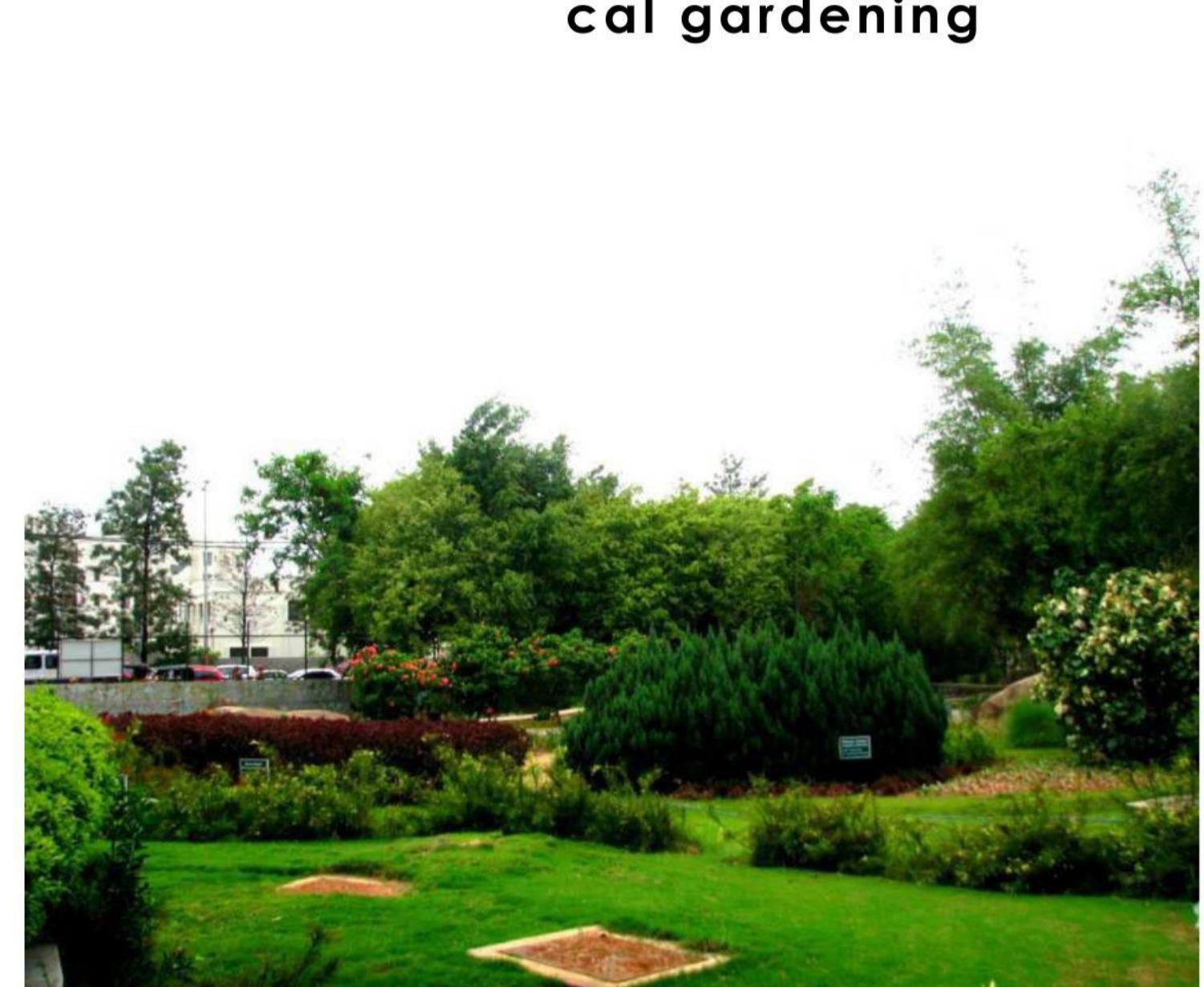
Bio degradable plastic grass crates used to hold grass- eas removal and maintenance



various species of plants used in vertical gardening



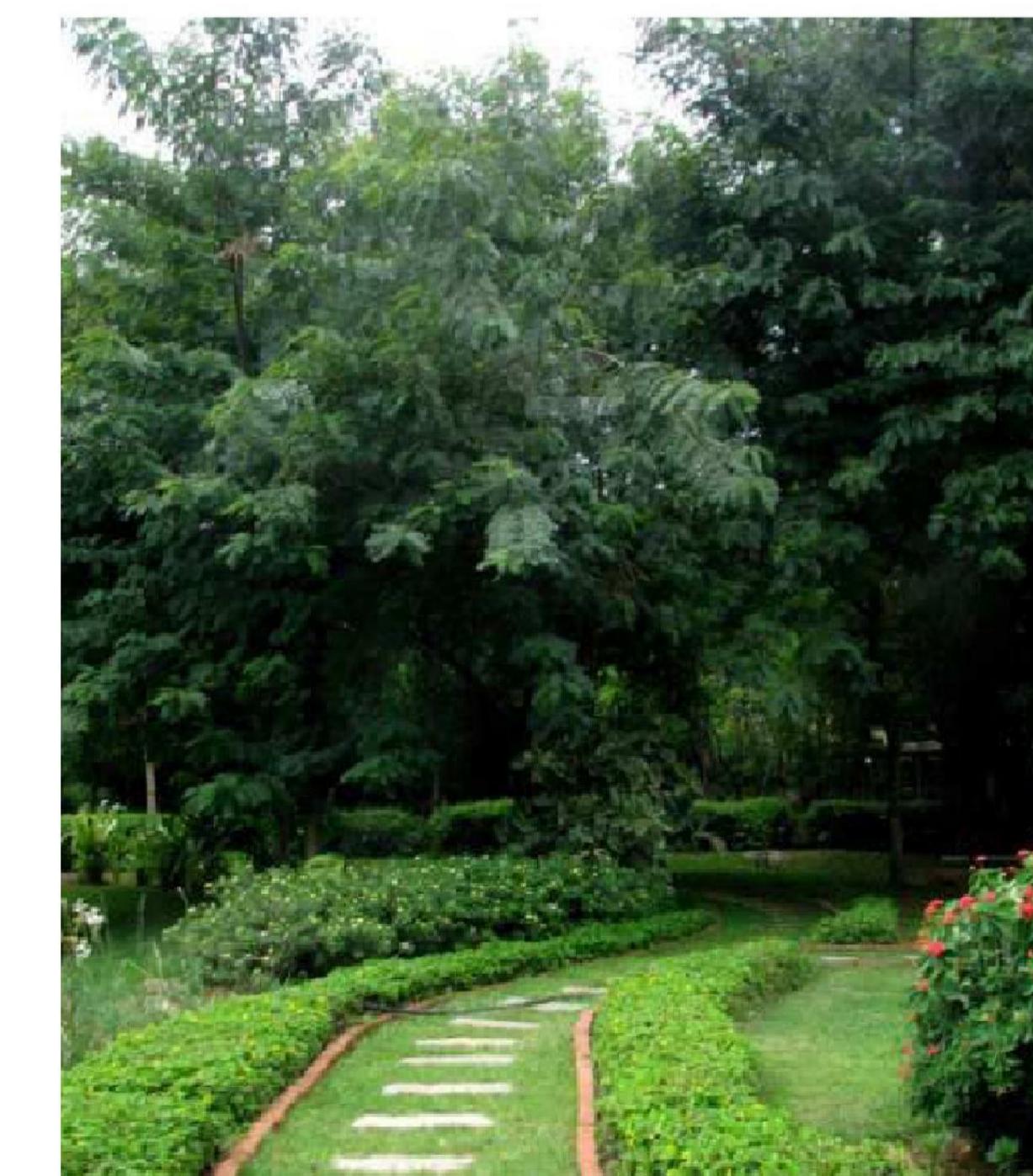
Existing features in the landform have been integrated into the design without causing much harm to the local ecosystem.



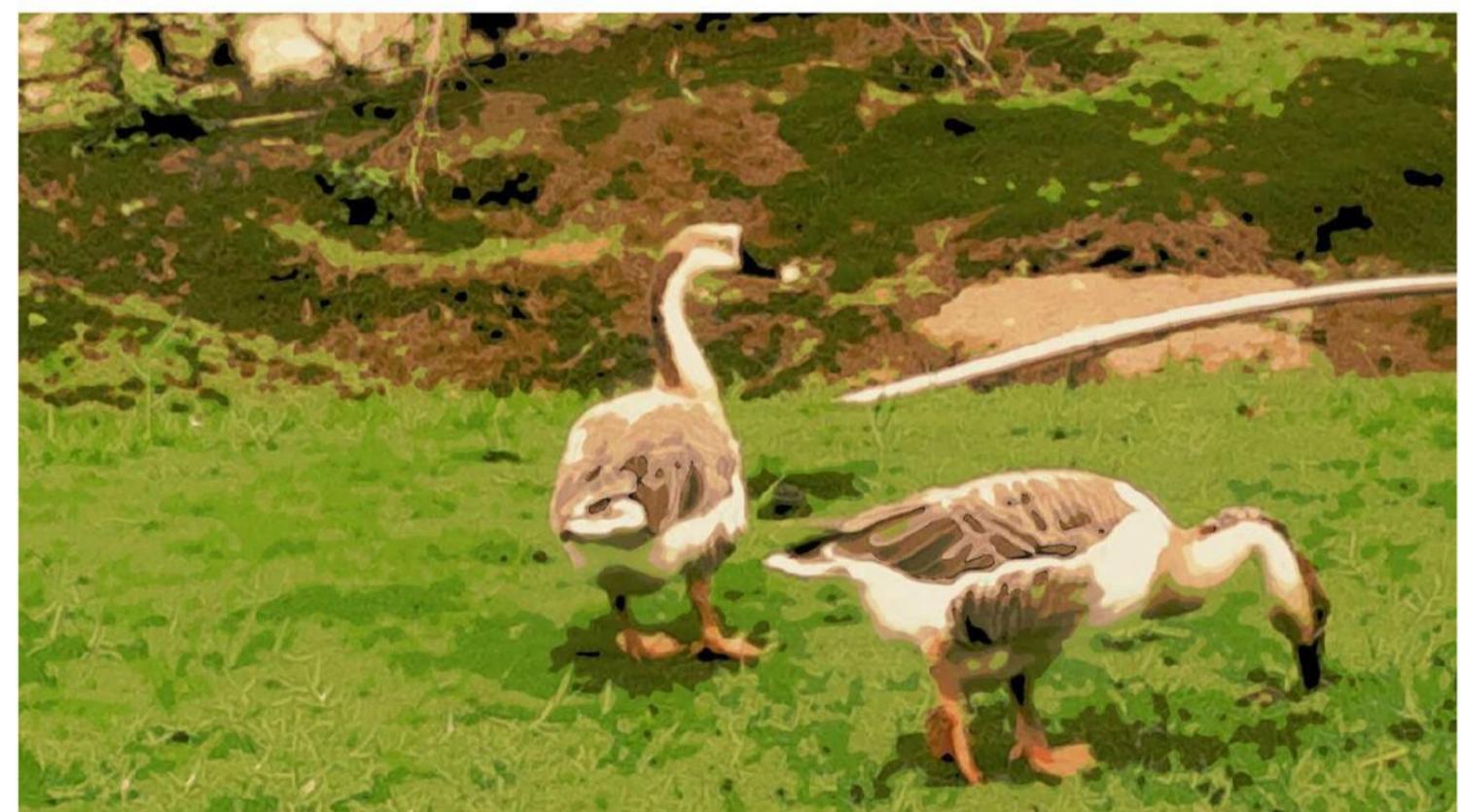
Tree trunks and columns lined with gravel stone attention to detail aesthtics



Large expanse of ground cover used to create focus on Local craftwork as landscape elements



Defined pathways in landscape to reduce disturbance to plant species



A Responsibility Towards The Environment Creating Awareness – About green architecture About the building About construction And material, flora

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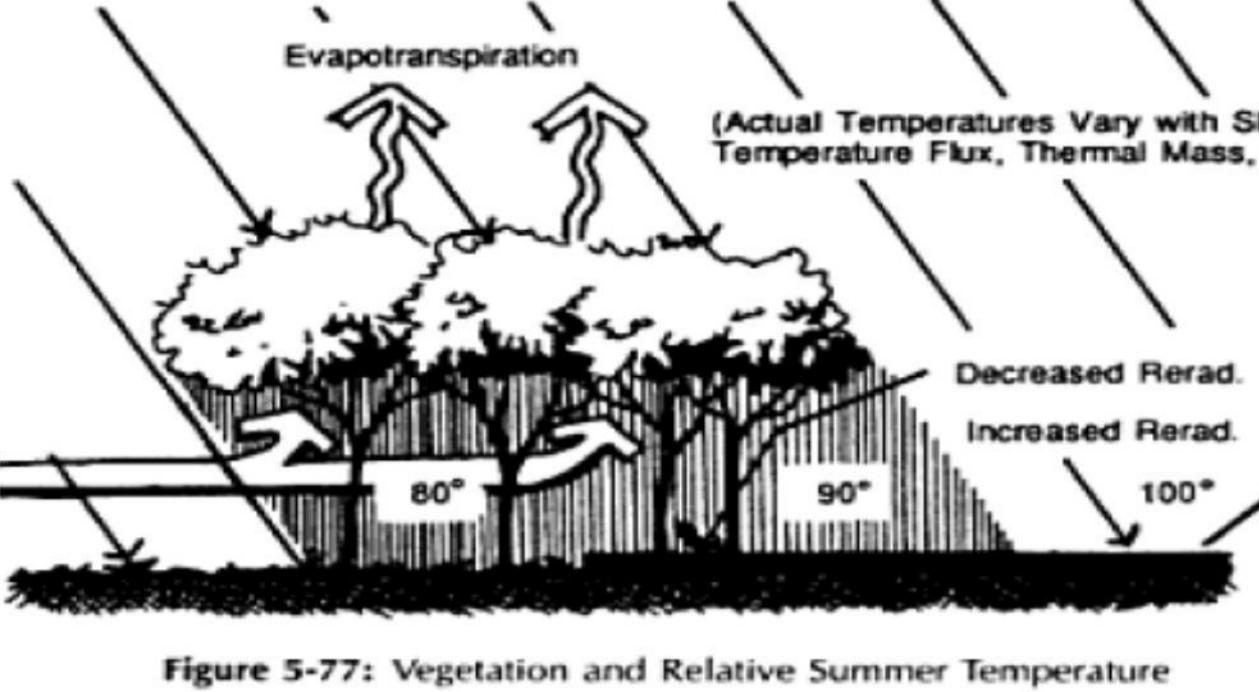
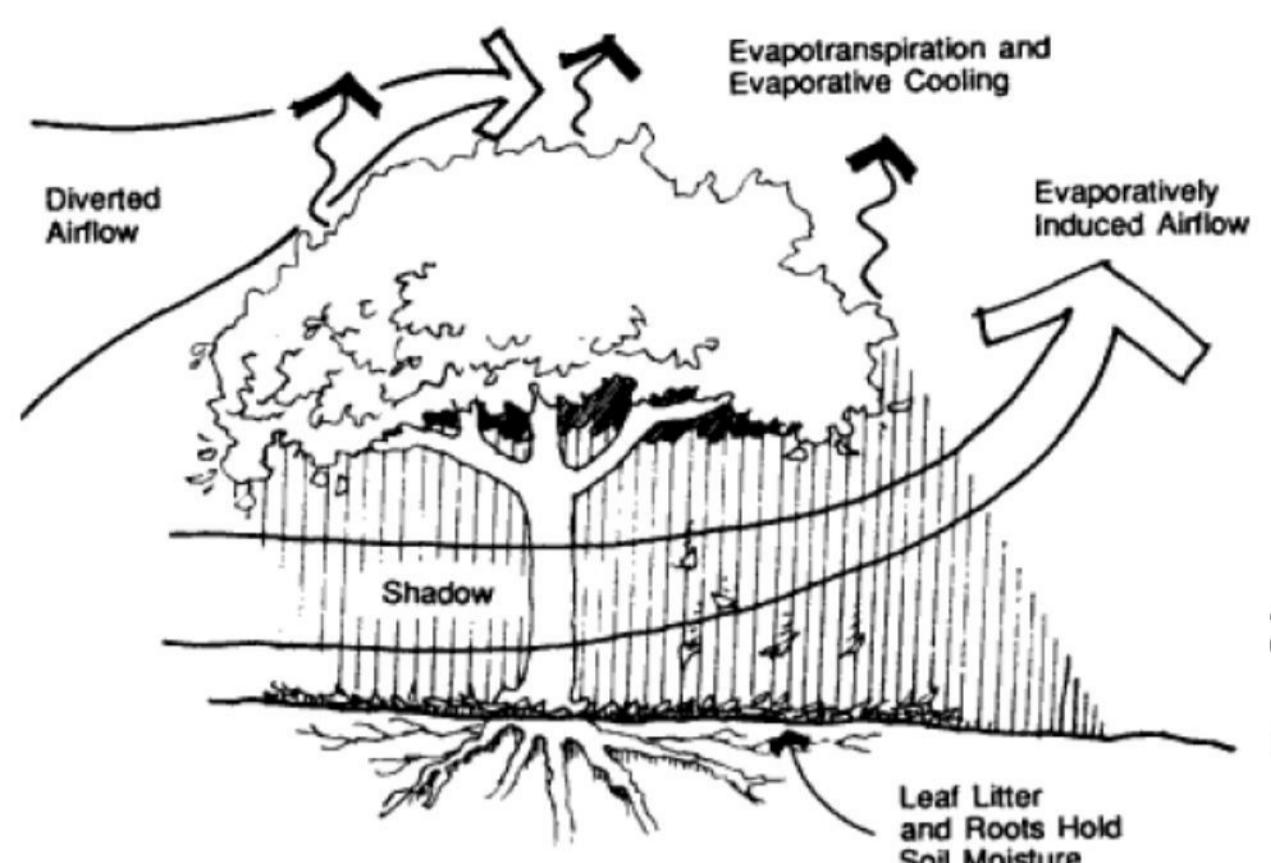
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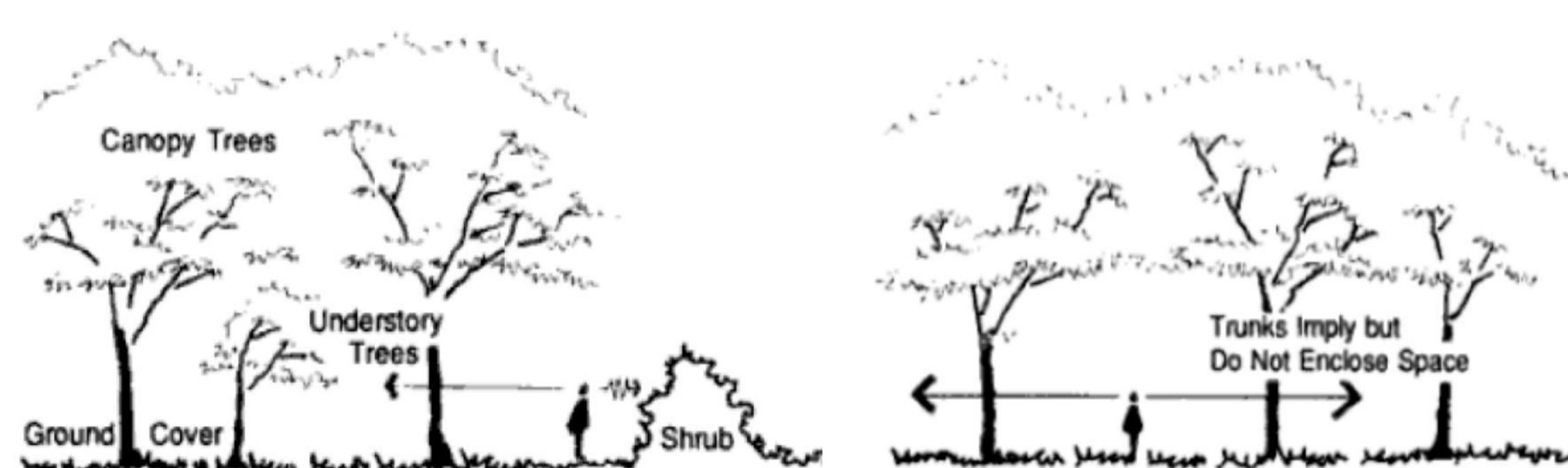
# LANDSCAPE



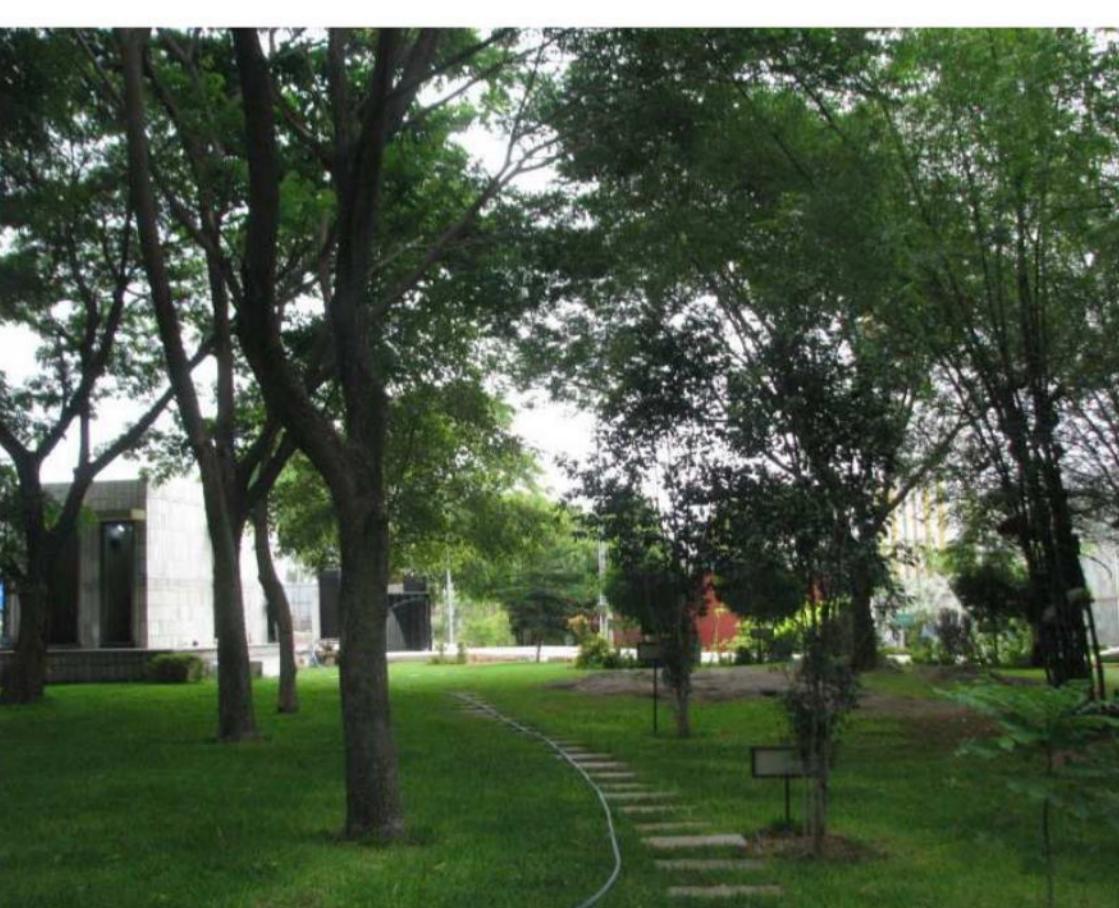
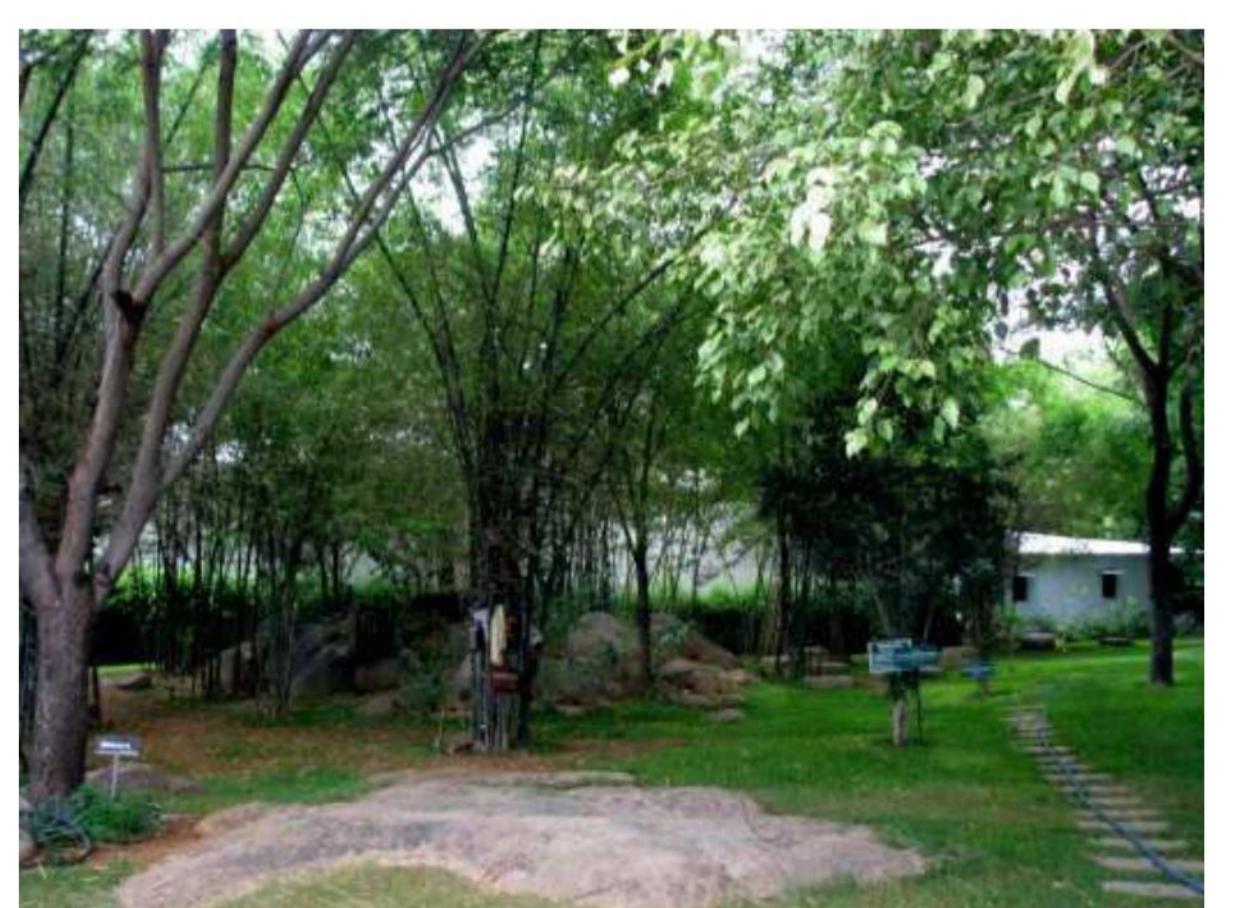
**Green cover acts as modifier of micro climate**



**Influences microclimate and hence human comfort**



**Landscaping by sequential arrangement of different sizes of plants for various effects**

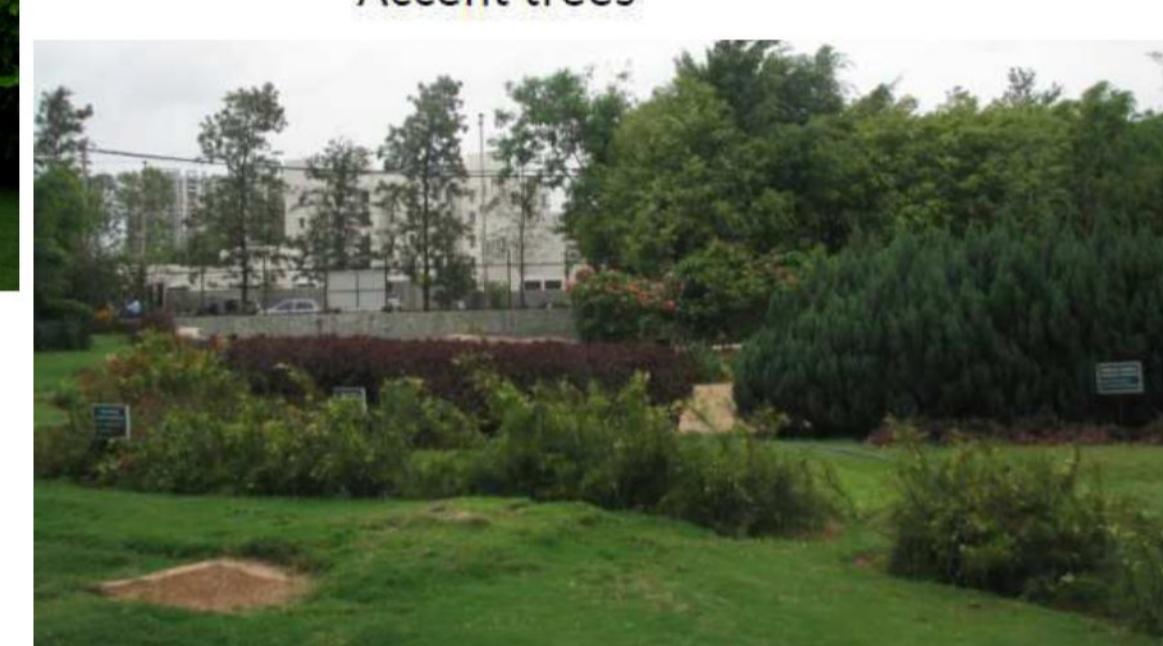
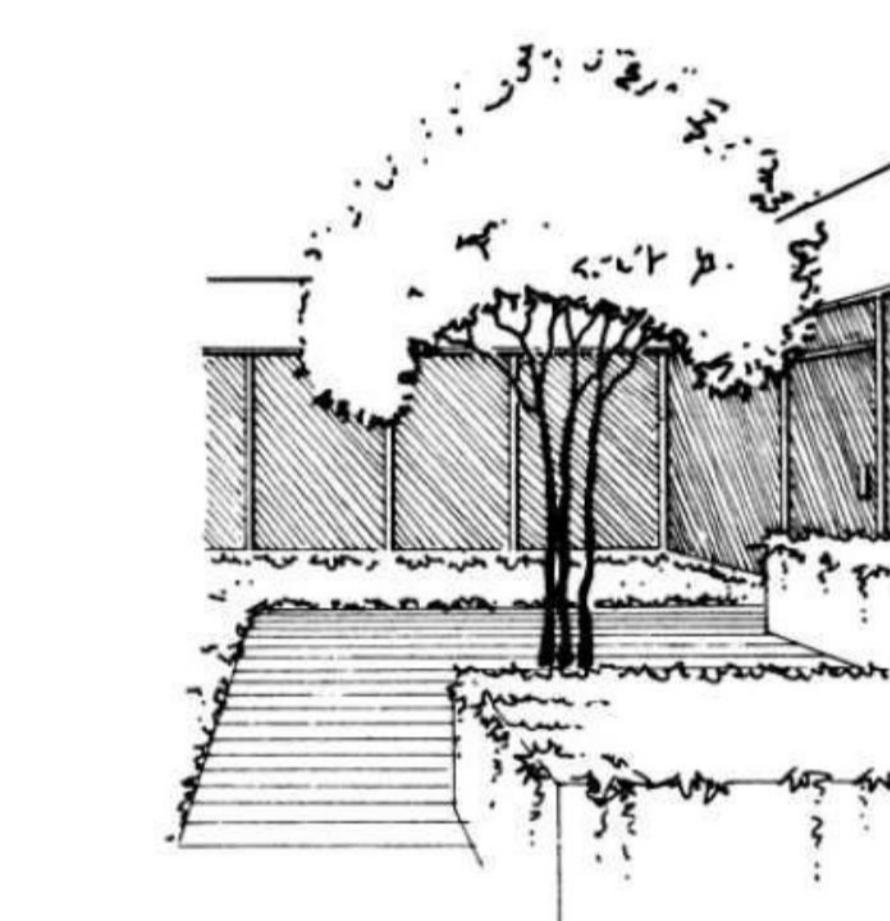
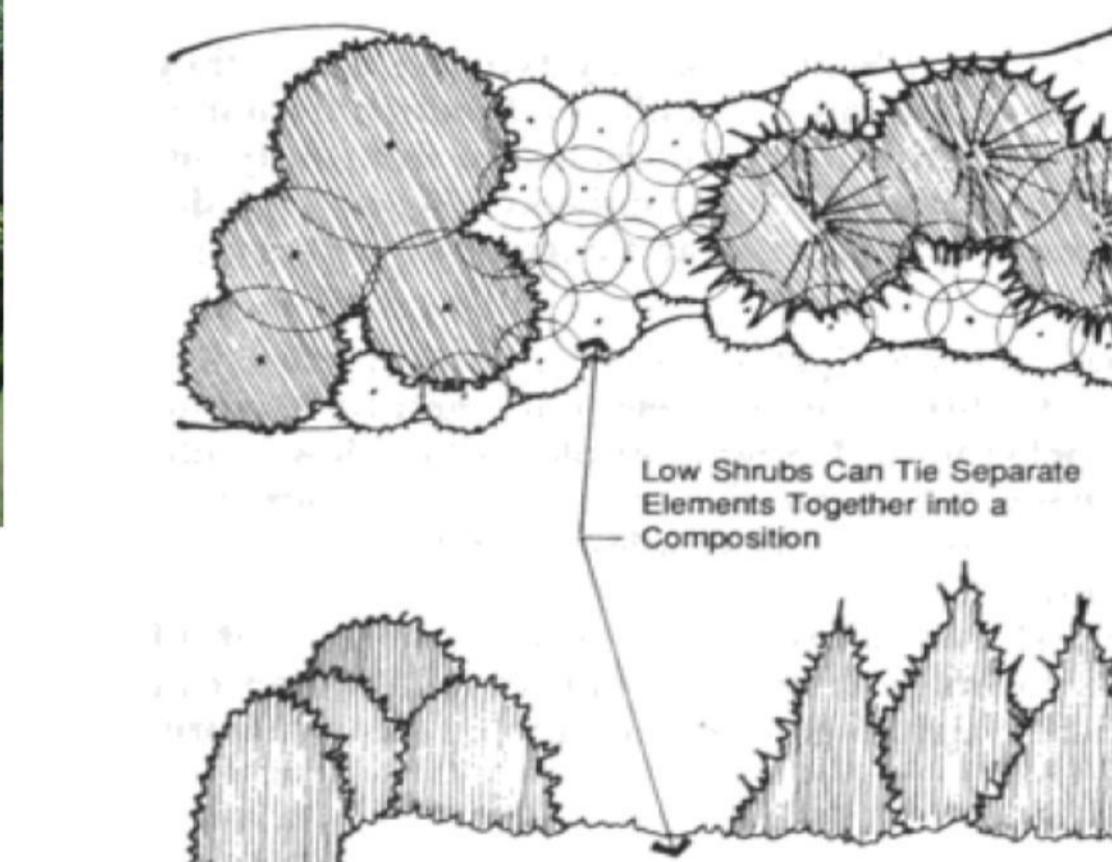


**Suitable for small, intimate courtyards**

**Provide colour, shade without overpowering the space**

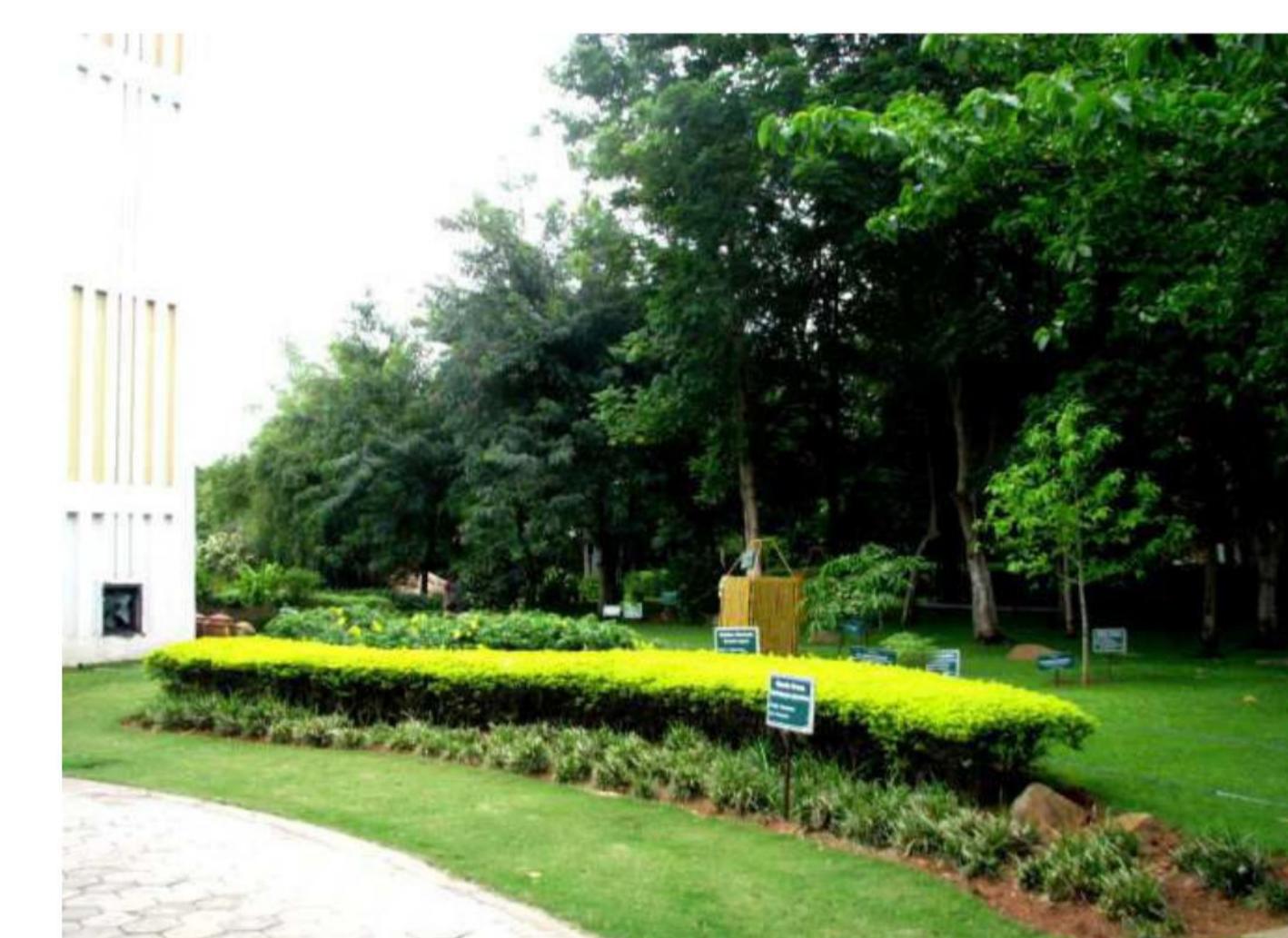
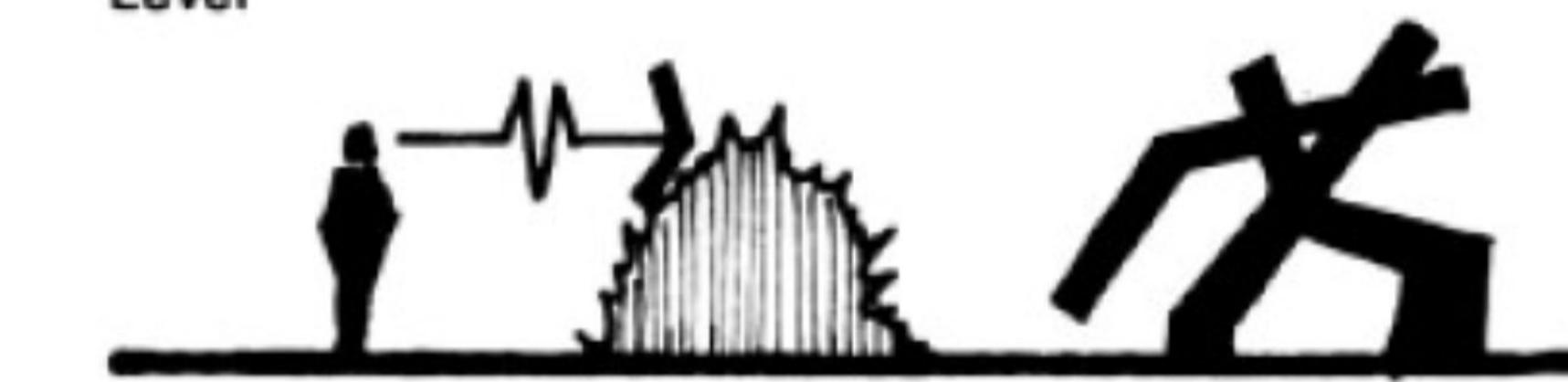
**Used as accent plants or focal plants**

**Are effective in screening mid or low angle sun**



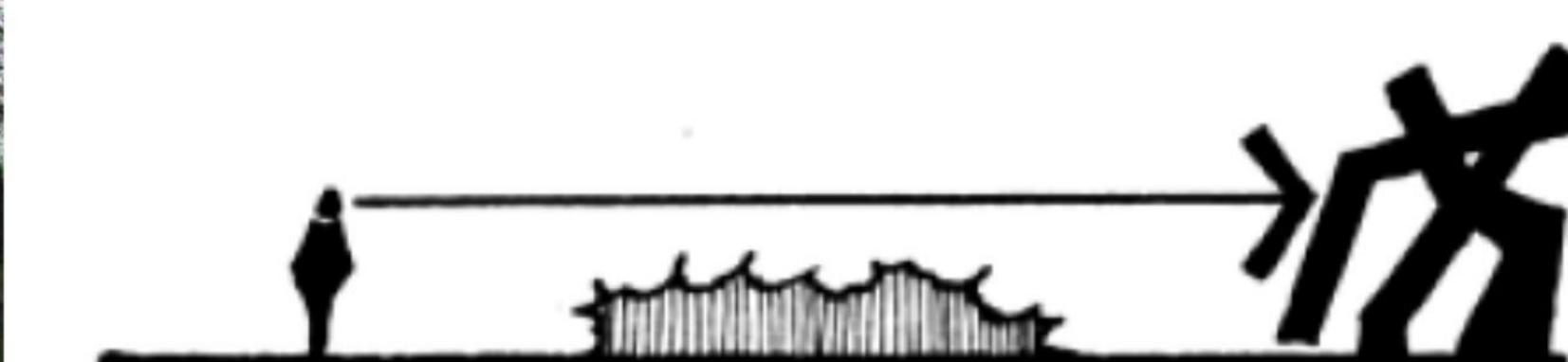
**Shrubs can effectively unify a composition**

**Shrubs Can Cause Tension  
If "Topping-out" at Eye Level**



**Intermediate shrubs and enclosure**

**Low Shrubs Separate Space but Do Not Block Vision**



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# LANDSCAPE

## UNIQUE PLANT SPECIES



**GOLDEN BAMBOO**



**CORAL JASMINE**  
*NYCHTHANTHES ARBORTISTIS*



**LAGENARIA SICERARIA**  
**BOTTLE GOURD OR**  
**CALABASH**



**BASIL**  
*OCIMUM BASILICUM*



**MAGNOLIA CHAMPACA**  
**CHAMPA**



**CORAL FLOWER**



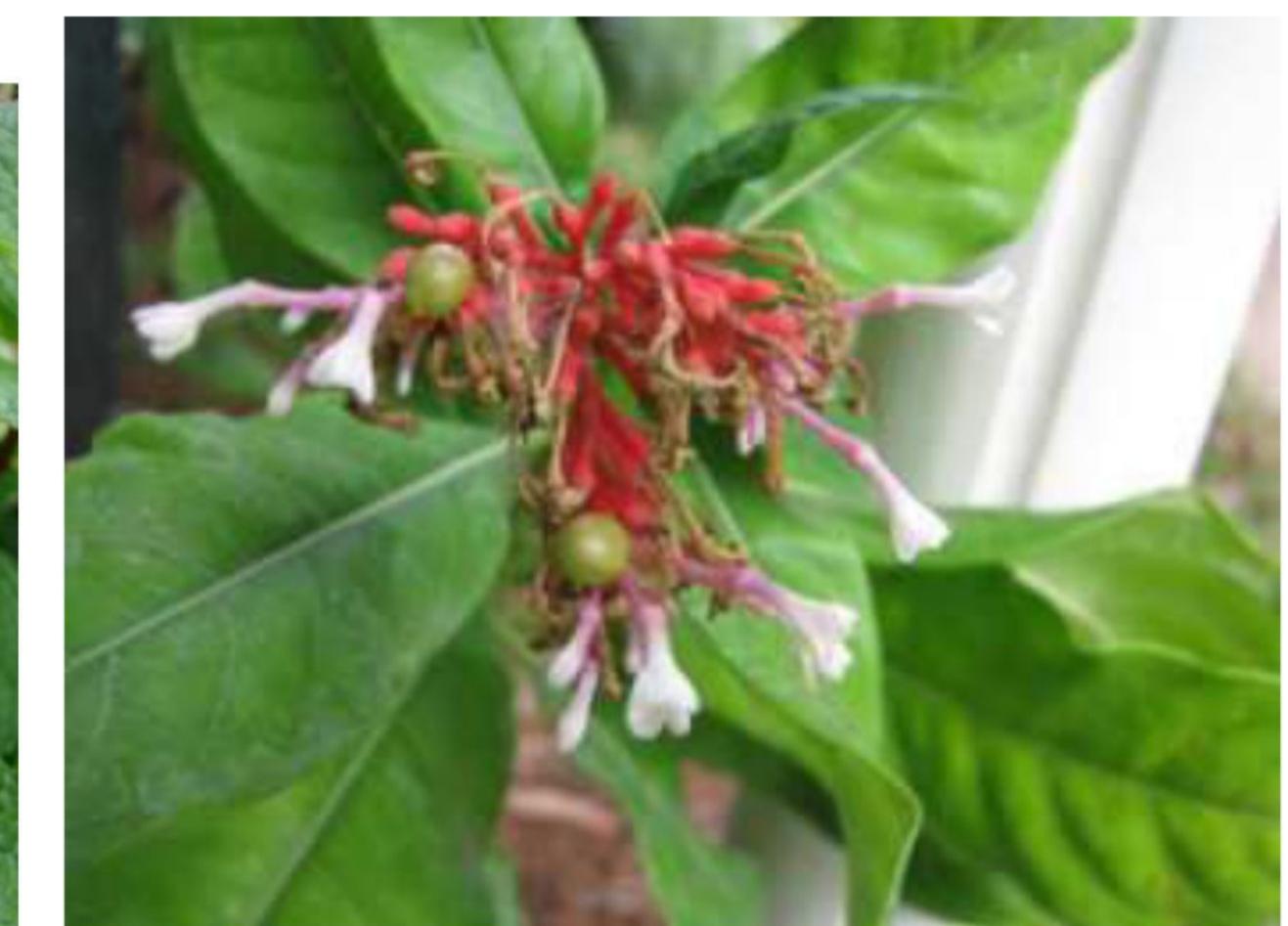
**CROSSANDRA**



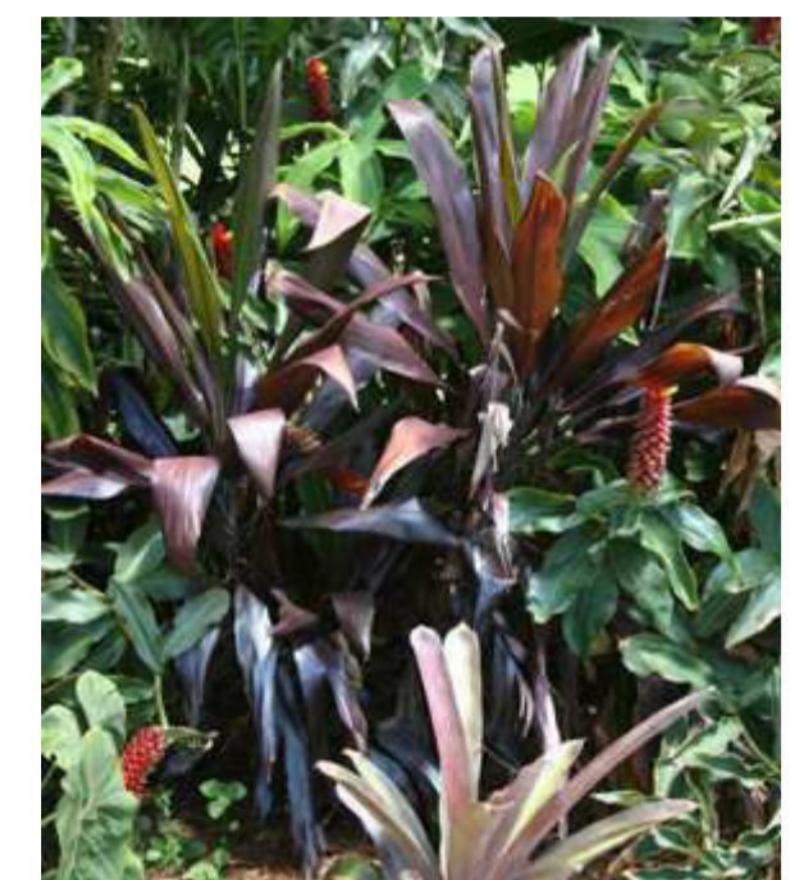
**MARIGOLD**



**SPEAR MINT**



**SARPAGANDHA**  
*RAUVOLFIA SERPENTINA*



**BLACK MAGIC PLANT**



**HIBISCUS**



**LIPSTICK PLANT**



**MIMOSA PUDICA**  
**THE SENSITIVE PLANT/ TOUCH-ME-NOT**



**RUFFLED FAN PALM**



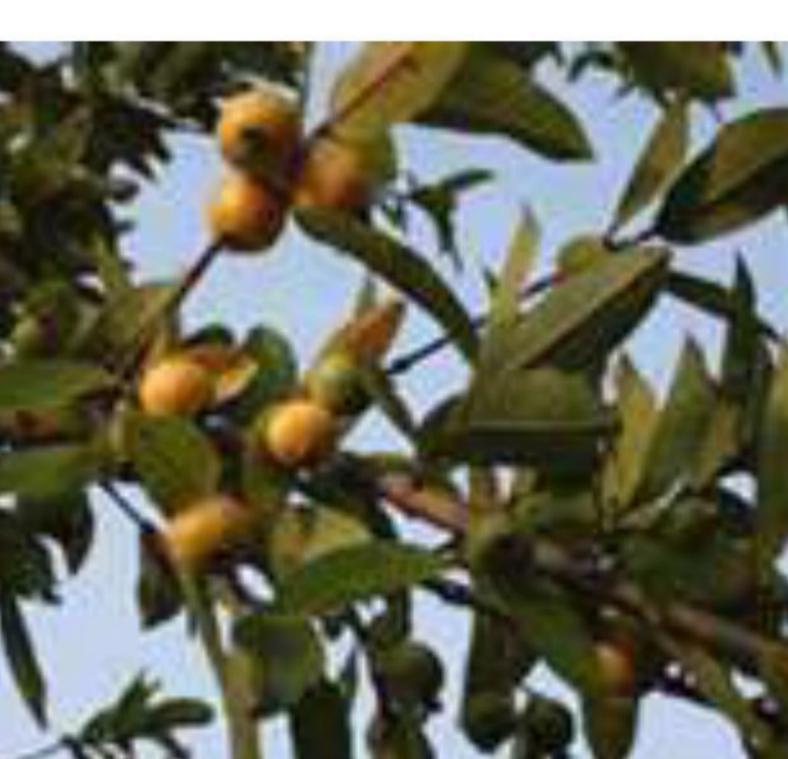
**CANNA**



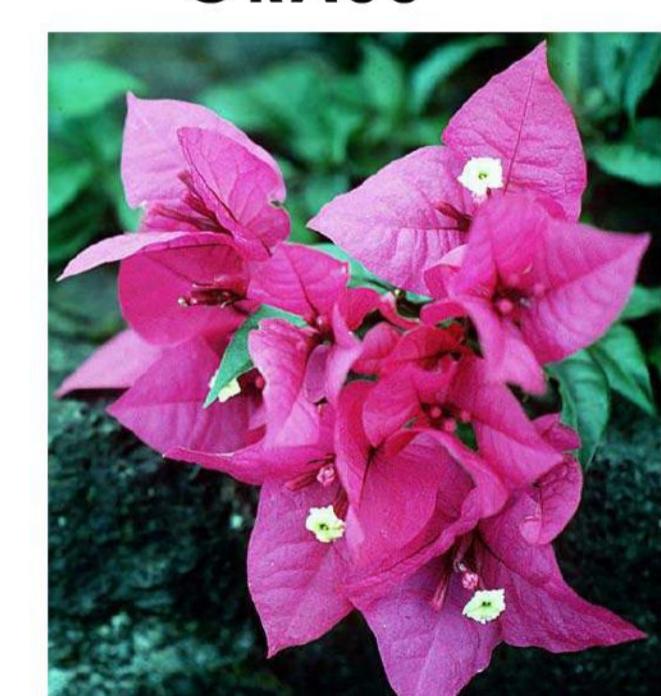
**SCREW PALM**



**MONDO GRASS**



**GUAVA**



**BOUGAINVILLEA**

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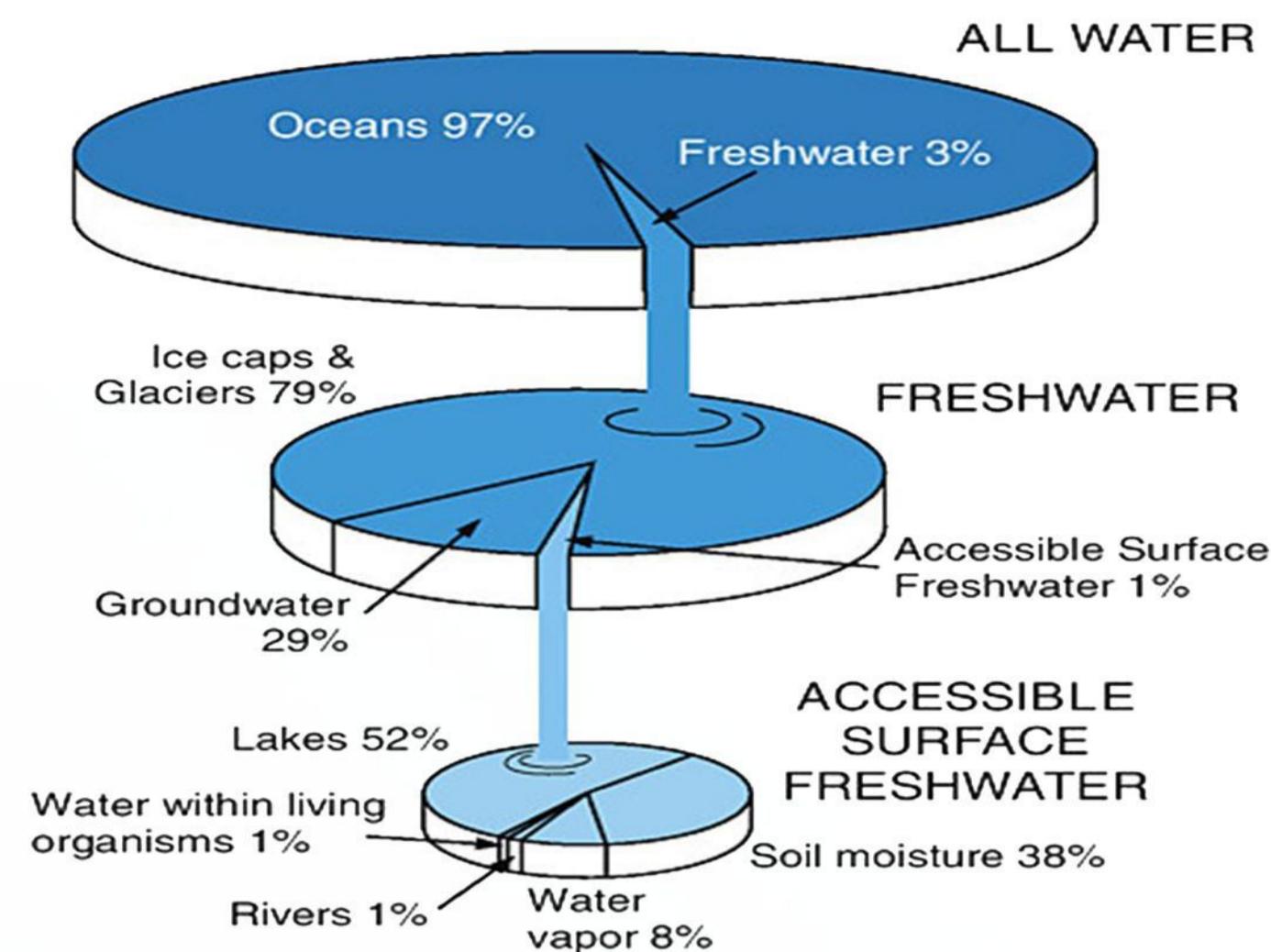
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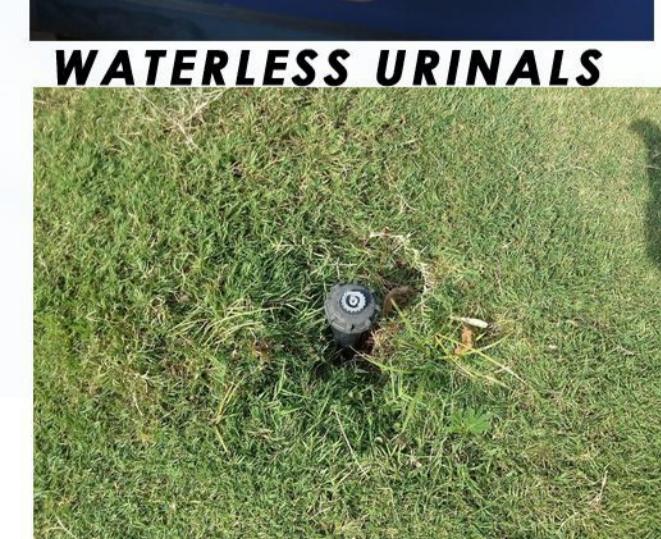
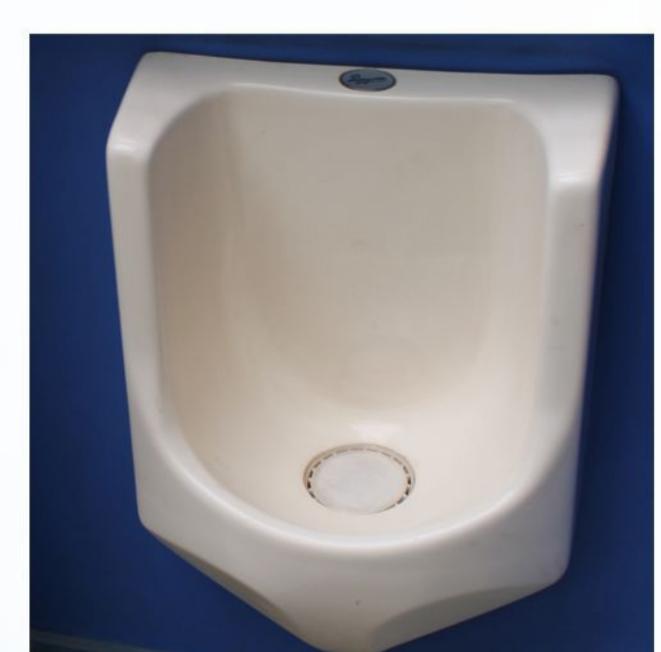
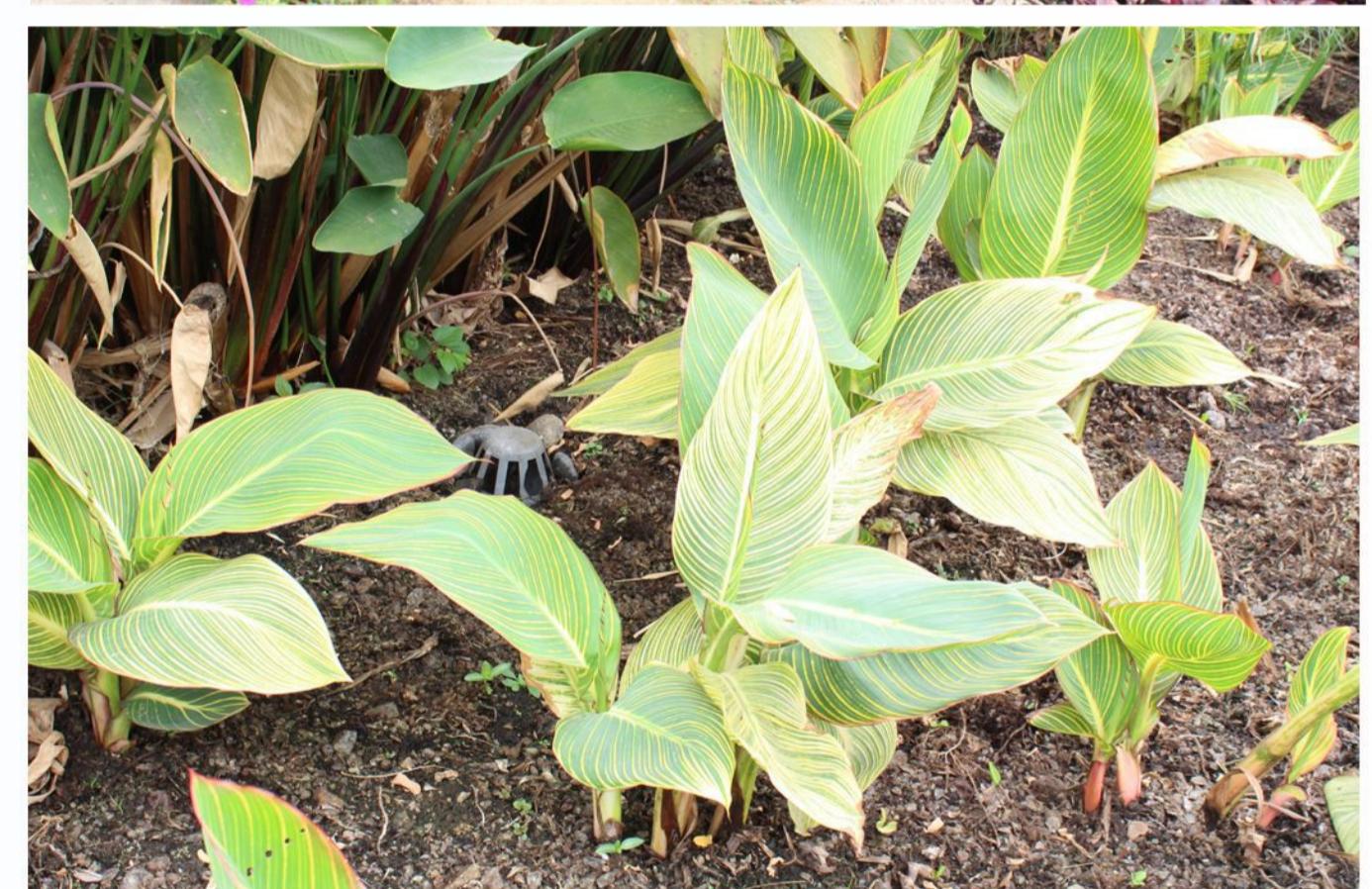


**WATER CONSERVATION**

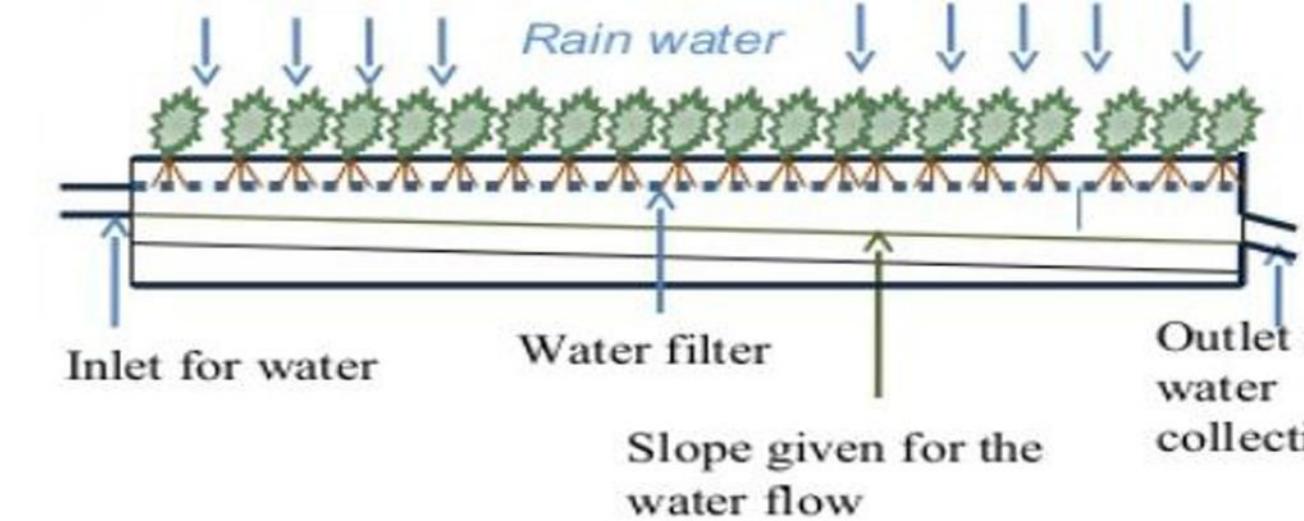
**WATER IS THE DRIVING FORCE OF ALL NATURE...**  
LEONARDO DA VINCI



Source: Wei Miao, colorado.edu



AERATOR USED

**WATER....**

Less than 1% water on earth can be used by humans which is free from salts and is clean. Survival without water is impossible and it demands to be conserved.

Approach used to conserve water

- Reduce – Reduce the consumption of water and wastage
- Recycle – Recycle as much water as possible
- Recharge – Recharge ground water for future purpose

Water bodies on the site are used for rain water harvesting. All the buildings and project is designed to harvest most of the rain water. All the pipelines from the roof are well channeled to the rain water harvesting pond.



RAIN WATER HARVESTING POND

**PHYTOREMEDIATION**

Water from the input tank is pumped to the roots of plants. Plants grows on a series of pebbles, gravels, stones and rocks so that their roots can penetrate deep into the ground. A system of pipeline is laid inside the layers through which the water is transferred. This plants treat the water which is then transferred to polishing pond where different species grow. The output water is odour free and suitable for flushing and irrigation purpose. Water is tested quarterly for proper monitoring.

**SYSTEMS INSTALLED IN THE SITE**

Drip irrigation is used for the plants and sprinkler system is installed for the turf area. Native species and drought tolerant species are preferred over foreign species as they are have more adaptability to the environmental conditions and they require less amount of water for their growth. Soil moisture sensors are installed which sense the moisture present in the soil and automatically shut-off the water supply.

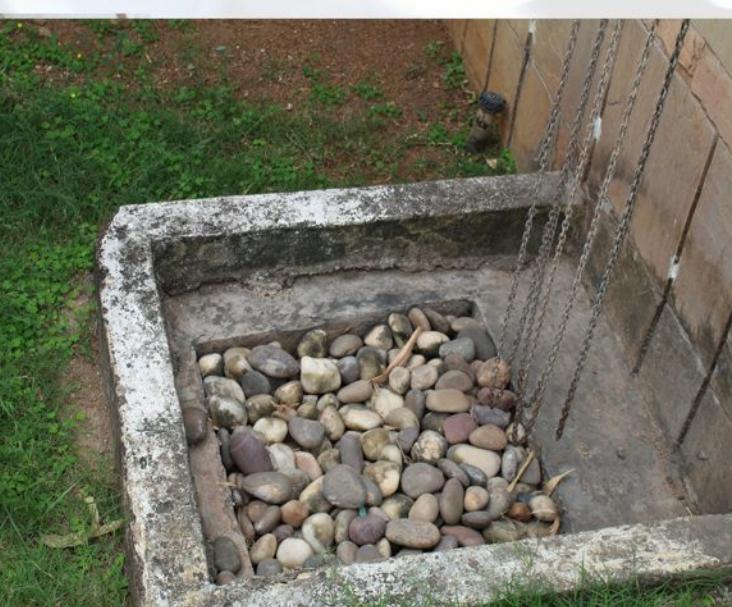
**WASTE WATER TREATMENT AND REUSE**

100% waste water is treated at the site using Phyto remediation technology. Phyto remediation is the direct use of living green plants for in situ, or in place for removal, degradation, or containment of contaminants in waste water. It can be used to treat any type of contaminant in environmental and climatic conditions.

**WORKING**

A combination of selected species are grown near the septic tank made for storage of waste water. Species used at the site -

- 1) Filtration Pond
  - a. Parakeet Flower
  - b. Alligator Flag
  - c. Papyrus
- 2) Polishing Pond
  - a. Indian Shot
  - b. Powdery Thalia
  - c. Giant Taro



RAIN WATER HARVESTING PITS

**WATER SYSTEM**

- # Collect rainwater for external use for garden and cleaning.
- # Use Water conserving appliances including toilets, shower taps, dishwasher eg. use of low flow fixtures, water saving dual flush tanks.
- # Reduce irrigation and surface water runoff.

**HIGHLIGHTS**

- # Zero water discharge building.
- # System 35% reduction in portable use.
- # Low flow water fixtures.
- # Waterless Urinals
- # Use of Storm water & recycled water for irrigation.
- # Entire waster water in the building is treated biologically thruough a process called "Root Zone Treatment".

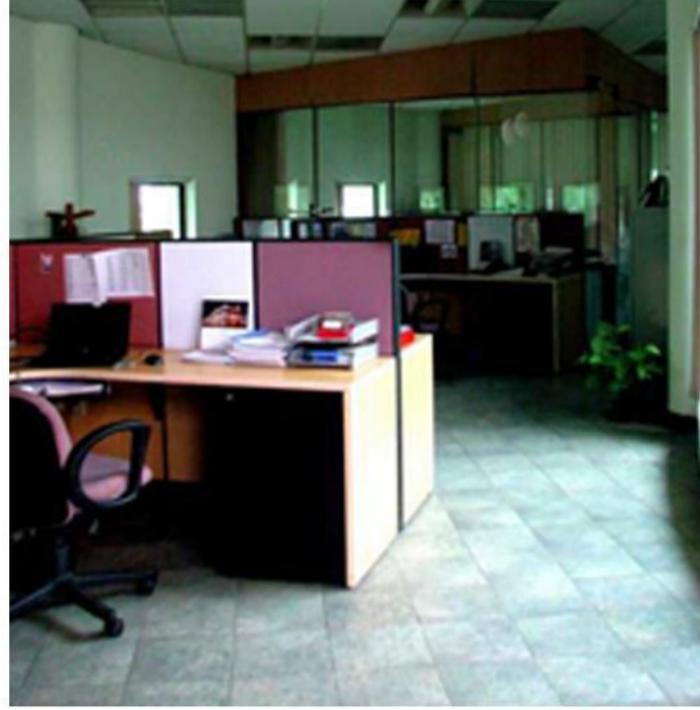
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**BUILDING MATERIALS AND RESOURCES**

Bagasse Board – by product of sugarcane industry-a good substitute for plywood or Particle Board  
It has wide usage for making partitions, furniture etc.  
Eco-friendly method - does not involve any harm to the timbers, unlike plywood.  
Used for furniture in interiors of the building



66% (by cost) of the material was sourced within a radius of 800 km  
Of this, 95 % of the raw material was extracted or harvested locally.  
An impressive 77 % of the building materials use recycled content in the form of fly ash, broken glass, broken tiles, recycled paper, recycled aluminum, cinder from industrial furnaces, bagasse, mineral fibers, cellulose fibers, and quarry dust.

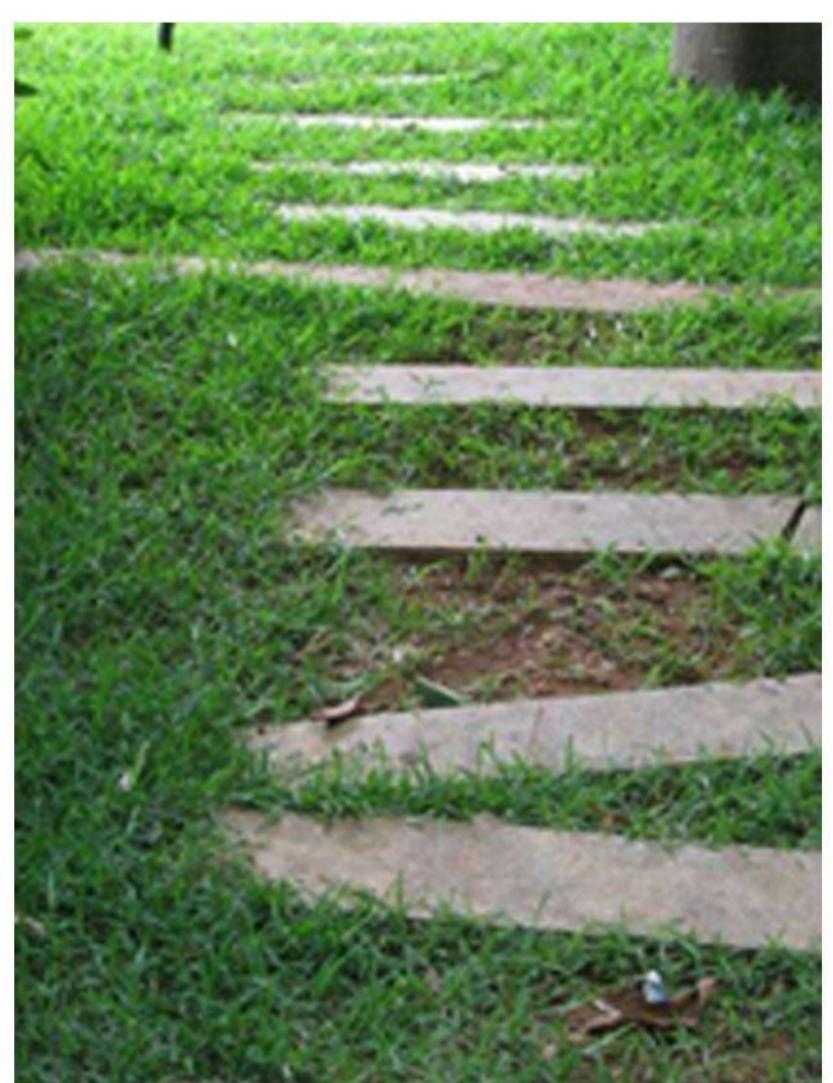
Low VOC paints have also been applied

All of the new wood used was sustainably harvested, as certified by the Forest Stewardship Council.

Reuse of a significant amount of material salvaged from other construction sites like toilet doors, interlocking pavement blocks, stone slabs, scrap steel, scrap glazed tiles, shuttering material and, the furniture in the cafeteria.



Stone grid pavers used on roads for easy drainage of water



Reuse of construction waste stone in paving the gardens



Clay tile paving in the gardens

**A waste management plan ensured that 96 % of construction waste was recycled.**

**FLY ASH BRICK**

Manufacturing method saves energy, reduces mercury pollution,  
• costs 20% less than traditional clay brick manufacturing.  
• Low embodied energy, High recycled content, low CO<sub>2</sub> emission  
Lighter than clay bricks.  
• High strength, practically no breakage during transport  
• Uniform size of bricks reduces mortar required for joints and plaster by 50%.  
• Lower water penetration, considerably reducing seepage of water through bricks

Gypsum plaster (plaster of Paris) can be directly applied on these bricks without a backing coat of lime plaster.



broken tiles on pillars



Lawn tray of recycled plastic



65% walls in GBC are constructed with this material



Use of bamboo as landscape elements



Furniture in the canteen with local Tandur stone flooring



**Reflective glass (mirror)  
Usage of Light Glazing and Vision Glazing  
Double glazed glass**

The double glazed glass will just allow the diffused sunlight to pass through and will radiate the solar radiation back. It is located in the western direction because the sun's rays are highly radiant when it is setting.

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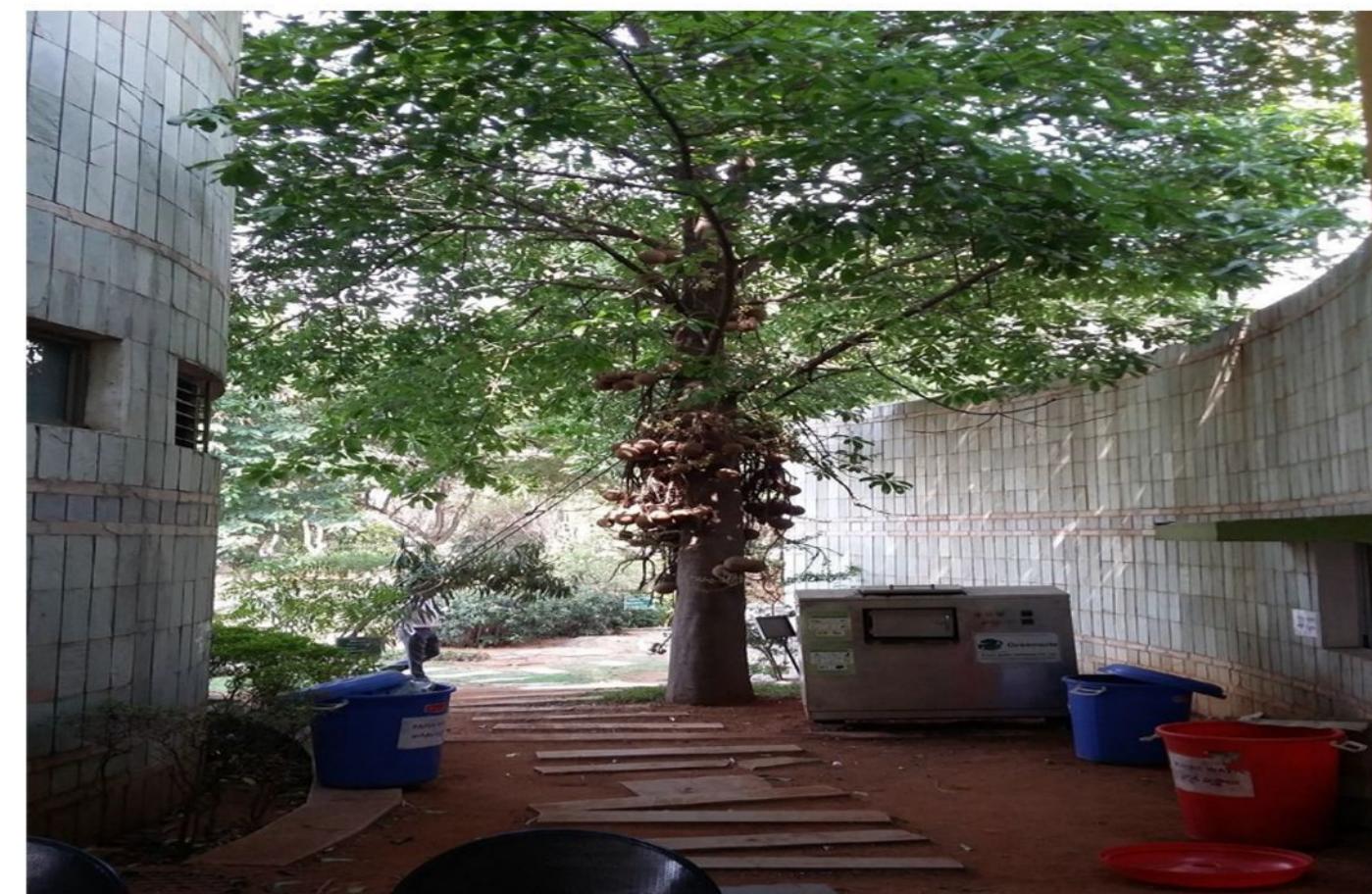
**BUSINESS CENTER**

**INNOVATION AND DEVELOPMENT****WASTE MANAGEMENT**

The daily waste is segregated into five categories

Paper Waste  
Food Waste  
Plastic Waste  
Metal Waste  
Glass Waste

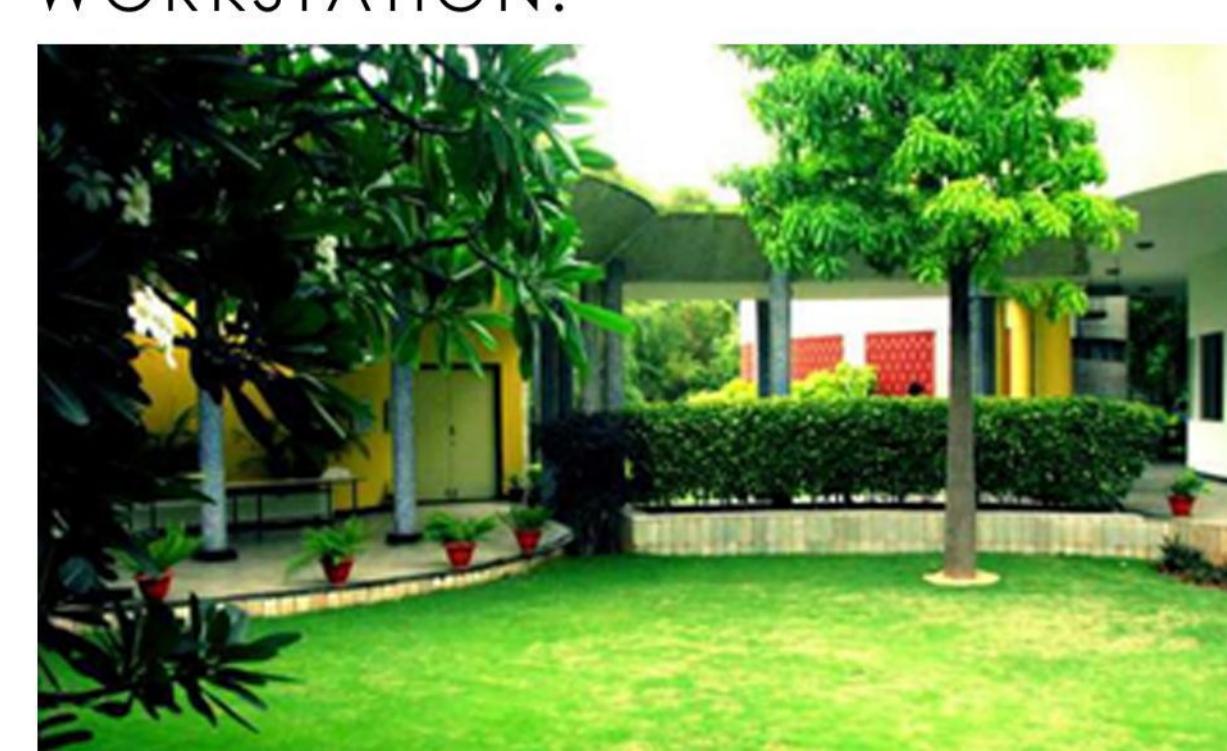
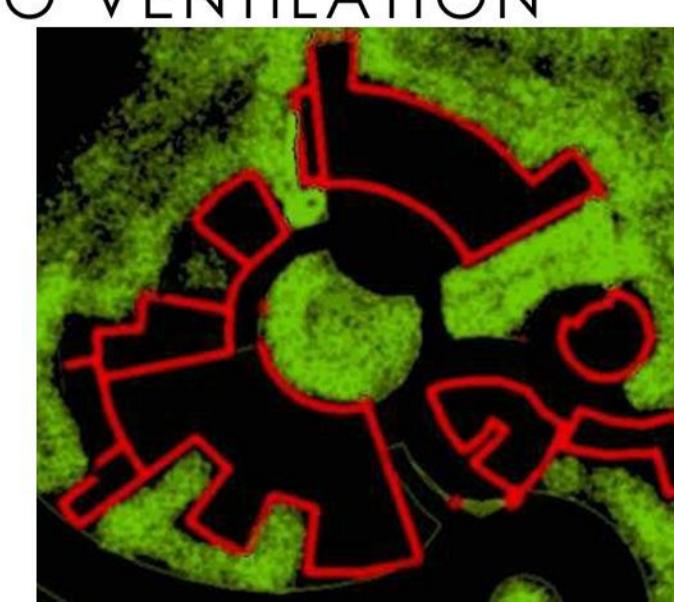
Food waste is artificially decomposed to make manure and all other types of waste are sent for recycling.

**PARKING**

- Bicycle riders are treated preferentially - convenient parking, lockers, shower cleaning
  - 30 % of employee transportation: car pools, bicycles, and LPG cars
  - Use of battery operated vehicles encouraged - Charging stations available
- The documented reduction of harmful emissions achieved is 62 %
- Encourage building occupants to minimize their reliance on fossil fuel-based transportation.



**JALLI [PERFORATED] FOR BRINGING IN NATURAL LIGHT AND ALSO VENTILATION**

**UNDERSTOREY TREES**

Suitable for small, intimate courtyards  
Provide colour, shade without overpowering the space  
Used as accent plants or focal plants  
Are effective in screening mid or low

**EARTH SHELTERING**

Earth sheltering is a ancient architectural practice of using earth against building walls/ roofs for external thermal mass, to reduce heat loss, and to easily maintain a steady indoor air temperature. Roof Gardens cover 55 % of the exposed roof area of the building – high reduction of heat gain

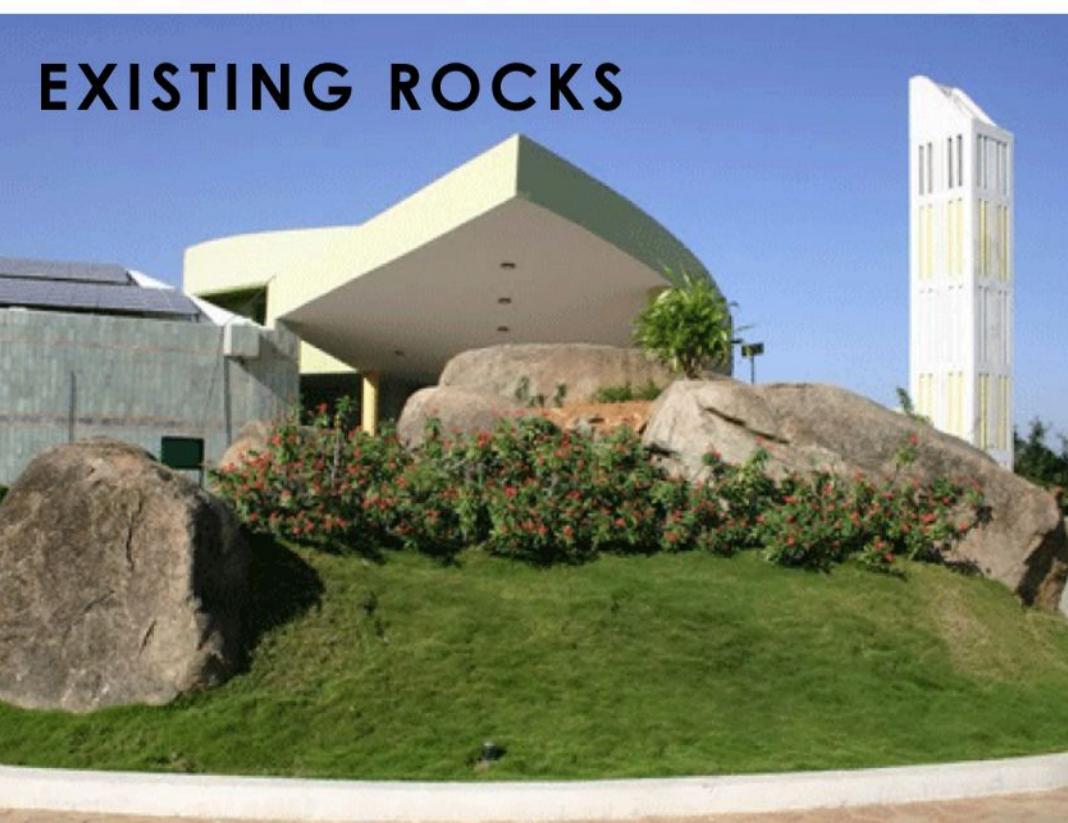
**WIND TOWER**

Energy savings are achieved by the GBCs two wind towers

- Air, cooled by upto 8 °C, is supplied to the AHUs, substantially reducing the load on the air conditioning system. A heavily insulated roof further reduces the cooling load.



Bio degradable plastic grass crates used to hold grass– easy removal and maintenance

**DESIGN STUDIO - 2**

**SUBMITTED BY**  
BHANU PALLAVI  
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**BUSINESS CENTER**

## INDOOR ENVIRONMENT QUALITY

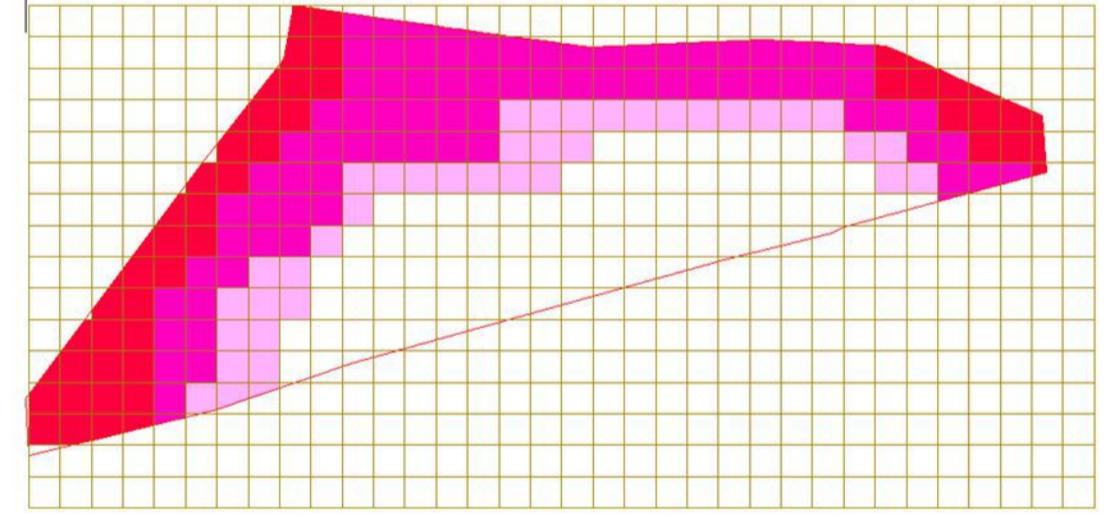
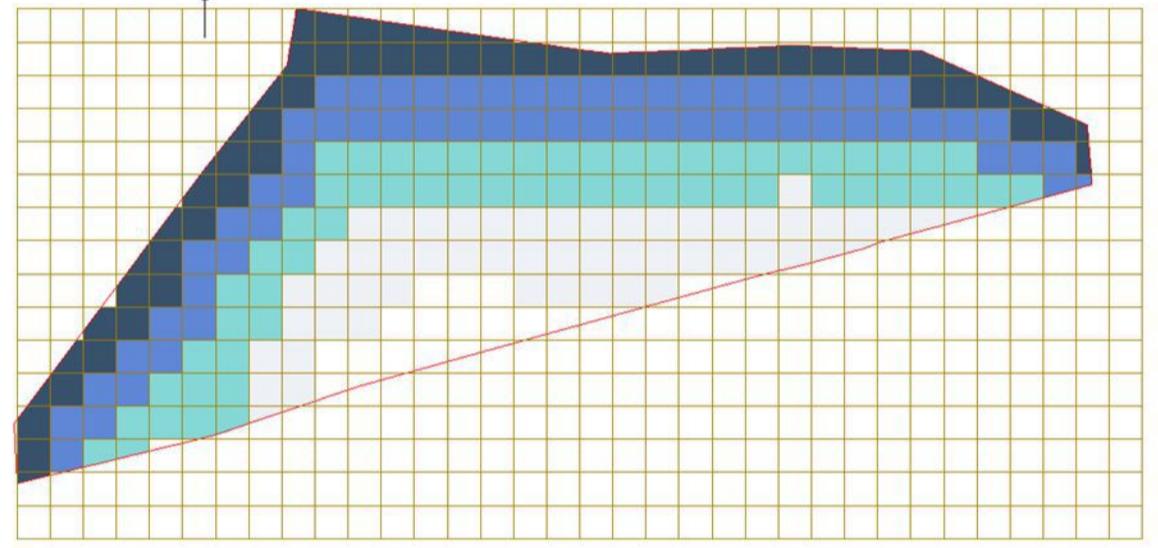
This building adopts the following concept:  
What derives from nature returns to it. This is applied in the practice of Architecture:  
- A Building gives back to nature even as it takes from it  
- thus reducing Ecological footprint

### ENVIRONMENTAL IMPACT:

An attempt to make a positive change in design by Reducing the negative impact on the environment in terms of:

Use of materials	Water Management
Energy Efficiency	Sustainability
Natural Ventilation	Reuse and Recycle
Renewable Energy	Effective Land Use
Ecological footprint	Carbon Footprint
Socio Cultural Response etc	

### POLLUTION ON SITE:



Maximum exposure to pollution- North and West boundaries of the site, along the main roads

### DRAINAGE ON SITE

Natural Drainage pattern utilized to harvest rain water at point of maximum accumulation

this is away from the block ,and follows the wind flow such that the breeze carry away the smell outside the side



## INTERNAL SPATIAL PLANNING

The spatial and formal elements around a courtyard create introverted blueprint. Courtyard space was not rigidly fixed but could be adaptable depending on the time of day, season its mood changed with varying degrees of light and shade, and with them the ambience

Centrally located, serves as visual anchor. It was the spatial, social, and environment control center of the home. By building them around a central open space ensured close relationships between separate units Brought in an additional usable space within the living space.



### FENESTRATION: LIGHT AND VENTILLATION

Building layout ensures that 90 % of spaces have daylight access and views to the outside.

North facades are glazed for efficient diffused light Low heat transmitting glass used Double glass to further reduce heat gain Natural lighting - no lights are used until late in the evening Minimum lux levels for all work stations have been ensured Light captured from as many sides possible - the use of courtyards



## SWOT ANALYSIS:

### STRENGTH:

The vast presence of open space and landscape in the site ensures effective ventilation through entire building.

The presence of water body provides evaporative cooling which is very effective in the climate of Hyderabad.

The entire campus provides calm and serene environment helps for a better productivity.

### WEAKNESS:

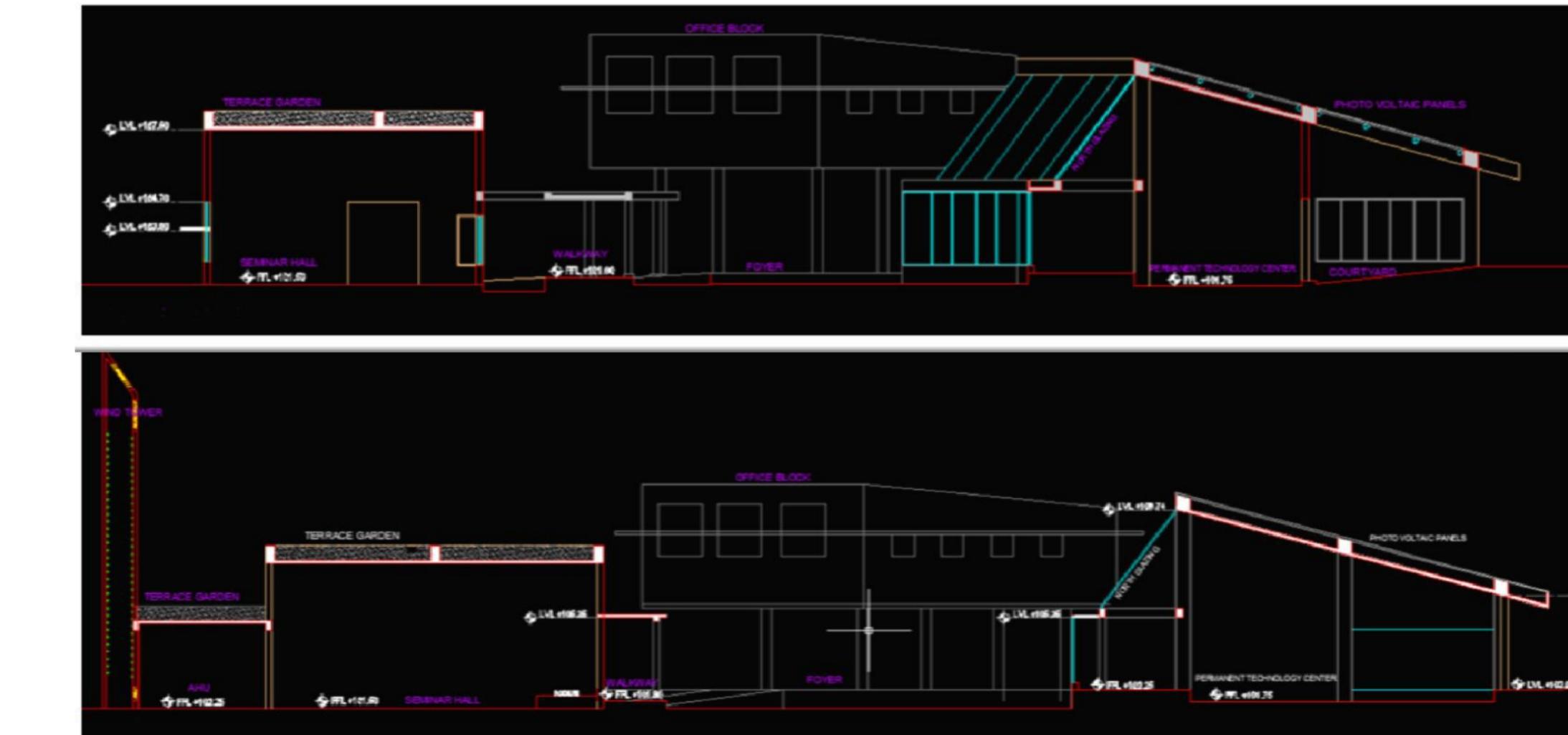
The campus adopted a structure which has less scope for future vertical expansion.

### OPPORTUNITIES:

The landscape in the site has a butterfly garden and medicinal garden which creates more jobs for its maintainence.

### THREATS:

The vast landscape area and rich greenery at the site is providing hideout for harmful species like snakes and insects.



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