Biophilic Design Approach for Improved Performance

Sustainable Buildings

Nature, Quality of Life, Sustainable, Green

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What is "Biophilic"?

"The human tendency to interact or be closely associated with other forms of life in nature"

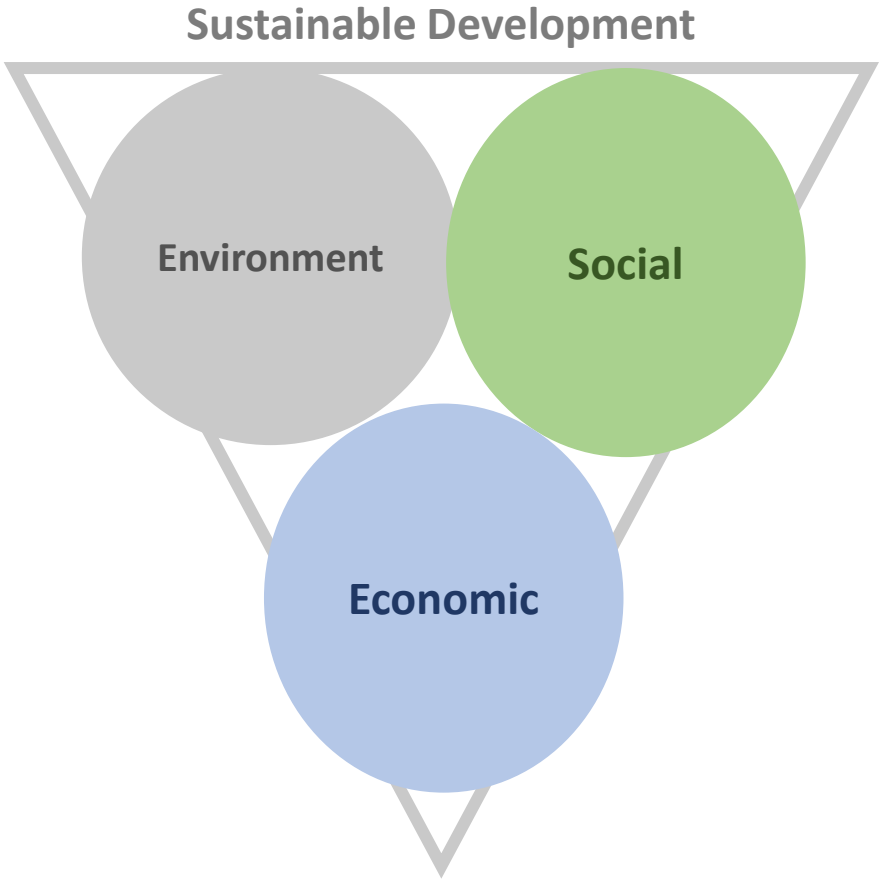
-Merriam Webster

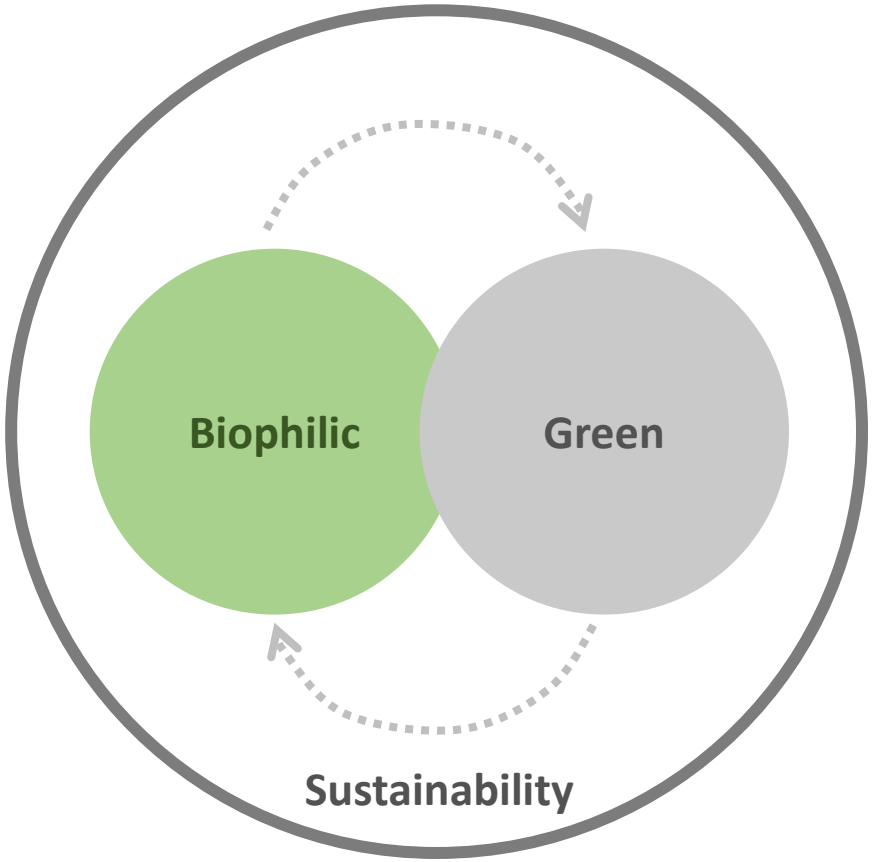
Biophilic architecture seeks to **connect people with nature** within buildings and built spaces. It is based on the philosophy that humans have the innate tendency to connect with nature. It incorporates **natural elements in the design** to enhance the well-being of the occupants of the space in terms of **health, happiness and overall quality of life**.

Biophilic vs. Sustainable vs. Green

Biophilic	Sustainable	Green
Is based on the innate connection between human and nature	Is based on reducing the negative impacts on environmental, social and economical facets of a building throughout it's life time	Is based on reducing the negative impacts on environmental facets of a building

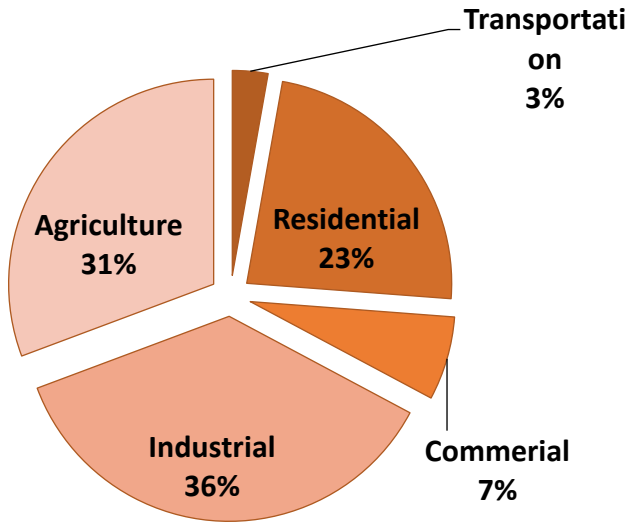
Biophilic vs. Sustainable vs. Green

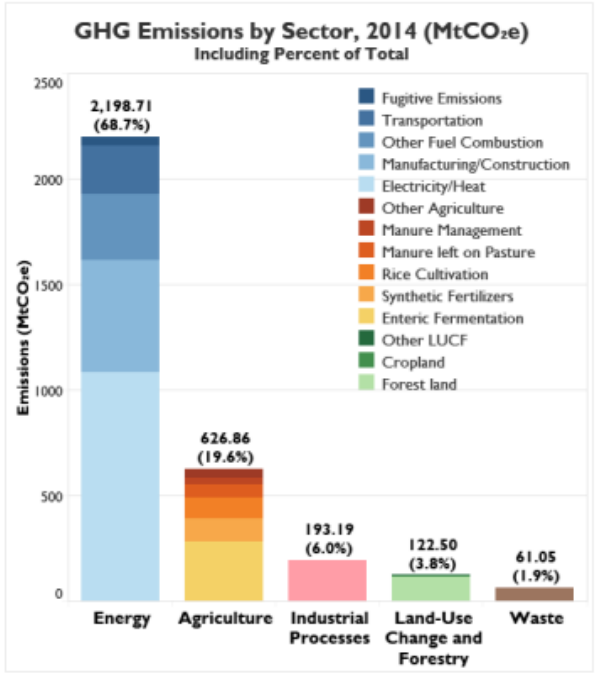




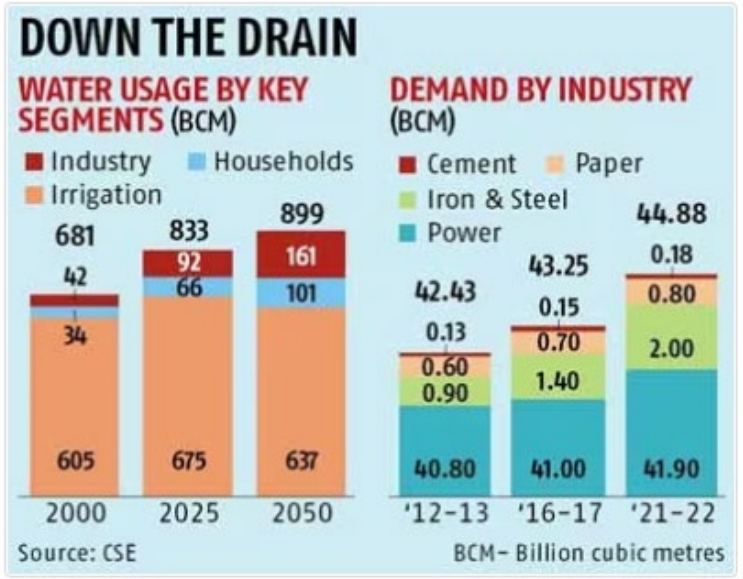
Why do we need "sustainable architecture"?

Sectoral Energy Consumption





Sources: WRI CAIT 4.0, 2017, FAOSTAT, 2018

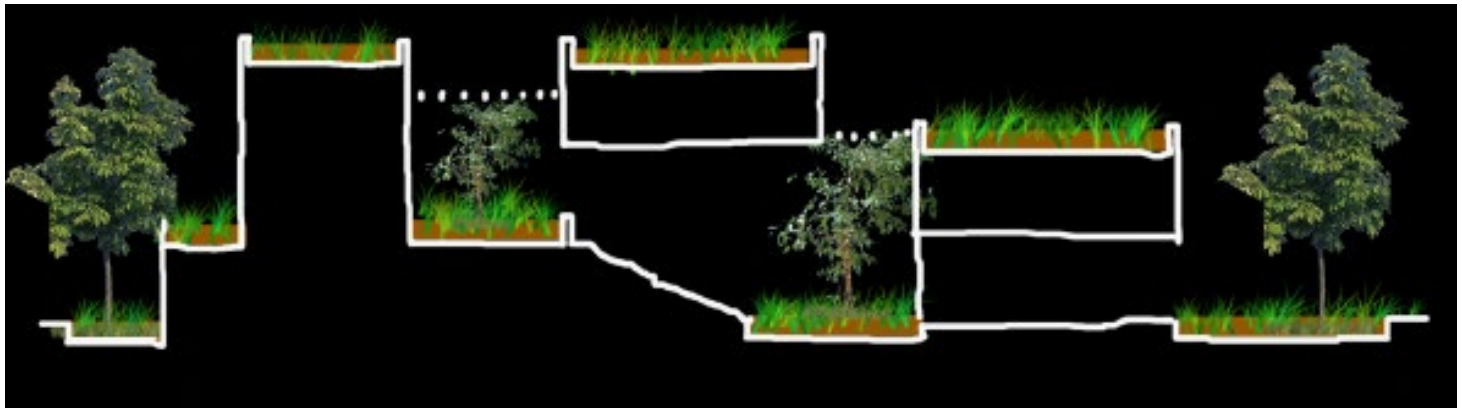


What all comprises biophilic design?

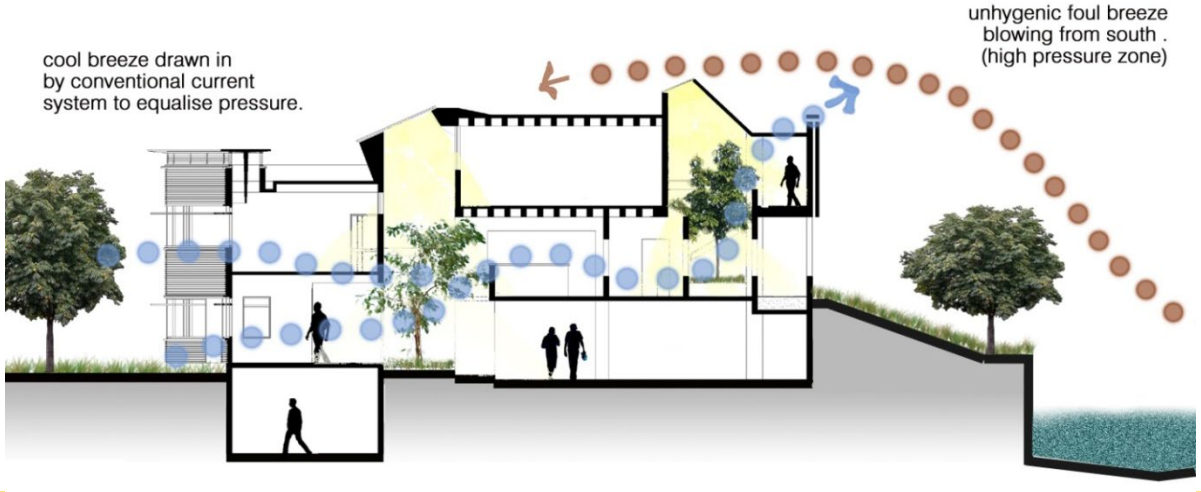
Environmental Features	Natural Patterns and Forms	Light and Space	Place-based Relationships	Connection with Nature
Characteristics of the natural world such as water features, sunlight, vegetation etc.	Using patterns and forms that are naturally found in nature such as shapes, motifs etc.	Using lighting to enhance the space especially natural lighting	Connection with local ecology and geographical features	Enhancing the inherent connection between humans and nature

Integrating "biophilic design" into "biophilic architecture"

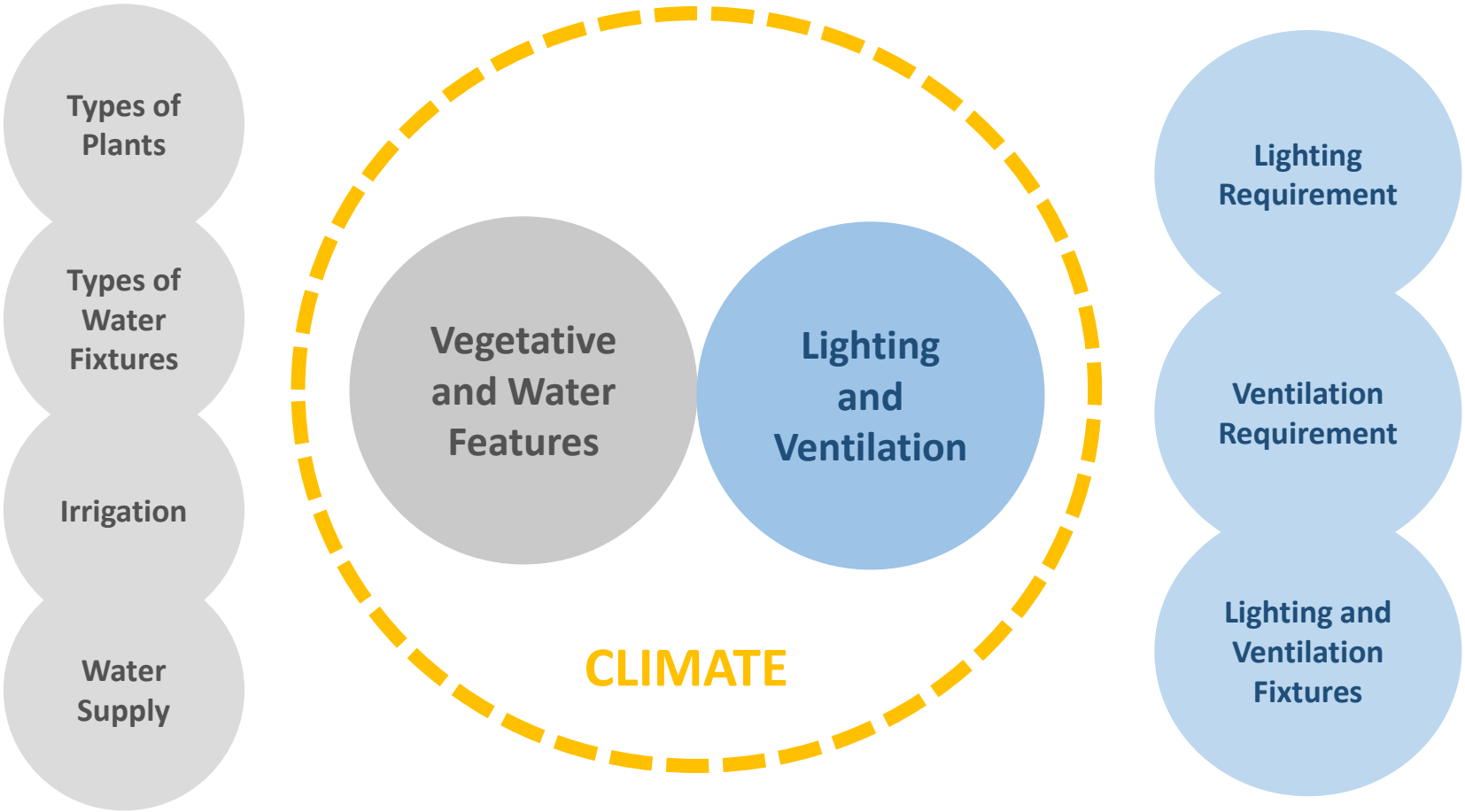
1 Provision of vegetative and water elements at regular intervals throughout the building



2 Provision of natural lighting and ventilation over artificial lighting and HVAC



Biophilic into Green

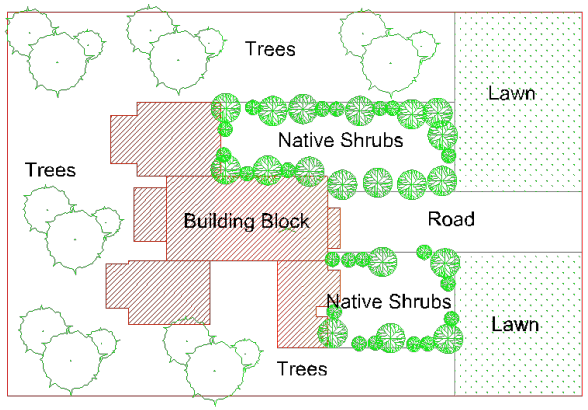


Biophilic into Green

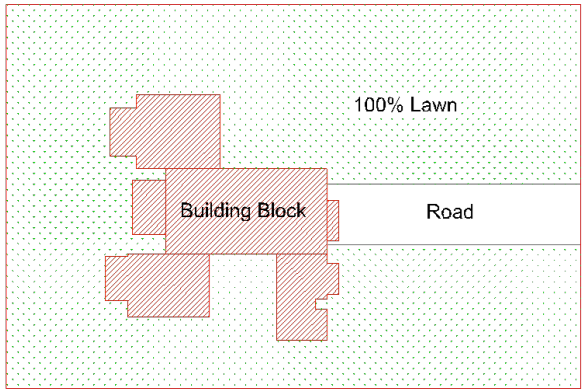
Use of plants that are native to the location and/or adaptive to the climate

Types of Plants

Vegetative and Water Features



PROPOSED CASE



BASE LINE CASE

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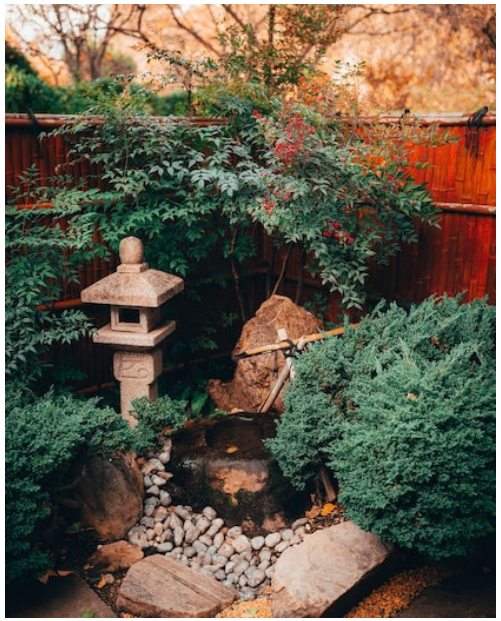
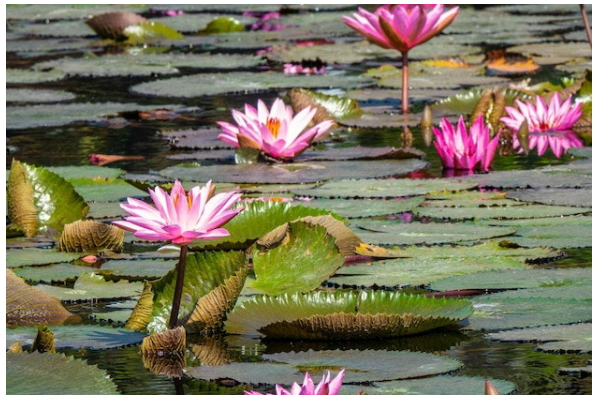
Types of Water Fixtures

Water features that are efficient in terms of water usage and losses

Vegetative and Water Features

- Smaller sizes
- Recycling water
- Use of plants to reduce evaporation
- Shading to reduce evaporation





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Irrigation

Use of efficient irrigation systems such as sprinklers or drip irrigation

Vegetative and Water Features

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Water Supply

Use of harvested rain water or treated sewage water in irrigation and water features

Vegetative and Water Features

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Lighting Requirement

Amount of lighting and type of lighting required as per the function of the space

Lighting and Ventilation

Daylight Factor Requirements for Different Types of Spaces as per SP 41

Sr No	Type of building	List of Living Area	Daylight Factor Percent
1	Dwellings	Kitchen	2.5
		Living Room	0.625
		Study room	1.9
		Circulation	0.313
2	Schools	Class room desk top, black board	1.9—3.8
		Laboratory	2.5—3.8
3	Offices	General	1.9
		Drawing, typing	3.75
		Enquiry	0.625—1.9
4	Hospitals	General wards	1.25
		Pathological laboratory	2.5-3.75
5	Libraries	Stack room	0.9—1.9
		Reading room	1.9-3.75
		Counter area	2.5—3.75
		Catalogue room	1.9—2.5

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Lighting Requirement

Lighting and Ventilation

Amount of lighting and type of lighting required as per the function of the space

Illumination Level Requirements for Different Types of Spaces as per NBC

Table 4 Recommended Values of Illuminance
(*Clauses* 4.1.3.1, 4.1.4, 4.1.4.2, 4.3.2 *and* 4.3.2.1)

Sl No.	Type of Interior or Activity	Range of Service Illuminance (*See* Note) lux	Quality Class of Direct Glare Limitation (*See* Note)	Remarks
(1)	(2)	(3)	(4)	(5)
1	**AGRICULTURE AND HORTICULTURE**			
1.1	Inspection of Farm Produce where Colour is Important	300-500-750	1	Local lighting may be appropriate
	Other Important Tasks	200-300-500	2	Local lighting may be appropriate
1.2	Farm Workshops			
1.2.1	General	50-100-150	3	
1.2.2	Workbench or machine	200-300-500	2	Local or portable lighting may be appropriate
1.3	Milk Premises	50-100-150	3	
1.4	Sick Animal Pets, Calf Nurseries	30-50-100	3	
1.5	Other Firm and Horticultural Buildings	20-30-50	3	
2	**COAL MINING (SURFACE BUILDINGS)**			
2.1	Coal Preparation Plant			
2.1.1	Walkways, floors under conveyors	30-50-100	3	
2.1.2	Wagon loading, bunkers	30-50-100	3	
2.1.3	Elevators, chute transfer pits, wash box area	50-100-150	3	
2.1.4	Drum filters, screen, rotating shafts	100-150-200	3	
2.1.5	Picking belts	150-200-300	3	Directional and colour properties of lighting may be important for easy recognition of coal and rock
2.2	Lamp Rooms			
2.2.1	Repair section	200-300-500	2	

As per Table 4, under section “Lighting and Natural Ventilation” Vol. 2, NBC 2016

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Ventilation Requirement

Lighting and Ventilation

Amount of ventilation and type of ventilation required as per the function of the space

Desirable wind speeds for thermal comfort conditions as per NBC

Dry bulb temperature (deg C)	Relative humidity (%)						
	30	40	50	60	70	80	90
28	*	*	*	*	*	*	*
29	*	*	*	*	*	0.06	0.19
30	*	*	*	0.06	0.24	0.53	0.85
31	*	0.06	0.24	0.53	1.04	1.47	2.10
32	0.20	0.46	0.94	1.59	2.26	3.04	**
33	0.77	1.36	2.12	3.00	**	**	**
34	1.85	2.72	**	**	**	**	**
35	3.20	**	**	**	**	**	**

As per Table 9, under section "Lighting and Natural Ventilation" Vol. 2, NBC 2016

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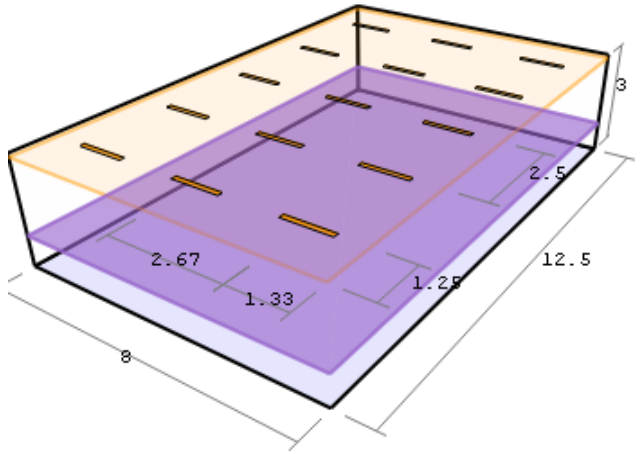
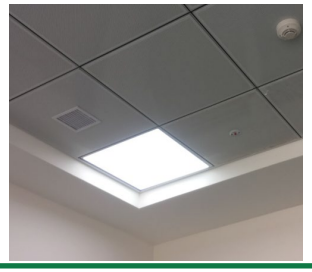
Lighting and Ventilation Fixtures

Use of energy efficient lighting and ventilation devices in the space



Lighting and Ventilation



Benefits of biophilic and green architecture

1. User satisfaction and increased productivity
2. Reduction in use of comfort appliances; in turn reducing energy/electricity required for their operation
3. Efficient use of water; in turn conservation of water
4. Improved air quality of the space
5. Increasing the amount of vegetation in the area; in turn reducing the urban heat island effect

Any questions?

References

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