CLARIDGES SEZ DEVELOPERS PVT. LTD.

104, Mittal Chambers, 10th Floor,Nariman Point, Mumbai - 400021
Tel. : 022-65085666 Email : info@csdpl.com

12th October, 2017

To,
The Director & Member Secretary,
Expert Appraisal Committee (2) in the Infrastructure Sector
Ministry of Environment Forest & Climate Change
Indira Paryavaran Bhavan,
Jor Bagh Road, New Delhi - 110003, India.

Subject : Submission of compliance report to the observations raised during 22nd Expert Appraisal Committee -2 (EAC-2) meeting in the Infrastructure Sector for the "Special Township Project" at Post-Sarang, Taluka- Khalapur, Dist - Raigad, State: Maharashtra – 410206.

Reference :
- Minutes of meeting (MoM) of 22nd EAC-2 (Item no. 22.4.19)
- F. No.- 21-285/2017-IA-III

Respected Sir,

This is with reference to the above mentioned subject. We are submitting herewith the point wise compliance report to the observations raised by Honorable EAC during the meeting as follows:

No.	Observations & Compliances
1.	**Observation:** Status of clearance from National Board of Wild Life (NBWL) **Compliance:** NOC from Wild Life Board is Not Applicable as per Notification reg. ESZ of Karnala Wildlife Sanctuary in Maharashtra published by MOEF & CC u/no. S.O. 230 (E) dated 22/01/2016, as our project site is not affected by the ESZ belt as per Notification published.
2.	**Observation:** The impact of dewatering for excavation of basements and plan for disposal of ground water generated in dewatering **Compliance:** Probable impacts due to dewatering for excavation of basements during construction phase are as follows: - Construction of basements or excavation below ground level may create sedimentation and impact on ground water quality. - Generation of large amount of ground water that need to be disposed off **Following mitigation measures are proposed for dewatering and disposal of ground water**: - Provision of dewatering pumps of adequate capacity as per site conditions - Suction points of the pumps will be equipped with silt screens and appropriate filters to minimize stile discharge - Collection of Subsoil water/ excess water during excavation and construction of basements in the sedimentation tank for 6 to 7 hrs. - Disposal of supernatant to the drain. - Guidelines issued by Central Ground Water Authority (CGWA) shall be followed strictly We shall obtain permission from CGWA during construction phase before dewatering of basements.

<table>
<tr><th>No.</th><th>Observations & Compliances</th></tr>
<tr><td>3.</td><td>Observation:
A certified report on the sources and availability of water from the local body supplying water along with the permission received by them for the same.

Compliance:
We have received NOC for water supply from Maharashtra Jeevan Pradhikaran (MJP) stating assured water supply and same is attached as Enclosure 1.</td></tr>
<tr><td>4.</td><td>Observation:
A detailed report on compliance to ECBC

Compliance:
Detailed report on compliance to ECBC is enclosed as Enclosure 2.</td></tr>
<tr><td>5.</td><td>Observation:
Detailed energy conservation measures to be taken. All points mentioned in the proposal such as orientation to support reduced heat again, use of ASHRAE 90.1, use of ECBC compliant envelope measures to be supported through drawings and details in the proposal.

Compliance:
The proposed township project at Raigad complies with ECBC by prescriptive method. ECBC 2007 is referred for residential buildings and for commercial buildings ECBC 2017 is considered. All the mandatory and prescriptive requirements of sections like building envelope, Heating, ventilation & HVAC, Service water heating, Lighting and Pumps & motors are compiled to achieve maximum energy efficiency.
The city specific climate was analysed to evaluate potential of passive strategies. Few strategies to reduce heat island effect & increase shading are also proposed. To reduce the load on energy solar PV and hot water are proposed.

Solar hot water provision is as follows -
<table><tr><td>For Residential Buildings</td><td>20%</td></tr><tr><td>For Hotel and Hospital</td><td>40%</td></tr></table>No solar hot water provision for Commercial and School building

The proposed solar PV constitutes 2.09% of the total demand load
<table><tr><td>Total Connected Load</td><td>3,09,258 kW</td></tr><tr><td>Total Demand Load</td><td>1,36,730 kW</td></tr><tr><td>Total Solar PV Proposed</td><td>2,857 kW (2.09% of Maximum Demand)</td></tr></table>
Detailed report on compliance to ECBC is given in same Enclosure 2.</td></tr>
<tr><td>6.</td><td>Observation:
An assessment of the cumulative impact of all development and increased inhabitation being carried out or proposed to be carried out by the project or other agencies in the core area, shall be made for traffic densities and parking capabilities in 05 Km radius from the site. A detailed traffic management and a traffic decongestion plan drawn up through an organization of repute and specializing in Transport Planning shall be submitted with the EIA. The Plan to be implemented to the satisfaction of the State Urban Development and Transport Departments shall also include the consent of all the concerned implementing agencies.

Compliance:
Detailed Traffic study by considering 5 Km cumulative study area is attached as Enclosure 3.</td></tr>
<tr><td>7.</td><td>Observation:
The EIA should also give a compliance plan to conditions stipulated in Annexure XIV of the amended EIA Notification vide S.O.3999 (E) dated 09.12.2016.</td></tr>
</table>

No.	Observations & Compliances
	Compliance: Appendix XIV of the amended EIA Notification vide S.O.3999 (E) dated 09.12.2016 stipulates the criteria condition for Category 1(5000 to 20000 Sq. mt.), Category 2 (20000 to 50000 Sq. mt.) and Category 3 (50000 to 150000 Sq. mt.) but total construction built up area of our project is 23, 63,400.26 Sq. mt. i.e. more than 300000 Sq. mt. for which there is no specific conditions stipulated in Appendix XIV. However as asked by Hon. EAC we are submitting herewith compliance plan considering conditions stipulated for Category 3 of Appendix XIV. Please refer **Enclosure 4.**

We sincerely hope that our reply will satisfy the observations raised by the respected Committee.

Please do the needful and oblige.

Thanking you,

Yours faithfully,

For CLARIDGES SEZ DEVELOPERS PVT. LTD.

AUTHORIZED SIGNATORY

Encl: As above

Enclosure 1

3)

MAHARASHTRA JEEVAN PRADHIKARAN

DR. S. V. DAHASAHASRA
B.E.M. Tech., Ph.D.,
Chief Engineer (Konkan Region),
New Administrative Building,
Kanhaiya Nagar, Kopri,
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daha2003@vsnl.net

No.MJP/CE(KR)/DE-I/CR- 4041/ 317 **Date :** 5/2/07

To,
M/s.CLARIDGES SEZ Pvt.Ltd;
10th Floor, 104 Mittal Chambers,
Nariman Point, Mumbai 400 021

Sub : Water Requirement for SEZ.
Ref : Your office letter No.SEZ/H-WR/01/07,dated 12/1/2007

Sir,

Vide letter under reference, you have informed about water requirement of 20,000 cum/day (20 MLD) for Multi Services SEZ at Village Sarang, near Chowk, Tal.Khalapur, Dist.Raigad. In this regard it is to inform you that we can supply the quantum of water required for SEZ. However, further details of the scheme would be worked out on receipt of location plan and other related details (year wise water requirement) of your project.

Thanking you,

Yours Sincerely,

SVDahasahasra

(Dr.S.V.Dahasahasra)
Chief Engineer (K.R.)

ECBC COMPLIANCE ANALYSIS REPORT

CLARIDGES SEZ

Mumbai, Maharashtra

ECBC COMPLIANCE REPORT : 10th October 2017

CLARIDGES SEZ DEVELOPERS PVT LTD

KAIZEN DESIGN SOLUTIONS

EXECUTIVE SUMMARY

This report has been prepared for Special Township Project at Raigad. This report is part of a process towards obtaining Environmental Clearance from MOEF. The specific objective of this report is to define design parameters for ECBC Compliance for maximum Energy Efficiency.

The city specific climate was analysed to evaluate potential of passive strategies. Few strategies to reduce heat island effect & increase shading are also proposed. Heat gain calculation

The report is structured as follows.

CLIMATIC ANALYSIS

HIE STRATEGIES

SHADING DESIGN

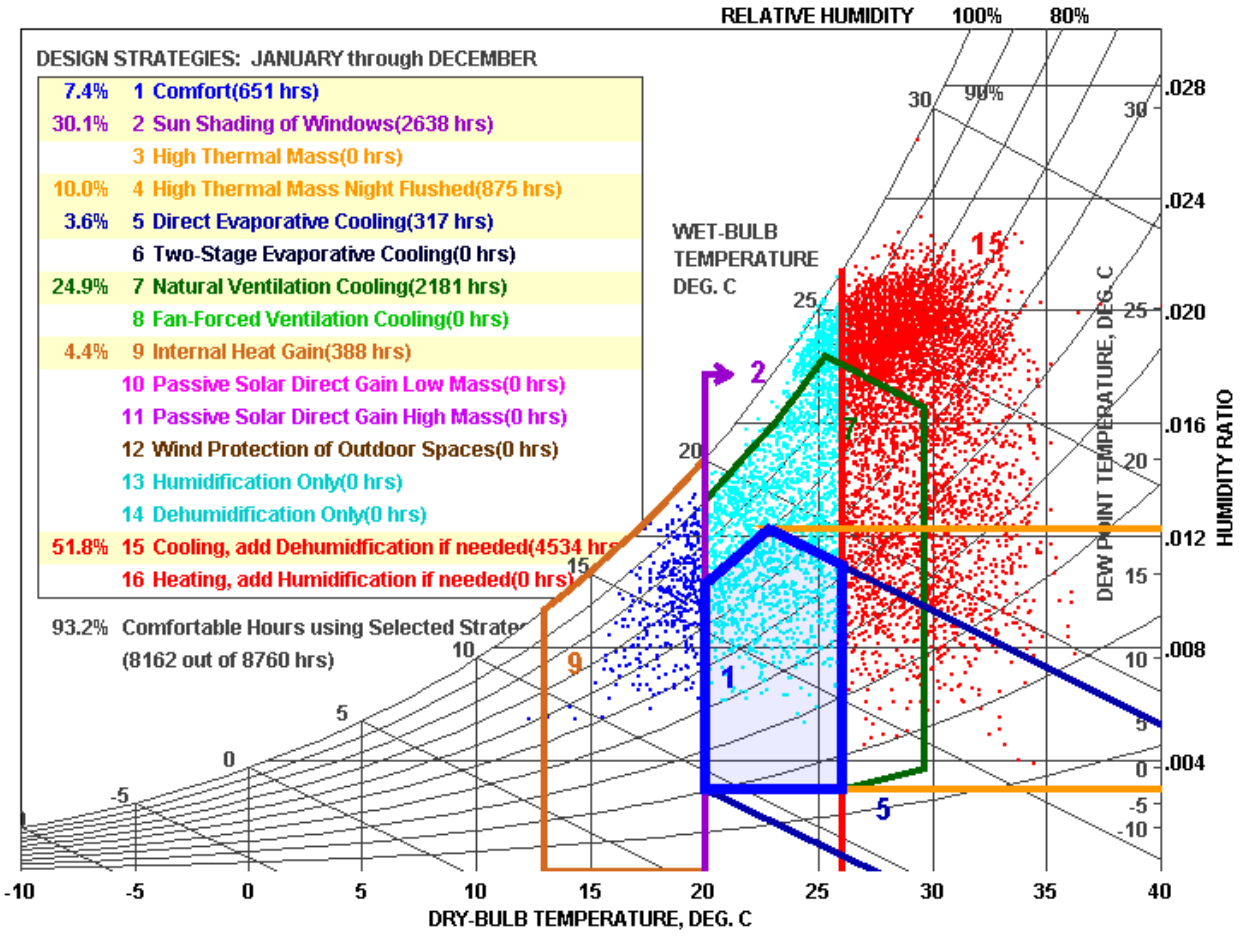
HEAT GAIN CALCULATION

ENVELOPE DETAILS

ECBC 2007 - COMPLIANCE RESIDENTIAL

ECBC 2017 - COMPLIANCE COMMERCIAL

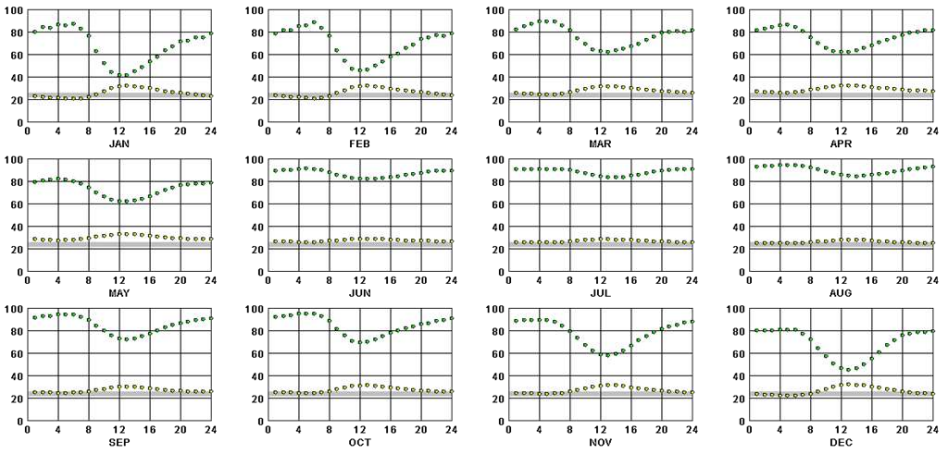
CLIMATIC ANALYSIS :



The Psychrometric Chart above explains that, no other strategy is effective for passive comfort except Shading & Ventilation. Around 20% of total comfort hours can be achieved by Sun Shading & Natural Ventilation. 10% can be achieved by ceiling fan forced ventilation & for the rest 70% of the time air conditioning may be required. For this analysis, the Comfort Criterion was set at 22 to 26 degree C for dry bulb temperature & relative humidity to 70%.

The graph plot on next page clearly shows the degree difference between the Dry Bulb Temperature & Relative Humidity. That's why strategies like Evaporative cooling, Thermal mass, Night purging etc. will not be effective at all. The Pshychrometric Chart above confirms that the only two effective strategies are Shading & Ventilation. As per the legend, at least 30% of the total hours are in comfort range with an effective wind speed of 3 to 5 m/s. Fan forced ventilation is certainly an effective strategy & comparatively cheaper than AC.

Next is he annual wind pattern of Mumbai city. The purpose is to understand this Wind Pattern. If you observe the legend carefully, you will understand that, 10% of the total annual wind is flowing from West direction, which has a temperature C, with a humidity around 70% & maximum wind speed is 8 m/s at one point of time. The predominant wind direction in Monsoon Period is West – South-West.

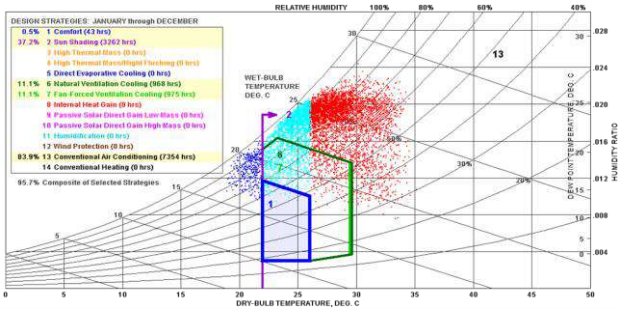


DRY BULB X RELATIVE HUMIDITY

Dry Bulb

Humidity

Comfort Zone



DRY-BULB TEMP (degrees C)

0%	< 0
4%	0 - 22
34%	22 - 26
61%	26 - 38
0%	> 38

WIND SPEED (m/s)

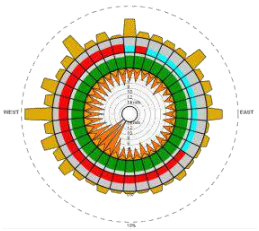
23%	< 2
34%	2 - 3
35%	3 - 5
6%	5 - 9
0%	> 9

TEMPERATURE (Deg. C)

- < 0
- 0 - 22
- 22 - 26
- 26 - 38
- > 38

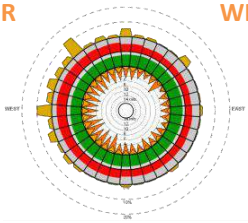
RELATIVE HUMIDITY (%)

- <30
- 30-70
- >70

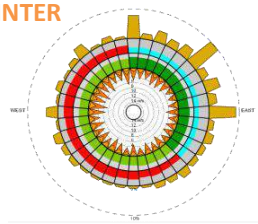


ANNUAL WIND PATTERNS

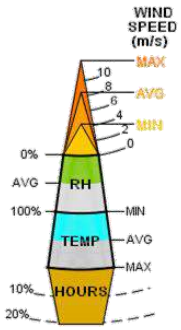
SUMMER



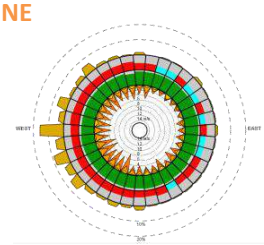
WINTER



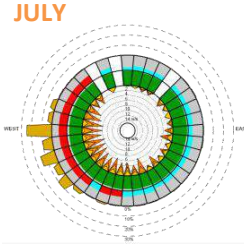
SEASONAL WIND PATTERNS



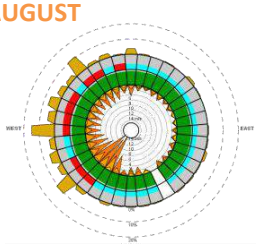
JUNE



JULY



AUGUST



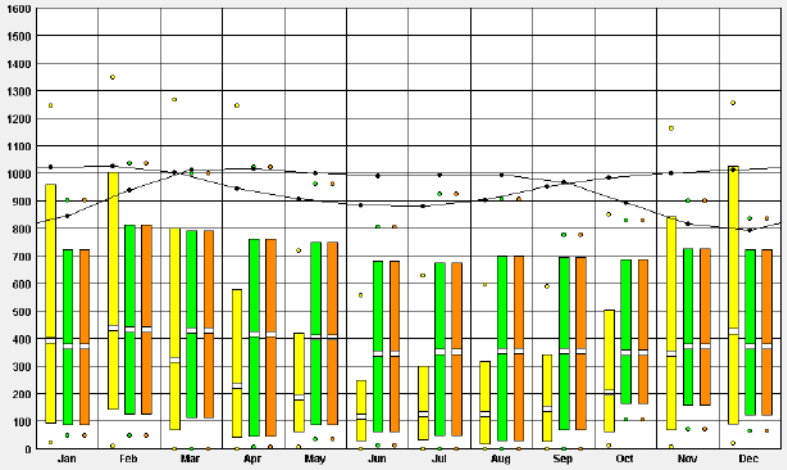
MONTH WISE DETAILS

HEAT ISLAND EFFECT:

Urban development has serious effects on the global environmental quality, including the quality of air, increase in temperature and traffic congestion. Construction of building itself is related to global changes in terms of increase of urban temperatures, the rate of energy consumption, the increased use of raw materials, pollution and the production of waste, conversion of agricultural land to developed land, loss of biodiversity and water scarcity. An urban heat island is a climatic phenomenon in which urban areas have higher air temperature than their rural surroundings as a result of anthropogenic modifications of land surfaces, significant energy use and its consequent generation of waste heat. Thus, this might prove to be an unsustainable factor that leads to excessive energy use for cooling and putting the urban population at great risk for morbidity and mortality. According to the above perspective and considering that rapid and huge population growth is expected in the near future, it becomes increasingly important to apply heat island mitigation strategies in order to reduce energy consumption and improve the quality of life.

Effects of Urban Heat Island

- Increased in cooling demand;
- Increased in energy usage;
- Increased air pollution;
- Increased CO2 emissions;
- Climate change;
- Increase health problems;
- Heat related illness & death;
- Impaired water quality



CONCLUSION -

Strategies like High SRI paint, Solar Panels on roof, Light Coloured or Open Grid Pavers, Shaded Streets, Maximum Green Area etc. can reduce heat island effect, surface absorbed radiation resulting is reduction of cooling loads.

Case 1: The case has been assumed with all the proposed buildings with convectional finish on top, asphalt road and dark colored paving on site without any green space.

Case 2: The case has been proposed with light coloured road surface and paver blocks with green space in open area areas which is help to reduce urban air temperature in surroundings.

High SRI Paints

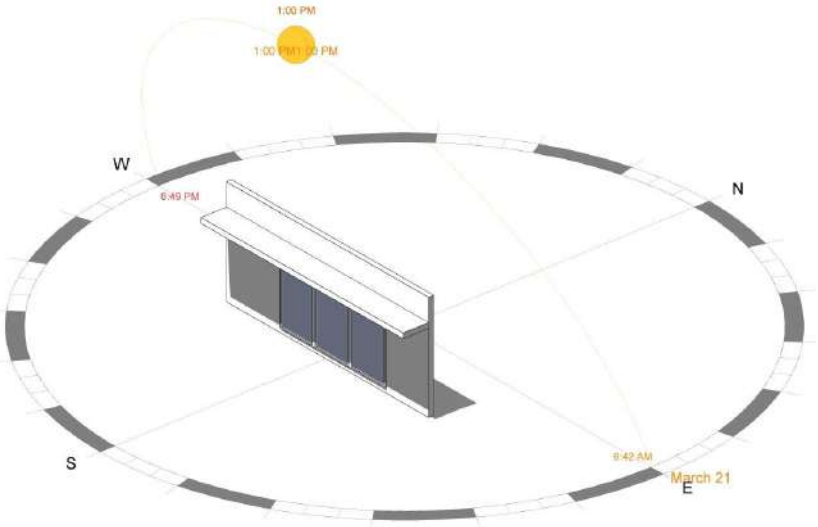
Light Colored Paver Block

Light Coloured & Shaded Roads

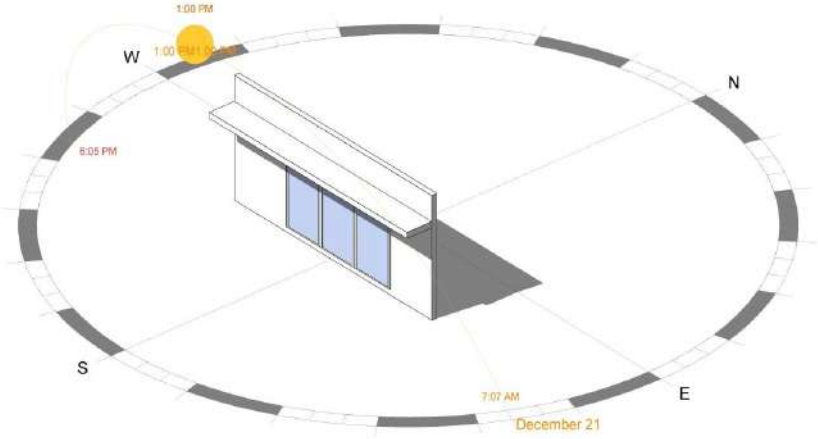
Green Open Area

SHADING DESIGN:

Following images confirm that, with the proposed shades of 600 – 750 mm deep, windows are completely shaded in summer season blocking summer heat & welcoming winter sun when it is required.



21ST MARCH 1PM

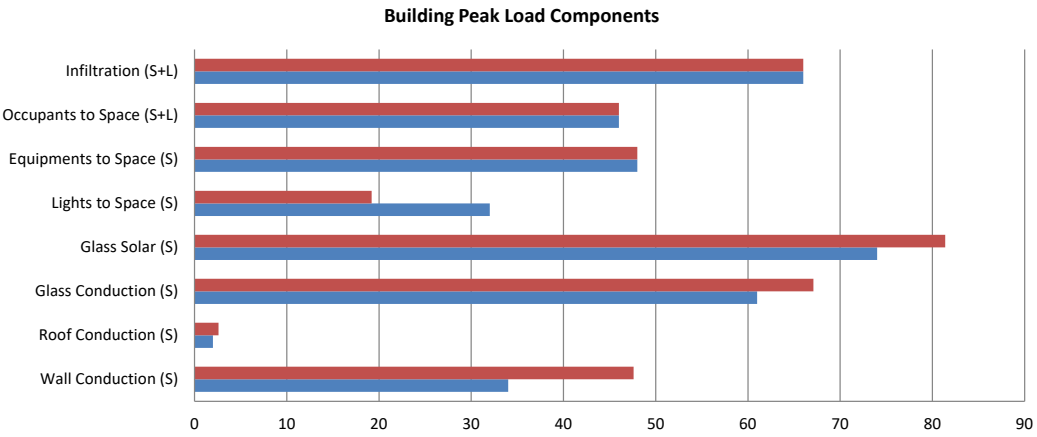


21ST DECEMBER 1PM

HEAT GAIN CALCULATION:

The building heat gain comparison between base case & proposed case is as follows. It is clearly observed from the table below that, for a naturally ventilated residential building, Envelope Shading is also an effective strategy along with insulation. Though the Base case (With Insulation – Without Shading) still has a lesser heat gain as compared to Proposed case (Without Insulation – With Shading), but the difference is marginal & can be easily compensated by reducing lighting & Equipment consumptions. This is possible mainly because Reduced Sol Air Temp & Shaded Walls, Windows & Roof.

Peak Condition - 1 May 2 pm			
Sr. No.	Description	Heat Gain in kW Base Case Sensible + Latent	Heat Gain in kW Proposed Case Sensible + Latent
1	Wall Conduction (S)	34	48
2	Roof Conduction (S)	2	3
3	Glass Conduction (S)	61	67
4	Glass Solar (S)	74	81
5	Lights to Space (S)	32	19
6	Equipments to Space (S)	48	48
7	Occupants to Space (S+L)	46	46
8	Infiltration (S+L)	66	66
9	**Total Load**	**363**	**378**
10	**% Increase**	**3.94**	



	Wall Conduction (S)	Roof Conduction (S)	Glass Conduction (S)	Glass Solar (S)	Lights to Space (S)	Equipments to Space (S)	Occupants to Space (S+L)	Infiltration (S+L)
Proposed Case	48	3	67	81	19	48	46	66
Basecase	34	2	61	74	32	48	46	66

ENVELOPE DETAILS –

Calculation of 'U' Value for A Wall Section -

Material Specification		'R' Value
1) Outside Air Film	–	0.17
2) 1" Cement Plaster	–	0.20
3) 8" AAC Wall	–	8.00
4) 1" EPS Insulation	–	4.00
5) ½" Cement Plaster	–	0.10
6) Inside Wall Air Film	–	0.68
		13.15

Therefore,

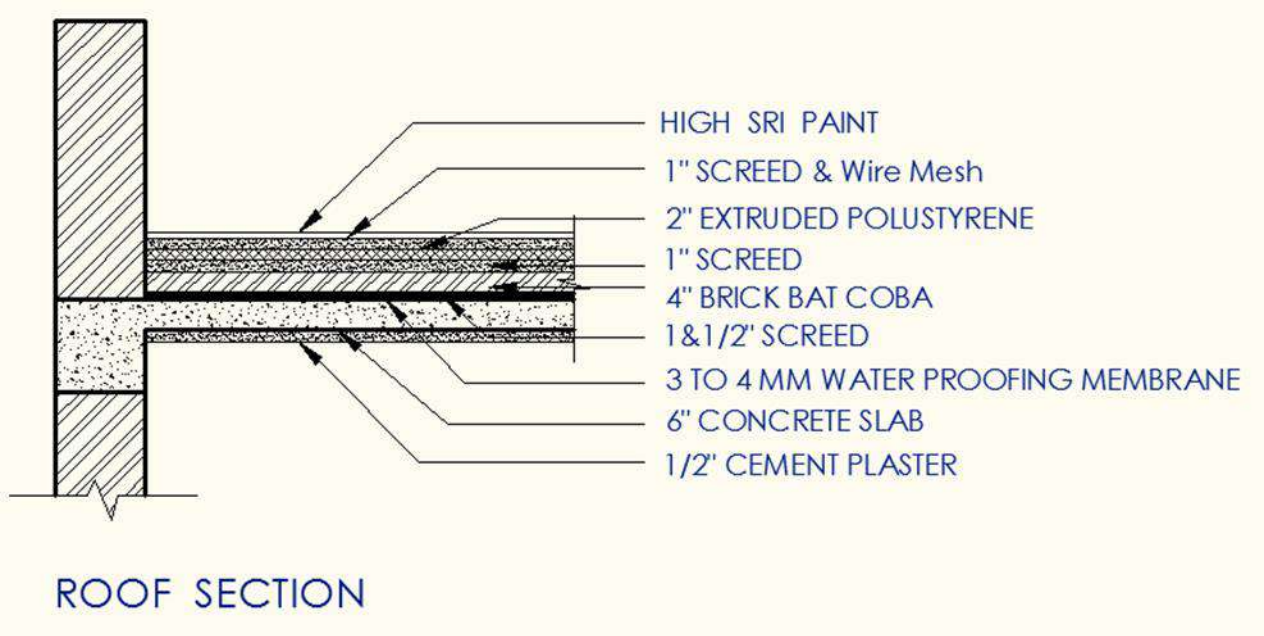
'R' Value of Vertical surface (Wall)	-	13.15 h ft^2 f/btu.
'U' Value - 1 / R - 1 / 13.15	-	0.076 btu/h ft^2 f. -
Value in W/Sq.m.K	-	0.43 W/Sq.m.K

Calculation Of 'U' Value For A Roof Section -

Material Specification		'R' Value
1) Outside Air Film	–	0.17
2) Floor Finish	–	0.15
3) 1" Screed	–	0.20
4) 2" XPS Insulation	–	12.0
5) 1" Screed	–	0.20
6) 6" Concrete Slab	–	0.60
7) ½" Cement Plaster	–	0.10
8) Inside Ceiling Air Film	–	0.61
		14.03 h ft^2 f/btu

Therefore,

'R' Value of horizontal surface (Roof)	-	14.03 h ft^2 f/btu.
'U' Value - 1 / R - 1 / 14.03	-	0.071 btu/h ft^2 f.
Value in W/Sq.m.K	-	0.404 W/Sq.m.K



AAC Block Cutsheet -

Specifications

Type - Aerated Autoclaved Concrete Block

Length- 625 mm

Height- 250 mm

Thickness-75 mm-300 mm (25 mm increment)

Property	Value	Unit
Density(oven dry)	550-650	kg/cum
Compressive Strength*	3.5	N/mm2
Thermal Conductivity(K Value)	0.142	W/M deg.k
Resistant to Fire*	2-6	hr
Drying Shrinkage	0.02	%
Sound Reduction	37-42	db

*Depending upon the thickness of the block

Thermal conductivity of 0.14 results is R Value of around 1.0 per inch.

Renewable Energy Calculation –

Phases	Connected Load (kW)	Maximum Demand (kW)	1% of Maximum Demand	Solar PV Capacity Provided
1	68265	27047	270.47	666
2	42884	18194	181.94	480
3	94220	36946	369.46	792
4	57340	37363	373.63	257
5	26208	10195	101.95	344
6	20341	6985	69.85	318

Total Connected Load – 3,09,258 kW

Total Demand Load – 1,36,730 kW

Total Solar PV Proposed – 2,857 kW (2.09% of Maximum Demand)

Glass Cutsheet –

GLASS DETAILS			LIGHT FACTORS			ENERGY FACTORS		
COLOUR SHADE	BRAND	CODE	TRANSMISSION%	REFLECTION% EXTERNAL	REFLECTION% INTERNAL	SOLAR FACTOR (SF)	SHADING CO-EFFICIENT (SC)	U VALUE (W/ SQM K)
SINGLE GLAZED UNIT								
Light Gold	Reflectasol		32	45	54	0.5	0.58	5.7
Dew Drop	Antelio Plus	ST 150	51	18	17	0.54	0.62	5.6
Sparkling Ice	Antelio Plus	ST 167	65	19	19	0.66	0.75	5.6
Graphite	Cool-lite	ST 136	37	22	18	0.42	0.48	5.5
Clear Cosmos	Evo	ET 125	28	27	9	0.29	0.33	3.8
Neutral	Evolite	ET 150II	50	13	11	0.5	0.58	5(0.88)
DOUBLE GLAZED UNIT 6mm Coated Glass (coatingface 2) -12mm air gap - 6mm Clear Glass								
Light Gold	Reflectasol		29	46	52	0.43	0.49	2.8
Dew Drop	Antelio Plus	ST 150	45	20	21	0.44	0.51	2.8
Sparkling Ice	Antelio Plus	ST 167	59	22	23	0.56	0.64	2.8
Graphite	Cool-lite	ST 136	33	23	22	0.33	0.38	2.7
Pristine White	Planitherm	PLT T	74	12	12	0.54	0.62	1.8

ECBC COMPLIANCE – RESIDENTIAL

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2007)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.43 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 409 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 2" XPS Insulation U-factor = 0. 404 W/Sq.m.K
3.	**Glazing**	U Value: 3.3 W/Sq.m.K SHGC (All) : 0.25 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value : 2.80 W/Sq.m.K SHGC : 0.44 VLT : 45% For Fenestration Assembly
4.	**WWR**	30%	30%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	15 W/m^2	15 W/m^2
7.	**Pumps & Motors**	Standard Efficiency – 70%	High Efficiency – 85%
8.	**Lighting Power Density**	7.5 W/m^2	7.5 W/m^2
9.	**External Lighting Load**	Efficacy 60 Lumen / W	Efficacy 50 Lumen / W
10.	**Domestic Hot Water**	20% on Solar (20 ltr/person/day)	20% on Solar (20 ltr/person/day)
11.	**HVAC System Type**	Packaged Single Zone (Split Unit) with COP 3.0.	Packaged Single Zone (Split Unit) with COP 3.0.
12.	**Process Loads**	As Per Design	As Per Design
13.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
14.	**PF Correction**	0.95	0.95
15.	**Power Distribution Losses**	< 1%	< 1%

ECBC COMPLIANCE – COMMERCIAL – Office / IT / Convention Centre

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	15 W/m^2	15 W/m^2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	9.5 W/m^2	9.5 W/m^2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As Per Annexure I	As Per Annexure I
12.	**Domestic Hot Water Generation**	Not Applicable	Not Applicable
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Under Floor Air Distribution System
16.	**Ventilation Requirement As per ASHRAE 62.1**	11 cfm / Person	15 cfm / Person

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
17.	Chiller Parameter	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	VSD's on Chiller	Not Applicable	Recommended
19.	VFD's on Cooling Tower	Recommended	Recommended
20.	Primary, Fire, Condenser Pump Class	Standard – 70%	Premium – 75%
21.	Primary, Fire, Condenser Motor Class	Standard – 70%	Premium – 85%
22.	HVAC System	AHU with VFD	AHU with VFD
23.	VFD's in A.H.U.'s & Secondary Pumps	Recommended	Recommended
24.	Demand Control Ventilation	Not Applicable (Applicable for ECBC + & Super ECBC)	CO2 Sensors to modulate fresh air
25.	Heat Recovery Wheel	Not Applicable (Applicable for Hotel & Healthcare)	Recommended to precool the fresh air
26.	Airside Economizer	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)
27.	CO Sensors	Not Applicable	Recommended in Basement Areas
28.	DG Set	BEE 3 Star Rated	BEE 3 Star Rated
29.	PF Correction	0.97	0.97
30.	Power Distribution Losses	< 3%	< 3%

ECBC COMPLIANCE – SCHOOL BUILDING

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	10 W/m^2	10 W/m^2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	11.2 W/m^2	11.2 W/m^2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per Annexure I	As per Annexure I
12.	**Domestic Hot Water Generation**	Not Applicable	Not Applicable
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable
16.	**Ventilation Requirement As per ASHRAE 62.1**	10 cfm / Person	10 cfm / Person

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
17.	Chiller Parameter	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	VSD's on Chiller	Not Applicable	Recommended
19.	VFD's on Cooling Tower	Recommended	Recommended
20.	Primary, Fire, Condenser Pump Class	Standard – 70%	Premium – 75%
21.	Primary, Fire, Condenser Motor Class	Standard – 70%	Premium – 85%
22.	HVAC System	AHU with VFD	AHU with VFD
23.	VFD's in A.H.U.'s & Secondary Pumps	Recommended	Recommended
24.	Demand Control Ventilation	Not Applicable (Applicable for ECBC + & Super ECBC)	Not Recommended
25.	Heat Recovery Wheel	Not Applicable (Applicable for Hotel & Healthcare)	Not Recommended
26.	Airside Economizer	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)
27.	CO Sensors	Not Applicable	No Basement
28.	DG Set	BEE 3 Star Rated	BEE 3 Star Rated
29.	PF Correction	0.97	0.97
30.	Power Distribution Losses	< 3%	< 3%

ECBC COMPLIANCE – HEALTH CARE BUILDINGS

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	25 W/m^2	25 W/m^2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	9.7 W/m^2	9.7 W/m^2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per Annexure I	As per Annexure I
12.	**Domestic Hot Water Generation**	40% on Solar (20 ltr/person/day & Process Water)	40% on Solar (20 ltr/person/day & Process Water)
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable
16.	**Ventilation Requirement As per ASHRAE 62.1**	Patient rooms 10 cfm / Person Medical procedure 20 cfm / Person Operating rooms 20 cfm / Person Physical therapy 20 cfm / Person	Patient rooms 13 cfm / Person Medical procedure 26 cfm / Person Operating rooms 26 cfm / Person Physical therapy 26 cfm / Person

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
17.	Chiller Parameter	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	VSD's on Chiller	Not Applicable	Recommended
19.	VFD's on Cooling Tower	Recommended	Recommended
20.	Primary, Fire, Condenser Pump Class	Standard – 70%	Premium – 75%
21.	Primary, Fire, Condenser Motor Class	Standard – 70%	Premium – 85%
22.	HVAC System	AHU with VFD	AHU with VFD
23.	VFD's in A.H.U.'s & Secondary Pumps	Recommended	Recommended
24.	Demand Control Ventilation	Not Applicable (Applicable for ECBC + & Super ECBC)	CO2 Sensors to modulate fresh air
25.	Heat Recovery Wheel	Recommended	Recommended to precool the fresh air
26.	Airside Economizer	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)
27.	CO Sensors	Not Applicable	Recommended in Basement Areas
28.	DG Set	BEE 3 Star Rated	BEE 3 Star Rated
29.	PF Correction	0.97	0.97
30.	Power Distribution Losses	< 3%	< 3%

ECBC COMPLIANCE – HOSPITALITY BUILDING

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	20 W/m^2	20 W/m^2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	9.5 W/m^2	9.5 W/m^2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per table in Annexure I	As per table in Annexure I
12.	**Domestic Hot Water Generation**	40% on Solar (20 ltr/person/day & Process Water)	40% on Solar (20 ltr/person/day & Process Water)
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable
16.	**Ventilation Requirement As per ASHRAE 62.1**	Office/Lockers 10 cfm / Person Dining/Kitchen 15 cfm / Person Spa & Gym 25 cfm / Person Bar & Lounge 13 cfm / Person	Office/Lockers 13 cfm / Person Dining/Kitchen 20 cfm / Person Spa & Gym 33 cfm / Person Bar & Lounge 17 cfm / Person

S.NO.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
17.	Chiller Parameter	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	VSD's on Chiller	Not Applicable	Recommended
19.	VFD's on Cooling Tower	Recommended	Recommended
20.	Primary, Fire, Condenser Pump Class	Standard – 70%	Premium – 75%
21.	Primary, Fire, Condenser Motor Class	Standard – 70%	Premium – 85%
22.	HVAC System	AHU with VFD	AHU with VFD
23.	VFD's in A.H.U.'s & Secondary Pumps	Recommended	Recommended
24.	Demand Control Ventilation	Not Applicable (Applicable for ECBC + & Super ECBC)	CO2 Sensors to modulate fresh air
25.	Heat Recovery Wheel	Recommended	Recommended to precool the fresh air
26.	Airside Economizer	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)
27.	CO Sensors	Not Applicable	Recommended in Basement Areas
28.	DG Set	BEE 3 Star Rated	BEE 3 Star Rated
29.	PF Correction	0.97	0.97
30.	Power Distribution Losses	< 3%	< 3%

Annexure I : External Building Lighting Power Density as per ECBC 2017

Table 6-7 Exterior Building Lighting Power for ECBC Buildings

Exterior lighting application	*Power limits*
Building entrance (with canopy)	10 W/m² of canopied area
Building entrance (w/o canopy)	90 W/ linear m of door width
Building exit	60 W/lin m of door width
Building façade	5.0 W/m² of vertical façade area
Emergency signs, ATM kiosks, Security areas façade	1.0 W/m²
Driveways and parking (open/ external)	1.6 W/m²
Pedestrian walkways	2.0 W/m²
Stairways	10.0 W/m²
Landscaping	0.5 W/m²
Outdoor sales area	9.0 W/m²

Annexure II : Building Envelope Sealing Requirement as per ECBC 2017

4.2.4 Building Envelope Sealing

Following areas of the building envelope, of all except naturally ventilated buildings or spaces, shall be sealed, caulked, gasketed, or weather-stripped:

(a) Joints around fenestration, skylights, and door frames
(b) Openings between walls and foundations, and between walls and roof, and wall panels
(c) Openings at penetrations of utility services through roofs, walls, and floors
(d) Site-built fenestration and doors
(e) Building assemblies used as ducts or plenums
(f) All other openings in the building envelope
(g) Exhaust fans shall be fitted with a sealing device such as a self-closing damper
(h) Operable fenestration should be constructed to eliminate air leakages from fenestration frame and shutter frame

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Enclosure 3

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1 INTRODUCTION

1.1 BACKGROUND

Project proponent has proposed to construct township Post-Sarang, Nadhal & Pali Khurd, Taluka-Khalapur, Dist- Raigad, State: Maharashtra. The project comprises of residential, commercial, reatail and educational development. On completion, the project will provide 21983 car parking spaces within the premises.

1.2 SCOPE

The scope of this study is listed below:

- **Traffic Surveys**: To conduct traffic surveys of area project site in order to capture base traffic:
    - Assess current traffic pattern on access road – neighboring road network
    - Capture traffic emanating from new developments and from adjacent properties
- **Traffic Circulation**: To review traffic circulation plan considering various types of vehicles users (cars, 2W, fire tender)
- **Impact Analysis**: Analyze the forecast project traffic in conjunction with base traffic. Conduct an Impact Analysis of project traffic as well as study impacts and suggest mitigation measures.
- **Swept Path Analysis**: Review traffic circulation to ensure proper and efficient traffic movement. Conduct swept path analysis at critical locations of project entry/exit to ensure safe and efficient turning maneuvers.
- **Traffic Control**: Address the provision of road signages, markings and traffic calming measures. Also provide a traffic management plan to address issues of traffic control and safe dispersal.
- **Retrieval analysis** of parking lot will also be undertaken analytically.

1.3 ASSUMPTIONS

GMD Engineering Consultants follows standard procedures and guidelines to determine the impact of added traffic on proposed facilities. In the following sections, the assumptions considered as well as selected design standards and parameters for the analysis have been discussed.

1.3.1 CODES AND MANUALS

Design standards are generally followed bottom-up or part to whole. Local bylaws are given highest priority to meet the requirements set by local development control agency. Other standards, although explicitly not mentioned by local development control agency, are referred from national or international design manuals that are accepted and widely referred by other professionals in the industry.

Following Codes and Manuals have been referred in this study:

- Codes by Indian Road Congress
- A Policy on Geometric Design of Highways and Streets' by American Association of State Highway and Transportation Officials (AASHTO)
- Trip Generation and Parking Generation handbooks by Institute of Transportation Engineers (ITE)
- Guidelines for Preparation of Traffic Impact Assessment Reports by LTA, Singapore
- Design recommendations for multi-storey and underground car parks 3rd Edition, IStruct, UK.

1.3.2 DESIGN PARAMETERS

The basic design parameters considered for the study has been illustrated below:

1) The social status as well as economic well-being of the residents plays an important role in determining the parking demand for any residential project.
2) The visitors will expect a safe and efficient circulation with good levels of service, i.e. minimum waiting time at security check, proper traffic control at entry / exits, minimum congestion delays and pleasing aesthetics.
3) A design vehicle is a vehicle whose dimensions and operational characteristics are used to establish layout geometry. Toyota Innova (Big Car) and Maruti Swift (Small Car) and Volvo 400 (Fire Tender) were chosen as the design vehicles.
4) The speed of the vehicle is restricted within the premises as below
    a. On the straight sections - 15 kmph
    b. On turns and bends - 10 kmph
    c. On ramps - 10 kmph
5) The maximum number of traffic a road can carry is referred to as its Capacity or design Service Volume. The service volumes considered for the project is given below.

Table 1-1 Roadway Capacities as per IRC 106: 1990

Type of Roadway	Road Capacity*	Category
4 Lane 2 Way (Divided)	5143	(Arterial)

*Indian Road Congress 106: 1990 Urban Road Capacity

6) Level of Service (LOS) can be defined as a letter designation that describes a range of operating characteristics on a given facility. Six Levels of Service are defined for capacity analysis. They are given letter designations from A to F, with LOS 'A' representing best level of operational standards and LOS 'F' the worst.

Table 1-2 Description of LOS based on V/C Ratio

Level of Service (LOS)	Volume/Capacity Ratio (V/C)	Level of Comfort	Nature of flow
A	<0.30	Highest	Free Flow
B	0.30 – 0.50		Reasonably free flow
C	0.50 – 0.70		Stable flow
D	**0.70 – 0.90**	**Threshold**	**Approaching unstable flow**
E	1.00		Unstable flow
F	>1.00	Lowest	Forced flow

Maximum waiting time for such high profile users preferred is **60 seconds**.

1.3.3 ENTRY / EXIT LANE CAPACITIES

The following capacities as recommended by UK – Institute of Structural Engineers have been adopted. These have been validated at a few Indian locations.

Entry/Exit Lane Capacities for Car Parks

Sr No	Type of Entry	Capacity (veh/hour/lane)
1	Free-flow access into internal distributor road/ structure (no parking spaces immediately after access, i.e. ramp distributing to several levels of car park)	800
2	Free-flow access	580
3	**Lifting-arm barrier without ticket issue**	**550**
4	**Lifting-arm barrier with automatic ticket issue (push button)**	**360**
5	**Lifting-arm barrier with access card (slot-based)**	**235**
6	Lifting-arm barrier with transponder (no slot – RFID etc.)	380

Sr No	Type of Exit	Capacity (veh/hour/ln)
1	**Ticket on entry and payment at a manned exit**	**240**
2	**Lifting-arm barrier without ticket issue**	**550**
3	Ticket on entry and variable payment to a machine linked to the exit barrier	270
4	Ticket on entry and operation of the exit barrier by a prepaid ticket or token	400
5	Free-flow exit	Analysis based on specific road layout (i.e.yield etc.)

Rates based on: „Design recommendations for multistory and underground car parks, Institute of Structural Engineers, 3rd Edition, June 2002" and „HBS 2001, FGSV Verlag, January 2002"

As per international practices it is preferred to restrict the queue length to around **18m i.e. 3 vehicles**. This is also linked with space availability at site for queuing.

1.4 TRAFFIC STUDY METHODOLOGY

The methodology adopted for traffic analysis for this project is represented in the form of a flowchart as shown in Figure 1-1.

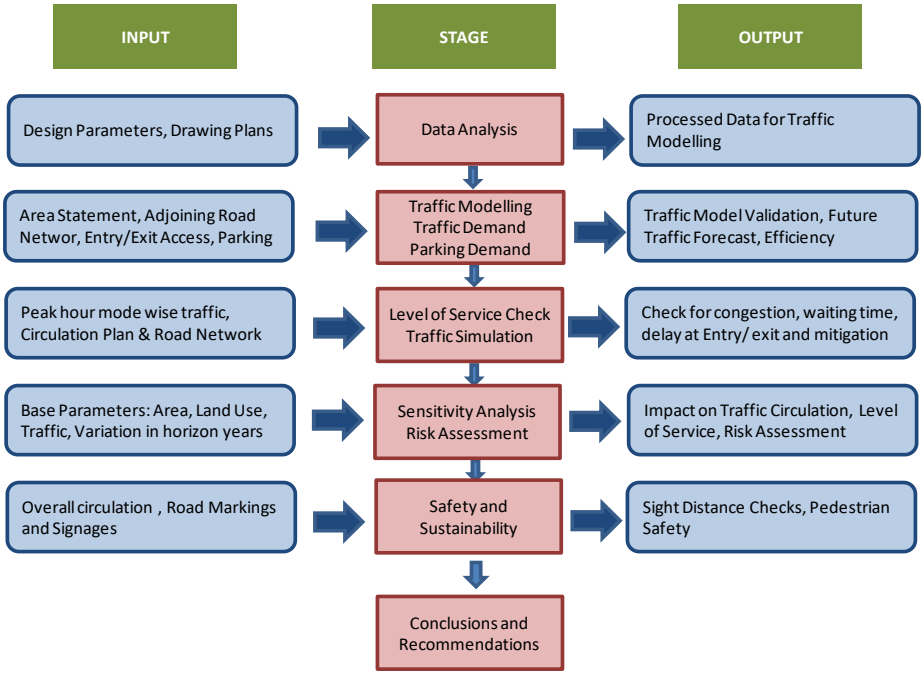


Figure 1-1 Traffic Study Methodology

1.5 TRAFFIC MODEL

Traffic modeling is the process of analyzing the pattern in which an area's transport network would be used by traffic given the distribution and characteristics of the area's population, employment and other land uses. The output of traffic analysis is forecast of vehicles using each road segment within the study area. Traffic forecast is best achieved by transportation modeling. The conventional transportation modeling is a four stage process. The most widespread form of model utilized is gravity model and the same is utilized for this project. The broad outline of this four stage gravity model is illustrated in Figure 1-2 below.

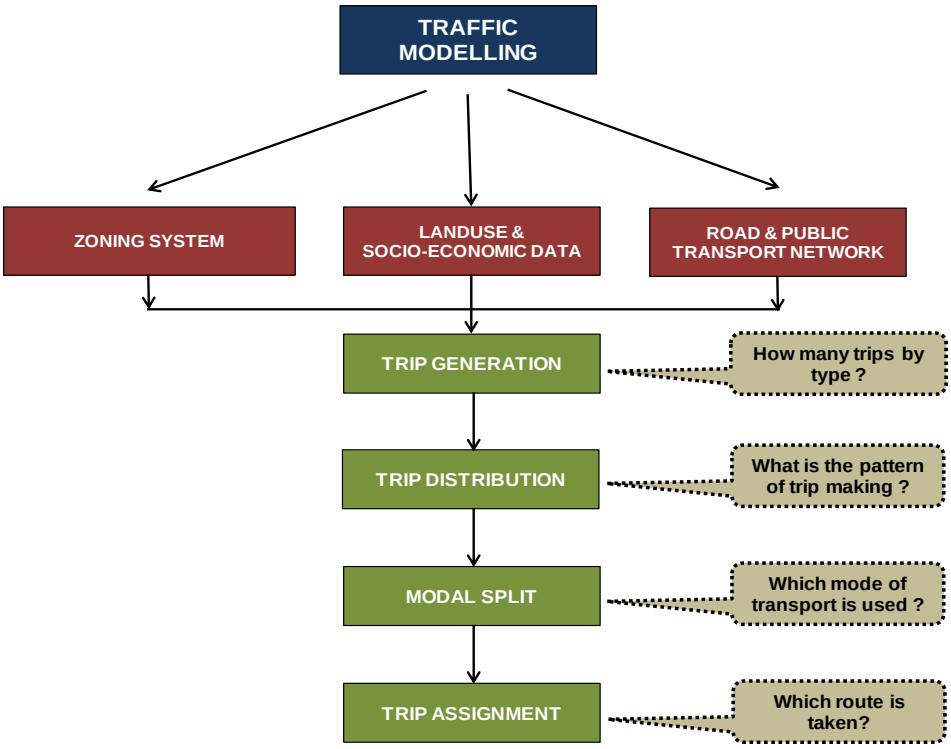


Figure 1-2 Traffic Model

1.6 OUTLINE OF THE REPORT

The report has been organized in the following order:

Chapter 1 Introduction, scope, assumptions and methodology

Chapter 2 Illustrates the existing road network and the present traffic scenario at the project site as well as details on external road network considered and neighbouring region profile to give an overview of the baseline (existing) traffic conditions**.**

Chapter 3 Explains the salient features of the proposed development.

Chapter 4 Describes the analysis of traffic survey and road network data for neighbouring roads and gives a better picture of where they stand as far as level of service is concerned. Also, the likely number of trips that would be generated by the project has been forecasted and its likely impact on road traffic was studied.

Chapter 5 Describes the analysis studies conducted to study various other aspects of the project. This includes swept path analysis and retrieval analysis.

Chapter 6 Describes the Traffic Management Plan including various traffic calming measures for the project to ensure safe and secure circulation of pedestrians and vehicles.

Chapter 7 Summarises the conclusions and recommendations of the study.

****

2 SITE APPRECIATION, EXISTING TRANSPORT NETWORK AND BASE TRAFFIC

The existing transport network surrounding the project has been illustrated in the section below.

2.1 PROJECT LOCATION

The project is located in Khalapur, Maharashtra. Chowk railway station is the nearest railway station located at a distance of 1.2 km from site which provides local connectivity. Chhatrapati Shivaji International Airport is the nearest airport from site which is located at distance of 61.5 km from site. The site is well connected to major landmarks in and around Raigad by road as well as rail. The project has direct access to Old Mumbai Pune Highway. Figure 2-1 shows an aerial view of the location.

Figure 2-1 Project Location

2.2 SURROUNDING ROAD NETWORK

The project location is surrounded by a planned road network. The project has direct access to Old Mumbai Pune Highway. The location of the proposed development and surrounding road network of 5KM from project location are illustrated in Figure 2-2.

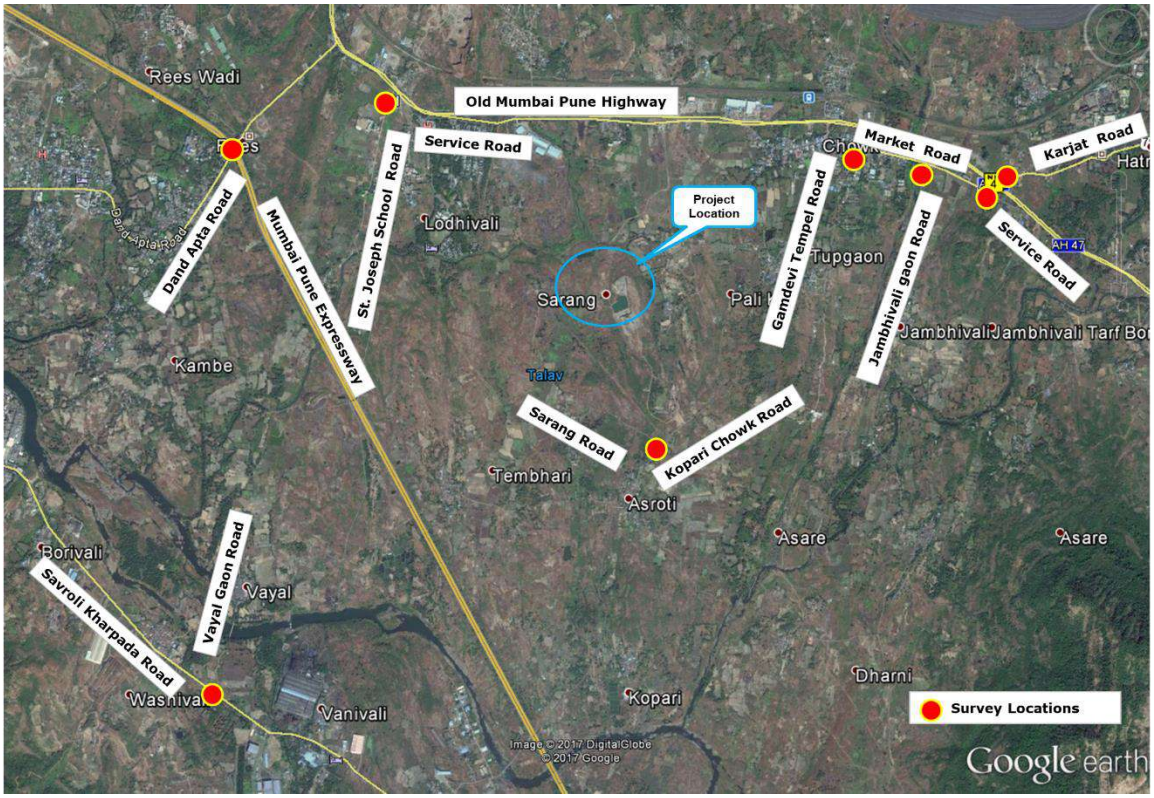


Figure 2-2 Surrounding Road Network and Traffic Survey Location within 5KM Radius

Following pictures depict the surrounding road network.

Figure 2-3 Old Mumbai Pune Highway

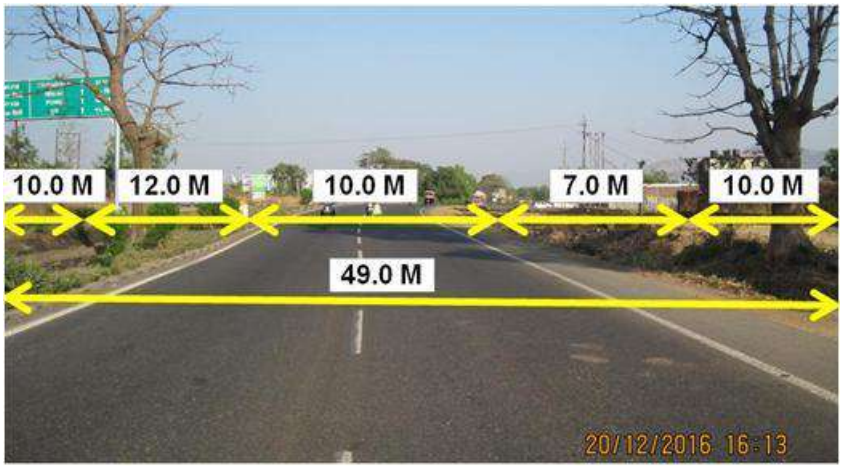


Figure 2-4 Old Mumbai Pune Highway(Opposite to Site)

Figure 2-5 Internal Site Road

Figure 2-6 *Dand Apta Road*

Figure 2-7 Mumbai Pune Expressway

Figure 2-8 School Road

Figure 2-9 Gamdevi Temple Road

Figure 2-10 Market Road

Figure 2-11 Jambhivali gaon Road

Figure 2-12 SH79

The site is well connected to major urban centers around Raigad via road and rail. It is connected to all basic services like hospital, police station, fire station, post office and others.

2.3 TRAFFIC SURVEYS

Traffic surveys are necessary to gather base data information about existing traffic and travel pattern on surrounding roads. Road network within 5km radius from the project location is considered for traffic study is shown in below . Network Inventory Survey. Traffic surveys were carried out on 17th December, 2016 (Saturday) and 20th December, 2016 (Tuesday). The traffic surveys included classified traffic volume counts. Traffic survey was conducted at Old Mumbai Pune Highway, Mumbai Pune Expressway, Sarvoli Kharpada Road, Dand Apta Road, School Road, Sarang Road, Site Access Road, Temple Road, Jambhivali gaon Road, Market Road and SH 79.

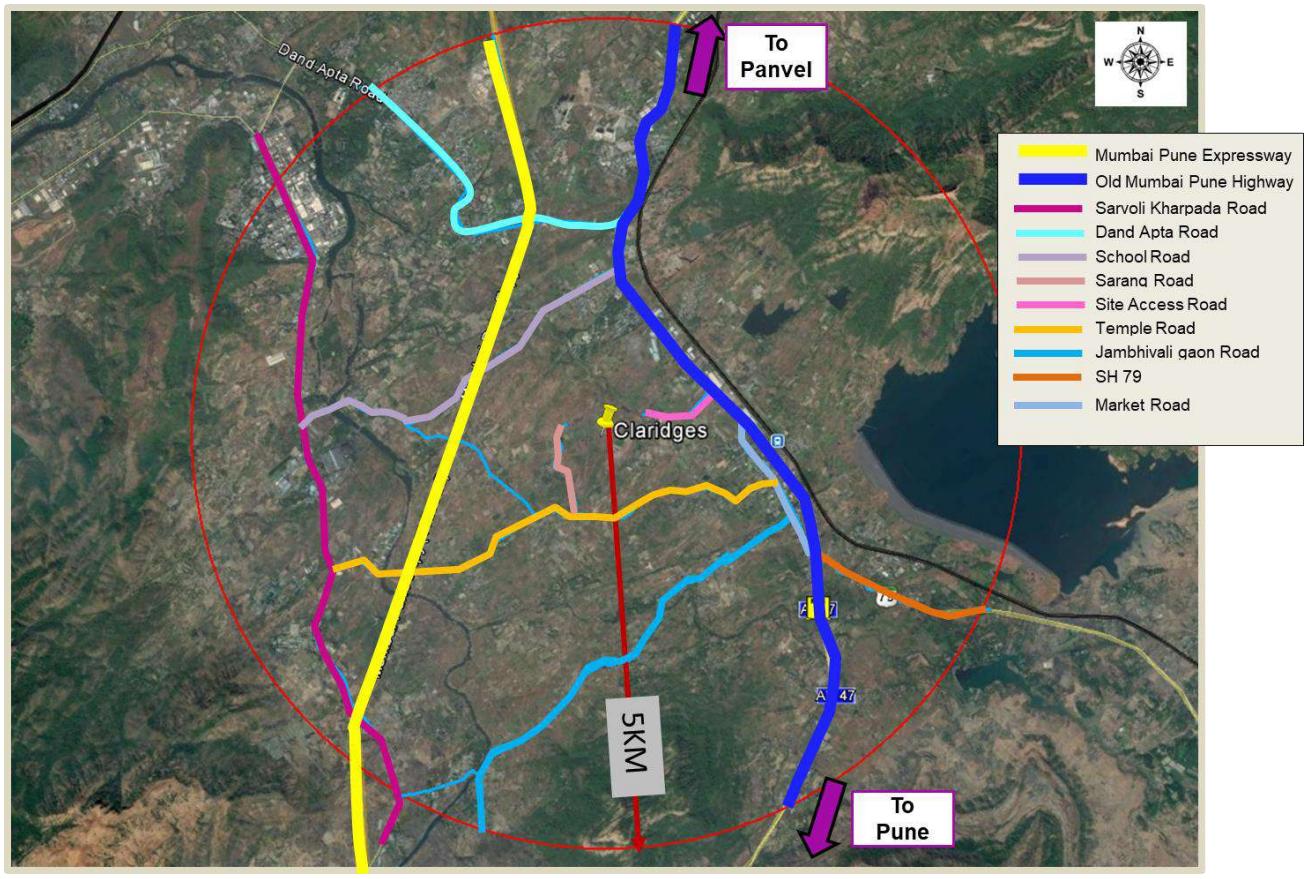


Figure 2-13 Study Area of 5KM from Project Location

2.4 BASE TRAFFIC

Traffic survey was conducted for 24 hours to understand the hourly traffic variation for the roads. The observed peak hour volume for Old Mumbai Pune Highway has been illustrated below. Also modal split along with directional distribution of traffic for each road has been illustrated in the figures below.

Table 2-1 Hourly Traffic Volume on Old Mumbai Pune Highway

Time Period	2W	3W	Cars	Buses	Lcv	2 Axle	3 Axle/ Multi Axle	Total Vehicles	Total PCU
8 to 9	235	361	357	8	15	0	0	976	873
9 to 10	291	446	441	9	19	0	0	1205	1079
10 to 11	268	411	406	9	17	0	0	1111	995
11 to 12	236	361	357	8	15	0	0	977	875
12 to 13	210	321	318	7	14	0	0	869	777
13 to 14	205	314	311	7	13	0	0	851	761
14 to 15	221	339	336	7	14	0	0	918	821
15 to 16	236	361	357	8	15	0	0	977	875
16 to 17	248	380	376	8	16	0	0	1028	920
17 to 18	271	415	411	9	17	0	0	1124	1006
18 to 19	311	476	471	10	20	0	0	1289	1153
19 to 20	284	436	431	9	18	0	0	1178	1054
20 to 21	245	375	371	8	16	0	0	1014	907
21 to 22	218	334	330	7	14	0	0	903	808
22 to 23	175	268	265	6	11	0	0	724	648
23 to 24	131	201	199	4	8	0	0	543	486
24 to 1	118	181	179	4	8	0	0	489	437
1 to 2	105	161	159	3	7	0	0	434	389
2 to 3	87	134	132	3	6	0	0	362	324
3 to 4	72	110	109	2	5	0	0	299	267
4 to 5	55	84	83	2	4	0	0	226	202
5 to 6	63	96	95	2	4	0	0	261	234
6 to 7	113	173	171	4	7	0	0	469	420
7 to 8	175	268	265	6	11	0	0	724	648
Total	**4571**	**7005**	**6931**	**147**	**295**	**0**	**0**	**18950**	**16959**

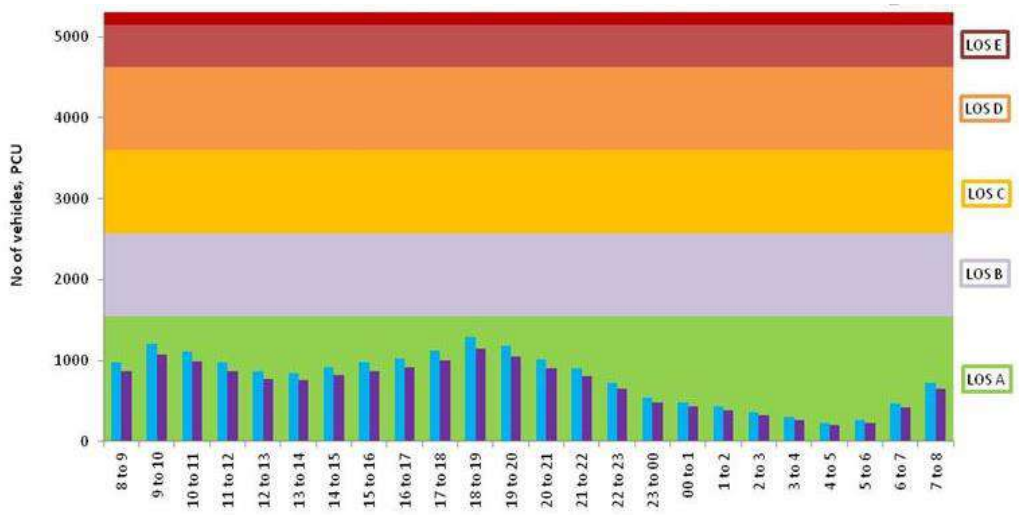


Figure 2-14 Hourly Traffic Distribution for Old Mumbai Pune Highway

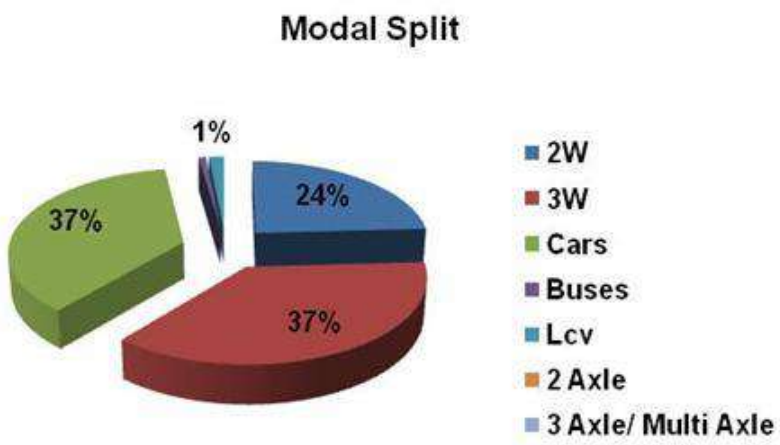


Figure 2-15 Modal Split (vehicles) for Old Mumbai Pune Highway

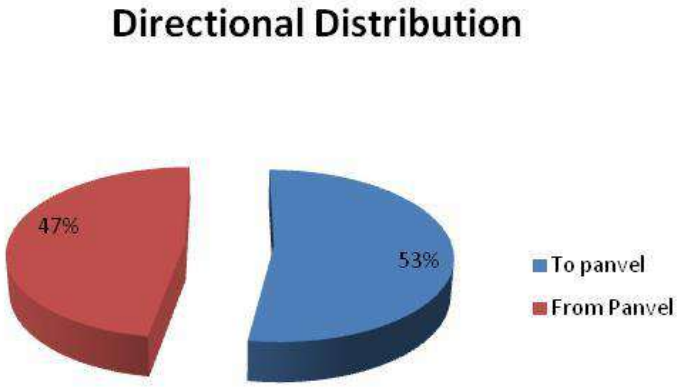


Figure 2-16 Directional Distribution for Old Mumbai Pune Highway

Based on preliminary analysis it was observed that:

- Peak morning traffic was observed between 9 and 10 AM and peak evening traffic was observed between 6 to 7 PM.
- The vehicular traffic predominantly consists of cars and three wheelers.
- Directional distribution analysis indicated that traffic is going more towards Panvel.

3 PROPOSED DEVELOPMENT

The plot is being developed as a special township project having comprising 21983 car parking spaces.

Provision of access points to drop off /pickup have been planned to facilitate efficient circulation and dispersal of traffic. These access points shall provide entry / exit facility to parking and drop off locations and are strategically located and designed in such a way that it not only adds efficacy to circulation and accessibility but also helps in safety, security and traffic management. The access points provided for the project is illustrated in Figure 3-1.

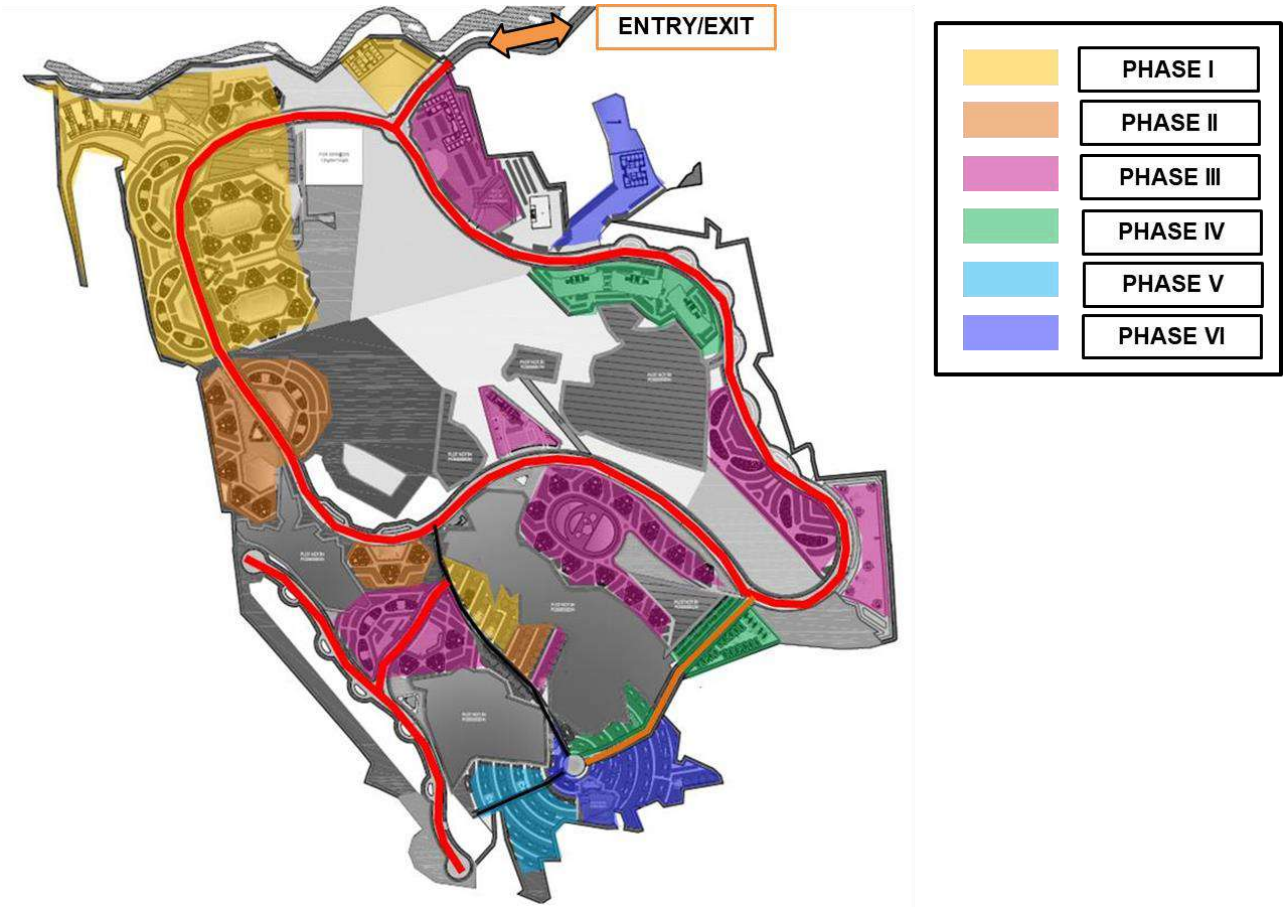


Figure 3-1 Phase wise Development – Layout Plan

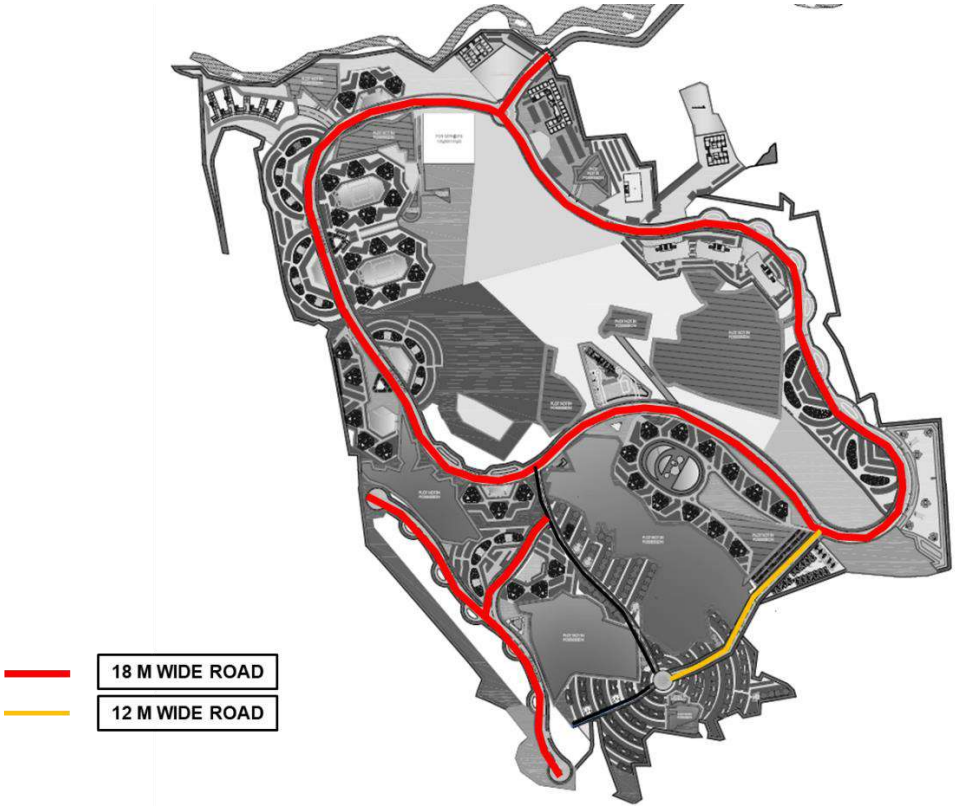


Figure 3-2 Access Roads – Layout Plan

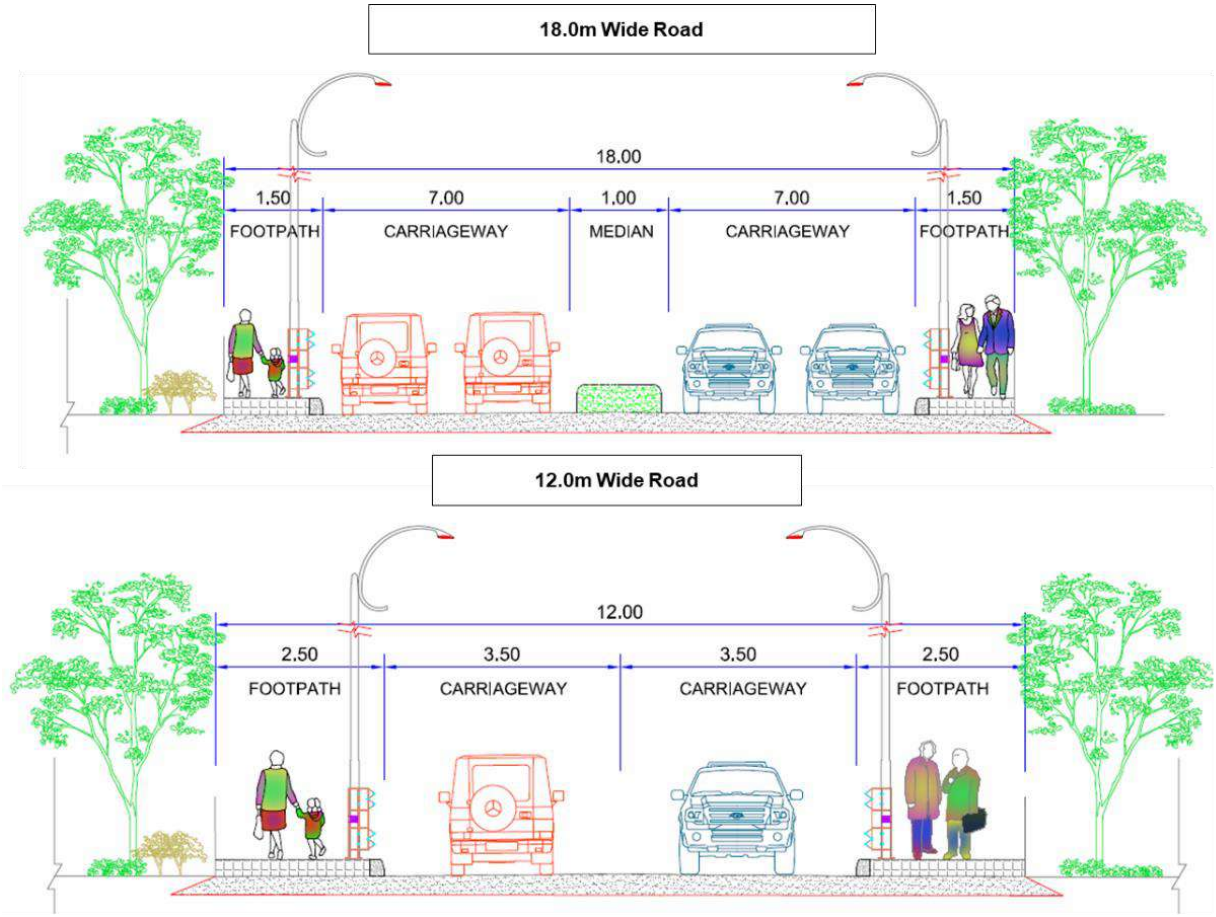


Figure 3-3 Proposed Road Cross Sections

3.1 AREA/UNIT STATEMENT

The area/unit statement is as given below.

UNIT/AREA STATEMENT

Residential Sale	Units
Phase 1	3,036
Phase 2	1,584
Phase 3	2,508
Total	**7128**
Residential EWS	**Units**
Phase 1	844
Phase 2	480
Phase 3	908
Phase 4	1140
Phase 5	1,632
Phase 6	1388
Total	**6392**
Grand Total	**13520**

Particulars	Area (sq.m)
Convenient shop/convenience centre	19394.76
School	53763.96
Hospital	12555.08
Hotel	34398
Commercial/office	8723.50
Market Mall	83667.40
IT park	185264.64
Resort	11648.45

3.2 PARKING STATEMENT

All the parking required for the project is being accommodated within the project premises. The parking statement is given in Table 3-1.

Table 3-1 Parking Statement

PHASE	Parking Spaces				
	No of Car	No of TW	No of Bus	No of Cycles	No of Ambulance
PHASE 1	5984	725	16	4338	3
PHASE 2	2977	327	-	3126	-
PHASE 3	7113	803	64	7852	2
PHASE 4	4919	460	-	1819	-
PHASE 5	521	63	-	2244	-
PHASE 6	469	58	50	1390	
Total	**21983**	**2436**	**130**	**20769**	**5**

4 TRAFFIC ANALYSIS

The traffic analysis comprises of:

- Traffic Forecast
- Traffic Impact Analysis
- Traffic Circulation

4.1 TRAFFIC FORECAST

Traffic forecasting is the process of estimating the total number of trips generated and attracted by each land-use.

Trip: A trip is an individual's one way travel from one point (origin) to other (destination). The trip can be for various reasons such as work, business, education, shopping, recreation, etc

Traffic forecasting is done using trip generation rates which are developed to estimate the number of trips generated from specific household and/or land use. For the purpose of this study, ITE trip generation manual were referred for arriving at basic trip generation rates and these rates were further modified suitably to represent Indian conditions. The no of trips include visitors, services and other trips attracted by residential, educational and commercial land use.

The project is expected to be commissioned by the year 2030. This would generate additional trips during day and peak hours. The trips generated by the project are given in table below:

Table 4-1 Trip Generation

Description	AM Peak Hour		PM Peak Hour		Total Trip AM Peak Hour	Total Trip PM Peak Hour
	Trip in	Trip out	Trip in	Trip out		
Residential	537	2147	1899	1023	2684	2922
Shops	4	18	80	43	22	123
Convention centre	434	234	146	151	668	297
Office	180	32	54	126	212	180
School	2601	650	96	867	3252	963
IT park	1227	216	495	1154	1443	1649
Hospital	36	21	30	50	57	80
Hotel	9	9	31	15	17	46
Resort	41	59	84	81	100	164

A traffic growth of 5% is considered per year for the surrounding network. Based on this, the traffic has been forecasted and has been summarized in Table 4-4 and Table 4-5.

Table 4-2 Base Traffic Forecast for Project Network Roads

Road Name	Description	Peak Traffic Volume in 2016(PCU/hr) (A)	Design Traffic Capacity as per IRC 106:1990 (PCU/hr)	V/C Ratio* (Peak volume /capacity)	LOS
NH4	4 Lane 2 Way (divided) (Arterial)	1153	5143	0.22	A

This project being of residential land use, once commissioned will be generating predominantly outgoing and incoming traffic during morning and evening peak hours respectively. There will be various modes of vehicles contributing to the traffic.

4.2 TRAFFIC ASSIGNMENT

Trip distribution essentially describes that how the generated / attracted traffic arrives and departs from the project development site and in which direction. An overall trip distribution was developed for the site after a review of the existing travel patterns in the area. The volume of traffic generated / attracted will have a defined pattern of distribution both for entry and exit. Locations of the residential zones, major roadways and highways that will serve the development have been considered to arrive at trip distribution.

The project site is surrounded by a well planned road network. Existing neighboring roads will carry traffic from and towards the site. The impact of the project traffic would be predominantly on Old Mumbai Pune Highway. Following has been assumed for assignment of trips on existing road network.

Table 4-3 Trip Assignment on Existing Road Network

Road Name	Project Impact (%)
Old Mumbai Pune Highway	100

4.3 VEHICLE CIRCULATION

The project is a special township project. Multiple access points for vehicles have been provided in order to ensure smooth vehicle movement. This has been illustrated in Figure 3-1. Also, the floor wise circulation proposed for the project has been illustrated in Figure 4-1.

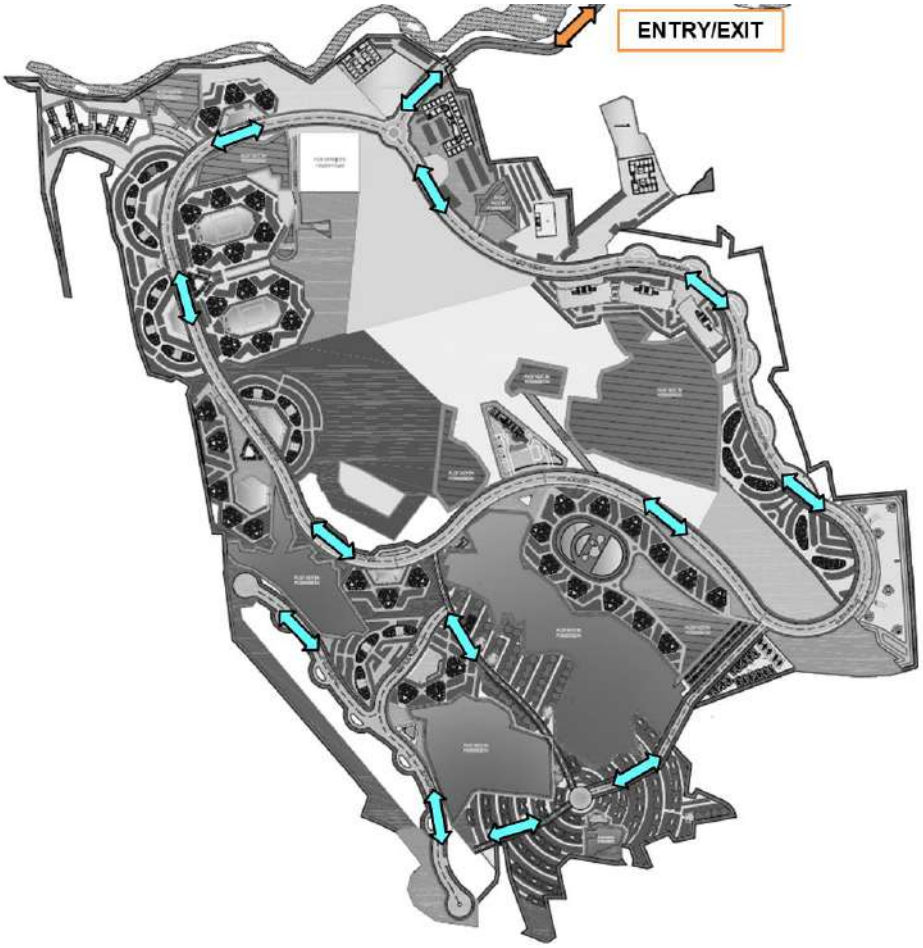


Figure 4-1 Layout Plan – Traffic Circulation

4.4 TRAFFIC IMPACT ANALYSIS

The traffic on Old Mumbai Pune Highway was analyzed to assess its traffic impact on the existing roads.

Future traffic on adjoining roads shall comprise of following two major components:

- Base Road Traffic (forecasted to year 2020 and 2025)
- Project Traffic (2020 and 2025)

The road traffic has been forecasted for year 2020 and 2025. This total traffic on the road is compared with its capacity. This V/C ratio of peak traffic volume and capacity is used as an index to determine level of congestion on link which is likely to occur when projected traffic is operative on link. Pedestrian traffic is assumed to use footpaths and not affect the road capacity. The summary of results for future traffic link flow conditions at different access roads is shown in Table 4-4 and Table 4-5.

Table 4-4 Traffic Capacity Analysis of Access Roads – 2020

Road Name	Peak Traffic Volume in 2020 (PCU/hr)(A)	Project Traffic (PCU/hr) (B)	Total Traffic in 2020 (A + B)	Design Traffic Capacity as per IRC 106:1990 (PCU/hr)	V/C Ratio (Peak volume /capacity)	LOS
NH4	1384	287	1671	5143	0.32	B

Table 4-5 Traffic Capacity Analysis of Access Roads – 2025

Road Name	Peak Traffic Volume in 2025 (PCU/hr)(A)	Project Traffic (PCU/hr) (B)	Total Traffic in 2025 (A + B)	Design Traffic Capacity as per IRC 106:1990 (PCU/hr)	V/C Ratio (Peak volume /capacity)	LOS
NH4	1672	717	2389	5143	0.46	B

**Note: If V/C ratio <1.0, it indicates acceptable level of service (LOS)*

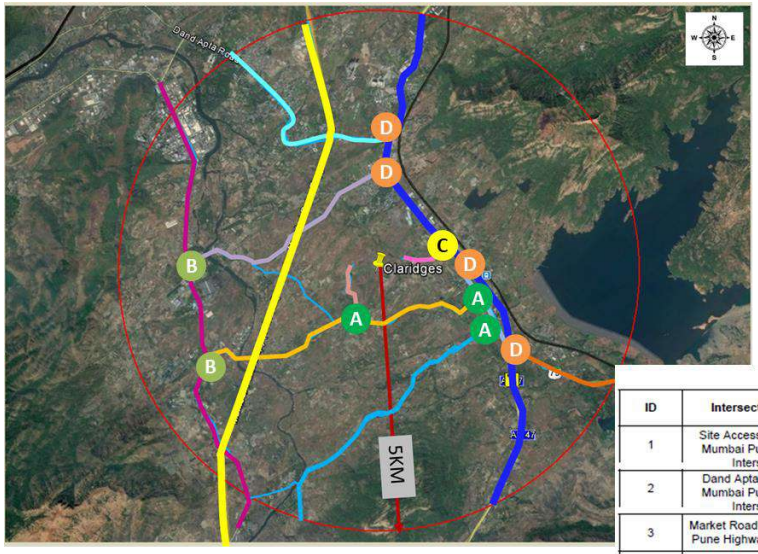
The above results indicated that there are no concerns on account of project traffic and the traffic will continue to run as usual even after commissioning of project.

Under present configuration the roads will operate at V/C ratio of maximum 0.32 and 0.46 for the year 2020 and 2025 respectively during the peak hour after completion of the proposed development, which indicates the traffic will continue to run as usual with appropriate vigil during peak hours after commissioning of project.

4.5 INTERSECTION ANALYSIS

The intersections adjacent to the project site under 5KM radius were studied to understand the impact of project traffic on the roadway. The peak traffic emanating from the site after completion of the project has been tabulated below.

The existing Level of Service (2017) for the neighboring intersections has been illustrated below. Refer Figure 4-2.



Mumbai Pune Expressway
Old Mumbai Pune Highway
Sarvoli Kharpada Road
Dand Apta Road
School Road
Sarang Road
Site Access Road
Temple Road
Jambhivali gaon Road
SH 79
SH 79
Market Road

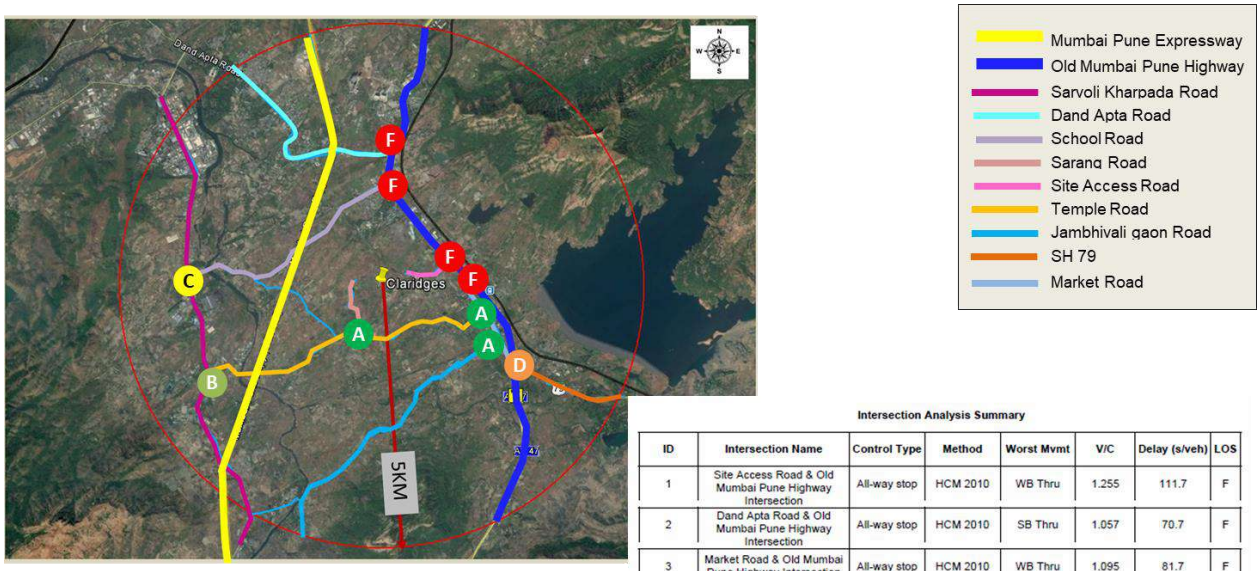
Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Site Access Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	EB Thru	0.773	24.2	C
2	Dand Apta Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	NWB Thru	0.817	28.7	D
3	Market Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	WB Thru	0.795	27.6	D
4	Market Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	WB Thru	0.195	7.9	A
5	Market Road & Jambhivali gaon Road Intersection	All-way stop	HCM 2010	NWB Thru	0.211	8.0	A
6	Savroli Kharpada Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	NWB Thru	0.542	11.2	B
7	Savroli Kharpada Road & School Road Intersection	All-way stop	HCM 2010	NWB Thru	0.528	10.8	B
9	Old Mumbai Pune Highway & Karjat Road Intersection	Signalized	HCM 2010	SEB Left	0.635	35.6	D
10	School Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	SEB Thru	0.780	25.9	D
11	Gamdevi Tempel Road & Sarang Road Intersection	All-way stop	HCM 2010	SWB Thru	0.101	7.5	A

Figure 4-2 Existing LOS for the neighboring road network (2017) - 5KM Study Area

The projected Level of Service of the year 2025 for the neighboring intersections has been illustrated below. Considering a growth factor of 5 % per year, the road traffic would grow by 40%. However, project traffic would contribute only 717 trips during peak evening hour refer Figure 4-3.

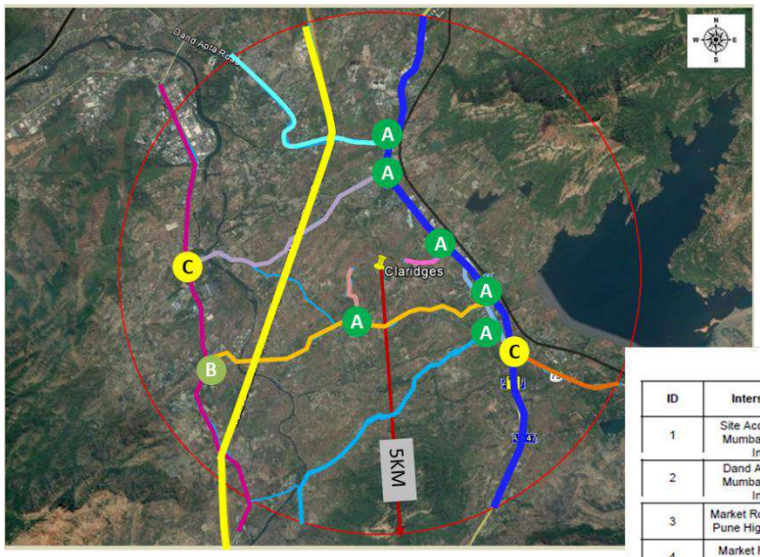
Traffic management for Road Network of 5km is proposed and as a mitigation measure Signalization of intersections are proposed. The analysis for the intersections as per proposed mitigation measures is shown Figure 4-4.



Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Site Access Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	WB Thru	1.255	111.7	F
2	Dand Apta Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	SB Thru	1.057	70.7	F
3	Market Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	WB Thru	1.095	81.7	F
4	Market Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	WB Thru	0.281	8.5	A
5	Market Road & Jambhivali gaon Road Intersection	All-way stop	HCM 2010	NWB Thru	0.305	8.7	A
6	Savroli Kharpada Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	NWB Thru	0.542	11.2	B
7	Savroli Kharpada Road & School Road Intersection	All-way stop	HCM 2010	NWB Thru	0.765	17.0	C
9	Old Mumbai Pune Highway & Karjat Road Intersection	Signalized	HCM 2010	SEB Left	0.641	36.0	D
10	School Road & Old Mumbai Pune Highway Intersection	All-way stop	HCM 2010	SEB Thru	1.094	74.7	F
11	Gamdevi Tempel Road & Sarang Road Intersection	All-way stop	HCM 2010	SWB Thru	0.144	7.8	A

Figure 4-3 Projected LOS for the neighboring road network (2025) – Do Nothing Scenario for 5Km Study Area



Mumbai Pune Expressway
Old Mumbai Pune Highway
Sarvoli Kharpada Road
Dand Apta Road
School Road
Sarang Road
Site Access Road
Temple Road
Jambhivali gaon Road
SH 79
Market Road

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Site Access Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NB Left	0.303	8.0	A
2	Dand Apta Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NEB Left	0.233	6.7	A
3	Market Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NWB Left	0.275	7.1	A
4	Market Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	WB Thru	0.281	8.5	A
5	Market Road & Jambhivali gaon Road Intersection	All-way stop	HCM 2010	NWB Thru	0.305	8.7	A
6	Savroli Kharpada Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	NWB Thru	0.542	11.2	B
7	Savroli Kharpada Road & School Road Intersection	All-way stop	HCM 2010	NWB Thru	0.765	17.0	C
9	Old Mumbai Pune Highway & Karjat Road Intersection	Signalized	HCM 2010	SEB Left	0.664	33.8	C
10	School Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NB Left	0.209	5.7	A
11	Gamdevi Tempel Road & Sarang Road Intersection	All-way stop	HCM 2010	SWB Thru	0.144	7.8	A

Figure 4-4 Projected LOS for the neighboring road network (2025) – Traffic Management Scenario for 5Km Study Area

4.6 TRAFFIC MANAGEMENT OF SURROUNDING ROADS

By 2025, Traffic management measures will have to be adopted to cater to the increasing traffic. The following measures have been proposed.

Install traffic management measures to regulate the flow of traffic

- Provide adequate traffic signs and signages to notify residents
- Signalization, signal optimization of junctions
- Install safety mirrors to aid visibility in conflict points
- Prevent on street parking
- Provide speed humps to regulate speed of vehicles on local streets
- Provide pedestrian crossings and dedicated footpath to cater to the walking population
- Assign traffic wardens to regulate flow of project traffic during peak hours

5 OTHER IMPORTANT ASSESSMENTS

5.1 SWEPT PATH ANALYSIS

It is the analysis of the path of the design vehicle undertaking a movement and/or a turning maneuver. At a basic level this includes calculating the thread of each wheel during the turn and also calculating the maneuvering space needed by the vehicle body (front & rear overhang).

5.2 OBJECTIVES

The objectives of performing swept path analysis are as follows:

- To check that the plan layout can accommodate the movement of the design vehicle expected by the development.
- To provide solutions to possible geometric congestions on the site.
- To provide information of the proposed layout and see if it serves the purpose, especially at turns where head room for vehicle maneuvers is limited.
- To provide to local authority and developers precise information and the swept path analysis of vehicles overlaid on the proposed site layout to demonstrate that the vehicles can maneuver safely and efficiently within the site layout.

5.3 DESIGN VEHICLE

A design vehicle is a vehicle whose dimensions and operational characteristics are used to establish layout geometry. From an optimum design perspective it is beneficial to select the design vehicle which is near to 85% percentile, i.e. 85% of vehicles will have smaller dimensions. This helps in optimizing the space requirements. The design vehicles selected for this particular project are as follows:

- Fire Tender

Detailed design and dimensions of design vehicle has been illustrated in Figure 5-1.

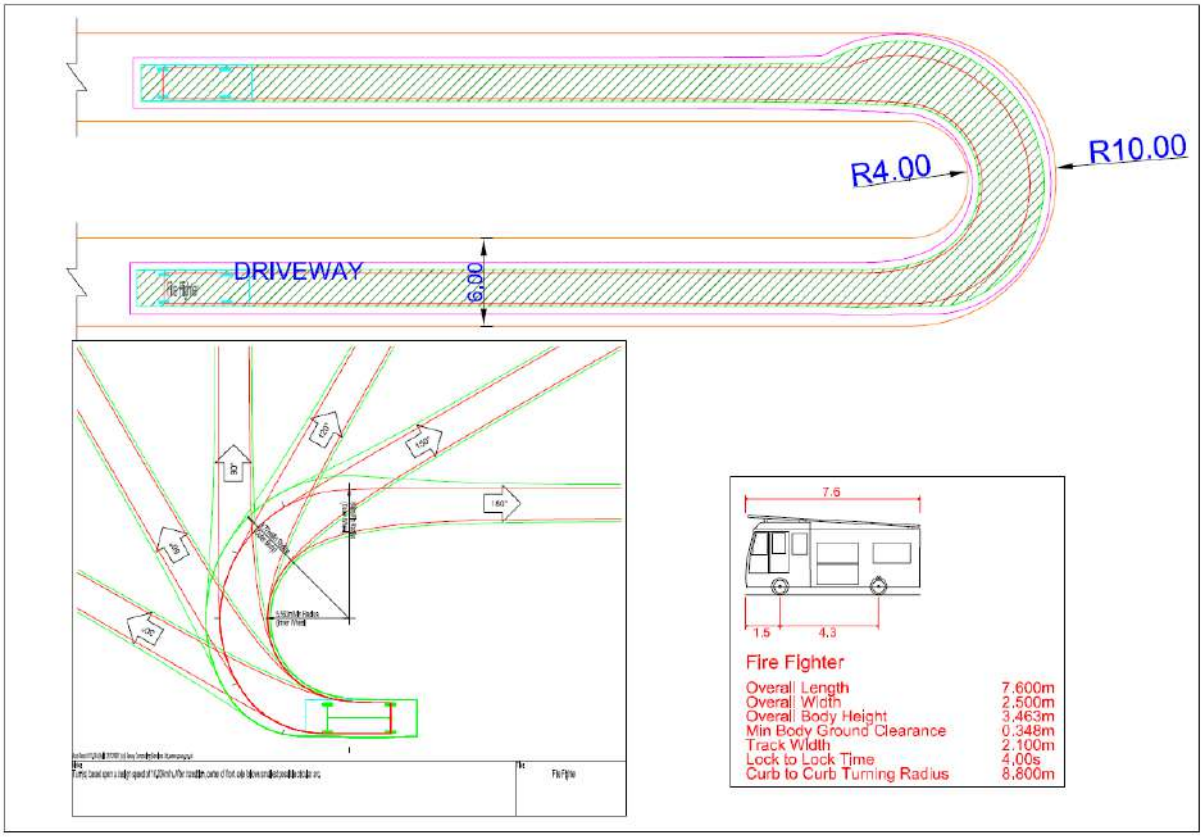


Figure 5-1 Dimensions of Fire Tender

5.4 LAYOUT PLAN

Entry/Exit points hold the key to a well efficient circulation plan. A well defined Entry/Exit area eases out traffic movement and reduces unnecessary congestion. Circulation path for Fire Tender travelling through layout is analyzed.

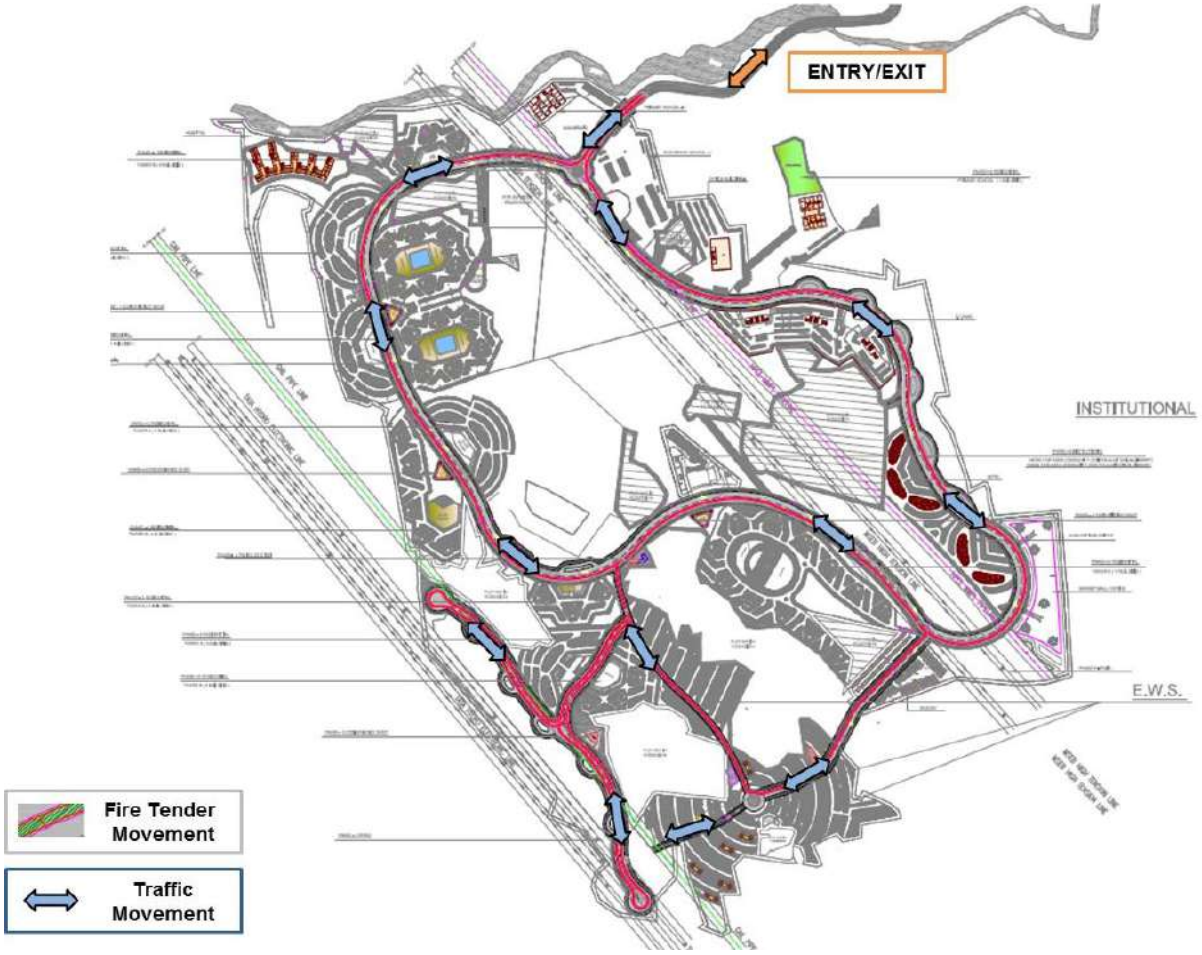


Figure 5-2 Fire Tender Movement Plan – Layout plan

6 TRAFFIC MANAGEMENT PLAN

The improvements to maintain the required level of service can be implemented by adopting traffic management measures for efficient traffic operations. Traffic Management Plan (TMP) indicates traffic routes and the measures for traffic regulation. It indicates the roads for use of certain classes of traffic, the location of traffic control i.e. signage and markings and the directions in which traffic should move. These are necessary for safe and efficient movement of vehicles and pedestrians.

6.1 TRAFFIC CALMING

A Traffic Management plan indicating traffic circulation, traffic calming and traffic control is indicated in Figure 6-2.Traffic calming is intended to slow and control motor-vehicle traffic in order to improve safety for pedestrians and bicyclists. Traffic calming measures are of various types like speed tables, curb extension, chicane etc. These are mitigation measures to ensure safety.

Following are the proposed specific improvements for each street.

6.2 TRAFFIC CONTROL MEASURES

The internal roads are undivided to maintain flexibility of traffic lanes. Minimum 6m wide roadway width has been provided for the movement of vehicles. Recommended design speed on the internal road is 15kmph and on the turns is 10kmph. Speed tables will be provided near the entrance/exit point to control traffic and regulate speed of vehicles.. An illustrative picture is also shown in Figure 6-1. Additionally, the following shall be required to maintain traffic flow at required level of service.

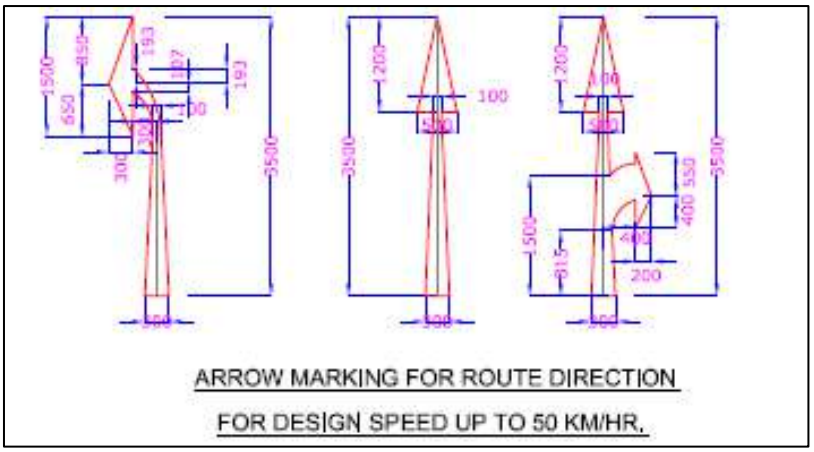
- Road Markings and Signages: Proper road markings (edge, median, arrows, turning, Kerb) and signages (direction, turning, speed, and pedestrian crossings) will be installed and maintained on all roads in the vicinity of project premises.
- On-street parking will be prohibited on all external and internal streets.
- Pick and drop at designated places only.
- Preferably no U-Turn on roadway
- Traffic calming measures – speed tables, signage

Apart from internal signage – it will be requested to provide necessary signage and traffic control measures, on neighboring roads, – such as Speed limit, Left hand curve, pedestrian crossing etc (Refer Table 6-1).

Table 6-1 Traffic Control Measures

Sr. No	Description	Signage
1	**Speed Limit**	
2	**Silence Zone**	
3	**Pedestrian Crossing**	
4	**Left Hand Curve**	

Figure 6-1 Illustration of a Speed Hump



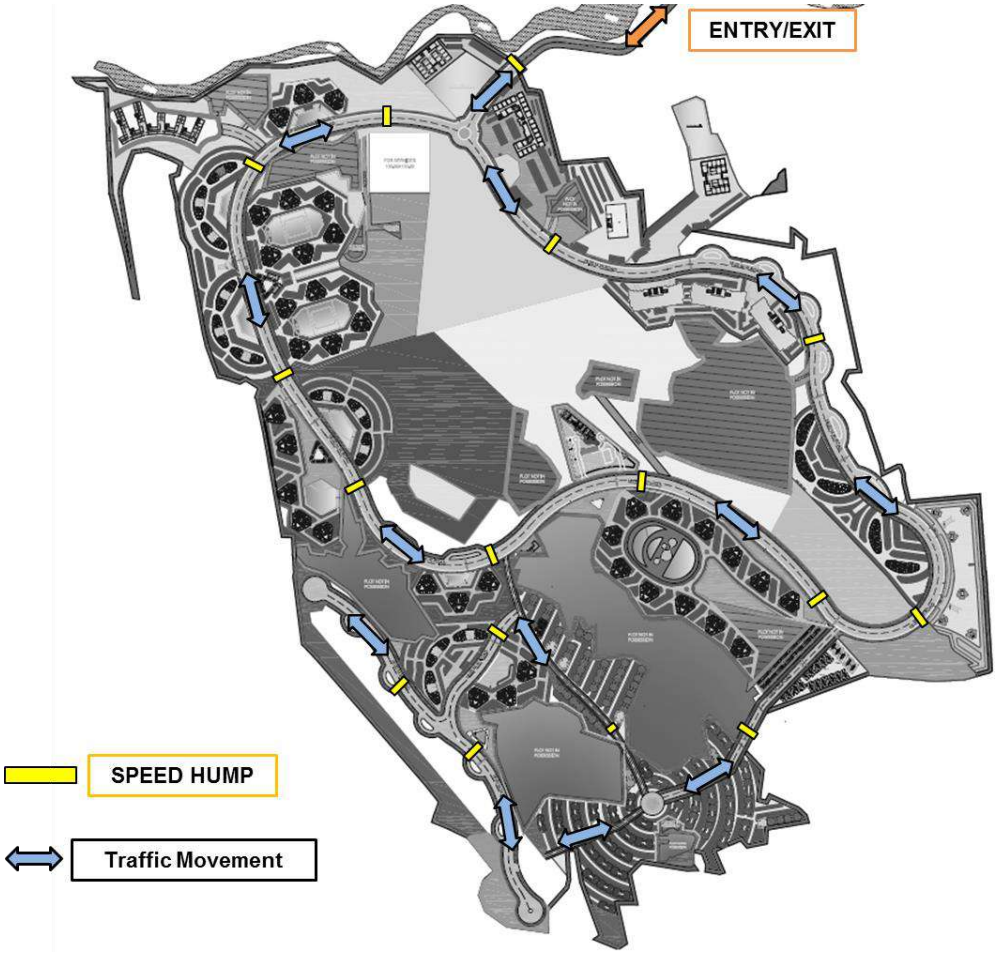


Figure 6-2 Traffic Calming Measures

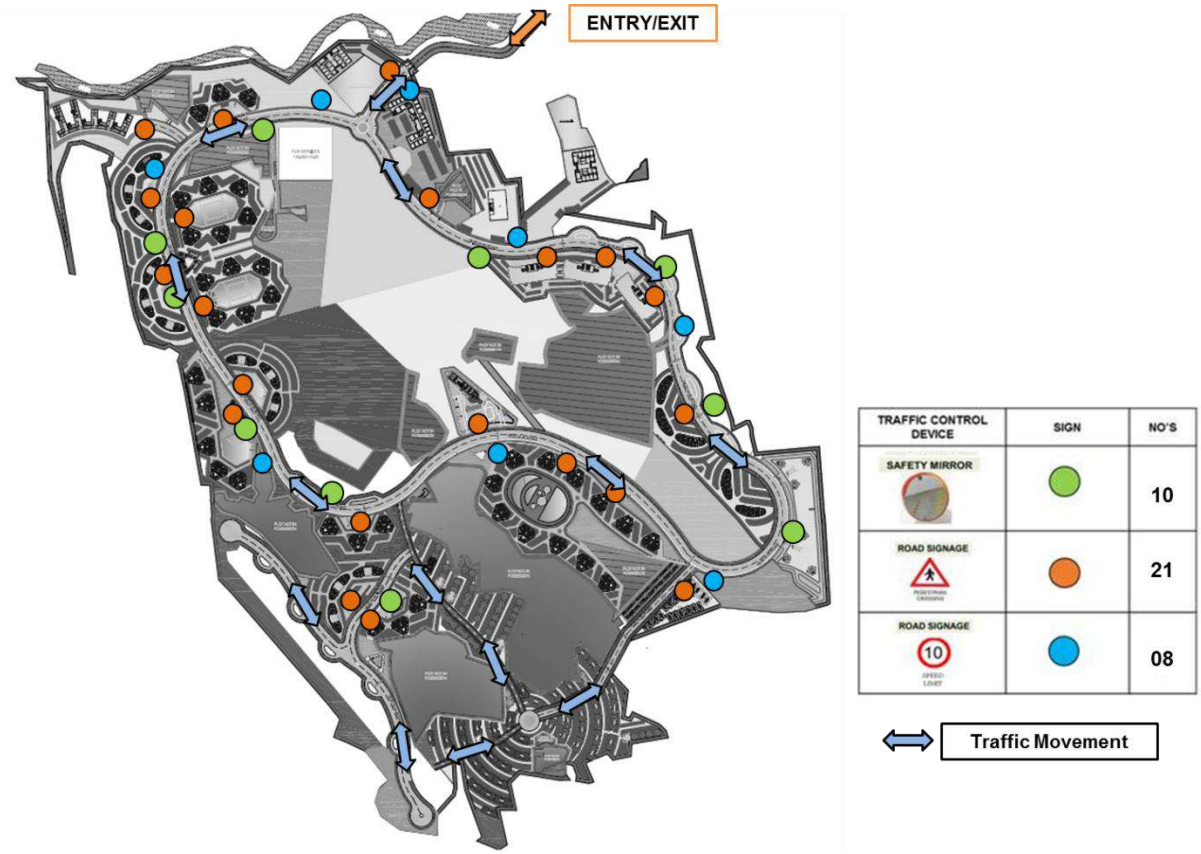


Figure 6-3 Traffic Management Plan

7 CONCLUSIONS & RECOMMENDATIONS

The traffic impact analysis was conducted and the results were discussed in earlier section. The conclusions and recommendations are summarized below:

1) The project traffic has been forecasted for year 2020 and 2025; this has been superimposed along with existing projected traffic to arrive at future traffic for year 2020 and 2025.

2) The forecast traffic on the roads adjoining the project Site access Road and Old Mumbai Pune Highway will operate at acceptable level of service in future up to 2030.

3) Swept Path analysis yielded that road geometry was adequate for vehicle turning maneuvers.

4) A Traffic Management Plan in terms of traffic calming measures and traffic control measures has been devised and proposed to maintain adequate level of service and safety of vehicles and pedestrian.

****

ANNEXURE 1

Traffic Management Report 2025 for 5KM road network around project location

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Intersection 3: Market Road & Old Mumbai Pune Highway Intersection 12
Intersection 4: Market Road & Gamdevi Tempel Road Intersection 16
Intersection 5: Market Road & Jambhivali gaon Road Intersection 18
Intersection 6: Savroli Kharpada Road & Gamdevi Tempel Road Intersection 20
Intersection 7: Savroli Kharpada Road & School Road Intersection 22
Intersection 9: Old Mumbai Pune Highway & Karjat Road Intersection 24
Intersection 10: School Road & Old Mumbai Pune Highway Intersection 28
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Proposed Township Project - Khalapur

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Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Site Access Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NB Left	0.303	8.0	A
2	Dand Apta Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NEB Left	0.233	6.7	A
3	Market Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NWB Left	0.275	7.1	A
4	Market Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	WB Thru	0.281	8.5	A
5	Market Road & Jambhivali gaon Road Intersection	All-way stop	HCM 2010	NWB Thru	0.305	8.7	A
6	Savroli Kharpada Road & Gamdevi Tempel Road Intersection	All-way stop	HCM 2010	NWB Thru	0.542	11.2	B
7	Savroli Kharpada Road & School Road Intersection	All-way stop	HCM 2010	NWB Thru	0.765	17.0	C
9	Old Mumbai Pune Highway & Karjat Road Intersection	Signalized	HCM 2010	SEB Left	0.641	36.5	D
10	School Road & Old Mumbai Pune Highway Intersection	Signalized	HCM 2010	NB Left	0.209	5.7	A
11	Gamdevi Tempel Road & Sarang Road Intersection	All-way stop	HCM 2010	SWB Thru	0.144	7.8	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report

Intersection 1: Site Access Road & Old Mumbai Pune Highway Intersection

Control Type:	Signalized	Delay (sec / veh):	8.0
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.303

Intersection Setup

Name						
Approach	Northbound		Eastbound		Westbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [m]	3.50	3.66	3.50	3.50	3.66	3.50
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	0	0	1897	0	0	1771
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	2.00	0.00	0.00	2.00	0.00
Growth Rate	1.10	1.00	1.10	1.00	1.10	1.10
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	251	0	466	0	466	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Left-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	251	0	2553	0	466	1948
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	63	0	638	0	117	487
Total Analysis Volume [veh/h]	251	0	2553	0	466	1948
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	1	0	0	0	0	2
Auxiliary Signal Groups						
Lead / Lag	-	-	-	-	-	-
Minimum Green [s]	15	0	0	0	0	60
Maximum Green [s]	15	0	0	0	0	60
Amber [s]	3.0	0.0	0.0	0.0	0.0	3.0
All red [s]	0.0	0.0	0.0	0.0	0.0	0.0
Split [s]	18	0	0	0	0	63
Vehicle Extension [s]	0.0	0.0	0.0	0.0	0.0	0.0
Walk [s]	0	0	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	0	0
Rest In Walk	No					No
I1, Start-Up Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
I2, Clearance Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Recall	No					No
Maximum Recall	No					No
Pedestrian Recall	No					No
Detector Location [m]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [m]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L		C	C
C, Cycle Length [s]	90		90	90
L, Total Lost Time per Cycle [s]	0.00		0.00	0.00
l1_p, Permitted Start-Up Lost Time [s]	0.00		0.00	0.00
l2, Clearance Lost Time [s]	0.00		0.00	0.00
g_i, Effective Green Time [s]	18		63	63
g / C, Green / Cycle	0.20		0.70	0.70
(v / s)_i Volume / Saturation Flow Rate	0.09		0.21	0.21
s, saturation flow rate [veh/h]	2754		2851	8826
c, Capacity [veh/h]	551		1996	6178
d1, Uniform Delay [s]	31.69		5.14	5.10
k, delay calibration	0.50		0.50	0.50
I, Upstream Filtering Factor	1.00		1.00	1.00
d2, Incremental Delay [s]	2.71		0.39	0.12
d3, Initial Queue Delay [s]	0.00		0.00	0.00
Rp, platoon ratio	1.00		1.00	1.00
PF, progression factor	1.00		1.00	1.00

Lane Group Results

X, volume / capacity	0.46		0.30	0.29
d, Delay for Lane Group [s/veh]	34.39		5.53	5.22
Lane Group LOS	C		A	A
Critical Lane Group	Yes		Yes	No
50th-Percentile Queue Length [veh]	5.14		3.75	3.57
50th-Percentile Queue Length [m]	39.17		28.57	27.23
95th-Percentile Queue Length [veh]	8.86		6.75	6.43
95th-Percentile Queue Length [m]	67.51		51.43	49.02

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	34.39	0.00	0.00	0.00	5.53	5.24
Movement LOS	C				A	A
d_A, Approach Delay [s/veh]	34.39		0.00		5.29	
Approach LOS	C		A		A	
d_I, Intersection Delay [s/veh]	8.03					
Intersection LOS	A					
Intersection V/C	0.303					

Sequence

Ring 1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report

Intersection 2: Dand Apta Road & Old Mumbai Pune Highway Intersection

Control Type:	Signalized	Delay (sec / veh):	6.7
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.233

Intersection Setup

Name						
Approach	Southbound		Northeastbound		Northwestbound	
Lane Configuration						
Turning Movement	Thru	Right	Left	Right	Left	Thru
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	1897	0	130	0	110	1651
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.05	1.00	1.05	1.00	1.05	1.05
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	466	0	0	0	0	251
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Left-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2458	0	137	0	116	1985
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	615	0	34	0	29	496
Total Analysis Volume [veh/h]	2458	0	137	0	116	1985
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	0	0	1	0	0	2
Auxiliary Signal Groups						
Lead / Lag	-	-	-	-	-	-
Minimum Green [s]	0	0	15	0	0	60
Maximum Green [s]	0	0	15	0	0	60
Amber [s]	0.0	0.0	3.0	0.0	0.0	3.0
All red [s]	0.0	0.0	0.0	0.0	0.0	0.0
Split [s]	0	0	18	0	0	63
Vehicle Extension [s]	0.0	0.0	0.0	0.0	0.0	0.0
Walk [s]	0	0	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	0	0
Rest In Walk			No			No
I1, Start-Up Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
I2, Clearance Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Recall			No			No
Maximum Recall			No			No
Pedestrian Recall			No			No
Detector Location [m]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [m]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group		L	C	C
C, Cycle Length [s]		90	90	90
L, Total Lost Time per Cycle [s]		0.00	0.00	0.00
l1_p, Permitted Start-Up Lost Time [s]		0.00	0.00	0.00
l2, Clearance Lost Time [s]		0.00	0.00	0.00
g_i, Effective Green Time [s]		18	63	63
g / C, Green / Cycle		0.20	0.70	0.70
(v / s)_i Volume / Saturation Flow Rate		0.05	0.17	0.18
s, saturation flow rate [veh/h]		2700	3057	8653
c, Capacity [veh/h]		540	2140	6057
d1, Uniform Delay [s]		30.34	4.89	4.95
k, delay calibration		0.50	0.50	0.50
I, Upstream Filtering Factor		1.00	1.00	1.00
d2, Incremental Delay [s]		1.13	0.27	0.10
d3, Initial Queue Delay [s]		0.00	0.00	0.00
Rp, platoon ratio		1.00	1.00	1.00
PF, progression factor		1.00	1.00	1.00

Lane Group Results

X, volume / capacity		0.25	0.25	0.26
d, Delay for Lane Group [s/veh]		31.47	5.16	5.06
Lane Group LOS		C	A	A
Critical Lane Group		Yes	No	Yes
50th-Percentile Queue Length [veh]		2.64	3.09	3.02
50th-Percentile Queue Length [m]		20.11	23.54	23.03
95th-Percentile Queue Length [veh]		4.75	5.56	5.44
95th-Percentile Queue Length [m]		36.20	42.38	41.46

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	0.00	0.00	31.47	0.00	5.16	5.08
Movement LOS			C		A	A
d_A, Approach Delay [s/veh]	0.00		31.47		5.08	
Approach LOS	A		C		A	
d_I, Intersection Delay [s/veh]	6.70					
Intersection LOS	A					
Intersection V/C	0.233					

Sequence

Ring 1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report

Intersection 3: Market Road & Old Mumbai Pune Highway Intersection

Control Type:	Signalized	Delay (sec / veh):	7.1
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.275

Intersection Setup

Name						
Approach	Eastbound		Westbound		Northwestbound	
Lane Configuration						
Turning Movement	Thru	Right	Left	Thru	Left	Right
Lane Width [m]	3.50	3.50	3.66	3.50	3.50	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	1897	0	66	1598	173	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	2.00	0.00	0.00	2.00
Growth Rate	1.05	1.00	1.05	1.05	1.05	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	466	0	0	466	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Left-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	2458	0	69	2144	182	0
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	615	0	17	536	46	0
Total Analysis Volume [veh/h]	2458	0	69	2144	182	0
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	2	0	0	0	1	0
Auxiliary Signal Groups						
Lead / Lag	-	-	-	-	-	-
Minimum Green [s]	60	0	0	0	15	0
Maximum Green [s]	60	0	0	0	15	0
Amber [s]	3.0	0.0	0.0	0.0	3.0	0.0
All red [s]	0.0	0.0	0.0	0.0	0.0	0.0
Split [s]	63	0	0	0	18	0
Vehicle Extension [s]	0.0	0.0	0.0	0.0	0.0	0.0
Walk [s]	0	0	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	0	0
Rest In Walk	No				No	
I1, Start-Up Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
I2, Clearance Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Recall	No				No	
Maximum Recall	No				No	
Pedestrian Recall	No				No	
Detector Location [m]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [m]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	C		L
C, Cycle Length [s]	90		90
L, Total Lost Time per Cycle [s]	0.00		0.00
l1_p, Permitted Start-Up Lost Time [s]	0.00		0.00
l2, Clearance Lost Time [s]	0.00		0.00
g_i, Effective Green Time [s]	63		18
g / C, Green / Cycle	0.70		0.20
(v / s)_i Volume / Saturation Flow Rate	0.21		0.07
s, saturation flow rate [veh/h]	11768		2754
c, Capacity [veh/h]	8237		551
d1, Uniform Delay [s]	5.12		30.84
k, delay calibration	0.50		0.50
I, Upstream Filtering Factor	1.00		1.00
d2, Incremental Delay [s]	0.09		1.60
d3, Initial Queue Delay [s]	0.00		0.00
Rp, platoon ratio	1.00		1.00
PF, progression factor	1.00		1.00

Lane Group Results

X, volume / capacity	0.30		0.33
d, Delay for Lane Group [s/veh]	5.21		32.44
Lane Group LOS	A		C
Critical Lane Group	Yes		Yes
50th-Percentile Queue Length [veh]	3.64		3.58
50th-Percentile Queue Length [m]	27.72		27.29
95th-Percentile Queue Length [veh]	6.55		6.45
95th-Percentile Queue Length [m]	49.90		49.12

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	5.21	0.00	0.00	0.00	32.44	0.00
Movement LOS	A				C	
d_A, Approach Delay [s/veh]	5.21		0.00		32.44	
Approach LOS	A		A		C	
d_I, Intersection Delay [s/veh]	7.09					
Intersection LOS	A					
Intersection V/C	0.275					

Sequence

Ring 1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report

Intersection 4: Market Road & Gamdevi Tempel Road Intersection

Control Type:	All-way stop	Delay (sec / veh):	8.5
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.281

Intersection Setup

Name						
Approach	Eastbound		Westbound		Northeastbound	
Lane Configuration						
Turning Movement	Thru	Right	Left	Thru	Left	Right
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	25	35	45	128	45	45
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	35	49	63	179	63	63
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	9	12	16	45	16	16
Total Analysis Volume [veh/h]	35	49	63	179	63	63
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	782	861	808
Degree of Utilization, x	0.11	0.28	0.16

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.36	1.15	0.55
95th-Percentile Queue Length [m]	2.74	8.80	4.20
Approach Delay [s/veh]	8.16	8.80	8.28
Approach LOS	A	A	A
Intersection Delay [s/veh]	8.54		
Intersection LOS	A		

Intersection Level Of Service Report

Intersection 5: Market Road & Jambhivali gaon Road Intersection

Control Type:	All-way stop	Delay (sec / veh):	8.7
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.305

Intersection Setup

Name						
Approach	Northbound		Eastbound		Northwestbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	35	52	35	35	55	133
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	49	73	49	49	77	186
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	12	18	12	12	19	47
Total Analysis Volume [veh/h]	49	73	49	49	77	186
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	781	780	862
Degree of Utilization, x	0.16	0.13	0.31

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.55	0.43	1.29
95th-Percentile Queue Length [m]	4.21	3.27	9.86
Approach Delay [s/veh]	8.46	8.27	9.00
Approach LOS	A	A	A
Intersection Delay [s/veh]	8.72		
Intersection LOS	A		

Intersection Level Of Service Report

Intersection 6: Savroli Kharpada Road & Gamdevi Tempel Road Intersection

Control Type:	All-way stop	Delay (sec / veh):	11.2
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.542

Intersection Setup

Name						
Approach	Southwestbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	25	65	385	65	25	85
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	25	65	385	65	25	85
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	6	16	96	16	6	21
Total Analysis Volume [veh/h]	25	65	385	65	25	85
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	697	830	796
Degree of Utilization, x	0.13	0.54	0.14

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.44	3.32	0.48
95th-Percentile Queue Length [m]	3.37	25.29	3.65
Approach Delay [s/veh]	8.93	12.35	8.25
Approach LOS	A	B	A
Intersection Delay [s/veh]	11.18		
Intersection LOS	B		

Intersection Level Of Service Report

Intersection 7: Savroli Kharpada Road & School Road Intersection

Control Type:	All-way stop	Delay (sec / veh):	17.0
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.765

Intersection Setup

Name						
Approach	Southbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [m]	3.50	3.50	3.66	3.50	3.50	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	25	35	430	20	25	88
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	2.00	0.00	0.00	2.00
Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	35	49	602	28	35	123
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	9	12	151	7	9	31
Total Analysis Volume [veh/h]	35	49	602	28	35	123
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	652	824	763
Degree of Utilization, x	0.13	0.77	0.21

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.44	7.47	0.77
95th-Percentile Queue Length [m]	3.36	56.91	5.90
Approach Delay [s/veh]	9.34	20.09	8.94
Approach LOS	A	C	A
Intersection Delay [s/veh]	17.04		
Intersection LOS	C		

Intersection Level Of Service Report

Intersection 9: Old Mumbai Pune Highway & Karjat Road Intersection

Control Type:	Signalized	Delay (sec / veh):	36.5
Analysis Method:	HCM 2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.641

Intersection Setup

Name						
Approach	Westbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Thru	Right	Left	Thru
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	455	212	1452	320	822	1075
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.01	1.01	1.01	1.01	1.01	1.01
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Left-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	460	214	1467	323	830	1086
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	115	54	367	81	208	272
Total Analysis Volume [veh/h]	460	214	1467	323	830	1086
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	0	3	1	0	0	2
Auxiliary Signal Groups						
Lead / Lag	-	Lag	-	-	-	-
Minimum Green [s]	0	35	30	0	0	35
Maximum Green [s]	0	35	30	0	0	35
Amber [s]	0.0	3.0	3.0	0.0	0.0	3.0
All red [s]	0.0	0.0	0.0	0.0	0.0	0.0
Split [s]	0	38	33	0	0	38
Vehicle Extension [s]	0.0	0.0	0.0	0.0	0.0	0.0
Walk [s]	0	0	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	0	0
Rest In Walk		No	No			No
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	0.0	2.0
I2, Clearance Lost Time [s]	0.0	1.0	0.0	0.0	0.0	1.0
Minimum Recall		No	No			No
Maximum Recall		No	No			No
Pedestrian Recall		No	No			No
Detector Location [m]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [m]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	R	C	C	C	C
C, Cycle Length [s]	109	109	109	109	109	109
L, Total Lost Time per Cycle [s]	3.00	3.00	0.00	0.00	3.00	3.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	1.00	1.00	0.00	0.00	1.00	1.00
g_i, Effective Green Time [s]	35	35	33	33	35	35
g / C, Green / Cycle	0.32	0.32	0.30	0.30	0.32	0.32
(v / s)_i Volume / Saturation Flow Rate	0.17	0.07	0.16	0.16	0.31	0.13
s, saturation flow rate [veh/h]	2700	3025	7874	3078	2700	8653
c, Capacity [veh/h]	867	971	2384	932	867	2778
d1, Uniform Delay [s]	30.28	27.03	31.67	31.67	36.27	28.72
k, delay calibration	0.50	0.50	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	2.32	0.52	0.88	2.24	21.81	0.42
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.53	0.22	0.54	0.54	0.96	0.39
d, Delay for Lane Group [s/veh]	32.60	27.55	32.55	33.92	58.08	29.14
Lane Group LOS	C	C	C	C	E	C
Critical Lane Group	Yes	No	No	Yes	Yes	No
50th-Percentile Queue Length [veh]	10.36	4.21	9.54	11.54	26.43	7.42
50th-Percentile Queue Length [m]	78.92	32.08	72.70	87.95	201.40	56.56
95th-Percentile Queue Length [veh]	15.64	7.58	14.61	17.11	34.86	11.89
95th-Percentile Queue Length [m]	119.14	57.73	111.30	130.41	265.65	90.60

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	32.60	27.55	32.72	33.92	58.08	29.14
Movement LOS	C	C	C	C	E	C
d_A, Approach Delay [s/veh]	31.00		32.94		41.68	
Approach LOS	C		C		D	
d_I, Intersection Delay [s/veh]	36.46					
Intersection LOS	D					
Intersection V/C	0.641					

Sequence

Ring 1	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report

Intersection 10: School Road & Old Mumbai Pune Highway Intersection

Control Type:	Signalized	Delay (sec / veh):	5.7
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.209

Intersection Setup

Name						
Approach	Northbound		Northwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Right	Left	Thru	Thru	Right
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	45	0	55	1716	1897	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.10	1.00	1.10	1.10	1.10	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	251	466	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Left-Turn on Red Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	50	0	61	2139	2553	0
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	13	0	15	535	638	0
Total Analysis Volume [veh/h]	50	0	61	2139	2553	0
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0		0		0	
Bicycle Volume [bicycles/h]	0		0		0	

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fixed time
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	1	0	0	2	0	0
Auxiliary Signal Groups						
Lead / Lag	-	-	-	-	-	-
Minimum Green [s]	15	0	0	60	0	0
Maximum Green [s]	15	0	0	60	0	0
Amber [s]	3.0	0.0	0.0	3.0	0.0	0.0
All red [s]	0.0	0.0	0.0	0.0	0.0	0.0
Split [s]	18	0	0	63	0	0
Vehicle Extension [s]	0.0	0.0	0.0	0.0	0.0	0.0
Walk [s]	0	0	0	0	0	0
Pedestrian Clearance [s]	0	0	0	0	0	0
Rest In Walk	No			No		
I1, Start-Up Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
I2, Clearance Lost Time [s]	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Recall	No			No		
Maximum Recall	No			No		
Pedestrian Recall	No			No		
Detector Location [m]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [m]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Lane Group Calculations

Lane Group	L	C	C	
C, Cycle Length [s]	90	90	90	
L, Total Lost Time per Cycle [s]	0.00	0.00	0.00	
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	
l2, Clearance Lost Time [s]	0.00	0.00	0.00	
g_i, Effective Green Time [s]	18	63	63	
g / C, Green / Cycle	0.20	0.70	0.70	
(v / s)_i Volume / Saturation Flow Rate	0.02	0.18	0.19	
s, saturation flow rate [veh/h]	2700	3115	8653	
c, Capacity [veh/h]	540	2181	6057	
d1, Uniform Delay [s]	29.34	4.92	5.00	
k, delay calibration	0.50	0.50	0.50	
I, Upstream Filtering Factor	1.00	1.00	1.00	
d2, Incremental Delay [s]	0.34	0.28	0.11	
d3, Initial Queue Delay [s]	0.00	0.00	0.00	
Rp, platoon ratio	1.00	1.00	1.00	
PF, progression factor	1.00	1.00	1.00	

Lane Group Results

X, volume / capacity	0.09	0.25	0.27	
d, Delay for Lane Group [s/veh]	29.68	5.20	5.12	
Lane Group LOS	C	A	A	
Critical Lane Group	Yes	No	Yes	
50th-Percentile Queue Length [veh]	0.92	3.25	3.20	
50th-Percentile Queue Length [m]	7.03	24.78	24.38	
95th-Percentile Queue Length [veh]	1.66	5.85	5.76	
95th-Percentile Queue Length [m]	12.66	44.60	43.88	

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	29.68	0.00	5.20	5.13	0.00	0.00
Movement LOS	C		A	A		
d_A, Approach Delay [s/veh]	29.68		5.14		0.00	
Approach LOS	C		A		A	
d_I, Intersection Delay [s/veh]	5.68					
Intersection LOS	A					
Intersection V/C	0.209					

Sequence

Ring 1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Intersection Level Of Service Report

Intersection 11: Gamdevi Tempel Road & Sarang Road Intersection

Control Type:	All-way stop	Delay (sec / veh):	7.8
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.144

Intersection Setup

Name						
Approach	Northeastbound		Southwestbound		Southeastbound	
Lane Configuration						
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [m]	3.66	3.66	3.66	3.66	3.66	3.66
No. of Lanes in Pocket	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	48.28		48.28		48.28	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		Yes	

Volumes

Name						
Base Volume Input [veh/h]	10	80	65	15	25	20
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Total Hourly Volume [veh/h]	14	112	91	21	35	28
Peak Hour Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	4	28	23	5	9	7
Total Analysis Volume [veh/h]	14	112	91	21	35	28
Pedestrian Volume [ped/h]	0		0		0	

Intersection Settings

Lanes

Capacity per Entry Lane [veh/h]	873	849	856
Degree of Utilization, x	0.14	0.13	0.07

Movement, Approach, & Intersection Results

95th-Percentile Queue Length [veh]	0.50	0.45	0.24
95th-Percentile Queue Length [m]	3.84	3.46	1.81
Approach Delay [s/veh]	7.82	7.88	7.54
Approach LOS	A	A	A
Intersection Delay [s/veh]	7.78		
Intersection LOS	A		

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Turning Movement Volume: Summary

ID	Intersection Name	Northbound	Eastbound	Westbound		Total Volume
		Left	Thru	Left	Thru	
1	Site Access Road & Old Mumbai Pune Highway Intersection	251	2553	466	1948	5218

ID	Intersection Name	Southbound	Northeastbound	Northwestbound		Total Volume
		Thru	Left	Left	Thru	
2	Dand Apta Road & Old Mumbai Pune Highway Intersection	2458	137	116	1985	4696

ID	Intersection Name	Eastbound	Westbound		Northwestbound	Total Volume
		Thru	Left	Thru	Left	
3	Market Road & Old Mumbai Pune Highway Intersection	2458	69	2144	182	4853

ID	Intersection Name	Eastbound		Westbound		Northeastbound		Total Volume
		Thru	Right	Left	Thru	Left	Right	
4	Market Road & Gamdevi Tempel Road Intersection	35	49	63	179	63	63	452

ID	Intersection Name	Northbound		Eastbound		Northwestbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
5	Market Road & Jambhivali gaon Road Intersection	49	73	49	49	77	186	483

ID	Intersection Name	Southwestbound		Northwestbound		Southeastbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
6	Savroli Kharpada Road & Gamdevi Tempel Road Intersection	25	65	385	65	25	85	650

ID	Intersection Name	Southbound		Northwestbound		Southeastbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
7	Savroli Kharpada Road & School Road Intersection	35	49	602	28	35	123	872

ID	Intersection Name	Westbound		Northwestbound		Southeastbound		Total Volume
		Left	Right	Thru	Right	Left	Thru	
9	Old Mumbai Pune Highway & Karjat Road Intersection	460	214	1467	323	830	1086	4380

ID	Intersection Name	Northbound	Northwestbound		Southeastbound	Total Volume
		Left	Left	Thru	Thru	
10	School Road & Old Mumbai Pune Highway Intersection	50	61	2139	2553	4803

ID	Intersection Name	Northeastbound		Southwestbound		Southeastbound		Total Volume
		Left	Thru	Thru	Right	Left	Right	
11	Gamdevi Tempel Road & Sarang Road Intersection	14	112	91	21	35	28	301

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Turning Movement Volume: Detail

ID	Intersection Name	Volume Type	Northbound	Eastbound	Westbound		Total Volume
			Left	Thru	Left	Thru	
1	Site Access Road & Old Mumbai Pune Highway Intersection	Final Base	0	1897	0	1771	3668
		Growth Rate	1.10	1.10	1.10	1.10	-
		In Process	0	0	0	0	0
		Net New Trips	251	466	466	0	1183
		Other	0	0	0	0	0
		Future Total	**251**	**2553**	**466**	**1948**	**5218**

ID	Intersection Name	Volume Type	Southbound	Northeastbound	Northwestbound		Total Volume
			Thru	Left	Left	Thru	
2	Dand Apta Road & Old Mumbai Pune Highway Intersection	Final Base	1897	130	110	1651	3788
		Growth Rate	1.05	1.05	1.05	1.05	-
		In Process	0	0	0	0	0
		Net New Trips	466	0	0	251	717
		Other	0	0	0	0	0
		Future Total	**2458**	**137**	**116**	**1985**	**4696**

ID	Intersection Name	Volume Type	Eastbound	Westbound		Northwestbound	Total Volume
			Thru	Left	Thru	Left	
3	Market Road & Old Mumbai Pune Highway Intersection	Final Base	1897	66	1598	173	3734
		Growth Rate	1.05	1.05	1.05	1.05	-
		In Process	0	0	0	0	0
		Net New Trips	466	0	466	0	932
		Other	0	0	0	0	0
		Future Total	**2458**	**69**	**2144**	**182**	**4853**

ID	Intersection Name	Volume Type	Eastbound		Westbound		Northeastbound		Total Volume
			Thru	Right	Left	Thru	Left	Right	
4	Market Road & Gamdevi Tempel Road Intersection	Final Base	25	35	45	128	45	45	323
		Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40	-
		In Process	0	0	0	0	0	0	0
		Net New Trips	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0
		Future Total	**35**	**49**	**63**	**179**	**63**	**63**	**452**

ID	Intersection Name	Volume Type	Northbound		Eastbound		Northwestbound		Total Volume
			Left	Right	Thru	Right	Left	Thru	
5	Market Road & Jambhivali gaon Road Intersection	Final Base	35	52	35	35	55	133	345
		Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40	-
		In Process	0	0	0	0	0	0	0
		Net New Trips	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0
		Future Total	**49**	**73**	**49**	**49**	**77**	**186**	**483**

ID	Intersection Name	Volume Type	Southwestbound		Northwestbound		Southeastbound		Total Volume
			Left	Right	Thru	Right	Left	Thru	
6	Savroli Kharpada Road & Gamdevi Tempel Road Intersection	Final Base	25	65	385	65	25	85	650
		Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	-
		In Process	0	0	0	0	0	0	0
		Net New Trips	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0
		Future Total	**25**	**65**	**385**	**65**	**25**	**85**	**650**

ID	Intersection Name	Volume Type	Southbound		Northwestbound		Southeastbound		Total Volume
			Left	Right	Thru	Right	Left	Thru	
7	Savroli Kharpada Road & School Road Intersection	Final Base	25	35	430	20	25	88	623
		Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40	-
		In Process	0	0	0	0	0	0	0
		Net New Trips	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0
		Future Total	**35**	**49**	**602**	**28**	**35**	**123**	**872**

ID	Intersection Name	Volume Type	Westbound		Northwestbound		Southeastbound		Total Volume
			Left	Right	Thru	Right	Left	Thru	
9	Old Mumbai Pune Highway & Karjat Road Intersection	Final Base	455	212	1452	320	822	1075	4336
		Growth Rate	1.01	1.01	1.01	1.01	1.01	1.01	-
		In Process	0	0	0	0	0	0	0
		Net New Trips	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0
		Future Total	**460**	**214**	**1467**	**323**	**830**	**1086**	**4380**

ID	Intersection Name	Volume Type	Northbound	Northwestbound		Southeastbound	Total Volume
			Left	Left	Thru	Thru	
10	School Road & Old Mumbai Pune Highway Intersection	Final Base	45	55	1716	1897	3713
		Growth Rate	1.10	1.10	1.10	1.10	-
		In Process	0	0	0	0	0
		Net New Trips	0	0	251	466	717
		Other	0	0	0	0	0
		Future Total	**50**	**61**	**2139**	**2553**	**4803**

ID	Intersection Name	Volume Type	Northeastbound		Southwestbound		Southeastbound		Total Volume
			Left	Thru	Thru	Right	Left	Right	
11	Gamdevi Tempel Road & Sarang Road Intersection	Final Base	10	80	65	15	25	20	215
		Growth Rate	1.40	1.40	1.40	1.40	1.40	1.40	-
		In Process	0	0	0	0	0	0	0
		Net New Trips	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0
		Future Total	**14**	**112**	**91**	**21**	**35**	**28**	**301**

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Fair Share Volumes

Intersection 1: Site Access Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Northbound	Eastbound	Westbound		Total
	Left	Thru	Left	Thru	
1: Site	251	466	466	0	1183
2: To Mumbai	251	466	466	0	1183
Site-Generated Trips	251	466	466	0	
Future Total Volume	251	2553	466	1948	

Intersection 2: Dand Apta Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Southbound	Northeastbound	Northwestbound		Total
	Thru	Left	Left	Thru	
1: Site	466	0	0	251	717
2: To Mumbai	466	0	0	251	717
Site-Generated Trips	466	0	0	251	
Future Total Volume	2458	137	116	1985	

Intersection 3: Market Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Eastbound	Westbound		Northwestbound	Total
	Thru	Left	Thru	Left	
1: Site	466	0	466	0	932
2: To Mumbai	466	0	466	0	932
Site-Generated Trips	466	0	466	0	
Future Total Volume	2458	69	2144	182	

Intersection 4: Market Road & Gamdevi Tempel Road Intersection							
Zone ID: Name	Eastbound		Westbound		Northeastbound		Total
	Thru	Right	Left	Thru	Left	Right	
1: Site	0	0	0	0	0	0	0
2: To Mumbai	0	0	0	0	0	0	0
Site-Generated Trips	0	0	0	0	0	0	
Future Total Volume	35	49	63	179	63	63	

Intersection 5: Market Road & Jambhivali gaon Road Intersection							
Zone ID: Name	Northbound		Eastbound		Northwestbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0	0	0	0	0	0	0
2: To Mumbai	0	0	0	0	0	0	0
Site-Generated Trips	0	0	0	0	0	0	
Future Total Volume	49	73	49	49	77	186	

Intersection 6: Savroli Kharpada Road & Gamdevi Tempel Road Intersection							
Zone ID: Name	Southwestbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0	0	0	0	0	0	0
2: To Mumbai	0	0	0	0	0	0	0
Site-Generated Trips	0	0	0	0	0	0	
Future Total Volume	25	65	385	65	25	85	

Intersection 7: Savroli Kharpada Road & School Road Intersection							
Zone ID: Name	Southbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0	0	0	0	0	0	0
2: To Mumbai	0	0	0	0	0	0	0
Site-Generated Trips	0	0	0	0	0	0	
Future Total Volume	35	49	602	28	35	123	

Intersection 9: Old Mumbai Pune Highway & Karjat Road Intersection							
Zone ID: Name	Westbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0	0	0	0	0	0	0
2: To Mumbai	0	0	0	0	0	0	0
Site-Generated Trips	0	0	0	0	0	0	
Future Total Volume	460	214	1467	323	830	1086	

Intersection 10: School Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Northbound	Northwestbound		Southeastbound	Total
	Left	Left	Thru	Thru	
1: Site	0	0	251	466	717
2: To Mumbai	0	0	251	466	717
Site-Generated Trips	0	0	251	466	
Future Total Volume	50	61	2139	2553	

Intersection 11: Gamdevi Tempel Road & Sarang Road Intersection							
Zone ID: Name	Northeastbound		Southwestbound		Southeastbound		Total
	Left	Thru	Thru	Right	Left	Right	
1: Site	0	0	0	0	0	0	0
2: To Mumbai	0	0	0	0	0	0	0
Site-Generated Trips	0	0	0	0	0	0	
Future Total Volume	14	112	91	21	35	28	

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Fair Share % of Net New Site

Intersection 1: Site Access Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Northbound	Eastbound	Westbound		Total
	Left	Thru	Left	Thru	
1: Site	100%	100%	100%	0%	100%
2: To Mumbai	100%	100%	100%	0%	100%
Total	100%	100%	100%	0%	

Intersection 2: Dand Apta Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Southbound	Northeastbound	Northwestbound		Total
	Thru	Left	Left	Thru	
1: Site	100%	0%	0%	100%	100%
2: To Mumbai	100%	0%	0%	100%	100%
Total	100%	0%	0%	100%	

Intersection 3: Market Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Eastbound	Westbound		Northwestbound	Total
	Thru	Left	Thru	Left	
1: Site	100%	0%	100%	0%	100%
2: To Mumbai	100%	0%	100%	0%	100%
Total	100%	0%	100%	0%	

Intersection 4: Market Road & Gamdevi Tempel Road Intersection							
Zone ID: Name	Eastbound		Westbound		Northeastbound		Total
	Thru	Right	Left	Thru	Left	Right	
1: Site	0%	0%	0%	0%	0%	0%	-%
2: To Mumbai	0%	0%	0%	0%	0%	0%	-%
Total	0%	0%	0%	0%	0%	0%	

Intersection 5: Market Road & Jambhivali gaon Road Intersection							
Zone ID: Name	Northbound		Eastbound		Northwestbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	-%
2: To Mumbai	0%	0%	0%	0%	0%	0%	-%
Total	0%	0%	0%	0%	0%	0%	

Intersection 6: Savroli Kharpada Road & Gamdevi Tempel Road Intersection							
Zone ID: Name	Southwestbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	-%
2: To Mumbai	0%	0%	0%	0%	0%	0%	-%
Total	0%	0%	0%	0%	0%	0%	

Intersection 7: Savroli Kharpada Road & School Road Intersection							
Zone ID: Name	Southbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	-%
2: To Mumbai	0%	0%	0%	0%	0%	0%	-%
Total	0%	0%	0%	0%	0%	0%	

Intersection 9: Old Mumbai Pune Highway & Karjat Road Intersection							
Zone ID: Name	Westbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	-%
2: To Mumbai	0%	0%	0%	0%	0%	0%	-%
Total	0%	0%	0%	0%	0%	0%	

Intersection 10: School Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Northbound	Northwestbound		Southeastbound	Total
	Left	Left	Thru	Thru	
1: Site	0%	0%	100%	100%	100%
2: To Mumbai	0%	0%	100%	100%	100%
Total	0%	0%	100%	100%	

Intersection 11: Gamdevi Tempel Road & Sarang Road Intersection							
Zone ID: Name	Northeastbound		Southwestbound		Southeastbound		Total
	Left	Thru	Thru	Right	Left	Right	
1: Site	0%	0%	0%	0%	0%	0%	-%
2: To Mumbai	0%	0%	0%	0%	0%	0%	-%
Total	0%	0%	0%	0%	0%	0%	

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Fair Share % of Future Total

Intersection 1: Site Access Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Northbound	Eastbound	Westbound		Total
	Left	Thru	Left	Thru	
1: Site	100%	18.25%	100%	0%	22.67%
2: To Mumbai	100%	18.25%	100%	0%	22.67%
Total	100%	18.25%	100%	0%	

Intersection 2: Dand Apta Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Southbound	Northeastbound	Northwestbound		Total
	Thru	Left	Left	Thru	
1: Site	18.96%	0%	0%	12.64%	15.27%
2: To Mumbai	18.96%	0%	0%	12.64%	15.27%
Total	18.96%	0%	0%	12.64%	

Intersection 3: Market Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Eastbound	Westbound		Northwestbound	Total
	Thru	Left	Thru	Left	
1: Site	18.96%	0%	21.74%	0%	19.2%
2: To Mumbai	18.96%	0%	21.74%	0%	19.2%
Total	18.96%	0%	21.74%	0%	

Intersection 4: Market Road & Gamdevi Tempel Road Intersection							
Zone ID: Name	Eastbound		Westbound		Northeastbound		Total
	Thru	Right	Left	Thru	Left	Right	
1: Site	0%	0%	0%	0%	0%	0%	0%
2: To Mumbai	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%	

Intersection 5: Market Road & Jambhivali gaon Road Intersection							
Zone ID: Name	Northbound		Eastbound		Northwestbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	0%
2: To Mumbai	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%	

Intersection 6: Savroli Kharpada Road & Gamdevi Tempel Road Intersection							
Zone ID: Name	Southwestbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	0%
2: To Mumbai	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%	

Intersection 7: Savroli Kharpada Road & School Road Intersection							
Zone ID: Name	Southbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	0%
2: To Mumbai	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%	

Intersection 9: Old Mumbai Pune Highway & Karjat Road Intersection							
Zone ID: Name	Westbound		Northwestbound		Southeastbound		Total
	Left	Right	Thru	Right	Left	Thru	
1: Site	0%	0%	0%	0%	0%	0%	0%
2: To Mumbai	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%	

Intersection 10: School Road & Old Mumbai Pune Highway Intersection					
Zone ID: Name	Northbound	Northwestbound		Southeastbound	Total
	Left	Left	Thru	Thru	
1: Site	0%	0%	11.73%	18.25%	14.93%
2: To Mumbai	0%	0%	11.73%	18.25%	14.93%
Total	0%	0%	11.73%	18.25%	

Intersection 11: Gamdevi Tempel Road & Sarang Road Intersection							
Zone ID: Name	Northeastbound		Southwestbound		Southeastbound		Total
	Left	Thru	Thru	Right	Left	Right	
1: Site	0%	0%	0%	0%	0%	0%	0%
2: To Mumbai	0%	0%	0%	0%	0%	0%	0%
Total	0%	0%	0%	0%	0%	0%	

Signal Warrants Report For Intersection 4: Market Road & Gamdevi Tempel Road Intersection

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	E, W
Minor Approaches	SW
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	E	W	SW
1	242	84	126
2	232	81	121
3	227	79	118
4	194	67	101
5	184	64	96
6	165	57	86
7	152	53	79
8	145	50	76
9	116	40	60
10	109	38	57
11	109	38	57
12	104	36	54
13	94	33	49
14	87	30	45
15	87	30	45
16	85	29	44
17	48	17	25
18	27	9	14
19	24	8	13
20	10	3	5
21	7	3	4
22	7	3	4
23	5	2	3
24	5	2	3

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
1	2	326	1	126	No	No	No	No	No	No	No	No	No	No
2	2	313	1	121	No	No	No	No	No	No	No	No	No	No
3	2	306	1	118	No	No	No	No	No	No	No	No	No	No
4	2	261	1	101	No	No	No	No	No	No	No	No	No	No
5	2	248	1	96	No	No	No	No	No	No	No	No	No	No
6	2	222	1	86	No	No	No	No	No	No	No	No	No	No
7	2	205	1	79	No	No	No	No	No	No	No	No	No	No
8	2	195	1	76	No	No	No	No	No	No	No	No	No	No
9	2	156	1	60	No	No	No	No	No	No	No	No	No	No
10	2	147	1	57	No	No	No	No	No	No	No	No	No	No
11	2	147	1	57	No	No	No	No	No	No	No	No	No	No
12	2	140	1	54	No	No	No	No	No	No	No	No	No	No
13	2	127	1	49	No	No	No	No	No	No	No	No	No	No
14	2	117	1	45	No	No	No	No	No	No	No	No	No	No
15	2	117	1	45	No	No	No	No	No	No	No	No	No	No
16	2	114	1	44	No	No	No	No	No	No	No	No	No	No
17	2	65	1	25	No	No	No	No	No	No	No	No	No	No
18	2	36	1	14	No	No	No	No	No	No	No	No	No	No
19	2	32	1	13	No	No	No	No	No	No	No	No	No	No
20	2	13	1	5	No	No	No	No	No	No	No	No	No	No
21	2	10	1	4	No	No	No	No	No	No	No	No	No	No
22	2	10	1	4	No	No	No	No	No	No	No	No	No	No
23	2	7	1	3	No	No	No	No	No	No	No	No	No	No
24	2	7	1	3	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	SW
Total Stopped Delay Per Vehicle on Minor Approach (s)	8.3
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:17
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	126
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	452
Number of Approaches on Intersection	3
Total Volume Condition Met	No
Warrant Met for Approach	No
Warrant Met for Intersection	**No**

Signal Warrants Report For Intersection 5: Market Road & Jambhivali gaon Road Intersection

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	SE, W
Minor Approaches	S
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	SE	W	S
1	263	98	122
2	252	94	117
3	247	92	115
4	210	78	98
5	200	74	93
6	179	67	83
7	166	62	77
8	158	59	73
9	126	47	59
10	118	44	55
11	118	44	55
12	113	42	52
13	103	38	48
14	95	35	44
15	95	35	44
16	92	34	43
17	53	20	24
18	29	11	13
19	26	10	12
20	11	4	5
21	8	3	4
22	8	3	4
23	5	2	2
24	5	2	2

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
1	2	361	1	122	No	No	No	Yes	No	No	No	No	No	No
2	2	346	1	117	No	No	No	Yes	No	No	No	No	No	No
3	2	339	1	115	No	No	No	Yes	No	No	No	No	No	No
4	2	288	1	98	No	No	No	No	No	No	No	No	No	No
5	2	274	1	93	No	No	No	No	No	No	No	No	No	No
6	2	246	1	83	No	No	No	No	No	No	No	No	No	No
7	2	228	1	77	No	No	No	No	No	No	No	No	No	No
8	2	217	1	73	No	No	No	No	No	No	No	No	No	No
9	2	173	1	59	No	No	No	No	No	No	No	No	No	No
10	2	162	1	55	No	No	No	No	No	No	No	No	No	No
11	2	162	1	55	No	No	No	No	No	No	No	No	No	No
12	2	155	1	52	No	No	No	No	No	No	No	No	No	No
13	2	141	1	48	No	No	No	No	No	No	No	No	No	No
14	2	130	1	44	No	No	No	No	No	No	No	No	No	No
15	2	130	1	44	No	No	No	No	No	No	No	No	No	No
16	2	126	1	43	No	No	No	No	No	No	No	No	No	No
17	2	73	1	24	No	No	No	No	No	No	No	No	No	No
18	2	40	1	13	No	No	No	No	No	No	No	No	No	No
19	2	36	1	12	No	No	No	No	No	No	No	No	No	No
20	2	15	1	5	No	No	No	No	No	No	No	No	No	No
21	2	11	1	4	No	No	No	No	No	No	No	No	No	No
22	2	11	1	4	No	No	No	No	No	No	No	No	No	No
23	2	7	1	2	No	No	No	No	No	No	No	No	No	No
24	2	7	1	2	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	3	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	S
Total Stopped Delay Per Vehicle on Minor Approach (s)	8.5
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:17
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	122
High Minor Volume Condition Met	Yes
Total Entering Volume on All Approaches During Same Hour	483
Number of Approaches on Intersection	3
Total Volume Condition Met	No
Warrant Met for Approach	No
Warrant Met for Intersection	**No**

Signal Warrants Report For Intersection 6: Savroli Kharpada Road & Gamdevi Tempel Road Intersection

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	SE, NW
Minor Approaches	NE
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	SE	NW	NE
1	450	110	90
2	432	106	86
3	423	103	85
4	360	88	72
5	342	84	68
6	306	75	61
7	284	69	57
8	270	66	54
9	216	53	43
10	203	50	41
11	203	50	41
12	194	47	39
13	176	43	35
14	162	40	32
15	162	40	32
16	158	39	31
17	90	22	18
18	50	12	10
19	45	11	9
20	18	4	4
21	14	3	3
22	14	3	3
23	9	2	2
24	9	2	2

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
1	2	560	1	90	No	No	No	Yes	No	No	No	Yes	No	No
2	2	538	1	86	No	No	No	Yes	No	No	No	Yes	No	No
3	2	526	1	85	No	No	No	Yes	No	No	No	Yes	No	No
4	2	448	1	72	No	No	No	No	No	No	No	No	No	No
5	2	426	1	68	No	No	No	No	No	No	No	No	No	No
6	2	381	1	61	No	No	No	No	No	No	No	No	No	No
7	2	353	1	57	No	No	No	No	No	No	No	No	No	No
8	2	336	1	54	No	No	No	No	No	No	No	No	No	No
9	2	269	1	43	No	No	No	No	No	No	No	No	No	No
10	2	253	1	41	No	No	No	No	No	No	No	No	No	No
11	2	253	1	41	No	No	No	No	No	No	No	No	No	No
12	2	241	1	39	No	No	No	No	No	No	No	No	No	No
13	2	219	1	35	No	No	No	No	No	No	No	No	No	No
14	2	202	1	32	No	No	No	No	No	No	No	No	No	No
15	2	202	1	32	No	No	No	No	No	No	No	No	No	No
16	2	197	1	31	No	No	No	No	No	No	No	No	No	No
17	2	112	1	18	No	No	No	No	No	No	No	No	No	No
18	2	62	1	10	No	No	No	No	No	No	No	No	No	No
19	2	56	1	9	No	No	No	No	No	No	No	No	No	No
20	2	22	1	4	No	No	No	No	No	No	No	No	No	No
21	2	17	1	3	No	No	No	No	No	No	No	No	No	No
22	2	17	1	3	No	No	No	No	No	No	No	No	No	No
23	2	11	1	2	No	No	No	No	No	No	No	No	No	No
24	2	11	1	2	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	3	0	0	0	3	0	0

Warrant 3 Condition A

Orientation	NE
Total Stopped Delay Per Vehicle on Minor Approach (s)	8.9
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:13
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	90
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	650
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	**No**

Signal Warrants Report For Intersection 7: Savroli Kharpada Road & School Road Intersection

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	SE, NW
Minor Approaches	N
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	SE	NW	N
1	630	158	84
2	605	152	81
3	592	149	79
4	504	126	67
5	479	120	64
6	428	107	57
7	397	100	53
8	378	95	50
9	302	76	40
10	284	71	38
11	284	71	38
12	271	68	36
13	246	62	33
14	227	57	30
15	227	57	30
16	221	55	29
17	126	32	17
18	69	17	9
19	63	16	8
20	25	6	3
21	19	5	3
22	19	5	3
23	13	3	2
24	13	3	2

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
1	2	788	1	84	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No
2	2	757	1	81	No	No	No	No	No	Yes	Yes	Yes	No	No
3	2	741	1	79	No	No	No	No	No	Yes	Yes	Yes	No	No
4	2	630	1	67	No	No	No	No	No	No	Yes	Yes	No	No
5	2	599	1	64	No	No	No	No	No	No	No	Yes	No	No
6	2	535	1	57	No	No	No	No	No	No	No	Yes	No	No
7	2	497	1	53	No	No	No	No	No	No	No	No	No	No
8	2	473	1	50	No	No	No	No	No	No	No	No	No	No
9	2	378	1	40	No	No	No	No	No	No	No	No	No	No
10	2	355	1	38	No	No	No	No	No	No	No	No	No	No
11	2	355	1	38	No	No	No	No	No	No	No	No	No	No
12	2	339	1	36	No	No	No	No	No	No	No	No	No	No
13	2	308	1	33	No	No	No	No	No	No	No	No	No	No
14	2	284	1	30	No	No	No	No	No	No	No	No	No	No
15	2	284	1	30	No	No	No	No	No	No	No	No	No	No
16	2	276	1	29	No	No	No	No	No	No	No	No	No	No
17	2	158	1	17	No	No	No	No	No	No	No	No	No	No
18	2	86	1	9	No	No	No	No	No	No	No	No	No	No
19	2	79	1	8	No	No	No	No	No	No	No	No	No	No
20	2	31	1	3	No	No	No	No	No	No	No	No	No	No
21	2	24	1	3	No	No	No	No	No	No	No	No	No	No
22	2	24	1	3	No	No	No	No	No	No	No	No	No	No
23	2	16	1	2	No	No	No	No	No	No	No	No	No	No
24	2	16	1	2	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	1	0	3	4	6	1	0

Warrant 3 Condition A

Orientation	N
Total Stopped Delay Per Vehicle on Minor Approach (s)	9.3
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:13
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	84
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	872
Number of Approaches on Intersection	3
Total Volume Condition Met	Yes
Warrant Met for Approach	No
Warrant Met for Intersection	**No**

Signal Warrants Report For Intersection 11: Gamdevi Tempel Road & Sarang Road Intersection

Warrants Summary

Warrant	Name	Met?
#1	Eight Hour Vehicular Volume	No
#2	Four Hour Vehicular Volume	No
#3	Peak Hour	No

Intersection Warrants Parameters

Major Approaches	NE, SW
Minor Approaches	NW
Speed > 40mph	Yes
Population < 10,000	No
Warrant Factor	70%

Warrant Analysis Traffic Volumes

Hour	Major Streets		Minor Streets
	NE	SW	NW
1	112	126	63
2	108	121	60
3	105	118	59
4	90	101	50
5	85	96	48
6	76	86	43
7	71	79	40
8	67	76	38
9	54	60	30
10	50	57	28
11	50	57	28
12	48	54	27
13	44	49	25
14	40	45	23
15	40	45	23
16	39	44	22
17	22	25	13
18	12	14	7
19	11	13	6
20	4	5	3
21	3	4	2
22	3	4	2
23	2	3	1
24	2	3	1

Warrant Analysis by Hour

Hour	Major Lanes		Minor Lanes		Warrant 1 Condition A				Warrant 1 Condition B				Warrant 2	Warrant 3
	Number	Volume	Number	Volume	100%	80%	70%	56%	100%	80%	70%	56%		Condition B
1	2	238	1	63	No	No	No	No	No	No	No	No	No	No
2	2	229	1	60	No	No	No	No	No	No	No	No	No	No
3	2	223	1	59	No	No	No	No	No	No	No	No	No	No
4	2	191	1	50	No	No	No	No	No	No	No	No	No	No
5	2	181	1	48	No	No	No	No	No	No	No	No	No	No
6	2	162	1	43	No	No	No	No	No	No	No	No	No	No
7	2	150	1	40	No	No	No	No	No	No	No	No	No	No
8	2	143	1	38	No	No	No	No	No	No	No	No	No	No
9	2	114	1	30	No	No	No	No	No	No	No	No	No	No
10	2	107	1	28	No	No	No	No	No	No	No	No	No	No
11	2	107	1	28	No	No	No	No	No	No	No	No	No	No
12	2	102	1	27	No	No	No	No	No	No	No	No	No	No
13	2	93	1	25	No	No	No	No	No	No	No	No	No	No
14	2	85	1	23	No	No	No	No	No	No	No	No	No	No
15	2	85	1	23	No	No	No	No	No	No	No	No	No	No
16	2	83	1	22	No	No	No	No	No	No	No	No	No	No
17	2	47	1	13	No	No	No	No	No	No	No	No	No	No
18	2	26	1	7	No	No	No	No	No	No	No	No	No	No
19	2	24	1	6	No	No	No	No	No	No	No	No	No	No
20	2	9	1	3	No	No	No	No	No	No	No	No	No	No
21	2	7	1	2	No	No	No	No	No	No	No	No	No	No
22	2	7	1	2	No	No	No	No	No	No	No	No	No	No
23	2	5	1	1	No	No	No	No	No	No	No	No	No	No
24	2	5	1	1	No	No	No	No	No	No	No	No	No	No
Hours Met					0	0	0	0	0	0	0	0	0	0

Warrant 3 Condition A

Orientation	NW
Total Stopped Delay Per Vehicle on Minor Approach (s)	7.5
Number of Lanes on Minor Street Approach	1
VehicleHours of Stopped Delay on Minor Approach ([h]h:mm)	0:07
Delay Condition Met	No
Volume on Minor Street Approach During Same Hour	63
High Minor Volume Condition Met	No
Total Entering Volume on All Approaches During Same Hour	301
Number of Approaches on Intersection	3
Total Volume Condition Met	No
Warrant Met for Approach	No
Warrant Met for Intersection	**No**

Proposed Township Project - Khalapur

Vistro File: D:\...\Vistro 1.vistro Scenario 2 2025 Traffic Management Scenario

Report File: D:\...\2025-Traffic Management Report for 5KM Road Network around Project Location.pdf 05-10-2017

Trip Generation summary

Added Trips

Zone ID: Name	Land Use variables	Code	Ind. Var.	Rate	Quantity	% In	% Out	Trips In	Trips Out	Total Trips	% of Total Trip
1: Site				1.000	0.000	50.00	50.00	466	251	717	50.00
2: To Mumbai				1.000	0.000	50.00	50.00	251	466	717	50.00
					Added Trips Total			**717**	**717**	**1434**	**100.00**

Proposed Township Project - Khalapur

Vistro File: D:\...\Vistro 1.vistro Scenario 2 2025 Traffic Management Scenario

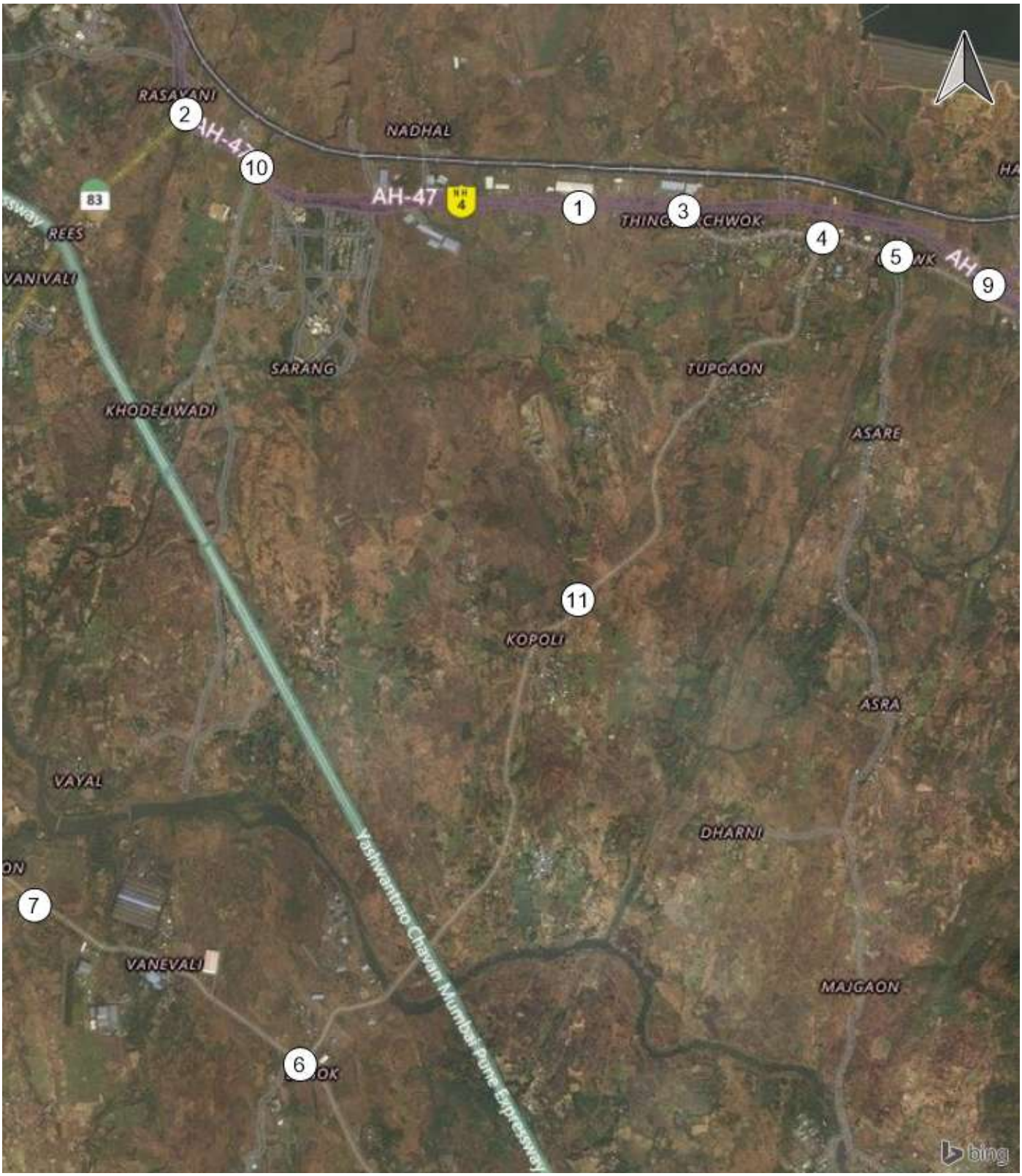
Report File: D:\...\2025-Traffic Management Report for 5KM Road Network around Project Location.pdf 05-10-2017

Trip Distribution summary

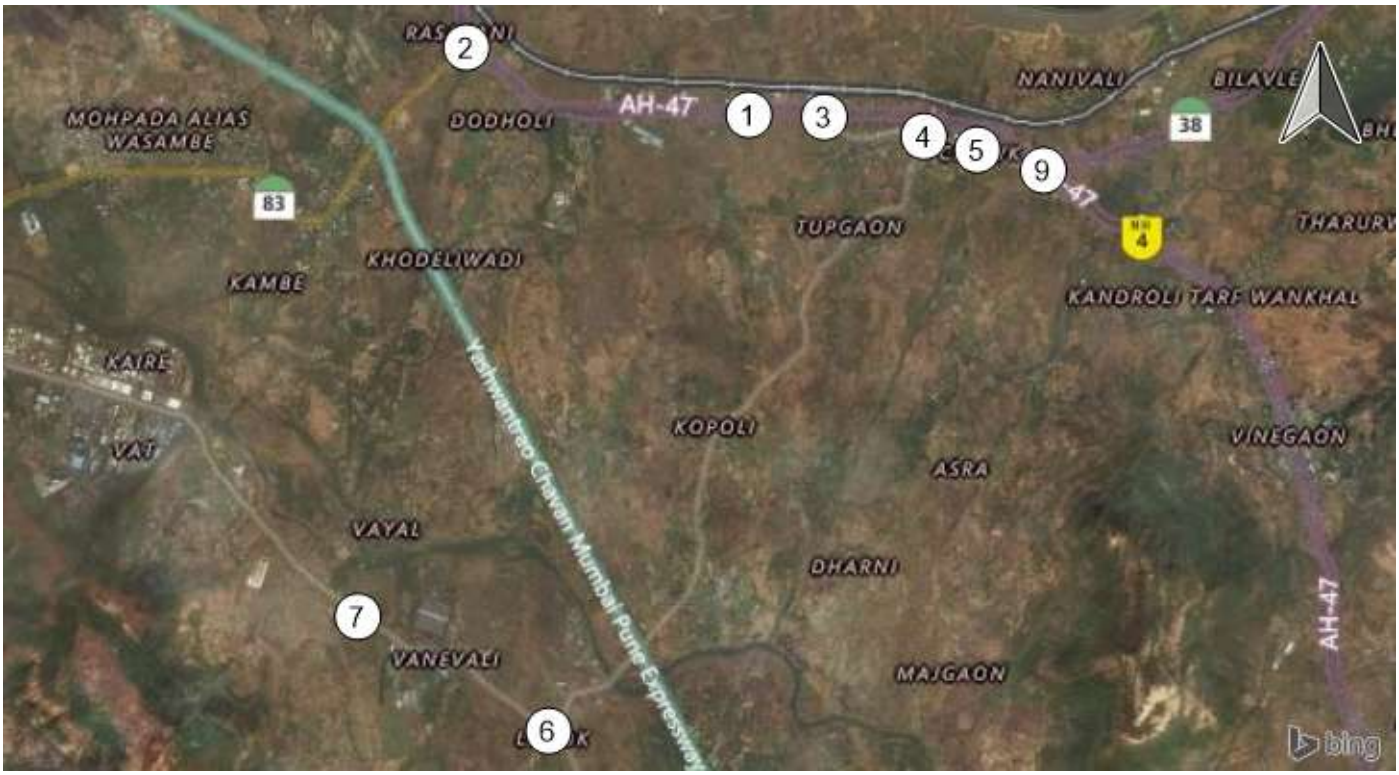
Zone / Gate	Zone 1: Site			
	To Site:		From Site:	
	Share %	Trips	Share %	Trips
2: To Mumbai	100.00	466	100.00	251
Total	**100.00**	**466**	**100.00**	**251**

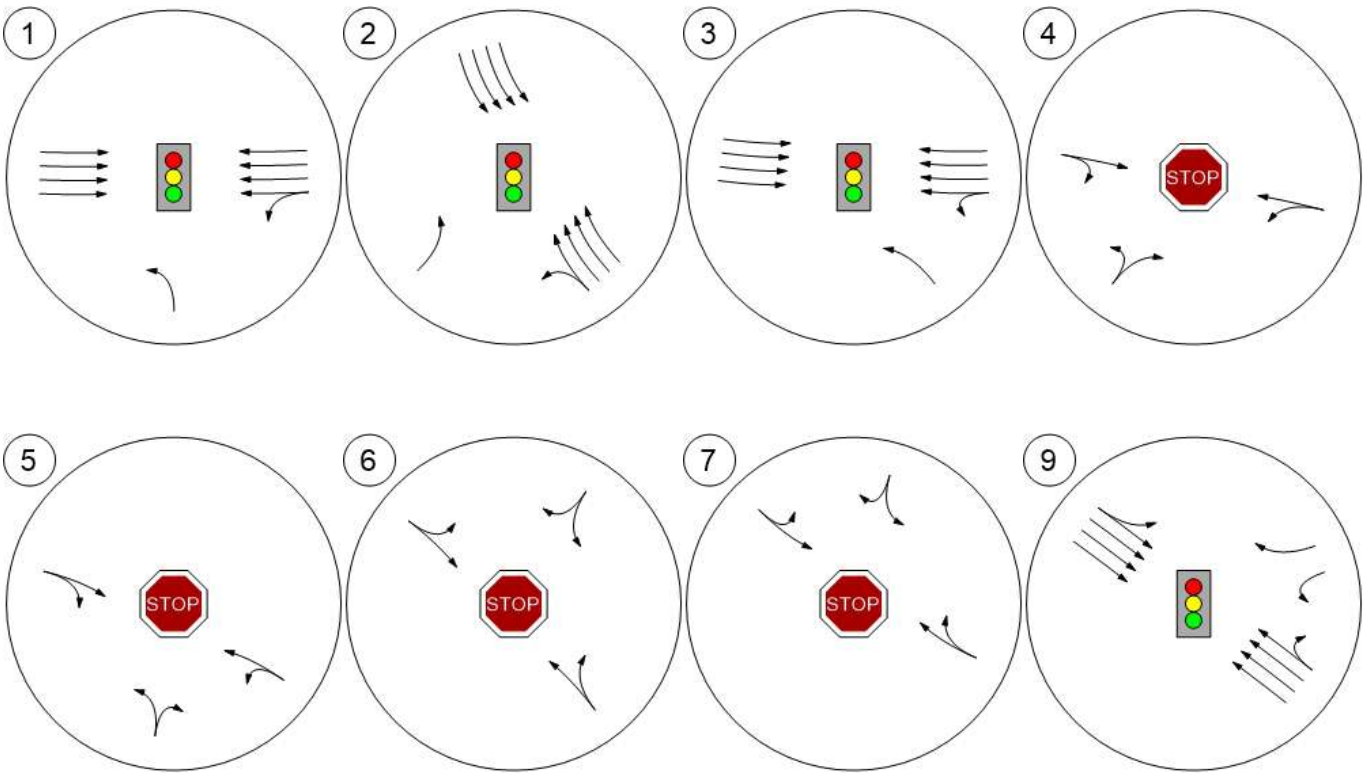
Zone / Gate	Zone 2: To Mumbai			
	To To Mumbai:		From To Mumbai:	
	Share %	Trips	Share %	Trips
1: Site	100.00	251	100.00	466
Total	**100.00**	**251**	**100.00**	**466**

Study Intersections

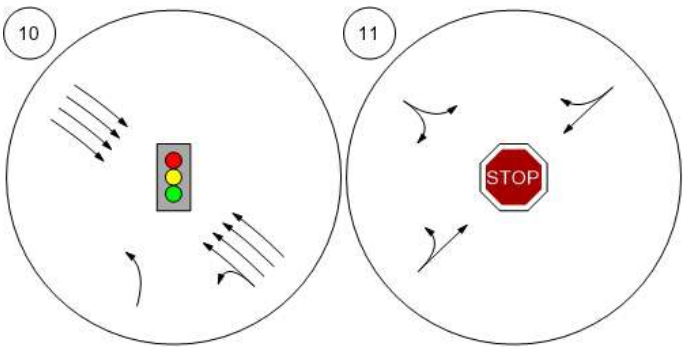


Lane Configuration and Traffic Control

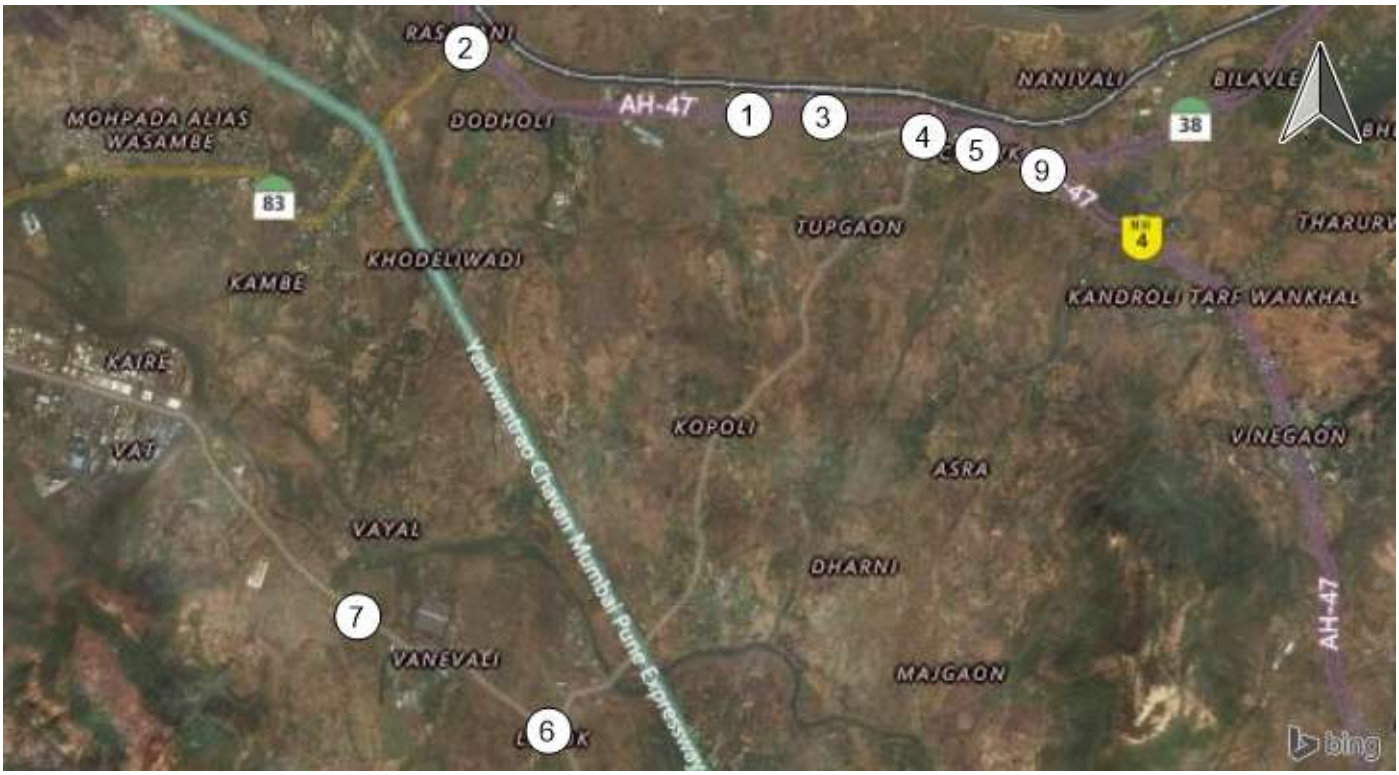


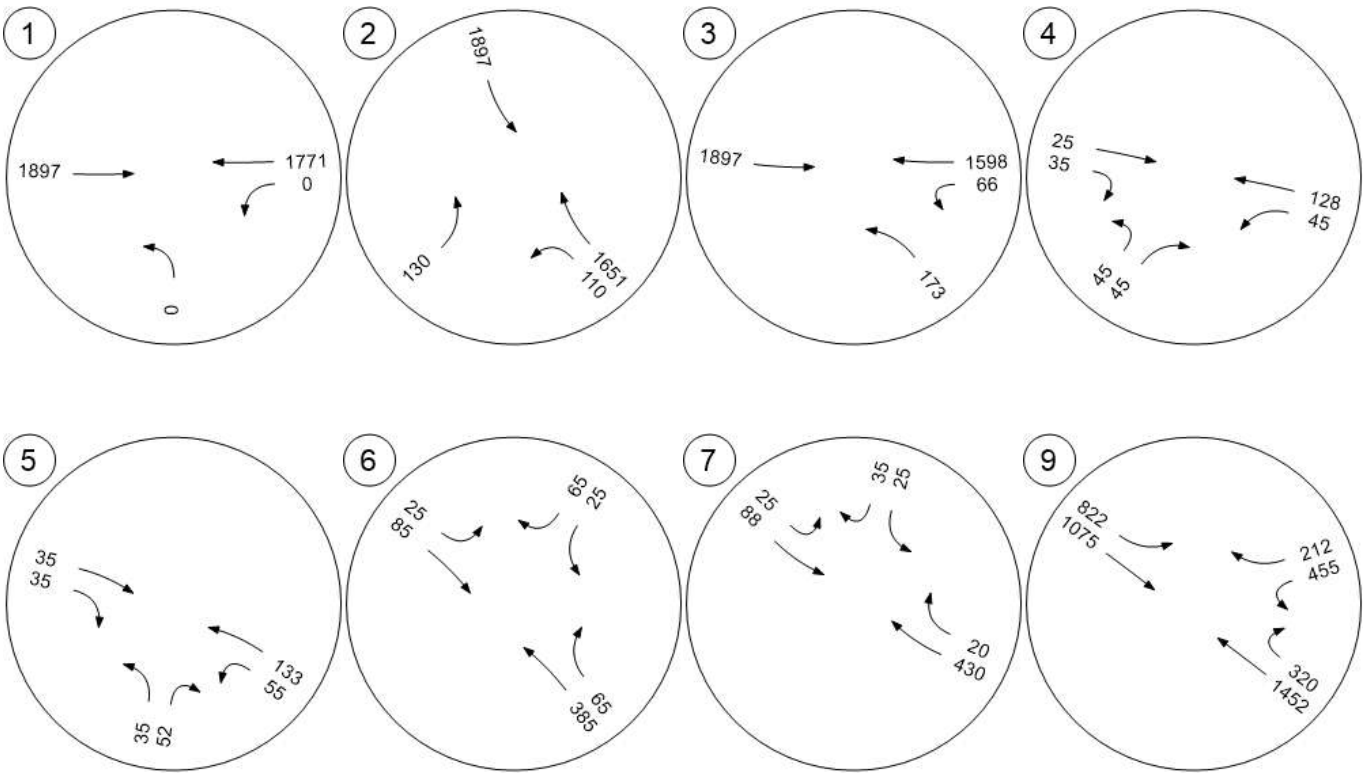


Lane Configuration and Traffic Control

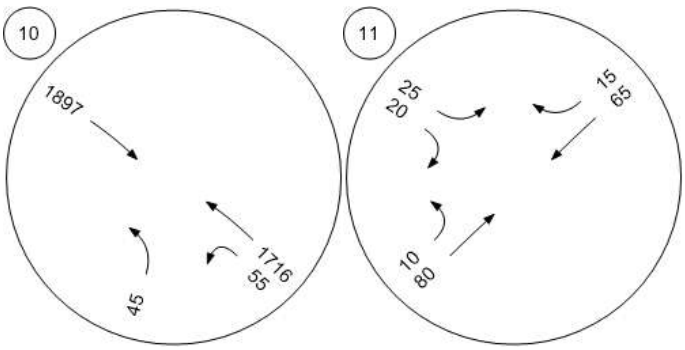


Traffic Volume - Base Volume

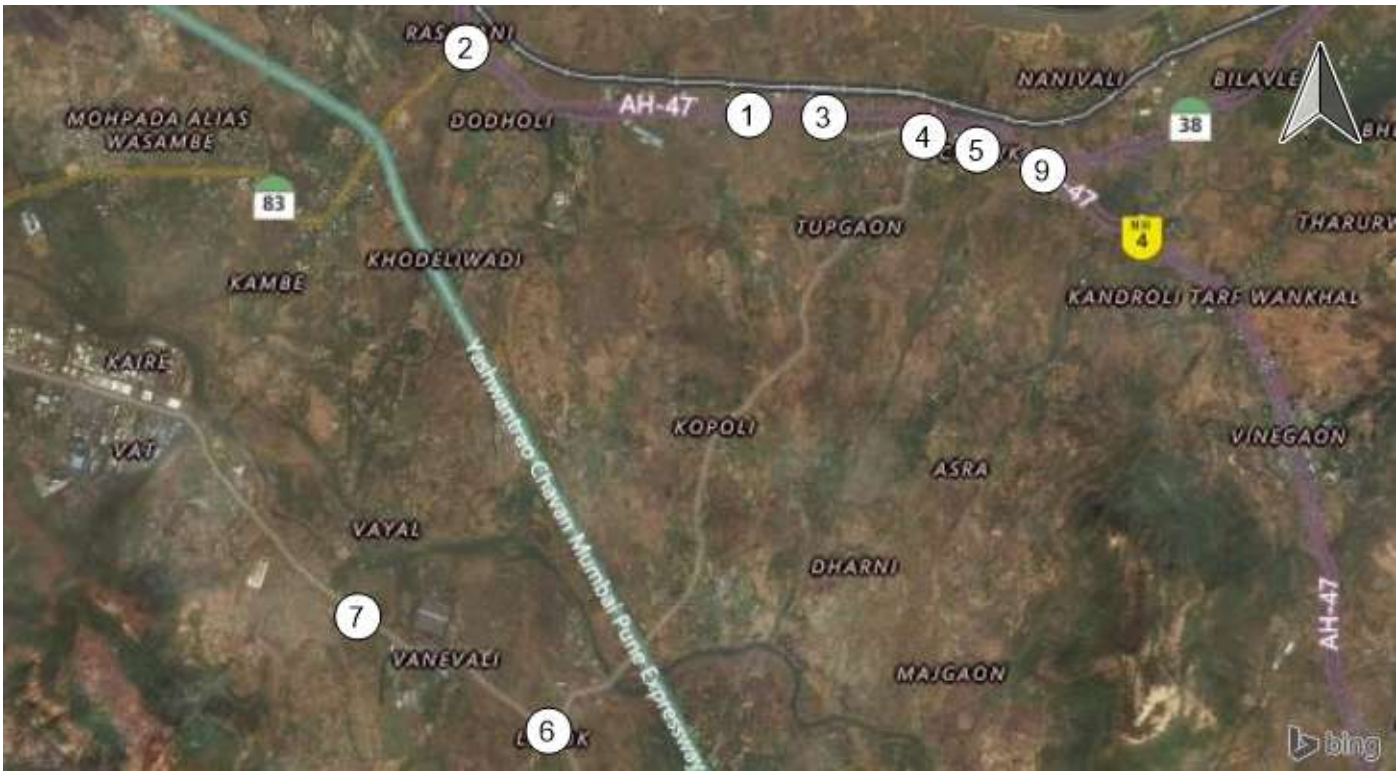


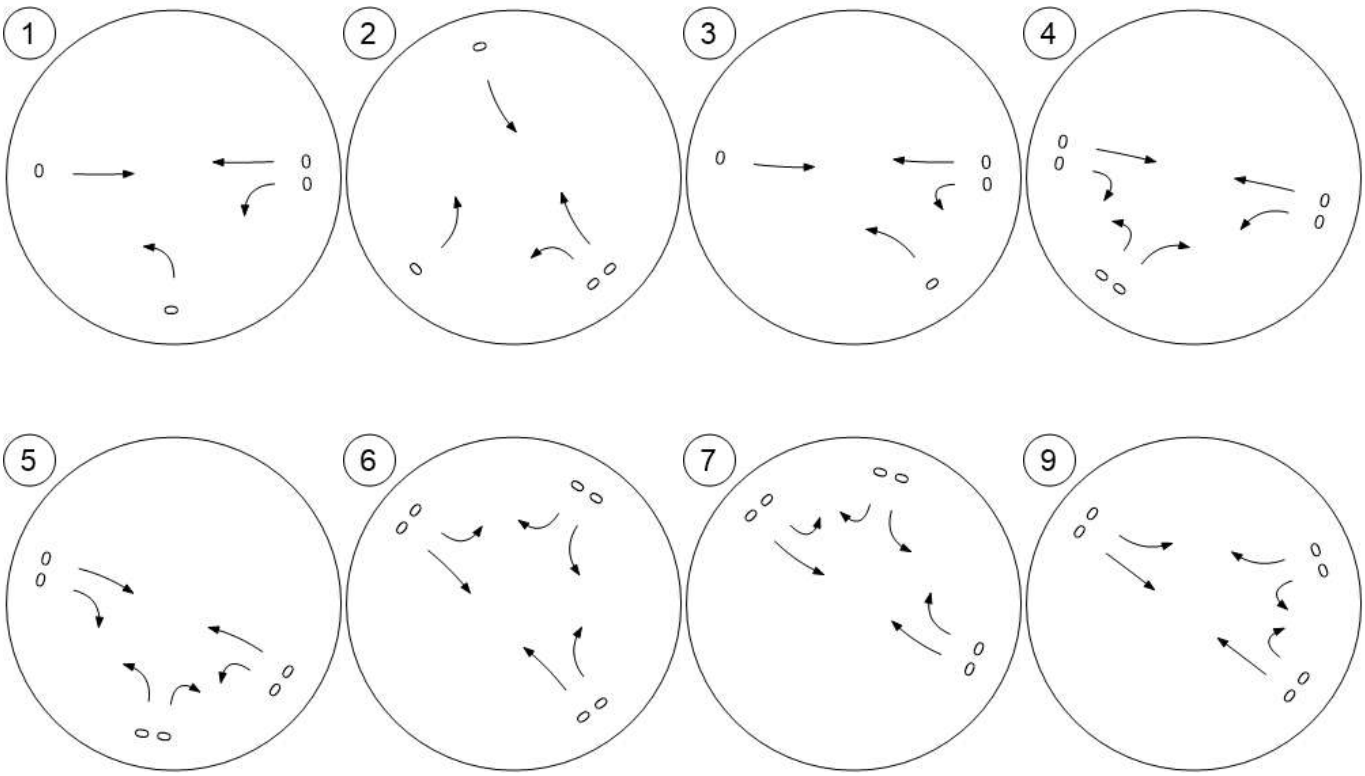


Traffic Volume - Base Volume

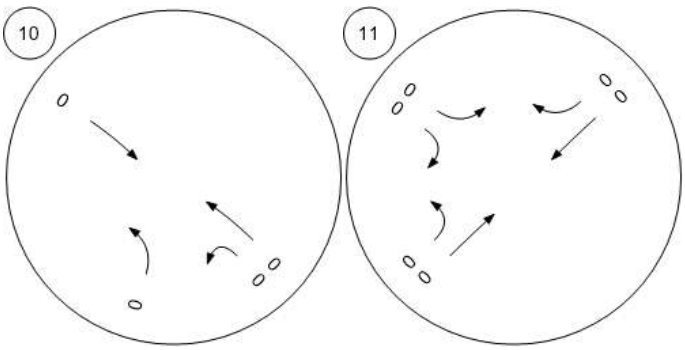


Traffic Volume - In-Process Volume

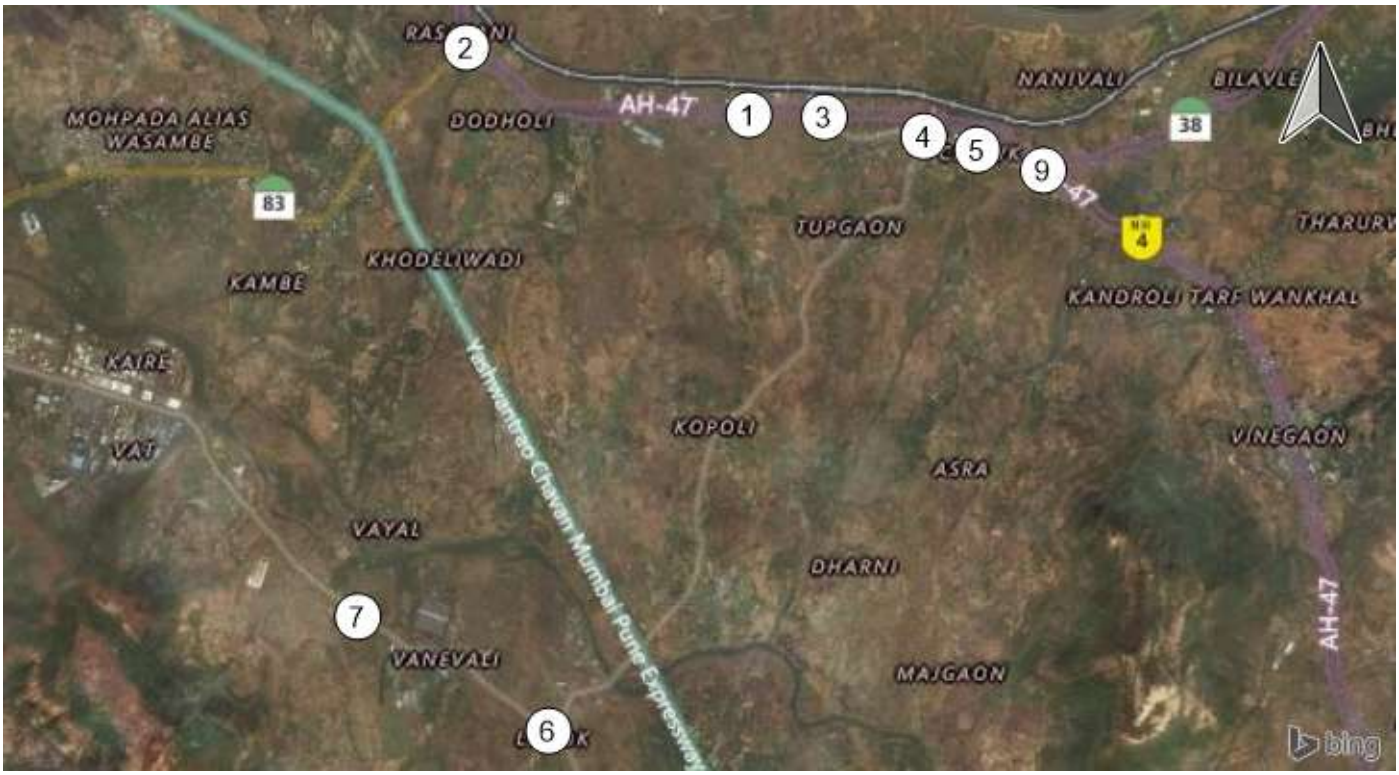


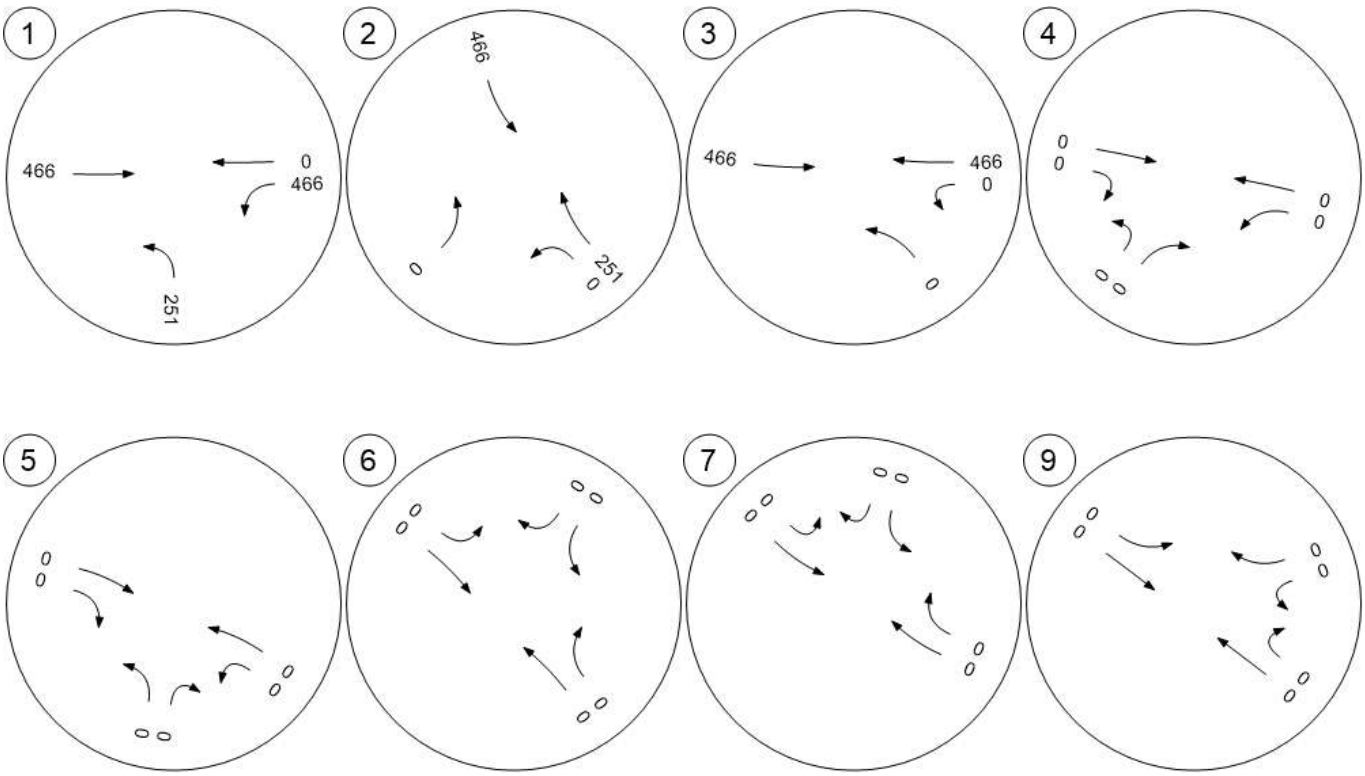


Traffic Volume - In-Process Volume

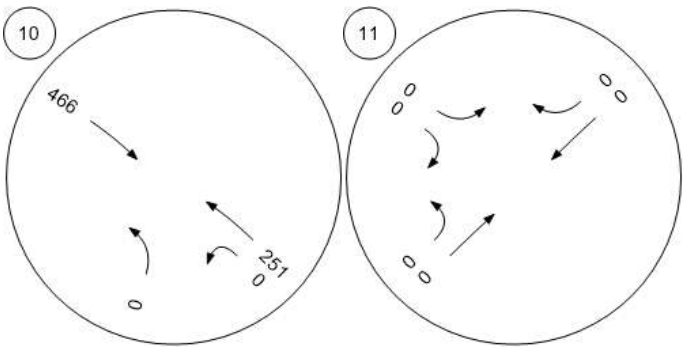


Traffic Volume - Net New Site Trips

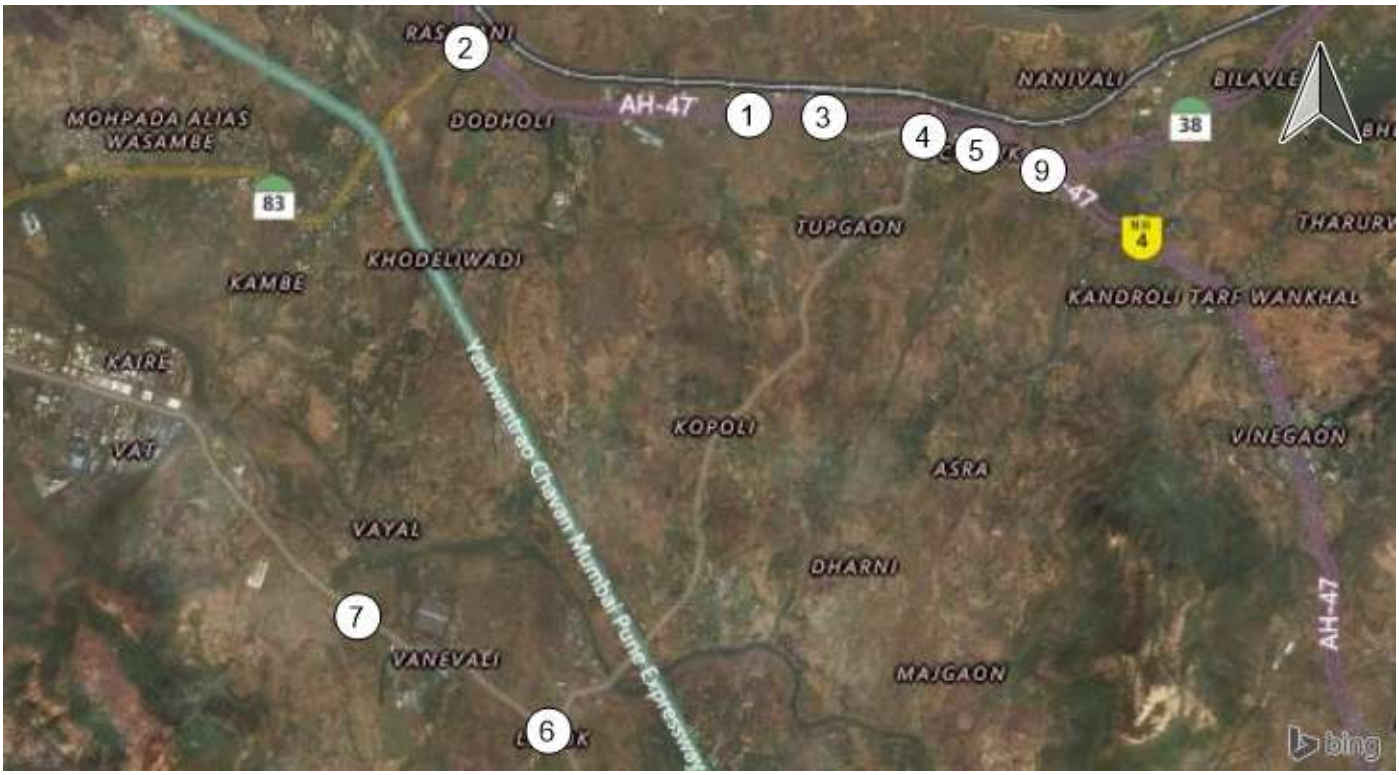


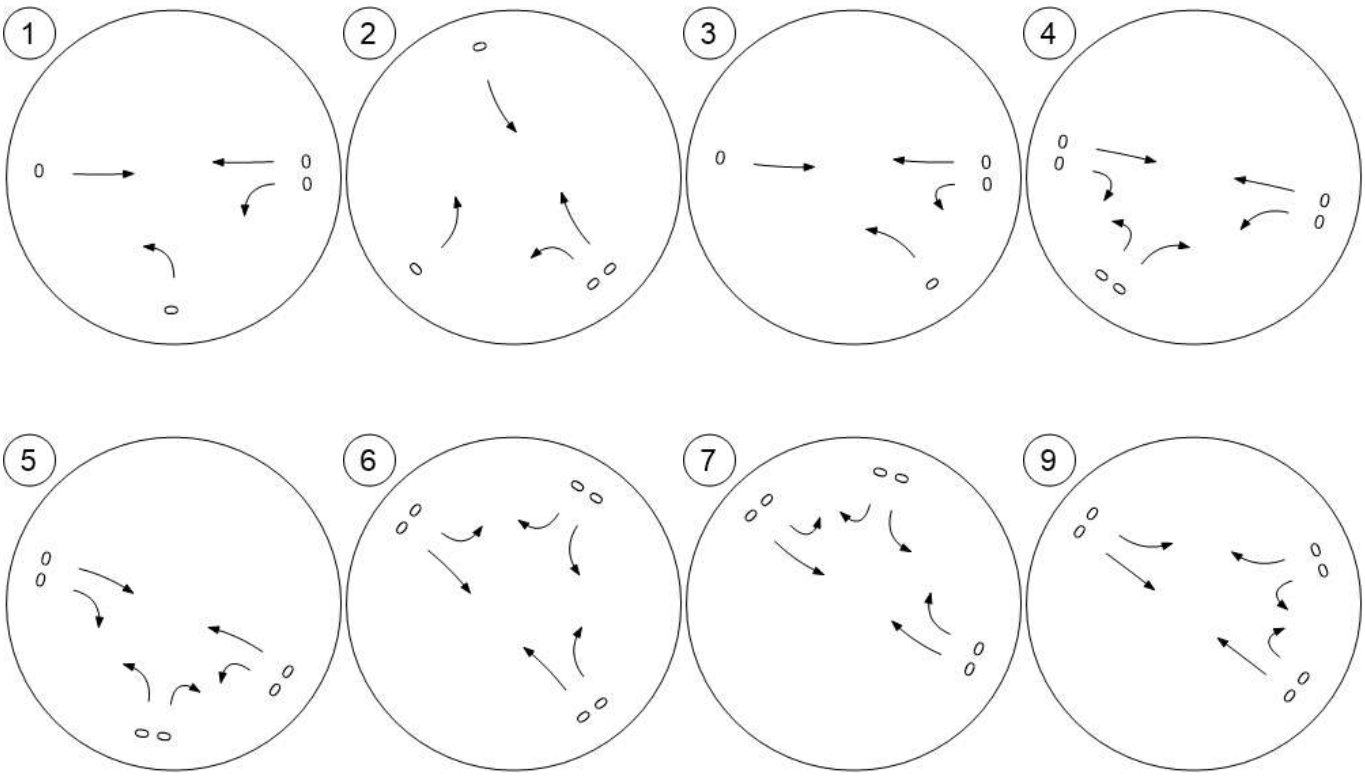


Traffic Volume - Net New Site Trips

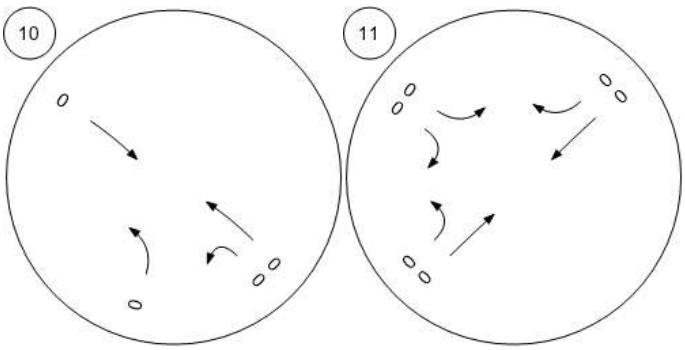


Traffic Volume - Other Volume

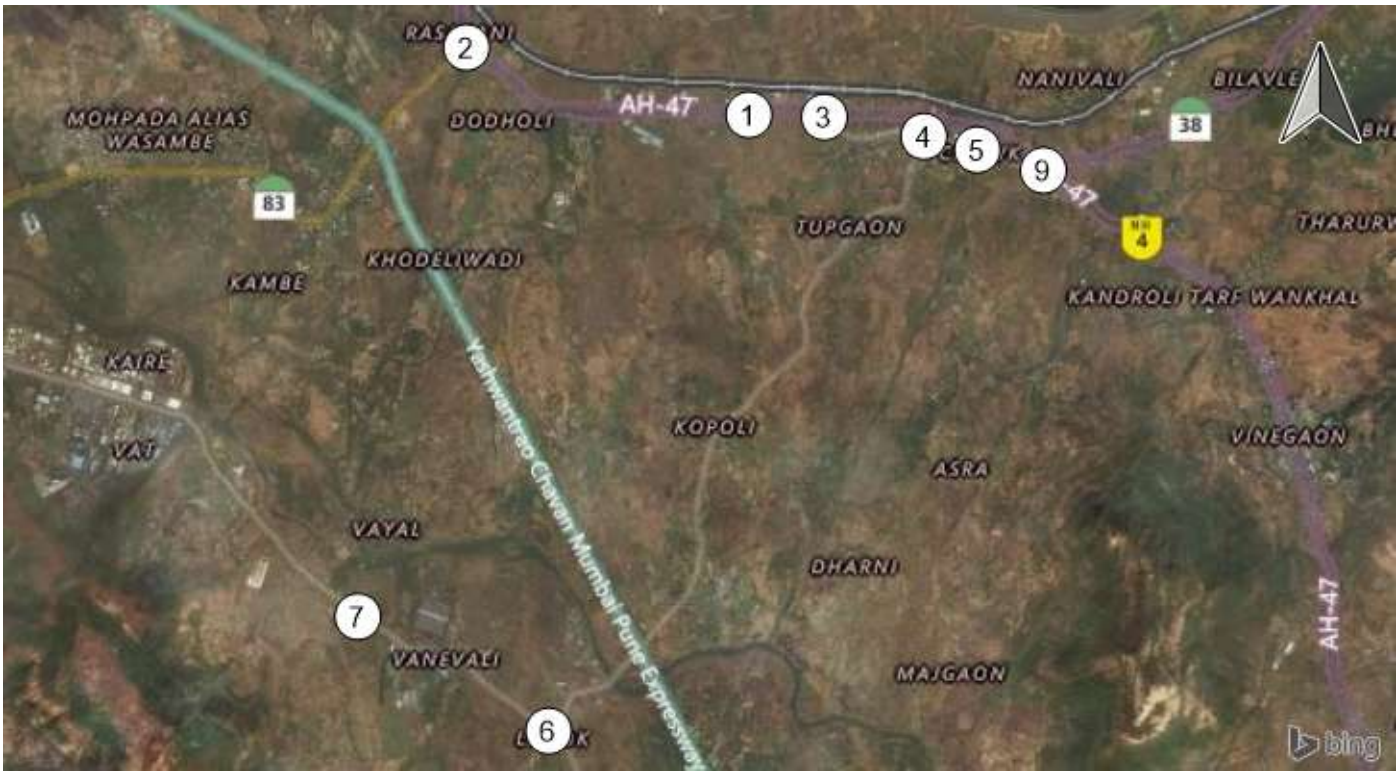


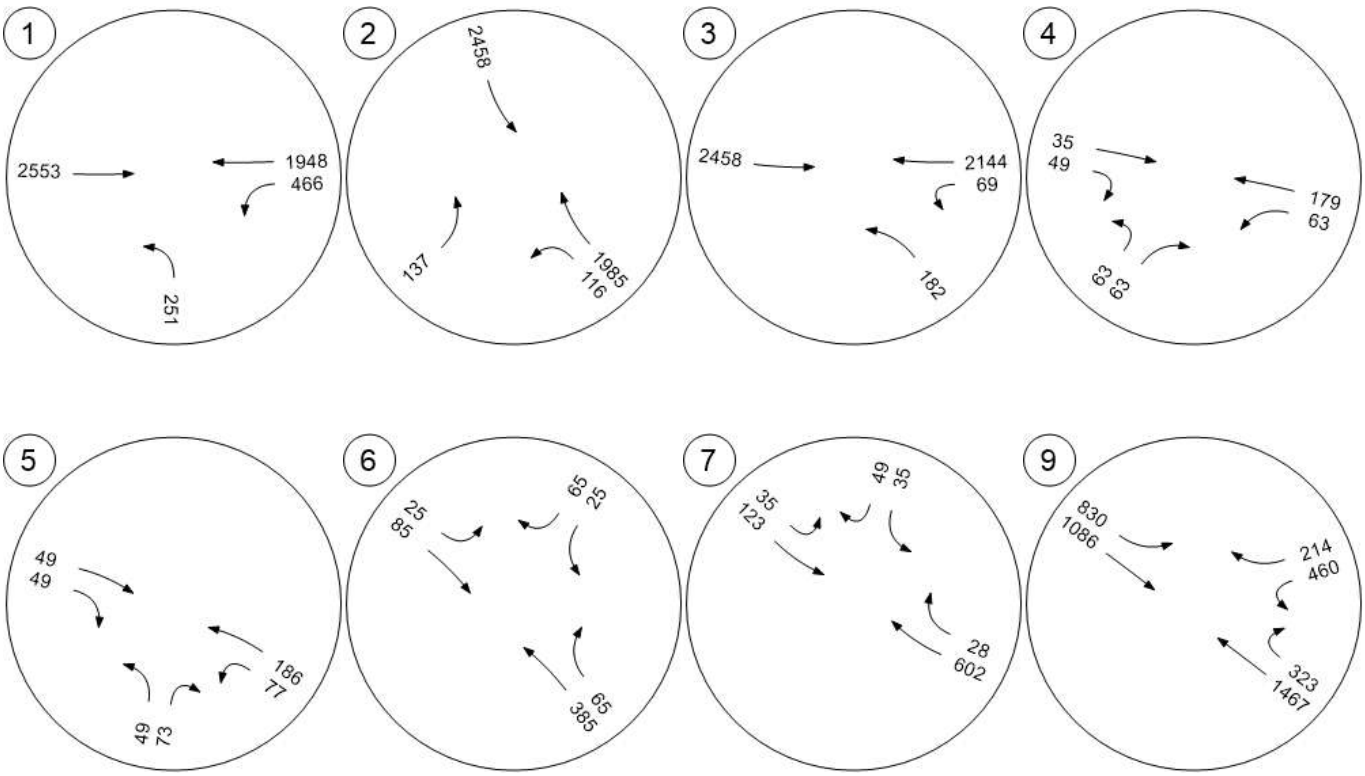


Traffic Volume - Other Volume



Traffic Volume - Future Total Volume





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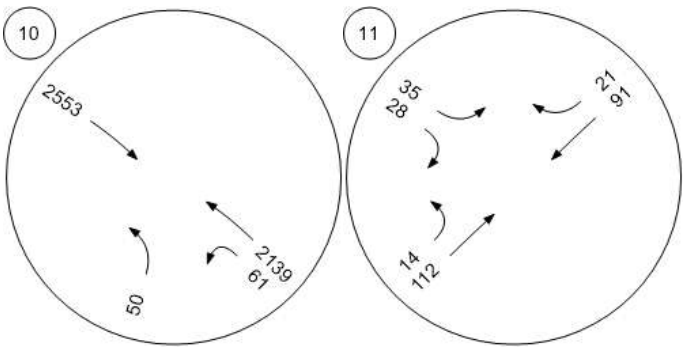
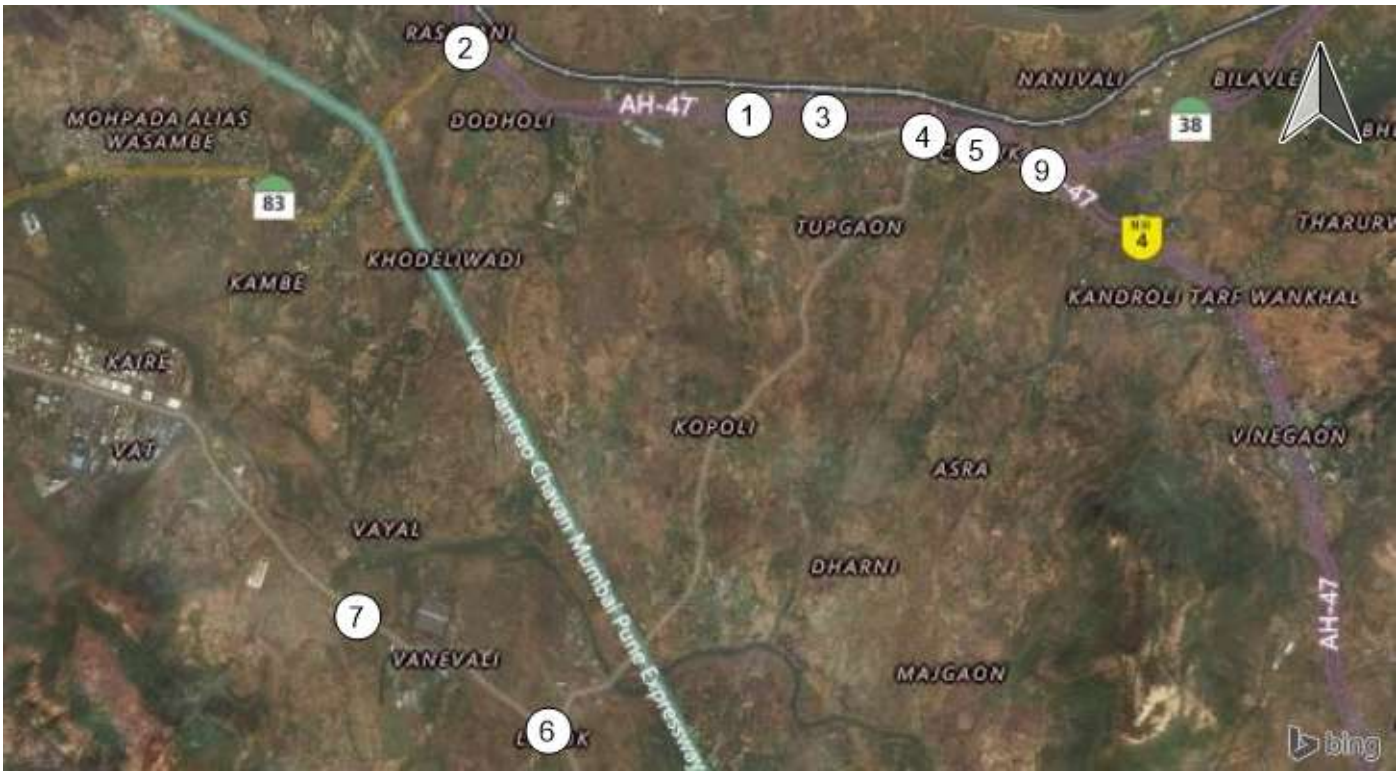
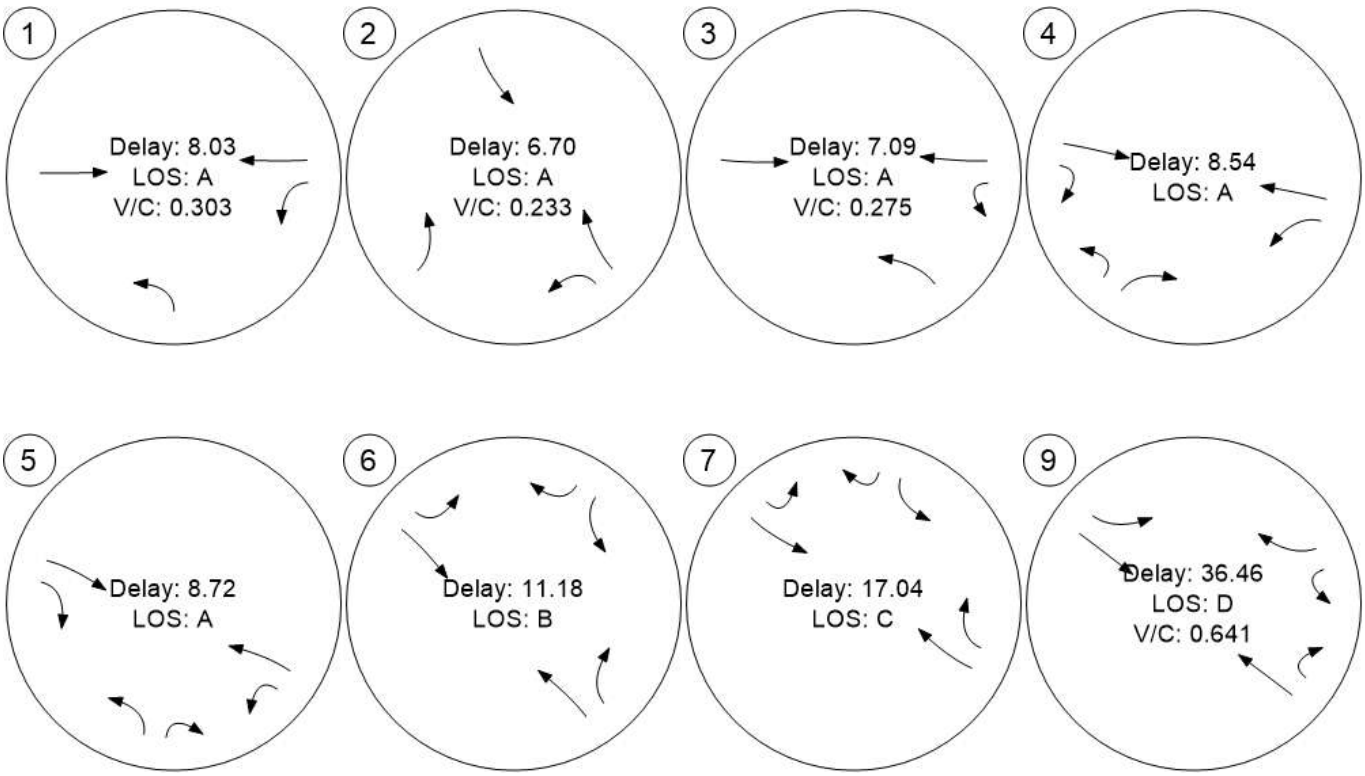


Traffic Conditions





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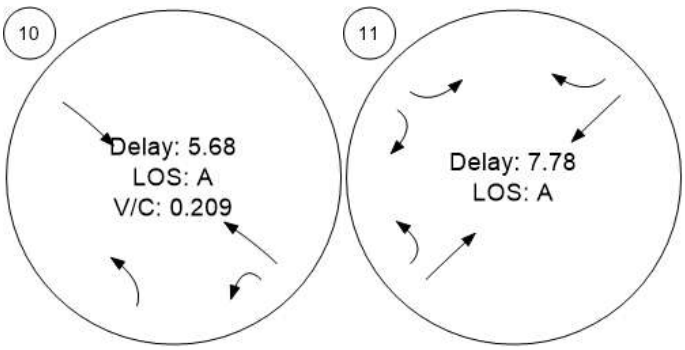
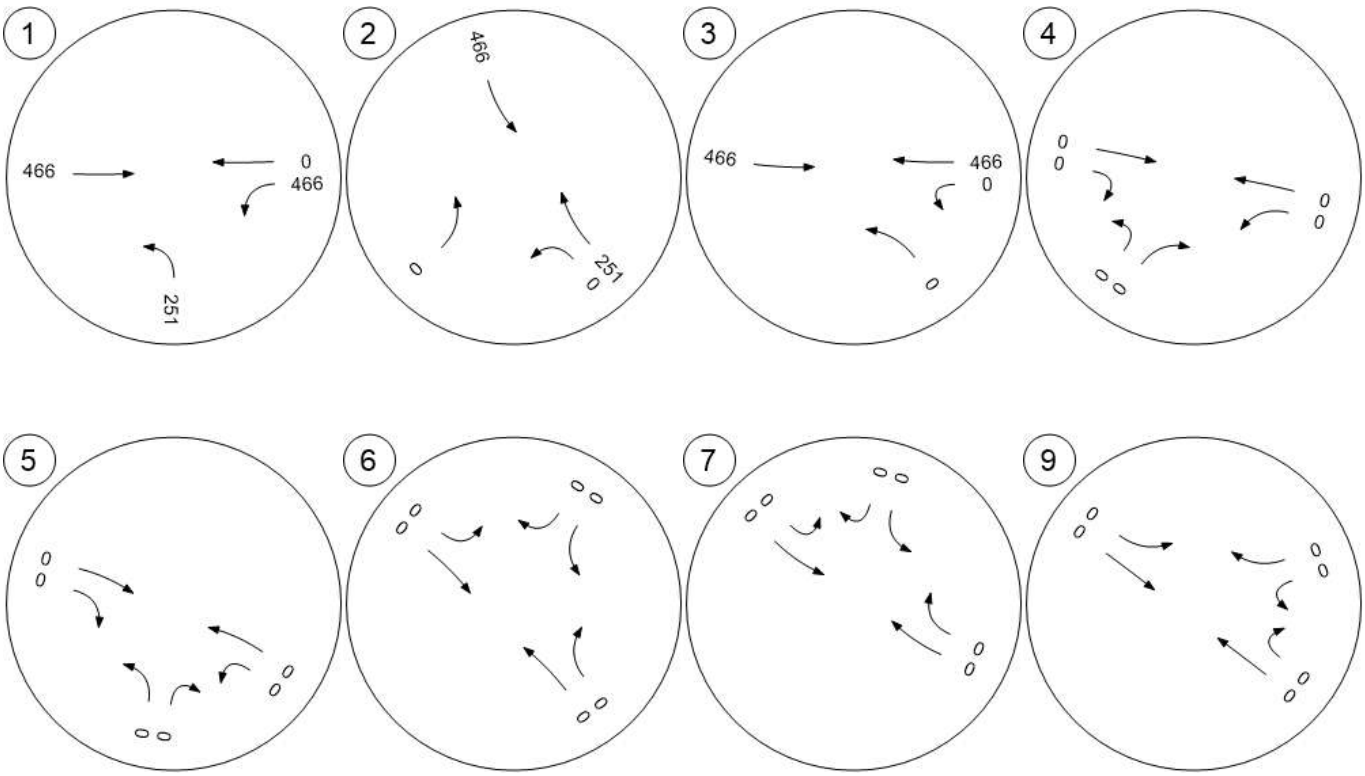


Fair Share - Fair Share Volumes - Zone 1: Site



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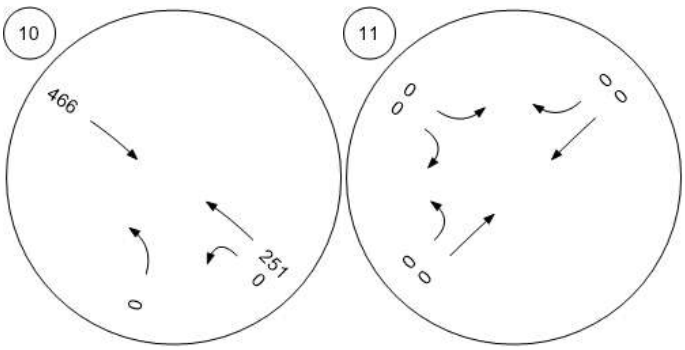
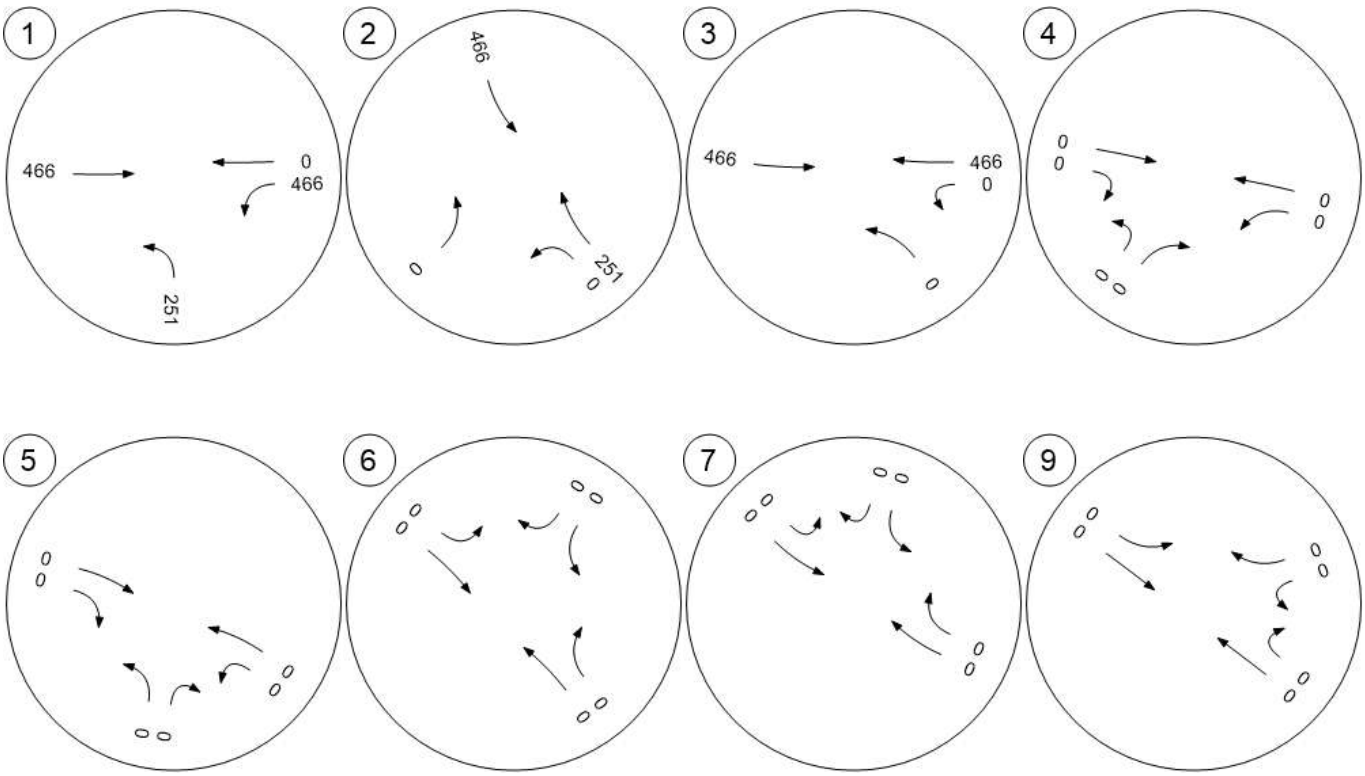
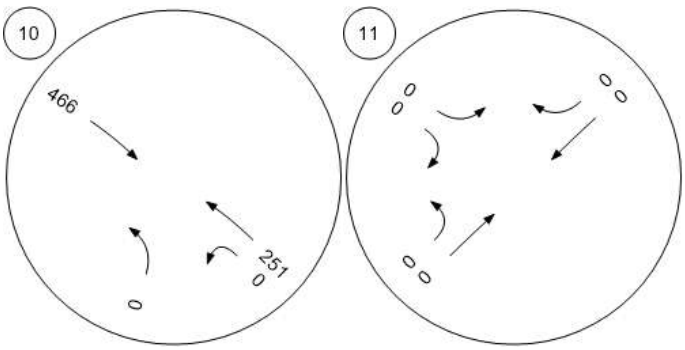


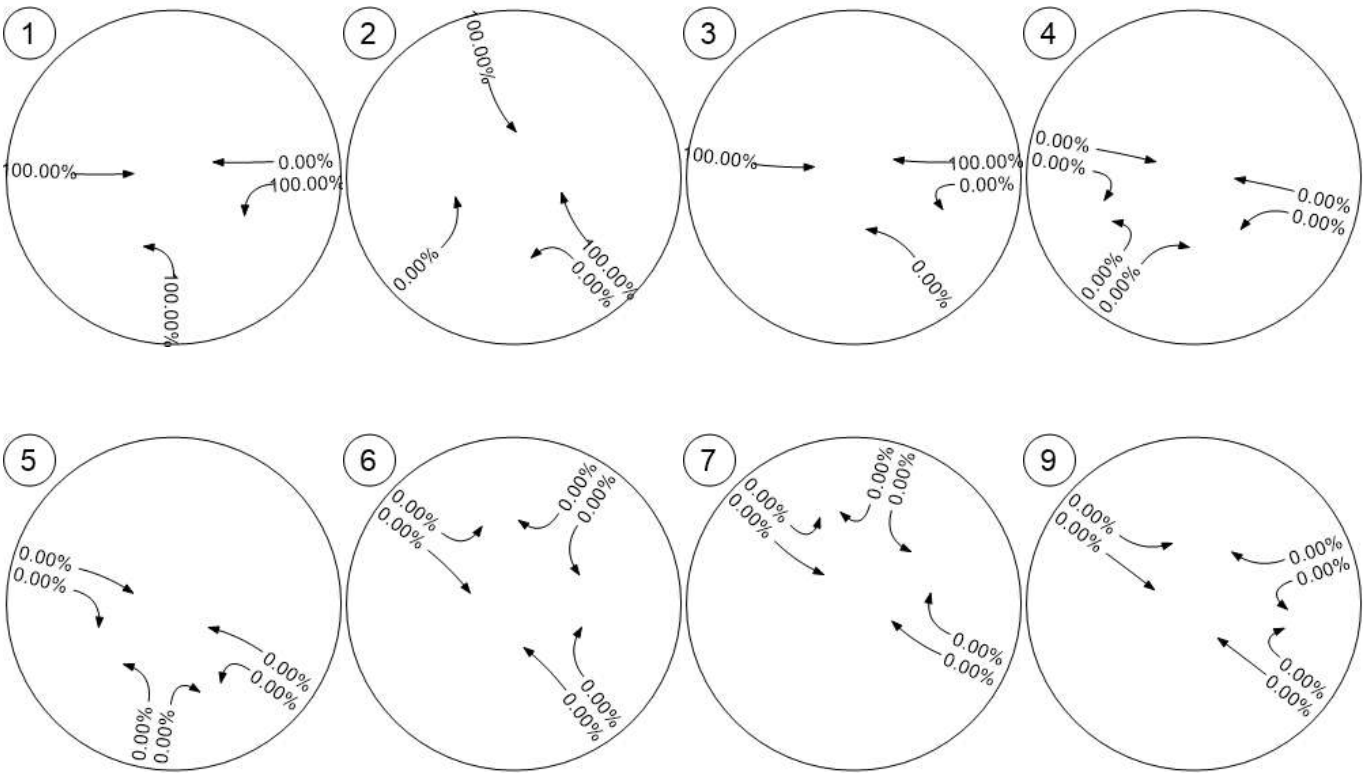
Fair Share - Fair Share Volumes - Zone 2: To Mumbai



Fair Share - Fair Share Volumes - Zone 2: To Mumbai



Fair Share - Fair Share % of Net New Site - Zone 1: Site



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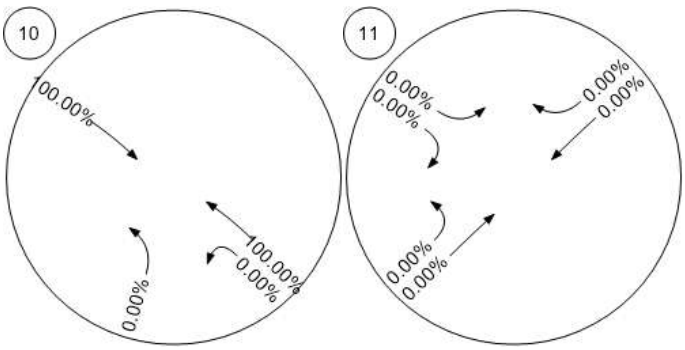
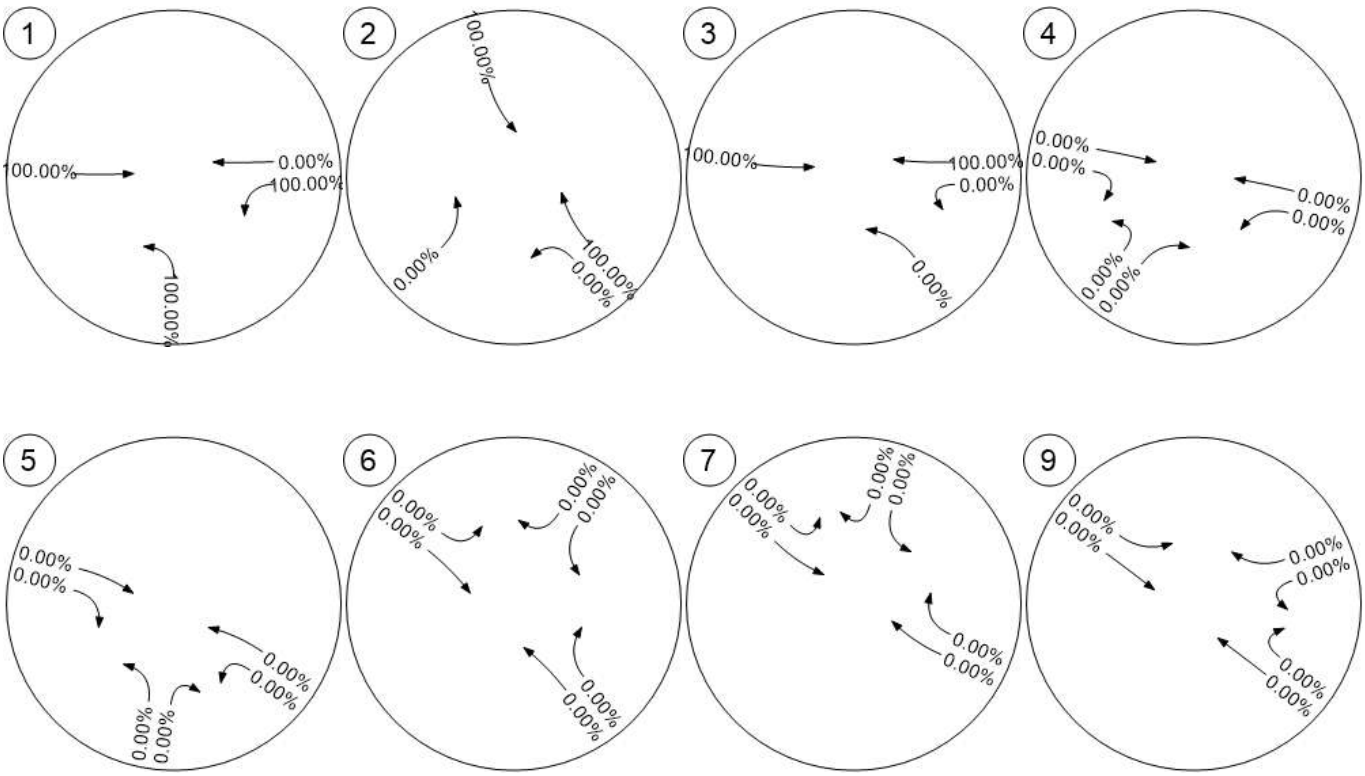
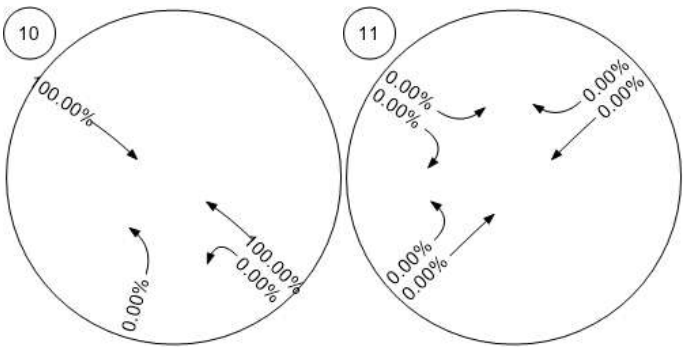


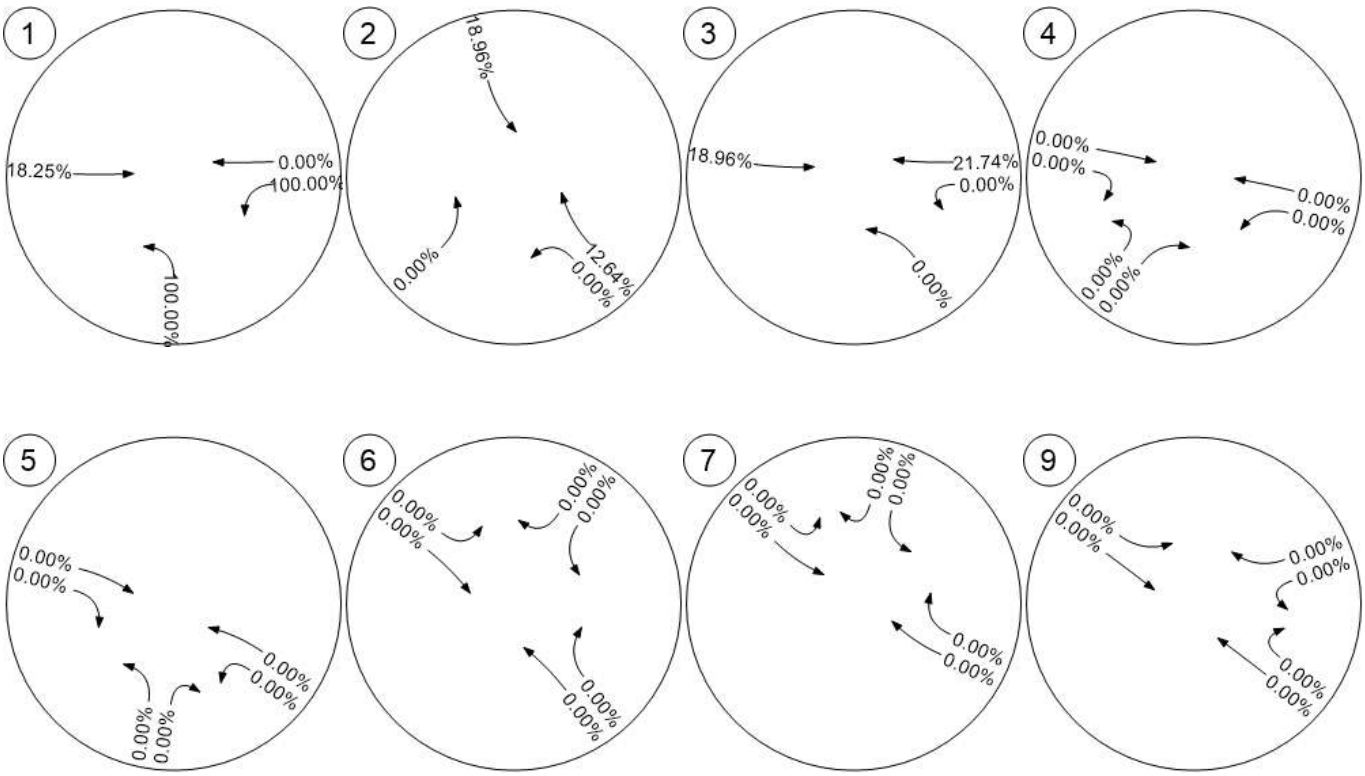
Fair Share - Fair Share % of Net New Site - Zone 2: To Mumbai



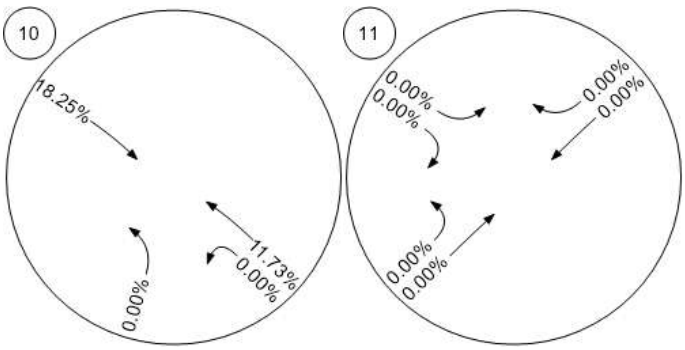
Fair Share - Fair Share % of Net New Site - Zone 2: To Mumbai



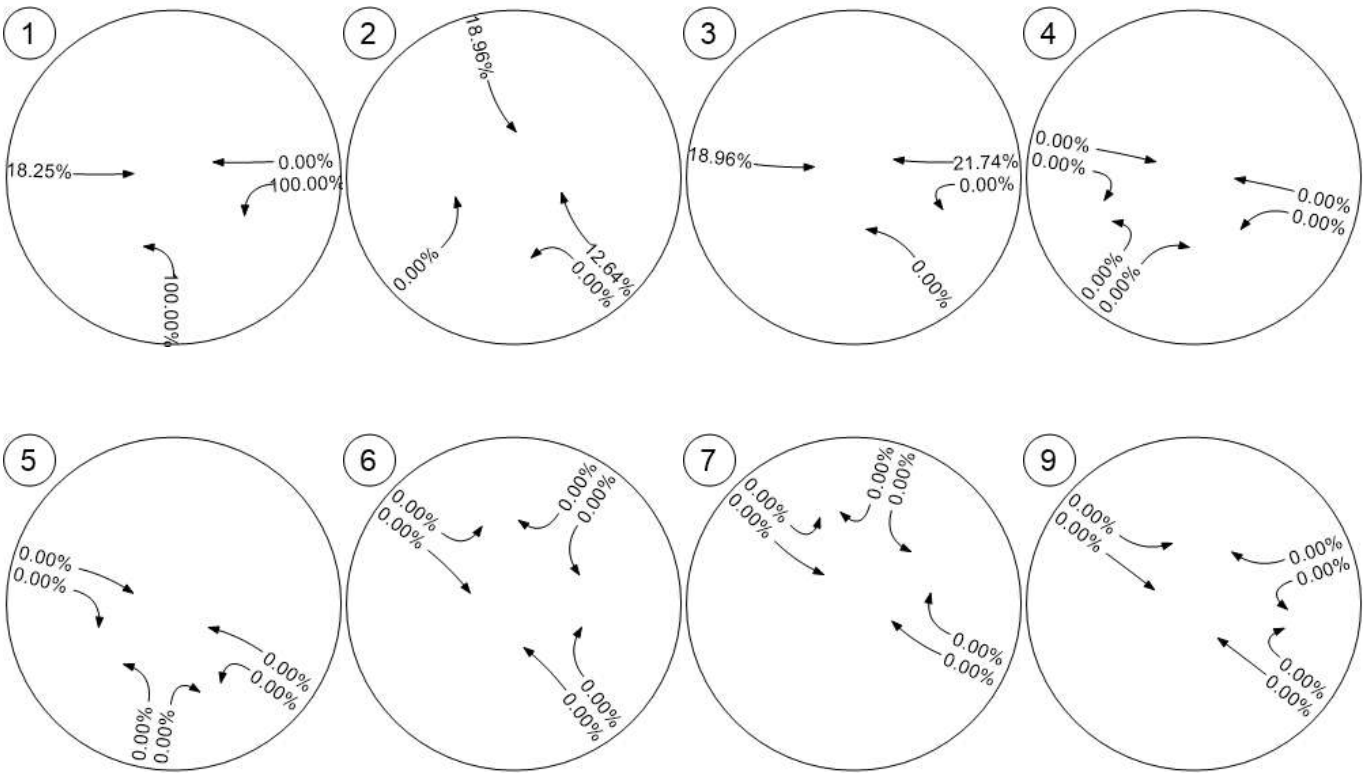
Fair Share - Fair Share % of Future Total - Zone 1: Site



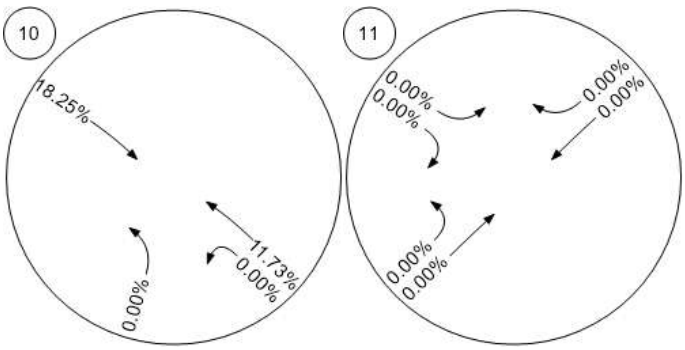
Fair Share - Fair Share % of Future Total - Zone 1: Site



Fair Share - Fair Share % of Future Total - Zone 2: To Mumbai



Fair Share - Fair Share % of Future Total - Zone 2: To Mumbai



APPENDIX XIV			
Medium	**No.**	**Environmental Conditions**	**Compliance**
Topography and Natural Drainage	1	The natural drain system should be maintained for ensuring unrestricted flow of water. No construction shall be allowed to obstruct the natural drainage through the site.	Nalla passing through plot but there will not be any obstruction to nallah due to proposed project. Detailed Nallah catchment study is carried out
		No construction is allowed on wetland and water bodies.	There are no wetland and water bodies on project site.
		Check dams, bio-swales, landscape, and other sustainable urban drainage systems (SUDS) are allowed for maintaining the drainage pattern and to harvest rain water.	Adequately designed storm water drain system shall be properly maintained to avoid choking of drains and water logging on site and ensuring discharge of storm water from the site without any sediment and pollution. Rain water harvesting: Proposed total 31 numbers of RWH tanks of total capacity 8981 KL.
		Buildings shall be designed to follow the natural topography as much as possible.	Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m). Buildings are designed as per natural topography
		Minimum cutting and filling should be done.	Minimal cutting /filling shall be done to maintain natural topography
Water conservation - Rain Water Harvesting, and Ground Water Recharge	2	A complete plan for rain water harvesting, water efficiency and conservation should be prepared. The local bye-law provisions on rain water harvesting should be followed. If local bye-law provisions are not available, adequate provision for storage and recharge should be followed as per the Ministry of Urban Development Model Building Byelaws, 2016. A rain water harvesting plan needs to be designed where the recharge bores of minimum one recharge bore per 5,000 square meters of built up area and storage capacity of minimum one day of total fresh water requirement shall be provided. In areas where ground water recharge is not feasible, the rain water should be harvested and stored for reuse.	Rain water harvesting is planned as per the geotechnical study report. Ground water recharging is not proposed. Rain water harvesting: Total 31 numbers of RWH tanks of total capacity 8981 KL shall be provided Use of harvested rain water for domestic purpose with the help of treatment unit (926 KLD) will reduce the fresh water demand by 15 %. (of domestic requirement only) [Daily rain water availability is calculated as per Av. 20 mm rainfall/ day considering only 50 rainy days (half of season)]

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Medium	**No.**	**Environmental Conditions**	**Compliance**
		The ground water shall not be withdrawn without approval from the Competent Authority.	No ground water withdrawal is proposed
		All recharge should be limited to shallow aquifer.	No ground water recharge is proposed
	2 (a)	At least 20% of the open spaces as required by the local building bye-laws shall be pervious. Use of Grass pavers, paver blocks with at least 50% opening, landscape, etc. would be considered as pervious surface.	Proposed R. G. Area = 3,43,571.58 sq.mt.(Over and above requirement of **3,40,000 sq.mt.** as per requirement of Special Township Project) More than 20% of RG area is pervious. Hence complying with the condition.
	2(b)	Use of water efficient appliances should be promoted. Low flow fixtures or sensors be used to promote water conservation	Provision of dual flush cistern, low flow fixtures and sensors to promote water conservation
	2 (c)	Separation of grey and black water should be done by the use of dual plumbing system. In case of single stack system separate recirculation lines for flushing by giving dual plumbing system be done	Provision of dual plumbing system Reduction in Net water demand by 43% in non-monsoon & 45 % in monsoon season by using treated sewage for secondary purpose
Waste Management	3	Solid waste: Separate wet and dry bins must be provided in each unit and at the ground level for facilitating segregation of waste.	Separate wet and dry bins shall be provided for facilitating segregation of waste.
		The provisions of the Solid Waste (Management) Rules 2016 and the e-waste (Management) Rules 2016, and the Plastics Waste (Management) Rules 2016 shall be followed.	As per provisions of the Solid Waste (Management) Rules 2016, E-waste (Management) Rules 2016, and the Plastics Waste (Management) Rules 2016 as follows: The calculation of solid waste generation is as per NBC Norms Biodegradable : 23607 Kg/day Non-Biodegradable : 15808 Kg/day • Segregation of non-biodegradable and biodegradable garbage on site. • Bio degradable garbage: **shall be treated in Biomethanation Plant** • Non-biodegradable garbage including plastic waste: **shall be handed over to an Agency named as Thane Waste-Tech &**

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Medium	**No.**	**Environmental Conditions**	**Compliance**
			Recyclers Private Limited for further disposal. • E-Waste (Approx. 24896 Kg/annum) from commercial portion of Phase 3 and Phase 4: Shall be stored separately and recycled through **authorized dealers** • Bio Medical Waste (56.3 Kg/ day) from Hospital of Phase 1 : Shall be handled and disposed as per **Bio-Medical Waste Management Rules, 2016** • Provision of adequate space for solid waste management of garbage ((2339.80 Sq.mt) shall be provided. This includes the space required for collection, segregation and treatment.
	3 (a)	All non-biodegradable waste shall be handed over to authorized recyclers for which a written tie up must be done with the authorized recyclers.	Non- biodegradable garbage: Shall be handed over to **an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal.**
	3 (b)	Organic waste compost/ Vermiculture pit with a minimum capacity of 0.3 kg/ person/ day must be installed.	Treatment of Bio degradable garbage in **Biomethanation Plant** as per criteria conditions.
Sewage Treatment Plant	4	Onsite sewage treatment of capacity of treating 100% waste water to be installed.	Sewage generation: Total Sewage: 10227 KLD Provision of Total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL for treatment of sewage up to tertiary level by Moving Bed Bio-Reactor (MBBR) Technology followed by Phythorid technology
		Treated waste water shall be reused on site for landscape, flushing, cooling tower, and other end uses.	Use of treated sewage for flushing (4400 KLD) and gardening (1044 KLD)
		Excess treated water shall be discharged as per CPCB norms. Natural treatment system shall be promoted.	Excess treated sewage shall be given for irrigation purposes outside the plot. The discharge standards as per CPCB norms shall be followed

APPENDIX XIV			
Medium	**No.**	**Environmental Conditions**	**Compliance**
		Sludge from the onsite sewage treatment, including septic tanks, shall be collected, conveyed and disposed as per the Ministry of Urban Development, Central Public Health and Environmental Engineering Organization (CPHEEO) Manual on sewerage and sewage treatment Systems, 2013.	STP Sludge (Dry sludge): Use as manure within the premises for plants
Energy	5	Compliance with Energy Conservation Building Code (ECBC) of Bureau of Energy Efficiency shall be ensured. Buildings in the states which have notified their own ECBC, shall comply with the state ECBC Wall, window, and roof U values shall be as per ECBC specifications	The project complies with ECBC of BEE with prescriptive method. As per ECBC, the proposed project site falls under Warm and Humid climatic zone. As the best suited strategies for such climate are shading and ventilation, shades are proposed over all the fenestrations to control the sun rays, glare and to reduce heat gain. At the same time, Window openings are designed in such a way that minimum ventilation rates and daylight levels are achieved. Overall building orientation and surrounding landscaping help to keep ambient conditions comfortable.
		Outdoor and common area lighting shall be LED	
		Concept of passive solar design that minimize energy consumption in buildings by using design elements, such as building orientation, landscaping, efficient building envelope, appropriate fenestration, increased day lighting design and thermal mass etc. shall be incorporated in the building design	
	5 (a)	Solar, wind or other Renewable Energy shall be installed to meet electricity generation equivalent to 1% of the demand load or as per the state level/ local building bye-laws requirement, whichever is higher	Renewable energy proposed in the project is 2.09% of demand load. Total Connected Load -3,09,258 kW Total Demand Load - 1,36,730 kW Total Solar PV Proposed - 2,857 kW (2.09% of Maximum Demand)
	5 (b)	Solar water heating shall be provided to meet 20% of the hot water demand of the commercial and institutional building or as per the requirement of the local building bye laws, whichever is higher. Residential buildings are also recommended to meet its hot water demand from solar water heaters, as far as possible.	Solar hot water provision- • 20% for residential buildings • 40% for hotel and hospital • For commercial and school building, no solar hot water is provided.

APPENDIX XIV			
Medium	**No.**	**Environmental Conditions**	**Compliance**
	5 (c)	Use of environment friendly materials in bricks, blocks and other construction materials, shall be required for at least 20% of the construction material quantity. These include fly ash bricks, hollow bricks, AACs, Fly ash Lime Gypsum blocks, compressed earth blocks, and other environment friendly materials. Fly ash should be used as building material in the construction as per the provisions of the Fly ash Notification of September, 1999 as amended from time to time.	Materials like AAC blocks will be preferred over bricks, since bricks consume much energy with their traditional kiln burning process. Similarly, air-dried timber will be used wherever required. Materials with higher recycled content will be preferred for civil construction work. Typically, steel with recycled content & cement with fly ash will be used. Preference will be given to procure materials which are manufactured locally to reduce additional transportation cost.
Air Quality and Noise	6	Dust, smoke & other air pollution prevention measures shall be provided for the building as well as the site. These measures shall include screens for the building under construction, continuous dust/ wind breaking walls all around the site (at least 3 meter height).	In order to avoid dust, smoke & air pollution, following measures shall be taken Provision of barricades of 3.0 mt. height along the periphery of the site
		Plastic/ tarpaulin sheet covers shall be provided for vehicles bringing in sand, cement, murram and other construction materials prone to causing dust pollution at the site as well as taking out debris from the site.	Use of covering sheets shall be done for vehicles carrying construction material i.e. sand, cement, murram, etc. to prevent air borne dust
		Wheel washing for the vehicles used be done	Wheel of the vehicles shall be cleaned/washed before the vehicles move out of the project site
		Sand, murram, loose soil, cement, stored on site shall be covered adequately so as to prevent dust pollution.	All material storages i.e. sand, murram, loose soil, cement, etc. shall be adequately covered to avoid dust/ particulate emissions
		Wet jet shall be provided for grinding and stone cutting.	Provision of wet jet for grinding and stonecutting (If required)
		Unpaved surfaces and loose soil shall be adequately sprinkled with water to suppress dust	Use of water for dust suppression
		All construction and demolition debris shall be stored at the site (and not dumped on the roads or open spaces outside) before they	Construction waste like concrete waste, steel, bricks and blocks, ceramic tiles, marble or granite shall be partly

APPENDIX XIV			
Medium	**No.**	**Environmental Conditions**	**Compliance**
		are properly disposed. All demolition and construction waste shall be managed as per the provisions of the Construction and Demolition Waste Rules 2016.	recycled and remaining shall dispose to authorized recycles. Construction waste like Empty Cement Bags, Paint container, other Barrels & Scrap metal will be handed over/sold to Authorized recyclers. The location for disposal of C & D waste shall be done only at authorised sites, as approval received from SWM Dept.
		All workers working at the construction site and involved in loading, unloading carriage of construction material and construction debris or working in any area with dust pollution shall be provided with dust mask.	Provision of the standard personal protective equipments like masks, goggles, etc. to the workers
		For indoor air quality the ventilation provisions as per National Building Code of India.	Indoor air quality: The ventilation provisions as per National Building Code of India.
	6 (a)	The location of the DG set and exhaust pipe height shall be as per the provisions of the CPCB norms.	Shall be complied as per CPCB Norms
Green Cover	7	A minimum of 1 tree for every 80 Sq. mt. of land should be planted and maintained. The existing trees will be counted for this purpose.	**As per Special Township Policy:** 150 to 400 Trees per hector Plot Area = 10, 62,500.00 Sq. mt. i.e.= 106.25 Hectare **Total trees required (106.25* 150): 15937 nos.** **As per Criteria condition:** 1 tree for every 80 sq. mt. of land to be planted Plot area: 10, 62,500.00 sq. mt. **New Tree Plantation required as per norms (1062500/80) = 13281 nos. of trees** Total New Tree plantation = 15900 nos. Trees to be retained on site = 328 Nos. **Total Trees on site after development including retained & new tree plantation: 16228 Nos.**

APPENDIX XIV			
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		Preference should be given to planting native species.	Tree plantation shall be done of native species
	7 (a)	Where the trees need to be cut, compensatory plantation in the ratio of 1:3 (i.e. planting of 3 trees for every 1 tree that is cut) shall be done and maintained.	Complied with the condition
Top Soil preservation and reuse	8	Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, and external services. It should be stockpiled appropriately in designated areas and reapplied during plantation of the proposed vegetation on site.	Top soil shall be stockpiled stored separately, preserved and shall be used for landscaping.
Transport	9	A comprehensive mobility plan, as per MoUD best practices guidelines (URDPFI), shall be prepared to include motorized, non-motorized, public and private networks. Road should be designed with due consideration for environment, and safety of users. The road system can be designed with these basic criteria. 1. Hierarchy of roads with proper segregation of vehicular and pedestrian traffic. 2. Traffic calming measures. 3. Proper design of entry and exit points. 4. Parking norms as per local regulation.	Site is well connected Old Mumbai – Pune Highway (NH4) Separate entry exit, adequate parking, traffic signages, traffic mirrors will be proposed for smooth traffic movement. Parking provision will be as per Local norms Detailed Traffic Management Studies is reflected in EIA report.
Environment Management Plan	10	An Environment Management plan (EMP) shall be prepared and implement to ensure compliance with the environmental conditions specified in Item no. 1 to 9 above. A dedicated Environmental Monitoring cell with defined functions and responsibility shall be put in place to implement to EMP. The environmental cell shall ensure that environment infrastructure like sewage treatment plant, landscaping, rain water harvesting, energy efficiency and conservation, solid waste management renewable energy etc. are kept operational and meet the required standards. The environmental cell shall also keep the record of environment monitoring and those related to the environment infrastructure.	Environment Management Plan (EMP) would consist of all mitigation measures for each activity to be undertaken during the construction and operation to minimize adverse environmental impacts. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. Detailed EMP is reflected in the EIA report

ENVIRONMENTAL IMPACT ASSESSMENT

FOR

SPECIAL TOWNSHIP PROJECT

AT

Post-Sarang, Taluka- Khalapur, District- Raigad, and State- Maharashtra.

By

M/s. Claridges SEZ Developers Pvt. Ltd.

B-406, Great Eastern Summit, Plot No.66, Sector 15, CBD Belapur, Navi Mumbai-400614

Report Prepared By

ULTRA-TECH

(Environmental Consultancy & Laboratory)

(An ISO 9001-2015 Company, Accredited by NABET , Lab : Gazetted by MOEF, GoI)

Thane (West) – 400601

Phone: (022) 25342776 / 25380198

Fax: (022) 25429650

Year : March 2016 to October 2017

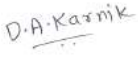
(Revision 2)

Declaration by Experts contributing to the EIA report for "**Special Township Project" (STP)** at Sarang village, Taluka. Khalapur. Raigad.
I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator:
Name: Mrs. Deepa Tamhane Karnik

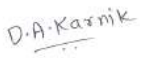
Signature and Date: D.A.Karnik
Contact Information: deepa@ultratech.in
Functional Area Experts:

S. No	Name of sector	Name of project	Name of Client	EIA Coordinator		Functional Area Experts involved		
				Name/s	Signature	FA	Name/s	Signature
1	Township and Area development 8 (a)	"Special Township Project" at Taluka: Khalapur, District: Raigad, Maharashtra Total Construction Built-up area: 23,63,400.26 Sq.mt.	M/s. Claridges SEZ Developers Pvt. Ltd.	Mrs. Deepa Tamhane Karnik Team member: Mrs. Rekha Margam & Mr. Shekhar Tamhane	D.A.Karnik	LU	Mr. Swapnil Awaghade	
						AQ	Archana Sadashiva	
						AP	Mr. Shekhar Tamhane AFAE: Neha Kavatkar	
						WP	Mrs. Rekha Margam	
						EB	Dr. T. K. Ghosh & Mrs. Padmini Shinde	
						SE	Mr. Kishor Wankhede	
						NV	Mr. Chintan Athalye	
						SC	Dr. D.S. Ramteke Team Member : Mrs. Padmini Shinde	
						HG	Basic details for the hydrology were reported by secondary data. HG expert was not involved for this project as soil report mentions about the ground water level and there is no planning for ground water withdrawal.	
						RH	Mr. Bonde AFAE: Mayuri Johari	

S. No	Name of sector	Name of project	Name of Client	EIA Coordinator		Functional Area Experts involved		
				Name/s	Signature	FA	Name/s	Signature
						SHW	Ms. Deepa Tamhane Karnik	
						MSW	Rekha Margam	
							AFAE: Ms. Mayuri Johari	

Declaration by the Head of the Accredited Consultant Organization/ authorized person

I, Mrs. Deepa Tamhane Karnik hereby, confirm that the above mentioned experts prepared the EIA for **Special Township Project (STP)** at Sarang village, Taluka. Khalapur. Raigad. I also confirm that the consultant organization shall be fully accountable for any misleading information mentioned in this statement.

Signature: 
Name: Mrs. Deepa Tamhane Karnik
Designation: Director
Name of the EIA Consultant Organization: **ULTRA-TECH**
NABET Certificate No. & Issue Date: NABET/EIA/1417/SA0011

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LIST OF ENCLOSURES

No.	Enclosure	Remarks
1.	Forwarding letter dt. 06.03.2017 for the prescribed Terms of Reference, mentioning its validity upto 22nd July, 2018	Not possible to upload due to size limitation, but submitted in hard copy
2.	Location Clearance from Urban Development Department, Mantralaya	
3.	Layout plan indicating road, greenbelt, drainage, sewer line, STP, Solid waste handling area, rain water harvesting structure, 3D plan for entire project	
4.	Tree plantation layout	
5.	The agreement between the Project proponent and Agency named as Thane Waste-Tech & Recyclers Private Limited for Disposal of Non-biodegradable garbage	
6.	Shadow and Wind Analysis Study Report	
7.	Contour map	
8.	Existing Tree details	
9.	Detailed Traffic analysis report	
10.	Layout for storm water drainage and detailed study of Storm water Disposal System	
11.	Geotechnical Investigation Report	
12.	Carbon Footprint Analysis Report	
13.	Lab reports	
14.	NABET Certificate	

QUESTIONNAIRE

QUESTIONNAIRE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT OF NEW CONSTRUCTION PROJECTS

I. BACKGROUND INFORMATION OF THE PROPOSED PROJECT

State clearly the objective of the project:	This is Special Township Project and is located at Village Sarang. Taluka- Khalapur, District – Raigad, State-Maharashtra. **M/s. Claridges SEZ Developers Pvt. Ltd.** has proposed **Special Township Project** in Sarang, Khalapur which includes Residential buildings & EWS (Economical Weaker Section) Housing Scheme along with amenities like Market Mall, Convention Centre, Hotels and Resorts, IT Park and Office Building, Hospital, Primary and Secondary School, Police Station, Auditorium, Library, Community Centre, Home for Aged Person. The region has mixed land use pattern comprising of residential and commercial development. This project has also obtained Location Clearance from Urban Development Department, Mantralaya on 10th September 2015.
Location of the project (attach map to a suitable scale) :	Town/Tehsil: Khalapur District: Raigad State: Maharashtra Latitude : 18°52'45.902"N to 18°54'4.004"N Longitude : 73°12'54.266"E to 73°13'56.908"E Location map of the project site with 10 Km radius around the plot boundary is given in *Chapter 2 of the Report enclosed.*
Names & distances from the nearest :	Chowk Railway Station: Approx. 1.0 Km (Road distance) Mumbai International Airport : Approx. 21.00 (Road distance)
Name of the agency proposing the new construction project:	**M/s. Claridges SEZ Developers Pvt. Ltd.**
Name of the Chief Executive & Postal address: Contact particulars (Tel/Fax/e-mail):	**Mr. Vijay Raichand - CEO** 104, Mittal Chambers, 10th Floor, Nariman Point, Mumbai - 400021. **Tel. Nos.** : 022- 27561442 **Fax Nos**.: -- **E- mail** : sp921963@gmail.com, info@csdpl.com
Type of project: Housing project/Industrial Estate or others:	Special Township Project
Estimated cost of the project: Land cost Estimated construction cost Cost of the Plant & machinery	Rs. 7500 Cr

II. SITUATION WITHIN 10 KM RADIUS FROM PROJECT SITE

General topography	Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m). *The details are referred in Chapter 3 of the Report enclosed.*
Specify general features of land	*The land use details for 10 Km radius around the project site are referred in Chapter 3 sec 3.1.2 of the Report enclosed.*
Tree cover-prominent species Fauna-wildlife/domesticated Avifauna	**Project site :** **A. Terrestrial Ecology:** **a) Flora:** The floristic survey reveals that at the project site there are different varieties of flora **(Table 3.23)**, such as:

	• **Trees: :** *Azadirachta indica, Syzygium cumini, Mangifera indica, Ixora coccinea, Tectona grandis, Tamarindus indica* • **Shrubs:** *Acacia torta, Euphorbia thymifolia Calatropis procera*, *Hyptis suaveolens* • **Herbs:** *Ageratum conyzoides, Alternanthera sessilis,Cassia tora and Tridax procumbens* **b) Fauna:** The fauna observed in project site are as follows; • **Mammals***: Canis lupus familiaris, Funambulus palmarum, Rattus rattus and Herpestes edwardsii* • **Avifauna:** *Merops orientalis, Milvus migran, Columba livia, Corvus splendens, Acridotheres tristis, Eudynamys scolopacea* and *Copsychus saulari* • **Butterflies:** *Papilio polymnestor, Eurema hecabe, Euploea core* and *Junonia atlites* • **Dragonflies** *Tramea basilaris* and *Ictinogomphus rapax* *The details are referred in Chapter 3 of the Report enclosed.*
Soil characteristics	Soil sampling was done to further establish the baseline characteristics. *The details are referred in Chapter 3 of the Report enclosed.*
Natural drainage pattern	Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m). Storm water will be discharged to external drain of adequate capacity (255.12 m^3/sec).
Flood prone areas	Project site and surrounding area is not flood prone.
Geological features including seismic zone	Raigad district sits on a seismically active zone. The area is classified as a Seismic Zone IV region
Existing landuse (area &percentages) map (to include agricultural & non-agricultural uses, commercial, industrial dense/open forests, fallow land, human settlements, water bodies, transport systems etc.)	The land use for the radius of 10 Km has been studied on the basis of satellite image analysis. Landuse pattern of the study area shows 5 landuse classes. Details of Landuse of study area *are referred Chapter 3 of the Report enclosed.*
Predominant activities – residential, institutional, commercial etc.	The region has mixed land use pattern comprising of residential and commercial development.
Special features : (such as tourist spots, monuments/archaeological sites, hospitals, schools, institutions, religious places, heritage areas and places of other interests)	*The details are referred in Chapter 2 of the Report enclosed.*
Specific environmental problems, if any (such as water and air pollution, land spoliation by natural & manmade factors, endemic diseases, traffic congestion spots in the vicinity of project site, loss of tree cover, open spaces etc.)	*The details are referred in Chapter 3 of the Report enclosed.*
Ground level concentrations (major parameters) SPM/RSPM, SO_2, NO_x, HC, Noise	Environmental Impact Assessment Report has been prepared based on baseline collected during March 2016 to May 2016. **Result for Ambient air quality:** The Ambient Air Quality Monitoring (AAQM) stations at

	all locations have been considered as residential zones. After tabular representation of Ambient Air quality it can be observed that: o PM_{10} ranges from 48µg/m^3 to 58µg/m^3 o $PM_{2.5}$ ranges from 24µg/m^3 to 48µg/m^3 All the parameters are found to be within range as compared with standards **Result for Noise Monitoring**: Ambient noise quality monitoring all stations has been considered as residential zones. Comparison of the ambient noise levels with the standards specified by CPCB reveals that the day time noise readings at locations N2, N7 and N8 are exceeds CPCB standards and remaining N1, N3 to N6, N9 and N10 area within the CPCB standards. Whereas at night time all noise readings at all locations founds within standards except location N8 due to vehicular movement. The Principal Rules of Noise Pollution were published in the Gazette of India, vide S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986. *The details are referred in Chapter 3 of the Report enclosed.*
Furnish wind rose diagram	Wind rose diagrams are enclosed *Sub-section 3.4.4 of Chapter 3 of the Report enclosed.*
General meteorological data(wind direction, speed, rainfall, temperature Details if any of heat islands, inversions, venturi effect. Impacts on the conceptualization of the proposal	
Human Resources i. Population of study area (10 km radius), ii. Decadal growth rate, settlement pattern and growth, iii. Socio-economic conditions iv. Health: Endemic diseases, Mortality, Epidemics.	*The details are referred in chapter 3 of the Report enclosed.* *The details are referred in chapter 3 of the Report enclosed.* Detailed Socio Impact Assessment study details are given in Chapter 3 of the report enclosed. No epidemic health problems are reported due to waste water/ air/ soil.
Environmental assessment and suitability of the proposed development (specifically identifying the limits)	Environmental Impact assessment for this project has been done by using Delphi Technique. With the methodical working of sensitivity index and weight-ages, the total scope of pollution potential has come to **418.20,** the site fits into **"LOW"** Pollution Potential. *The details are referred in Chapter 4 of the Report enclosed.*

III. PROMINENT FEATURES WITHIN ABOUT 100 METRES RADIUS FROM THE SITE BOUNDARY (LOCAL AND IMMEDIATE VICINITY)

General description (contours at 1m intervals)	Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m).
Natural resources i. Water: a. ground water table, rate of recharge present restrictions on withdrawal, available yield, quality of water (physical, chemical, biological) b. Surface water location, source and yield, present use (for agriculture, human consumption, industry, etc.)	Ground water samples were analyzed Primary data was collected from project site to 10 km radius of the project site for major surface water locations. *The details are referred in Chapter 3 of the EIA Report enclosed*
ii. Ambient air quality levels (standard parameters including noise)	All the parameters are found to be within range as compared with standards *The details are referred in Chapter 3 of the Report enclosed.*
iii. Minerals: type, location, quantum (estimated)	Not Applicable.
iv. Energy: consumption pattern for hydrocarbons, gas, electricity and any other non-conventional energy source	*The details are referred in Chapter 4 of the Report enclosed.*
Details of new construction Plot coverage, height, FSI (permissible/proposed)	This study is limited to project site. Details of project proposal and area statement are given in Chapter 2 *of the Report enclosed.*
Details of public utilities required for the project during: (may be indicated separately for construction & operation phases) i. Water supply: a. Source of water supply and quantities to be drawn.	*The details are referred in chapter 2 of the Report enclosed.* Fresh Water Supply: 12763 KLD • For Domestic: From Maharashtra Jeevan Pradhikaran (MJP): 7283 KLD • For Swimming pool: From Tanker water of potable quality: 36 KLD Secondary requirements: 5444 KLD (For Flushing (4400 KLD) and Gardening (1044 KLD) available from recycling of STP treated sewage) *The details are referred in Chapter 2 of the Report enclosed.*
b. Type of treatment, if any.	No
c. Continuous/Intermittent supply	Continuous supply from MJP
ii. Sewage, Collection, Treatment & Disposal a. Mode of collection of domestic effluent - Surface drains - Underground - System and capacity	Sewage shall be collected through pipe networks to Sewage Treatment Plants.

b. Mode of treatment
   - Septic tank and filters (capacity)
   - Biological treatment capacity & other details

Construction phase: Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage.

Operation phase:

Phases	**Sewage (KLD)**	**Total STP capacity (KL)**	**Number of STPs and capacity of each STP**
1	2441	2807 (Total 11 Nos.)	1 STP : 305 KL 1 STP : 665 KL 1 STP : 530 KL 1 STP : 530 KL 1 STP : 127 KL 1 STP : 80 KL 1 STP : 421 KL 1 STP : 64 KL 1 STP : 54 KL 1 STP : 27 KL 1 STP : 4 KL
2	1485	1634 (Total 07 Nos.)	1 STP : 332 KL 1 STP : 185 KL 1 STP : 250 KL 1 STP : 257 KL 1 STP : 304 KL 1 STP : 301 KL 1 STP : 5 KL
3	2776	3283 (Total 08 Nos.)	1 STP : 1060 KL 1 STP : 328 KL 1 STP : 258 KL 1 STP : 559 KL 1 STP : 167 KL 1 STP : 517 KL 1 STP : 12 KL 1 STP : 382 KL
4	1485	1624 (Total 04 Nos.)	1 STP : 786 KL 1 STP : 68 KL 1 STP : 768 KL 1 STP : 2 KL
5	955	1100 (Total 01 No.)	1 STP : 1100 KL
6	1085	1177 (Total 04 Nos.)	1 STP : 236 KL 1 STP : 634 KL 1 STP : 298 KL 1 STP : 9 KL
Total	**10227**	**11625**	**Total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL**

<table>
<tr><td>c. Mode of disposal
- Soak pits / Disposal to local sewer/ water bodies (specify)
- Use for cultivation</td><td>Excess treated sewage shall be given for irrigation purposes outside the plot.</td></tr>
<tr><td>iii. Solid Wastes:
- estimated quantity of each types of solid waste:
- Mode of collection and disposal:
- Recycling to be instituted, if any:</td><td>The total quantities of solid waste that will be generated in the project: 15808 kg/day will be non-biodegradable and 23607 kg/day will be biodegradable.

• Segregation and storages facilities for all solid waste streams.
• Biodegradable garbage shall be treated in Biomethanation plant
• Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal.
• E-Waste will be stored separately and disposed through authorized recyclers
• Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016
• Dried sludge from STP will be used as manure.</td></tr>
<tr><td>iv. Power System:
- Sources of power and supply capacity

- Distribution System

- Alternate supply for essential services

-
- DG Set: Type of fuel used and capacity</td><td>For operation phase:
Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)
<table><tr><th>Phases</th><th>Connected Load (KW)</th><th>Maximum Demand (KW)</th></tr><tr><td>1</td><td>68265</td><td>27047</td></tr><tr><td>2</td><td>42884</td><td>18194</td></tr><tr><td>3</td><td>94222</td><td>36946</td></tr><tr><td>4</td><td>57340</td><td>37362</td></tr><tr><td>5</td><td>26208</td><td>10195</td></tr><tr><td>6</td><td>20341</td><td>6985</td></tr></table>
Distribution system : LT supply
<table><tr><th>Phases</th><th>Capacities of DG sets</th></tr><tr><td>1</td><td>2 DG sets of 320 KVA each
2 DG sets of 500 KVA each
6 DG sets of 625 KVA each
1 DG set of 100 KVA
2 DG sets of 1000 KVA each
1 DG set of 320 KVA
1 DG set of 600 KVA</td></tr><tr><td>2</td><td>1 DG set of 1000 KVA
2 DG sets of 400 KVA each
1 DG set of 600 KVA
1 DG set of 500 KVA
3 DG sets of 2500 KVA each</td></tr><tr><td>3</td><td>7 DG sets of 1010 KVA each
1 DG set of 400 KVA
2 DG set of 750 KVA each
1 DG set of 140 KVA
2 DG sets of 1250 KVA each
6 DG sets of 2000 KVA each
5 DG sets of 1500 KVA each</td></tr></table></td></tr>
</table>

	<table><tr><td>4</td><td>4 DG sets of 1000 kVA each 1 DG set of 400 KVA</td></tr><tr><td>5</td><td>2 DG sets of 600 KVA each 2 DG sets of 350 KVA each</td></tr><tr><td>6</td><td>1 DG set of 380 KVA 1 DG set of 750 KVA 1 DG set of 80 KVA 1 DG set of 400 KVA</td></tr></table> **Fuel** : Diesel
Impact of the new development on the surrounding areas i. Traffic management at peak hours ii. Provision of service roads iii. Buffer zone planned, if so, details iv. Activities likely to come up in the surrounding areas from the project during construction & operation phases. v. Agencies and the measures proposed to regulate unplanned developments like slums, shops, etc.	During construction phase there will be transport of construction materials. Precautions will be taken to reduce the impact of the vehicular movement by restricting movement in non-peak hours Detailed traffic survey has been done & report is enclosed. --- --- The Proponent will continue regular environmental awareness programs to bring forth the benefits of development in terms of improvement in quality of life The Project Area is falls under limits of Mumbai Metropolitan (MMR) Region and special planning authority is Navi Mumbai Airport Influence Notified Area (NAINA) hence no unauthorized or unplanned development can take place.
State briefly impacts predicted on the quality and quantity of natural resources from the proposed new development: - Air quality - Vegetation - Animal/Aquatic life Surface/ Ground Water	Environmental Impact assessment for this project was done by using Delphi Technique. *The details are referred in Chapter 4 of the Report enclosed.*
State briefly impacts predicted on the quality and quantity of manmade features from the proposed new development: - Transport Linkages: a. Road b. Rail c. Water d. Air e. Others - Heritage areas/ecologically sensitive areas	The project site is being developed with well infrastructural facilities and there will be no major impact on the existing infrastructure and amenities. *The details are referred in Chapter 4 of the Report enclosed.* Traffic survey assessment is done and the Report is enclosed.

Landscaping /Tree Plantation i. Numbers and types of trees to be planted inside & outside the plot: a. Parks and gardens b. Along roads and pedestrian movement c. In public areas' ii. Other special features of proposed landscape design iii. Likely impacts from proposed landscaping	Plantation of New trees as per Norms. *The details are referred in Chapter 4 of the Report enclosed.* -- --
Any other relevant information of environmental significance-such as disabled-friendly design, flyash utilization, Greening of supply chain, heat islands/inversions/venturi effects, Timber-free construction, Green rating, energy efficiency for lighting & ventilation, Intelligent building, life cycle costs, measurable design impacts on human health, indoor environment related to occupational health etc.	Details of energy conservation measures are given in Chapter 4 *of the Report enclosed.*

CHAPTER: 1
INTRODUCTION

CHAPTER: 1
INTRODUCTION

1.0 PURPOSE OF THE REPORT:

The project site under reference is located at Post-Sarang, Taluka- Khalapur, District- Raigad, and State-Maharashtra. M/s. Claridges SEZ Developers Pvt. Ltd. have received Location Clearance (LC) from Urban Development Department, Mantralaya on 10th September 2015 in respect of an area which includes land admeasuring about 106.24 Ha from Village Sarang, Tal-Khalapur, District-Raigad for the purpose of development of "Special Township Project".

As per the Environment Impact Assessment (EIA) Notification dated 14th September 2006 as amended, the proposed project requires preparation of EIA Report. Project specific **ToR received from State Level Environmental Assessment Committee - 2 (SEAC 2), Maharashtra in July, 2015**

As per the amendment in EIA Notification dt. 9th December 2016, the proposed project falls under **'Category A'** with activity number **'8 (b)'**, hence has to be appraised at MoEF & CC. **Hence the project file was transferred** from Director (Environment Dept.), Government of Maharashtra **to the Member Secretary Infrastructure EAC (2), MoEF & CC with an forwarding letter dt. 06.03.2017 for the prescribed Terms of Reference, mentioning its validity upto 22nd July, 2018** for the submission of EIA/EMP report, the same is attached as **Enclosure 1**.

We would like to mention here that, TOR was presented on conceptual plan (Plot area = 12,20,137.31 Sq.mt.; Total construction Built-up area = 33,88,252.49 Sq.mt.) subsequently for this project Locational clearance (LC) was received from Urban Development Department (Plot area = 10,62,500.00 Sq.mt. ; Total construction Built-up area = 23,63,400.26 sq.mt.).Hence the EIA and EMP prepared and submitted is with the lesser areas and impacts than the prescribed ToR.

1.1 IDENTIFICATION OF PROJECT AND PROJECT PROPONENT:

This Special Township Project comprises of Residential buildings & EWS (Economical Weaker Section) Housing Scheme along with amenities like Market Mall, Convention Centre, Hotels and Resorts, IT Park and Office Building, Hospital, Primary and Secondary School, Police Station, Auditorium, Library, Community Centre, Home for Aged Person. There is no litigation pending against the project.

Type of Project	**Special Township Project**
Name, contact number & address of Project Proponents	**M/s. Claridges SEZ Developers Pvt. Ltd.** **Mr. Vijay Raichand (CEO)** 104, Mittal Chambers, 10th Floor, Nariman Point, Mumbai - 400021. **Tel. Nos.** : 022- 27561442 **Fax Nos**.: -- **E- mail**: raichandvijay@gmail.com, info@csdpl.com
Name, contact number & address of Consultants	**Environmental Consultants:** **M/s. Ultra-Tech** **Environmental Consultancy & Laboratory** **(An ISO 9001-2015 Company, Accredited by NABET ,** **Lab : Gazetted by MOEF, GoI)** Unit No. 206, 224, 225, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) – 400601 Tel.: 91-22-25342776, 25380198, 25331438.

	Fax : 91-22-25429650 Email : deepa@ultratech.in, shekhartamhane@ultratech.in Website : www.ultratech.in
Location of the project	At plot bearing survey & Hissa nos. 2/3, 3/0, 4/1, 4/2, 4/3, 4/4, 5/1, 5/2, 5/3, 6/1, 6/2, 6/3, 6/4, 6/5, 6/9, 6/10, 6/12, 6/14, 6/15, 6/19, 6/20, 6/22, 6/23,7/0(Pt),8/4,10/1B,10/1C,10/1D,10/2A, 11/3, 12/0, 13/1, 13/2, 14/0, 15/0,16/1A,16/1B,17/0(Pt.), 18/0, 19/0(Pt), 21/0, 22/0, 47/0, 53/2A, 53/2B(Pt.), 53/4, 53/5A, 53/5B, 53/6, 53/7, 53/8, 54/1, 54/2, 55/1A, 55/2A, 55/2B, 59/0, 60/1, 60/2(Pt), 61/0, 63/0, 64/2, 65/0, 66/0(Pt), 67/0, 68/0(Pt), 69/0(Pt), 70/0(Pt), 71/1A(Pt),71/2,71/3(Pt), 71/4, 72/1,72/2B,72/3,72/4, 72/5, 72/6A, 72/6B(Pt), 72/6C, 72/7, 72/8, 72/9, 72/10, 73/1, 73/2, 73/3, 73/4, 73/5, 73/6, 73/7, 73/9, 74/2, 74/3, 75/0, 76/2, 76/3, 76/7, 76/8, 76/9, 76/10, 76/11, 78/0, 79/0, 80/0, 81/0, 82/0, 83/1, 83/2A, 83/2B, 83/2C, 83/3, 83/4, 84/0, 86/0, Post-Sarang, Taluka-Khalapur, Dist – Raigad.
Site conditions	Open land
Total Plot Area	10,62,500 Sq.mt.
Total Construction Built-up Area	23,63,400.26 Sq.mt.

1.2 APPLICABLE ENVIRONMENTAL REGULATIONS:

With respect to prevention and control of environmental pollution, the following Acts and Rules of Ministry of Environment Forest and Climate Change, Government of India governs the proposed project:

- Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988
- Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987
- Environment (Protection) Act, 1986 amended in 1991 and Environment (Protection) rules, 1986 and amended
- Solid Waste Management Rules, 2016
- The Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 as amended
- Bio-Medical Waste Management Rules, 2016
- E-waste (Management) Rules, 2016
- The Noise Pollution (Regulation and Control) Rules, 2000 and as amended
- EIA Notification dated 14.09.2006 as amended
- Wildlife (Protection)Act, 1972 as amended

1.3 OBJECTIVE & SCOPE OF EIA STUDY:

EIA integrates the environmental concerns in the developmental activities and enables the integration of environmental concerns and mitigation measures in project development.

The study included detailed characterization of existing status of environment in an area of 10 km radius around project site.

In order to identify the existing state of the environment, various environmental attributes such as meteorology, air quality, water quality, soil quality, noise level, ecology and socio-economic environment are studied /monitored. Environmental baseline monitoring has been carried out during March 2016 to May 2016 and used to identify potential significant impacts.

The scope of the study broadly includes:-

- To describe the project and associated works together with the requirements for carrying out the proposed development
- To establish the baseline environmental and social scenario of the project site and its surroundings
- To identify and describe the elements of the community and environment likely to be affected by the project
- To identify, predict and evaluate environmental and social impacts during the construction and operation phase of the project
- To study the existing traffic load, predict the increment in traffic due the project and to suggest the management plan for the same
- Details about conservation of resources
- To design and specify the monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the mitigation measures adopted
- To assess risk during construction and operation phase and formulate the disaster management plan onsite and offsite
- To evaluate proposed pollution control measures and delineate environmental management plan (EMP)
- To delineate post-project environmental quality monitoring programme to be pursued by **M/s. Claridges Developers Pvt. Ltd.**

1.4 STRUCTURE OF EIA REPORT

The report is organized in following ten chapters:

- **Chapter 1 : Introduction**

  This chapter describes objectives and methodology for EIA.

- **Chapter 2 : Project Description**

  This chapter gives a brief description of the location, approachability, amenities, layout, area statement, project proposal, occupancy, utilities and the quantities discharges /wastes generated in this project along with building materials which will be used during construction activity. In addition to that we have also done comparison of proposed project with special features for bench marks and reference framework for smart cities.

- **Chapter 3 : Description of The Environment**

  This chapter presents details of the baseline environmental status of existing land use of study area, water environment, air environment, biological environment and socio-economic environment etc. Traffic and transportation studies are also included in this chapter

  - **Natural Environment:** The Topography, Geology, Rainfall, Climate, Temperature, Humidity, Winds, Soil, Land-use, Water bodies, Flora, Fauna
  - **Manmade Environment:** Human settlement, Housing, Habitation, Employment & Wages, Occupation, Industries, Transport System, Literacy, Demography
  - Monitoring results of various facets of Environment in Study area

- **Chapter 4 : Anticipated Impact And Mitigation Measures**

  This chapter discusses the possible sources of pollution and environmental impacts due to the project during construction and operation phases and suggests the mitigation measures. It also includes air emission and dispersion and Noise modeling study and also includes study of

Computation of the external catchment area contributing the project site and subsequently estimation of the contributing runoff & capacities of external drain.

- **Chapter 5 : Environmental Monitoring Programme**

  This chapter discusses the details about the environmental monitoring programme during construction and operation phases.

- **Chapter 6 : Additional Studies**

  This chapter covers Risk Assessment Studies for the construction and operation phase, the safety precautions that are taken during construction phase and the Disaster Management Plan and Emergency Preparedness Plan Onsite and Offsite. ECBC compliance analysis report and Carbon footprint analysis report are also included in this chapter.

- **Chapter 7 : Project Benefits**

  This chapter presents the benefits from this project.

- **Chapter 8 : Environmental Management Plan**

  This chapter deals with the Environmental Management Plan (EMP) for this project and indicates measures proposed to minimize the likely impacts on the environment during construction and operation phases and budgetary allocation for the same.

- **Chapter 9 : Summary And Conclusions**

  This chapter gives the Executive Summary of the EIA report.

- **Chapter 10 : Disclosure Of Consultants**

  This chapter deals with the details of consultants engaged and the National Accreditation Board for Education and Training (NABET) accreditation details of Environmental Consultants.

CHAPTER: 2
PROJECT DESCRIPTION

CHAPTER: 2
PROJECT DESCRIPTION

2.0 PREAMBLE:

M/s. Claridges SEZ Developers Pvt. Ltd. proposes a Special Township Project at Village Sarang. Taluka- Khalapur, District – Raigad, State-Maharashtra. The project site is an open land & now shall be developed as a Special Township Project, ensuring easy accessibility and high quality of amenities for residents/ employees, safe environment in area.

Project site falls within the limits of Mumbai Metropolitan (MMR) Region and special planning authority is Navi Mumbai Airport Influence Notified Area (NAINA). This Special Township Project comprises of Residential buildings & EWS (Economical Weaker Section) Housing Scheme along with amenities like Market Mall, Convention Centre, Hotels and Resorts, IT Park and Office Building, Hospital, Primary and Secondary School, Police Station, Auditorium, Library, Community Centre, Home for Aged Person. The region has mixed land use pattern comprising of residential and commercial development.

2.1 SITE LOCATION & SURROUNDING DETAILS:

2.1.1 Site Location Analysis:

- **Location of the Project**

Project site is located in Village Sarang. Taluka- Khalapur, District – Raigad, State-Maharashtra at Latitude of 18°52'45.902"N to 18°54'4.004"N and Longitudes of 73°12'54.266"E to 73°13'56.908"E.

Sarang Village is not listed under ESA as per list of villages prepared by High Level Working Group (HL WG) given in Annexure A of the directions by Ministry of Environment and Forests (MoEF) dt.13.11.2013. This Village is also not listed in boundary of the Matheran Eco-Sensitive Zone comprising of Matheran Hill Station Municipal Council, contiguous Forest Zone of the Regional Plan for MMR and Buffer Zone around the Forest Zone.

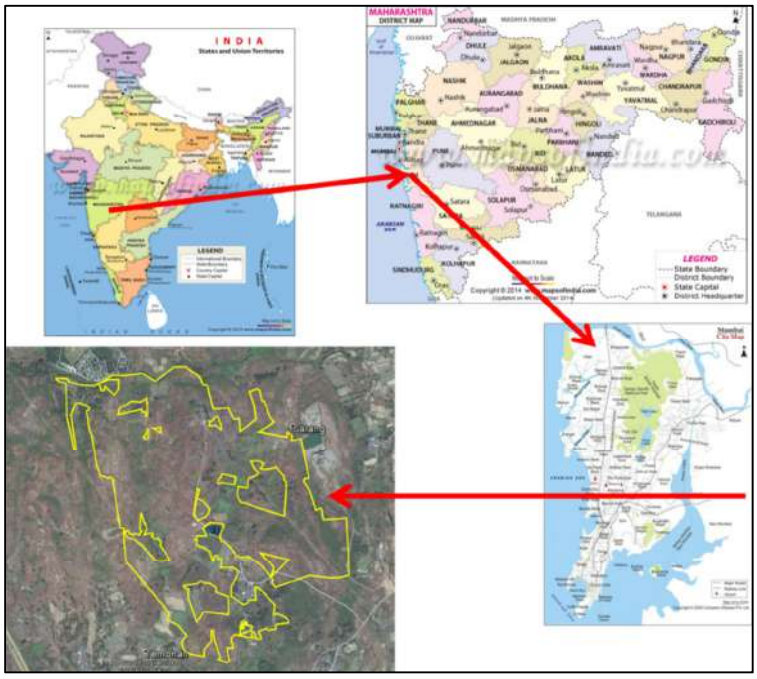
This project has also obtained Location Clearance from Urban Development Department, Mantralaya on 10th September 2015. Copy of Location Clearance is attached as **Enclosure -2.**

The site is an Open Land deriving direct access from Existing old Mumbai – Pune National Highway.

The site is surrounded by the following:

- East: Tupgaon village
- West: Lodhivali village
- North: National Highway 4
- South: Tembhari village

The nearest railway station is Chowk railway station on main line of Central railway.



2.1: Project Location

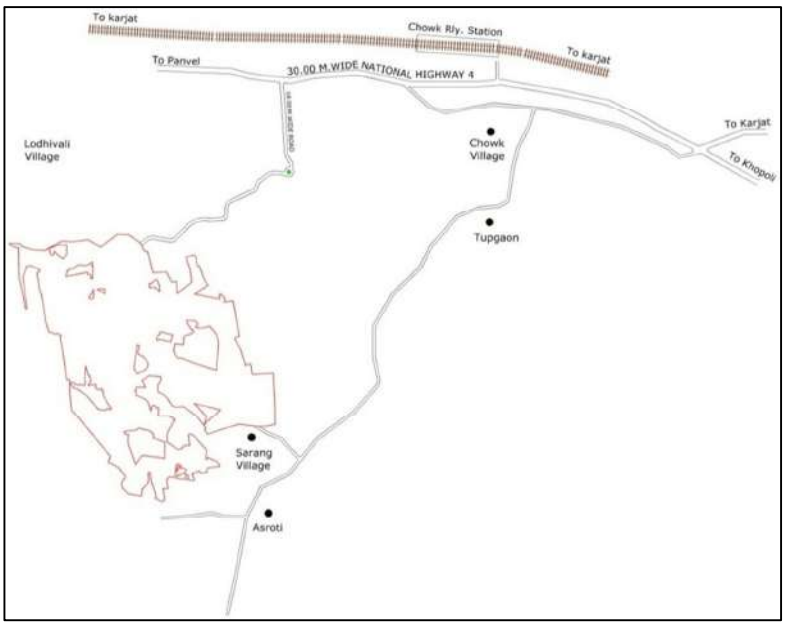
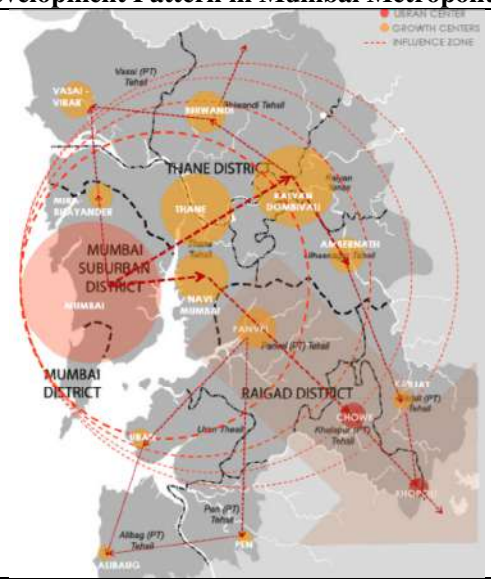


Fig. 2.2: External Road Network

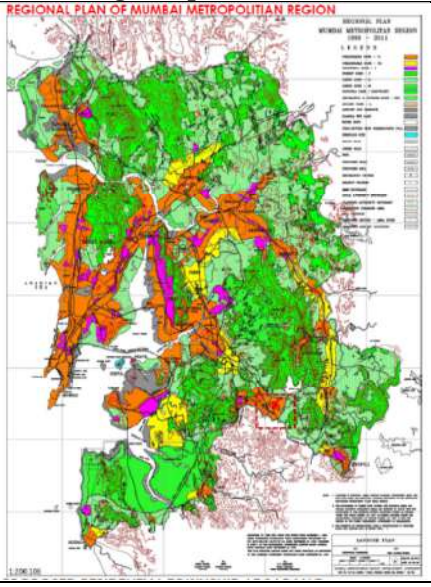
Fig. 2.3: Location Plan

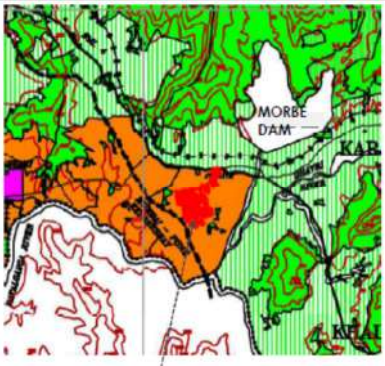
- **Development Pattern in Mumbai Metropolitan Region (MMR):**



AREA	:	4,355 SQ.KM
GREATER MUMBAI POPULATION (2011)	:	1,24,78,447
TOTAL MMR POPULATION (2011)	:	2,09,98,395
REGION	:	MUMBAI METROPOLITIAN REGION
SATTELITE TOWNS OF MUMBAI	:	
NORTH	:	VASAI-VIRAR, MIRA-BHAYANDER
NORTH EAST	:	KALYA-DOMBIVLI, AMBERNATH - BADLAPUR, BHIWANDI AND ULHASNAGAR
EAST	:	NAVI MUMBAI ,URAN
SOUTH –EAST	:	PANVEL,CHOWK , KHOPOLI,PEN , ALIBAUG

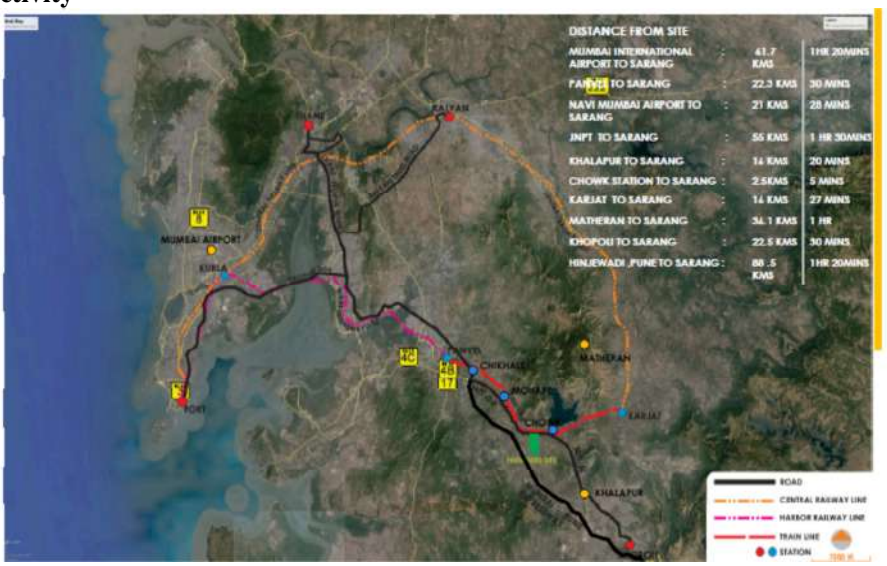
- **Strategic Importance:**





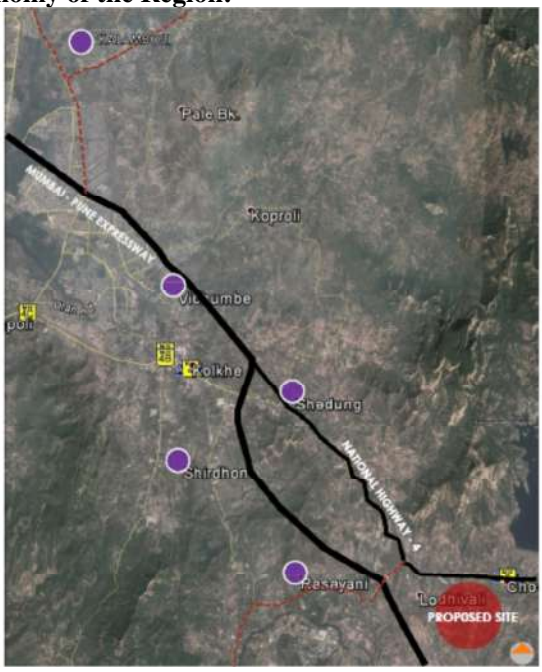
Site is in Urbanisable Zone

- **Connectivity**



Road and Rail Connectivity

- **Economy of the Region:**



ECONOMIC BASE OF REGION

Service sector in Panvel

DISTANCE OF THE INDUSTRIAL AREAS FROM SITE

RASAYANI	:	11.5 KM
SHEDUNG	:	14.4 KM
VICHUMBE	:	22.0 KM
KALAMBOLI	:	25.4 KM
TALOJA	:	29.4 KM
JNPT	:	45.5 KM
ADLABS IMAGICA	:	21.0 KM

MAHARASHTRA INDUSTRIAL DEVELOPMENT CORPORATION(MIDC) ZONE

RASAYANI (PATALGANGA) : CHEMICAL INDUSTRIES

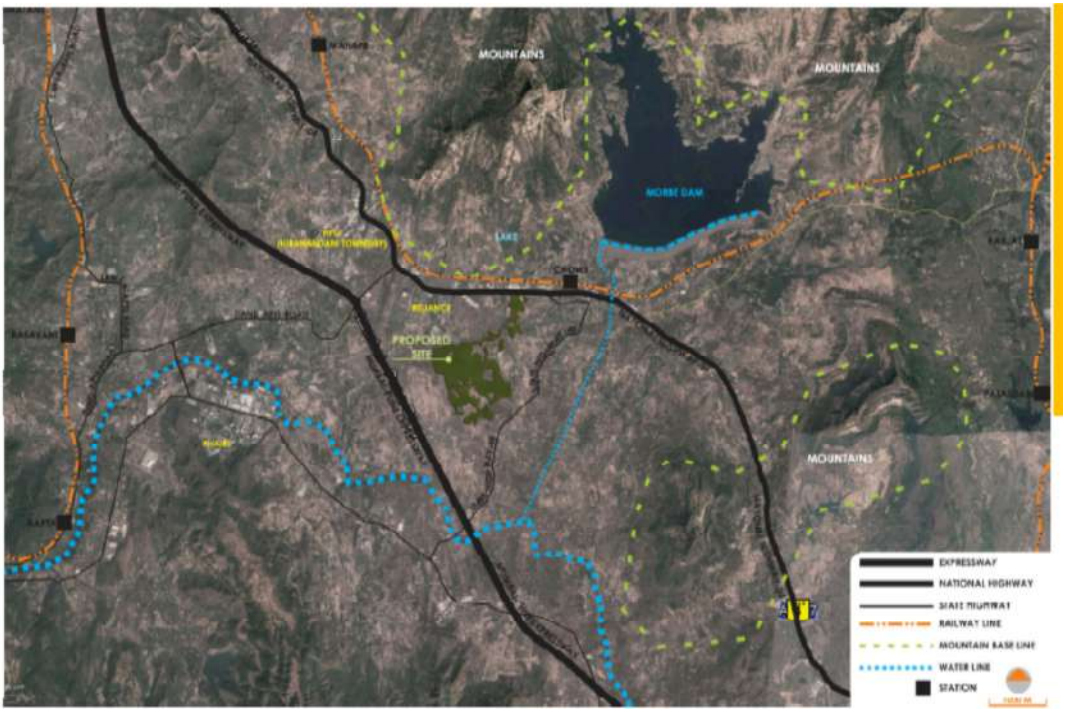
RASAYANI (PATALGANGA)

SHEDUNG

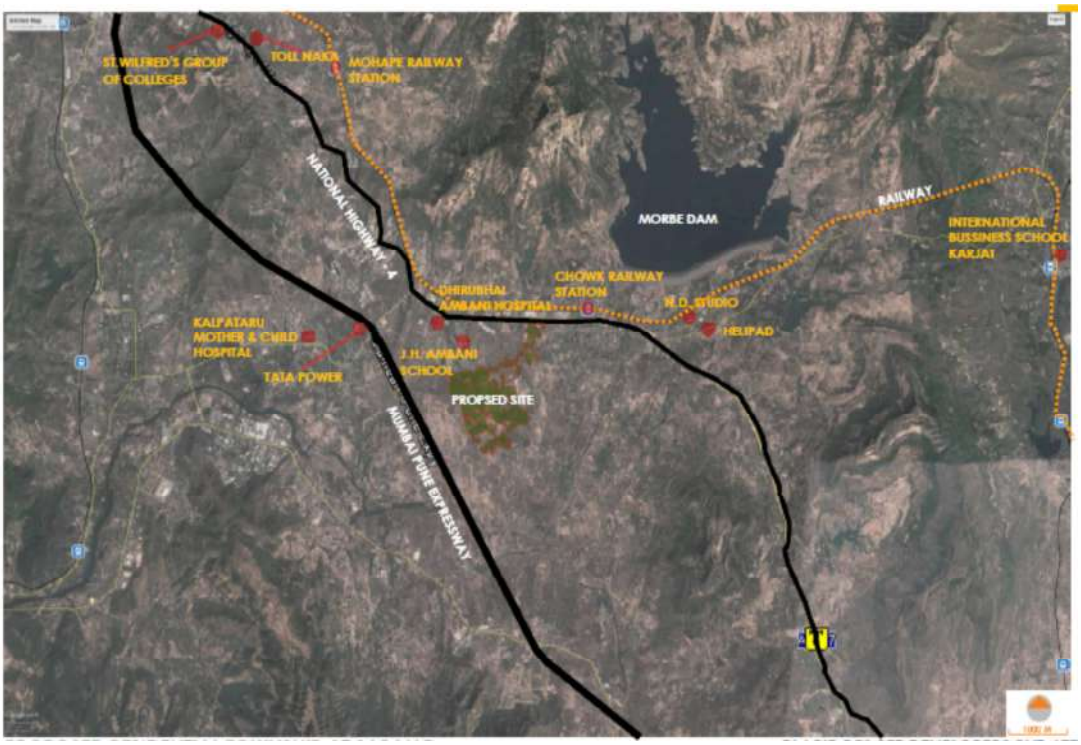
SHIRDHON

VICHUMBE

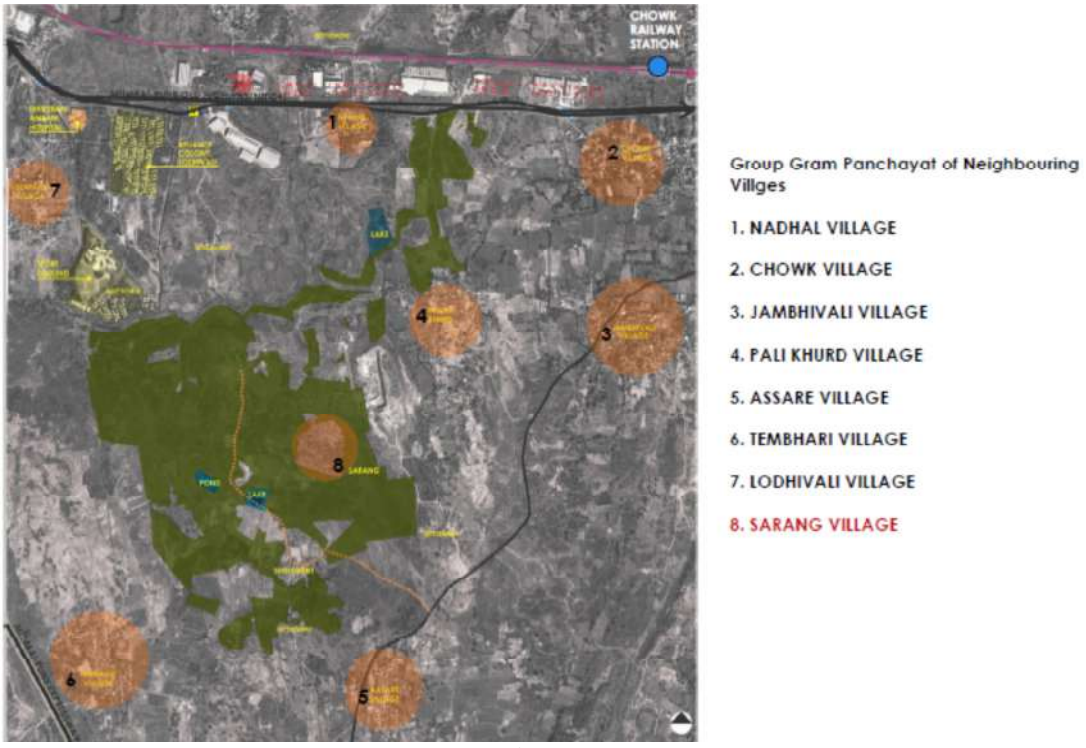
- **Site Context**



Connectivity



Amenities



Villages

Summary of each attribute is given as below:

Attributes	Details
Road and Rail Connectivity	Chowk Station: 1.00 Km Mumbai International Airport :58.00 Km Navi Mumbai Airport : 21.00Km JNPT to Sarang : 55.00 Km Khalapur and Karjat from Sarang : 16.00 Km
Economy of the Region:	**Nearby Industrial Areas** Rasayani, Shedung, Vichumbe, Kalamboli, Taloja, JNPT and Adlabs Imagica
Nearby Amenities	Kalpataru Mother and Child Hospital, TATA Power, J. H. Ambani School, Dhirubhai Ambani hospital, Chowk Railway station, N D Studio, Helipad and International Business School Karjat
Group Gram Panchayat	Nadhal Village, Chowk village, Jambhivali village, Pali khurd village, Assare village, Tembhari Village, Lodhivali Village, Sarang village

Considering all the attributes of site location analysis; proposed site location is suitable for development of Township.

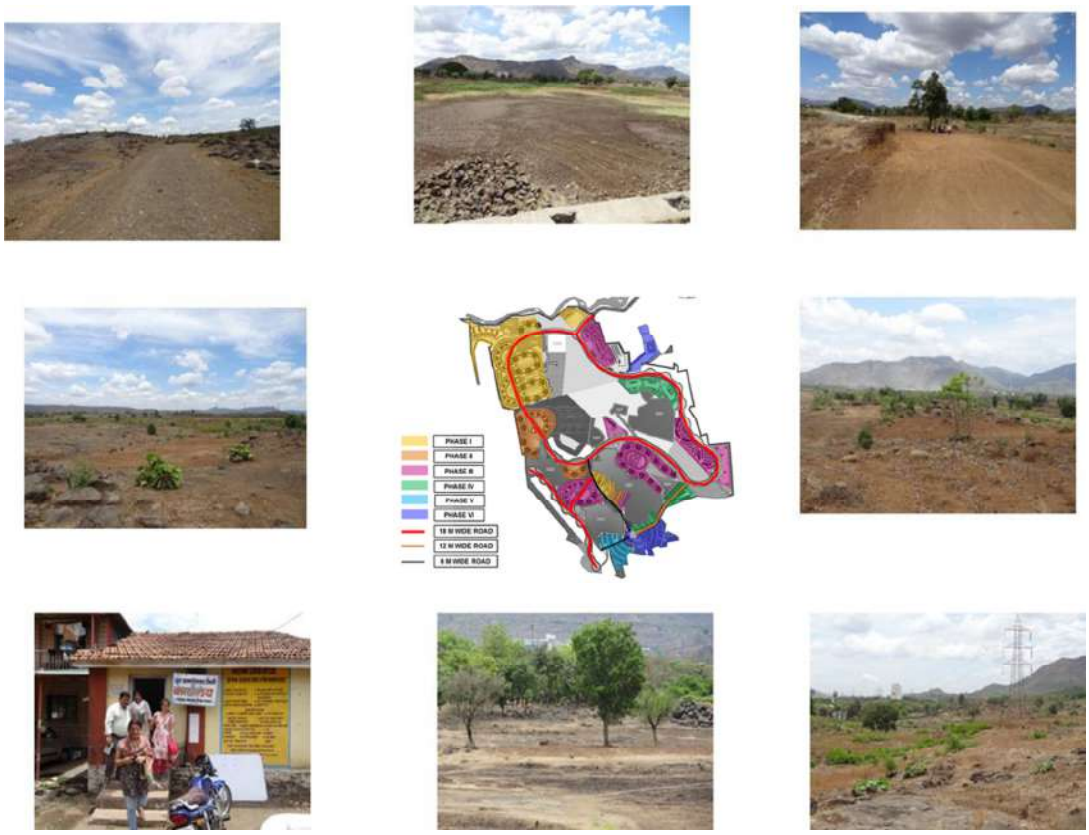


Plate 2.1: Photographs of the Project Site

Fig. 2.4: Study area of Proposed Project 10 Km radius around the plot boundary

2.1.2 Social Infrastructure and nearby amenities:

The village has two schools, one Zilla Parishad Primary School and other privately owned Sarang Vidya Mandir, also an upper primary school. There is also an anganwadi for small kids. For higher studies, students have multiple options of going to nearby villages of Chowk, Lodhivali, and Pali which has both English and Marathi medium secondary schools. Panvel is the nearest city with college and high school for further education, which is very well connected by NH-4, with many travelling options.

There is no health care facility available in the village. The villagers for health care prefer to go to Chowk which has some private health care facilities such as Clinics. Also there is Dhirubhai Ambani Hospital, in Lodhivali; a 78-bed state-of-the-art hospital that caters to an industrial and rural population in the nearby villages.

The proximities to the amenities are as follows:

Table 2.1: Proximities to the amenities

Amenities	Name	Approx. Road distances (Km)
Airport	Mumbai Chhatrapati Shivaji Terminals (International AirPort)	58.00
Nearest Railway Station	Chowk Railway Station	1.00
Bus Depot	ST Bus Depot, Bhisegaon, Karjat Khalapur ST Depot	11.00 12.00
Highway	Mumbai Pune Expressway Old Mumbai – Pune Highway-NH4	4.00 Abutting at the North end of the site
Banks	HDFC Bank Branch / ATM, Lodhivali Khalapur The Federal Bank, Chowk	3.00 2.00
Markets*	Chowk Gaon Market Raigad Bazar, Lodhivali	1.00 3.00
Post office	Rasayani Post Office	7.00

Amenities	Name	Approx. Road distances (Km)
Fire Station	Panvel Municipal Corporation Fire Station Karjat Fire Station	18.00 12.00
Police Station*	Khopoli Police Station	18.00

*These amenities and Social Infrastructure are not very nearby to the project site hence proposed amenities within the site in conformity with norms of Special Township Project.

2.1.3 Land use map and Land Utilization:

Location Clearance from Urban Development Department, GoM on 10th September 2015.

Site is an open land and shall be developed as Special Township project. The project comprises of Residential buildings & EWS (Economical Weaker Section) Housing Scheme along with all basic amenities & Commercial development.

Land utilisation/essential facilities proposed in the project inconformity with norms of Special Township project is given as below:

- **Amenities:**

Amenity	Norms of Special Township project	Provision in the project itself
Market (Market mall, Ikea mall) / Shopping Area / Town Hall (Community Centre, Gurudwara, Church, Mosque, Iskon Temple Complex)/ Library	5 % amenity space: 85,000 Sq. mt.	Convenient shop & Convention center: 17747.94 Sq. mt. (5.62 %) Convenient shop: 548.94 Sq. mt. (0.30%) Market Mall, Shopping, Community centre, Library, Auditorium: 56803.21 Sq. mt. (17.29 %) Convenient shop: 548.94 Sq. mt. (0.75%) Total Amenity: 75649.03 Sq. mt.*

*Amenity provision is done on the basis of proposed built up area as per FSI. Balance amenity space shall be provided after utilization of balance FSI

- **Economic activities**

Amenity	Norms of Special Township project	Provision in the project itself
Education and Hospital/Primary health care center/ Tourism (Hotel & Convention Centre) Trade/Commerce (Commercial Office Complex, Sales Office), Education (Primary School 1,Primary School 2,Secondary School 1,Secondary School 2,International School, Sports Academy)/ Health Care (Home For Aged, Naturopathy Resort, Hospital) / Tourism (Hotel & Convention Centre) Service Industries (It Park Public Utilities (Petrol Pump, Fire Station, Police Station, Post Office, Bus	20 % Economic Activity: 3,40,000 Sq. mt.	Hospital: 12,555.08 Sq. mt. (3.97 %) School: 7387.80 Sq. mt. (2.34 %) Hotel: 34,398.00 Sq. mt. (18.90%) School, Office buildings, Home for Aged person: 75489.36 (20.23%) IT park, Police Station and

Terminus) / **Education (Primary School 1, Primary School 2, Secondary School 1, Secondary School 2, International School, Sports Academy)**		Resorts: 196913.09 Sq. mt. (81.98 %) School Building: 20174.60 Sq. mt. (27.59%) Total Economic Activity: 3,47,277.93 Sq. mt.

2.2 PROJECT IMPLEMENTATION SCHEDULE:

2.2.1 Development Strategy, Phasing of the project:

- The site is an open land; hence no demolition activities are involved.
- The proposed construction will not cause any resettlement and rehabilitation of the population.
- The construction work for proposed project has been reckoned in six phases.
- The construction period for proposed project is approximately 15 years.

Phases	Duration
1	3 Years
2	3 Years
3	2 Years
4	4 Years
5	1 Year 6 months
6	1 Year 6 months
Total	**15 years**

2.3 RESOURCE REQUIREMENT:

2.3.1 Building Materials and construction Equipment's:

- **Details of construction Equipment's:**

Table 2.2: Details of Major Equipment and Machinery

No.	Equipment / Machinery	Quantity
1.	Excavator cum Loader	8
2.	JCB	8
3.	Breaker attached in Poclain	2
4.	Power roller	2
5.	Dumper/Tipper	15
6.	Concrete lifting pump	2
7.	Concrete mixer	60
8.	Welding machine	15
9.	Generator set (DG sets)	5
10.	Hoist	60

- **Building materials:**

Building materials choices are important in sustainable design because of the extensive network of extraction, processing and transportation steps required to process them. Activities to create building materials pollute the air and water, destroy natural habitats and deplete natural resources.

When new materials are used in buildings, it is important to consider different sources. Salvaged materials can substitute for new materials, save on material costs and perhaps add character to the building. Recycled content materials reuse waste products that would otherwise be deposited in landfills. The use of local materials supports the local economy and reduces the impacts of transportation. Use of the building materials and products that are extracted and manufactured within

the region, shall be done in this project thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.
The conservation material & resources strategy will be achieved through the following:

- Reducing and Reusing of Waste
- Using recycled material in construction
- Use of Regional Material in construction
- Pozzolana Cement containing up to 20% fly ash will be used for plaster, masonry, flooring
- Old bricks will be used for water proofing
- Brick Bat Coba water proofing will be done with old bricks
- Low VOC (volatile organic compound) paints will be used.
- Use of china mosaic for roofing
- Energy efficient materials and systems will be utilized.
- Use of single glazed glass for windows

2.3.2 Manpower Requirement:

Proposed project requires manpower during construction phase & operation phase thereby creating job opportunities. Local skilled and unskilled laborers will have an opportunity for employment directly or indirectly. On an average the number of workers envisaged during construction phase are 100 residential and 200 non-residential for each phase.

2.4 INFRASTRUCTURE AND FACILITIES / UTILITIES: DURING CONSTRUCTION PHASE:

Infrastructure and facilities / utilities during construction phase are detailed as follows:

Table 2.3: Infrastructure and facilities / utilities during construction phase

<table>
<tr><th>Items</th><th>Details</th></tr>
<tr><td>Electrical Supply</td><td>Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)</td></tr>
<tr><td>Backup during power failure for emergency services</td><td>As per requirement</td></tr>
<tr><td>Water Requirement</td><td>

For workers : 23 KLD for each phase
Source : Tanker water of potable quality
For construction of each phase (depending on construction activity): Source Water tankers*

<table>
<tr><th rowspan="2">Details</th><th colspan="7">Phases</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>Total</th></tr>
<tr><td>Domestic</td><td>13</td><td>13</td><td>13</td><td>13</td><td>13</td><td>13</td><td>78</td></tr>
<tr><td>Flushing</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>60</td></tr>
<tr><td>Construction</td><td>200</td><td>100</td><td>225</td><td>250</td><td>70</td><td>80</td><td>925</td></tr>
</table>
(*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity)
</td></tr>
<tr><td>Sewage Generation, Collection and Disposal</td><td>i. Quantity of Sewage : 22 KLD (for each phase)
ii. Disposal: Shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants</td></tr>
<tr><td>Solid Waste Generation during Excavation/Construction</td><td>The wastes generation during construction phase shall be recycled and reused to the maximum possible extent and remaining shall be disposed to authorized landfill site with due care and precautions and with prior permissions from the concerned departments of local authority. The</td></tr>
</table>

<table>
<tr><th>Items</th><th>Details</th></tr>
<tr><td></td><td>excavation waste quantities and its management is explained in detail in chapter 4 section 4.2.3.2</td></tr>
<tr><td>Hazardous wastes</td><td>There will be designated storage for Hazardous wastes and its disposal shall be done to authorized common hazardous waste disposal site for further treatment and disposal.</td></tr>
<tr><td>Storage space for construction waste</td><td>Adequate storage space shall be provided.
Separate covered storage for materials like masonry blocks, etc. shall be provided.</td></tr>
<tr><td>Solid waste generation by workers (Garbage)</td><td><table><tr><th colspan="3">Solid Waste Generation Kg /day</th></tr><tr><th>Non-biodegradable</th><th>Biodegradable</th><th>Total</th></tr><tr><td>24</td><td>6</td><td>30</td></tr></table>Considerations for solid waste generation:
For workers: Total 0.1 Kg/person /day out of which 20 % wet garbage and 80 % dry garbage</td></tr>
<tr><td>Disposal of garbage</td><td>These wastes shall be segregated into biodegradable and non-biodegradable and shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal</td></tr>
<tr><td>E waste</td><td>Separate storage space within project site and subsequently it shall be handed over to authorized recyclers.</td></tr>
<tr><td>Facilities for workers</td><td>Drinking water facility and toilet bathing facilities
Health checkup facilities
Personal protective and safety equipment</td></tr>
<tr><td>Site Sanitation Measures</td><td>For sewage disposal: Treatment in Sewage Treatment Plant
For storm water: Proper management of channelization of water to avoid water logging at site
Provision of silt trap and oil & grease trap at the discharge point before disposal to external drain
Regular pest control at site</td></tr>
</table>

2.5 DETAILS ABOUT THE PROJECT DURING OPERATION PHASE:

2.5.1 Area statement:

The area statement explaining the total plot area, net plot area available for development, green areas is as per **Table 2.4 and table 2.5.** In this table the built up area as per Floor Space Index (FSI) and the construction built up area which includes FSI and non FSI area is also explained.

Table 2.4: Area Statement

No	Description	Area (Sq.mt.)
1.	Plot Area	10,62,500.00
2.	Ground Coverage Area	**2,71,235.46**
3.	Recreational Green (R.G.) Area	**3,43,571.58**
4.	Built – up Area as per FSI	**12,47,741.00**
5.	Total Construction Built – up Area (FSI + NON FSI)	**23,63,400.26**

Table 2.5: Phase wise Area Statement

No	Description	Area (Sq.mt.)						
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total
1.	Ground Coverage Area	90,929.70	49,788.81	85,392.96	31,684.15	5,990.60	7,449.24	**271,235.46**

No	Description	Area (Sq.mt.)						
		Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Total**
2.	R.G. Area	93,431.89	67,541.37	20,933.05	76,886.64	24,559.49	60,219.14	**3,43,571.58**
3.	Built – up Area as per FSI	316,019.10	181,905.40	374,991.12	240,187.65	61,534.80	73,102.93	**12,47,741.00**
4.	Total Construct-ion Built – up Area (FSI + NON FSI)	5,60,383.51	3,12,790.33	6,28,322.70	7,07,982.10	71,887.20	82,034.42	**23,63,400.26**

Layout plan indicating road, greenbelt, drainage, sewer line, STP, Solid waste handling area, rain water harvesting structure, etc. is enclosed as Enclosure 3.

2.5.2 Buildings Details :

The building details are as follows:

Table 2.6: Phase wise Building Details and Occupancy

Phases	Building Details	Occupancy
1	**21 nos. of Residential Buildings:** Type A buildings : 6 buildings of Ground + Podium + 22 Upper Floors Type B buildings : total 15 buildings 12 buildings of Ground + Podia + 22 Upper Floors 3 buildings of Ground + 2 Podia + 22 Upper Floors **Total Flats: 3036 nos.**	**23851**
	Convenient Shopping : 1 building : Ground+ 1 Upper Floor **Shops: 2 units**	
	Convention Centre: 2 buildings of Ground + 2 Podia+ 15 Upper Floors	
	Primary School : Ground+ 4 Upper Floors **Classrooms: 72 nos**.	
	Hospital: Basement+ Ground+ 4 Upper Floors **Beds: 150 Nos.**	
	Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A: 7 buildings of Ground + 12 Upper Floors Type B: 2 buildings of Ground + 11 Upper Floors Type E: 1 building of Ground + 12 Upper Floors **Total Flats: 844 nos.**	
2	**11 nos. of Residential Buildings:** Type A buildings :3 buildings of Ground + Podium + 22 Upper Floors Type B buildings : 8 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 1584 nos.**	**12568**
	Convenient Shopping : 1 building : Ground+1 Upper Floor **Shops: 2 unit**	
	Hotel: 3 buildings of Ground + 2 Podia+20 Upper Floors **Rooms: 840 nos.**	
	Economical Weaker Section (EWS) scheme: 5 nos. of Residential buildings: Type A : Ground + 12 Upper Floors **Total Flats: 480 nos.**	
3	**18 nos. of Residential Buildings:**	**50456**

Phases	Building Details	Occupancy
	Type A buildings : 3 buildings of Ground + Podium+ 3 part podia + 22 Upper Floors Type B buildings : 15 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 2508 nos.**	
	Convenient Shopping : 1 building : Ground+ 1 Upper Floors **Shops: 2 units**	
	Secondary School : Ground+ 7 Upper Floors Classrooms: 182 nos.	
	Office building: Ground+ 5 Upper Floors	
	Office and Market Mall: 6 Buildings of Ground+ 3 Podia+ 5 Upper Floors (market mall) + 6 to 20 upper floors (offices)	
	Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A : 7 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type F : 1 building of Ground + 12 Upper Floors Type I : 1 building of Ground + 12 Upper Floors **Total Flats: 908 nos.**	
	Home for aged person, Community Centre, Library, Auditorium 1 building with 4 wings Wing A: Home for aged: 2 Basements + Ground +6 Podia + 5 Upper Floors **Rooms:110** Wing B: Community center : 2 Basements + Ground +6 Podia + 5 Upper Floor Wing C: Library: 2 Basements + Ground +6 Podia + 4 Upper Floor Wing D: Auditorium: 1 building of 2 Basements + Ground +6 Podia +5 Upper Floor	
4	**IT park:** Total 3 buildings 2 Basements+ Ground+ 4 Podia+ 24 Upper Floors	**26870**
	Resort: Type A : 2 buildings of Ground + 4 Upper Floors Type B : 1 building of Ground + 3 Upper Floors Type C : 1 building of Ground + 5 Upper Floors	
	Economical Weaker Section (EWS) scheme: 12 nos. of Residential buildings: Type C : 11 buildings of Ground + 12 Upper Floors Type D : 1 building of Ground + 12 Upper Floors **Total Flats: 1140 nos.**	
	Police Station	
5	**Economical Weaker Section (EWS) scheme:** 18 nos. of Residential buildings: Type F : 16 buildings of Ground + 12 Upper Floors Type G : 2 building of Ground + 12 Upper Floors **Total Flats: 1632 nos.**	**8160**
6	**Economical Weaker Section (EWS) scheme:**	**13688**

Phases	Building Details	Occupancy
	15 nos. of Residential buildings: Type A : 2 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type C : 8 buildings of Ground + 12 Upper Floors Type F : 4 building of Ground + 12 Upper Floors **Total Flats: 1388 nos.**	
	Convenient Shopping : **1 building: Ground+ 1 Upper Floor** **Unit: 2 nos.**	
	Primary School : Ground+ 10 Upper Floors Classrooms: 200 nos.	
	Total	**1,35,593**

Reference: National Building Code (NBC) -2005 – Part 4, Page 27, Occupant Load

2.6 INFRASTRUCTURE AND FACILITIES / UTILITIES / WASTE GENERATION : DURING OPERATION PHASE

Infrastructure and facilities / utilities / Waste generation during operation phase are detailed as follows:

Table 2.7: Details about utilities & environmental liabilities

Component: Onsite Parking Facility

Phase	Parking required as per Local Norms (nos.)					Parking Provision (nos.)				
	4W	2W	Cycle	Bus	Ambu-lance	4W	2W	Cycle	Bus	Ambu-lance
1	5609	561	4338	16	3	5984	725	4338	16	3
2	2798	280	3126	-	-	2977	327	3126	-	-
3	6396	640	7852	63	2	7113	803	7852	64	2
4	4760	476	1819	-	-	4919	460	1819	-	-
5	460	46	2244	-	-	521	63	2244	-	-
6	465	53	1390	50	-	469	58	1390	50	-
Total	**20488**	**2056**	**20769**	**129**	**5**	**21983**	**2436**	**20769**	**130**	**5**

Electrical Supply

From Maharashtra State Electricity Distribution Company Limited (MSEDCL) Details of Electrical load is given as follows :

Phases	Connected Load (KW)	Maximum Demand (KW)
1	68265	27047
2	42884	18194
3	94222	36946
4	57340	37362
5	26208	10195
6	20341	6985

Backup during power failure for emergency services

Phases	Capacities of DG sets
1	2 DG sets of 320 KVA each 2 DG sets of 500 KVA each 6 DG sets of 625 KVA each 1 DG set of 100 KVA 2 DG sets of 1000 KVA each 1 DG set of 320 KVA 1 DG set of 600 KVA
2	1 DG set of 1000 KVA 2 DG sets of 400 KVA each 1 DG set of 600 KVA 1 DG set of 500 KVA 3 DG sets of 2500 KVA each

<table>
<tr><th>Component</th><th>Details</th></tr>
<tr><td></td><td>
<table>
<tr><td>3</td><td>7 DG sets of 1010 KVA each
1 DG set of 400 KVA
2 DG set of 750 KVA each
1 DG set of 140 KVA
2 DG sets of 1250 KVA each
6 DG sets of 2000 KVA each
5 DG sets of 1500 KVA each</td></tr>
<tr><td>4</td><td>4 DG sets of 1000 kVA each
1 DG set of 400 KVA</td></tr>
<tr><td>5</td><td>2 DG sets of 600 KVA each
2 DG sets of 350 KVA each</td></tr>
<tr><td>6</td><td>1 DG set of 380 KVA
1 DG set of 750 KVA
1 DG set of 80 KVA
1 DG set of 400 KVA</td></tr>
</table>
The diesel generators sets will be provided with stacks as per CPCB norms
Layout showing location for DG sets is enclosed as an Enclosure 4.
</td></tr>
<tr><td>Water Supply & Storage</td><td>
Fresh Water Supply (for domestic): Maharashtra Jeevan Pradhikaran (MJP)
Secondary requirements (flushing and gardening) : STP treated sewage
Details of water requirement is given in Table 2.9
Provision of adequate storage tanks:
<table>
<tr><th></th><th colspan="3">Underground tank (KL)</th><th colspan="3">Over Head Tank (KL)</th></tr>
<tr><th>Phases</th><th>Domestic</th><th>Flushing</th><th>Fire Fighting</th><th>Domestic</th><th>Flushing</th><th>Fire Fighting</th></tr>
<tr><td>1</td><td>2441</td><td>1682</td><td>2400</td><td>935</td><td>624</td><td>220</td></tr>
<tr><td>2</td><td>1775</td><td>957</td><td>1700</td><td>592</td><td>319</td><td>140</td></tr>
<tr><td>3</td><td>3049</td><td>2422</td><td>3000</td><td>1016</td><td>807</td><td>150</td></tr>
<tr><td>4</td><td>1416</td><td>1172</td><td>750</td><td>472</td><td>391</td><td>50</td></tr>
<tr><td>5</td><td>1103</td><td>556</td><td>600</td><td>368</td><td>185</td><td>20</td></tr>
<tr><td>6</td><td>1153</td><td>808</td><td>1000</td><td>384</td><td>365</td><td>80</td></tr>
</table>
</td></tr>
<tr><td>Rain water harvesting System</td><td>
<table>
<tr><th>Phases</th><th>RWH tanks</th></tr>
<tr><td>1</td><td>Residential Building: 4 RWH tanks of total capacity 1137 KL
EWS: 1 RWH tank of capacity 275 KL
School Building: 1 RWH tank of capacity 173 KL
Hospital Building: 1 RWH tank of capacity 321 KL
Convention Centre: 1 RWH tank of capacity 125 KL</td></tr>
<tr><td>2</td><td>Residential Building: 4 RWH tanks of total capacity 594 KL
EWS Building: 1 RWH tank of capacity 153 KL
Hotel Building: 1 RWH tank of capacity 187 KL</td></tr>
<tr><td>3</td><td>Residential Building: 3 RWH tanks of total capacity 959 KL
EWS Building: 1 RWH tank of capacity 293 KL
Institutional Building : 1 RWH tank of capacity 288 KL
School Building: 1 RWH tank of capacity 173 KL
Office Building: 1 RWH tank of capacity 163 KL
Market Mall and Office Building: 1 RWH tank of capacity 1478 KL</td></tr>
<tr><td>4</td><td>IT park Building: 1 RWH tank of capacity 784 KL
Resort (Type A, B & C): 1 RWH tank of capacity 296 KL
EWS Building: 1 RWH tank of capacity 374 KL</td></tr>
<tr><td>5</td><td>EWS Building: 2 RWH tanks of total capacity 539 KL</td></tr>
<tr><td>6</td><td>EWS Building: 2 RWH tanks of total capacity 455 KL
Convenient Shopping: 1 RWH tank of capacity 26 KL</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Component</th><th>Details</th></tr>
<tr><td></td><td>Primary School Building: 1 RWH tank of capacity188 KL</td></tr>
<tr><td>Storm Water Drainage</td><td>Provision of SWD of total capacities 29.61 m^3/sec
and external drain including major drain is 255.12 m^3/sec</td></tr>
<tr><td>Sewage Quantity Treatment</td><td>
<table>
<tr><th>Phases</th><th>Sewage (KLD)</th><th>Total STP capacity (KL)</th><th>Number of STPs and capacity of each STP</th></tr>
<tr><td>1</td><td>2441</td><td>2807
(Total 11 Nos.)</td><td>1 STP : 305 KL,
1 STP : 665 KL,
1 STP : 530 KL,
1 STP : 530 KL,
1 STP : 127 KL
1 STP : 80 KL,
1 STP : 421 KL,
1 STP : 64 KL,
1 STP : 54 KL,
1 STP : 27 KL,
1 STP : 4 KL</td></tr>
<tr><td>2</td><td>1485</td><td>1634
(Total 07 Nos.)</td><td>1 STP : 332 KL,
1 STP : 185 KL,
1 STP : 250 KL,
1 STP : 257 KL,
1 STP : 304 KL,
1 STP : 301 KL,
1 STP : 5 KL</td></tr>
<tr><td>3</td><td>2776</td><td>3283
(Total 08 Nos.)</td><td>1 STP : 1060 KL,
1 STP : 328 KL,
1 STP : 258 KL,
1 STP : 559 KL,
1 STP : 167 KL,
1 STP : 517 KL,
1 STP : 12 KL,
1 STP : 382 KL</td></tr>
<tr><td>4</td><td>1485</td><td>1624 (Total 04 Nos.)</td><td>1 STP : 786 KL,
1 STP : 68 KL
1 STP : 768 KL,
1 STP : 2 KL</td></tr>
<tr><td>5</td><td>955</td><td>1100
(Total 01 No.)</td><td>1 STP : 1100 KL</td></tr>
<tr><td>6</td><td>1085</td><td>1177
(Total 04 Nos.)</td><td>1 STP : 236 KL,
1 STP : 634 KL,
1 STP : 298 KL,
1 STP : 9 KL</td></tr>
<tr><td>Total</td><td>10227</td><td>11625</td><td>Total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL</td></tr>
</table>
Reference: For calculation of quantity of sewage generation Manual on norms and standards for EC of large construction projects suggested by MoEF is referred
</td></tr>
<tr><td>Solid Waste(Biodegradable & Non-biodegradable):</td><td>
<table>
<tr><th rowspan="2">Phases</th><th colspan="3">Solid waste generation (kg/day)</th></tr>
<tr><th>Biodegradable</th><th>Non-biodegradable</th><th>Total</th></tr>
<tr><td>1</td><td>6197</td><td>2963</td><td>9160</td></tr>
<tr><td>2</td><td>4079</td><td>1830</td><td>5909</td></tr>
<tr><td>3</td><td>6221</td><td>5963</td><td>12184</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Component</th><th>Details</th></tr>
<tr><td></td><td>
<table>
<tr><td>4</td><td>2219</td><td>2463</td><td>4682</td></tr>
<tr><td>5</td><td>2570</td><td>1102</td><td>3672</td></tr>
<tr><td>6</td><td>2321</td><td>1488</td><td>3809</td></tr>
<tr><td>Total</td><td>23607</td><td>15808</td><td>39415</td></tr>
</table>
Considerations for solid waste generation:
For Residential, home for aged person: Total 0.45 Kg/person /day out of which 70 % wet garbage and 30 % dry garbage

Staff and Visitors for Convenient Shopping, Convention Centre, Hospital, Offices, Assembly, IT, Police Station, Hotel and Resorts and School: 80% dry garbage and 20% wet garbage out of total 0.1 Kg/person/day
</td></tr>
<tr><td>E-waste</td><td>
Office buildings and IT park are proposed in phase 3 and 4 respectively hence quantification of E-waste generation is done for these two phases only. Details are as follows:

<table>
<tr><th>Phase</th><th>Quantity (Kg /annum)</th></tr>
<tr><td>Phase 3</td><td>4887</td></tr>
<tr><td>Phase 4</td><td>20,009</td></tr>
<tr><td>Total</td><td>24,896</td></tr>
</table>
E-Waste covers the following equipment:-
<table>
<tr><td>Computers</td><td>Server / Desktop computer (CPU, Monitor, Keyboard and Mouse), Laptop, Notebook, etc. or similar items</td></tr>
<tr><td>Printer & Accessories</td><td>Printer, Scanner, Printer Cartridge, Toner, etc. or similar items</td></tr>
<tr><td>Network equipment</td><td>Routers, Switches, Patch panel, Modem, Converter, VSAT equipment , etc. or similar items</td></tr>
<tr><td>IT Accessories</td><td>CD and DVD, Pen Drive, External Hard disk, External CD / DVD writer, DAT Drive, Speaker, Laptop Battery, Hand Held device, VC equipment, Data Cartridge, etc. or similar items</td></tr>
<tr><td>Associated Electrical items</td><td>Power cable, Data cable, UPS, etc. or similar items</td></tr>
</table>
</td></tr>
<tr><td>Biomedical waste</td><td>
<table>
<tr><th rowspan="2">No. of beds</th><th colspan="4">Criteria for Bio Medical Waste Generation (Kg/day/bed)</th><th colspan="4">Total (Kg/ day)</th></tr>
<tr><th>Total</th><th>Non Infectious</th><th>Infectious</th><th>Hazardous</th><th>Non Infectious</th><th>Infectious</th><th>Hazardous</th><th>Total</th></tr>
<tr><td>150</td><td>0.38</td><td>80%</td><td>15%</td><td>5%</td><td>45.0</td><td>8.44</td><td>2.81</td><td>56.3</td></tr>
</table>
Estimated generation of total waste @ 1.5 kg/bed
Estimated generation of bio-medical waste @ 25% of the total waste generated
Reference: Manual on Solid Waste Management (CPHEEO) – Chapter 7, Page 148,Waste Management System- Biomedical waste
(Weblink :http://moud.gov.in/sites/upload_files/moud/files/pdf/uidssmt/swm/chap7.pdf)
</td></tr>
<tr><td>Household Hazardous Waste</td><td>
○ Leftovers or empty containers of: Furniture and shoe polish, paints, insect repellent, fungicides, herbicides, rodent killers, weed killers, air freshener, general cleaning agents, disinfectants etc.
○ Fluorescent light tubes, used inverter batteries, used car batteries, chlorine bleach, Medicines out of expiry dates etc.
○ There will be separate storage for Household Hazardous wastes and its disposal shall be done to authorized CHWTSDF sites
</td></tr>
</table>

Component	Details
Solid Waste segregation, storages and Treatment Facilities	• Segregation and storages facilities for all solid waste streams • Biodegradable garbage shall be treated by Biomethanation plant • Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal. The agreement between the Project proponent and Agency is attached as **Enclosure 5.** • E-Waste will be stored separately and disposed through authorized recyclers • Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016
Facilities for workers (Household servants, drivers, sweepers, gardeners, watchmen, etc.)	Provision of drinking water facility & toilets Security Cabins for watchmen Maintenance room Provision of utility/service area

2.6.1 Water Requirement for the Project :

Total water requirement for the project during construction phase are given in **Table 2.8**

Table 2.8: Total water requirement for the project during construction phase

Details	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total
Domestic	13	13	13	13	13	13	**78**
Flushing	10	10	10	10	10	10	**60**
Construction	200	100	225	250	70	80	**925**

WATER BALANCE PER DAY BASIS DURING CONSTRUCTION PHASE

All Quantities are in KLD

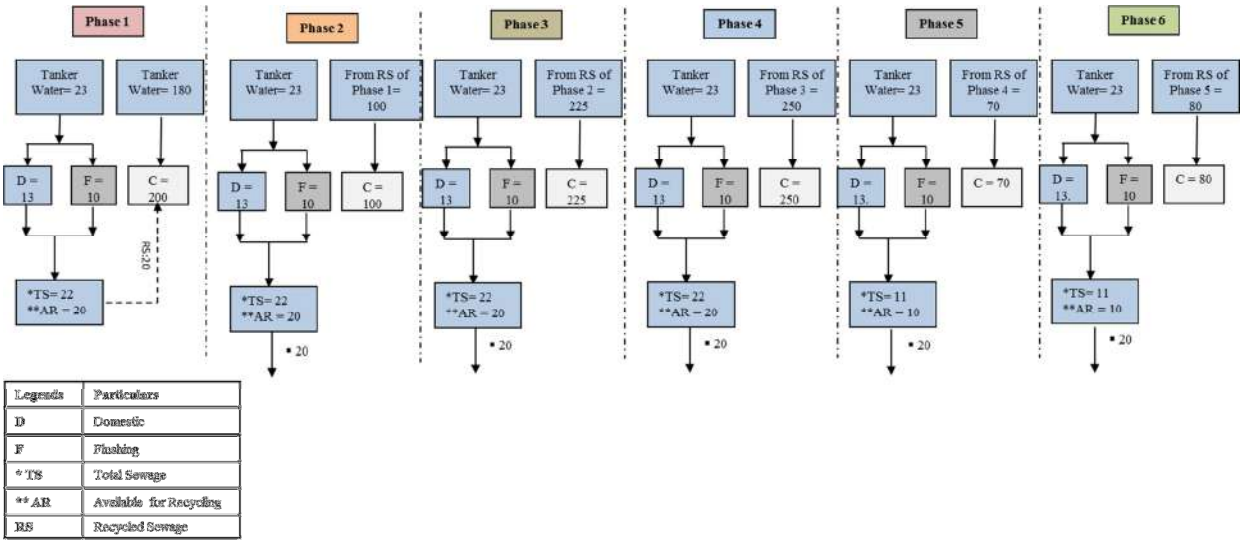


Fig. 2.5: Water balance per day basis during construction phase

Treated sewage from each phase shall be used for water sprinkling, road washing and watering nursery plants.

Total water requirement for the project and sources during operation phase are given in **Table 2.9**

Table 2.9: Total water requirement for the project and source during operation phase

No.	Description	Quantity of water required (KLD)							Source of water supply
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total	
1.	Domestic	1840	1166	1876	909	734	758	**7283**	MJP / RWH
2.	Flushing	969	552	1275	758	367	479	**4400**	Treated sewage from STP
3.	Gardening	280	203	63	231	87	181	**1044**	Treated sewage from STP
4.	Swimming Pool	36						**36**	Tanker Water of Potable Quality

Reference: This is in agreement National Building Code (NBC) -2005 – Part 9, Page 19, *Water Requirement*

Considerations for water requirement:

Residential:

90 Liter/Person/day for domestic and 45 Liter/Person/day for flushing

Commercial, School, police station & Shops:

20 Liter/Person/day for domestic and 25 Liter/Person/day for flushing

Visitors & community hall:

5 Liter/Person/day for domestic and 10 Liter/Person/day for flushing

WATER BALANCE PER DAY BASIS DURING NON-MONSOON

All Quantities are in KLD

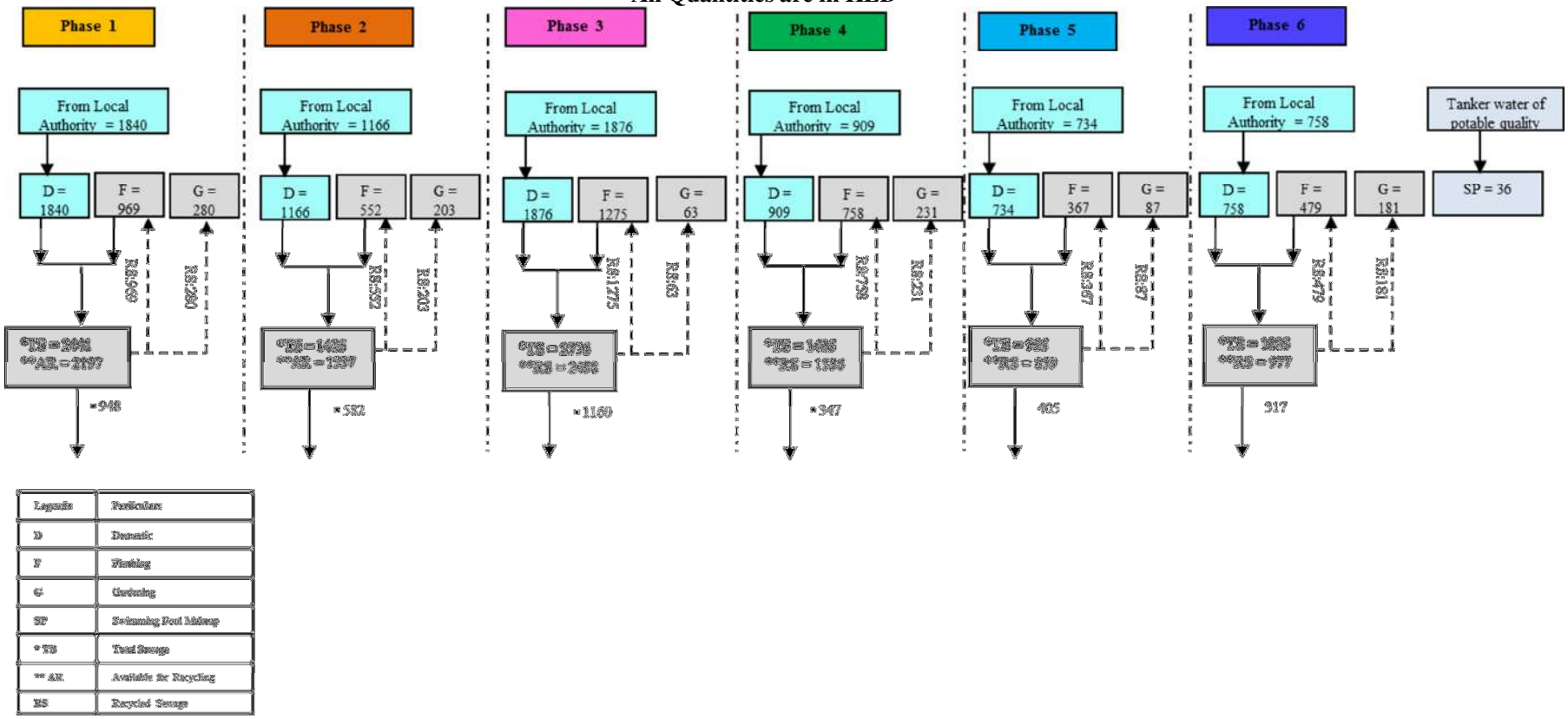


Fig. 2.6: Water balance per day basis during non-monsoon

Please Note:
*Considered 80 % sewage of total of domestic and 100 % of flushing requirement hence total sewage generation is 10227 KLD

**Considered 10 % less availability of sewage for recycling considering losses of sewage in evaporation and sludge formation hence sewage available for recycling is 9204 KLD

- The stored excess treated sewage (3759 KLD): Shall be given for irrigation purposes outside the plot.

Total water requirement = 12763 KLD

Recycling of treated Sewage (5444 KLD) shall be done for gardening (1044 KLD) and flushing (4400 KLD)

Hence Net water requirement: 12763 – 5444 = 7319 KLD [i.e. For Domestic purpose = 7283 KLD (Source: MJP) and for Swimming pool make up water = 36 KLD (Source: tanker water of potable quality)]

Reduction in Net water demand = 43%

Details of the Reuse Scheme:

- For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers.

- Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage.

- Provision of pond of adequate capacity (48965.05 Sq.mt. with depth 1 m) for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.

WATER BALANCE PER DAY BASIS DURING MONSOON

All Quantities are in KLD

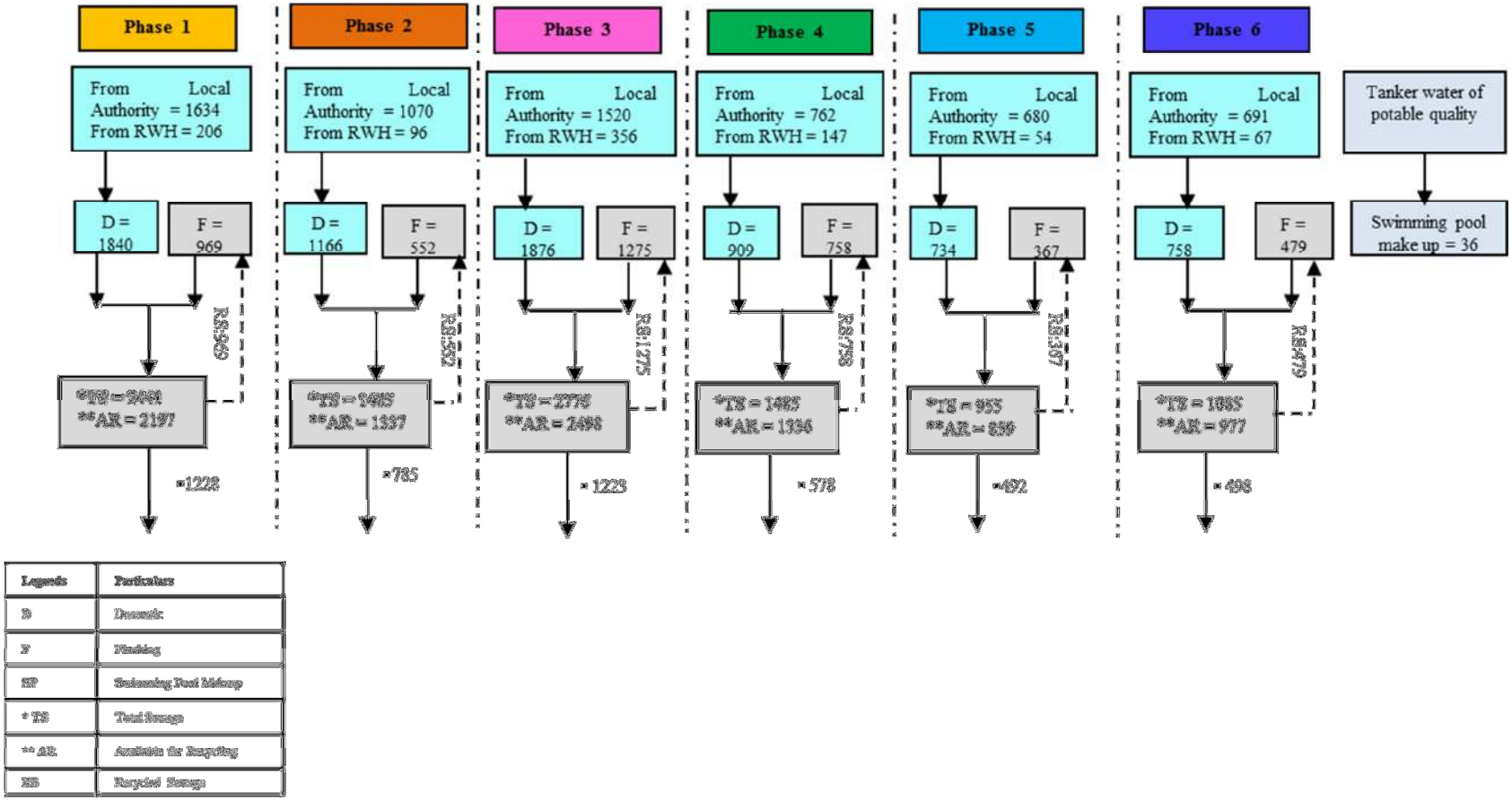


Fig. 2.7: Water balance per day basis during monsoon

Please Note:
*Considered 80 % sewage of total of domestic and 100 % of flushing requirement hence total sewage generation is 10227 KLD

**Considered 10 % less availability of sewage for recycling considering losses of sewage in evaporation and sludge formation hence sewage available for recycling is 9204 KLD

- The stored excess treated sewage (4804 KLD): Shall be given for irrigation purposes outside the plot.

Daily rain water availability is calculated as per Av. 20 mm rainfall/day considering only 50 rainy days (half of season)

Total water requirement = 11719 KLD

Recycling of treated Sewage (4400 KLD) shall be done for flushing (4400 KLD)

From RWH tanks = 926 KLD (For domestic purpose)

Hence **Net water requirement**: 11719 – 4400 - 926 = 6393 KLD [i.e. For **Domestic** purpose = 6357 KLD (Source: MJP) and for **Swimming pool make up water** = 36 KLD (Source: tanker water of potable quality)]

Reduction in Net water demand = 45 %

Details of the Reuse Scheme:

- For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers.

- Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage.

- Provision of pond of adequate capacity (48965.05 Sq.mt. with depth 1 m) for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.

2.7 COMPARISION OF SPECIAL FEATURES FOR BENCH MARKS AND REFERENCE FRAMEWORK FOR SMART CITIES:

Maharashtra Economic Development Council (MEDC) Research Team has complied the data from different sources to showcase the different parameters and benchmarks for smart cities. The same parameters/benchmarks are considered for comparison of proposed township with framework for smart cities. Details are given as below:

No.	Parameters	Benchmark	Remarks
A.	**Transport**	• Maximum travel time of 30 minutes in small & medium size cities and 45 minutes in metropolitan areas • Continuous unobstructed footpath of minimum 2m wide on either side of all street with RoW 12m or more • High quality and high frequency mass transport	Chowk Station: 1.00 Km Navi Mumbai Airport : 21.00 Km JNPT to Sarang : 55.00 Km Khalapur and Karjat city from Sarang : 16.00 Km These all above areas are

		within 800m (10-15 minute walking distance)	within distance of 30- 45 minutes
B.	**Special Planning**	• 95% of residences should have daily needs retail, parks, primary schools and recreational areas accessible within 400m walking distance. • 95% of residences should have access to employment and public and institutional services by public transport or bicycle or walk • At least 20% of all residential units to be occupied by economically weaker sections	Provision of Economic activities and housing for EWS section as follows: 75% of Residential 5% Amenity 20% Economic Activities 0.20% EWS is proposed within project site
C.	**Shadow and Wind**	Shadow analysis: • Potential impact of the development on the neighboring properties which falls under key sunlight sensitive areas. • A potential benefit of shading for adjacent structures may be a cooling effect gained during warm weather • Factors influencing the relative impact of shadow effects are site-specific and include differences in terrain elevation between involved properties, the height and bulk of structures, the time of year, the duration of shading in a day, and the sensitivity of adjacent land uses to loss of sunlight • Distance between the 2 buildings is more than 20 m so that there is no blocking of daylight of buildings	The impacts of cluster on each other are lower than 4hrs. Also minimum distances between the towers are 21m thus there is no major blocking of daylight for towers in the proposed development.
		Wind Analysis: • Wind analysis of buildings helps in predicting the wind pattern on the surrounding area of the building under analysis. This enables the designer to take decisions with respect to layout of the building, orientation of the building, placement of windows etc. This study also helps in understanding the impact of the proposed building on the adjacent structures and on the neighboring streets.	• Wind analysis for west south west and north wind direction shows that there is reduced wind speed at the height below 10m because of podiums • No negative pressure zone is created which suggest that no wind shadowing/ wind blackout is observed. • The wind speed around the towers is observed to be 1-1.5m/s at lower height from of the development. With increase in height the wind movement observed to be increased too. Derailed shadow and wind analysis study is attached as **Enclosure 6.**
D.	**Water Supply**	• 24 x 7 supply of water • 100% household with direct water supply connections	shall be complied
E.	**Sewerage & Sanitation**	• 100% households should have access to toilets • 100% households should be connected to the waste water network	Total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL is

		• 100% efficiency in the collection and treatment of waste water • 100% efficiency in the collection of sewerage	provided
F.	**Solid Waste Management**	• 100% households are covered by daily door-step collection system • 100% collection of municipal solid waste • 100% segregation of waste at source, i.e. bio-degradable and non – degradable waste • 100% recycling od Solid Waste	Provision is made for Biogas plant
G.	**Storm Water Drainage**	• 100% coverage of road network with storm water drainage network • 100% rainwater harvesting	Provision for internal SWD having adequate capacity 29.61 m^3/sec
H.	**Electricity**	• 100% households have electricity connection • 24 x 7 supply of electricity • 100% metering of electricity supply	shall be complied
I.	**Telephone connections**	• 100% households have a telephone connection	shall be complied
J.	**Health Care Facilities**	• Availability of telemedicine facilities to 100% residents • 30 minutes emergency response time • 1dispensary for every 15,000 residents • Nursing home, child, welfare and maternity, centre • 1 Diagnostic centre for every 50,000 residents	Provision of Hospital and clinics is already made in the proposal
K.	**Education**		
1.	Pre Primary to Secondary Education	• 1 Pre Primary / Nursery School • 1 Primary school (class I to V) • 1 Senior Secondary School (class VI o XIII)	Education facilities are already proposed in the planning.
L.	**Others**	• Use of renewable energy all sectors • Rooftop solar panels on all public, institutional and commercial buildings as well as multistoried residential housings • Common ducting for all services • Cities to formulate building and parking standards	• Provision of Solar Panels for apartment internal lighting , fan load and water heating • Street area lights based on Biogas generator • Provision of LED lights • Use of Electronic Ballast • Use of timers in buildings common lighting and external lighting • Use of Star rated geysers and AC

(**Source:** Maharashtra Economic Development Council (MEDC) Monthly Economic Digest Vol.XLVI No.: 06 April 2017, ISSN 2456-2457)

CHAPTER: 3
DESCRIPTION OF THE ENVIRONEMENT

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DESCRIPTION OF THE ENVIRONEMENT

3.0 INTRODUCTION

Determination of baseline conditions of the environment is essential for evaluation of environmental impacts of the proposed development on the existing conditions. It is necessary to ascertain existing environmental quality of the project site and environmentally significant factors that could preclude project development. This chapter provides information on existing environmental status incorporating land use of study area, air environment, water environment, biological environment and socio-economic environment.

- **STUDY AREA**

As per the standard Terms of Reference (ToR) notified on 22.07.2015 for Township and area development projects by MoEF & the project specific TOR by SEAC - 2, Maharashtra, study area considered for this report is 10 Km radius around the project site. The study area marked on Toposheet is depicted in **Figure 3.1.**

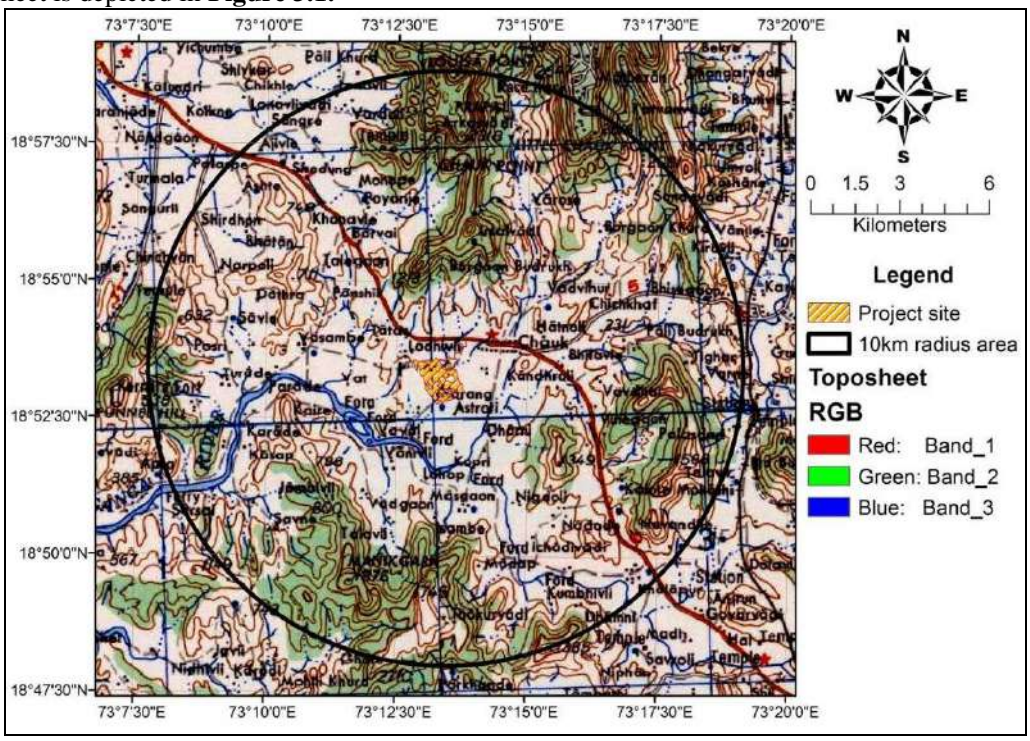

Fig.3.1: Toposheet map of 10 km radius area around project site

Environmental sensitive places within study area are given in Table 3.1.

Table 3.1: Environmental Sensitive Places within 10 Km

Environmental Sensitive Places	Locations	Aerial distances (in km) from Plot boundary
Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	Project site is located at Sarang village which is not listed under ESA as per list of villages prepared by High Level Working Group (HL WG) given in Annexure A of the directions by Ministry of Environment and Forests (MoEF) dt.13.11.2013. But in the study area few villages of Khalapur Taluka are listed under Eco Sensitive Areas (ESA) of Western Ghat. The details are given as follows:	
	Warose Tarf Wankhal	9.00
	Sondewadi	9.00
	Borgaon Khurd	7.00

Environmental Sensitive Places	Locations	Aerial distances (in km) from Plot boundary
	Nadhal	2.00
	Palasdari	9.00
	Talawali	10.00
	Kalote Mokashi	7.00
	Ghodivali	10.00
	Kalote Rayati	6.00
	Nigdoli	4.00
	Parkhande	9.00
	Talashi	10.00
	Project site is located at Sarang village which is not listed under ESA of Matheran as per notification dt. 04.02.2003 and amended notification dt. 16.04.2004. But details of nearest boundary of Eco sensitive zone of Matheran from project boundary is given as follows:	
	Nearest boundary of Eco-sensitive Zone of Matheran	0.20
National Park/Wildlife Sanctuary/	*Karnala Bird Sanctuary	9.00
Nature Park	Nil	NA
Reserved Forest	Near Karade Budrukh Manikgad Devloli Narpoli Prabhalgad Vinegaon	5.00 7.00 8.00 6.00 8.00 6.00
Habitat for migratory birds	Karnala Bird Sanctuary Patalganga River (upstream) Ulhas River	9.00 1.00 10.00
Water bodies	Nadhal Reservoir Bhilavle Reservoir Morbe Reservoir Jambivali Reservoir Pond Hatnoli Lake Usran Lake, Rasayani Vinegaon Lake Varne Lake Patalganga River (upstream) Ulhas River	1.00 4.00 2.00 6.00 Adjacent to the project site 5.00 7.00 6.00 10.00 1.00 10.00
Archaeological Sites	Karnala Fort Manikgad	9.00 7.00

*NOC from Wild Life Board is Not Applicable as per Notification reg. ESZ of Karnala Wildlife Sanctuary in Maharashtra published by MOEF & CC u/no. S.O. 230 (E) dated 22/01/2016, as our project site is not affected by the ESZ belt as per Notification published.

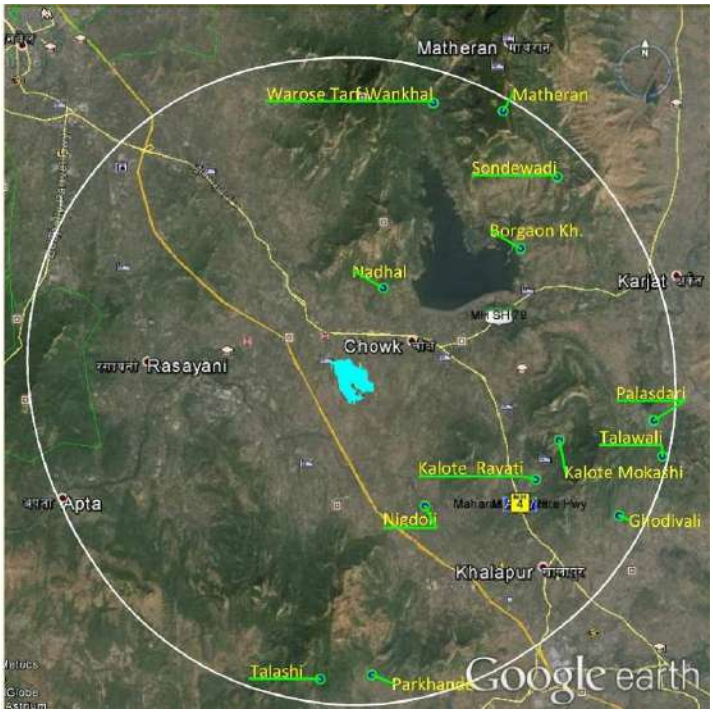

Fig 3.2 Few villages of Khalapur Taluka listed under Eco Sensitive Areas (ESA) of Western Ghat

- **METHODOLOGY FOR CLASSIFICATION OF THE STUDY AREA:**

Classification of the study area and generation of the baseline data is as per Guidance Manual for Building, Construction, Township and Area Development projects approved by MoEF for preparation of EIA report and as per the Standard Terms of Reference (ToR) notified dt. 10/04/2015 for Township projects by MoEF & CC.

Baseline information with respect to air quality, noise level, water and soil quality. Biological environment in the study area was collected by conducting primary sampling / field studies during March 2016 to May 2016 (Pre-monsoon season). Baseline status of Land and Socio-economical environment are also studied simultaneously.

The environmental attributes studied are detailed out in Table 3.2 as follows:

Table 3.2: Methodology adopted for classification of the Study Area

No.	Study Area	Type of Baseline data collection
1	Project Site	Type of data : Primary Attributes: Ambient air quality, Ground water, Surface water, Noise levels, Flora, Fauna, Socio economic aspects, Traffic studies.
2	Area with angular distance of 2 Km surrounding the project site	Type of data : Primary Attributes: Ambient air quality, Ground water, Surface water, Flora, Fauna, Noise levels (500 m radius from site), Traffic study (at major traffic junctions around 2 Km from site.)
3	Area with angular distance of 2 Km upto 10 km surrounding the project site	Type of data: Secondary data from various reliable sources. Attributes: Meteorological data, Surface water bodies, Flora, Fauna, Socio economic aspects, Land environment. Note: Whenever the secondary data is not available primary data collection to be done for the respective attribute.

- **GENERATION OF BASELINE DATA:**

Baseline data generation has been done during March 2016 to May 2016.
The environmental attributes studied are detailed out in **Table 3.3**.

Table 3.3: Environmental Attributes

<table>
<tr><th>No.</th><th>Attribute</th><th>Details of Baseline Data</th><th>Remarks</th></tr>
<tr><td>1</td><td colspan="3">Air Environment</td></tr>
<tr><td>i</td><td>Ambient air quality</td><td>Type of data: Primary data
Sampling Locations: Project site and 6 other locations within 2 Km radius of the project site
Period: March 2016 to May 2016</td><td>As stated in Table 3.2 and as per the Guidance Manual for Township and Area development projects approved by MoEF the locations were selected within 2 Km radius of project site</td></tr>
<tr><td>ii</td><td>Noise Level</td><td>Type of data : Primary data
Sampling Locations: Project site (5 Locations) and 5 surrounding area within 500 m radius of the project site
Frequency: Once during the study period</td><td>This being Township and Area development project impacts on noise level are envisaged in the nearby areas only. Hence the locations are selected within 500 m radius as per suggestions given by Functional Area Expert for Noise and Vibrations.</td></tr>
<tr><td>iii</td><td>Meteorological Data</td><td>Type of data : Secondary
Meteorological data for the year 2016 from IMD, Alibaug</td><td>--</td></tr>
<tr><td>2</td><td colspan="3">Water Environment</td></tr>
<tr><td>i</td><td>Surface water</td><td>Surface water bodies
<table><tr><th>Location</th><th>Nos.</th></tr><tr><td>2 Km radius from the project site</td><td>4</td></tr><tr><td>2 Km to 10 km radius from the project site</td><td>7</td></tr></table>Type of data : Primary
Frequency: Once during the study period</td><td>As stated in Table 3.2 and as per the Guidance Manual for Township and Area development projects approved by MoEF, it is permissible to report the secondary data for the water bodies from 2 Km to 10 Km from site. However as secondary data is not available for all these water bodies we have collected the primary data.</td></tr>
<tr><td>ii</td><td>Ground water</td><td>Type of data : Primary
Sampling location: Within 2 Km
Frequency: Once during the study period</td><td>--</td></tr>
<tr><td>3</td><td colspan="3">Land Environment</td></tr>
<tr><td>i</td><td>Land use & land cover</td><td>Type of data : Secondary
Source:
GIS Study for Landuse/Landcover details of 10 km radius</td><td>Land use/ land cover classification was made based on the satellite data (RESOURCESAT-2 LISS- III cloud free data) collected.</td></tr>
<tr><td>ii</td><td>Soil analysis</td><td>Type of data : Primary
Sampling Location: Project site (3 locations)</td><td>This being building construction project no impacts are envisaged on soil quality outside the project site. Hence soil sampling and analysis was limited up to project site only.</td></tr>
<tr><td>4</td><td>Socio – Economic Environment</td><td>1. Primary data: Project site.
2. Secondary data :
Source :
i. ‘Census of India’ 2011</td><td>--</td></tr>
<tr><td>5</td><td>Biological Environment</td><td>1. Primary data: Project site and selected locations in the 2 Km radius from the project site (Period : March 2016)
2.Secondary data : From 2 Km upto 10 km radius from the project site</td><td>Matheran Hills are situated at a distance of 7.0 Km from plot boundary.</td></tr>
</table>

No.	Attribute	Details of Baseline Data	Remarks
6	**Traffic study**	Traffic survey was carried out for Traffic density / pattern was carried out in March 2016 (Survey done by M/s. GMD Consultants)	

(Ref.: Guidance Manual for Township and Area Development Projects approved by MoEF for preparation of EIA report)

3.1 LAND ENVIRONMENT

The status of land environment was assessed through reconnaissance in the project area, characterization of soil through field studies, land use/ land cover and cropping pattern corresponding to the project area.

3.1.1 Reconnaissance

The 10 km area around project site covers built up land (Settlements), water bodies (Tank/River/Dry Reservoir etc.), vegetation/forest, crop land (Irrigated crop land and Fallow land) and waste lands (Land with scrub and Land without scrub). The project site shows from slopping pattern from North West to south side slope. The higher elevation contour line is shows on north-west side of 1 km angular distance around the project side buffer. Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m).

The climate of the district is characterized with plentiful and regular seasonal rainfall, oppressive weather in summer and high humidity throughout the year. The mean minimum temperature is 16.1°C and means maximum temperature is 40.4°C. The soils in the district are formed from the Deccan Trap which is predominating rock formation with small out crops of Laterite at a few places in the Poladpur Taluka and Matheran Hill.

a. Drainage and Hydrology

Drainage layer, which was generated after scanning the thematic manuscripts, was edited for line the errors. Two different layers were made separately for line drainage. Drainage order was given to all the drain lines in the layer's. Strahler method of ordering was used for giving order to drainage. Whenever two drains of any order joined the order of next drain was increase by one.
The area shows not much of undulating topography thus it shows the dendritic drainage patterns.

The drainage pattern around project site is shown below in **Fig: 3.3 and runoff contributing to the main drains are shown in Fig. 3.4**
The Stormwater drain disposal system of proposed site and adjoining area was identified and Stormwater from the plot is proposed to be disposed in to an existing natural drain passing adjacent to the plot.

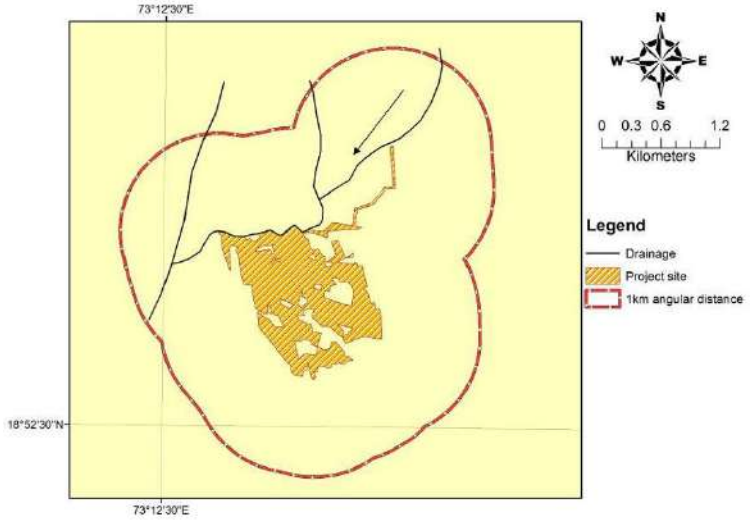

Fig. 3.3 Drainage map of 1km angular distance around project site, Claridges Sarang, Khalapur

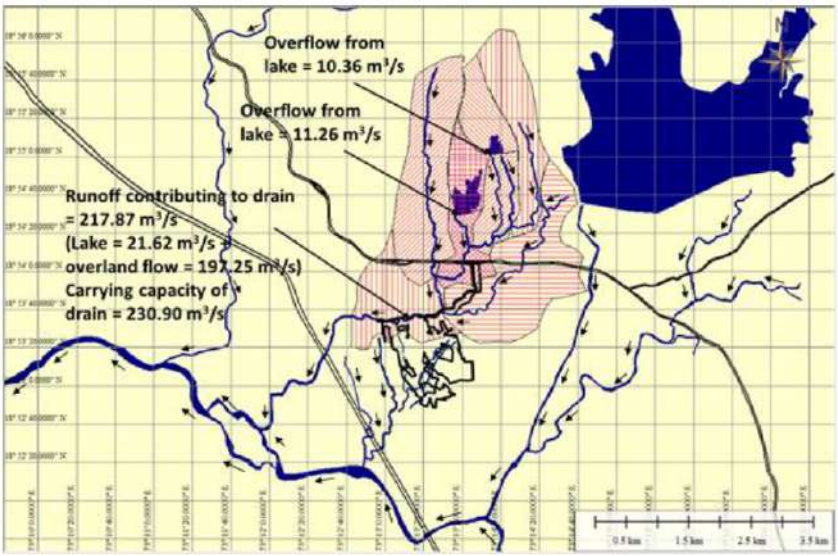

Fig. 3.4: Contributing runoff and carrying capacity of an existing major drain

b. Geology

The geology of the entire district consists of dark-coloured volcanic lava flows and laterites. The soils in the district are formed from the Deccan Trap which is predominantly rock formation with small out crops of Laterite at a few places in the Poladpur Taluka and Matheran Hill. The soils are grouped as Forest, Varkas, Rice, Khar or Saline, Coastal Alluvium and Laterite as per the location and topographical situation.

Source: https://cultural.maharashtra.gov.in/english/gazetteer/KOLABA/agri_soils.html

3.1.2 Physico-Chemical characteristics of soil

a. Soil Characteristics

Soil sample was collected from project sites at various locations and characterized for physicochemical parameters to know the pristine quality of the soil under study.

A soil sample was collected from the project sites. Representative soil samples from depth (0-15 cm) were collected for estimation of the physico- chemical characteristics of soil samples. Standard methods were followed for the analysis of soil samples as given in **Table 3.4**

Table 3.4: Methodology of soil sample monitoring

Parameters	Analytical equipment	Standard Method	Methodology	Sensitivity / Detection limit	Units	Remarks
Color	--	--	Visual Observation	--	--	--
Bulk Density	Weighing Balance	IS 2720 (Part 03) - 1980	Density Measurement	1.0	kg/m^3	--
Water Holding Capacity	i)Oven ii)Weighing balance iii) Gooch Crucible	ASTM- T7367-07	Gravimetric method	0.1	%	Analysis as per Standard Methods specified
Moisture Content	i)Oven ii)Weighing balance	IS:2720 (Part 02) - 1973	Gravimetric method	0.1	%	
pH	pH meter	IS : 2720 (Part 26) - 1987	Electrometric method	0.1	--	1:2 Soil extract
Electrical Conductivity	Electrical conductivity meter	IS 14767 - 2001	Conductometry	0.001	mS/cm	
Organic matter	i)Oven ii)Weighing balance iii)Volumetric	IS : 2720 (Part 22) - 1972	Titrimetric method	0.1	%	Analysis as per Standard Methods

Parameters	Analytical equipment	Standard Method	Methodology	Sensitivity / Detection limit	Units	Remarks
	apparatus					specified
Total Organic Carbon	i)Oven ii)Weighing balance iii)Volumetric apparatus	IS : 2720 (Part 22) - 1972; Methods Manual for Soil Testing, DAC-MOA, GOI	Calculation using Organic matter content	0.1	%	
Cation Exchange Capacity	i) Volumetric apparatus ii) Filtration Assembly	USEPA 1998 SW-846,9080	Ammonium Acetate Method	1.0	meq/ 100g	
Dissolved Analytes	i)Oven ii)Mechanical Shaker iii)Weighing balance iv)Volumetric apparatus	1:10 water extract for dissolved analytes				
Chlorides as Cl^-	Volumetric apparatus	IS 3025 (Part 32) 1988	Argentometric method	5.0	mg/kg	10% Water Extract to be made and analysed as per Standard Methods specified.
Calcium as Ca	Volumetric apparatus	IS 3025 (Part 40) 1991	EDTA Complexometric method	10.0	mg/kg	
Magnesium as Mg	Volumetric apparatus	IS 3025 (Part 46) 1994	By Calculation	10.0	mg/kg	
Sodium as Na	Atomic Absorption Spectrophotometer	IS 3025 (Part 45) 1993	AAS on Emission mode	10.0	mg/kg	
Potassium as K	Atomic Absorption Spectrophotometer	IS 3025 (Part 45) 1993	AAS on Emission mode	10.0	mg/kg	
Sulphates as $SO4^{--}$	UV Visible Spectrophotometer	IS 3025 (Part 24) 1986	Turbidimetric method	10.0	mg/kg	
Total Metals	i)Oven ii)Weighing balance iii) Hot plate iv)Volumetric apparatus	USEPASW846 7000	1:100 acid (HNO_3) digested extract and estimation made on AAS			
Copper as Cu	Atomic Absorption Spectrophotometer	USEPA SW846 7210	Flame Atomic Absorption Spectrophotometry	2.0	mg/kg	1% acid digested sample used for metal analysis. Analysis has been carried out as per USEPA SW 846 methods.
Total Chromium as Cr		USEPA SW846 7190		5.0	mg/kg	
Cobalt as Co		USEPA SW846 7200		5.0	mg/kg	
Cadmium as Cd		USEPA SW846 7130		0.5	mg/kg	
Zinc as Zn		USEPA SW846 7950		0.5	mg/kg	
Lead as Pb		USEPA SW846 7420		10.0	mg/kg	
Nickel as Ni		USEPA SW846 7520		4.0	mg/kg	
Iron as Fe		USEPA SW846 7380		3.0	mg/kg	
Manganese as Mn		USEPA SW846 7460		1.0	mg/kg	

Parameters	Analytical equipment	Standard Method	Methodology	Sensitivity / Detection limit	Units	Remarks
TCLP Metals	i)Oven ii)Weighing balance iii)TCLP Extraction Assembly iv)Filtration Assembly v)Volumetric apparatus	USEPA SW846	1:20 selective buffer extraction and measurement of extracted sample on AAS			
Copper as Cu	Atomic Absorption Spectrophotometer	USEPA SW846 1311 & 7210	Flame Atomic Absorption Spectrophotometry	0.5	mg/L	Buffer extracted sample used for metal analysis. Analysis has been carried out as per USEPA SW 846 methods
Total Chromium as Cr		USEPA SW846 1311 & 7190		1.0	mg/L	
Cobalt as Co		USEPA SW846 1311 & 7200		1.0	mg/L	
Cadmium as Cd		USEPA SW846 1311 & 7130		0.1	mg/L	
Zinc as Zn		USEPA SW846 1311 & 7950		0.4	mg/L	
Lead as Pb		USEPA SW846 1311 & 7420		0.1	mg/L	
Nickel as Ni		USEPA SW846 1311 & 7520		0.2	mg/L	
Iron as Fe		USEPA SW846 1311 & 7380		2.0	mg/L	
Manganese as Mn		USEPA SW846 1311 & 7460		1.0	mg/L	
Exchangeable Cations	i)Oven ii)Mechanical Shaker iii)Weighing balance iv)Volumetric apparatus	Soil is extracted using 1N Ammonium acetate solution in ratio 1:25 (Soil: Ammonium acetate)				
Calcium as Ca	Volumetric apparatus	IS 3025 (Part 40) 1991	EDTA Complexometric method	1.0	meq/ 100g	Ammonium Acetate Extract to be made as per USEPA SW846 9080 and exchangeable cations are analyzed as per Standard Methods specified.
Magnesium as Mg	Volumetric apparatus	IS 3025 (Part 46) 1994	By Calculation	1.0	meq/ 100g	
Sodium as Na	Atomic Absorption Spectrophotometer	IS 3025 (Part 45) 1993	AAS on Emission mode	1.0	meq/ 100g	
Potassium as K	Atomic Absorption Spectrophotometer	IS 3025 (Part 45) 1993	AAS on Emission mode	1.0	meq/ 100g	
Available Nutrients	i) Mechanical Shaker ii) Weighing balance iii) Volumetric apparatus	--				
Available Nitrogen	Volumetric apparatus	Methods Manual for Soil Testing, DAC-MOA, GOI	Subbia & Asija Method; Titrimetric method	3	kg/ha	Alkaline KMnO4 oxidative hydrolysis

Parameters	Analytical equipment	Standard Method	Methodology	Sensitivity / Detection limit	Units	Remarks
Available Potassium as K_2O	Volumetric apparatus	Methods Manual for Soil Testing, DAC-MOA, GOI	Toth & Prince Method; Flame Photometry	10	kg/ha	process 20% Ammonium Acetate Extract
Available Phosphorous as P_2O_5	Flame photometer	Methods Manual for Soil Testing, DAC-MOA, GOI	Bray's OR Olsen's Method; Stannous Chloride Spectrophotometric method	1	kg/ha	10% Bray's Extract for acidic soil OR 5% Sodium Bicarbonate Extract for neutral or alkaline soil

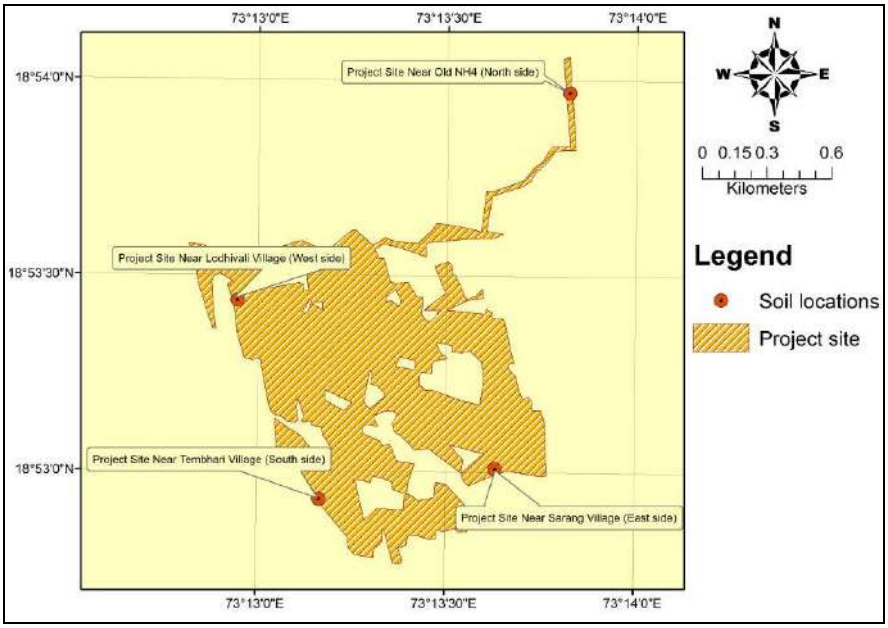

Fig. 3.5: Soil Sampling Locations

Sample No.	Locations
S1	Project Site Near Mandir (North side)
S2	Project Site Near Sarang Village (East side)
S3	Project Site Near Tembhari Village (South side)
S4	Project Site Near Lodhivali Village (West side)

b. Physical Properties of Soil

The physical properties of soil determine the aeration of the soil and the ability of water to infiltrate and to be held in the soil. Color, Bulk density and Water Holding Capacity were analysed as shown below:

Table 3.5 (A): Physical Properties of Soil

No.	Parameter	Result of analysis				Unit
		S1	S2	S3	S4	
1.	Color	Brown	Brown	Brown	Brown	--
2.	Bulk Density	1150	1113	1102	1106	kg/m^3
3.	Water Holding Capacity	42.1	41.1	43.0	45.0	%
4.	Moisture content	1.4	1.8	2.0	1.6	%

c. Chemical Properties of Soil

The collected soil sample were analysed for various chemical parameters. The parameters selected were pH, electrical conductivity, soluble anions and cations, nutrients and organic carbon content.

pH is an important parameter which indicates the alkaline and acidic nature of soil. It regulates the nutrient availability and greatly attacks the microbial population as well as solubility of metal ions. The pH of the soil in the project site is slightly acidic in reaction having pH ranged from 6.2- 6.7. This pH is in the range of 5.5-8.4 which is suitable for most crops. Electrical conductivity ranged from 0.079 to 0.094 mS/cm which is less than 2 mS/cm indicating no salinity problem can be expected in the soil.

The Electrical conductivity (EC) for the soil sample is ranges from 0.079 to 0.094 mS/cm and Cation Exchange Capacity (CEC) is 21.2 meq/100g to 24.7 meq/100g indicating Moderate productivity since the CEC is 21-50 meq/100g, moreover it can be interpreted that the soil has Low productivity and Moderate absorption capacity. Most of the important cations and anions present in soluble salts in the soil are Calcium, Magnesium, Sodium, Potassium, Chloride, Sulphate, Nitrate, Carbonate and bi-carbonate. It was observed that the concentration levels of Calcium and Magnesium were 33 to 83 mg/kg and 30 to 51 mg/kg respectively. Sodium and Potassium concentrations were 20 to 48 mg/kg and 2 to 6 mg/kg respectively. The physico chemical characteristic of soil is presented in **Table 3.5 (B)** and subsequently relationship between CEC-productivity and CEC-absorptivity in **Tables 3.5 (C)** and **3.5 (D)** respectively.

Table 3.5 (B): Chemical Properties of Soil

No.	Parameter	Result of analysis				Unit
		S1	**S2**	**S3**	**S4**	
1.	pH	6.2	6.7	6.4	6.3	--
2.	Electrical Conductivity	0.079	0.089	0.081	0.094	mS/cm
3.	Calcium as Ca^{2+}	33	67	83	33	mg/kg
4.	Magnesium as Mg^{2+}	40	30	40	51	mg/kg
5.	Sodium as Na^{+}	48	20	28	34	mg/kg
6.	Potassium as K^{+}	6	3	2	5	mg/kg
7.	Chloride as Cl^{-}	68	87	78	97	mg/kg
8.	Sulphates as SO_4^{--}	31	56	62	49	mg/kg
9.	Cation Exchange Capacity (NH_4OAc Extract)	24.7	24.2	21.2	24.6	meq/100g

Table 3.5 (C): Relationship of CEC with Productivity

CEC	Range in meq/100g	Productivity	Observed Values
Very low	<10	Very Low	S1: 24.7 meq/100g:This soil represents **Moderate** Productivity S2: 24.2 meq/100g:This soil represents **Moderate** Productivity S3: 21.2 meq/100g: This soil represents **Moderate** Productivity S4: 24.6 meq/100g: This soil represents **Moderate** Productivity
Low	10-20	Low	
Moderate	21-50	Moderate	
High	>50	High	

Table 3.5 (D): Relationship of CEC with Absorptivity

CEC	Range in meq/100g	Absorptivity	Observed Values
Very low	<10	Low or Limited absorption	S1: 24.7 meq/100g: This soil represents Moderate Absorptivity
Low	10-20	Moderate absorption	

CEC	Range in meq/100g	Absorptivity	Observed Values
Moderate	21-30	High absorption	S2: 24.2 meq/100g: This soil represents Moderate Absorptivity S3: 21.2 meq/100g: This soil represents Moderate Absorptivity S3: 24.6 meq/100g: This soil represents Moderate Absorptivity
High	>30	Very High absorption	

d. Exchangeable Cations and Fertility Status of Soil

The concentration levels of available cations in the soil with respect to Calcium, Magnesium, Sodium, and Potassium and fertility status in the form of NPK value, Organic Matter and Organic Carbon are presented in **Table 3.5 (E)**.Organic Matter present in the soil influences the soil's physical and chemical properties. It is also responsible for stability of the soil aggregates. Organic matter was found to be 1.6 to 2.7 % as mentioned in **Table 3.5 (E)** below. On comparison with the classification made as shown in **Tables 3.5 (F) and 3.5 (G)**, it was observed that the fertility status of soils in the project area was found to be poor.

Table 3.5 (E): Nutrient Status of Soil

No.	Parameter	Result of analysis				Unit
		S1	S2	S3	S4	
1	Exchangeable Calcium as Ca^{2+}	12.45	9.96	11.62	13.28	meq/100g
2	Exchangeable Magnesium as Mg^{2+}	10.81	11.64	7.48	9.15	meq/100g
3	Exchangeable Sodium as Na^{+}	1.07	0.70	0.95	0.86	meq/100g
4	Exchangeable Potassium as K^{+}	0.39	0.28	0.50	0.19	meq/100g
5	Organic Matter	2	2.7	2.3	1.6	%
6	Organic Carbon	1.2	1.5	1.3	0.9	%
7	Available Nitrogen	105	121	113	127	kg/ha
8	Available P_2O_5	49	36	72	45	kg/ha
9	Available K_2O	104	98	101	92	kg/ha

Table 3.5(F): Fertility Status Classification

Fertility Status	Organic Carbon (%)	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Poor Soil	<0.5	<280	<23	<133
Medium Fertile Soil	0.5-0.75	280-560	23-57	133-337
Fertile Soil	>0.75	>560	>57	>337

Table 3.5(G): Fertility Status Classification for Soil at Project Site

For Soil Sample 1

Fertility Status	Organic Carbon (%)	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Medium Fertile Soil	1.2	105	49	104

For Soil Sample 2

Fertility Status	Organic Carbon (%)	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Poor Soil	1.5	121	36	98

For Soil Sample 3

Fertility Status	Organic Carbon (%)	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Poor Soil	1.3	113	72	101

For Soil Sample 4

Fertility Status	Organic Carbon (%)	Nitrogen (kg/ha)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Poor Soil	0.9	127	45	92

e. Heavy Metal Content in the Soil

Soil samples were also analyzed for heavy metals such as Chromium, Cadmium, Cobalt, Copper, Lead, Iron, Manganese, Nickel and Zinc. At present, to check the soil contamination there are no specific standards available in India. The only set of standards available for heavy metals is in the Hazardous and Other Wastes (Management and Tran boundary Movement) Rules, 2016. Schedule II of the said rule defines concentration of certain constituents to be labeled as hazardous wastes.

Concentrations of heavy metal present in the soil sample along with comparison of results with Schedule II of Hazardous Wastes are given below

Table 3.5 (H): Heavy Metals in Soil

Sr. No.	Parameter	Result of analysis				Standards	Unit
		S1	S2	S3	S4		
1.	Iron as Fe	BDL	BDL	BDL	BDL	NS	mg/L
2.	Copper as Cu	BDL	BDL	BDL	BDL	25.0	mg/L
3.	Manganese as Mn	BDL	BDL	BDL	BDL	10.0	mg/L
4.	Chromium as Cr	BDL	BDL	BDL	BDL	5.0	mg/L
5.	Cobalt as Co	BDL	BDL	BDL	BDL	80.0	mg/L
6.	Cadmium as Cd	BDL	BDL	BDL	BDL	1.0	mg/L
7.	Zinc as Zn	BDL	BDL	BDL	BDL	250	mg/L
8.	Lead as Pb	BDL	BDL	BDL	BDL	5.0	mg/L
9.	Nickel as Ni	BDL	BDL	BDL	BDL	20.0	mg/L

NS: Not Specified

After detailed assessment of on-site soil for heavy metal contamination, it is concluded that soil in the project area is not contaminated with any eco toxic heavy metals as per rule Hazardous and Other Wastes (Management and Tran boundary Movement) Rules, 2016.

3.2 EXISTING LAND USE OF STUDY AREA

3.2.1 Site Topography and Geographical Location of site:

Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m). The Contour map of the project site is attached in **Enclosure 7.** of this report. The satellite imagery alongwith latitude and longitude is presented in **Figure 3.6**.

Latitude : 18°47'59.819"N to 18°58'51.152"N
Longitude : 73°7'46.196"E to 73°19'7.535"E
Tehsil : Khalapur
District : Raigad
State : Maharashtra

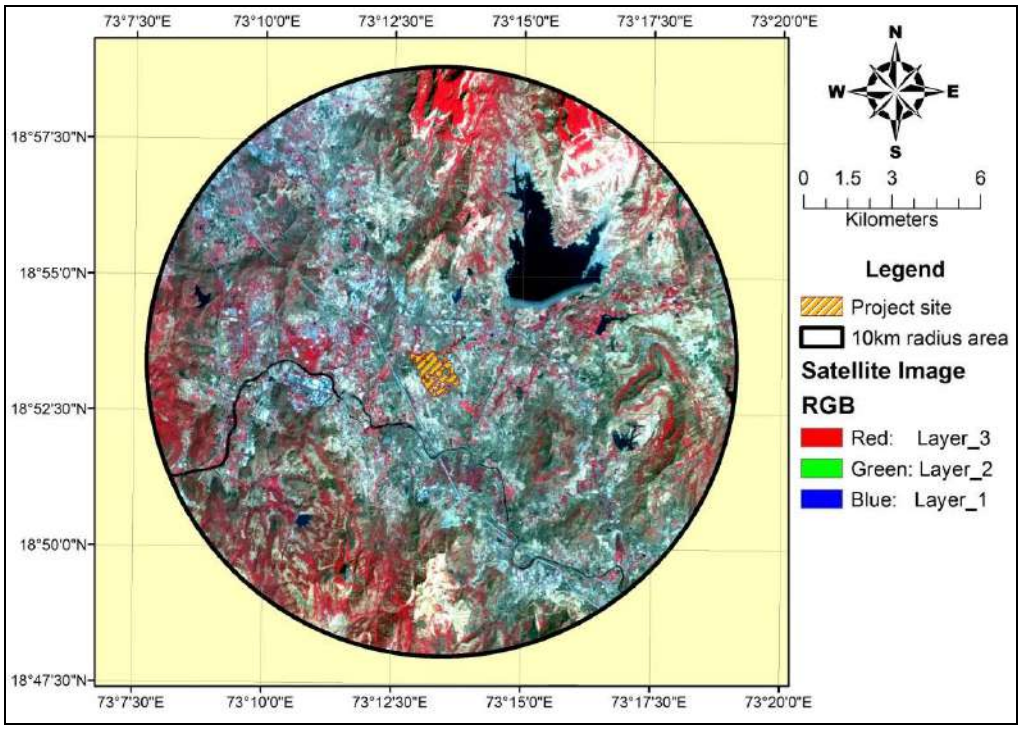

Fig. 3.6: Satellite image of 10 km radius around project site.

3.2.2 Land use/ Land cover Classes Details:

The land use/ land cover classes were identified in total area of 10 Km radius around project site through the satellite imagery as shown in **Figure 3.6** and classified in different features as presented in **Figure 3.7**.The details regarding satellite data procured is as follows:

Data:

Satellite Data: **RESOURCESAT-2** LISS- III cloud free data has been used for Land use / land cover analysis.

Satellite Sensor – **RESOURCESAT-2 LISS**- III Path and Row – Path 94, Row 59

Resolution - 23.5 m. Date of Pass: 5-Jan-2017

The area under each land use/land cover class has been calculated and presented in table below:

Table 3.6: Land use/Land Cover Features of the Study Area (Within 10 km radius from the project site)

No.	LAND USE	AREA (Ha)	AREA (%)
1	**Built-Up Land**		
	Settlements	1292.72	4.11
2	**Water Bodies**		
	Tank/River/Dry Reservoir etc.	934.06	2.97
3	**Vegetation**		
	Vegetation	5773.37	18.33
4	**Crop Land**		
	Irrigated crop land	1319.33	4.19
	Fallow land	4779.48	15.18
5	**Waste Lands**		
	Land with scrub	11946.5	37.95
	Land without scrub	5435.89	17.27
	Total	**31481.4**	**100.00**

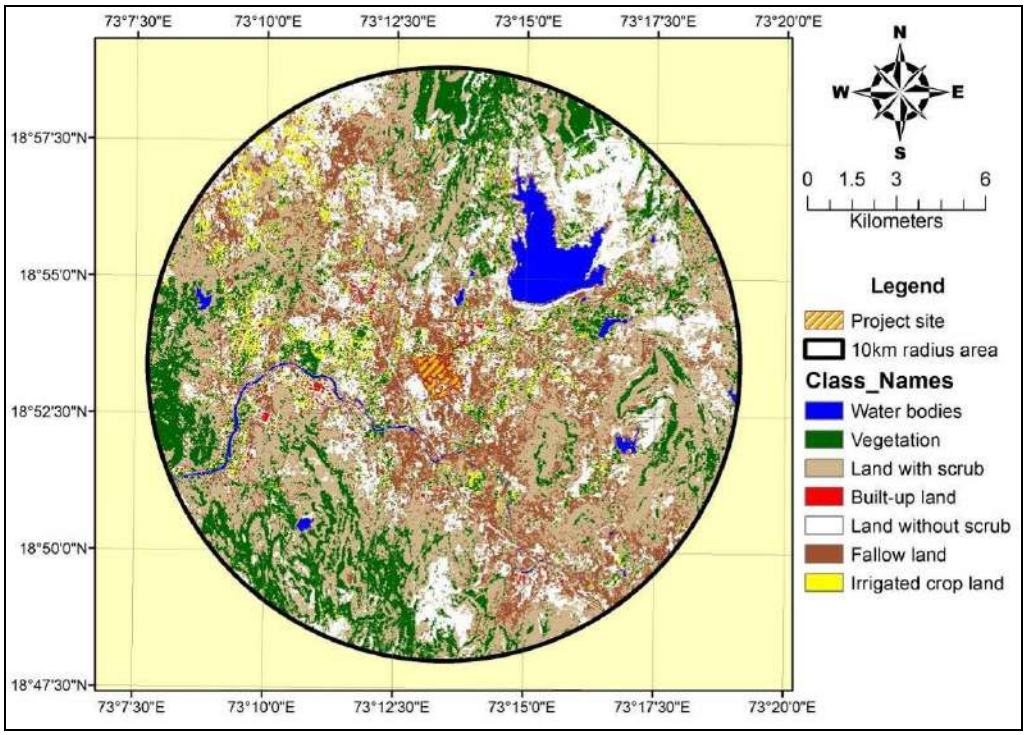

Fig. 3.7.: Land use/land cover of 10 km radius area around project site

Table 3.7: Land use/Land Cover Features of the Study Area
(Within 2 Km radius from the project site)

No.	LAND USE	AREA (Ha)	AREA (%)
1	**Built-Up Land**		
	Settlements/road	187.77	6.46
2	**Water Bodies**		
	Tank/River/Dry Reservoir etc.	40.32	1.39
3	**Vegetation**		
	Vegetation	204.71	7.04
4	**Crop Land**		
	Irrigated crop land	178.04	6.12
	Fallow land	1036.85	35.66
5	**Waste Lands**		
	Land with scrub	667.42	22.95
	Land without scrub	592.7	20.38
	Total	**2907.81**	**100.00**

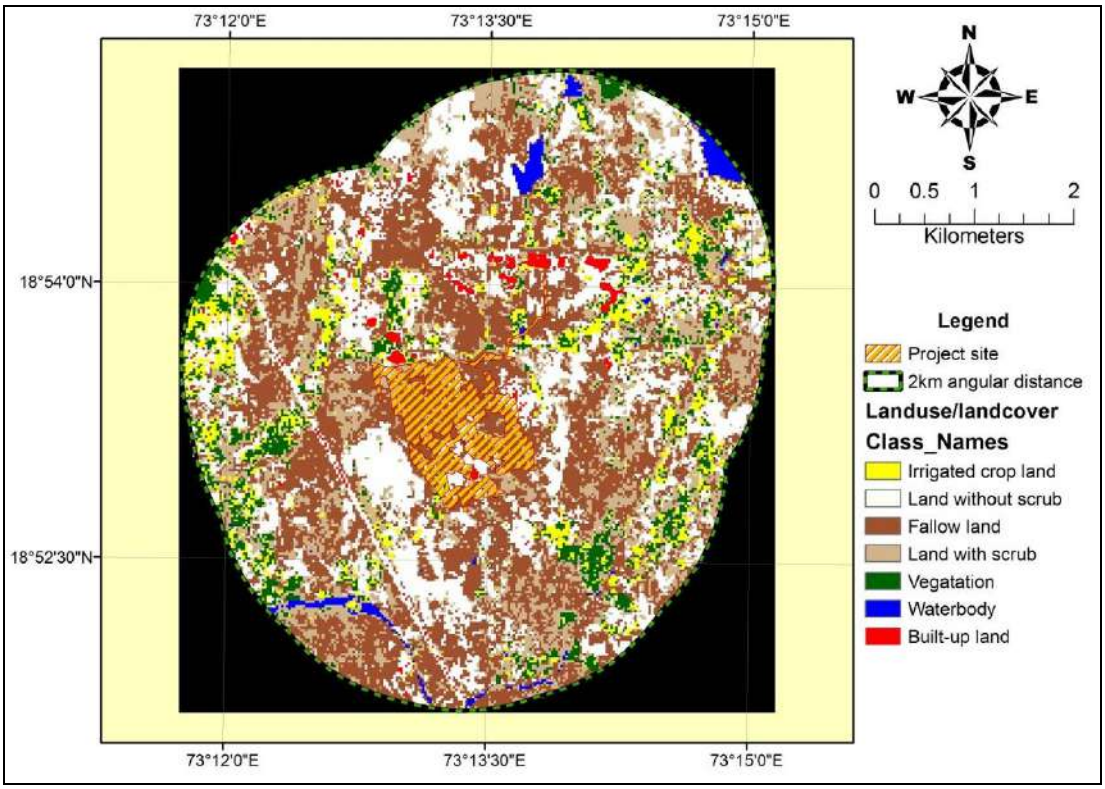

Fig. 3.8: Land use/land cover of 2 km radius area around project site

Table 3.8: Land use/Land Cover Features of the Study Area (Within 500 mt. radius from the project site)

No.	LAND USE	AREA (Ha)	AREA (%)
1	**Built-Up Land**		
	Settlements	42.05	6.32
2	**Water Bodies**		
	Tank/River/Dry Reservoir etc.	0.69	0.1
3	**Vegetation**		
	Vegetation	20.05	3.02
4	**Crop Land**		
	Irrigated crop land	27.47	4.13
	Fallow land	298.03	44.83
5	**Waste Lands**		
	Land with scrub	113.02	17
	Land without scrub	163.53	24.6
	Total	**664.84**	**100**

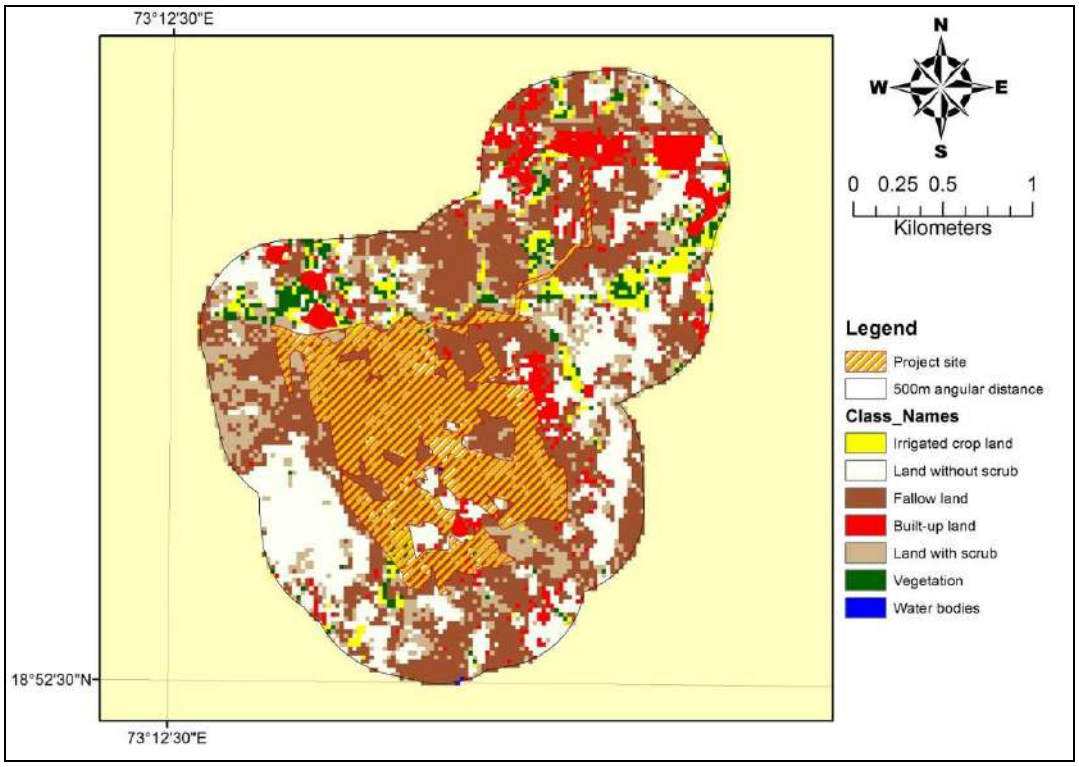

Fig. 3.9: Land use/land cover of 500 mt. radius area around project site

3.2.3 Seismicity

Raigad district sits on a seismically active zone. The area is classified as a Seismic Zone IV region.

3.3 WATER ENVIRONMENT

This section documents the baseline scenario of the water environment in the study area.

3.3.1 Surface water:

The sampling locations of surface water bodies found within study area are tabulated in **Table 3.9**

Table 3.9: Sampling Locations of Surface Water bodies in the study area

Code	Surface Water body	Aerial Distance in km from Plot Boundary	Classes of Water	Table No.
SW1	Nadhal Reservoir	1.00	C	**3.11 (A)**
SW2	Bhilavle Reservoir	4.00	C	**3.11 (A)**
SW3	Morbe Reservoir	2.00	B	**3.11 (B)**
SW4	Jambivali Reservoir	6.00	C	**3.11 (A)**
SW5	Pond (adjacent to plot)	--	B	**3.11 (B)**
SW6	Hatnoli Lake	5.00	E	**3.11 (C)**
SW7	Usran Lake,Rasayani	7.00	C	**3.11 (A)**
SW8	Vinegaon Lake	6.00	B	**3.11 (B)**
SW9	Varne Lake	10.00	B	**3.11 (B)**
SW10	Patalganga River (upstream)	1.30	D	**3.11 (D)**
SW11	Ulhas River Near Khopoli Rd Via Gundage	10.10	A	**3.11 (E)**

Sampling Frequency: Once at each location

Map showing the locations of collection of surface water samples is given below:

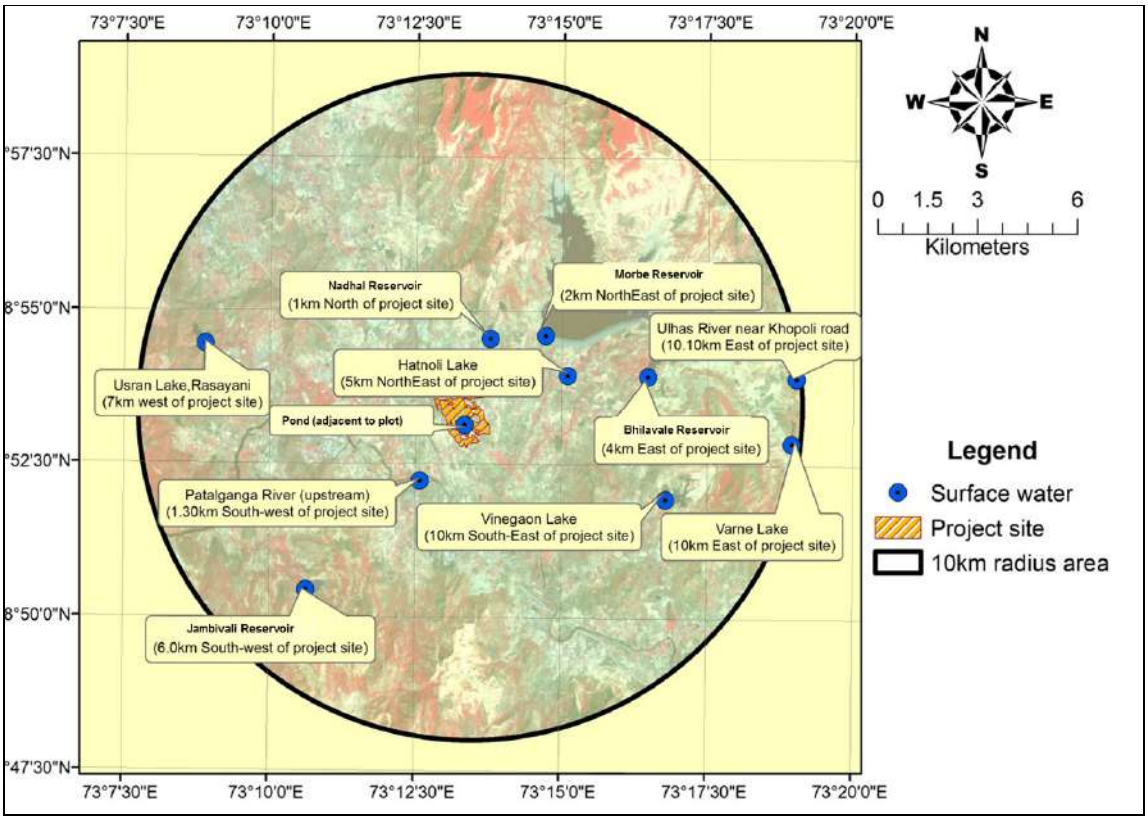

Fig. 3.10: Surface water sampling site map of 10 km radius area around project site

- **Classification of Surface Water Bodies:**

The Classes of the water bodies found in study area are to be defined as per the CPCB guidelines for Designated Best Use Classification of Surface Waters.

Designated best use	Quality Class	Primary Water Quality Criteria
Drinking water source without conventional treatment but with chlorination	A	○ Total coliform organisms (MPN*/100 ml) shall be 50 or less ○ pH between 6.5 and 8.5 ○ Dissolved Oxygen 6 mg/l or more ○ Biochemical Oxygen Demand 2 mg/l or less
Outdoor bathing (organized)	B	○ Total coliform organisms(MPN/100 ml) shall be 500 or less ○ pH between 6.5 and 8.5 ○ Dissolved Oxygen 5 mg/l or more ○ Biochemical Oxygen Demand 3 mg/l or less
Drinking water source with conventional treatment	C	○ Total coliform organisms(MPN/100 ml) shall be 5000 or less ○ pH between 6 and 9 ○ Dissolved Oxygen 4 mg/l or more ○ Biochemical Oxygen Demand 3 mg/l or less
Propagation of wildlife and fisheries	D	○ pH between 6.5 and 8.5 ○ Dissolved Oxygen 4 mg/l or more ○ Free ammonia (as N) 1.2 mg/l or less
Irrigation, industrial cooling, and controlled disposal	E	○ pH between 6.0 and 8.5 ○ Electrical conductivity less than 2250micromhos/cm ○ Sodium Absorption Ratio less than 26 ○ Boron less than 2 mg/l

The results of baseline monitoring of surface water are compared with the standards of Environment (Protection) Rules, 1986, and IS: 2296, 1982.

As per Environment (Protection) Rules, 1986 in a coastal segment, marine water is subjected to several types of uses. Depending on the types of uses and activities, water quality criteria have been specified to determine its suitability for particular purpose. Among the various types of uses there is one use that demands highest level of water quality/purity and that is termed as "designated best use" in that stretch of the coastal segment.

- **Classification of River:**

The river parameters were analyzed, as per CPCB guidelines for water quality monitoring dated 27th December, 2007.

After primary survey and analysis of parameters of surface water i.e. Ulhas River following the classification adopted by IS: 2296 and CPCB, it was found that Ulhas River at this stretch can be classified as Class-A for which best use is for Drinking water source without conventional treatment but with chlorination and Patalganga River at this stretch can be classified as Class-D for which best use is for Propagation of wildlife and fisheries. This classification is also in accordance to CPCB guidelines for Designated Best Use Classification of Surface Waters.

- **Classification of Lake and Reservoir/Pond:**

As per IS: 2296, 1982 the tolerance limits of parameters are specified as per classified use of water depending on various uses of water in India. After analysis of parameters of surface water of as per classification adopted by IS: 2296 and CPCB, it was found that Nadhal Reservoir (S1), Bhilavle Reservoir (S2), Jambivali Reservoir (S4) and Usran Lake (S7) can be classified as Class-C for which best use is for Drinking water source with conventional treatment followed by disinfection. Morbe Reservoir (S3), Pond (adjacent to plot) (S5), Vinegaon Lake (S8) and Varne Lake (S9) can be classified as Class-B for which best use is for Outdoor bathing (organized) and Hatnoli Lake (S6) can be classified as Class-E for which best use is for Irrigation, industrial cooling, and controlled disposal.

Table 3.10: Monitoring methodology of surface water

No.	Parameter	Method Details	Standard Method	Method Detection Limit
A. General				
1	Colour	Pt-Co (Visual Comparison) Method	IS 3025 (Part 04) 1983	5
2	Odour	Manual	IS 3025 (Part 05) 1983	-
3	Temperature	Thermometer	IS 3025 (Part 09) 1984	0.1
4	pH	pH Meter	IS 3025 (Part 11) 1983	0.1
5	Electrical Conductivity	Conductivity Meter	IS 3025 (Part 14) 1984	2
6	Dissolved Oxygen	Azide Modification Method	IS 3025 (Part 38) 1989	0.1
7	Turbidity	Nephelometer	IS 3025 (Part 10) 1984	0.1
8	Total Dissolved Solids	Gravimetry	IS 3025 (Part 16) 1984	5
B. Nutrients				
9	Ammonical Nitrogen as NH_3-N	Titrimetric	IS 3025 (Part 34) 1988	2
10	Nitrite Nitrogen as NO_2-N	Colorimetry	IS 3025 (Part 34) 1988	0.001
11	Nitrate Nitrogen as NO_3-N	Colorimetry	IS 3025 (Part 34) 1988	0.05
12	Total Phosphate as PO_4^{-3}	Colorimetry	APHA, 21st Ed, 2005,4500-P E	0.03
C. Organic Matter				
13	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	DO Consumption in 3 days	IS 3025 (Part 44) 1993	2
14	Chemical Oxygen Demand	Potassium Dichromate Method	IS 3025 (Part 58) 2006	2
D. Major Ions				

No.	Parameter	Method Details	Standard Method	Method Detection Limit
15	Potassium as K	AAS on Emission mode	IS 3025 (Part 45) 1993	0.1
16	Sodium as Na	AAS on Emission mode	IS 3025 (Part 45) 1993	0.1
17	Calcium as Ca	EDTA Titrimetric	IS 3025 (Part 40) 1991	1
18	Magnesium as Mg	EDTA Titrimetric	IS 3025 (Part 46) 1994	1
19	Carbonates as CO_3^{-2}	Titrimetric	IS 3025 (Part 51) 2001	1
20	Bicarbonates as HCO_3^-	Titrimetric	IS 3025 (Part 51) 2001	1
21	Chlorides as Cl^-	Argentometric Titration	IS 3025 (Part 32) 1988	1
22	Sulphates as SO_4^{-2}	Turbidimetry	IS 3025 (Part 24) 1986	1
E. Other Inorganics				
20	Fluoride as F^-	Colorimetry	APHA, 22nd Ed, 2005, 4500-F- D	0.05
21	Boron as B	Curcumin Method	APHA, 22nd Ed, 2012, 4500-B B	0.1
F. Microbiological				
22	Total *coliform*	Multiple Tube Fermentation technique	IS 1622 : 1981	2
23	*Fecal coliform*	Multiple Tube Fermentation technique	IS 1622 : 1981	2

Analysis results for environmental parameters of the surface water bodies are given below:

Table: 3.11 (A). Analysis Results of Water Quality of Nadhal Reservoir (SW1), Bhilavle Reservoir (SW2), Jambivali Reservoir (SW4) and Usran Lake (SW7)

No.	Parameter	Results of Analysis of				Standards IS:2296, Class-C	Unit
		SW1	SW2	SW4	SW7		
A. General							
1.	Colour	BDL	BDL	BDL	BDL	300	Hazen
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	No offensive odor	-
3.	Temperature	27.6	27.7	27.9	27.7	NS	^{0}C
4.	pH	7.7	7.8	8.2	8.1	6.5-8.5	-
5.	Electrical Conductivity	163	159	138	142	NS	µS/cm
6.	Turbidity	1.4	1.4	1.3	1.4	NS	NTU
7.	Dissolved Oxygen	6.0	6.0	5.8	6.0	4.0 mg/l	mg/L
8.	Total Dissolved Solids	106	102	90	92	1500 mg/l	mg/L
B. Nutrients							
9.	Ammonical Nitrogen as NH_3-N	BDL	BDL	BDL	BDL	NS	mg/L
10.	Nitrite Nitrogen as NO_2-N	BDL	BDL	BDL	BDL	NS	mg/L
11.	Nitrate Nitrogen as NO_3-N	0.43	1.06	0.24	0.36	50	mg/L
12.	Total Phosphate as PO_4^{-3}	0.03	BDL	0.07	0.06	NS	mg/L
C. Organic Matter							
13.	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	BDL	BDL	BDL	BDL	3	mg/L
14.	Chemical Oxygen Demand	8	8	16	8	NS	mg/L
D. Major Ions							
15.	Potassium as K	1.1	1.0	1.0	0.9	NS	mg/L
16.	Sodium as Na	4.6	5.7	4.1	4.9	NS	mg/L
17.	Calcium as Ca	13	15	14	13	NS	mg/L
18.	Magnesium as Mg	12	9	7	8	NS	mg/L
19.	Carbonates as CO_3^{-2}	BDL	BDL	BDL	BDL	NS	mg/L
20.	Bicarbonates as HCO_3^-	80	76	72	63	NS	mg/L
21.	Chlorides as Cl^-	8	9	6	8	600	mg/L
22.	Sulphates as SO_4^{-2}	16	13	8	14	400 mg/l	mg/L
E. Other Inorganics							
23.	Fluoride as F^-	0.40	0.42	0.29	0.62	1.5 mg/l	mg/L
24.	Boron as B	0.3	0.4	0.4	0.3	NS	mg/L

No.	Parameter	Results of Analysis of				Standards IS:2296, Class-C	Unit
		SW1	SW2	SW4	SW7		
F. Microbiological							
25.	Total *coliform*	1600	900	900	1600	5000/100 ml (MPN)	MPN/100ml
26.	*Fecal coliform*	23	14	70	26	NS	MPN/100ml
NS-Not Specified BDL-Below Detectable Limit, MPN-Most Probable Number # *: The detection limit for Carbonates is applicable when pH > 8.3; for pH<8.3 the carbonates are zero*							

Presentation of Water Quality analysis of Nadhal Reservoir (SW1), Bhilavle Reservoir (SW2), and Jambivali Reservoir (SW4), and Usran Lake (SW7):

- The pH of all Lakes is within notified standards
- BOD found within limit
- Dissolved Oxygen in water, which is essential for respiration of aquatic plants and animals was found adequate.
- TDS is also found within standards for all locations

Table: 3.11 (B). Analysis Results of Water Quality of Morbe Reservoir (SW3), Pond (Adjacent to plot) (SW5), Vinegaon Lake (SW8) and Varne Lake (SW9)

No.	Parameter	Results of Analysis of				Standards IS:2296, Class-B	Unit
		SW3	SW5	SW8	SW9		
A. General							
1.	Colour	BDL	BDL	BDL	BDL	300	Hazen
2.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	No offensive odor	-
3.	Temperature	27.4	27.4	27.6	27.4	NS	^{0}C
4.	pH	7.7	8.1	8.2	8.2	6.5-8.5	-
5.	Electrical Conductivity	114	225	126	142	NS	µS/cm
6.	Turbidity	1.2	2.4	2.1	1.2	NS	NTU
7.	Dissolved Oxygen	5.9	5.6	5.8	6.0	5.0 mg/l	mg/L
8.	Total Dissolved Solids	74	146	92	82	NS	mg/L
B. Nutrients							
9.	Ammonical Nitrogen as NH_3-N	BDL	BDL	BDL	BDL	NS	mg/L
10.	Nitrite Nitrogen as NO_2-N	<0.001	<0.001	<0.001	<0.001	NS	mg/L
11.	Nitrate Nitrogen as NO_3-N	0.74	0.71	0.47	0.34	NS	mg/L
12.	Total Phosphate as PO_4^{-3}	0.07	0.11	0.07	<0.03	NS	mg/L

No.	Parameter	Results of Analysis of				Standards IS:2296, Class-B	Unit
		SW3	SW5	SW8	SW9		
C. Organic Matter							
13.	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	<2	2.8	<2	<2	3	mg/L
14.	Chemical Oxygen Demand	12	28	20	8	NS	mg/L
D. Major Ions							
15.	Potassium as K	1.2	4.2	0.8	0.9	NS	mg/L
16.	Sodium as Na	6.1	19.5	3.8	4.1	NS	mg/L
17.	Calcium as Ca	8	15	11	15	NS	mg/L
18.	Magnesium as Mg	7	8	8	7	NS	mg/L
19.	Carbonates as CO_3^{-2}	<1	<1	<1	<1	NS	mg/L
20.	Bicarbonates as HCO_3^-	43	68	72	75	NS	mg/L
21.	Chlorides as Cl^-	10	30	6	6	NS	mg/L
22.	Sulphates as SO_4^{-2}	13	21	5	6	NS	mg/L
E. Other Inorganics							
23.	Fluoride as F^-	0.36	0.54	0.49	0.36	1.5 mg/l	mg/L
24.	Boron as B	0.3	0.2	0.5	0.2	NS	mg/L
F. Microbiological							
25.	Total *coliform*	350	500	240	140	500/100 ml (MPN)	MPN/100ml
26.	*Fecal coliform*	4	8	13	<2	NS	MPN/100ml
NS-Not Specified BDL-Below Detectable Limit, MPN-Most Probable Number *# : The detection limit for Carbonates is applicable when pH > 8.3; for pH<8.3 the carbonates are zero*							

Presentation of Water Quality analysis of Morbe Reservoir (SW3), Pond (Adjacent to plot) (SW5), Vinegaon Lake (SW8) and Varne Lake (SW9):

- The pH of all sampling location is within notified standards
- BOD level is found within notified standards
- Dissolved Oxygen in water, which is essential for respiration of aquatic plants and animals was found adequate as compared to standards

Table: 3.11 (C). Analysis Results of Water Quality of Hatnoli Lake (SW6)

No.	Parameter	Hatnoli Lake (SW6)	Standards IS:2296, Class-E	Unit
A. General				
1.	Colour	15	NS	Hazen
2.	Odour	Disagreeable	NS	-
3.	Temperature	27.5	NS	^{0}C
4.	pH	6.4	6.0-8.5	-
5.	Electrical Conductivity	265	2250	µS/cm
6.	Dissolved Oxygen	5.1	NS	mg/L
7.	Turbidity	8.9	NS	NTU
8.	Total Dissolved Solids	172	2100	mg/L
B. Nutrients				
9.	Ammonical Nitrogen as NH_3-N	5	NS	mg/L
10.	Nitrite Nitrogen as NO_2-N	BDL	NS	mg/L
11.	Nitrate Nitrogen as NO_3-N	2.43	NS	mg/L
12.	Total Phosphate as PO_4^{-3}	3.24	NS	mg/L
C. Organic Matter				
13.	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	14	NS	mg/L
14.	Chemical Oxygen Demand	164	NS	mg/L
D. Major Ions				
15.	Potassium as K	3.2	NS	mg/L
16.	Sodium as Na	31.2	NS	mg/L
17.	Calcium as Ca	17	NS	mg/L
18.	Magnesium as Mg	8	NS	mg/L
19.	Carbonates as CO_3^{-2}	BDL	NS	mg/L
20.	Bicarbonates as HCO_3^-	65	NS	mg/L
21.	Chlorides as Cl^-	53	600	mg/L
22.	Sulphates as SO_4^{-2}	15	1000	mg/L
E. Other Inorganics				
23.	Fluoride as F^-	0.78	NS	mg/L
24.	Boron as B	0.6	2	mg/L
F. Microbiological				
25.	Total *coliform*	>1600	NS	MPN/100ml

No.	Parameter	Hatnoli Lake (SW6)	Standards IS:2296, Class-E	Unit
26.	*Fecal coliform*	130	NS	MPN/100ml
# *: The detection limit for Carbonates is applicable when pH > 8.3; for pH<8.3 the carbonates are zero.*				

Presentation of Water Quality analysis of Hatnoli Lake (SW6):

- The pH of all sampling location is within notified standards
- Presence of high level BOD shows pollution of water body

Table: 3.11 (D). Analysis Results of Water Quality of Patalganga River (SW10)

No.	Parameters	Results of Analysis Patalganga River (SW10)	Standards IS:2296, Class-D	Units
A. General				
1.	Color	<5	NS	Hazen
2.	Odor	Agreeable	NS	-
3.	Temperature	27.1	NS	^{0}C
4.	pH	6.6	6.5 – 8.5	-
5.	Electrical Conductivity	98	1000	µS/cm
6.	Dissolved Oxygen	7.5	4.0	mg/L
7.	Turbidity	1.2	NS	NTU
8.	Total Dissolved Solids	64	NS	mg/L
B. Nutrients				
9.	Ammonical Nitrogen as NH_3-N	<2	NS	mg/L
10.	Nitrite Nitrogen as NO_2-N	<0.001	NS	mg/L
11.	Nitrate Nitrogen as NO_3-N	2.24	NS	mg/L
12.	Total Phosphate as PO_4^{-3}	0.19	NS	mg/L
C. Organic Matter				
13.	Biological Oxygen Demand @ 27 ^{0}C, 3 days	20	NS	mg/L
14.	Chemical Oxygen Demand	64	NS	mg/L
D. Major Ions				
15.	Potassium as K	1.2	NS	mg/L
16.	Sodium as Na	6.8	NS	mg/L
17.	Calcium as Ca	8	NS	mg/L
18.	Magnesium as Mg	4	NS	mg/L

No.	Parameters	Results of Analysis Patalganga River (SW10)	Standards IS:2296, Class-D	Units
19.	Carbonates as CO_3^{-2}	<1	NS	mg/L
20.	Bicarbonates as HCO_3^-	33	NS	mg/L
21.	Chlorides as Cl^-	11	NS	mg/L
22.	Sulphates as SO_4^{-2}	9	NS	mg/L
E. Other Inorganics				
23.	Fluoride as F^-	0.32	NS	mg/L
24.	Boron as B	0.20	NS	mg/L
F. Microbiological				
25.	Total *coliform*	1600	NS	MPN/100 ml
26.	*Fecal coliform*	34	NS	MPN/100 ml

Presentation of Water Quality analysis of Patalganga River (SW10):

- The pH of all sampling location is within notified standards
- Presence of high level BOD shows pollution of water body

Table: 3.11 (E). Analysis Results of Water Quality of Ulhas River (SW11)

No.	Parameter	Results of Analysis of Ulhas River (SW11)	Standards IS:2296, Class-A	Detection Limit	Unit
A. General					
1.	Colour	BDL	10	5	Hazen
2.	Odour	Agreeable	Unobjectionable	-	-
3.	Temperature	28.5	NS	0.1	^0C
4.	pH	7.2	6.5-8.5	0.1	-
5.	Electrical Conductivity	220	NS	2	µS/cm
6.	Turbidity	1.3	NS	0.1	NTU
7.	Dissolved Oxygen	5.9	6.0 mg/l	0.1	mg/L
8.	Total Dissolved Solids	132	500 mg/l	5	mg/L
B. Nutrients					
9.	Ammonical Nitrogen as NH_3-N	BDL	NS	2	mg/L
10.	Nitrite Nitrogen as NO_2-N	<0.001	NS	0.001	mg/L
11.	Nitrate Nitrogen as NO_3-N	3.9	NS	0.05	mg/L
12.	Total Phosphate as PO_4^{-3}	0.12	NS	0.03	mg/L

No.	Parameter	Results of Analysis of Ulhas River (SW11)	Standards IS:2296, Class-A	Detection Limit	Unit
C. Organic Matter					
13.	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	BDL	2.0	2	mg/L
14.	Chemical Oxygen Demand	8	NS	2	mg/L
D. Major Ions					
15.	Potassium as K	2.0	NS	0.1	mg/L
16.	Sodium as Na	8.0	NS	0.1	mg/L
17.	Calcium as Ca	12	200	1	mg/L
18.	Magnesium as Mg	20	100 mg/l	1	mg/L
19.	Carbonates as CO_3^{-2}	BDL	NS	1$^{\#}$	mg/L
20.	Bicarbonates as HCO_3^-	106	NS	1	mg/L
21.	Chlorides as Cl^-	18	250 mg/l	1	mg/L
22.	Sulphates as SO_4^{-2}	17	400 mg/l	1	mg/L
E. Other Inorganics					
23.	Fluoride as F^-	BDL	1.5 mg/l	0.05	mg/L
24.	Boron as B	BDL	NS	0.1	mg/L
F. Microbiological					
25.	Total *coliform*	26	50/100 ml (MPN)	2	MPN/100ml
26.	*Fecal coliform*	4	NS	2	MPN/100ml
NS-Not Specified BDL-Below Detectable Limit, MPN-Most Probable Number *# : The detection limit for Carbonates is applicable when pH > 8.3; for pH<8.3 the carbonates are zero*					

Presentation of Water Quality analysis of Ulhas River (SW11):

- The pH of all sampling locations is within notified standards
- BOD level is found within notified standards.
- Dissolved Oxygen in water, which is essential for respiration of aquatic plants and animals was found adequate as compared to standards

3.3.2 Ground Water:

Total 2 Ground water samples were collected from project site. The parameters selected for analysis of ground water are based on the guidelines given by Central pollution Control Board (CPCB) for ground water bodies (Ref: Guidelines for Water Quality Monitoring by CPCB, Refer to Table 1, Pg- 14) The results are compared with the standard IS 10500, 2012.

Table 3.12: Ground Water Sampling Locations

Code	Ground water sampling locations
GW1	At Project site near old NH4
GW2	At Project site near Mandir

Sampling Frequency: Once at each location

Map showing the locations of collection of Ground water samples is given below:

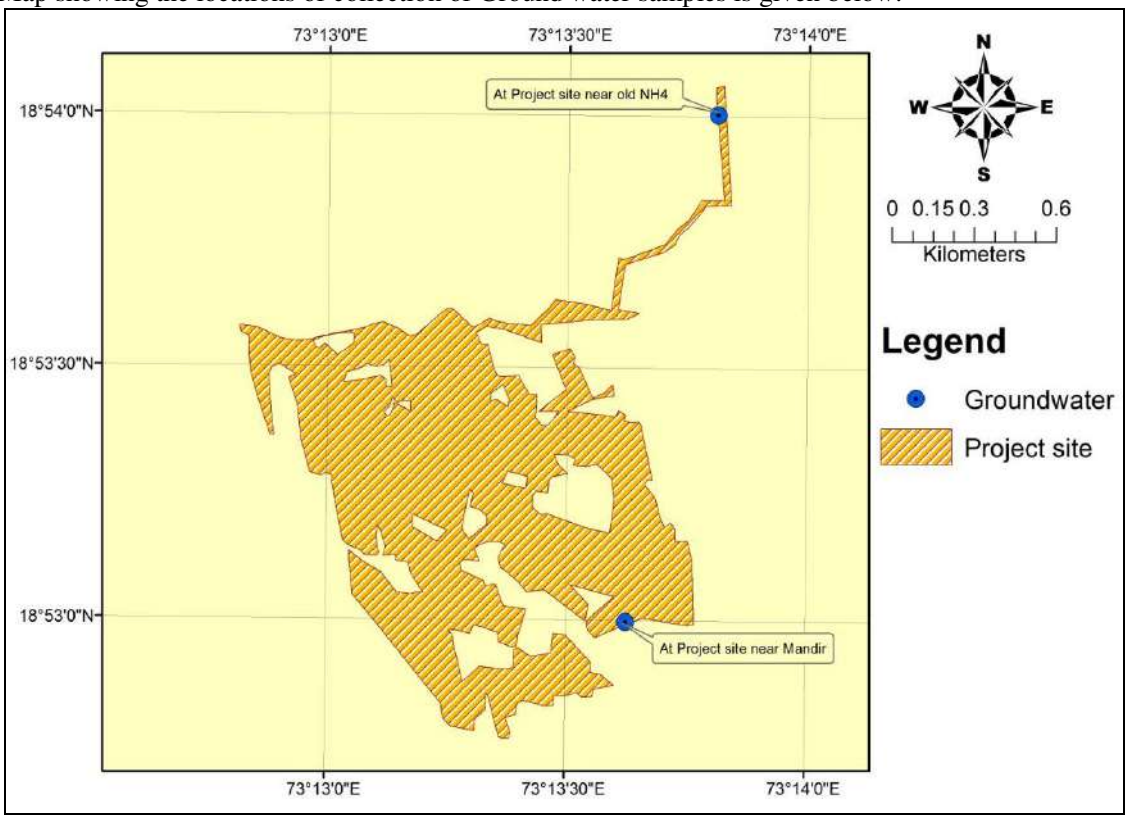

Fig. 3.11: Ground water sampling site map within project site

The parameters selected for analysis of ground water are based on the guidelines given by Central pollution Control Board (CPCB) for ground water bodies (Ref: Guidelines for Water Quality Monitoring by CPCB, Refer to Table 1, Pg-14) The results are compared with the standard IS 10500, 2012.

Table 3.13: Monitoring methodology of Ground water

No.	Parameter	Method Details	Standard Method	Method Detection Limit
A. General				
1	Colour	Pt-Co (Visual Comparison) Method	IS 3025 (Part 04) 1983	5
2	Odour	Manual	IS 3025 (Part 05) 1983	-
3	Temperature	Thermometer	IS 3025 (Part 09) 1984	0.1
4	pH	pH Meter	IS 3025 (Part 11) 1983	0.1
5	Electrical Conductivity	Conductivity Meter	IS 3025 (Part 14) 1984	2
6	Dissolved Oxygen	Azide Modification Method	IS 3025 (Part 38) 1989	0.1

No.	Parameter	Method Details	Standard Method	Method Detection Limit
7	Turbidity	Nephelometer	IS 3025 (Part 10) 1984	0.1
8	Total Dissolved Solids	Gravimetry	IS 3025 (Part 16) 1984	5
B. Nutrients				
9	Ammonical Nitrogen as NH_3-N	Titrimetric	IS 3025 (Part 34) 1988	2
10	Nitrite Nitrogen as NO_2-N	Colorimetry	IS 3025 (Part 34) 1988	0.001
11	Nitrate Nitrogen as NO_3-N	Colorimetry	IS 3025 (Part 34) 1988	0.05
12	Total Phosphate as PO_4^{-3}	Colorimetry	APHA, 21st Ed, 2005,4500-P E	0.03
C. Organic Matter				
13	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	DO Consumption in 3 days	IS 3025 (Part 44) 1993	2
14	Chemical Oxygen Demand	Potassium Dichromate Method	IS 3025 (Part 58) 2006	2
D. Major Ions				
15	Potassium as K	AAS on Emission mode	IS 3025 (Part 45) 1993	0.1
16	Sodium as Na	AAS on Emission mode	IS 3025 (Part 45) 1993	0.1
17	Calcium as Ca	EDTA Titrimetric	IS 3025 (Part 40) 1991	1
18	Magnesium as Mg	EDTA Titrimetric	IS 3025 (Part 46) 1994	1
19	Carbonates as CO_3^{-2}	Titrimetric	IS 3025 (Part 51) 2001	1
20	Bicarbonates as HCO_3^-	Titrimetric	IS 3025 (Part 51) 2001	1
21	Chlorides as Cl^-	Argentometric Titration	IS 3025 (Part 32) 1988	1
22	Sulphates as SO_4^{-2}	Turbidimetry	IS 3025 (Part 24) 1986	1
E. Other Inorganics				
20	Fluoride as F^-	Colorimetry	APHA, 22nd Ed, 2005, 4500-F- D	0.05
21	Boron as B	Curcumin Method	APHA, 22nd Ed, 2012, 4500-B B	0.1
F. Microbiological				
22	Total *coliform*	Multiple Tube Fermentation technique	IS 1622 : 1981	2
23	*Fecal coliform*	Multiple Tube Fermentation technique	IS 1622 : 1981	2

Analysis results for environmental parameters of the ground water are given in **Table 3.14**

Table 3.14: Ground Water Analysis Report

No.	Parameter	GW1	GW2	Standard IS:10500, 2012		Unit
				Acceptable	Permissible	
A. General						
1.	Color	BDL	BDL	5.0	15	Hazen
2.	Odor	Agreeable	Agreeable	Agreeable	Agreeable	-
3.	Temperature	27.3	26.9	NS	NS	^{0}C
4.	pH	7	7.2	6.5-8.5	No relaxation	-
5.	Electrical Conductivity	1206	351	NS	NS	µS/cm
6.	Turbidity	2.3	2.1	1	5	NTU
7.	Total Dissolved Solids	784	228	500	2000	mg/L
8.	Dissolved Oxygen	5.7	5.6	NS	NS	mg/L
B. Nutrients						
9.	Ammonical Nitrogen as NH_3-N	<2	<2	NS	NS	mg/L
10.	Nitrite Nitrogen as NO_2-N	<0.001	<0.001	NS	NS	mg/L
11.	Nitrate Nitrogen as NO_3-N	3.93	4.52	45	No relaxation	mg/L
12.	Total Phosphate as PO_4^{-3}	0.66	0.20	NS	NS	mg/L

No.	Parameter	GW1	GW2	Standard IS:10500, 2012		Unit
				Acceptable	Permissible	
C. Organic Matter						
13.	Biochemical Oxygen Demand @ 27 ^{0}C, 3 days	<2	<2	NS	NS	mg/L
14.	Chemical Oxygen Demand	20	4	NS	NS	mg/L
D. Major Ions						
11	Potassium as K	8.5	3.1	NS	NS	mg/L
12	Sodium as Na	134.2	27	NS	NS	mg/L
13	Calcium as Ca	78	28	75	200	mg/L
14	Magnesium as Mg	37	12	30	100	mg/L
15	Carbonates as CO_3^{-2}	BDL	BDL	NS	NS	mg/L
16	Bicarbonates as HCO_3^-	291	113	NS	NS	mg/L
17	Chlorides as Cl^-	207	42	250	1000	mg/L
18	Sulphates as SO_4^{-2}	84	26	200	400	mg/L
E. Other Inorganics						
19	Fluoride as F^-	0.64	BDL	1.0	1.5	mg/L
20	Boron as B	0.5	BDL	0.5	1.0	mg/L
21	Total coliform	500	26	NS	NS	MPN./100ml
22	Faecal coliform	8	4	NS	NS	MPN./100ml

BDL: *Below Detection Limit,* NS-Not Specified

$^{\#}$ *: The detection limit for Carbonates is applicable when pH > 8.3; for pH<8.3 the carbonates are zero*

Presentation of Ground Water Quality Status:

After tabular representation of important parameters of ground water quality it can be observed that:

- pH of water samples were within the acceptable range
- Total Dissolved Solids (TDS) found be within the permissible range
- Chloride and Sulphate is within the acceptable range.

3.4 AIR ENVIRONMENT :

3.4.1 Climate

The climate of this district is typical of that on the west coast of India, with plentiful and regular seasonable rainfall, oppressive weather in the hot months and high humidity throughout the year. The summer season from March to May is followed by the south-west monsoon season from June to September. October and November form the post-monsoon or the retreating monsoon season. The period from December to February is the cold season.

3.4.2 Humidity

The air is humid throughout the year. Relative humidity is on an average over 80 per cent during the south-west monsoon season. In the rest of the year the relative humidity is between 65 per cent and 75 per cent.

3.4.3 Rainfall

The south-west monsoon commences by about the first week of June and the rains continue till about the beginning of October. The average annual rainfall for the district as a whole is 3,028.9 mm. (119.25"). On an average there are 88 rainy days (that is days on which the rainfall is 2.5 mm.-10 cents-or more) in year.

3.4.4 Cloud Cover

During the South-West monsoon months the skies are generally heavily clouded or overcast. In May and October the clouding is moderate. Clear or very lightly clouded skies are common in the rest of the year. Cloudiness decreases after the withdrawal of the South-West monsoon towards the end of September. During the period December to March clear or lightly clouded skies prevail generally. Later cloudiness increases with the progress of the season.

3.4.5 Winds

Winds are very strong and blow from west or south-west during monsoon season. During the period from October to December winds are generally moderate but sometimes strong in October and blow from directions between north-east and south-east. In the three months from January to March the winds continue to be moderate and are predominantly from directions between north and east. In April while there is a slight strengthening of wind, the direction is variable. In May there is a further strengthening of winds and the directions are between south-west and north-west.

Source: http://raigad.nic.in/dg/1964/gen_climate.html

3.4.6 Meteorology

Metrological Data from October 2016 to December 2016 received from IMD Alibaug.
The parameters for which data have been collected are:

- Wind speed
- Wind direction
- Temperature
- Relative humidity

Table 3.15: Meteorological data for the year 2016

Study Period	Temp (^{0}C)		Wind 0830 Hrs		Wind 1730 Hrs		Relative Humidity(%)	
	Max.	Min	Dir.	Speed (Km)	Dir.	Speed (Km)	Max	Min.
October	34.3	19.5	ENE	5	SSW	11	87	80
November	36.5	17.2	ENE	005	NW	008	79	64
December	35.0	17.0	E	006	NW	008	79	68

The prevailing wind direction at site is shown through following wind roses prepared for 3 months of the year 2016 is as follows:

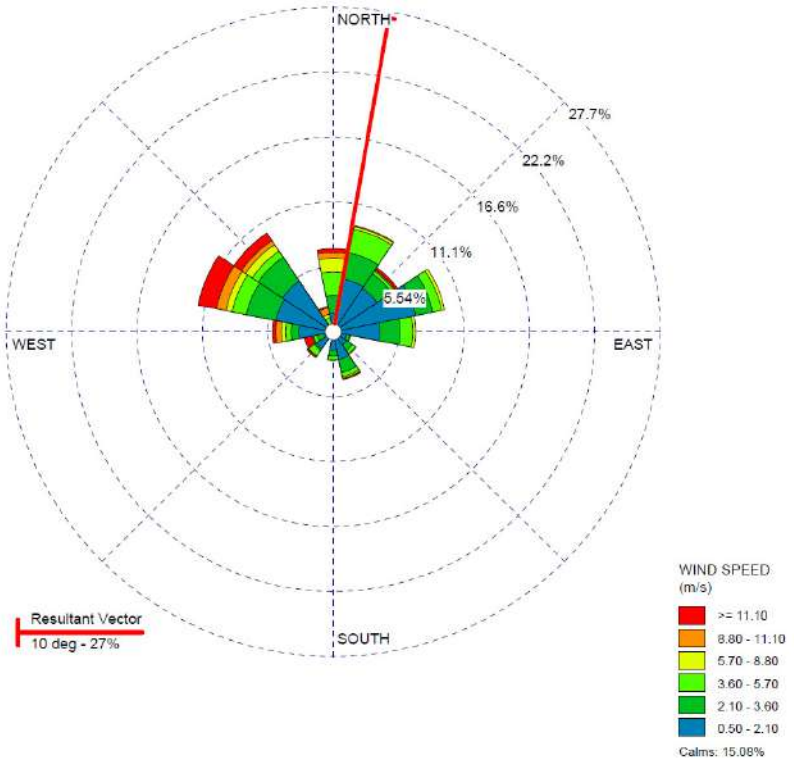

Fig. 3.12: Windrose diagram for October to December 2016

3.4.7 Ambient Air Quality:

An assessment of baseline air quality was undertaken to establish the status of exposure of the major sensitive receptors and to assess the background air quality at the project location.

Season and Period of Monitoring
The ambient air monitoring was carried out in March 2016 to May 2016.

Selected Sampling Locations
The locations for Ambient Air Quality Monitoring were decided based on the guidelines given in the Guidance Manual for Township and Area development projects approved by MoEF and as explained in **Table 3.16.** For this EIA, the purpose is to ascertain the baseline pollutant concentrations in ambient air at project site and nearby areas.

Locations selected for ambient air quality monitoring are presented in **Table 3.16**

Table 3.16: Ambient air quality monitoring location details

Station Code	Description	Distance from project site
AAQM-1	Project Site	--
AAQM-2	Near Zilla Parishad School Behind Vitthal Rukmini Temple At Pali khurd Village	560 mt.
AAQM-3	Near Saint Gora Kumbhar Temple Opposite to Tupagaon Bus Stop, Tupgaon	746 mt.
AAQM-4	Near Jaiganesh Hardware Opp to Samarth Krupa Chawl, Ris Kamba Village Dand Apta Road	1600 mt.
AAQM-5	Near Ram Mandir at Village Entrance, Varosewadi Village North side	800 mt.

Station Code	Description	Distance from project site
AAQM-6	Near Vayal Pumping Station (NMMC), Vayal Village	1500 mt.
AAQM-7	Near Vitthal Rukhmini Temple, Tembhri Gaon	406 mt.

Map showing the locations of ambient air quality monitoring is given below.

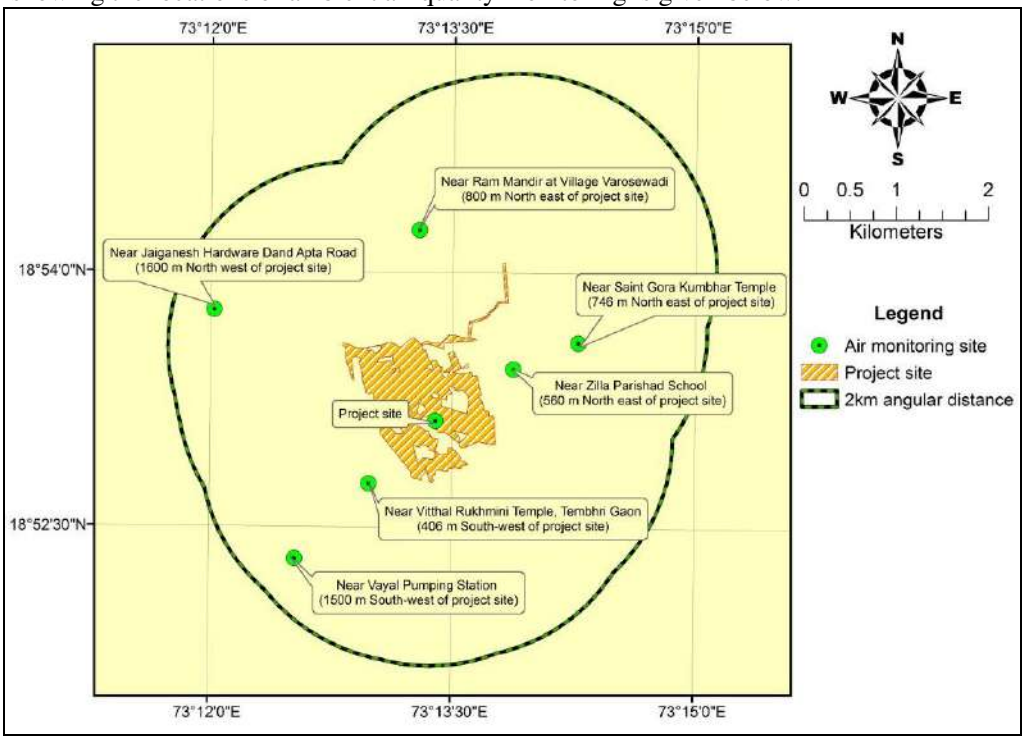

Fig. 3.13: Air monitoring site map of 2Km radius area around project site

- **Sampling Frequency**

The frequency of monitoring was 24 hrs twice a week at each station spread over the season except for CO which was 1 hr twice a month.

- **Parameters Monitored and Methods Used**

The parameters monitored were Respirable Suspended Particulate Matter (RSPM), Sulphur Dioxide (SO_2), Nitrogen Oxides (NOx) and CO. The detailed monitoring methodology for ambient air is given in **Table 3.17**

Table 3.17: Methodology of Ambient Air Monitoring

Sampling Parameters	Sampling Frequency	Sample collection		Sample Analysis		Methodology
		Sampling equipment	Sensitivity / Detection Limit	Analytical Equipment	Sensitivity/ Detection Limit	
RSPM (PM_{10}, $PM_{2.5}$), SO_2, NOx	24 hrs twice a week at each station	RSPM (PM_{10}), Respirable Dust Sampler	10 µg/m^3	RSPM (PM_{10}), Monopan Balance	0.0001mg	Gravimetric (HVS) IS : 5182 (Part 23) : 2006 (through Cyclonic flow Technique)
		RSPM ($PM_{2.5}$), Fine Dust Sampler	2.5 µg/m^3	Monopan Balance	0.0001g	Gravimetric Method – NAAQS Monitoring & Analysis Guidelines Volume 1 By CPCB

Sampling Parameters	Sampling Frequency	Sample collection		Sample Analysis		Methodology
		Sampling equipment	Sensitivity / Detection Limit	Analytical Equipment	Sensitivity/ Detection Limit	
		SO_2: Rotameter for measurement of air flow	05 µg/m^3	SO_2: Spectrophotometer	-	IS : 5182 (Part 2) : 2001
		NO_x: Rotameter for measurement of air flow	05 µg/m^3	NO_x: Spectrophotometer	-	IS : 5182 (Part 6) : 2006
CO	1hrs twice a month at each station	Gas Bladder	--	NDIR Spectroscopy	< 0.05 ppm	IS : 5182 (Part 10) : 1999 Non Dispersive Infra Red (NDIR) Spectroscopy

- **Results of Ambient Air Monitoring**

Results of Ambient Air monitoring are given in **Table 3.18**

Table 3.18: Ambient Air Quality around the Project Site
Period: March 2016 to May 2016

Station Code	Location of AAQM Station	$PM_{2.5}$(24 hr) (µg/m^3)	PM_{10} (24hr) (µg/m^3)	SO_2 (24hr) (µg/m^3)	NOx (24hr) (µg/m^3)	CO (1 hr) (mg/m^3)
		Average	Average	Average	Average	Average
AAQM-1	Project Site	24	48	12	14	0.8
AAQM-2	Near Zilla Parishad School Behind Vitthal Rukmini Temple At Pali khurd Village	27	47	15	16	1.0
AAQM-3	Near Saint Gora kumbhar Temple Opposite to Tupa Gaon Bus Stop, Tupgaon	30	50	15	19	1.1
AAQM-4	Near Jaiganesh Hardware Opp to Samarth Krupa Chawl, Ris Kamba Village Dand Apta Road	40	54	19	20	1.4
AAQM-5	Near Ram Mandir at Village Entrance, Varose wadi Village North side	48	58	20	21	1.5
AAQM-6	Near Vayal Pumping Station (NMMC), Vayal Village	38	52	18	18	1.3
AAQM-7	Near Vitthal Rukhmini Temple, Tembhri Gaon	30	50	13	16	1.0

Table 3.19: National Ambient Air Quality Standards

Pollutants	$PM_{2.5}$ (24hr) ($\mu g/m^3$)	PM_{10} (24hr) ($\mu g/m^3$)	SO_2 (24hr) ($\mu g/m^3$)	NOx (24hr) ($\mu g/m^3$)	CO(1 hr) (mg/m^3)
Residential, Industrial, rural area & other area	60	100	80	80	04
Sensitive	60	100	80	80	04

The National Ambient Air Quality Standard (NAAQS) issued by Central Pollution Control Board (CPCB) is B-29016/20/90/PCI-I dated November 18, 2009.

- **Presentation of Ambient Air Quality analysis results:**

The Ambient Air Quality Monitoring (AAQM) stations at all locations have been considered as residential zones. After tabular representation of Ambient Air quality it can be observed that:

- PM_{10} ranges from 48µg/m^3 to 58µg/m^3
- $PM_{2.5}$ ranges from 24µg/m^3 to 48µg/m^3

All the parameters are found to be within range as compared with standards

- **Calibration of RSPM ($PM_{2.5}$, PM_{10})**

All $PM_{2.5}$, PM_{10} samplers used for sampling purpose have been calibrated by Poll-tech Instrument" Mumbai & Eco-tech Instrument- Noida.

3.4.8 Noise Environment:

Noise can affect human health and behavior. Construction equipment and road traffic are the major sources of noise. Baseline noise data of the project area and the neighborhood habitat areas was ascertained to establish existing conditions of ambient noise in the project site.

- **Monitoring Methodology of Noise Level**

Methodology for monitoring of noise levels is given in **Table 3.20**

Table 3.20: Monitoring Methodology of Noise

Environmental Component	Sampling location	Sampling Parameter	Sampling Frequency	Sampling equipment
Ambient Noise levels	10 locations	Decibels – dB (A)	Hourly reading for 24 hours at each location	Noise Level Meter

- **Noise Level Results**

Noise readings were taken at different locations around the project site. The readings are presented vide **Table 3.21**

Table 3.21: Noise level readings 500 m around the project site

Station Code	Location of Noise Monitoring Station	Distances	Zone	Equivalent Noise levels in Leq	
				Day	Night
ANQM-1	Project Site	--	Residential	50.5	37.2
ANQM-2	North side of Project Site	--	Residential	62.0	45.0
ANQM-3	South side of Project Site	--	Residential	51.3	40.6
ANQM-4	East side of Project Site	--	Residential	48.9	38.3
ANQM-5	West side of Project Site	--	Residential	47.8	39.4
ANQM-6	Near Siyaram Automall (East)	58 m	Residential	53.9	40.1
ANQM-7	Near Zilla Parishad School	500 m	Residential	61.1	40.0
ANQM-8	Near Building 12B Sector E, Reliance Township	200 m	Residential	59.0	53.0
ANQM-9	At 200m Site Boundary towards South East	200 m	Residential	47.4	39.5
ANQM-10	Sarang Asorti Junction	185 m	Residential	49.2	37.9

Map showing the locations of noise level monitoring around project site is given in **Fig 3.14.**

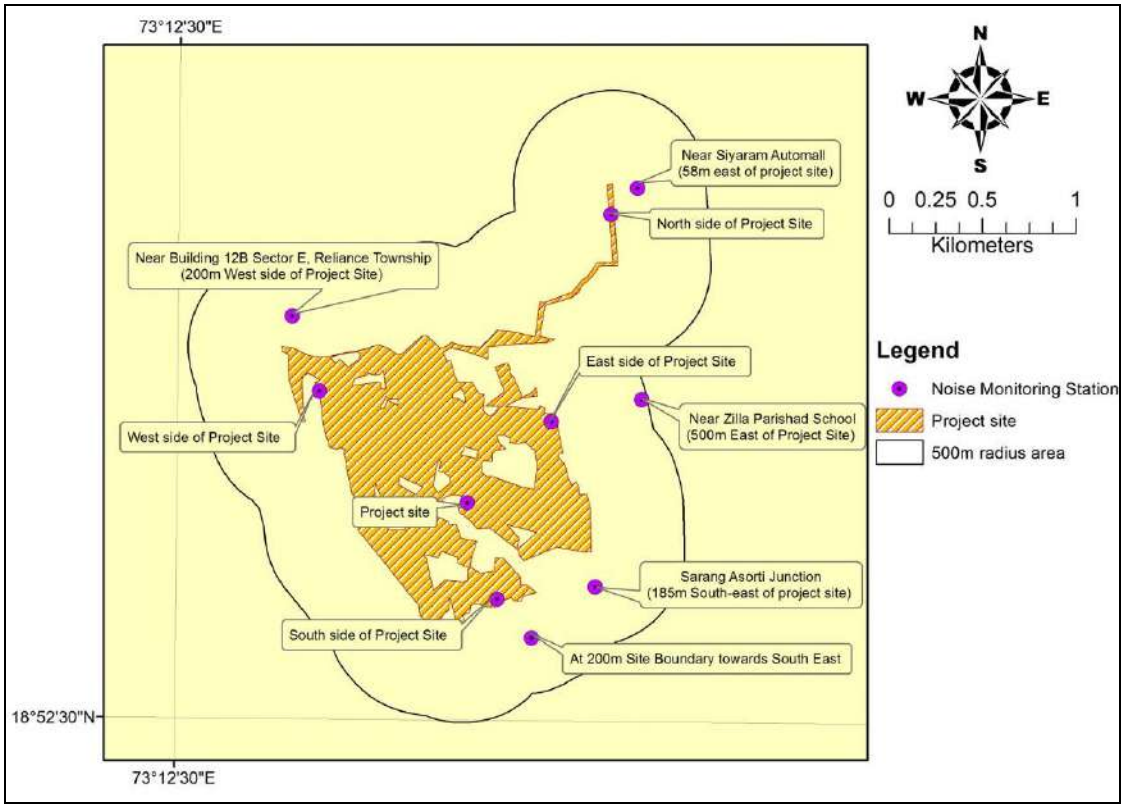

Fig. 3.14: Noise monitoring site map 500 m around the project site

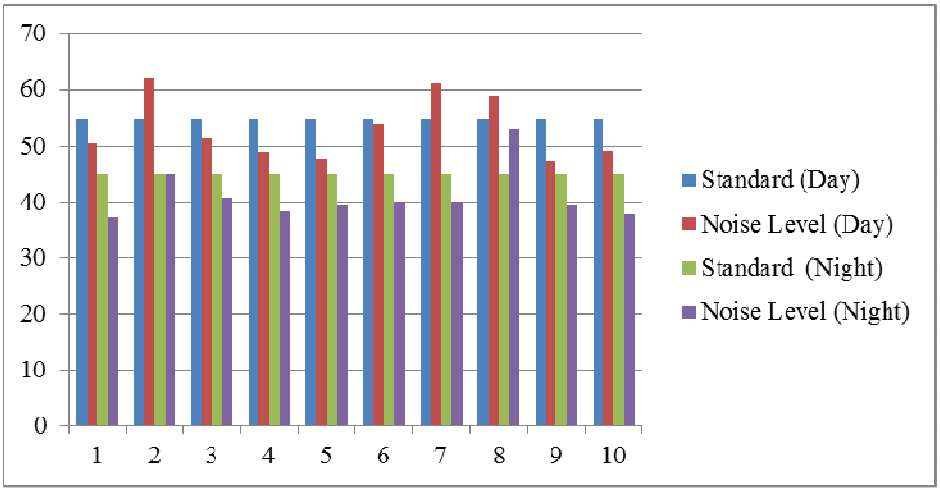

Fig. 3.15: Graphical representation of noise quality data around project site

Table 3.22: Ambient Noise Levels Standards Specified By CPCB

Category of Area	Limits in dB (A) Leq	
	Day Time (6 am – 9 pm)	Night Time (9 pm – 6 am)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

- **Presentation of Ambient Noise Quality results:**

Ambient noise quality monitoring all stations has been considered as residential zones.
Comparison of the ambient noise levels with the standards specified by CPCB reveals that the day time noise readings at locations N2, N7 and N8 are exceeds CPCB standards and remaining N1, N3 to N6, N9 and N10 area within the CPCB standards. Whereas at night time all noise readings at all locations founds within standards except location N8 due to vehicular movement. The Principal Rules of Noise Pollution were published in the Gazette of India, vide S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.

3.5 BIOLOGICAL ENVIRONMENT:

3.5.1 Preamble

In view of the need for conservation of environmental quality and biodiversity, study of biological environment is one of the most important aspects for Environmental Impact Assessment. Ecological systems show complex inter-relationships between biotic and abiotic components viz. physical and chemical sections of the environment. Generally, biological communities are the indicators of climatic and edaphic factors. The biological environment includes components including dependence, competition and mutualism. Biotic components comprises of both plant and animal communities, which interact not only within and between them but mainly terrestrial and aquatic ecosystems.

The term "habitat" has been used in broad sense for the general land cover and physiognomy for a particular species. The information on prevailing baseline in the proposed project site is important because project activities might lead to loss of the ecological resources, if existing. The information will further enable to evaluate the feasibility and efficacy of the mitigation options that are being proposed by environmentalist and conservationist to incorporate conservation concerns in mitigating the impacts of developmental project.

3.5.2 Objectives

The present study was undertaken with the following objectives:

- To assess the nature and distribution of vegetation in and around the project site
- To evaluate the distribution of animal life spectra, including avifauna and butterflies, available in this area
- To ascertain whether the proposed project will have any adverse impact on the ecology in and around project areas, and suggest mitigation measures, if needed

3.5.3 Study Area

The proposed project is located at Village Sarang, Taluka Khalapur, Dist- Raigad, in Maharashtra.
As per guidelines of MoEF for Environmental Impact Assessment, pertaining to Township and area development projects, total study area is restricted up to 10Km periphery from the project site, of which primary data need to be collected from the area up to 2Km periphery, while remaining 8Km will be represented by secondary data. The data up to 2Km were generated with reference to topography, land use, habitats, flora and fauna etc. All observations were undertaken in March 2016 at selected sampling locations (Fig.3.16). The climatic conditions in the study area are severe with hot climate and moderate rainfall.

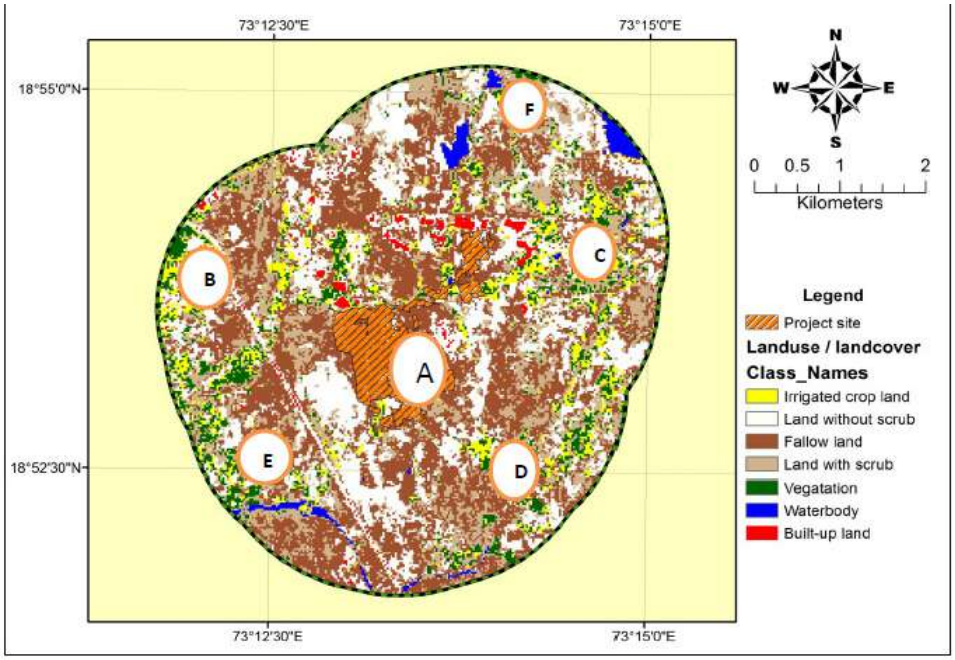

Fig.3.16: Locations (A-F) of field survey for vegetation and avifauna within 2 km periphery of project site

3.5.4 Biodiversity

3.5.4.1 Project site

A. Terrestrial Ecology:

a) Flora:

The floristic survey reveals that at the project site there are different varieties of flora **(Table 3.23)**, such as:

- **Trees: :** *Azadirachta indica, Syzygium cumini, Mangifera indica, Ixora coccinea, Tectona grandis, Tamarindus indica*
- **Shrubs:** *Acacia torta, Euphorbia thymifolia Calatropis procera, Hyptis suaveolens*
- **Herbs:** *Ageratum conyzoides, Alternanthera sessilis,Cassia tora and Tridax procumbens*

Amongst these plants Azadirachta indica, Ixora coccinea were most dominant.

Existing Tree details are attached herewith as **Enclosure 8.**

b) Fauna:

The fauna **(Table 3. 24)** observed in project site are as follows;

- **Mammals***: Canis lupus familiaris, Funambulus palmarum, Rattus rattus and Herpestes edwardsii*
- **Avifauna:** *Merops orientalis, Milvus migran, Columba livia, Corvus splendens, Acridotheres tristis, Eudynamys scolopacea* and *Copsychus saulari*
- **Butterflies:** *Papilio polymnestor, Eurema hecabe, Euploea core* and *Junonia atlites*
- **Dragonflies** *Tramea basilaris* and *Ictinogomphus rapax*

There is a pond adjacent to the project. Samples were collected for plankton analysis and the data are presented subsequently in Aquatic section.

3.5.4.2 Area between project site and 2 km surroundings

A. Terrestrial Ecology:

a) Flora:

The area shows abundance of *Bombax ceiba, Syzygium cumini , Mangifera indica, Madhuca longifolia etc*. **(Table 3.23)**

A

B

C

D

E

F

Plate 3.1: Presence of vegetation (A-E) within 2 km periphery from the project site

Table3.23: Presence of vegetation within 2 km surroundings of the project site

No.	Botanical name	Common name	Family	Status	Status as per International Union for Conservation of Nature (IUCN)
Trees					
1.	*Albizia lebbeck*	Siris	Fabaceae	Common (Indigenous)	Not assessed
2.	*Alstonia scholaris*	Saptaparni	Apocynaceae	Common	Least Concern
3.	**Azadirachta indica*	Neem	Meliaceae	Common	Not assessed
4.	*Artocarpus heterophyllus*	Jackfruit	Moraceae	Frequent	Not assessed
5.	*Araucaria columnaris*	Christmas tree	Araucariaceae	Frequent	Least Concern
6.	*Acacia auriculiformis*	Earleaf acacia	Mimosaceae	Frequent	Least Concern
7.	*Bauhinia variegata*	Kanchan	Caesalpiniaceae	Frequent	Least Concern
8.	**Bombax ceiba*	Silk cotton tree	Bombacaceae	Frequent	Not assessed
9.	*Ceiba pentandra*	Kapok	Malvaceae	Common	Not assessed
10.	*Butea monosperma*	Palas	Fabaceae	Common	Not assessed
11.	*Delonix regia*	Gulmohar	Fabaceae	Common	Least Concern
12.	*Erythrina variegata*	Pangara	Fabaceae	Frequent	Least Concern
13.	**Ficus religiosa*	Pimpal	Moraceae	Common (Native)	Not assessed
14.	*Ficus benghalensis*	Vad, Banyan	Moraceae	Frequent	Not assessed
15.	*Ficus elastica*	Rubber fig	Moraceae	Frequent	Not assessed
16.	*Leucaena leucocephala*	Subabul	Fabaceae	Common	Not assessed
17.	*Lagerstroemia speciosa*	Taman	Lythraceae	Frequent	Not assessed
18.	**Mangifera indica*	Mango	Anacardiaceae	Common	Not assessed
19.	*Moringa oleifera*	Drumstick tree	Moringaceae	Frequent	Not assessed
20.	**Madhuca longifolia*	Moha	Sapotaceae	Common	Least Concern
21.	*Muntingia calabura*	Jamaica cherry	Muntingiaceae	Frequent	Not assessed
22.	*Peltophorum pterocarpum*	Copperpod	Caesalpiniaceae	Frequent	Not assessed
23.	*Pithecellobium dulce*	Manila tamrind	Fabaceae	Frequent	Not assessed
24.	*Pongamia pinnata*	Karanj	Fabaceae	Frequent	Least Concern
25.	*Polyalthia longifolia*	False ashok	Annonaceae	Common (Native)	Not assessed
26.	*Plumeria obtusa*	White frangipani	Apocynaceae	Frequent	Not assessed
27.	*Plumeria rubra*	Red frangipani	Apocynaceae	Frequent	Not assessed
28.	**Syzygium cumini*	Jambul	Myrtaceae	Frequent	Not assessed
29.	**Terminalia catappa*	Bareservoir	Combretaceae	Common (Native)	Not assessed
30.	**Tamarindus indica*	Tamarind, Imli	Fabaceae	Frequent	Not assessed
31.	**Tectona grandis*	Sag	Lamiaceae	Common (Native)	Not assessed
32.	*Thespesia populnea*	Indian tulip tree	Malvaceae	Frequent	Not assessed
33.	*Ziziphus mauritiana*	Ber	Rhamnaceae	Frequent	Not assessed
Shrubs					
1.	**Acacia torta*	Chilar	Mimosaceae	Common	Not evaluated
2.	**Calotropis procera*	Rui	Asclepiadaceae		
3.	*Clerodendrum inerme*	Sangam	Verbenaceae	Frequent	Not assessed
4.	*Crotalaria retusa*	Gagra	Fabaceae	Frequent	Not assessed

No.	Botanical name	Common name	Family	Status	Status as per International Union for Conservation of Nature (IUCN)
5.	**Euphorbia thymifolia*	Milk weed	Euphorbiaceae	Common	Not evaluated
6.	*Hibiscus rosa-sinensis*	China rose	Malvaceae	Frequent	Not assessed
7.	**Hyptis suaveolens*	Vantulsi	Lamiaceae	Common	Not evaluated
8.	**Lantana camara*	Wild sage	Verbenaceae	Common	Not assessed
9.	*Vitex negundo*	Nilanirgundi	Verbenaceae	Frequent	Not assessed
Herb					
1.	*Argemone mexicana*	Dhotra	Papaveraceae	Common	Not assessed
2.	**Ageratum conyzoides*	Billygoat weed	Asteraceae	Common	Not evaluated
3.	*Abutilon indicum*	Petari	Malvaceae	Frequent	Not assessed
4.	**Alternanthera sessilis*	Chubukata	Amaranthaceae	Common	Least Concern
5.	*Achyranthes aspera*	Chirchita	Amaranthaceae	Common	Not assessed
6.	**Cassia tora*	Chakvad	Fabaceae	Common	Not assessed
7.	**Tridax procumbens*	Ekdandi	Asteraceae	Common	Not evaluated
Grass					
1.	*Corchorus olitorius*	Banpat	Tiliaceae	Frequent	Not assessed
2.	*Andropogon muricatus*	Khas-khas	Poaceae	Common	Not assessed
3.	*Cynodon dactylon*	Dhurva	Poaceae	Common	Not assessed
4.	*Cyperus compactus*	Mandarin	Cyperaceae	Frequent	Least Concern
5.	*Eleocharis dulcis*	Water chestnut	Cyperaceae	Frequent	Not assessed
6.	*Fimbristylis cymosa*	Button sedge	Cyperaceae	Frequent	Least Concern
7.	*Phragmites australis*	Common reed	Poaceae	Common	Least Concern
Climber					
1.	*Ipomea digitata*	Vidari	Convolvulaceae	Frequent	Not assessed

Note: Source: Primary data generation by Ultra-Tech team
*** Also observed on site A (Project site)**

b) Fauna

Observation

- ***Vertebrates***

Mammals

The domestic animals in the study area mostly comprise of dog, cat and squirrel. The survey revealed that 8 species of mammals were recorded in and around the study area while no wild mammal was observed in this area. Two species of reptiles were recorded. Availability of fauna in the vicinity of the sites is presented in **Table 3.24**. None of these animals are endangered (Schedule I) as per Wildlife (Protection) Act 1972.

Avifauna

Birds were studied by direct observation with the help of ''Olympus 10 x 50 DPS I'' binocular and were identified by adopting available literature (Grimmett *et al.* 1998). During the survey, 21 species of birds were noticed. The dominant birds were little green bee eater, Indian myna, purple sunbird, house crow, etc. It has been observed that the majority of birds were insectivorous in habit preferring insects, worms and arachnids. None of these birds are endangered (Schedule I) as per Wildlife (Protection) Act 1972. **Table3.24**

- ***Invertebrates***

Butterflies

Study area comprises of 13 species of butterflies, dominated by *Euploea core, Papilio demoleus, Catopsilia Pomona, Eurema hecabe* and *Danaus chrysippus.* Butterfly diversity and community composition are dependent on plants, as their caterpillars are highly specific to host plants on which they feed and metamorphose into the adults. Fairly good butterfly diversity in this area is conspicuous due to presence of wide varieties of flowering trees. Therefore, richness of host plant diversity contributes to butterfly diversity. None of these is endangered (Schedule I) as per Wildlife (Protection) Act 1972.

Dragonflies

Two species of dragonflies and reservoirselflies were recorded. Species like *Tramea basilaris* and *Ictinogomphus rapax* were commonly seen throughout the project area.

Table 3.24: Fauna recorded in the study area up to 2 km periphery

No.	Common Name	Scientific Name	
Mammals			
1.	*Common dog	*Canis lupus familiaris*	Not enlisted
2.	Common cat	*Felis silvestris catus*	Not enlisted
3.	*Squirrel	*Funambulus palmarum*	Sch-IV
4.	Domestic buffalo	*Bubalus bubalis*	Not enlisted
5.	Cow	*Bos taurus*	Not enlisted
6.	Goat	*Capra hircus aegagrus*	Not enlisted
7.	*Rat	*Rattus rattus*	Sch-V
8.	*Indian grey mongoose	*Herpestes edwardsii*	Sch – II
Reptiles			
1.	Common garden lizard	*Calotes versicolor*	Not enlisted
2.	Rock lizard	*Psmmophilus blanfordanus*	Not enlisted
Avifauna			
1.	*Black kite	*Milvus migrans*	Not enlisted
2.	*Blue rock pigeon	*Columba livia*	Sch – IV
3.	Cattle egret	*Bubulcus ibis*	Sch – IV
4.	Common swallow	*Hirunds rustica*	Sch – IV
5.	Crow pheasant	*Centropus sinensis*	Sch – IV
6.	*House crow	*Corvus splendens*	Sch – V
7.	House sparrow	*Passer domesticus*	Sch – IV
8.	House swift	*Apus affinus*	Sch – IV
9.	Indian black drongo	*Dicrurus adsimilis*	Sch – IV
10.	*Indian myna	*Acridotheres tristis*	Sch – IV
11.	*Koel	*Eudynamys scolopacea*	Sch – IV
12.	Little swift	*Apus affinis*	Sch – IV
13.	*Magpie robin	*Copsychus saularis*	Sch – IV
14.	Purple sunbird	*Nactarinia asiatica*	Sch – IV
15.	Red wattled lapwing	*Vanellus indicus*	Sch – IV
16.	Roseringed parakeet	*Paittacula krameri*	Sch – IV
17.	Redvented bulbul	*Pycronotus cafer*	Sch – IV
18.	Small blue kingfisher	*Alcedo atthis*	Sch – IV
19.	Small green bee eater	*Merops orientalis*	Sch – IV
20.	Jungle babbler	*Turdoides striata*	Sch – IV
21.	Common babbler	*Turdoides caudatus*	Sch – IV

Butterflies			
1.	*Blue mormon	*Papilio polymnestor*	Not enlisted
2.	Blue pansy	*Junonia orithy*a	Not enlisted
3.	Common sailor	*Neptis hylas*	Not enlisted
4.	Common evening brown	*Melanitis leda*	Not enlisted
5.	*Common grass yellow	*Eurema hecabe*	Not enlisted
6.	*Common Indian crow	*Euploea core*	Sch – IV
7.	Common leopard	*Phalanta phalantha*	Not enlisted
8.	Common mormon	*Papilio polytes*	Not enlisted
9.	*Gray pansy	*Junonia atlites*	Not enlisted
10.	Lime butterfly	*Papilio demoleus*	Not enlisted
11.	Plain tiger	*Danaus chrysippus*	Not enlisted
12.	Common wanderer	*Pareronia valeria*	Not enlisted
13.	Common emigrant	*Catopsilia pomona*	Not enlisted
Dragonflies			
1.	*Red marsh trotter	*Tramea basilaris*	Not enlisted
2.	*Common clubtail	*Ictinogomphus rapax*	Not enlisted

Source: Primary data generation by Ultra-Tech team
***Observed also in site 1 (Project site)**

B) Aquatic:
Primary data
The surroundings of the project site are primarily covered by scrub land with a few trees. Patalganga River (1 km), Morbe reservoir (2 km), Nadhal reservoir (1.00 km) and a pond within project site are recorded as surface water bodies within 2 km surroundings of project site. Samples from these water bodies were collected during March 2016 for phytoplankton and zooplankton analyses.

Sampling
To enumerate phytoplankton, unfiltered surface waters were collected from the water bodies. Phytoplankton samples were immediately fixed in Lugol's iodine solution so as to prevent adverse effects of light and temperature which might cause rapid decay of organisms. Subsequently microscopic analysis was undertaken in laboratory (**APHA 2005**). For zooplankton, about 40 liter water was filtered through plankton net having mesh size of 75µ to represent all the available groups. The samples were fixed immediately with 5 % buffered formalin and subsequently analysed under microscope in the laboratory with the help of Sedgwick rafter cell.

a) Phytoplankton
Phytoplankton counts, recorded at different sampling stations, are presented in **Table 3.24** Total algal population varied between 146 and 3100 algal cells ml^{-1}. Altogether 20 genera of phytoplankton were recorded **(Table 3.25)** Amongst 6 groups, Cyanophyceae dominated in Pond & Patalganga river, while Chlorophyceae outnumbered other groups in Morbe and Nadhal reservoirs.

Plate 3.2: Collection of water samples from Morbe reservoir and pond at Project Site for plankton analysis

Table 3.25: Enumeration of Phytoplankton at different locations

Phytoplankton								
Sample No.	Name of sampling locations	Phyto plankton (No/ml)	Percent composition of algal groups				Pyro-phyceae	Chryso-phyceae
			Cyano-phyceae	Chlro-phyceae	Bacillario-phyceae	Eugleno-phyceae		
1	Patalganga river	2235	40	21	35	4	-	-
2	Pond in project site	3100	52	22	26	-	-	-
3	Morbe reservoir	146	18	30	25	-	15	12
4	Nadhal reservoir	158	25	28	21	-	14	12

Table 3.26: Phytoplankton genera observed at different locations

Name of sampling locations					
No.	**Genera**	**Patalganga river**	**Pond in project site**	**Morbe reservoir**	**Nadhal reservoir**
A	**Cyanophyceae**				
1	*Anabaena* sp.	+	+	+	+
2	*Pediastrum* sp	-	+	+	+
3	*Aphanocapsa* sp.	-	+	-	-
4	*Spirulina sp*	+	-	+	-
5	*Microcystissp*	+	-	+	+
6	*Oscillatoria* sp	+	+	+	+
B	**Chlorophyceae**				
1	*Ankistrodesmu*s sp.	-	+	+	-
2	*Chlamydomonas* sp.	+	+	+	+
3	*Pediastrum* sp.	-	+	-	+
4	*Ulothrix* sp.	-	+	+	-
5	*Cosmarium* sp.	+	+	+	+
6	*Chlorellasp*	+	-	+	-
C	**Bacillariophyceae**				
1	*Navicula* sp.	+	-	+	+
2	*Gyrosigma* sp.	-	+	+	+
3	*Nitzschia* sp.	+	+	+	+
4	*Cytotella sp*	+	-	+	+
5	*Synedra sp*	+	-	+	-
D	**Euglenophyceae**				
1	*Euglena sp*	+	-	+	-
E	**Pyrophyceae**				
1	*Ceratium sp*.	-	-	+	+
F	**Chryso-phyceae**				
1	*Chrysococcus* sp.	-	-	+	+

(b) Zooplankton

Zooplankton counts, recorded at different sampling stations, are presented in **Table 3.27.** Density of zooplankton varied between 58 and 4260 N/m^3. Only 16 genera from four different groups (**Table 3.28)** were recorded. Rotifera followed by Cladocera dominated in surface waters, while Copepoda was sub dominant in reservoirs.

Table 3.27: Enumeration of Zooplankton at different locations

Zooplankton						
Sample No.	**Sampling locations**	**Zooplankton (No/m^3)**	**Percent composition of zooplankton in groups**			
			Rotifera	**Cladocera**	**Copepoda**	**Protozoa**
1	Patalganga river	3432	63	32	3	2
2	Pond in project site	4260	55	30	15	-
3	Morbe reservoir	75	55	25	20	-
4	Nadhal reservoir	58	44	32	24	-

Table 3.28: Recorded Zooplankton genera in sampling stations

		Name of sampling locations			
No.	**Genera**	**Patalganga river**	**Morbe reservoir**	**Nadhal reservoir**	**Pond in project site**
A	**Cladocera**				
1	*Alonella* sp.	-	-	+	+
2	*Daphnia* sp.	-	-	-	+
3	*Leydigia sp.*	+	+	-	-
4	*Bosminopsis sp.*	+	+	+	-
5	*Moina micrura*	+	+	+	-
B	**Rotifera**				
1	*Brachionus* sp	-	-	+	+
2	*Cephalodella sp.*	+	-	-	-
3	*Keratella* sp.	-	-	-	+
4	*Polyarthra sp.*	+	+	+	--
5	*Lecane luna*	+	+	+	-
C	**Copepoda**				
1	*Cyclops* sp.	-	-	-	+
2	*Diaptomus* sp.	-	-	+	+
3	*Mesocyclops leukarti*	+	+	+	-
4	*Copepod* nauplius	+	+	+	-
D	**Protozoa**				
1	*Paramoecium sp.*	+	-	-	-
2	*Vorticella*	+	-	-	-

Patalganga River and Morbe & Nadal Reservoirs

Observed flora and fauna surrounding the water bodies are declined hereunder.

a. Flora

Trees: *Azadirachta indica* (Neem), *Albizia lebbeck* (Siris), *Bombax ceiba* (kate-sawar), *Cassia fistula* (Bahava), *Delonix regia* (Gulmohar), *Madhuca longifolia* (Moha), *Ficus religiosa* (Peepal), *Mangifera indica* (Mango) *Ziziphus mauritiana* (Ber), *Bauhinia racemosa* (Apta), *Ficus racemosa* (Umber), *Pongamia pinnata* (Karanj), *Tectona grandis(Sag), Lagerstroemia speciosa* (Taman), *Syzigium cumini* (Jambhul), *Tamarindus indica* (Tamarind) etc.

b. Fauna

Birds: *Acridotheres tristis* (Common myna), *Ardeola grayii* (*Indian* pond heron), *Corvus splendens* (House crow), *Pycnonotus jocosus* (Redwhiskered bulbul), *Microcarbo niger* (Little cormorant), *Apus nipalensis* (House Swift) etc.

Butterflies: *Papilio polymnestor* (Blue mormon), *Papilio demoleus* (Lime butterfly), *Catopsilia pomona* (Common emigrant), *Catopsilia pyranthe* (Mottled emigrant), *Larus canus* (Common gull) etc.

Aquatic Fauna

The Patalganga River is about 1km away from the project site. The common fish species available in the river are given in Table 3.29

Table 3.29 Common fish species recorded in Patalganga River

No.	Common name	Scientific name
1.	Catla	*Catla catla*
2.	Rohu	*Labeo rohita*
3.	Maral	*Channa punctata*
4.	Dokh	*Channa gachua*
5.	Mangur	*Clarias batrachus*
6.	Dandvan	*Garra mulllya*
7.	Malya	*Oreochromis mosambicus*
8.	Darai	Puntius sarana
9.	Khavli	Puntius sophore
10.	Dara	*Rasbora daniconius*
11.	Chikli	*Indoreonectes evezardi*
12.	Chikani	*Lepidocephalichthys thermalis*

Source: EIA Report for Proposed Expansion of Organic Chemical Manufacturing Plant, Village Kumbhivali, District Raigad, Maharashtra

3.5.4.3 Area between 2 km and 10 km

Records of Divisional Forest Office, Alibag, Matheran & Karnala Bird Sanctuary within the 10 km periphery of the project site were evaluated. The data pertaining to flora and fauna of the region have been generated based on discussions with concerned forest department officials, local people, published literature, NGOs etc. and supported by physical verifications, wherever feasible. The collated data have been delineated hereunder.

Forest

According to Champion and Seth (1967), forest type of study area is classified as mixed deciduous forest. As per discussions and records of Range Forest Offices, Alibag, and supported by land use map, the study area is having patches of reserved forests in various blocks at different directions within 5 to 8 km from the project site. The list of forest blocks and their distances from project site are presented in **Table 3.30**

Table 3.30: List of forest blocks within 10 km radius of project site (Source: Range Khalapur, Alibag Forest Division)

No.	Name of forest block	Type of Forest	Direction	Distance (Km)
1	Karde Budrukh	Reserved forest	W	5.0
2	Manigad	Reserved forest	SW	7.0
3	Devloli	Reserved forest	NW	8.0
4	Narpoli	Reserved forest	NW	6.0
5	Prabhagad	Reserved forest	N	8.0
6	Vinegaon	Reserved forest	E	6.0

a) Flora

Trees: *Acacia nilotica* (babul), *Albizia lebbeck* (Siris), *Bombax ceiba* (kate-sawar), *Cassia fistula* (Bahava), *Delonix regia* (Gulmohar), *Eucalyptus globulus* (Nilgiri), *Emblica officinalis* (Aavla), *Mangifera indica* (Mango), *Mitragyna parviflora* (Kareservoir), *Madhuca latifolia* (Moha), *Ficus racemosa* (Umber), *Peltophorum pterocarpum* (Copper pod), *Pongamia pinnata* (Karanj), *Tectona grandis(Sag), Lagerstroemia speciosa* (Taman), *Syzigium cumini* (Jambhul), *Tamarindus indica* (Tamarind), *Terminalia tomentosa* (Sadada), *Terminalia catappa* (Almond), *Ziziphus mauritiana* (Ber) etc.

Shrubs: *Calotropis procera* (Rue), *Catharanthus roseus* (Cape periwinkle), *Lantana camara* (Ghaneri), *Hibiscus* sp.(Jasvand), *Barleria prionitis* (Katekoranti), *Helicteris isora* (Murudsheng), *Mimosa hamata* (Alai), *Nerium indicum* (Kanher),*Tephrosia purpurea* (Unhali), *Ricinus communis* (Castor plant), *Calotropis gigantea* (Rui) etc.

Herbs*: Alternanthera sessilis* (Chubukata), *Achyranthes aspera* (Aghada), *Cassia tora* (Takla), *Tridax procumbens* (Ekdandi), *Ocimum sanctum* (Tulsi), *Solanum nigrum* (Kangni), *Mimosa pudica* (Lajalu), *Chenopodium album* (Chandanbatwa), *Vernonia cinerea* (Sahadevi), *Cleome gynandra* (Pandhri-Tilvan) etc.

Grasses: *Cynodon dactylon* (Bermuda grass), *Digitaria ciliaris* (Wild crabgrass), *Dendrocalamus calostachyus, Eleusine indica* (Crow foot grass), *Chloris barbata* (Swollen finger grass) etc.

b) Fauna

Butterflies

Common butterflies available within 10km surroundings are *Athyma perius* (Common sergeant), *Appias albino* (Common albatross), *Graphium doson* (Common jay), *Graphium agamemnon* (Tailed jay), *Pachliopta aristolochiae* (Common rose), *Papilio polymnestor* (Blue mormon), *Papilio demoleus* (Lime butterfly), *Catopsilia pomona* (Common emigrant), *Catopsilia pyranthe* (Mottled emigrant), *Larus canus* (Common gull), *Delias eucharis* (Common jezebel), *Acraea terpsicore (*Angled castor), *Euploea core* (Common Indian crow), *Euthalia aconthea* (Common baron), *Hypolimnas bolina* (Great eggfly), *Hypolimnas misippus* (Danaid eggfly), *Junonia almanac* (Peacock pansy), (*Junonia atlites* (Grey pansyc), *Junonia lemonias* (Lemon pansy), *Junonia orithya* (Blue pansy), *Melanitis leda* (Common Evening brown), *Melanitis phedima* (Dark Evening brown), *Melanitis zitenius* (Great Evening brown), *Mycalesis mineus* (Dark branded bush brown), *Bicyclus safitza* (Common bush brown), *Mycalesis visala* (Long brand bush brown), *Neptis hylas* (Common sailer), *Parantica aglea* (Glassy tiger), *Phalanta phalantha* (Common leopard), *Tirumala limniace* (Blue tiger), *Ypthima asterope* (Common three ring), *Ypthima baldus* (Common five ring), *Celastrina lavendularis* (Plain hedge blue), *Chilades lajus* (Lime blue), *Chilades pandava* (Plains cupid), *Catochrysops Strabo* (Forget-me-not), *Leptotes plinius* (Zebra blue), *Prosotas nora superdates* (Common line blue), *Surendra quercetorum* (Common acacia blue), *Matapa aria* (Common red eye), *Pelopidas subochracea* (Large Branded swift), etc.

Birds

Birds like *Accipiter nisus* (Eurasian Sparrow hawk), *Accipiter badius* (Shikra), *Acridotheres ginginianus* (Bank Myna), *Acridotheres tristis* (Common Myna), *Aegithina tiphia* (Common Iora), *Alcedo atthis* (Common Kingfisher), *Amandava amandava* (Red Avadavat), *Amaurornis phoenicurus* (White-breasted Waterhen), *Anas crecca* (Common Teal), *Apus nipalensis* (House Swift), *Ardea purpurea* (Purple Heron), *Athene brama* (Spotted Owlet), *Buteo buteo* (Common Buzzard), *Coracias benghalensis* (Indian Roller), *Coturnix coturnix* (Common Quail), *Orthotomus sutorius* (Common Tailorbird), *Pernis ptilorhynchus* (Oriental Honey Buzzard), *Phalacrocorax carbo* (Great Cormorant), *Phalacrocorax fuscicollis* (Indian Cormorant), *Prinia inornata* (Plain Prinia), *Pseudibis papillosa* (Black Ibis), *Rhipidura albicollis* (White throated Fantail), *Tringa totanus* (Common Redshank),

Turdus simillimus (Indian Blackbird), *Upupa epops* (Common Hoopoe), *Vanellus indicus* (Red-wattled Lapwing), *Ardeola grayii* (pond heron), *Anhinga melanogaster* (Indian darter) etc.

1. Karnala Bird Sanctuary:

Karnala Bird Sanctuary is located at a distance of approximately 9 km from the project site. It is the declared Bird Sanctuary.

In this Sanctuary there is Karnala fort since ancient times. The surroundings of Karnala fort shows the presence of numerous and different varieties of flora and fauna. Keeping in view the importance of such rich biodiversity, Government declared the Karnala fort along with its surrounding area upto 4.48 Sq.km, as Bird Sanctuary in 1968. Famous ornithologist and naturalist Dr. Salim Ali had given very important contribution for the building-up of bird sanctuary. Botanical Survey of India (BSI) had studied the Karnala sanctuary area in 1980 and recorded 642 floral species. In this sanctuary, around 134 resident birds and 38 non-resident birds have been recorded by bird watchers. A large number of various plant species have been recorded **(Table 3.31)**

Table 3.31: List of plants recorded in Karnala Bird Sanctuary area

No.	Botanical Name	Common Name	No.	Botanical Name	Common Name
Trees					
1.	*Vangueria spinosa*	Huloo, Alu	2.	*Azadirachta indica*	Neem
3.	*Flacourtia indica*	Athruna	4.	*Ficus retusa*	Nandruk
5.	*Bauhinia racemosa*	Aapta	6.	*Butea monosperma*	Palas
7.	*Emblica officinalis*	Amla	8.	*Stereospermum chelonoides*	Paadal
9.	*Bridelia retusa*	Asana	10.	*Ficus arnottiana*	Payar
11.	*Morinda pubescens*	Dhaula, Indian Mulberry	12.	*Olea dioica*	Parjamb
13.	*Spondias pinnata*	Ambada	14.	*Ficus tsiela*	Pipar
15.	*Mangifera indica*	Mango tree	16.	*Peltophorum ferrugineum*	Pivla Gulmohar
17.	*Ficus glomerata*	Udumbar	18.	*Erythrina indica*	Pangara
19.	*Terminalia tomentosa*	Ain	20.	*Acacia ferruginea*	Pandhra khair
21.	*Hymenodictyon excelsum*	Bhorsal, Kambal	22.	*Randia uliginosa*	Kalaphendra
23.	*Ficus asperrima*	Karvat	24.	*Ficus religiosa*	Pimpal
25.	*Murraya koenigii*	Curry tree	26.	*Albizia chinensis*	Faradi, Laeli
27.	*Dillenia pentagyna*	Piwala karmal	28.	*Microcos paniculata*	Shirali
29.	*Pongamia glabra*	Karanj	30.	*Dalbergia paniculata*	Faasi
31.	*Mitragyna parvifolia*	Kalam	32.	*Mimusops elengi*	Bakuli
33.	*Garuga pinnata*	Kakad, Kharpat	34.	*Cassia fistula*	Bahava
35.	*Lepisanthes tetraphylla*	Kurpa	36.	*Pterocarpus marsupium*	Bibala
37.	*Wrightia tinctoria*	Kala kuda	38.	*Semecarpus anacardium*	Bibba
39.	*Anacardium occidentale*	Kaju	40.	*Aegle marmelos*	Bael
41.	*Sideroxylon tomentosum*	Katekubhal	42.	*Terminalia bellirica*	Bahera
43.	*Albizia procera*	Kinae	44.	*Lagerstroemia parviflora*	Bhondara
45.	*Casearia tomentosa*	Modgi	46.	*Elaeodendron glaucum*	Bhitiya
47.	*Holarrhena antidysenterica*	Kutaja	48.	*Cordia dichotoma*	Shelu, Bhokar
49.	*Schleichera oleosa*	Kusum	50.	*Ziziphus jujuba*	Bhor
51.	*Garcinia indica*	Kokum	52.	*Thespesia populnea*	Bhend
53.	*Bauhinia malabarica*	Amli	54.	*Murraya exotica*	Makadi, Kunti
55.	*Sterculia urens*	Sardol	56.	*Dolichandrone falcata*	Medhshingi
57.	*Careya arborea*	Kumbha	58.	*Madhuca latifolia*	Mahua
59.	*Radermachera xylocarpa*	Kadashing	60.	*Maba nigrescens*	Raktarohida

No.	Botanical Name	Common Name	No.	Botanical Name	Common Name
61.	*Sterculia colorata*	Kaushi	62.	*Trewia nudiflora*	Raan bhendi, Gutel
63.	*Streblus asper*	Kharota	64.	*Sapindus emarginatus*	Reetha
65.	*Manilkara hexandra*	Karani	66.	*Wrightia arborea*	Tambda kuda,Lal kuda
67.	*Acacia catechu*	Khair	68.	*Ixora parviflora*	Lokhandi
69.	*Randia dumetorum*	Gela, Golaphal	70.	*Ixora arborea*	Lokhandi
71.	*Gliricidia sepium*	Giripushpa	72.	*Ficus benghalensis*	Wad
73.	*Ziziphus xylopyrus*	Katber	74.	*Heterophragma roxburghii*	Waras
75.	*Grewia serrulata*	Chitrak, Kaori	76.	*Holoptelea integrifolia*	Vavala
77.	*Erinocarpus nimmonii*	Jangli-bhendi, Chera	78.	*Embelia robusta*	Waiwarung
79.	*Bauhinia foveolata*	Chamoli, Chambal	80.	*Kydia calycina*	Warang
81.	*Macaranga peltata*	Chandwar	82.	*Albizia odoratissima*	Kala siris
83.	*Tamarindus indica*	Tamarind	84.	*Albizia lebbeck*	Siris
85.	*Lagerstroemia reginae*	Jarul	86.	*Gmelina arborea*	Sivan
87.	*Xylia xylocarpa*	Jamba	88.	*Dalbergia latifolia*	Vilayati shisham
89.	*Eugenia jambolana*	Jambhul	90.	*Lannea coromandelica*	Shemat
91.	*Oroxylum indicum*	Tetu	92.	*Phoenix sylvestris*	Shindi, wild date palm
93.	*Diospyros melanoxylon*	Timburni	94.	*Mallotus philippensis*	Shendari
95.	*Gardenia gummifera*	Dekamali	96.	*Tectona grandis*	Saag
97.	*Borassus flabellifer*	Taad	98.	*Alstonia scholaris*	Satwin
99.	*Cordia macleodii*	Dahinada	100.	*Bombax ceiba*	Katesawar
101.	*Ficus heterophylla*	Datir	102.	*Salmalia insignis*	Sawar pandhari
103.	*Dalbergia lanceolaria*	Dondus	104.	*Sageraea laurifolia*	Sageri
105.	*Grewia tiliifolia*	Dhaman	106.	*Mammea suriga*	Surangi
107.	*Anogeissus latifolia*	Dhavada	108.	*Terminalia chebula*	Hirad
109.	*Tabernaemontana heyneana*	Nagarkuda	110.	*Adina cordifolia*	Haldu
111.	*Lagerstroemia microcarpa*	Nana	112.	*Sarcopetalum harveyanum*	Humb
Shrubs					
1.	*Adhatoda vasica*	Adulsa	2.	*Vitex negundo*	Nirgudi
3.	*Jatropha curcas*	Aranda	4.	*Opuntia elatior*	Phadya nivadung
5.	*Carissa congesta*	Karvand	6.	*Pogostemon purpurascens*	Pangali, Sangbrei
7.	*Moghania strobilifera*	Kanfhuti	8.	*Barleria prionitis*	Piwalikoranti,
9.	*Strobilanthes callosus*	Karvy	10.	*Helicteres isora*	Murud sheng
11.	*Crotalaria retusa*	Gagra, Khulkhula	12.	*Ocimum americanum*	Rantulsi
13.	*Lantana camara*	Ghaneri	14.	*Thespesia lampas*	Raanbhendi
15.	*Allophylus cobbe*	Theepani	16.	*Eupatorium glandulosum*	Raanmodi
17.	*Ziziphus rugosa*	Toran	18.	*Calotropis gigantea*	Rui
19.	*Woodfordia fruticosa*	Dhayati, Dowari	20.	*Xanthium indicum*	Shankeshrvar,
21.	*Datura inoxia mill*	Dhotara			
Climbers					
1.	*Gnetum ula*	Omali	2.	*Caesalpinia sepiaria*	Chillari
3.	*Calycopteris floribunda*	Ukshi	4.	*Butea superta*	Palasvel
5.	*Gloriosa superba*	Kal-lavi	6.	*Dalbergia horrida*	Petungal,Muldi
7.	*Celastrus paniculatus*	Kanguni	8.	*Combretum ovalifolium*	Bokad vel, Odaikodi

No.	Botanical Name	Common Name	No.	Botanical Name	Common Name
9.	*Mucuna pruriens*	Kuhili	10.	*Capparis sepiaria*	Mastodi, Kantharyel
11.	*Entada rheedii*	Garambi	12.	*Clematis triloba*	Morvel
13.	*Abrus precatorius*	Gunj	14.	*Wagatea spicata*	Waghati, Wakeri
15.	*Tinospora cordifolia*	Gulvel	16.	*Cocculus glaucescens*	Vatoli
Herbs					
1.	*Hemidesmus indicus*	Anantamul	2.	*Musa superba*	Ran Kela
3.	*Indigofera enneaphylla*	Bhingule	4.	*Solanum anguivi*	Ranvangi
5.	*Cassia tora*	Takala	6.	*Curcuma aromatica*	Ranhaldi
7.	*Urena Lobata*	Lichi,Vanbhendi	8.	*Asteracantha Longifolia*	Kulikhara
9.	*Pavetta tomentosa*	Papadi	10.	*Senecio grahamii*	Sonki
11.	*Cleome viscose*	Piiwala Tilpan			
Grasses					
1.	*Ischaemum pilosum*	Kunda	2.	*Andropogon triticeus*	Bhol kusal
3.	*Eragrostis tenella*	Koteri	4.	*Anthistria ciliata*	Bhongroot
5.	*Andropogon pumilus*	Godvel	6.	*Andropogon annulatus*	Morevel
7.	*Andropogon gayanus*	Ghanyagavat	8.	*Andropogon schoenanthus*	Rosha
9.	*Dendrocalamus strictus*	Bamboo	10.	*Ischaemum indicum*	Sheda
11.	*Ischaemum rugosum*	Ber, Saromacca grass	12.	*Cynodon dactylon*	Harali

Fauna: The fauna recorded in Karnala Bird Sanctuary are presented in Table 3.32

Table 3.32: Birds commonly found in Karnala Bird Sanctuary

R= Resident **M= Migratory** **LM=Local Migratory**
BM =Breeding Migrant **C= Common** **O=Occasional**

No.	Species	Status	Schedule
BABBLER			
1.	Indian scimitar	R, C	Sch – IV
2.	Jungle	C	Sch – IV
3.	Puff-throated (spotted)	C	Not enlisted
4.	Tawny-bellied	O	Not enlisted
5.	Fulvetta, Brown-Cheeked (Quaker babbler)	C	Sch – IV
BARBET			
1.	Brown-headed (large green)	C	Sch – IV
2.	Coppersmith (Crimson Breasted)	C	Sch – IV
BEE-EATER			
1.	Small green	O	Sch – IV
BULBUL			
1.	Red-vented	C	Sch – IV
2.	Red-whiskered	C	Sch – IV
3.	White-browed	C	Not enlisted
4.	White-eared (white-cheeked)	Rare	Not enlisted
BUZZARD			
1.	Oriental honey	C	Not enlisted
2.	White-eyed	O	Sch – IV
CROW			
1.	House	C	Sch – V
2.	Large-billed (jungle)	C	Sch –V
3.	Coucal, Greater (Crow Phesant)	C	Sch – IV

CUCKOO			
1.	Koel Asian	C	Sch – IV
2.	Banded-bay	O	Not enlisted
3.	Common Hawk	O	Not enlisted
4.	Drongo	Rare	Sch – IV
5.	Pied/Jacobin	O	Not enlisted
DOVE			
1.	Emerald	O	Not enlisted
2.	Spotted	C	Sch – IV
DRONGO			
1.	Ashy	C	Sch – IV
2.	Black	C	Sch – IV
3.	Bronzed	O	Sch – IV
4.	Greater racket tailed	C	Sch – IV
5.	Spangled/Hair-crested	O	Sch – IV
6.	White-Bellied	O	Sch – IV
EAGLE			
1.	Black	Rare	Not enlisted
2.	Booted	Rare	Not enlisted
3.	Crested serpent	C	Not enlisted
EGRET			
1.	Cattle	C	Sch – IV
FALCON			
1.	Common Kestrel	O	Sch – IV
2.	Peregrine-shaheen	C	Sch – IV
HAWK/SHIKRA			
1.	Shikra	C	Not enlisted
2.	Basera sparrow hawk	Rare	Not enlisted
3.	Eurasian sparrow hawk	Rare	Not enlisted
FLOWERPECKER			
1.	Pale-billed (Tickell's)	C	Sch – IV
2.	Thick-billed	C	Sch – IV
FLYCATCHER			
1.	Asian brown	O	Sch – IV
2.	Asian paradise	C	Sch – IV
3.	Green-headed canary	O	Sch – IV
4.	Monarch black naped	C	Sch – IV
5.	Red brested	O	Sch – IV
6.	Rusty tailed	Rare	Sch – IV
7.	Tickell's blue	C	Sch – IV
8.	Ultramarine	O	Sch – IV
9.	Verditer	O	Sch – IV
10.	White throated Fantail	C	Sch – IV
HERON			
1.	Black crowned night	O	Not enlisted
2.	Indian pond	C	Not enlisted
HOOPOE			
1.	Hoopoe, common	O	Not enlisted
HORNBILL			
1.	Indian grey	C	Sch – I
IORA			
1.	Common Iora	C	Sch – IV
FOWL			

1.	Jungle fowl, Grey	Rare	Sch – IV
2.	Peafowl, common	Rare	Sch – I
3.	Spurfowl, Red	Rare	Sch – IV
KINGFISHER			
1.	Common	C	Sch – IV
2.	Oriental dwarf (three toed)	Rare	Sch – IV
3.	White throated	C	Sch – IV
KITE			
1.	Black	C	Sch – IV
2.	Black-shouldered	O	Sch – IV
LAPWING			
1.	Red-wattled	C	Not enlisted
LARK			
1.	Malabar	O	Sch – IV
LEAFBIRD/CHOROPSIS			
1.	Blue-winged/Jerdon's	C	Not enlisted
2.	Golden-fronted	C	Not enlisted
MARTIN			
1.	Dusky crag	C	Not enlisted
MINIVET			
1.	Orange	C	Sch – IV
2.	Small	C	Sch – IV
MUNIA			
1.	Scaly –breasted	C	Sch – IV
2.	White-rumped	O	Sch – IV
3.	Avadavat,Red	O	Sch – IV
MYNA			
1.	Common	C	Sch – IV
2.	Jungle	O	Sch – IV
NIGHTJAR			
1.	Grey	O	Sch – IV
2.	Indian	O	Sch – IV
ORIOLE			
1.	Black-hooded	C	Sch – IV
2.	Black-naped	Rare	Sch – IV
3.	Eurasian golden	C	Sch – IV
OWLET/OWL			
1.	Jungle Barred	C	Sch – IV
2.	Spotted	O	Sch – IV
PARAKEET			
1.	Alexandrine	C	Sch – IV
2.	Plum-headed	C	Sch – IV
3.	Rose-ringed	C	Sch – IV
4.	Vernal Hanging (Lorikeet)	Rare	Sch – IV
PEGION			
1.	Pompadour green/ Grey fronted	C	Not enlisted
2.	Blue Rock	C	Not enlisted
3.	Yellow-footed green	O	Not enlisted
PIPIT			
1.	Tree	O	Sch – IV
PITTA			
1.	Indian Pitta	O	Sch – IV
REDSTART			

1.	Black Redstart	Rare	Not enlisted
ROBIN			
1.	Indian	C	Not enlisted
2.	Oriental magpie	C	Not enlisted
ROLLER			
1.	Indian	Rare	Sch – IV
SANDPIPER			
1.	Common	O	Not enlisted
2.	Green	O	Not enlisted
SHAMA			
1.	White-rumped Shama	C	Not enlisted
SHRIKE			
1.	Long-tailed/Rufous-backed	C	Not enlisted
2.	Common wood	C	Not enlisted
3.	Black-headed	O	Not enlisted
4.	Large Grey	O	Not enlisted
SPARROW			
1.	Chestnut-Shouldered (Yellow-Throated Sparrow)	C	Not enlisted
2.	Sparrow, House	C	Not enlisted
STARLING			
1.	Asian-pied (pied myna)	O	Sch – IV
2.	Chestnut-tailed (grey-headed)	O	Sch – IV
SUNBIRD			
1.	Crimson (yellow baked)/Vigor's	O	Sch – IV
2.	Crimson backed (small)	C	Sch – IV
3.	Loten's	O	Sch – IV
4.	Purple	C	Sch – IV
5.	Purple rumped	C	Sch – IV
SWALLOW			
1.	Barn	C	Not enlisted
2.	Red-rumped	O	Not enlisted
SWIFT			
1.	Asian palm	C	Not enlisted
2.	House	O	Not enlisted
TAILOR BIRD			
1.	Common tailorbird	C	Not enlisted
THRUSH			
1.	Blue rock	Rare	Not enlisted
2.	Blue-capped rock	Rare	Not enlisted
3.	Malabar whistling	C	Not enlisted
4.	Orange headed	C	Not enlisted
TREEPIE			
1.	Rufous Treepie	C	Sch – IV
WAGTAIL			
1.	Forest	O	Not enlisted
2.	Grey	O	Not enlisted
WARBLER			
1.	Booted	C	Not enlisted
2.	Greenish	C	Not enlisted
3.	Sulphur bellied	O	Not enlisted
WATERHEN			
1.	Waterhen, White-Breasted	C	Not enlisted

WEAVER			
1.	Baya	C	Sch – IV
WOODPECKER			
1.	Brown-capped pygmy	C	Sch – IV
2.	Heartspotted	O	Sch – IV
3.	Rufous	O	Sch – IV
4.	White-naped (black-backed)	C	Sch – IV
5.	Yellow-crowed (Mahratta)	O	Sch – IV

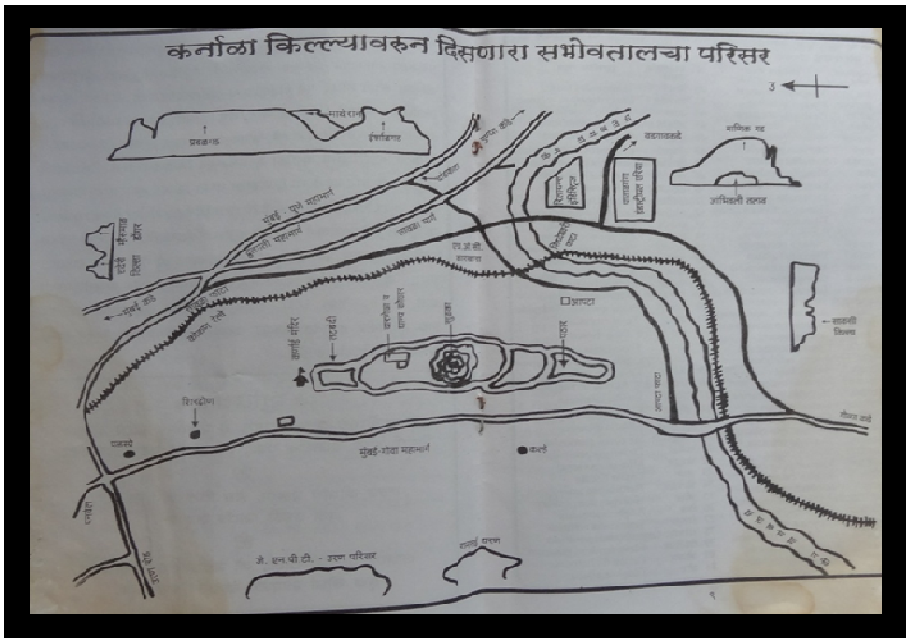

Plate 3.3 Aerial view Around Karnala Fort

Source: Karnala Bird Sanctuary Information Book by Ministry of Forest, Wildlife Dept, Thane. 2008-2009 Edition.

2. Prabalgad Hill

Prabalgad is a hill fort at a distance of 8 km from the site is located in Khalapur Taluka of Raigad District. Height of Prabalgad is 2320 feet i.e. 707 meters above sea level, which is easy to trek.

3. ESA villages within study area

There are 10 villages, viz. Nadhal, Palasdari, Talawali, Kalote Mokashi, Ghodivali, Kalote Rayati, Nigdoli, Parkhande, Talashi and Matheran coming under Eco Sensitive Areas (ESA) of Western Ghat. Amongst these villages, Matheran hill, covering an area of 7.2 sq.km at about 760 m above sea level, is most important due to its attraction to tourists. The average tourist towards Matheran is increasing by 20 to 22 thousand per annum during last 15 years and in 2010 it was 4.95 Lakhs. The deep ravines around it are covered by dense forests, while the top of hill is a large plateau.

Biodiversity in Matheran

Matheran hill, on the Western Ghats, is located at about 7 km from the project boundary. It is very rich in biodiversity as it supports evergreen forest.

Flora:
Green forest of Matheran shows presence of varieties of trees, shrubs, wild vegetables, flowering plants and medicinal plants, such as *Mangifera indicia* (Mango), *Ficus retusa* (Banyan tree), *Ficus religiosa* (Peepal), *Olea dioica* (Rose Sandal Wood), *Cylea pelta* (Mothi pahadvel), *Asclepias Curassavica* (Haldi), *Calotropis gigantea* (Rui) etc. are to name a few as endemic to Matheran. Due to presence of a number of medicinal plants and herbs, Matheran can also be called as a health sanatorium in itself.

Fauna
It is home of endangered endemic mammal *Ratufa indica* (Giant squirrel), which is an endangered species classified in the "Near Threatened" category of IUCN Red list. The evergreen forest is dwelling to leopard, Bonnet Macaque, Barking deer, Grey Mongoose, Common Palm Civet, Rhesus Macaque Black, Common Langur, Three-striped Palm Squirrel and Indian porcupine. Matheran exhibits numerous varieties of birds such as Asian koel, Asian Palm Swift, Asian paradise–flycatcher, Black Drongo, Common pigeon, Crested hawk Eagle, Indian Blue Robin, Copper smith Barbet, Red breasted flycatcher, Shikra, Scaly breasted Munia, Indian Golden Oriole, Tyler's leaf warbler, Jungle Myna, Crimson backed Sunbird etc. Amphibians found in Matheran are Common Indian Toad, Indian Bullfrog, Common Indian Tree Frog, Ramanella Montana and Skittering frog. Reptiles such as bark Gecko, Monitor Lizard, spotted Rock Gecko, Indian rock python, Decan Banded Gecko, spectacled Cobras, bamboo pit Viper etc. are available in this area. Among the insects, commonly found in Matheran are Coleoptera or Beetles, *Butocera rubra, Prionus orientalis,* a large Scarabaeus, hundreds of humming Chafers, Anomala elata, Golden Beetles or Buprestidae, spotted Lady Birds, Paussidae, Hispa, Blister flies etc. Numerous butterflies' species, such as Blue Mormon, Blue oak leaf, Chestnut, Common Jezbel, Vindhyan bob, Golden angle, Common Blue Bottle etc can be spotted in lushes.

Generally available flora and fauna in other ESA villages are delineated hereunder.

Flora: *Acacia nilotica, Bombax ceiba , Cassia fistula, Delonix regia, Emblica officinalis, Mangifera indica, Mitragyna parviflora, Madhuca latifolia, Ficus racemosa, Peltophorum pterocarpum, Pongamia pinnata, Tectona grandis, Syzigium cumini, Tamarindus indica, Terminalia tomentosa, Terminalia catappa , Ziziphus mauritiana* etc.

Fauna: *Accipiter badius (Shikra), Acridotheres ginginianus (Bank Myna), Acridotheres tristis (Common Myna), Aegithina tiphia (Common Iora), Alcedo atthis (Common Kingfisher), Anas crecca (Common Teal), Apus nipalensis (House Swift), Ardea purpurea (Purple Heron), Athene brama (Spotted Owlet), Buteo buteo (Common Buzzard), Coracias benghalensis (Indian Roller), Coturnix coturnix (Common Quail)*

Wetland Ecology
Within the study area there are Lakes like Hatnoli, Usran, Vinegaon, Varne, besides Jambivali reservoir, Bhilavle reservoir and Ulhas river at about 10 km.

Secondary data for Hatnoli Lake, Usran Lake, Vinegaon Lake, Varne Lake, besides Jambivali reservoir , Bhilavle reservoir are not available.

Secondary data pertaining to flora and fauna of the Ulhas river have been generated from secondary sources and discussions with local people.

Ulhas River

Phytoplankton
Phytoplankton counts were recorded in Ulhas river in earlier EIA report (2015) where total algal population varied between 2700 and 3500 cells ml^{-1}. Total 12 genera of phytoplankton were recorded from 3 groups, dominated by Bacillariophyceae. The observed genera under different groups were: **Cyanophyceae :** *Anabaena* sp., *Pediastrum* sp, *Aphanocapsa* sp, *Oscillatoria* sp.;

Chlorophyceae: *Ankistrodesmu*s sp., *Chlamydomonas* sp., *Pediastrum* sp., *Ulothrix* sp., *Cosmarium* sp; **Bacillariophyceae:** *Gyrosigma* sp., *Nitzschia* sp.

Zooplankton
Zooplankton studies, in the year 2013-14, revealed that density varied between 4600 and 5920 N/m3. Only 6 genera from three different groups were recorded. Cladocera (*Alonella* sp. and *Daphnia* sp.) followed by Rotifera (*Brachionus* sp.) dominated in all the samples. The Copepods, represented by *Cyclops* sp. and *Diaptomus* sp., were least common.

Fisheries
Based on discussion with local people, the fishes, commonly recorded from Ulhas river, are *Catla catla* (catla), *Labeo rohita* (rohu), *Cirrhinus mrigala* (mrigal), *Labeo calbasu* (Calbasu), *Cyprinus carpio* (Common carp), *Labeo bata* (Bata), *Oreochromis mossambicus* (Tilapia) 0 etc. Among these fishes, *Oreochromis mossambicus,* which can tolerate wide range of salinity, was most dominant.

(***Source****: EIA report: PuraniK Megatown, Neral; Ultra Tech, Thane; 2015*)

a. Flora
General Trees and Palms species found in the surroundings are:
Trees: *Ziziphus mauritiana* (Ber), *Bauhinia racemosa* (Apta), *Ficus racemosa* (Umber), *Phyllanthus emblica* (amla), *Thespesia populnea* (Indian tulip tree), *Terminalia catappa* (Bareservoir), *Azadirachta indica* (Neem), *Ficus religiosa* (Peepal), *Mangifera indica* (Mango) etc.
Palms: *Cocos nucifera* (Coconut) and *Borassus flabellifer* (Tadgola)

b. Fauna
Birds: *Columba livia* (Blue rock pigeon), *Acridotheres tristis* (Common myna), *Corvus splendens* (House crow), *Pycnonotus jocosus* (Redwhiskered bulbul), *Ardeola grayii* (*Indian* pond heron), *Microcarbo niger* (Little cormorant) etc.

3.6 SOCIO ECONOMIC ENVIRONMENT:

The proposed Special Township in the villages of Sarang would make major land use changes in the area and will have impact on quality of life of local inhabitants, especially those who are currently on the bottom of socio-economic ladder. The overall aim of this study is to provide baseline data pertaining to socio-economic conditions in the study area, so that during the course of various interventions, these conditions need to be addressed and wherever required need to be strengthened.

3.6.1 Background of the Project:
The project site is located in village Sarang, Tal Khalapur, Dist Raigad being located in a under developing area with very few new housing and commercial projects have just started there in last five years.

3.6.2 Raigad District: Basic Information
Raigad District is situated in western Maharashtra in the konkan region. The district has geographical area of 7152 sq. km. For administrative purposes the district is divided into 4 sub divisions viz., Alibag, Panvel, Mangaon and Mahad and 15 tahsils. According to the 2011 census Raigad District has a population of 2,634,200 representing 2.35% of the state population. The district has a population density of 368 persons per sq. km with decadal growth rate of 19.31%. Raigad district has a sex ratio of 959 females for every 1000 males, and a literacy rate of 83.14%. Raigarh district presently consist of 42 towns, and 1909 villages.

Table 3.33: Demographic Profile for Raigad District

1.	Area	7152 sq. km.
2.	Population	2.63 million
3.	Decadal Growth rate	19.31%

4.	Male population	1.34 million
5.	Female population	1.28 million
6.	Density of population (persons per sq. km.)	368
7.	Sex Ratio (females per 1000 males)	959
8.	Literacy	83.14%
9.	Male literacy	89.13 %
10.	Female literacy	76.92 %
11.	Urban Population	36.84%

Source: Primary Census Abstract, Census of India 2011

The rate of increase of decadal population of Raigad district is 19.31% as the population increased from 2.2 million in 2001 to 2.63 million in 2011. The urban population increased tremendously from 5.34 lakh in 2001 to 9.70 lakh in 2011 with a decadal growth rate of 81.64%, whereas the rural population decreased from 16.73 lakh in 2001 to 16.64 lakh in 2011 with a negative decadal growth rate of -0.53%.

3.6.3 Study area

The study area for socio economic assessment was defined as an area within 2 km radius around the proposed project site as per the statutory requirement of the Ministry of Environment & Forest. Designation of impact zone is based on the EIA guidance manual. As mentioned earlier, the project site is in the Khalapur Taluka of Raigad District. There are 16 small villages and one Census Town in 2 km radius of the project site. There are no towns or cities in the study area. The location is essential rural with moderate in habitation. The nearest city of Panvel is 21 km by road from the project site towards north-west.

3.6.4 Methodology

For socio-economic baseline data generation following methodological approach was employed:

(i) Collecting data and information from available secondary sources like records and reports of Government Department, academic and research institutions, NGOs etc.,
(ii) Primary site visit to the project site and nearby villages and one-to-one meetings were made with key gram panchayat officials and representatives
(iii) The village profile was developed for all the 17 villages in the study area
(iv) Village level data for population trend, demographic details, population density, sex ratio, literacy rate, % of main workers, % of marginal workers, % of non-workers

The data is collected and analysed using secondary sources viz. Census records, District Statistical Abstract, Official Document etc. on following parameters for the study region.

- Demographic structure
- Infrastructure resource base
- Economic attributes
- Health status

The demographic profile, infrastructure facilities and socio-economic condition is being described under different classifications in the following section.

3.6.5 Demographic Profile

Summary of demographic structure with reference to population, household, literacy, community structure and employment are presented in this section. As per 2011 Census, the total population of the study area is 28,731 with 14,650 males and 13,721 females. The demographic status of the study area is shown in Table 3.34.

Table 3.34: Demographic Characteristics of the Study Area

Villages	No. of Households	Total Population	Sex Ratio	Literacy	% of SC	% of ST	average size of household
Lodhivali	514	2005	928	88.39	2.04	13.07	4
Nadhal	418	1911	921	61.26	10.94	47.15	5
Chouk Manivali	735	3309	928	73.73	1.96	27.83	5
Hatnoli	674	2837	913	81.19	4.65	8.53	4
Tupgaon	398	1847	1032	85.69	10.29	1.25	5
Pali Kh.	64	317	1019	75.36	1.89	14.83	5
Sarang	128	646	1071	72.18	21.98	22.29	5
Tembhari	251	1136	919	64.89	3.26	37.68	5
Vayal	159	755	1551	66.86	12.05	0.00	5
Kambe	157	745	901	86.72	0.54	0.27	5
Vanivali	115	522	806	83.05	0.00	2.11	5
Kopari	124	605	915	81.92	0.00	33.72	5
Asroti	107	578	953	84.01	13.15	0.00	5
Jambhivali Tarf Boreti	138	748	938	80.42	0.00	0.00	5
Asare	240	1221	935	61.70	0.00	25.96	5
Dharni	112	557	954	60.29	0.00	36.45	5
Rees (CT)	1983	8632	895	92.86	8.46	1.40	4
Total	**6317**	**28371**	**937**	**81.16**	**6.07**	**13.49**	**4**

There are 6,317 households in the study area and the average size of household is 5 members per household in the study area. The dependent population below 6 years is 2971 (10.47% of the total population) in the study area.

3.6.6 Sex Ratio

The sex ratio of the study area is 937 females per 1000 males, which is lower to the sex ratio of the Raigad district i.e. 959 but higher than the sex ratio of the State i.e. 929 females per 1000 males. The child sex ratio for the study is only 825 female children per 1000 male children which is very low and shows grim perspective for the future.

3.6.7 SC & ST Population

According to the 2011 census, the ratio of scheduled caste population in the study area to the total population is 6.07% and scheduled tribe population is 13.49%. The overall percentage of scheduled caste and scheduled tribe population of the study area is low. Together they constitute about 19.56% of total population of the study area.

3.6.8 Literacy Rate

In the study area the average literacy rate is 81.16%. The female literacy rate is low in the study area, which is 75.92% as compared to the male literacy rate, which is 86.11%. The female literacy rate is poor as compared to the male literacy in the study area. The literacy rate of Raigad district is 83.14% and literacy rate of Maharashtra State is 82.34%, the literacy rate in the study are is low as compared to the literacy rate of Raigad district.

3.6.9 Economic Activity

As per the Census 2011, the workforce in the study area is 10841 which constitute 38.21% of the total population of the study area. The male workers constitute 76.19% and female workers constitute 23.81% of the total workers.

Main workers[1] constitute 88.11% of the total workers. The remaining 11.89% are marginal workers[2]. The study area has high majority of main workers. Among the main workers, male main workers are 79% and female main workers are only 21%. As the area is rural in nature and predominant workers are absorbed in farming related activities thus there is high proportion of male main workers.

Table 3.35: Status of working population in the study area

Study Area	Work Participation rate	Total Workers and Types of Workers			
		Total workers	Main workers	Marginal Workers	Non Workers
Total	38.21	10841	9552	1289	17530

3.6.10 Occupational structure

The occupational structure of the population in the study area has been studied. The relative importance of the main spheres of economic activity is the gauged from the pattern of distribution of total workers classified on the basis of Industrial category of workers into the following four categories:

1. Cultivators
2. Agricultural Labourers
3. Household Industry Workers
4. Other Workers

Of the total workers category, cultivators (14%) and agricultural labour (15%) together constitute 29% of the total workers. It reflects that agricultural sector is not the largest livelihood provider in the study area. Merely 4% of workers in the study area are engaged in the household industry.

Table 3.36: Distribution of Total workers by category

	Total workers	Total Workers			
		Cultivators	Agricultural Labourers	Household Industry	Other Workers
Study Area	10841	1533	1662	420	7226

It reflects that other worker category i.e. 67% is the dominant workforce, which includes all government servants, municipal employees, teachers, factory workers, plantation workers, those engaged in trade, commerce, business, transport banking, mining, construction, political or social work, priests, entertainment artists, etc.

Although the area is rural in nature but its proximity of Mumbai Metropolitan Area and the MIDC Patalganga and Taloja nearby is the pull factor behind the high number of other workers in the study area. The other workers dominant in the study area are mostly male workers as compared to the female workers.

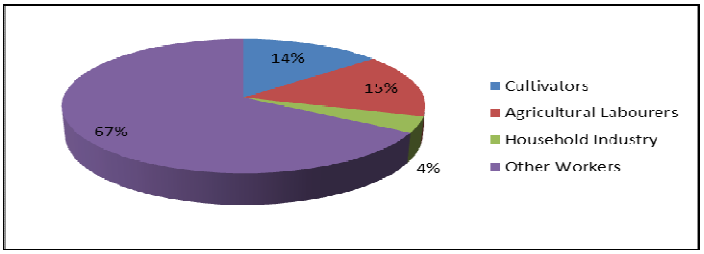

Fig 3.17: Percentage Distribution of Workers in the Study Area

[1] Main workers were those who had worked for the major part of the year preceding the date of enumeration i.e., those who were engaged in any economically productive activity for 183 days (or six months) or more during the year.

[2] Marginal workers were those who worked any time at all in the year preceding the enumeration but did not work for a major part of the year, i.e., those who worked for less than 183 days (or six months).

3.6.11 Socio Economic Survey

Socio economic survey was undertaken in the Sarag village of the study area. The Sarang village is part of the Tembhri group Gram Panchayat of the study area. The main objective of the survey was to visit the project site and collect the socio-economic data from the villages and observe the basic infrastructure available. A keen observation of the quality of life of the study area was also carried out.

The project site visit and observation has been used tool for collecting data about people and processes as part of qualitative research. Special care was taken to observe prevailing socio-economic condition in the sample village and also assess awareness opinion and reaction of the inhabitants about the project.

3.6.12 Village – Sarang

Sarang is a small village near Panvel and it comes under Tembhri group Gram Panchayat. The project is located in the village. There were only 120-130 households in the village of which mostly belong to farming community, but recently non farming activities such as jobs and service sector is the main source of livelihood.

The village has two schools, one Zilla Parishad Primary School and other privately owned Sarang Vidya Mandir, also an upper primary school. There is also an anganwadi for small kids. For higher studies, students have multiple options of going to nearby villages of Chowk, Lodhivali, and Pali which has both English and Marathi medium secondary schools. Panvel is the nearest city with college and high school for further education, which is very well connected by NH-4, with many travelling options.

There is no health care facility available in the village. The villagers for health care prefer to go to Chowk which has some private health care facilities such as Clinics. Also there is Dhirubhai Ambani Hospital, in Lodhivali; a 78-bed state-of-the-art hospital that caters to an industrial and rural population in the nearby villages. It provides free outpatient and subsidised inpatient treatment for the needy and poor patients as well as for senior citizens.

Most of houses in the villages are pucca and very small numbers of houses are semi-pucca. All the households in the village have power supply facility for domestic use and are using LPG as cooking fuel as well as other purposes. Approach road to the village is pucca whereas internal road network is semi pucca and somewhere paved. Major source of drinking water comprises of MJP scheme water supply through pipeline, distributed by the Gram Panchayat.
Although majority of village population is not aware of the project. However as per the Gram Panchayat officials the project should improve the basic infrastructure of all the villages around the project.

Transport & Connectivity in the study area is good as it is located on the National Highway No. 4 connecting Mumbai to Bangalore via Pune and Kolhapur. The Karjat Panvel Railway line also passes through the study area. The project site is very close to the highway and the highway provides both public (MSRTC, KMT, buses) and private (auto, tempo) travel options for the commuters. However, the internal transport from highways to the internal villages is poor with limited options. Chowk railway station is located 2 Km from the project site and daily 2 set of passenger trains stop here, providing the travel option to the commuter.

Photo Documentation

Discussion with Gram Panchayat official

The Gram Panchayat office

Drinking Water Facility

3.7 TRAFFIC PATTERN AND DENSITY

The Proposed Project is deriving access from Existing NH4 of 30 m wide Road. The Proposed Project is comprises of 18 m wide road to cater the Traffic from various land uses. Also Village roads passing through abutting villages viz: Sarang and Chowk will also useful to cater partial traffic from Southern side Parcel of Proposed Project. Road network within 5km radius from the project location is considered for traffic study. Traffic survey was conducted at Old Mumbai Pune Highway, Mumbai Pune Expressway, Sarvoli Kharpada Road, Dand Apta Road, School Road, Sarang Road, Site Access Road, Temple Road, Jambhivali gaon Road, Market Road and SH 79

Conclusion & Recommendation:

The conclusions and recommendations are summarized below:

1. The project traffic has been forecasted for year 2020 and 2025; this has been superimposed along with existing projected traffic to arrive at future traffic for year 2020 and 2025.

2. The forecast traffic on the roads adjoining the project Site access Road and Old Mumbai Pune Highway will operate at acceptable level of service in future up to 2030.

3. Swept Path analysis yielded that road geometry was adequate for vehicle turning maneuvers.

4. A Traffic Management Plan in terms of traffic calming measures and traffic control measures has been devised and proposed to maintain adequate level of service and safety of vehicles and pedestrian.

Detailed Traffic analysis report is attached as **Enclosure 9.**

CHAPTER: 4
ANTICIPATED IMPACT AND MITIGATION MEASURES

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ANTICIPATED IMPACT AND MITIGATION MEASURES

4.0 INTRODUCTION:

This chapter describes the anticipated environmental impacts on the surrounding area / environment due to the implementation of project. The major objectives of describing the anticipated impacts and mitigation measures are:

- To identify pollution sources-characteristics, quantification and prediction during construction and operation phase
- To suggest suitable avoidance / mitigation methods for each of the impacts due to project activity

The impacts have been assessed for the project assuming that the pollution due to the existing activities has already been covered under baseline environmental monitoring and continue to remain the same during the operation phase. The project would create impact on the environment in two distinct phases.

- During the Construction phase which may be regarded as temporary or short term
- During the Operation phase

The impact identification and prediction process also aims to:

- Identify potential source in project activities or cause of impact throughout the life of project.
- Characterize the potential impacts affecting a target or receptor (physical, human and socio-economic).
- Assess the potential of changing likelihood of impact through Environmental Management Plan (EMP)
- Prediction of the impacts due to the development, construction and functional activities encompass the developmental processes to be undertaken during construction and functional phases.

4.1 PREDICTION OF IMPACTS & MITIGATION MEASURES:

The activities that take place during construction phase and operation phase of the project and the potential impacts on the environment, their prediction, significance and mitigation are as follows.

4.1.1 Land Environment:

During Construction Phase:

- **Anticipated Impacts –**

- The waste generated during excavation and construction activity.
- Improper disposal of the excavated earth and waste generated during construction may cause irreversible negative impacts on land environment
- Storage of construction material/chemicals if not done at designated place can cause nuisance and hazards
- Accidental spillage of chemicals/oil may lead to soil contamination
- Improper segregation and disposal of the solid waste by workers dwelling on site during construction phase may cause negative impacts on land environment

- **Mitigation Measures-**

- Designated storage of construction material
- Waste Management Plan during excavation is formulated in which reuse of all excavation earth onsite is envisaged.

- Excavated material will be fully reused on site for backfilling purpose.
- The solid waste generation due to workers dwelling on the site will be segregated on site and handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal.
- Bituminous materials /any other chemicals shall not be allowed to leach into the soil
- Waste oil generated from D.G. sets will be handed over to authorized recyclers approved by CPCB
- Hazardous waste shall be handed over to authorized common hazardous waste disposal site for further treatment and disposal

During Operation Phase:

- **Anticipated Impacts -**

- Various types of solid wastes, if disposed improperly, can have a negative impact on land environment
- Accidental spillage of oil from vehicles leads to soil contamination

- **Mitigation Measures-**

- Waste minimization recovery and reuse
- Segregation at source for all solid waste streams
- Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal.
- Biodegradable garbage (23607Kg/day) shall be treated in Biomethanation Plant
- E-waste (24895 Kg/annum) from commercial portion of Phase 3 and Phase 4 and will be stored separately and disposed through authorized recyclers
- Bio Medical Waste (56.3 Kg/ day) from Hospital of Phase 1 and same will be handled and disposed as per Bio-Medical Waste Management Rules, 2016
- Adequate space for solid waste management shall be earmarked. This includes the space required for collection, segregation and treatment
- Use of dried sludge from STP and waste generation from Biogas plant as manure
- All the occupants shall be informed that they should dispose their E- waste or household hazardous waste to the designated common storage so that these will not be mixed with municipal solid waste and can be disposed as per norms

This being a construction project apart from impacts on the site, no adverse impact on the land environment and soil in the surrounding area is anticipated.

4.1.2 Water Environment (Water Resources and Quality):

During Construction Phase:

- **Anticipated Impacts-**

- Increase in water demand during construction phase for site preparation, water spraying for dust suppression, for construction activities, curing, domestic and other water requirements for labour and staff onsite
- Waste water disposal by construction labour and staff can lead to pollution of nearby water courses
- Sedimentation of outside drains
- Water logging creates unsanitary conditions and mosquito breeding at site
- Construction of basements or excavation below ground level may create sedimentation and impact on ground water quality during dewatering for excavation of basements and also generation of large amount of ground water that need to be disposed off

- **Mitigation Measures –**

- Wastage of water used for construction curing shall be avoided
- Use of polymeric dust suppression system wherever possible to save water
- The sewage generated (22 KLD) for each phase from construction workers and staff etc. and shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants
- Site sanitation & good housekeeping
- Sedimentation of outside drains shall be avoided by using screens and silt traps
- Proper management of channelization of water to avoid water logging at site

During Operation Phase:

- **Anticipated Impacts –**

- Increase in fresh water demand (7283 KLD)
- Disposal of sewage (10227 KLD) can lead to pollution of nearby water courses if not treated or disposed properly
- Sedimentation and pollution of outside drains
- Provision of dewatering pumps of adequate capacity as per site conditions
- Suction points of the pumps will be equipped with silt screens and appropriate filters to minimize stile discharge
- Collection of Subsoil water/ excess water during excavation and construction of basements in the sedimentation tank for 6 to 7 hrs.
- Disposal of supernatant to the drain.
- Guidelines issued by Central Ground Water Authority (CGWA) shall be followed strictly and also permission from CGWA shall be obtained during construction phase before dewatering of basements

- **Mitigation Measures –**

- Use of water saving practices like dual flush cisterns and low loss plumbing fixtures to reduce water consumption
- Treatment of sewage (10227 KLD) into total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL and its reuse for secondary requirements like flushing (4400 KLD) and gardening (1044 KLD) within site.
- ETP is proposed for Hospital in phase 1, primary treatment shall be done for effluent and then it will be connected to STP.
- Provision of water holding pond having adequate space (48965.05 Sq.mt. with depth 1 m.) for storage of excess treated sewage
- Provision of adequate water purification system like aerators etc. to keep the optimum oxygen level and avoid breeding of the mosquitoes.
- Stored excess treated sewage shall be given for irrigation purposes outside the plot.
- Proper operation and maintenance of STP and daily analysis of the excess treated sewage to ensure discharge standards as per EP Act. To keep a daily watch on pH, BOD, COD and TSS & O & G of the STP outlet to ensure good treatment of waste water by provision of sensors
- Rain water collection from terraces into total 31 numbers of RWH tanks of total capacity 8981 KL and its reuse thereby reducing the fresh water demand in monsoon season up to 45 %
- Provision of internal Storm water drainage system with adequate capacity i.e.29.61 m^3/sec and external drain with adequate capacity 255.12 m^3/sec
- Surface rainwater to be passed through oil & grease trap & desilting chamber and then transferred to external drain
- Proper maintenance of storm water drainage to avoid choking of drains and flooding on site

4.1.3 Air Environment:

During Construction Phase:

- **Anticipated Impacts –**

- Increase in level of dust and other air pollutants due to building construction and other related activities
- Emissions from vehicles carrying the construction materials
- Emissions from DG sets
- Open burning of solid wastes can cause air pollution

- **Mitigation Measures-**

- Use of water for dust suppression and polymeric dust suppression system (wherever possible)
- Use of covering sheets shall be done for trucks carrying construction material to prevent air borne dust
- All material storages shall be adequately covered to avoid dust / particulate emissions
- Use of CPCB approved DG sets
- Proper maintenance of DG sets
- Adequate parking provision and proper traffic movement for smooth traffic flow
- Vehicles having valid pollution under control certificate shall be allowed to ply on site
- Open burning of solid waste shall be prohibited
- Regular health checkup of the workers
- Use of the standard personal protective equipments like masks, goggles etc.

During Operation Phase:

- **Anticipated Impacts –**

- Vehicular emissions
- Emissions from DG sets

- **Mitigation Measures –**

- Adequate parking provision: 4W: 21983 Nos., 2W: 2436 Nos., Bus: 130 nos. and Ambulance: 5 Nos. Proper traffic management for smooth traffic flow (Detailed traffic report is enclosed)
- DG sets with acoustic enclosures is to be installed and stacks height to be kept as per Central Pollution Control Board (CPCB) norms to allow effective dispersion of pollutants
- Periodic monitoring of SPM and SO_2 concentration and thereby schedule and implement proper maintenance of DG sets
- Plantation of trees (Approx.: 15900 Nos.) of various varieties shall be planted on ground

4.1.3.1 Air Emission and Dispersion Modeling:

The process of determining power backups along with future traffic levels generated and attracted to the whole development involves the identification of suitable assumptions. The impact on ambient air quality was assessed hereunder in view of the following activities:

- ✓ Analysis and plots as per Baseline traffic
- ✓ Construction source emissions
- ✓ Vehicular re-suspended dust
- ✓ Wind erosion from stockpiling of earlier excavated material and back filling
- ✓ Future analysis considering 25 yr traffic projection
- ✓ Results calculated as 24 hr average along with peak hour traffic

Dispersion modeling has been carried out using area source emissions with meteorology data to predict ground level Fugitive Dust concentration. Existing peripheral road traffic along with constriction phase scenario i.e. fugitive dust emissions and operational phase traffic pattern and generator use because of the development is estimated in this Chapter.

- **Analysis details**

Tools and methods

The major source of pollutant in the vicinity of the proposed project is vehicular exhaust i.e. line source. The fugitive sources of particulate matter in the vicinity of the proposed project are area polygon source i.e. actual construction activity and volume source i.e. excavation and stockpiling of excavated soil. And re-suspension of road dust because of vehicular movement. There are no other significant sources of fugitive dust pollution in the neighborhood. Source dispersion analysis is assumed based on AERMOD View^{TM} model. This model enables analysis with respect to PM10, PM2.5, NOx and CO and gives results in easy to understand graphical format.

The following steps are involved in the analysis:

I. Inputs are entered into the software as per the general modeling parameters.
II. Information on the roadway network, traffic volume, excavated and stockpiled soil, construction activity, generator set and receptor is added to the software.
III. The analysis process is done by the model.

- **Input(s) needed and assumption**

Table 4.1 Illustrates series of input and some of assumptions gone into the model

Table 4.1: Input and Assumptions

No.	Inputs Required		Availability for this project
1.	Traffic Parameters	Traffic Volume	Yes
		Traffic Composition	Yes
		Type of Fuel used by each category	Yes
		Average speed of vehicles	No
2.	Construction parameters	Heavy construction activity & Construction of haul road	Yes
		Construction vehicle plying	Yes
		Excavation, Soil Stockpiling	Yes
3.	Generator set	Capacity	Yes
		Stack details	Referred – CPCB'86
4.	Meteorological Parameters	Wind Speed, Wind Direction, Cloud Cover, Temperature, Humidity, Station Pressure, etc.	IMD Weather data
5.	Emission Parameters	Expressed in grams/distance travelled	CPCB 2007
		Expressed in grams/second emitted	US-EPA, AP42
		Expressed in grams/second emitted	US-EPA, AP42
6.	Road Geometry	Road Width	Google image
		Median Width	Actual
7.	Receptor Location	Uniform grid	Uniform grid

- **Methodology**

Vehicle number is the most important parameter to quantify the emissions from mobile sources in addition to the distance travelled by each of the vehicles also known as Vehicle Kilometers Travelled (VKT). Emission factors of different types and origin have been used in the past by researches. However, the commonest method and more appropriate method based on the data available is to use emission factor in terms of pollutant mass per kilometer run of the vehicle. The emission factors developed for Indian conditions have been taken from a report "Air Quality Monitoring Project-Indian Clean Air Program, 2007" prepared by CPCB (with ARAI).

Heavy construction activity and construction of haul road dust emissions were represented as gm/m^2/sec (Ref: USEPA's Compilation of Air Pollutant Emission Factors, 5th edition, 1995 (AP-42), Section 13.2.3.3). Emission factor for traffic on dusty ground referred from "USEPA's Compilation of Air Pollutant Emission Factors, 5th edition, 1995 (AP-42), Section 13.2.2". Fugitive dust emission

calculations were done with wind erosion emission factor of activity was taken from "USEPA's Compilation of Air Pollutant Emission Factors, 5th edition, 1995 (AP-42), Section 13.2.5".
For the generators proposed on site details procured from Emission Regulations – Part IV, CPCB'86 was utilized for emissions estimation. Widespread method based on the data available was to use emission factor in terms of pollutant mass per second generator operated. The emission factors have been taken from "AP42 Ref Stationary Internal Combustion Engines Diesel Fired Ref 3.1" prepared by US – EPA.

- **Data collection**

Based on the proposal mentioned, information of traffic Survey for finding demand of parking in the area, review the external and internal connectivity aspects so as to appreciate the adequacy of the infrastructure proposed in terms of number of road lanes at the entry etc. The road network under consideration will be studied in detail. Comparative account of traffic volume survey and future projected traffic with proposed development is given in **Table 4.2**

Table 4.2: Traffic Count Survey

Location	2W	3W	Car	LCV	Bus	Truck
Present Scenario						
Old NH4	15590	2740	11938	2684	1132	7654
Future Estimates						
Old NH4	37339	6562	28592	6428	2711	18332

A vehicle counting program specific to the need for developing emissions inventory was planned and executed at specific locations all across the area of influence of the project were considered. Construction phase detailing was collected from client. For the generators proposed on site details procured from Emission Regulations – Part IV, CPCB'86 was utilized for emissions estimation.

- **Baseline emission estimates**

Based on the primary activity data gathered from emission factors the total estimated emissions of different categories of pollutants are represented in **Table 4.3.**

Table 4.3: Vehicular Emission Estimates

Location	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)	CO (g/s)
Old NH4	0.4792	0.3258	2.2975	2.7443

The emissions were calculated for each vehicle type and the total emissions for all the vehicles of each road at Baseline and in the future in g/s. Heavy construction activity, haul road and onsite soil stockpile emissions rate calculated as $g/m^2/sec$ and were represented as g/s. Construction vehicle plying on unpaved site road was represented as g/s. Construction phase pollutant emissions are given in Table 4.4 (a & b). Construction phase pollutant emissions are given in Table 4.5

Table 4.4 (a): Emissions for Each Pollutant during construction phase (7yrs)

Location	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)	CO (g/s)
Old NH4	0.6790	0.4617	3.3848	4.5237
Demolition and Construction Activity	0.0186	0.0128	--	--
Material trucks	0.0025	0.0017	0.0008	0.006
Stockpiling	0.0003	0.0002	--	--

Table 4.4 (b): Emissions for Each Pollutant during construction phase (15yrs)

Location	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)	CO (g/s)
Old NH4	0.9022	0.6135	4.5683	6.3578
Demolition and Construction Activity	0.0186	0.0128	--	--
Material trucks	0.0025	0.0017	0.0008	0.006
Stockpiling	0.0003	0.0002	--	--

Table 4.5: Emissions for Each Pollutant in Operation Phase (25yrs)

Location	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)	CO (g/s)
Old NH4	1.1689	0.7949	5.8471	7.8868

Proposed project will have almost sixty generator sets having capacities ranging from 80kVA – 2500kVA. If these used, DGs will run mostly during power cuts and it is most unlikely phenomenon. These generators use diesel as fuel thereby having minimal potential to cause particulate and gaseous pollution. Emissions estimated for the same are given in **Table 4.6**.

Table 4.6: Generator Set Emission Estimates

Parameter	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	NOx (g/s)	CO (g/s)
80 KVA DG Set (01 No.)	$8.33x10^{-09}$	$5.67x10^{-09}$	$1.68x10^{-25}$	$6.31x10^{-34}$
100 KVA DG Set (01 No.)	$1.04x10^{-08}$	$7.08x10^{-09}$	$3.28x10^{-25}$	$1.54x10^{-33}$
140 KVA DG Set (01 No.)	$1.46x10^{-08}$	$9.92x10^{-09}$	$9.00x10^{-25}$	$5.92x10^{-33}$
320 KVA DG Set (03 No.)	$1.00x10^{-07}$	$6.80x10^{-08}$	$3.22x10^{-23}$	$4.85x10^{-31}$
350 KVA DG Set (02 No.)	$7.29x10^{-08}$	$4.96x10^{-08}$	$2.81x10^{-23}$	$4.62x10^{-31}$
380 KVA DG Set (01 No.)	$3.96x10^{-08}$	$2.69x10^{-08}$	$1.80x10^{-23}$	$3.21x10^{-31}$
400 KVA DG Set (05 No.)	$2.08x10^{-07}$	$1.42x10^{-07}$	$1.05x10^{-22}$	$1.97x10^{-30}$
500 KVA DG Set (03 No.)	$1.56x10^{-07}$	$1.06x10^{-07}$	$1.23x10^{-22}$	$2.89x10^{-30}$
600 KVA DG Set (04 No.)	$2.50x10^{-07}$	$1.70x10^{-07}$	$2.83x10^{-22}$	$7.99x10^{-30}$
625 KVA DG Set (06 No.)	$3.91x10^{-07}$	$2.66x10^{-07}$	$4.80x10^{-22}$	$1.41x10^{-29}$
750 KVA DG Set (03 No.)	$2.34x10^{-07}$	$1.59x10^{-07}$	$4.15x10^{-22}$	$1.46x10^{-29}$
1000 KVA DG Set (07 No.)	$7.29x10^{-07}$	$4.96x10^{-07}$	$2.30x10^{-21}$	$1.08x10^{-28}$
1010 KVA DG Set (07 No.)	$7.36x10^{-07}$	$5.01x10^{-07}$	$2.37x10^{-21}$	$1.12x10^{-28}$
1250 KVA DG Set (02 No.)	$2.60x10^{-07}$	$1.77x10^{-07}$	$1.28x10^{-21}$	$7.52x10^{-29}$
1500 KVA DG Set (05 No.)	$7.81x10^{-07}$	$5.31x10^{-07}$	$5.53x10^{-21}$	$3.90x10^{-28}$
2000 KVA DG Set (06 No.)	$1.25x10^{-06}$	$8.50x10^{-07}$	$1.57x10^{-20}$	$1.48x10^{-27}$
2500 KVA DG Set (03 No.)	$7.81x10^{-07}$	$5.31x10^{-07}$	$1.54x10^{-20}$	$1.81x10^{-27}$

- **Model Inputs**

AERMOD View™ has been used for evaluating the emission scenarios for proposed project. The inputs to the model are defined in 5 functional pathways as represented in the following sections. Each of these functional parameters include several options that may be user defined or set as default, the details of some of these essential elements of AERMOD View™ runs have been explained in the discussions.

A. Control pathway inputs

- ✓ Default option
- ✓ Calculate the concentration
- ✓ Averaging period of 24 hr and 1hr depending on the NAAQS and pollutant type

B. Source pathway inputs

- ✓ Includes definition of source, its locations
- ✓ Vehicle source parameter include emissions ($g/m^2/s$)
- ✓ Construction area source parameter include emissions ($g/m^2/s$)
- ✓ Soil stockpiling source parameter include emissions ($g/m^2/s$)
- ✓ Generator source parameter include emissions (g/s)

C. Receptors pathway inputs

- ✓ Cartesian grid starting at the SE corner of the ward with 400m increment over X & Y coordinates, thus forming a receptor output grid radius of 2km.
- ✓ Uniform grid is selected with 10x10 cell size.

D. Meteorology pathways inputs

- ✓ One hourly data from 1st March 2014 to 31st May 2014 was used as an input in the meteorology processor to generate model ready one hourly input surface & profile meteorology files.
- ✓ Roughness length of 1m of measurement height, displacement height of 0.2m, Albedo of 0.2 & measurement height of 14m i.e. the height at which measurements of meteorology have been done.
- ✓ The minimum wind speed (0.5 m/s lower than 1m/s considered as calm by IMD), minimum mixed layer height (50m), and minimum heat flux 20 $W/M^2/s$).
- ✓ The Bowen ratio=Sensible Heat flux/Latent Heat Flux as a function of month to allow smaller Bowen Ratios during the Indian monsoon season when the ground is wet and latent heat fluxes become significant (from 2 in non-monsoon to 0.5 in monsoon).
- ✓ The potential temperature gradient above the mixed layer (0.008 degrees/m)
- ✓ The weather data for Mumbai base station provided by Indian Meteorological Department (IMD) have been used for the Baseline project. The data was compiled in AERMET module of AERMOD ViewTM and the results of this final analysis were used as input meteorological data.

E. Output Pathway

The model has been run for 24hr, 4hr and 1hr average as per the pollutant type and the NAAQS standards criteria. The contour for 1st highest reading is shown for each pollutant based on Baseline and future scenario.

Model outputs were obtained for emissions of each of the pollutants in each of the 400m x 400m receptor grid spread across gridded impact zone. Contour map are plotted for each of the study pollutants and the impact by the line source i.e. future scenario including growth rate and additional vehicle assumed to be added due to project. This map is superimposed on the road tile map of the proposed location. The air quality results in the future are also predicted including project traffic during the peak hours. The added percentage of vehicles by the project is negligible compared to the peak hour traffic in the future scenarios & the total peak hour traffic is well within the capacity of the roads at Baseline since the location of this site is primarily covering extensive network of roads distributing the traffic. To avoid redundancy, no separate analysis is included in the results differentiating Baseline & future traffic as it shows no significant difference for future traffic with the project.

- **Scenario analysis for Particulate Matter (PM10)**

Model simulations considering baseline activity for baseline, construction and operation considering BAU scenario with incremental vehicle average and fugitive emissions from the proposed project are presented as peak hr in **Figure 4.1(a-d)** and 24hr in **Figure 4.2(a-d)**. Modeled peak hr average PM_{10} concentration was 10µg/m^3 with Baseline traffic scenario, 60µg/m^3 with construction phase (7yr), 70µg/m^3 with construction phase (15yr) and 50µg/m^3 for operation scenario. Modeled 24hr average PM_{10} concentration was 10µg/m^3 with Baseline traffic scenario, 20µg/m^3 with construction phase (7yr), 30µg/m^3 with construction phase (15yr) and 20µg/m^3 for operation scenario.

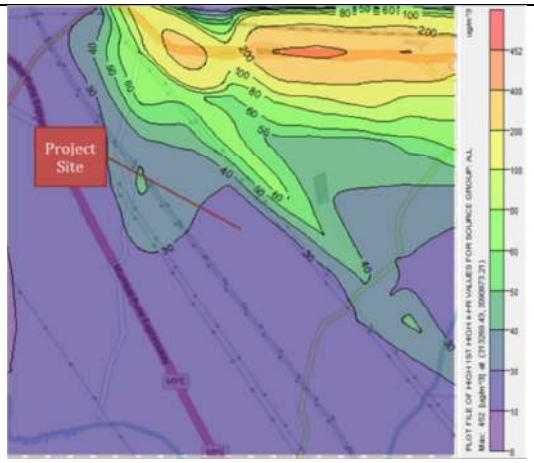


Fig. 4.1 a Baseline PM10 peak hr average emission dispersion contours

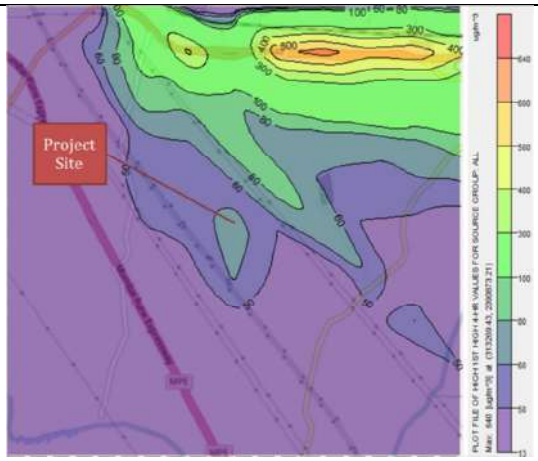


Fig. 4.1 b PM10 peak hr average emission dispersion contours – Construction Phase (7yr)

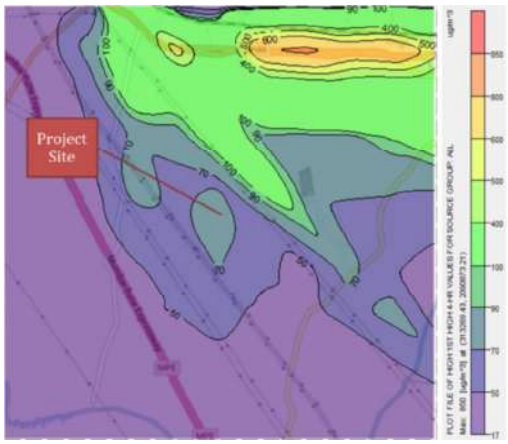


Fig. 4.1 c PM10 peak hr average emission dispersion contours – Construction Phase (15yr)

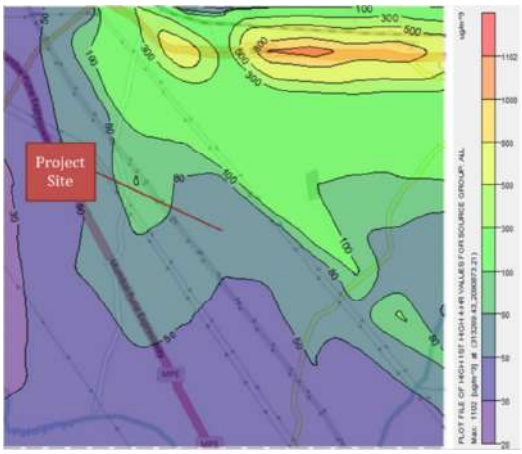


Fig. 4.1 d PM10 peak hr average emission dispersion contours – Operations Phase (25yrs)

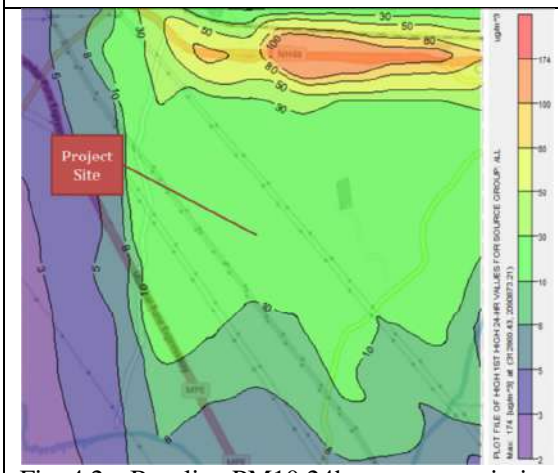


Fig. 4.2 a Baseline PM10 24hr average emission dispersion contours

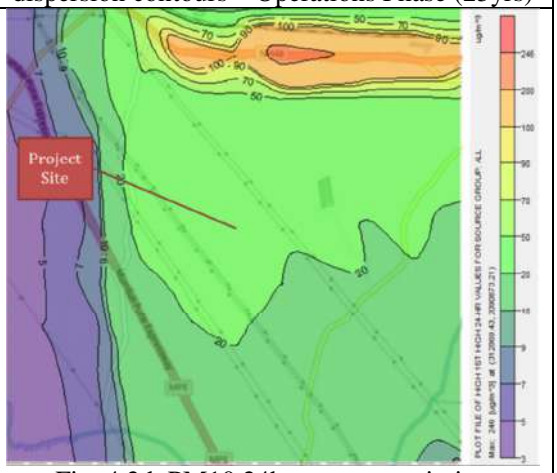


Fig. 4.2 b PM10 24hr average emission dispersion contours – Construction Phase (7yr)

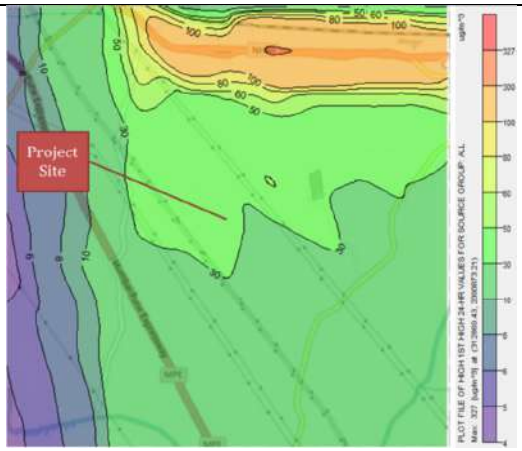


Fig. 4.2 c PM10 24hr average emission dispersion contours – Construction Phase (15yr)

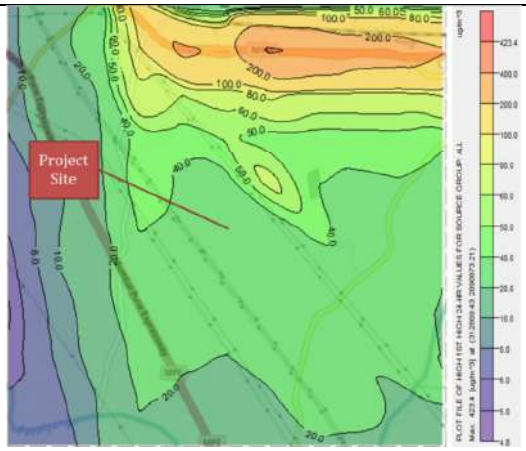


Fig. 4.2 d PM10 24hr average emission dispersion contours – Operations Phase (25yrs)

- **Scenario analysis for Particulate Matter (PM2.5)**

Model simulations considering baseline activity for baseline, construction and operation considering BAU scenario with incremental vehicle average and fugitive emissions from the proposed project are presented as peak hr in **Figure 4.3(a-d)** and 24hr in **Figure 4.4(a-d)**. Modeled peak hr average $PM_{2.5}$ concentration was 10µg/m^3 with Baseline traffic scenario, 30µg/m^3 with construction phase (7yr), 40µg/m^3 with construction phase (15yr) and 30µg/m^3 for operation scenario. Modeled 24hr average $PM_{2.5}$ concentration was 8µg/m^3 with Baseline traffic scenario, 10µg/m^3 with construction phase (7yr), 10µg/m^3 with construction phase (15yr) and 20µg/m^3 for operation scenario.

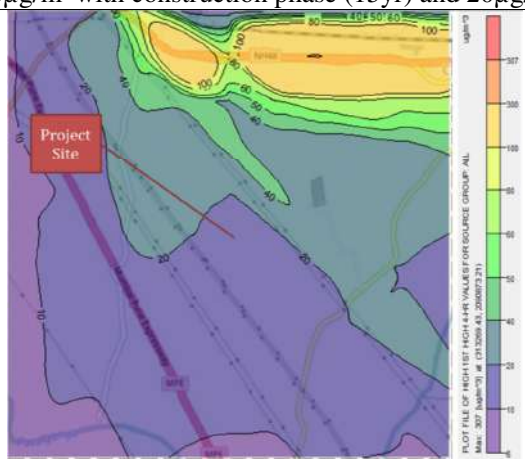


Fig. 4.3 a Baseline PM2.5 peak hr average emission dispersion contours

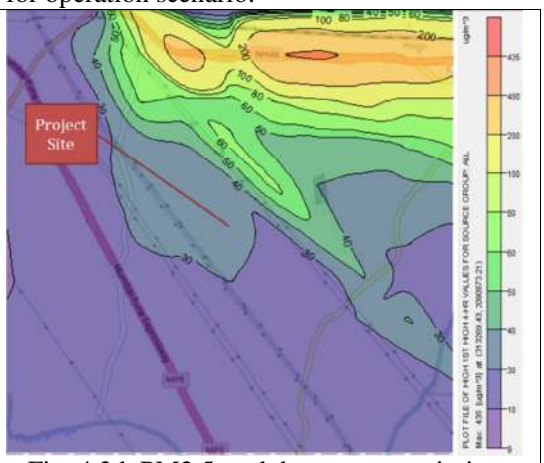


Fig. 4.3 b PM2.5 peak hr average emission dispersion contours – Construction Phase (7yr)

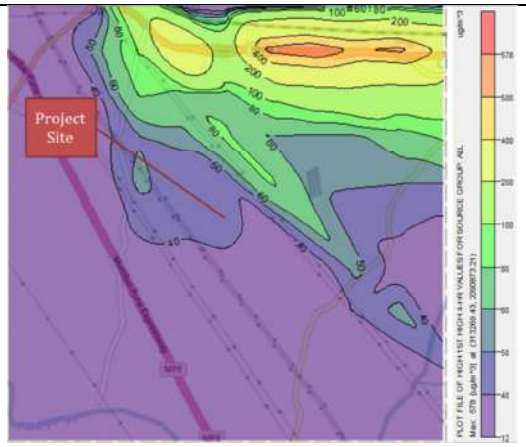


Fig. 4.3 c PM2.5 peak hr average emission dispersion contours – Construction Phase (15yr)

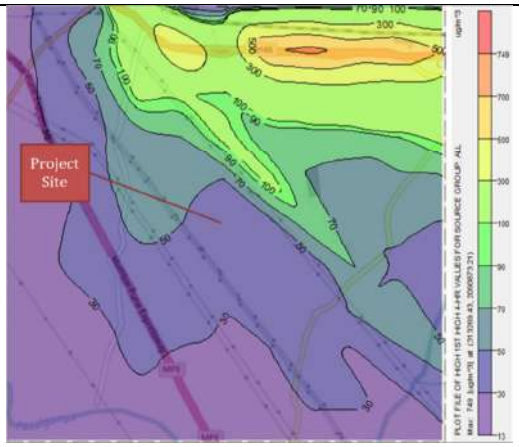


Fig. 4.3 d PM2.5 peak hr average emission dispersion contours – Operations Phase (25yrs)

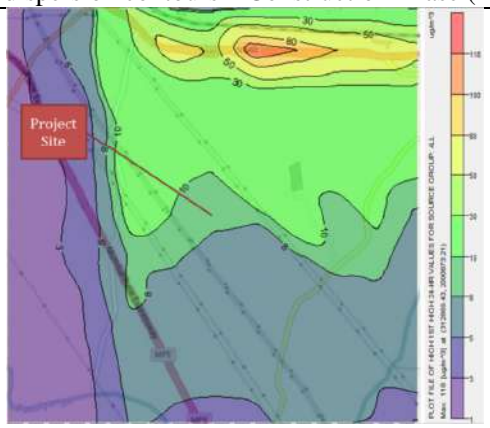


Fig. 4.4 a Baseline PM2.5 24hr average emission dispersion contours

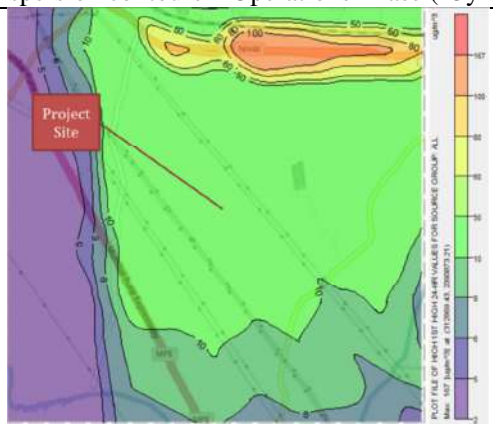


Fig. 4.4 b PM2.5 24hr average emission dispersion contours – Construction Phase (7yr)

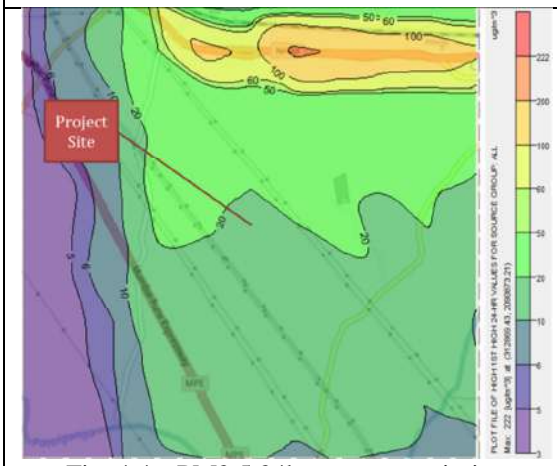


Fig. 4.4 c PM2.5 24hr average emission dispersion contours – Construction Phase (15yr)

Fig. 4.4 d PM2.5 24hr average emission dispersion contours – Operations Phase (25yrs)

- **Scenario analysis for Oxides of Nitrogen (NOx)**

Model simulations considering baseline activity for baseline, construction and operation considering BAU scenario with incremental vehicle average and fugitive emissions from the proposed project are presented as peak hr in **Figure 4.5 (a-d)** and 24hr in **Figure 4.6 (a-d)**. Modeled peak hr average NOx concentration was 100µg/m^3 with Baseline traffic scenario, 100µg/m^3 with construction phase (7yr), 200µg/m^3 with construction phase (15yr) and 200µg/m^3 for operation scenario. Modeled 24hr average NOx concentration was 60µg/m^3 with Baseline traffic scenario, 80µg/m^3 with construction phase (7yr), 100µg/m^3 with construction phase (15yr) and 100µg/m^3 for operation scenario.

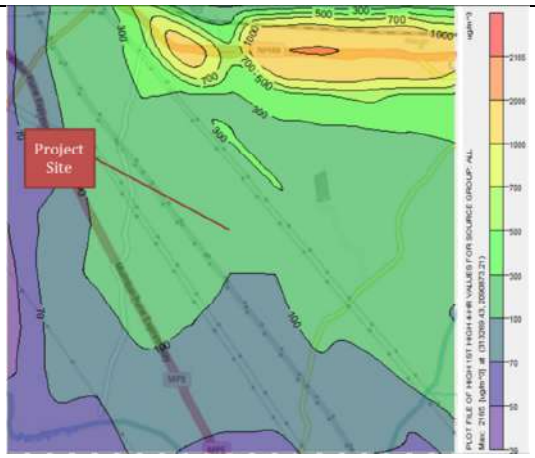


Fig. 4.5 a Baseline NOx peak hr average emission dispersion contours

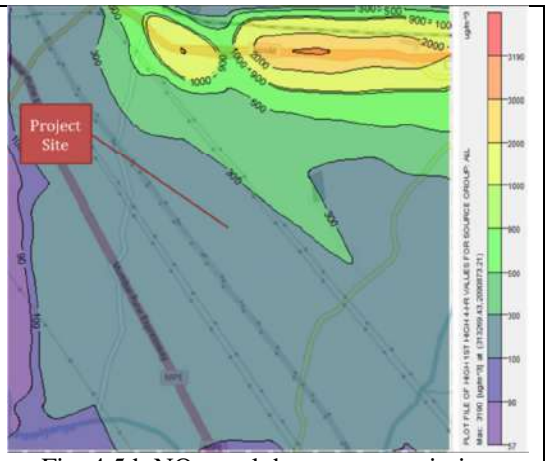


Fig. 4.5 b NOx peak hr average emission dispersion contours – Construction Phase (7yr)

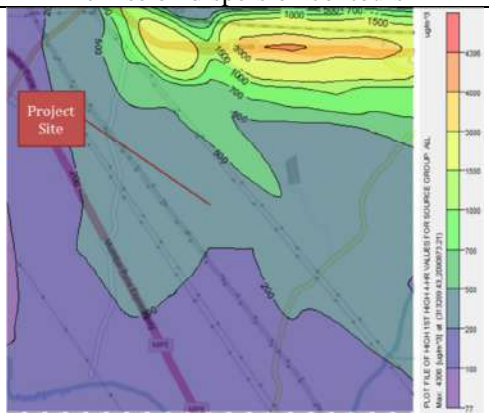


Fig. 4.5 c NOx peak hr average emission dispersion contours – Construction Phase (15yr)

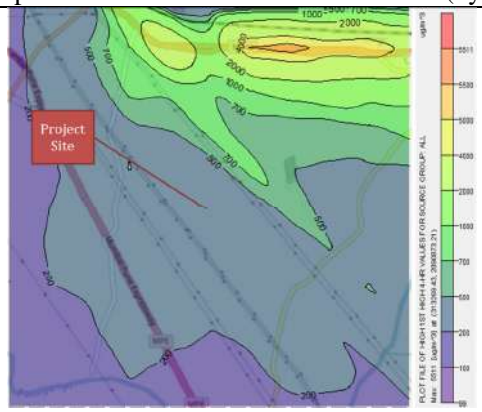


Fig. 4.5 d NOx peak hr average emission dispersion contours – Operations Phase (25yrs)

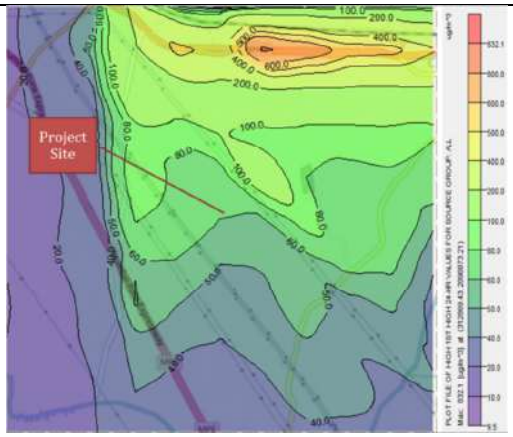


Fig. 4.6 a Baseline NOx 24hr average emission dispersion contours

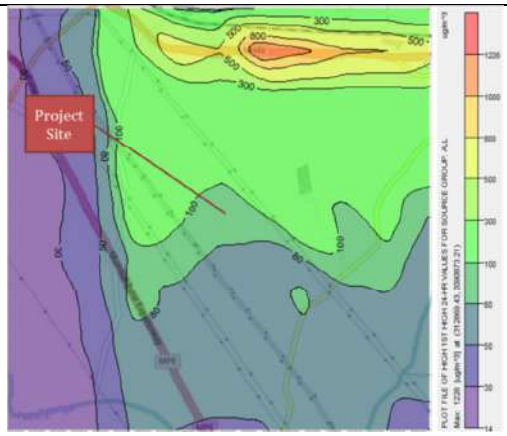


Fig. 4.6 b NOx 24hr average emission dispersion contours – Construction Phase (7yr)

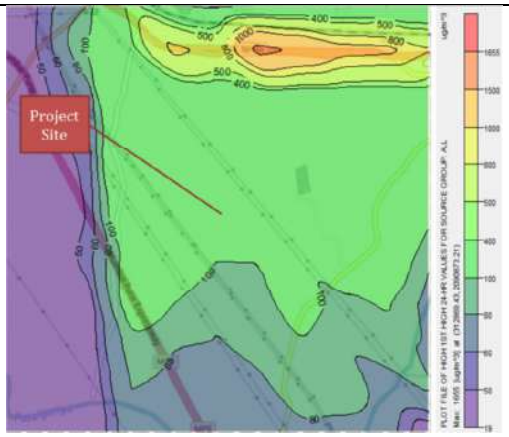


Fig. 4.6 c NOx 24hr average emission dispersion contours – Construction Phase (15yr)

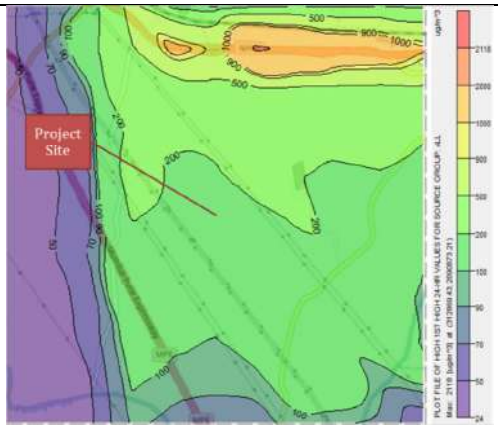


Fig. 4.6 d NOx 24hr average emission dispersion contours – Operations Phase (25yrs)

- **Scenario analysis for Carbon Monoxide (CO)**

Model simulations considering baseline activity for baseline, construction and operation considering BAU scenario with incremental vehicle average and fugitive emissions from the proposed project are presented in **Figure 4.7(a-d).** Modeled 1hr average CO concentration was 100µg/m3 with Baseline traffic scenario, 100µg/m3 with construction phase (7yr), 600µg/m3 with construction phase (15yr) and 700µg/m3 for operation scenario.

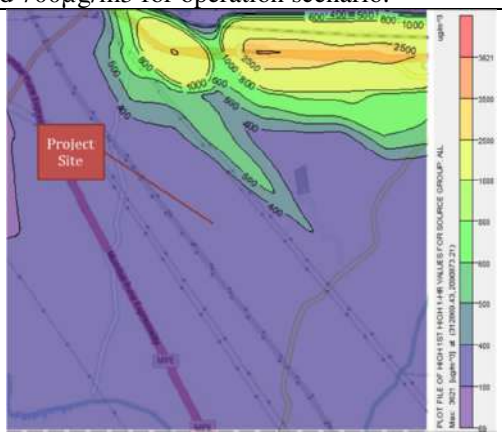


Fig. 4.7 a Baseline CO 1hr average emission dispersion contours

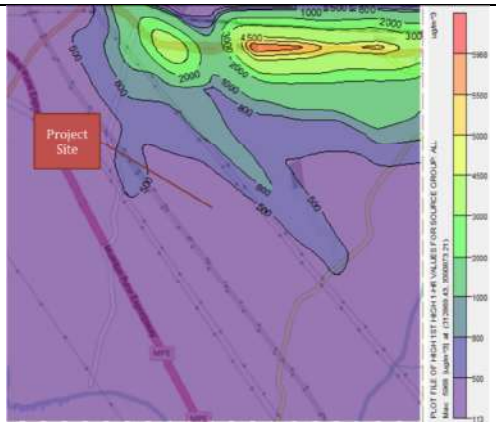


Fig. 4.7 b CO 1hr average emission dispersion contours– Construction Phase (7yrs)

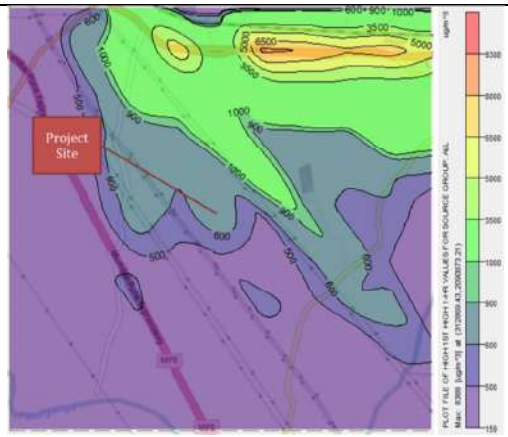


Fig. 4.7 c CO 1hr average emission dispersion contours– Construction Phase (15yrs)

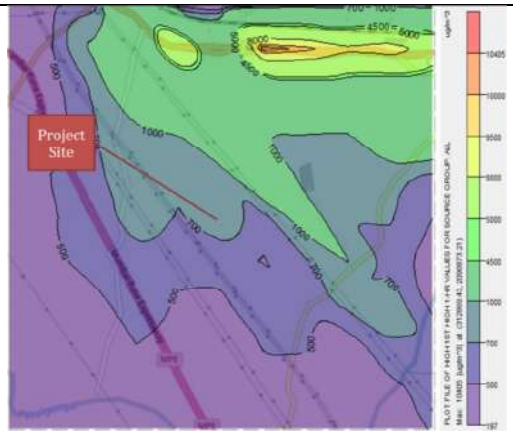


Fig. 4.7 d CO 1hr average emission dispersion contours – Operations Phase (25yrs)

- **Result:**

The major road have been represented in the contour plots for concentration to understand the impact of individual roads on the overall area of influence, though combined influence have been already assessed and modeled for future scenario i.e. with projected vehicular traffic. Modeled pollutant concentrations were tabulated for Baseline, construction and 25yrs down the line in operations phase scenario Table 4.7(a, b).

Table 4.7(a): Modeled Peak hour concentrations for all modeled scenarios

Parameters	Baseline	Construction(7yr)	Construction(15yr)	Operations
PM_{10}*(peak hr average)*	10	60	70	50
$PM_{2.5}$*(peak hr average)*	10	30	40	30
NOx*(peak hr average)*	100	100	200	200
CO *(peak hr average)*	100	100	600	700

Table 4.7(b): Modeled 24 hour concentrations for all modeled scenarios

Parameters	Baseline	Construction(7yr)	Construction(15yr)	Operations
PM_{10}*(24hr average)*	10	20	30	20
$PM_{2.5}$*(24hr average)*	8	10	10	20
NOx*(24hr average)*	60	80	100	100
CO *(1hr average)*	100	100	600	700

Comparative account of each pollutant concentration with respective National Ambient Air Quality Standards (NAAQS) is given. NAAQS has no peak hour standards as such. The emissions were compared with 24hr average. Both the results were presented in Table 4.8(a, b, c, d, e, f). Particulate matter and gaseous pollutant levels account for no raise over future scenario break point.

Table 4.8(a): Peak hr emissions of baseline to construction (7yr) scenario (µg/m^3)

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
PM_{10}*(peak hr average)*	48	50	98	**100**
$PM_{2.5}$*(peak hr average)*	24	20	48	**60**
NOx*(peak hr average)*	14	00	14	**80**
CO *(peak hr average)*	800	00	800	**4000**

***NAAQS –** National Ambient Air Quality Standards, 2009*

Table 4.8(b): Peak hr emissions of baseline to construction (15yr) scenario (µg/m3)

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
PM_{10}*(peak hr average)*	48	60	108	**100**
$PM_{2.5}$*(peak hr average)*	24	30	54	**60**
NOx*(peak hr average)*	14	100	114	**80**
CO *(1hr average)*	500	4.7	504.70	**4000**

***NAAQS –** National Ambient Air Quality Standards, 2009*

Table 4.8(c): Peak hr emissions of baseline to operation scenario (µg/m^3)

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
PM_{10}*(peak hr average)*	48	60	108	**100**
$PM_{2.5}$*(peak hr average)*	24	30	54	**60**
NOx*(peak hr average)*	14	100	114	**80**
CO *(1hr average)*	500	4.7	504.70	**4000**

***NAAQS –** National Ambient Air Quality Standards, 2009*

Table 4.8(d): 24hr emissions of baseline and construction (7yr) scenario (µg/m3)

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
PM_{10}*(24hr average)*	48	10	58	**100**

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
$PM_{2.5}$*(24hr average)*	24	2	26	**60**
NOx*(24hr average)*	14	20	34	**80**
CO *(1hr average)*	800	00	800	**4000**

***NAAQS –** National Ambient Air Quality Standards, 2009*

Table 4.8(e): 24hr emissions of baseline and construction (15yr) scenario (µg/m3)

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
PM_{10}*(24hr average)*	48	20	68	**100**
$PM_{2.5}$*(24hr average)*	24	12	36	**60**
NOx*(24hr average)*	14	40	54	**80**
CO *(1hr average)*	800	500	1300	**4000**

***NAAQS –** National Ambient Air Quality Standards, 2009*

Table 4.8(f): 24hr emissions of baseline and operation scenario (µg/m3)

Parameters	Concentrations			NAAQS*($\mu g/m^3$)
	Baseline($\mu g/m^3$)	Change($\mu g/m^3$)	Resultant($\mu g/m^3$)	
PM_{10}*(24hr average)*	48	10	58	**100**
$PM_{2.5}$*(24hr average)*	24	12	36	**60**
NOx*(24hr average)*	14	40	54	**80**
CO *(1hr average)*	800	600	1400	**4000**

**NAAQS – National Ambient Air Quality Standards, 2009*

The outputs for the modeled pollutant concentrations are done with regards to identified road as classified in earlier sections of the report for Baseline year and future. Simulations for individual & combined activities on this road along with proposed generators were also done. Modeled predictions for pollutant concentrations due to combined activities on all the roads seems to be a much more valuable input to discussions and thereby have been used in further sections of this report, though all the individual simulations for various permutation and combination of activities on roads are portrayed

Conclusion

Baseline monitoring results illustrates to be complying with prescribed national standards. Modeled particulate load for peak hour of peak traffic were violating with prescribed standards. Construction activity and respective particulate emissions were within the standards. The proposed project and future scenario analysis illustrates, pollutant concentrations to be within prescribed standards. Hence, project has no implication on overall air quality.

4.1.4 Noise Environment:

During Construction Phase:

- **Anticipated Impacts –**

- Noise due to construction activities
- Impact due to transportation activities
- Nuisance to nearby areas due to noise polluting work at night
- Noise generation due to DG sets

- **Mitigation Measures –**

- During construction activities the noise monitoring will be done to ascertain the noise levels are within limit
- All precautions for noise abatement shall be taken during the construction activities
- It is recommended that Contractors to use well maintained & relatively newer equipments to mitigate noise generation in initial stages when excavation & earth removal is carried out
- During high noise construction activity there will be provision of ear plugs for construction labour and staff

- No noise polluting work in night shifts
- Provision of barricades along the periphery of the site
- Acoustic enclosure for DG sets

During Operation Phase:

- **Anticipated Impacts –**
- Impact of noise due to vehicular traffic
- Noise generation due to DG sets

- **Mitigation Measures –**
- Provision of proper parking arrangement, traffic management plan for smooth flow of a vehicle helps to abate noise pollution due to vehicular traffic
- Plantation of trees of various varieties shall be planted on ground that shall act as natural noise buffer
- Acoustic enclosure for DG sets

4.1.4.1 Noise Modeling Studies:

Noise Modeling means predictive analysis of how much would be the noise levels at different distances from the project site, depending upon the predicted maximum noise levels at the project site. (Due to DG Sets, other machineries, etc.)
This Special Township project is located where population density is low as compared to urban areas like Mumbai. Therefore, baseline noise levels are expected to be lower than the CPCB limits. Therefore, noise monitoring was done within distances of 50~500 meters from the construction project site.

No.	Location	Leq Day (dB)	Leq Night (dB)	Distance from Project Boundary(m)	CPCB Limit for Leq Day (dB)	CPCB Limit for Leq Night (dB)
1.	Project Site	50.5	37.2	0.0	55	45
2.	Nr. Siyaram Automall	53.9	40.1	58	55	45
3.	Sarang Asorti Junction	49.2	37.9	185	55	45
4.	Reliance Township	59.0	53.0	200	55	45
5.	ZP School	61.1	40.0	500	55	45

It was noted that the noise levels during the day were lower than the allowable CPCB limits at project site, as well as at Siyaram Automall, Sarang Asorti Junction. Noise Levels are noted higher than CPCB limits, at 59.0 dB at Reliance Township and 61 dB during the day at ZP School. During the night, at all noise monitoring locations apart from Reliance Township, the noise levels were noted below the allowable CPCB limit.

A. Construction Phase

Most of the sources of noise will be present at the project site during the construction phase. Following are the major sources of noise identified from the list of machinery to be used during the construction phase. Only the sources of noise with noise levels above 80~85 dB are considered in this list.

1) Tower Cranes - < 85 dB
2) Excavators/JCB/Dumpers/Loaders/Jack Hammers – 90 dB Each
3) Concrete Pumps – 95 dB
4) Construction/Material Hoists - 85 dB
5) DG Sets (Multiple) – 85~88 dB Each.
6) Compressors (Electric and Diesel) – 90 dB

Compressors: Air compressors, be it Screw Compressors or Reciprocating Compressors, generate noise levels above 100 dB even if they are electric driven or engine driven. Engine Driven compressors are bound to make even more noise due to the diesel engine.
Compressors with pre-installed Acoustical Canopy should be chosen so that the noise generated at the source itself is lesser than 85 dB.

Mitigations:

- The contractor should carefully choose the above equipment in order to meet with the CPCB Norms.
- Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise.
- Valves should be covered with Removable Acoustical Blankets. The contractor should choose controlled operating hours for noisy activities such as delivery, loading unloading etc.

Concrete Pumps: Concrete Pumps, usually Diesel Engine Driven, generate noise levels exceeding 100 dBA during its operation. The operation of Concrete Pumps is usually continuous for duration of 6~8 Hours when operated. However, concrete pumps would not be operated every day, but only when there would be the construction of Concrete Slabs. Noise levels of this source need to be reduced to at least 70 dBA, for which 30 dBA Transmission Loss Rating Acoustic Enclosures are suggested for this source of noise.

De-watering Pumps: De-watering pumps, can generate noise levels exceeding 90 dB. Small close-fitted Acoustic Enclosures with 10 dB Transmission loss Rating are recommended for the De-watering pumps.

Noise Modeling Study:
A Noise modeling study was conducted to quantify the impact on the local noise environment during the construction phase of any particular Residential/commercial project. Noise levels within the distances of 100~200 meters from the local project site were measured, and quantified impact was predicted as a result of construction activity onto the local noise environment (Leq Day) over the baseline noise levels. Below is the result of the Noise Modeling study.

Table 4.9: Noise Modeling Calculations – construction phase

Long Duration Noise Sources							
No.	**Noise generating areas**	**Noise level at source (dBA)**	**Anticipated Noise level (dBA)**				
			Location 1: Towards East side	**Location 2: Towards South-East side**	**Location 3: Towards North-West side**	**Location 4: Towards East side**	**Distance from plot boundary**
		(at 1 meter distance from project site (m)	58	185	200	500	150
1	Earth moving machinery (JCB/ Jackhammer/ Proclain/ Trucks etc.)	90	54.7	44.7	44.0	36.0	46.5
2	Concrete pumps	100	54.7	54.7	54.0	46.0	56.5
3	Material hoists, Other construction activities	90	54.7	44.7	44.0	36.0	46.5
4	DG sets	80	44.7	34.7	34.0	26.0	36.5

	Cumulative Noise Levels	65.6	55.5	54.8	46.8	57.3
	Attenuation due to Green belt and acoustic enclosure	15.0	15.0	15.0	15.0	15.0
	Existing Noise Levels (day-time)	53.9	49.2	59.0	61.1	55.0
	Cumulative Noise Levels (Day)	55.6	49.7	59.1	61.1	55.2

- **Results of Noise modeling studies:**

From the Noise modelling study, approximately 1.7 dB of increase was predicted at Suyaram Automall located at 58 meters from the project boundary. At Sarang Asorti Junction, 0.5 dB of increase is predicted at 185 meters. At 200 meters distance, increase predicted is 0.1 dB and no increase is predicted at ZP school which is at 500 meters distance. The Time-averaged increase in LeqDay predicted in the noise modeling study is negligible at all noise monitoring locations. Another assumed reading was considered at 150 meters from the project boundary, at the CPCB limit of 55.0 dB. At this reading, 0.2 dB of increase was predicted at 150 meters distance.
This analysis is done assuming that the Noise level of the mentioned sources is going to be 85~100 dB at the Boundary of the project site, where as in actual, the machinery will be installed well within the boundary of the Plot, and other sound sources e.g. Ventilation system etc. are going to be installed inside the constructed building, because of which there will additional attenuation and hence the SPL measured at the boundary of the project because of the machinery involved in this project is going to be much lower than what is considered in this report. This Analysis is done for the absolute worst case scenario for the Noise Environment.

Summary of Quantified Impacts from Noise Modelling Study:
During the Construction Phase, Maximum increase in Sound Pressure Level was predicted at 0.1~1.7 dB at a distance of 200 meters from the project site, 0.2 dB at 150 meters (at assumed reading, with 55 dB background noise level).

Mitigation Measures:

Mitigations Measures as listed below should be implemented for avoiding any potential impact on the Noise Environment.

No.	Machinery / Equipment Description	Predicted SPL at 1 meter distance	Mitigations Required
1.	JCB / Earth Moving Machines / Excavators / Dumpers / Jack Hammers	85~95 dB	The JCB/Proclain machines or Earth moving machines make Noise Levels of up to 85 dB when measured at 1 meter distance from the machine. When multiple machines are running simultaneously, the SPL can go up to 95 dB. This is an unavoidable source of noise which cannot be attenuated by any means. However, this source has been already considered In the Noise Modeling study, and its impact will not make any significant difference on the Noise Environment. For the people working in the near field of these equipment, 85 dBA is a perfectly safe noise level for continuous noise dose of up to 8 hours.
2.	Concrete Mixers / Concrete Plant	85~90 dB	The SPL for Concrete Mixer or even Transit mixers / Concrete Plant is approximately measured at 85~95 dB at 1 meter distance. Although there are multiple number of Concrete Mixer, not all of the mixers are going to be present at the same location of the project site location at once, and hence this is not one of the

			major sources of noise for the project site. There are no mitigations necessary for this source of noise.
3.	Concrete Pump / De-watering Pumps	95 dB	Noise Levels of up to 95 dB may be generated due to the Concrete Pumps running on Diesel Engines. 1. Concrete Pumps with preinstalled Acoustical Enclosures / Canopy should be preferred for the Project. The operating hours of the Concrete pump should be selected during the daytime, because of high noise levels are generated during the night, it is observed that in absence of other noise sources during the night, the sound travels further, and may affect the sensitive areas nearby.
4.	DG Sets (Multiple Nos.)	<85 dB	Diesel Generator Sets are supposed to have Sound Pressure Levels of lesser than 75 dBA when measured at 1 meter distance. The DG Sets of more than 1000 KVA and 2000 KVA Capacity are recommended with a minimum Transmission Loss Rating of 30 dBA.
6.	Tower Crain / Material Hoist	85~90 dB	The lifting mechanism of the Tower Crane or the builders hoist usually has very low noise levels of less than 75 dBA. However they are usually powered by Diesel Engines in order to make them portable, and hence the noise of the diesel engine itself can exceed 90 dBA. Therefore following mitigations should be implemented : Acoustical Canopy for the Diesel Engine running the portable hoists/cranes to be installed with TL Rating of 30 dB.
7.	Additional Mitigations / Cares to take	N/A	1. Sound Reflective barriers to be installed at the boundary of the project site. 2. All people working in the vicinity of the Equipment/Machinery with Sound Pressure Levels higher than 95 dB should wear protective ear plugs to avoid permanent hearing damage.

B. Operational Phase :

Table 4.10: Noise Modeling Calculations – operational phase

Long Duration Noise Sources							
No.	**Noise generating areas**	**Noise level at source (dBA)**	**Anticipated Noise level (dBA)**				
			Location 1: Towards East side	**Location 2: Towards South-East side**	**Location 3: Towards North-West side**	**Location 4: Towards East side**	**Distance from plot boundary**
		(at 1 meter Distance from project site (m)	58	185	200	500	150
1	STP (Blower, Pumps)	100	64.7	54.7	54.0	46.0	56.5
2	DG sets	90	54.7	44.7	44.0	36.0	46.5
3	Vehicular movement	80	44.7	34.7	34.0	26.0	36.5
Cumulative Noise Levels			65.0	55.1	54.4	46.5	56.9
Attenuation due to Green belt and			20.0	20.0	20.0	20.0	20.0

acoustic enclosure					
Existing Noise Levels (day-time)	53.9	49.2	59.0	61.1	55.0
Cumulative Noise Levels (Day)	54.4	49.4	59.0	61.1	55.1

- During operational phase, the only sources going to be present at the project site are the DG Sets, the Sewage treatment plant which would have multiple Blowers, Pumps etc., the combined noise of which is assumed at 100 dB, and the vehicular movement, the noise contribution of which is minimal.
- During the operational phase, 0.5 dB of increase is predicted at Siyaram Automall which is at 58 meters. 0.2 dB of increase is predicted at Sarang Asorti Junction located at 185 meters. No increase was predicted at any noise monitoring locations beyond 200 meters distance.
- However, although the increase appears to be of 0.5 dB at distances of 100 meters or so, at closer distances, such as in the buildings right next to the STP plant, higher noise levels may be observed which may trouble the residents. Therefore, Acoustical Enclosures with 30 dB Transmission Loss Ratings are recommended for the Blowers of the STP.
- Contribution due to vehicular movement is likely to be even less than 80 dB, and it would be significant only during morning and evening peak hours, hence no mitigations are required for this source of noise.

Summary of Quantified Impacts from Noise Modelling Study:
During the operational phase, up to 0.5 dB of increase in SPL is predicted within 100 meters distance.

4.1.5 Biological Environment:

➢ **Probable Impact**

There are trees, shrubs, herbs and climbers on project site. Due to lack of proper habitat, animal biodiversity, including insects, is meager. During construction, certain trees and shrubs will also be removed, resulting in deterioration of biodiversity.

Mitigation

Biodiversity will be increased by developing green belt (on R. G Area) by plantation of varieties of trees and shrubs, besides a remarkable area of grassland development. Plantation within the project site will remarkably enhance biodiversity of flora and fauna.

➢ **Probable Impact**

Due to construction activities and movement of vehicles, particulate matters in the surrounding air will be increased. Particulate matter in a form of dust may affect photosynthesis, respiration, transpiration and allow penetration of phototoxic gaseous pollutants in plants. Dusts at the levels of 2.5 to104 µg/m^3 usually block stomata, thereby reducing photosynthesis, degradation of chlorophyll-a etc. Similar effects have been reported for mango trees (*Mangifera indica*) at 4.5 to 30.0 µg/m^3 of dust. The average baseline levels of particulates of $PM_{2.5}$ & PM_{10}, up to a distance of 500m in the surrounding air of the project site are about 27 and 47 µg/m3 respectively. It thus, appears that the trees in the locality or in the city are already in stress due to activities other than the proposed project.

Mitigation

The standard stipulated by CPCB for $PM_{2.5}$ is 60 µg/m^3 (annual average) and the same, based on the epidemiological studies, is recommended as 10 µg/m^3 (annual) by WHO. Thus predicted levels of particulate matters are well within the limits. As a precautionary measure, certain measures must be adhered to minimize the dust levels.

- Sprinkling of water and fine spray from nozzles at regular intervals to suppress the dust.
- Use of covering sheets to prevent dust dispersion from the vehicles, used for carrying construction materials at site.
- Use of covering sheets for covering construction materials, stored at site.
- Vehicles having pollution under control certificate should be allowed in the site

➢ **Probable Impact**

Nocturnal insects are strongly attracted to light sources that emit large amounts of UV radiation (blue fluorescent lights, black lights and mercury lamps). Behaviors, such as flight and mating are inhibited in such insects that are exposed to bright light at night. Light toxicity occurs when the retinas of compound eyes of an insect are exposed to UV radiations, damaged and structurally degenerated. Insects gather around these lamps at high densities instead of navigating naturally. Moths (Lepidoptera) are the major nocturnal pollinators of a diverse range of plant species in diverse ecosystems across the world. Artificial night lighting might in turn affect the provision of pollination by moths.

Mitigation

Unless essential, excessive light during night hours should be strictly avoided. Use of yellow lights is suggested in open areas.

➢ **Probable Impact**

The project proponent has a plan to treat sewage and use the treated sewage for green belt in an R. G. area. No treated sewage will be discharged outside without affecting water quality and biota of natural resources.

Mitigation

Treated sewage must be thoroughly checked with special reference to BOD, COD, TDS, Total coliform & fecal coliform prior to utilization in green belt.

Details for varieties of tree plantation are given in chapter 3.

4.1.6 Socio-Economic Environment:

The setting up of any kind project would undoubtedly have some impact on socio-economic and cultural life of the people in the project area. Here, an attempt is made to visualize and discuss such tentative impacts likely to be induced by the project.

The likely impacts due to project activity are described below:

➢ **Positive Impacts**

- During the construction phase, there would be growth in indirect jobs and business opportunities to the local and people such as contractors, transporters and raw material suppliers etc. due to the proposed development in the area.
- There would be up gradation of existing local infrastructure, where there would be improvement of access due to widening of the main road and improvement of transport services in the surrounding villages of the project.
- The project would also provide housing to the 5252 EWS families.
- The project would provide a hospital, which would benefit the project residents as well as the nearby villages.
- A primary school and a secondary school would be provided as part of the project. Students from the project site as well as nearby villages would be benefitted from the project.
- The project would also provide commercial space consisting market for daily needs, IT Park and offices, Hotel, Resort which would provide better livelihood space to the people.
- Besides these, the project also provides auditorium, library, home for aged, community centre, convention centre, petrol pump, police station etc.
- The amenities mentioned above would not only benefit project population but also would benefit the population residing in the nearby villages.
- In the operation phase, the project would provide job opportunities in the organized and unorganized sector. There is likely to be increased demand for security, kitchen help, need for drivers etc;

- Self- employment options for individuals possessing vocational or technical training skills like electricians, welders, fitters etc, which are likely to be sourced locally for the maintenance of the township.
- A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores, grocery stores etc.

➢ **Negative Impacts**

- There could be influx of workers during construction phase, which could put pressure on key local infrastructure which is already inadequate.
- As it is a development of Special Township there would be influx of people, both residential and floating population, thus increasing the density of the population.
- The construction activity could lead to increase in nuisance level from air emissions and noise due to transportation of material and equipment as well as labourers. There is also likely to be temporary traffic impacts like accidents, diversions or blockage of access etc due to narrow roads during construction activity.
- The construction activity will also result in water logging in mud pockets and there could be apparent degradation of the water and air quality.
- Lack of hygiene and adequate sanitation facilities at construction site could create health ailments.

Socio Economic Environment: Mitigating Measures

In order to mitigate the adverse impacts likely to arise in the surrounding area due to proposed project activity, it is necessary to formulate an effective mitigation plan. The suggestions are as follows:

➢ **Before Commencing and During Initial Phase:**

- Communication with the local community should be institutionalized and done on a regular basis. The forum could provide opportunities to discuss local critical issues and prepare programmes of mutual benefits
- Information regarding the proposed development plan, community programmes etc. should be communicated to the local community in the form of booklets and audio-visuals.
- As per the expectations of the local people, project authorities should organize guidance centre for youths, technical education centre and training programme.

➢ **Construction Phase:**

- Project proponent should take appropriate steps to keep environment clean and healthy during construction phase.
- Provision of adequate drinking water, toilet and bathing facilities should be made available on project site.
- Water shall be sprinkle/spread to suppress dust during construction phase to control air pollution and thereby avoid adverse health impact.
- Proper living condition with appropriate facilities for residential labours should be provided.
- Proper Training and awareness programme should be carried out so that the workers understand the importance of wearing the personal protective equipment's.

➢ **Operation Phase:**

- The project collectively will need a pool of watchmen, gardeners, sweepers, plumbers, fitters, STP operators, lift operators and solid waste collectors. Preference should be given to local people for all this.
- The township management should help in promoting local people for livelihood commensurate with their will, skill and abilities by utilizing the minimum amount.

4.2 ENVIRONMENTAL LIABILITIES:

Waste management like treatment, recycle and adequacy and technical capabilities of the systems designed for the same are always priceless for making the project environmentally sustainable by minimizing negative impacts on city infrastructure, on the aesthetics and health and hygiene of project site and surrounding areas.

Following environmental liabilities shall be undertaken for this project:

4.2.1 Water Saving Practices

The details of Water saving practices are as follows

- **Dual Flush Cisterns:**

Dual flushing cisterns shall be installed, which have two flush settings, one for normal operation to flush solids 6 lit per flush and a second reduced amount for liquids as 3 lit per flush, thus saving considerable amount of water

- Water efficient landscaping
- Use of water saving practices like low loss plumbing fixtures and flow control devices
  - **Showers/Faucets:** 2.5 gallons per minute (9.5 liters per minute, lpm)
  - **Water Closets:** 1.6 gallons per flush (6.1 liters per flush, lpf)
  - **Urinals:** 1.0 gallons per flush (3.8 liters per flush, lpf)

- **Rainwater Harvesting:**

Provision of 31 RWH tanks of total capacity 8981 KLD

Phases	RWH tanks
1	Residential Building: 4 RWH tanks of total capacity 1137 KL EWS: 1 RWH tank of capacity 275 KL School Building: 1 RWH tank of capacity 173 KL Hospital Building: 1 RWH tank of capacity 321 KL Convention Centre: 1 RWH tank of capacity 125 KL
2	Residential Building: 4 RWH tanks of total capacity 594 KL EWS Building: 1 RWH tank of capacity 153 KL Hotel Building: 1 RWH tank of capacity 187 KL
3	Residential Building: 3 RWH tanks of total capacity 959 KL EWS Building: 1 RWH tank of capacity 293 KL Institutional Building : 1 RWH tank of capacity 288 KL School Building: 1 RWH tank of capacity 173 KL Office Building: 1 RWH tank of capacity 163 KL Market Mall and Office Building: 1 RWH tank of capacity 1478 KL
4	IT park Building: 1 RWH tank of capacity 784 KL Resort (Type A, B & C): 1 RWH tank of capacity 296 KL EWS Building: 1 RWH tank of capacity 374 KL
5	EWS Building: 2 RWH tanks of total capacity 539 KL
6	EWS Building: 2 RWH tanks of total capacity 455 KL Convenient Shopping: 1 RWH tank of capacity 26 KL Primary School Building: 1 RWH tank of capacity188 KL

Plan showing location of rain water harvesting tanks is attached as **Enclosure 3.**

4.2.2 Wastewater Management During Operation Phase:

Total sewage generation from the proposed development will be 10227 KLD. This sewage will be treated in total 35 numbers of Sewage Treatment Plants (STPs) of total capacity 11625 KLD Treated sewage generated will be reused for secondary requirements like gardening (1044 KLD) and flushing (4400 KLD).

While proposing location of STP care is taken that it is not proposed near any underground domestic water storage tanks. The technology used for treatment of sewage is Moving Bed Bio Reactor (MBBR). The STP location is indicated on the layout plan attached as **Enclosure 3** of this report.

Capacity of Sewage Treatment Plants

Phases	Sewage (KLD)	Total STP capacity (KL)	Number of STPs and capacity of each STP
1	2441	2807 (Total 11 Nos.)	1 STP : 305 KL 1 STP : 665 KL 1 STP : 530 KL 1 STP : 530 KL 1 STP : 127 KL 1 STP : 80 KL 1 STP : 421 KL 1 STP : 64 KL 1 STP : 54 KL 1 STP : 27 KL 1 STP : 4 KL
2	1485	1634 (Total 07 Nos.)	1 STP : 332 KL 1 STP : 185 KL 1 STP : 250 KL 1 STP : 257 KL 1 STP : 304 KL 1 STP : 301 KL 1 STP : 5 KL
3	2776	3283 (Total 08 Nos.)	1 STP : 1060 KL 1 STP : 328 KL 1 STP : 258 KL 1 STP : 559 KL 1 STP : 167 KL 1 STP : 517 KL 1 STP : 12 KL 1 STP : 382 KL
4	1485	1624 (Total 04 Nos.)	1 STP : 786 KL 1 STP : 68 KL 1 STP : 768 KL 1 STP : 2 KL
5	955	1100 (Total 01 No.)	1 STP : 1100 KL
6	1085	1177 (Total 04 Nos.)	1 STP : 236 KL 1 STP : 634 KL 1 STP : 298 KL 1 STP : 9 KL
Total	**10227**	**11625**	**Total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL**

The generated sewage will be collected by gravity through pipe network to STP. Basis characteristics of untreated and treated sewage are as follows:

Table 4.11: Untreated & Treated Sewage Quality

No.	Details	Values		UNITS
		Untreated	Treated	
1.	pH	7.0 – 8.0	6.5 – 7.5	--
2.	Total Suspended solids	200 – 450	≤ 10	mg/lit
3.	Chemical Oxygen Demand	400 – 600	≤ 30	mg/lit
4.	BOD,3days,27^0C	250 – 400	<5	mg/lit
5.	Oil & Grease	50	<5	mg/lit

➢ **Design Basis of Treatment plant – MBBR (Moving Bed Bio Reactor)**

- **Bar Screen:-**

o A bar screen is a mechanical filter used to remove large objects, such as rags and plastics, from wastewater. It is part of the primary filtration flow and typically is the first, or preliminary, level of filtration, being installed at the influent to a wastewater treatment plant. They typically consist of a series of vertical steel bars spaced between 1 to 3 inches apart.

o Bar screens come in many designs. Some employ automatic cleaning mechanisms using electric motors and chains, some must be cleaned manually by means of a heavy rake. Items removed from the influent are collected in dumpsters and disposed of in landfills. As a bar screen collects objects, the water level will rise, and so they must be cleared regularly to prevent overflow.

- **Oil & Grease Trap:-**

A grease trap is a device used for removing oil and grease from wastewaters. Grease traps perform this function very well, provided they are constructed and maintained properly. Provide sufficient capacity to slow down the passing wastewater, giving greasy waste the opportunity to separate out. A grease trap should be able to hold all the kitchen wastewater entering it during times of maximum water use for a period of 20 minutes.

- **Equalization / Collection Tank:-**

A Collection tank which is simply a well - mixed vessel with fluctuating input flow rates and / or concentration with fairly constant output flow rates and/or concentrations. Processes for waste treatment work best with uniform conditions. Shocks to the bioprocesses in the form of sudden changes in concentrations of nutrients can cause upsets. If the input flow increases suddenly, the settling patterns will be upset to lower collection efficiency. Equalization dampens fluctuations. Flow equalization can improve performance of subsequent steps significantly. Often the rest of the plant can be designed with smaller equipment (less capital investment) because of this improvement in performance. Equalization allows reactions in the equalization tank. There may be aeration both to keep the fluid from becoming anaerobic and smelly and to biodegrade some of the organic compounds present.

- **MBBR Reactor:-**

o Moving Bed Biofilm Reactor (MBBR) processes improve reliability, simplify operation, and require less space than traditional wastewater treatment systems.

o MBBR technology employs thousands of polyethylene biofilm carriers operating in mixed motion within an aerated wastewater treatment basin. Each individual bio carrier increases productivity through providing protected surface area to support the growth of bacteria within its cells. It is this high-density population of bacteria that achieves high-rate biodegradation within the system, while also offering process reliability and ease of operation.

o This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm.

- **Settling Tank (Tube Settler):-**

Suspended/settable solids present in water having specific gravity greater than that of water tend to settle down by gravity as soon as the turbulence is retarded by offering storage. Basin in which the flow is retarded is called settling tank. Theoretical average time for which the water is detained in the settling tank is called the detention period. The PVC tube settler media provides more surface area for settling.

- **Phythoroid Zone /Area:-**

In this process the treated waste water is brought in contact with the roots of the plants which are selected and capable of utilizing/absorbing the organic matter present in the treated waste water. This zone with plantation ensures proper removal of dissolved BOD and degradation of fine suspended particles which may tend to escape from the system after secondary biological treatment.

- **Supernatant Tank:-**

This sump is used to store the treated water before passing it through the filtration system. Here the disinfectants can be dosed and a contact time can be given which shall ensure proper disinfection.

- **Filtration System (Pressure Sand Filter and Activated Carbon Filter):-**

Filtration is commonly the mechanical or physical operation which is used for the separation of solids from fluids (liquids or gases) by interposing a medium through which only the fluid can pass. The fluid that passes through is called the filtrate. Oversize solids in the fluid are retained, but the separation is not complete; solids will be contaminated with some fluid and filtrate which will contain fine particles (depending on the pore size and filter thickness). Filtration is also used to remove undesirable constituents by absorption into a carbon layer provided in the Activated Carbon Filter.

- **Filtration System (Ultrafiltration Unit):-**

Ultra filtration (UF) is a variety of membrane filtration in which forces like pressure or concentration gradients lead to a separation through a semipermeable membrane. Suspended solids and solutes of high molecular weight are retained in the so-called retentate, while water and low molecular weight solutes pass through the membrane in the permeate. UF can be used for the removal of particulates and macromolecules from raw water to produce cleaner water.

- **Sludge Dewatering Unit (Filter Press):-**
  - Sludge dewatering is, as the name clearly implies, removing water from sludge. Sludge dewatering is typically the final step for wastewater treatment processes and plants. After wastewater treatment the sludge remaining is very high in water content that can be reclaimed through sludge dewatering.
  - This depends on the evaluation of your specific needs including the final disposition of your sludge cake including whether you will be applying the sludge to land applications, landfill disposal, alternative fuels, further processing and so on. Analyzing each situation is critical to optimize the wastewater sludge aspect of your wastewater treatment processes. Here we have suggested filter press for sludge dewatering as we are going to use it as manure for gardening.

The scheme for treatment of sewage is given as follows:

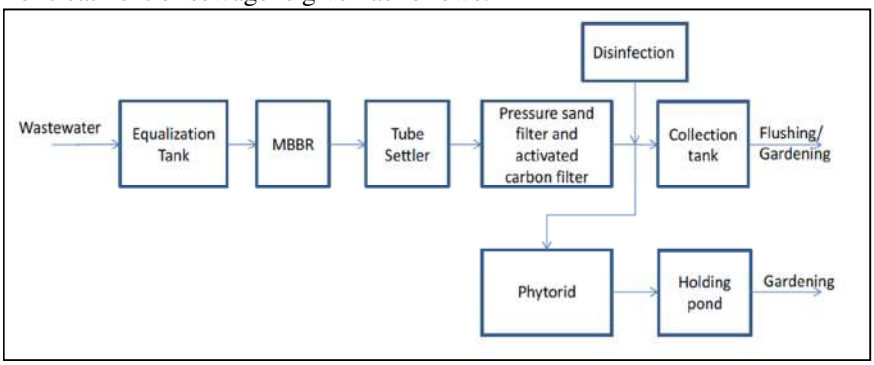


Fig. 4.8: Scheme for treatment of sewage (MBBR process followed by DEWATS Phythoroid Technology)

- **Anaerobic Baffle Reactor:-**
  - The reactor consists of a series of chambers, in which the wastewater flows up stream as shown in Fig. 4.9. Activated sludge is located at the bottom of each chamber.
  - The inflowing effluent is mixed with the sludge and is inoculated with bacterial mass which decompose the Pollutants.
  - At this stage the BOD reduction rate is 90 %. The pathogen reduction is in the range between 40 – 75 %.

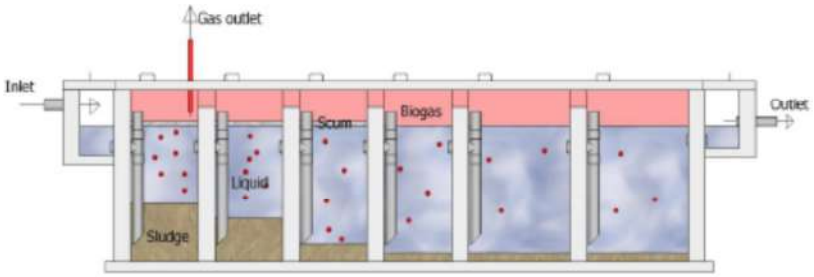


Fig 4.9: Anaerobic Baffle Reactor

- **Anaerobic Baffle Filter:-**
  - The anaerobic filter has a similar flow pattern like the Fluidized Bed Reactor as shown in Fig. 4.10. Filter materials such as gravel, rocks or specially formed plastic components are used to provide additional surface area for bacteria to settle.
  - Non-settle able and dissolved solids are treated by bringing them in close contact with a surplus of active bacterial mass fixed on filter material.
  - The BOD removal rate at this stage is in the range of 70- 90%. The surplus of activated sludge produced has to be removed in intervals of 1 to 3 years.

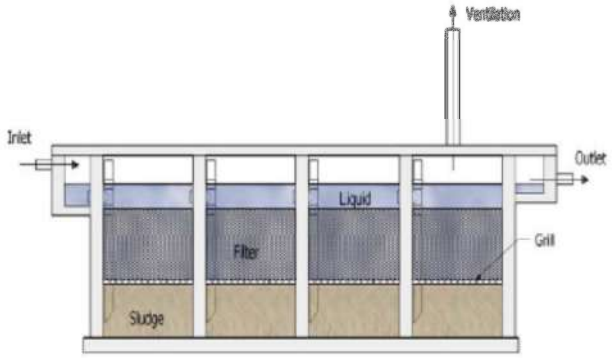


Fig 4.10: Anaerobic Baffle Filter (ABF)

- **Planted Gravel Filter (PGF):**
  - The Planted Gravel Filter (PGF) is built of reed planted filter bodies consisting of fine gravel as shown in Fig. 4.11. The main removal mechanisms are biological conversion, physical filtration and chemical adsorption.
  - Reduction rate of BOD is between 75 - 90 %. Reduction of infective organisms is over 95 %. Operation and maintenance of the system is simple (mainly garden work). The spatial requirements are compensated by integrating it with the landscapes.

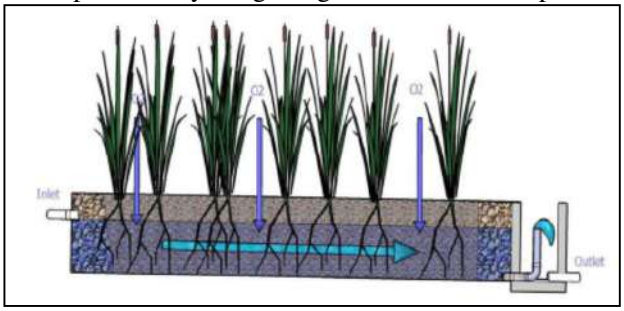


Fig 4.11: Planted Gravel Filter (PGF)

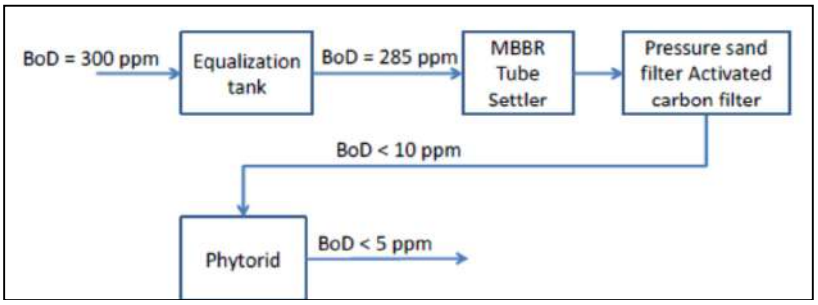


Fig 4.12: BOD reduction in STP component

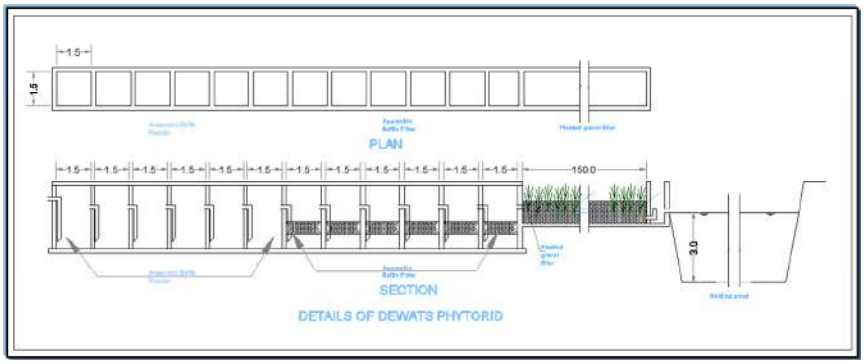


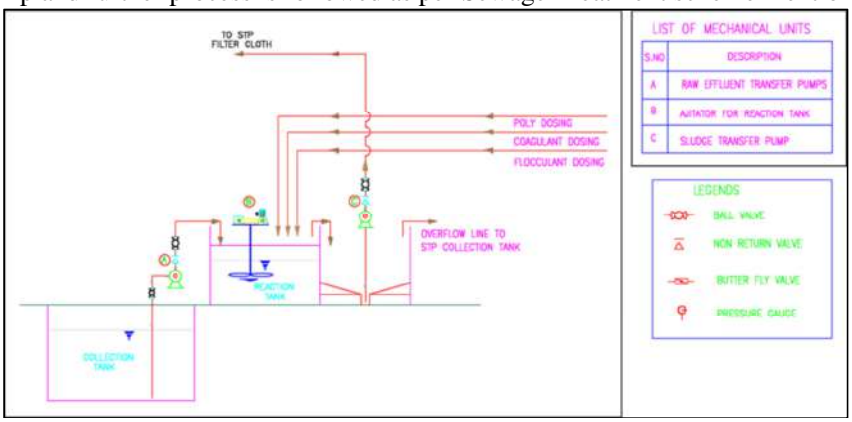
Fig 4.13: Schematic of DEWATS Phytorid and holding pond

Adequate water purification systems like aerators etc. shall be provided to keep the optimum oxygen level and avoid breeding of the mosquitoes

Layout showing location of Water Holding Pond is attached.

- **Hospital (Phase 1) Waste Pre- treatment process details:**

The effluent shall be collected in Collection Tank. The effluent from the collection Tank is pumped to the reaction tank, where Poly, Coagulant and Flocculent are added to remove the color present in the effluent and leads to clarifier. The effluent from the Clarifier tank is allowed to Settle, Where the Sludge gets settled at the bottom of the Clarifier tank and the clear water is led in to the STP collection sump and further process is followed as per Sewage Treatment scheme mentioned above.



ETP PROCESS DIAGRAM

4.2.3 Solid Waste Management:

4.2.3.1 During Construction Phase:

- **Anticipated Impacts -**

- Impact on environment due to improper disposal of construction waste, solid waste by construction workers and staff, Hazardous waste, E waste etc.
- Nuisance created in & around site due to improper handling and disposal of excavated matter.
- Improper storage of construction material leading to pollution of land, water, air.

- **Mitigation Measures –**

- Designated and covered storage for waste
- Construction waste minimization and reuse
- During construction waste shall be segregated into biodegradable and non-biodegradable, garbage (30 kg/day) from workers. And these wastes shall be segregated into biodegradable and non-biodegradable and shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal.
- Separate storage for Hazardous wastes and its disposal to authorized CHWTSDF sites
- Preparation of Construction Waste Management plan and its positive implementation.

- **Expected hazardous waste during construction phase :**
  - Fuel and Heating oil's and other volatile/flammable liquids such as coolants, grease, etc.
  - Centering oil, formwork oil
  - Tar and Tar products (bitumen, felt, water proofing compounds etc.)
  - Chemicals, admixtures, sealants, adhesives solvents etc.
  - Empty containers of Paints and primers
  - Empty containers of pesticides, wood preservatives
  - Tarpaulin
  - Product packaging (cement bags, cartons, containers, plastic covers etc.)
  - Plastics, Acrylics, Silica, PVC
  - Fluorescent Lamps Intact and Crushed, Incandescent Lamps.
  - Mercury Containing Lamps and Tubes, Mercury Containing Devices – Mercury switches, relays, regulators, thermostats, thermometers, manometers etc.
  - All types of Batteries
  - Electronic Ballasts, PCBs, Transformers, capacitors, switchgear, Lead Cable, Oil filled /gel filled cables

- **Management of Hazardous waste:**
  - The dustbins for these wastes shall be made of durable materials like metal or even masonry as the project's construction span is 15 years.
  - Isolated, covered and raised storage for hazardous wastes
  - Installation of fire extinguisher shall be done near storage of hazardous wastes
  - The hazardous waste shall not be stored over a long period and shall be disposed within time as per regulations and with to authorize CHWTSDF sites as per regulations.

4.2.3.4 Construction Waste Management Details:

No.	Item	Reuse/Recycle (Quantity and Details)
1	Excavation material	18,00,000 Cum shall be reused for backfilling on site
2	Concrete Waste	Shall be reused for void filling, compaction of internal roads & compaction of paving
3	Steel	Shall be reused for lintels and remaining shall be given to authorized recyclers
4	Bricks & Blocks	Shall be reused for waterproofing works on site.
5	Ceramic tiles	Shall be used for waterproofing work

No.	Item	Reuse/Recycle (Quantity and Details)
6	Marble/granite	Shall be used in paving & landscaping areas

4.2.3.5 During Operation Phase:

- **Anticipated Impacts & Mitigation Measures -**

There are various types of wastes during operation phase their type and management are detailed out as under.

- **Solid Waste Management:**

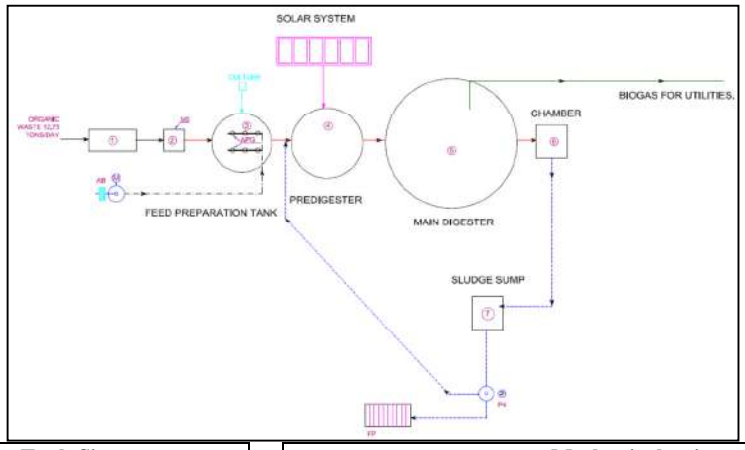
The quantification of municipal solid waste is given in sec. 3.7 of Chapter 3 of this report. During operation phase there will be provision for segregation and collection of biodegradable & non-biodegradable waste within the premises. Biodegradable waste will be treated by Biomethanation plant. Details of Bio-gas plant are given below. The non-biodegradable waste shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal

- **Waste Management :**
  - The facility management services would transfer the biodegradable waste to be processed in Bio-gas plant
  - Adequate Space shall be provided for solid waste management for all buildings which includes the space required for treatment and segregation etc.
  - The Operation and maintenance of Biogas Plant shall be given on contract basis to outside agencies.
  - Disposal of Slurry shall be done through an authorized agency
  - The energy generated from biogas plant and it will be used for lighting of street light lamps.

- **Process:**
  - The waste resources which can be processed using Biogas plant include biodegradable kitchen waste, paper waste, green grass, leaf litter, animal remains in abattoirs, hospital waste, green plant waste, cow dung, crop residues, sugarcane, baggase, water hyacinth, etc.
  - The waste is first segregated carefully to remove non-biodegradable material and then homogenized to make slurry. It is then processed in a sequential manner first by aerobic and then by anaerobic process. The products of the process are biogas consisting of methane, carbon dioxide and water vapor& weed free good quality manure. About 70% of Water can be recycled at the end of the process.

- **Advantage:**
  - Bio Gas Plant would serve many purposes such as:-

1. Environment friendly disposal of waste, which is the need of the hour.
2. Generation of fairly good amount of fuel biogas, which will definitely support the dwindling energy resources. The gas can be used for as fuel in the kitchen or for power generation.
3. Generation of high quality, weed free manure, which is an excellent soil conditioner. This is very important for replenishing organic carbon in the undernourished soil after years of agriculture.



Process Tank Sizes	
No.	**Tank Name**
1.	Segregation Platform
2.	Feed preparation tank
3.	Predigestor
4.	Main digestor
5.	Chamber
6.	Sludge sump
7.	Treated water tank
	Sludge holding tank

Mechanical unit			
Mark	**Unit**	**MOC**	**QTY**
MS	Mixer for crushing waste	C1	Two (1W + 1SB)
AB	Air blowers	C1	Two (1W + 1SB)
APG	Air pirging unit	HDPE	LOT
C	Culture dosing	C1	Two (1W + 1SB)
SS	Solar system	C1	Two (1W + 1SB)
FP	Sludge dewatering system	MS/CI	One

Fig. 4.14: Process flow diagram of Biogas Plant

The layout plan showing location of Biogas Plant is enclosed as **Enclosure 3.**

- **Household Hazardous waste Management :**

Suggestions for Household Hazardous waste Management

- Household Hazardous Waste (HHW) is always labeled as toxic, poisonous, corrosive, flammable, combustible or irritant. Hence while purchasing one can take care to buy non-toxic/less hazardous products and only what are really needed.
- These materials should be kept out of reach of children and pets.
- HHW should not be thrown into household garbage, toilets or sinks or never to be dumped on the ground or poured down into the storm drains as HHW can cause contamination of surface and ground water and hence posing health hazards.

Disposal of Household Hazardous waste

There will be common storage facility for Hazardous wastes and its disposal shall be done to authorized CHWTSDF sites as per regulations.

4.2.4 Energy Conservation & Eco-Friendly Measures:

- Provision of Solar Panels for apartment internal lighting , fan load and water heating
- Street area lights based on Biogas generator
- Provision of LED lights
- Use of Electronic Ballast
- Use of timers in buildings common lighting and external lighting
- Use of Star rated geysers and AC

4.2.4.1 Energy Saving Statement:

Energy Saving statement is given below:

Table 4.12: Overall Energy Saving Statement

Phases	Average Energy Saving (%)
1	17.23
2	20.56
3	14.21
4	16.09
5	14.36
6	14.41

4.2.5 Green Belt Development:

There are existing trees (total 789 nos.). Out of which 461 nos. shall be cut and 328 nos. of trees shall be retained. Details of existing tress are given in Section 3.5.4 of Chapter 3.

RG area will be maintained at ground level. Plantation of trees of various varieties shall be done on ground.

Tree plantation layout is enclosed as **Enclosure 4.**

4.2.6 Indoor Air Environment:

Ventilation analysis is performed all typical floor plans with perspective method and results are compared with IGBC norms.

IGBC Norms:

Space Type	Openable Area as a Percentage of Carpet Area
Living Spaces	13%
Kitchen	10%
Bathrooms	5%

Table 4.13 Ventilation Analysis

Room	Area (Sq.mt.)	Natural Ventilation Window / Door Opening Area	Actual Openable Area	Actual Openable Area As A Percentage Of Total Area	Minimum Openable Area To Satisfy IGBC Mandatory Requirement
TOWER TYPE -A : Type-1 flat (2BHK)					
Living & Dining	21.89	6.45	4.3	20%	10%
Bedroom-1	11.37	6.45	4.3	38%	10%
Bedroom-2	10.53	6.45	4.3	41%	10%
Kitchen	8.42	5.16	3.10	37%	8%
Toilet 1	3.6	0.36	0.18	5%	4%
Toilet 2	3.6	0.36	0.18	5%	4%
TOWER TYPE –A: Type -2 flat (1BHK)					
Living & Dining	18.00	6.45	4.3	24%	10%
M. Bedroom	11.88	7.57	5.05	42%	10%
Kitchen	7.20	5.16	3.10	43%	8%
Toilet1	3.6	0.36	0.18	5%	4%
Toilet2	3.6	0.36	0.18	5%	4%
TOWER TYPE -A : Type-3 flat (1BHK)					
Living & Dining	19.53	6.45	4.3	22%	10%

Room	Area (Sq.mt.)	Natural Ventilation Window / Door Opening Area	Actual Openable Area	Actual Openable Area As A Percentage Of Total Area	Minimum Openable Area To Satisfy IGBC Mandatory Requirement
Bedroom	9.06	6.47	4.31	48%	10%
Kitchen	7.20	4.60	2.76	38%	8%
Toilet1	2.7	0.36	0.18	7%	4%
TOWER TYPE –B: TYPE- 1(2 BHK)					
Living & Dining	21.86	7.16	4.77	22%	10%
M. Bedroom	9.28	3.10	2.06	22%	10%
Bedroom 1	8.50	6.24	4.16	49%	10%
Kitchen	6.17	2.48	1.49	17%	8%
Toilet1	2.84	0.36	1.24	44%	4%
Toilet2	2.84	0.36	0.18	6%	4%
TOWER TYPE -C: TYPE-1 (3BHK)					
Living & Dining	23.16	7.74	5.16	22%	10%
M. Bedroom	12.87	7.10	4.73	37%	10%
Bedroom 1	12.87	5.29	3.53	27%	10%
Bedroom 2	12.72	4.79	3.20	25%	10%
Kitchen	7.99	3.68	2.88	22%	8%
Toilet 1	3.44	0.36	1.84	14%	4%
Toilet`2	3.435	0.36	0.18	5%	4%
Toilet 3	3.4808	0.36	0.18	5%	4%
TOWER TYPE –C: TYPE-2 (2BHK)					
Living & Dining	23.20	6.51	4.343	19%	10%
M. Bedroom	11.44	6.45	4.3	38%	10%
Bedroom 1	12.81	6.45	4.30	34%	10%
Kitchen	7.38	4.30	2.58	20%	8%
Toilet 1	3.14	0.36	0.18	6%	4%
Toilet`2	3.14	0.36	0.18	6%	4%

Conclusion:
From results of Prescriptive method, it is observed that all habitable spaces in the project are properly naturally ventilated as per the requirements prescribed by IGBC

4.3 DETAILS OF IMPACT ON EXISTING INFRASTRUCTURE DUE TO THE PROJECT :

Detailed examination of the project and project site have been made with reference to impact on infrastructure covering water supply, carrying capacities of storm water drainage, sewers, electrical load etc.

4.3.1 Details of the project with reference to water supply:

The requirement of fresh water will be fulfilled from Maharashtra Jeevan Pradhikaran (MJP). All other secondary requirements like flushing & gardening are getting fulfilled by treated water from STP. Hence the overall reduction in total water demand shall be 43%.

4.3.2 Details of Project with reference to Storm Water Drainage

- **Runoff from site:**

The Stormwater drain disposal system of proposed site and adjoining area has been identified and Stormwater from the plot is proposed to be disposed in to an existing natural drain passing adjacent to the plot and shown in Fig. 4.15

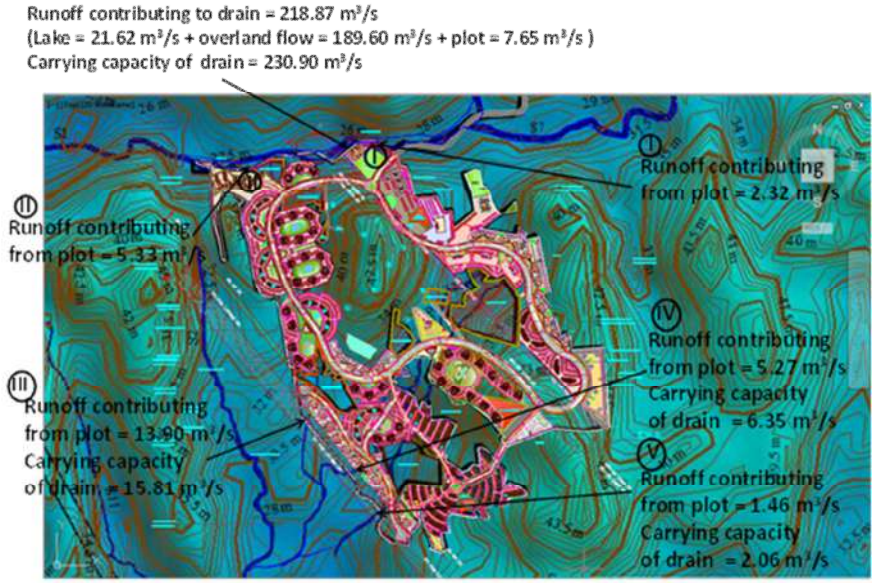


Fig. 4.15: Runoff contributing and carrying capacity of an existing drain.

Table 4.14 Summary of runoff and drain carrying capacity

Details	m^3/sec
Runoff before development from plot	13.29
Runoff after development from plot (In future after development of all phases)	26.58
Runoff from pond adjacent to the plot contributing to plot drain	1.06
Peak runoff from catchment area outside plot contributing to plot drain	0.64
Total runoff from plot	28.28
Runoff contributing to major drain (Nadhal Lake surplus = 21.62 m^3/s; overland flow = 189.60 m^3/s and plot = 7.65 m^3/s)	218.87

- **Carrying capacity of Storm water Drainage:**

Table 4.15: Carrying capacity of Storm water Drainage

Details	Capacity(m^3/sec)
Carrying capacity of internal drain	29.61
Carrying capacity of external North drain	230.90
Carrying capacity of external South drain (three streams)	24.22
Total carrying capacity of North and South drain	255.12

Assessment of drain carrying capacity:

1. Catchment based approach has been considered in designing rather than isolated individual plot/area based approach. Catchment area contributing to the major drain has been delineated and depicted in Fig. 4.16 and 4.17. Catchment contributing to the major drain from hilly area, plain areas, part plot area and areas including areas contributing to dam is 11.43 km^2. Catchment contributing to the major drain excluding dam is 10.02 km^2, out of which pervious and impervious areas are 5.85 km^2

and 4.17 km^2 respectively.

2. The surplus runoff from the dam is estimated by using weir formula. The water depth has been considered as 0.25 m and 0.30 m for dam D1 and D2 respectively. The surplus runoff from the dam has been computed as 11.26 m^3/s and 10.36 m^3/s for dam D1 and D2 respectively. Thus the total surplus runoff from dam is 21.62 m^3/s.
3. Coefficient of runoff for pervious and impervious areas has been taken as 0.50 and 1.00 respectively. Peak rainfall intensity has been considered as 100 mm/h. Subsequently, the runoff from the catchment area other than dam has been computed as 197.25 m^3/s (overland flow = 189.60 m^3/s and plot = 7.65 m^3/s).
4. The total runoff contributing to major drain located in North in which project runoff (disposal locations I and II) is proposed to be disposed is 218.87 m^3/s (dam surplus = 21.62 m^3/s; overland flow = 189.60 m^3/s and plot = 7.65 m^3/s) as shown in Figure 4.17.

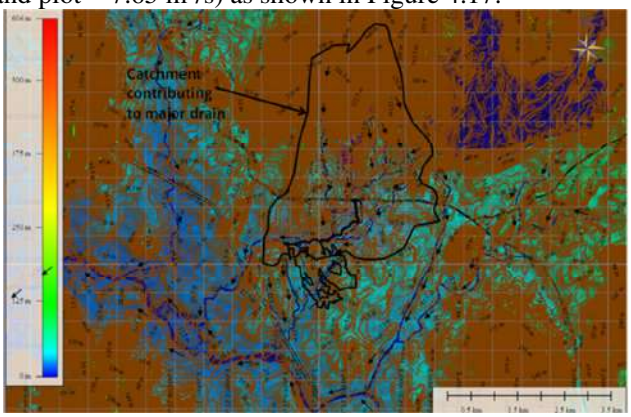


Fig. 4.16: Catchments contributing to the major drain from hilly and plain areas.

5. The total runoff contributing from plot (disposal locations III, IV and V) to three streams passing South of the plot is 20.63 m3/s and carrying capacity is 24.22 m3/s as shown in Fig. 4.17

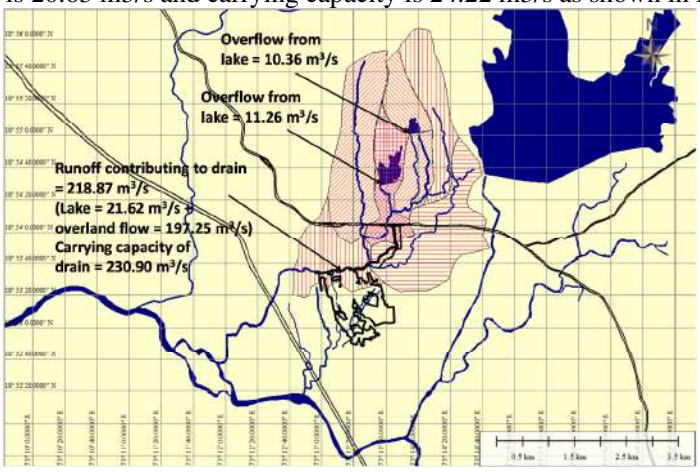


Figure 4.17. Contributing runoff and carrying capacity of an existing major drain

6. 1.0 coefficient of runoff has been considered for computation of runoff by rational method for impervious and pervious areas respectively for internal drains. Drain sizes has been worked considering the rainfall intensity of 100 mm/h.
7. Stormwater from the plot is proposed to be disposed at five locations in and existing natural drain as shown in Fig. 4.17. Runoff contributing at each disposal location and carrying capacity of the drain has been computed as shown in Fig. 4.17 and tabulated in Table 4.15. The overflow from and existing ponds and adjoining future development is also considered. Drains are adequate to carry the runoff from the plot; hence plot is free from flooding.

Storm water drainage system of adequate capacity shall be laid down and proper maintenance shall be

done. These drains shall have silt and oil and grease traps to avoid pollution of water in drains outside the plot.

The layout for storm water drainage and detailed study of Storm water Disposal System of proposed project and adjoining areas is given.

4.3.3 Details of the project with reference to sewerage:

The implementation of Sewerage Treatment plants and reuse of treated sewage for secondary requirements like gardening and flushing. The probable time frame for completion will be Fifteen years.
For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers.

After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage.

Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.

The Stored excess treated sewage shall be given for irrigation purposes outside the plot.

4.3.4 Details of the project with reference to Electrical Supply:

The power demand for proposed development is 309258 KW. With the use of various energy conservation and non-conventional energy (solar) energy shall be saved. The details are given in sec 4.2.4.1

4.4 IMPACT ASSESSMENT BY INTEGRATION:

Impact identification for this project was done by using Delphi Technique.

4.4.1 Technique:

For sitting of an activity, **"Delphi Technique"** is advised by MoEF. The Government of India has recommended this technique in the book on Sitting of Hazardous Waste Disposal Areas, prepared by NEERI, Nagpur and published by the Ministry of Environment and Forest (MoEF) in 1991. The same is proposed to be used with due improvisation, mutatis mutandis, covering other media of environment.

a. (i) The Delphi Technique considers the following 34 attributes and
Four weightages i.e.:
7 attributes, receptor related
10 attributes, pathway related
8 attributes, pollutant related
9 attributes, waste management related.

(ii) The modified Technique used here considers 23 attributes and
Five weightages i.e.:
7 attributes, receptor related
5 attributes, pathway related
5 attributes, water pollution & waste management related
4 attributes, air pollution and waste management related
2 attributes, solid waste management related.

b. Four types of marks for each attribute like 0 to 0.25, 0.25 to 0.5, 0.5 to 0.75 and 0.75 to 1.0 depending on facts of situations, chemical properties of pollutants and quantification are considered. These marks are known as Sensitivity Index (SI).

c. Combined consideration of (1) and (2) together gives attribute-wise weight-ages. These are the negative marks out of 1000 and ranking of candidate sites is based on comparison of these marks.

Finding the sensitivity index (SI) shall be first task and is done in the table below.

4.4.2 Marks Allocation and Ranking:

Site selection depends on site evaluation. Site evaluation will depend on consideration of sensitivities of various attributes and the weight-ages attachable to each. Finding the sensitivity index (SI) shall be first task and is done in the table given below.

The attribute measurements or values or description are known as the team has traversed the area. The sensitivity index is awarded based on attribute properties in above table. The attribute wise score is arrived at by multiplying the sensitivity index and the weight-age of each attribute and is given in **Table 4.16**

Table 4.16: Sensitivity Index and the Weight-Age of Each Attribute

Attribute	Sensitivity Index			
	0.0 - 0.25	**0.25 - 0.5**	**0.5 - 0.75**	**0.75 - 1.0**
Receptor Related				
Population within 500 meters	0 to 100	100 to 250	250 to 1000	> 1000
Distance to nearest drinking water well	> 5000 m	2500 to 5000 m	1000 to 2500 m	< 1000 m
Use of site by nearby residents	No used	Occasional	Moderate	Regular
Distance to nearest off site building	> 3000 m	1500 to 3000 m	500 to 1500 m	< 500 m
Presence of major transportation routes	Airport	Internal road	Highway	Rail
Land use/ Zoning	Completely remote (Zoning not applicable)	Agricultural	Commercial or industrial	Residential
Critical environments	Not a critical environmental element	Pristine natural areas	Wetlands, flood plains, &preserved areas	Major habitat or endangered or threatened species
Pathway Related				
Distance to nearest surface water	> 8000 m	1500 to 8000 m	500 to 1500 m	< 500 m
Ground water depth	> 30 m	15 to 30 m	5 to 15 m	< 5 m
Type of contamination	No Contamination	Soil Contamination only	Biota contamination	Air, Water or food contamination
Precipitation effectiveness index	Semi arid	Semi humid	Humid	Wet
Susceptibility to erosion & run-off problem	0 - 0.25 not susceptible	0.25 - 0.50 Potential	0.50 - 0.75 Moderate	0.75 - 1 Severe
Waste Related				

Attribute	Sensitivity Index			
	0.0 - 0.25	0.25 - 0.5	0.5 - 0.75	0.75 - 1.0
Water				
BOD generation level	< 250 mg/l	250- 500 mg/l	500- 1000 mg/l	Above 1000 mg/l
Treatability COD-BOD	< 2.5	2.5 – 3.5	3.5 - 5	Above 5
Treatment	Tertiary	Secondary	Primary	No
Disposal	Land assured & crop perennial	Land seasonal	Stream up to 5km	Riparian
pH	6 - 8	5- 6 or 8 - 9	3 - 5 or 9- 11	<3 or >11
Air				
Industrial mix Fuel	Electricity	Oil	Bagasse	Coal
Control equipment	All including ESP or wet scrubber	Bag filter	Cyclone, Fly ash arrestor	None though required
Stacks heights	As per Act	30	< 30	None though required
Noise at boundary	upto 55 dB(A)	55 to 70 dB(A)	70 to 85 dB(A)	Above 85 dB(A)
Solid Waste				
Industrial mix (waste type)	None	Non-hazardous	Hazardous & Non-hazardous	Hazardous
Treatment - • Non hazardous	Recycle/sale	Secured landfill	Low landfill	None though required
• Hazardous	Recycle/ Incinerator	Secured landfill	Sanitary landfill	None though required

Table 4.17: Ranking for Project Site

Attribute	Attribute Measurement	Sensitivity Index	Weight-age	Attribute Score
Receptor Related				
Population within 500 meters	> 1000	0.75	80	60
Distance to nearest drinking water well, m	< 1000 m	0.75	60	45
Use of site by nearby residents	Moderate	0.75	50	50.7
Distance to nearest off site building	500 to 1500 m	0.75	40	30
Land use/ Zoning	Residential	0.75	30	22.5
Presence of transportation routes	Highway, Train	0.75	30	22.5
Critical environments	Not a critical environmental element	0.25	30	7.5
Sub total		4.75	320	238.20
Pathway Related				
Distance to nearest surface water	< 500 m	0.75	55	41.25
Depth of ground water	6 to 7.5m	0.65	45	29.25
Type of contamination	No Contamination	0.25	45	11.25
Precipitation effectiveness index	Humid	0.5	25	12.5

Attribute	Attribute Measurement	Sensitivity Index	Weight-age	Attribute Score
Susceptibility to erosion and runoff problems	Potential	0.25	25	6.25
Sub total		2.4	195	100.5
Waste related				
BOD, mg/l	< 250 mg/l	0.10	40	4
PH	6 - 8	0.20	20	4
Treatability (COD:BOD)	<2.5	0.25	40	10
Treatment	Tertiary	0.25	50	12.5
Disposals	Land assured & crop perennial	0.05	50	2.5
Air				
Industrial mix (Fuel)	Electricity	0.1	70	7
Control equipment	Wet scrubber	0.1	50	5
Stacks	As per Act	0.1	50	5
Noise at boundary	Up to 55 dB(A)	0.1	30	3
Solid Waste				
Waste Type	Non Hazardous	0.5	45	22.5
Facilities	Recycle/sale	0.1	40	4
Sub total		1.85	485	79.50
Total				**418.20**

Ranking

From the above considerations we have to place our present Project site at appropriate level as per following slabs.

Score 750 to 1000 = Pollution Potential Very High
Score 600 to 750 = Pollution Potential High
Score 450 to 600 = Pollution Potential Moderate
Score 300 to 450 = Pollution Potential Low
Score below 300 = Pollution Potential Very Low

Yard-Stick for Ranking

Since with the methodical working of sensitivity index and weight-ages, the total scope of pollution potential has come to **418.20,** the site fits into **"LOW"** Pollution Potential.

CHAPTER 5
ENVIRONMENTAL MONITORING PROGRAMME

CHAPTER 5
ENVIRONMENTAL MONITORING PROGRAMME

5.0 MONITORING PROGRAM:

A monitoring program has been detailed out in which the frequencies of measurement, the planned location of measurement and detailed budgets are listed.

The environmental monitoring program includes following:

- Ambient air quality
- Monitoring of exhausts from DG sets
- Noise level monitoring
- Water quality monitoring
- Wastewater Analysis

The MoEF approved laboratory shall be appointed for the environmental monitoring during construction and operation phases. There will be one record section for recording all the sampling frequencies and analysis reports.

➢ **During Construction Phase:**

- **Air & Noise Monitoring**

To monitor air quality on site sensors shall be installed during construction phase. This will help to keep daily record of the air quality. Additionally the ambient air quality for the parameters $PM_{2.5}$, PM_{10}, SO_2, NO_x & CO shall also be monitored quarterly through an approved laboratory by MOEF & CC.

The noise levels shall be recorded by the Site Personnel of project proponents and record shall be kept for daily readings. The locations shall be selected in the area where there are chances of high noise levels due to construction activities and nearby plot boundaries to ascertain the noise levels are within the prescribed limits.

- **Water Analysis**

The drinking water shall be checked monthly for physicochemical and bacteriological parameters.

➢ **During Operation Phase:**

- **Air & Noise Monitoring**

The ambient air quality for the parameters $PM_{10,}$ PM $_{2.5}$, SO_2, NOx, CO and Noise levels shall be monitored quarterly as per guidelines at five locations within the project site to ascertain that they are within the prescribed limits.

There will be provision of DG sets during power failure for emergency load. The emissions from the DG sets are only limited while those are in operation. Emissions of DG sets shall be monitored as per guidelines quarterly by taking test run of DG sets.
During operation phase to control emissions from DG sets, stack heights of DG sets shall be as per CPCB guidelines. With regards to concern from vehicular emissions, the exhaust emissions due to rise in peak hour traffic will be mitigated by adopting traffic management measures and permitting vehicles having valid PUC. The ambient air quality will be regularly monitored on site.

During operational period the major noise pollution source will be DG sets, surrounding traffic

activity. In order to prevent adverse noise exposure to the occupants, optimal mix of mitigation measures such as low noise generation units, acoustic enclosures, and plantation of trees as noise barriers all around the project boundary has been planned. Air and Noise modeling studies have been done for the prediction of impacts and mitigation measures have been suggested and reported in Chapter -4.

- **Water & Wastewater Analysis**

The water shall be available through Maharashtra Jeevan Pradhikaran (MJP). To ascertain its quality as a precaution it shall be checked quarterly by outside Laboratory for physicochemical and bacteriological parameters.

Water conservation shall be done with the help of collecting rain water and using it for domestic purpose and thereby minimizing requirement of fresh water from MCGM. Rainwater collection tank is proposed and the rain water collected from terraces shall be used for domestic purpose after treatment like filtration and disinfection. This treated water shall be tested monthly by MOEF approved External Laboratory during rainy season for physicochemical and bacteriological parameters to ascertain its quality for domestic use.

Treatment of waste water shall be done in Sewage Treatment Plant (STP) and its use shall be ensured for secondary requirements like flushing, gardening etc. Hence analysis of both untreated and treated sewage shall be daily by sensors.

5.1 ENVIRONMENTAL MONITORING PLAN WITH BUDGETARY ALLOCATION:

During construction and operation phase the environmental monitoring shall be done regularly as per the statutory conditions as explained in section 5.0

The budgetary allocation for environmental monitoring plan for construction and operation phase of the project is as explained in **Table 5.1 & 5.2.**

Table 5.1: Environmental Monitoring Plan with Costing

During Construction Phase:

No.	Item	Parameters	Frequency	Location	Total Cost (Rs. in Lacs)
1.	Ambient Air Quality	$PM_{2.5}$, PM_{10}, SO_2 & NO_X	Quarterly	At major construction area	13.20
2.	Noise Level	Equivalent Noise Level dB(A)	Daily		
3.	Water Analysis	Physical, Chemical and Bacteriological Parameters	Monthly	Municipal Supply	2.70
				Total	**15.90**

The budgetary allocation for operation phase of the project is given in **Table 5.2.**

Table 5.2: Environmental Monitoring Plan with Costing (Per Annum) During Operation Phase

#	Item	Parameters	Location	Frequency of monitoring by By MOEF approved External Laboratory	Costing (Rs in Lacs /yr)	
					By MOEF approved External Laboratory	By Monitoring Sensors (Frequency: Daily)
1.	Ambient Air Quality	$PM_{2.5}$, PM_{10}, SO_2 & NO_X	Project site	Quarterly	0.28	--
2.	Noise Level	Equivalent Noise level	Project site			
3.	Exhaust from DG Set	SPM, SO2	Stack of DG sets	Quarterly	1.49	
4.	Water Analysis (for rain water)	Physical, Chemical and Bacteriological Parameters	Domestic Water tank	Quarterly	2.04	
5.	Water Analysis (for rain water)	Physical, Chemical and Bacteriological Parameters	Rain water stored in tank (After treatment)	Monthly during rainy season	1.40	
6.	Sewage Analysis	pH, BOD, COD, TSS, TDS, O & G	STP	Six monthly	1.03	38.00
Total					**6.24**	**38.00**
Grand total					**44.24**	

CHAPTER 6
ADDITIONAL STUDIES

CHAPTER 6
ADDITIONAL STUDIES

6. INTRODUCTION:

This chapter covers Risk Assessment Studies for the construction and operation phase, the safety precautions that have to be taken during construction phase and the Disaster Management Plan and Emergency Preparedness Plan Onsite and Offsite. Also this chapter includes ECBC studies.

6.1 DISASTER MANAGEMENT PLAN:

RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN
RED PAGE
EMERGENCY PHONE NUMBER

FIRE STATION	
Fire Station (Vijay Marg), New Panvel.	022 - 2745 2337
POLICE	
Khalapur Police Station.	02192- 275033
HOSPITAL/ NURSING HOME	
Dhirubhai Ambani Hospital, Lodhivali.	02192 - 255 141
EMERGENCY COORDINATOR	
Responsible persons of The Complex Housing Society Primary School Secondary school IT park Market	
DISTRICT DISASTER CONTROL ROOM	
Disaster Management Control Room	

SECTION 1: INTRODUCTION

OVER VIEW OF THE PROJECT

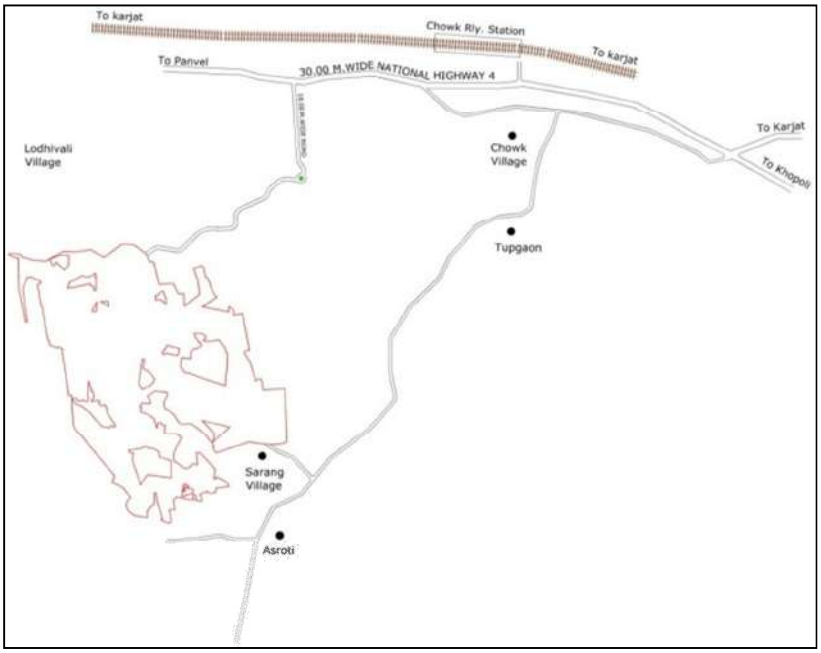
THE PROPOSAL

Proposed Special Township Project at village –Sarang, Taluka –Khalapur, District –Raigad, Maharashtra

PROJECT PROPONENT

M/s. Clarideges SEZ Developers Private Limited.

SITE OVERVIEW



LOCATION MAP

GOOGLE MAP

Access	The site is accessible from Existing old Mumbai – Pune National Highway (NH4)
Corporation/ Jurisdiction	Mumbai Metropolitan (MMR) Region and special planning authority is Navi Mumbai Airport Influence Notified Area (NAINA).

Layout

Occupancy: Total Occupancy: 1, 35,593

Phases	Occupancy
1	23851
2	12568
3	50456
4	26870
5	8160
6	13688

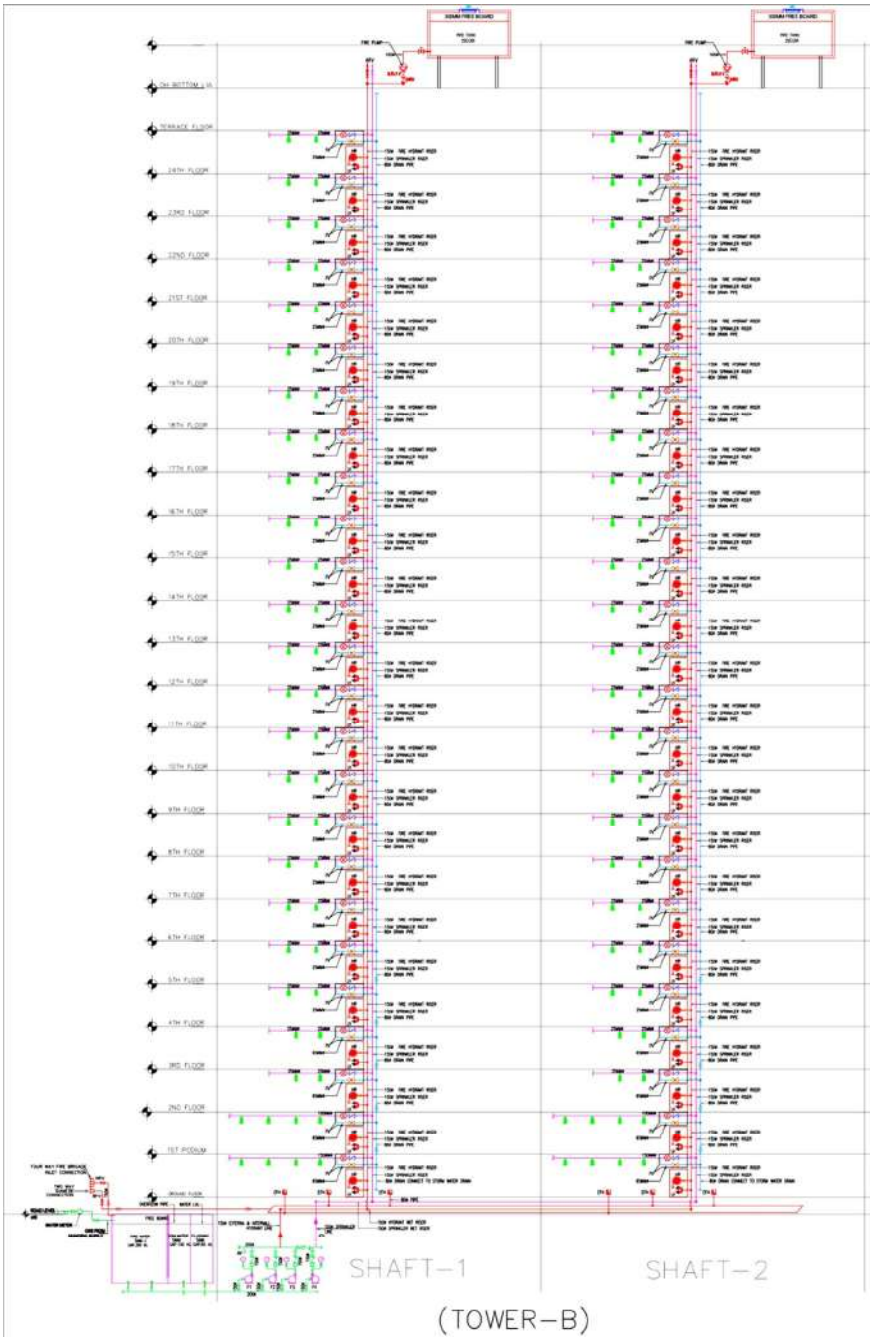
BUILDING CONFIGURATION

Phases	Building Details
1	**21 nos. of Residential Buildings:** Type A buildings : 6 buildings of Ground + Podium + 22 Upper Floors Type B buildings : total 15 buildings 12 buildings of Ground + Podia + 22 Upper Floors 3 buildings of Ground + 2 Podia + 22 Upper Floors **Total Flats: 3036 nos.**
	Convenient Shopping : 1 building : Ground+ 1 Upper Floor **Shops: 2 units**
	Convention Centre: 2 buildings of Ground + 2 Podia+ 15 Upper Floors
	Primary School : Ground+ 4 Upper Floors **Classrooms: 72 nos**.
	Hospital: Basement+ Ground+ 4 Upper Floors **Beds: 150 Nos.**
	Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A: 7 buildings of Ground + 12 Upper Floors Type B: 2 buildings of Ground + 11 Upper Floors Type E: 1 building of Ground + 12 Upper Floors **Total Flats: 844 nos.**
2	**11 nos. of Residential Buildings:** Type A buildings :3 buildings of Ground + Podium + 22 Upper Floors Type B buildings : 8 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 1584 nos.**
	Convenient Shopping : 1 building : Ground+1 Upper Floor **Shops: 2 unit**
	Hotel: 3 buildings of Ground + 2 Podia+20 Upper Floors **Rooms: 840 nos.**
	Economical Weaker Section (EWS) scheme: 5 nos. of Residential buildings: Type A : Ground + 12 Upper Floors **Total Flats: 480 nos.**
3	**18 nos. of Residential Buildings:** Type A buildings : 3 buildings of Ground + Podium+ 3 part podia + 22 Upper Floors Type B buildings : 15 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 2508 nos.**
	Convenient Shopping : 1 building : Ground+ 1 Upper Floors **Shops: 2 units**
	Secondary School : Ground+ 7 Upper Floors Classrooms: 182 nos.
	Office building: Ground+ 5 Upper Floors

Phases	Building Details
	Office and Market Mall: 6 Buildings of Ground+ 3 Podia+ 5 Upper Floors (market mall) + 6 to 20 upper floors (offices)
	Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A : 7 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type F : 1 building of Ground + 12 Upper Floors Type I : 1 building of Ground + 12 Upper Floors **Total Flats: 908 nos.**
	Home for aged person, Community Centre, Library, Auditorium 1 building with 4 wings Wing A: Home for aged: 2 Basements + Ground +6 Podia + 5 Upper Floors **Rooms:110** Wing B: Community center : 2 Basements + Ground +6 Podia + 5 Upper Floor Wing C: Library: 2 Basements + Ground +6 Podia + 4 Upper Floor Wing D: Auditorium: 1 building of 2 Basements + Ground +6 Podia +5 Upper Floor
4	**IT park:** Total 3 buildings 2 Basements+ Ground+ 4 Podia+ 24 Upper Floors
	Resort: Type A : 2 buildings of Ground + 4 Upper Floors Type B : 1 building of Ground + 3 Upper Floors Type C : 1 building of Ground + 5 Upper Floors
	Economical Weaker Section (EWS) scheme: 12 nos. of Residential buildings: Type C : 11 buildings of Ground + 12 Upper Floors Type D : 1 building of Ground + 12 Upper Floors **Total Flats: 1140 nos.**
	Police Station
5	**Economical Weaker Section (EWS) scheme:** 18 nos. of Residential buildings: Type F : 16 buildings of Ground + 12 Upper Floors Type G : 2 building of Ground + 12 Upper Floors **Total Flats: 1632 nos.**
6	**Economical Weaker Section (EWS) scheme:** 15 nos. of Residential buildings: Type A : 2 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type C : 8 buildings of Ground + 12 Upper Floors

Phases	Building Details
	Type F : 4 building of Ground + 12 Upper Floors **Total Flats: 1388 nos.**
	Convenient Shopping : **1 building: Ground+ 1 Upper Floor** **Unit: 2 nos.**
	Primary School : Ground+ 10 Upper Floors Classrooms: 200 nos.

Resources for Tower A & B


SHAFT-1
SHAFT-2
(TOWER-B)

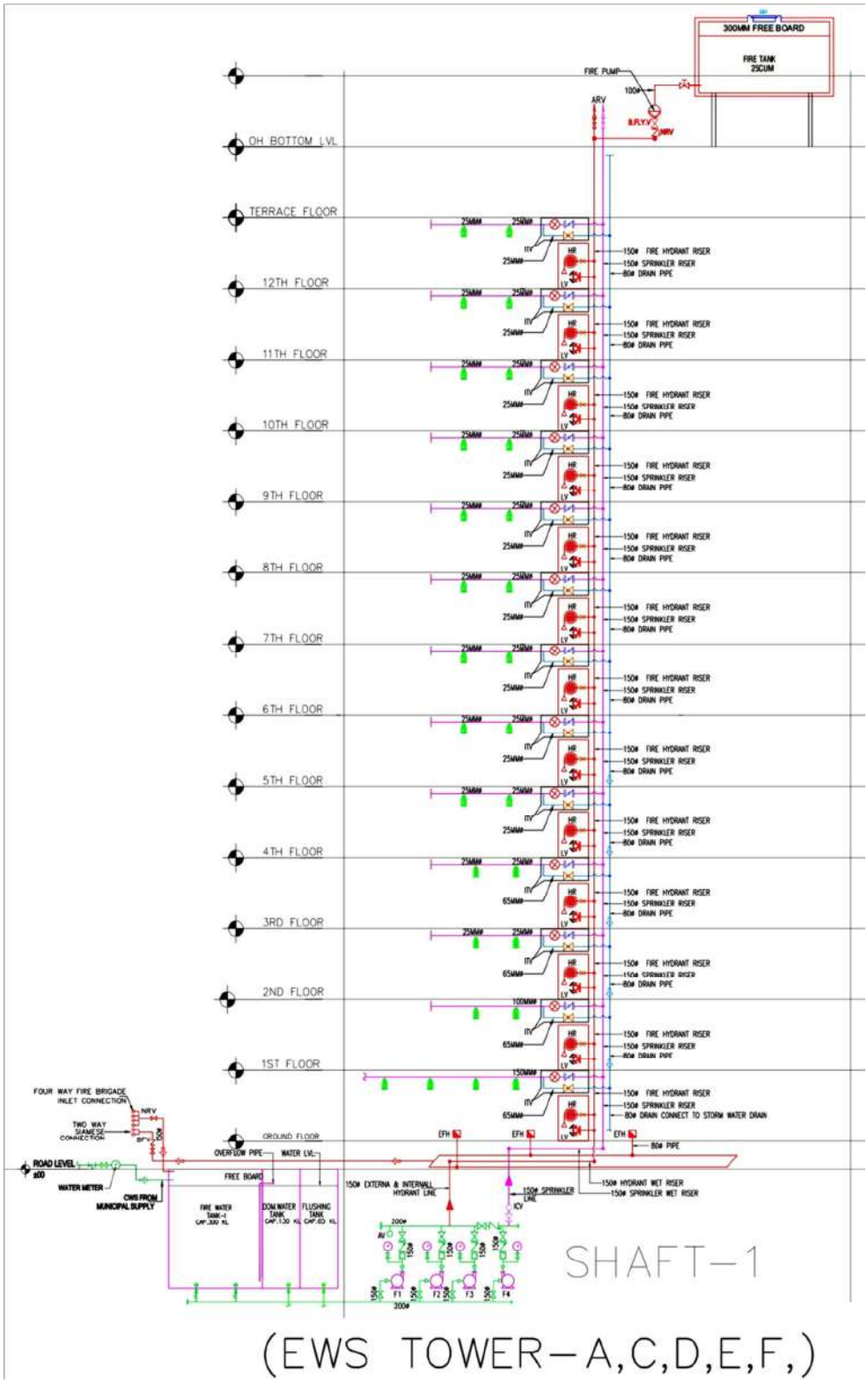
RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18	Fire drenchers	√	at fire check floor
19	Fire chute.	√	
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.	X	

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for EWS Tower A, C, D, E, F



RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18	Fire drenchers	X	
19	Fire chute.	X	
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.	X	

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
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F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
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J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for Primary and secondary Schools

RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty.	Remark
1	Portable Fire extinguishers	V	ABC, CO2 & DCP type will be provided
2	Hose reel & box	V	
3	Wet riser	V	
4	Yard hydrant	V	
5	Automatic sprinkler system	V	
6	Fire alarm system	V	
7	Gas detector.	V	In laboratory, pantry, parking
8	UG static water storage tank	V	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	V	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	V	
11	Fire brigade connection valve	V	
12	Fire lift	V	
13	Fire doors	V	2 hrs fire resistance
14	Pressurization system	V	For Fire Lifts & Internal fire staircases
15	Emergency lights	V	in escape route
16	PA system	V	
17	Refuge, ECC area equipments	V	
18	Fire drenchers	X	at fire check floor
19	Fire chute.	X	
20	Ventilation fans	V	
21	Emergency power	V	DG set
22	CCTV system	V	
23	Lightning arrestor	V	
24	height indicator light	V	
25	Dewatering Pump.	V	
26	Life jackets.	V	
27	RWH tank	V	
28	Mechanical evacuation.	X	

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	30	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	31	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for Hospital

RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking , store
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18	Fire drenchers	X	at fire check floor
19	Fire chute.	X	
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.	X	

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for Hotel and Resort

RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18	Fire drenchers	√	at fire check floor
19	Fire chute.		
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.		

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for Home for aged, Community centre, Library and auditorium

RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18			
19	Fire chute.	X	
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.		

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for Convenient shopping, Convention centre, Office building, Office and Market Mall

RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18	Fire drenchers	√	at fire check floor
19	Fire chute.	√	
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.		

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

***Approximate Estimated Quantity**

Resources for IT Park

RESOURCES – Numbers are not available at this stage of working.

Item no.	Description	Qty .	Remark
1	Portable Fire extinguishers	√	ABC, CO2 & DCP type will be provided
2	Hose reel & box	√	
3	Wet riser	√	
4	Yard hydrant	√	
5	Automatic sprinkler system	√	
6	Fire alarm system	√	
7	Gas detector.	√	In Kitchen, At parking
8	UG static water storage tank	√	Flushing- ,Domestic- ,Fire- nos
9	OH Terrace water tank	√	Flushing- ,Domestic- ,Fire- nos
10	Fire pump	√	
11	Fire brigade connection valve	√	
12	Fire lift	√	
13	Fire doors	√	2 hrs fire resistance
14	Pressurization system	√	For Fire Lifts & Internal fire staircases
15	Emergency lights	√	in escape route
16	PA system	√	
17	Refuge, ECC area equipments	√	
18	Fire drenchers	√	at fire check floor
19	Fire chute.	√	
20	Ventilation fans	√	
21	Emergency power	√	DG set
22	CCTV system	√	
23	Lightning arrestor	√	
24	height indicator light	√	
25	Dewatering Pump.	√	
26	Life jackets.	√	
27	RWH tank	√	
28	Mechanical evacuation.		

	Item	Qty.		Item	Qty.
29	**SEARCH & RESCUE KIT**	*	**30**	**PPE (PERSONAL PROTECTIVE EQUIPMENT)**	*
A	Torch with battery.	04	A	Safety Helmet.	15
B	Whistles.	10	B	Safety Goggles.	15
C	Ropes -Nylon (800 m).	800mtrs	C	Safety Shoes/ Boots.	15
D	Ladder.	08	D	Orange Jacket.	15
E	Search light.	04	E	Masks.	15
F	Two way radio.	04	**31**	**SAFETY SIGNAGES**	
G	Hand Operating Siren.	02	A	Signs at lift landings.	20
H	Metal Cutting set.	02	B	Floor numbering signs.	Every floor
I	Portable Mega Phone.	01	C	Stair and elevator identification sign	Every floor
J	Barricade tape.	10	D	Stair reentry signs.	Every floor
K	Flags.	08	E	Floor layout plans.	Every floor
L	Stretcher	01	F	At change of direction in the escape route.	10
M	First aid box	04	G	Assembly point.	05
N	Wheel chair	01	H	Emergency Control Centre (ECC).	01
O	Mud pan, bucket	10	I	First aid.	01
P	Bucket	10	J	Danger at electrical rooms.	Each
Q	Pulley , crab winch	02	K	Exit signs at each exit door.	Every floor

*Approximate Estimated Quantity

IDENTIFICATION OF HAZARD:

		Phase of the project			
Sr. no.	Hazard	Pre-Construction	Construction	Operation	Post Operation / Decommissioning
Natural causes	Cyclone		√	√	√
	Earth quake		√	√	√
	Land slide		√	√	√
	Flooding - heavy rain, storm drain system failure	√	√	√	√
	Flooding - water pipeline burst	√	√	√	√
	Flooding – overflowing	√	√	√	√
	Tsunami		√	√	√
Physical hazards	Noise		√	√	√
	Radiation (UV , radioactive materials)		√		
	Extreme temperatures		√		
	Vibration		√	√	√
Biohazards	Bio hazardous waste at hospital			√	√
	Epidemics /Communicable diseases by pests ,insects ,rodents etc		√	√	√
	Animal / snake bites		√	√	√
	Occupational health hazards at industry			√	√
Electrical hazard	Transformer fire /explosion		√	√	√
	Power transmission tower line wire snap /up routing tower	√	√	√	√
	Lightning strike	√	√	√	√
	fires due to Short circuit		√	√	√
	Power outage		√	√	√
Hazardous substances and wastes	AC , Refrigerators , Air conditioners Units fire/ explosion		√	√	
	Diesel fire at DG set		√	√	√
	Foul odor at dumping sites			√	√
	Hazardous waste uncontrolled disposal - batteries , Asbestos containing Dust, Glass, Plastics, steel		√	√	√
	Hazardous waste uncontrolled disposal - e –waste batteries		√	√	√
	Construction accidents , gas release , fire /explosion /		√	√	√
	PNG/LPG / Acetylene gas cylinders fire /explosion		√	√	√
	PNG / fuel pipeline failure fire /explosion	√	√	√	√
	Bio gas plant gas release – flash fire/explosion			√	√
	Release of toxic gas at (such as Chlorine) at CT, Filtration plants at WTP, Swimming pools.			√	√
	Hazardous waste road transport mishap			√	√
	School laboratories fire /explosion			√	√
	Site decontamination				√
	Smoke in fire , acrid gases in fire , dumping yard			√	√
	Vehicles fuel fire	√	√	√	√

		Phase of the project			
Sr. no.	Hazard	Pre-Construction	Construction	Operation	Post Operation / Decommissioning
Mechanical	Failure of machinery and equipment		√	√	√
	Lack of safety guards in machines		√	√	√
	Poor maintenance of machinery and equipment		√	√	√
	power driven tools , saws , grinders and abrasive cutting wheels		√	√	√
	scaffolding –fixed and portable failure		√	√	√
	structural failure		√	√	√
	Truck and transport vehicles		√	√	√
Frequent causes of accidents during construction Activity	Being struck by falling object		√	√	√
	Caught in or compressed		√	√	√
	Cranes , winches , hoisting and hauling equipments malfunction		√	√	√
	Dusting		√	√	√
	Electricity (electrocution)		√	√	√
	Fall from height,		√	√	√
	Fire and explosion -Explosives , Blasting chemicals uncontrolled explosion during demolition / land development		√		√
	Hit by sharp objects		√		√
	Injuries during Handling heavy objects		√		√
	Lack of PPE , housekeeping practices , safety signs		√	√	√
	Oxygen deficiency in confined spaces			√	√
	Paint/ thinner cleaners, pesticides , waste oil , flammable combustible materials fire at store		√	√	√
	Poor illumination		√	√	√
	Slipping on wet surfaces		√		√
	Snapping cables , ropes , chains , slings , hooks , chains		√	√	√
	Struck by moving objects	√	√	√	√
	Welding fumes and Radiations		√		√
Ergonomics & psychosocial	Repetitive and monotonous work, excessive workload , strain injuries		√	√	
	Mental stress , human relations (aggressive behavior , alcohol and drug abuse , violence)		√	√	√
	Poverty , low wages , lack of education		√	√	√
	Long working hours , shift work , night work , temporary employment		√	√	√

	Site surrounding specific hazards	Phase of the project			
Sr. no.	Hazard	Pre-Construction	Construction	Operation	Post Operation / Decommissioning
Gas pipeline (GAIL)	Corrosion hole Leak of gas pipeline The gas is non-toxic, posing only an asphyxiation hazard.	√	√	√	√
	10 % pipeline hole due to Defective Pipe and Welds leading to jet fire , flash fire , VCE		√	√	√
	Full bore Rupture of gas pipeline during excavation, abuse at encroachment - flash fire , VCE		√	√	√
	Environmental damage from gas fire incidents associated with a failure to control fire		√	√	√
HT electric power transmission line	Operating a crane near overhead wires is hazard , may lead to shock or fatality	√	√	√	√
	Accidentally Directing firefighting water towards overhead HT wires		√	√	√
	HT power Wire breaking and falling down may lead to shock or fatality		√	√	√
	Vehicle accidents with tower		√	√	√
	Open arcing and fire hazard , power outage hazard		√	√	√
	Fall of tower during natural calamities		√	√	√
Petroleum Products Pipeline (	Corrosion hole Leak of Petroleum Products Pipeline fire /explosion hazard	√	√	√	√
	10 % pipeline hole due to Defective Pipe and Welds leading to spillage of the containment , pool fire , flash fire , VCE		√	√	√
	Full bore Rupture of gas pipeline during excavation, abuse at encroachment, mechanical damage due to impact of vehicle accidents – pool fire ,flash fire , VCE		√	√	√
	Environmental damage from released petroleum products , fire incidents associated with a failure to control fire		√	√	√
	Unauthorized persons engaged in collecting the released petroleum products in fire incidence	√	√	√	√
Other	Escalating the designed event during MOCK drill		√	√	√
	Fire tender located at a distance of greater than 10 minutes.		√	√	√
	Obstruction in fire tender path at HPCL , MMPL pipeline mishap		√	√	√
	Reversing of the fire tender		√	√	√
	Organic contaminated water generated during firefighting entering in to storm water drain / water body		√	√	√

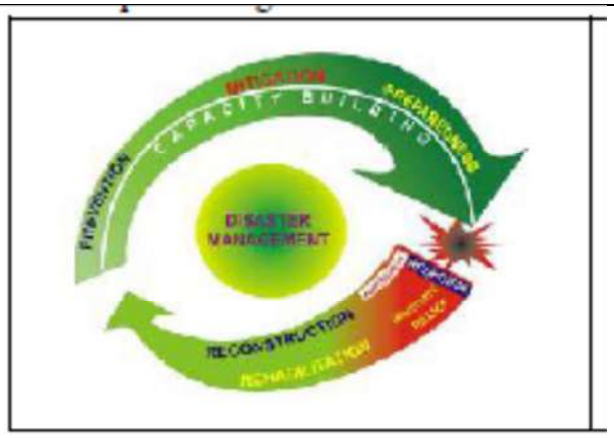
	Site surrounding specific hazards	Phase of the project			
Sr. no.	Hazard	Pre-Construction	Construction	Operation	Post Operation / Decommissioning
Other	Single access to the hospital in Phase I		√	√	√
	Emergency equipments /power cable failure		√	√	√
	Shortage of fire water supply		√	√	√
	Stampede during evacuation /at assembly point		√	√	√
	Spreading Rumors	√	√	√	√
	Overcrowding rescue boats		√	√	√
	Inadequate separation in neighboring installations		√	√	√

Phases	Capacities of DG sets
1	3 DG sets of 320 KVA each 2 DG sets of 500 KVA each 6 DG sets of 625 KVA each 1 DG set of 100 KVA 2 DG sets of 1000 KVA each 1 DG set of 600 KVA
2	1 DG set of 1000 KVA 2 DG sets of 400 KVA each 1 DG set of 600 KVA 1 DG set of 500 KVA 3 DG sets of 2500 KVA each
3	7 DG sets of 1010 KVA each 1 DG set of 400 KVA 2 DG set of 750 KVA each 1 DG set of 140 KVA 2 DG sets of 1250 KVA each 6 DG sets of 2000 KVA each 5 DG sets of 1500 KVA each
4	4 DG sets of 1000 kVA each 1 DG set of 400 KVA
5	2 DG sets of 600 KVA each 2 DG sets of 350 KVA each
6	1 DG set of 380 KVA 1 DG set of 750 KVA 1 DG set of 80 KVA 1 DG set of 400 KVA

PURPOSE OF THE PLAN

DISASTER MANAGEMENT

Disaster management means a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for;



- Prevention of danger or threat of any disaster.
- Mitigation or reduction of risk of any disaster or its severity or consequences.
- Capacity building.
- Preparedness to deal with any disaster.
- Prompt response to any threatening disaster situation or disaster.
- Assessing the severity or magnitude of effects of any disaster.
- Evacuation, rescue and relief.

DM plan is intended to provide guidance to all emergency respondents within the department with a general concept of potential emergency assignments before, during, and following emergency situations

SCOPE

This document is designed to cover the following with dovetailing information for linkage to DDMP:

- Emergency prevention;
- Emergency preparedness;
- Emergency mitigation;
- Activities for preparing for and prevention of emergencies such as training and maintenance;
- Overall control and coordination arrangements for emergency response.

AUTHORITIES, CODES, POLICIES

AUTHORITY

- Chief Site Controller.
- The District Disaster Management Authority under the chairmanship of the Collector/ District Magistrate/ Deputy Commissioner.
- The State Disaster Management Authority under the chairmanship of the state Chief minister.

CODE

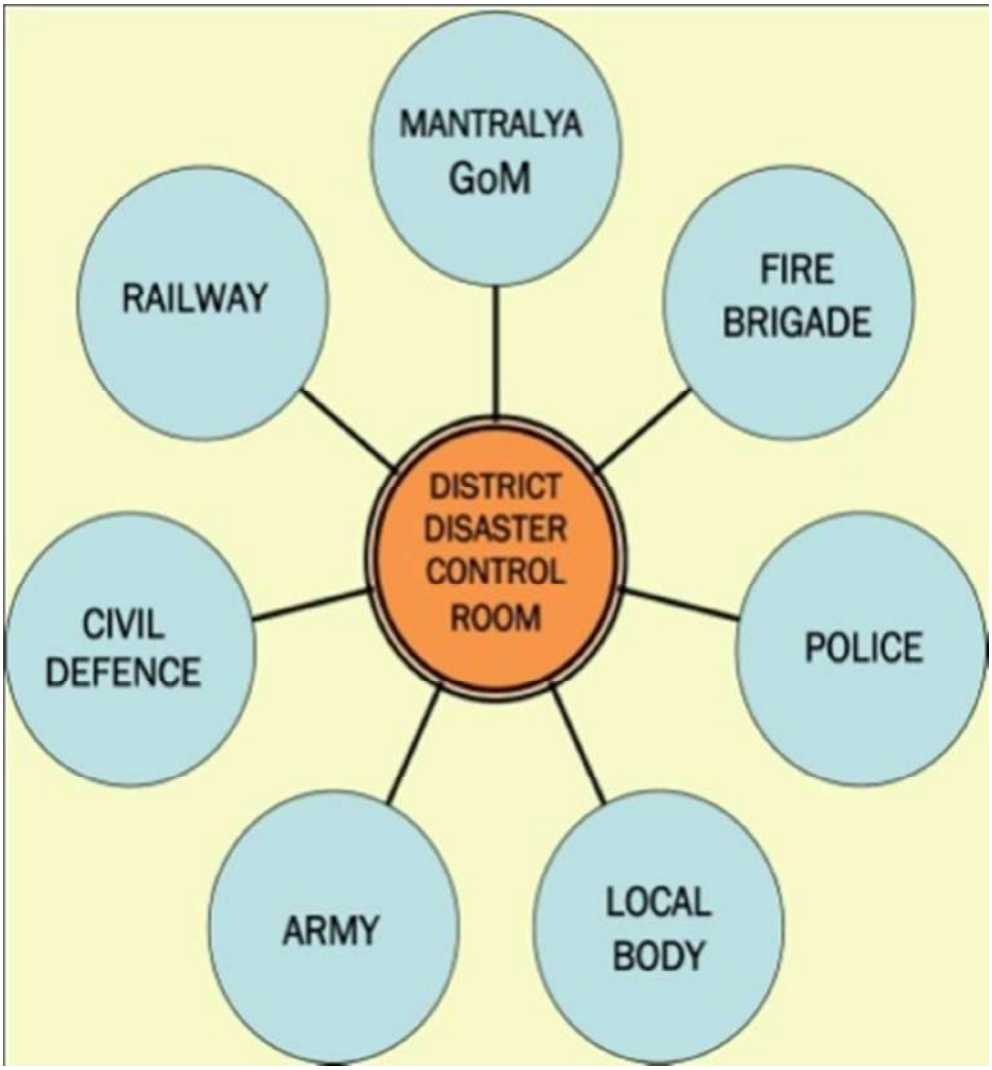
- National Building Code as amended.
- D. C. Rules.

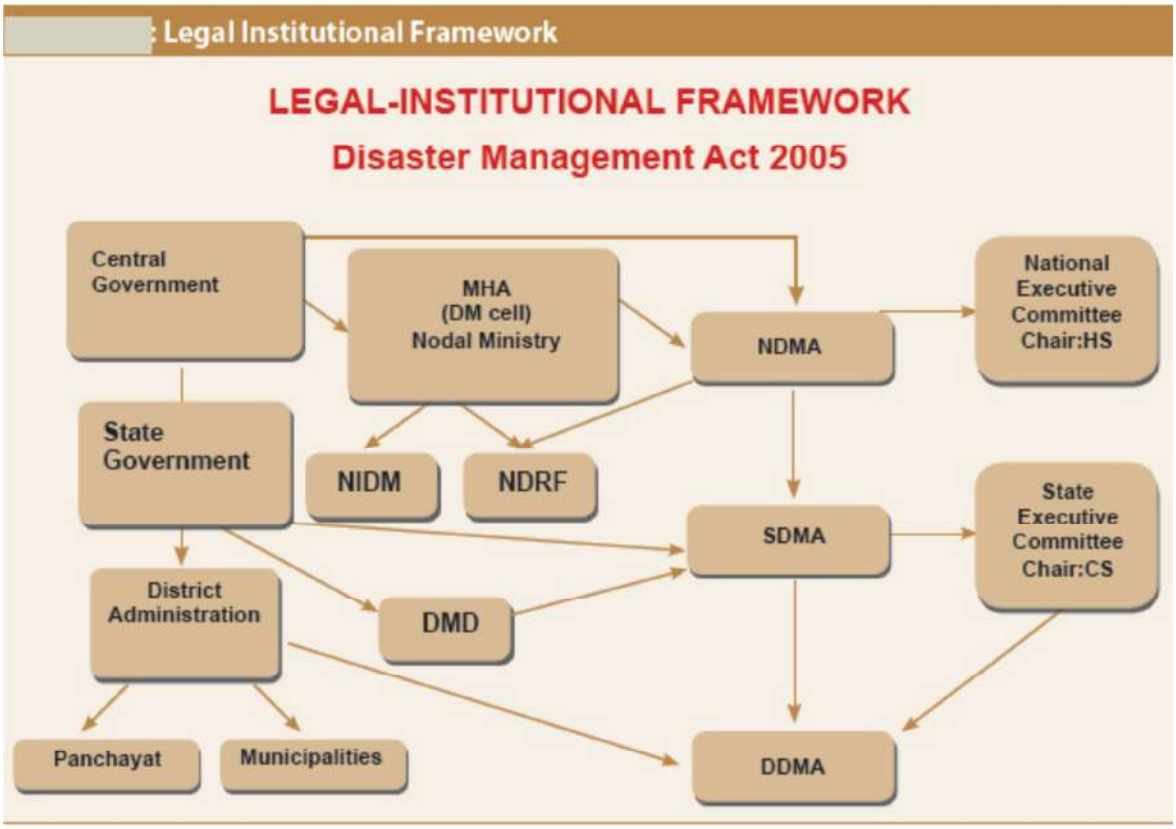
- D. P. Rules.

POLICIES

- Withdraw the staff in case of the human life is in peril.
- Any equipment including PPE deployed in the rescue is inspected and replaced as required on the advice of the supplier. No access to the roof can be made in the interim unless an alternative system or kit is used.
- To insure all our rights and obligations under the relevant insurance policy and all losses are claimed
- The entire family would evacuate together as a unit. However, to avoid stampede, confusion and in cases of inadequate transport or limited time, emergency evacuation would be undertaken in the following order - Seriously injured & sick, Children, women & physically challenged, Old and able-bodies.
- In case of fire make sure that all elevators serving the fire floor are recalled to the lobby level (unless the fire is occurring in the lobby) and taken out of service.

INSTITUTIONAL ARRANGEMENTS FOR DISASTER





PLAN MANAGEMENT

TABLE 6.1: DISASTER MANAGEMENT

ACTIVITY	RESPONSIBILITY ON	FREQUENCY
Development & approval.	Project Proponent.	At project proposal stage.
Maintaining.	Fire Department.	Maintaining copies at concerned Dept.
Revision.	Fire Department.	Two years.
Updating.	Fire Department.	By creating – Live page.
Implementation.	Fire Department.	Need bases.
Review.	Fire Department.	Review of SOP, check list yearly.
Rehearsal/ Drill.	Fire Department.	As per following table.

TABLE 6.2: DMP REHEARSAL/ MOCK DRILL SCHEDULE.

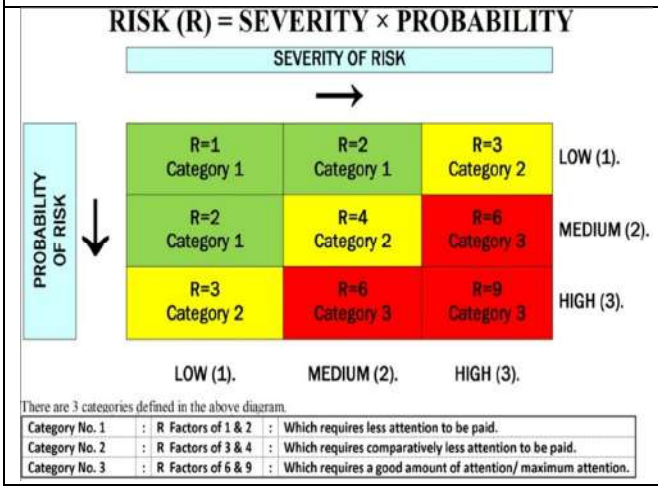
Sr. No.	Activity	Frequency	Remarks
1	Fire Evacuation Exercise.	Annually.	Planned or false alarm.
2	Mock Drill ▪ Construction Phase ▪ Operation Phase	 Quarterly Annually.	Table-top run through with testing Overall Plan Mobilization of Emergency Control Room, Evacuation.
3	Spill.	Annually.	Use of spill kit Practical demo.
4	Flammable Gas release.	Annually.	Awareness program.
5	Overall plan.	Annually.	Table top.
6	Fire Extinguisher.	Half Yearly.	Practical demo.
7	Fall & Rescue.	Half Yearly.	Ground & roof.
8	Fire Drill.	Quarterly.	Hydrant system preparedness.

SECTION 2: RISK ASSESSMENT & VULNERABILITY ANALYSIS

HISTORY

The past data includes Killari earthquake (6.4 on Richter scale) on September 1993, Bhuj Earth quake in January 2001; **The study results by IIT-B revels presence of active fault line in Panvel around 40 km from Mumbai** . The study also found that in 1618 , close to 20000 people lost their lives after an earthquake struck Mumbai which at the time had a population of 2 lakh. Flood due to heavy rain on 26th and 27th July 2005 (Santacruz had recorded a 944 mm of rain for 24 hours ended at 8.30 hrs on 27th July 2005. Makran earthquake on 27th November 1945 resulted estimated wave height of 2 m at Mumbai. There are number of fire, Explosion instances of involving LPG gas cylinders in buildings e.g. fire on 12th floor of the Mont Blank building at Kemps corner on 13th in December 2013. Even there are instances of fire and explosion during rescue operation while removing debris by earth moving machinery damaging trapped gas cylinders. However, in the present case the Project proponent maintained high standard of safety record in the past.

RISK MATRIX



Risk is a concept which describes a potential set of consequences that may arise from a given set of circumstances. In the context of emergency management, risks are generated when hazards interact with communities. The expression Risk is the combination of probability and consequence severity.

HAZARD IDENTIFICATION AND RISK ASSESSMENT

TABLE 6.3: HAZARD IDENTIFICATION AND RISK ASSESSMENT

Sr. No.	Hazardous Event	Demolition Phase			Construction Phase			Operation Phase		
		P	S	R	P	S	R	P	S	R
1.	Fall of Structure.	3	2	6	2	2	4	1	2	2
2.	Trapped in Lift.	NA	NA	NA	NA	NA	NA	1	2	2
3.	Fire/ Explosion.	1	1	2	1	2	2	2	3	6
4.	Bomb Threat.	NA	NA	NA	1	2	2	2	3	6
5.	Flooding.	NA	NA	NA	NA	NA	NA	NA	NA	NA
6.	Cyclone.	1	1	1	1	2	2	2	3	6
7.	Earthquake.*	2	1	2	2	2	4	2	3	6*

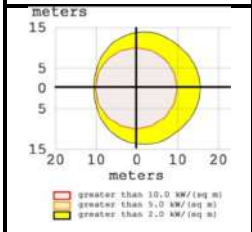
Note 1: *Earth quake may lead to fires and combined risk of the earth quake during operation phase event should be considered as highest.
Note 2: NA = Not anticipated and not considered as credible event.

VULNERABLE ZONES

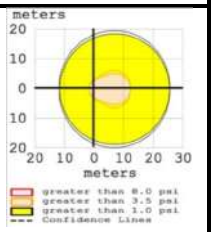
FIRE AND EXPLOSION

FIGURE: FIRE & EXPLOSION LPG CYLINDER – VULNERABLE ZONE.

JET FIRE



EXPLOSION



SR. NO.	ACCIDENT SCENARIO	DOWNWIND AFFECT DISTANCE (m)							
		FLAMMABLE VAPOR CLOUD (LEL)		BLAST OVER PRESSURE (psi)			THERMAL RADIATION (KW/m²)		
		60 %	10 %	8	3.5	1.0	10	5	2
1.	Diesel Pool Fire.	-	-	-	-	-	11	12	13.5
2.	LPG Gas Piping Jet Fire.	<10	19	-	-	-	<10	<10	<10
3.	LPG Cylinder Release & Jet Fire.	14	45	-	-	-	<10	<10	<10
4.	LPG Cylinder Explosion.	-	-	NA.	12	26	-	-	-

TABLE 6.4: EFFECT OF BLAST PRESSURE WAVE.

OVER PRESSURE (psi)	EFFECTS	
8	Red:	Destruction of buildings.
3.5	Orange:	Serious injury likely.
1	Yellow:	Shatters glass.

TABLE 6.5: EFFECT OF THERMAL RADIATION.

RADIATION (KW/M^2)	EFFECTS	
10	Red:	Potentially lethal within 60 sec).
5	Orange:	2^{nd} degree burns within 60 sec).
2	Yellow:	Pain within 60 sec.

SMOKE

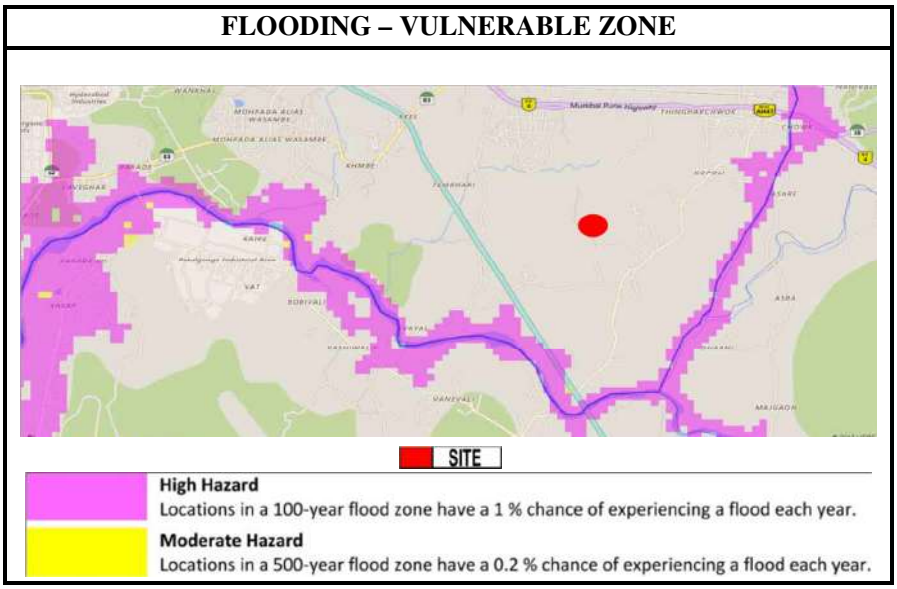
In the early stages, smoke from the fire will quickly rise into the roof space. The smoke can spread laterally at a velocity of up to 5 m/s. An average person will walk at 1 to 2 m/s and run at 7.5 m/s. Once the building roof space is full, the smoke will start to build down. The rate at which this occurs varies significantly with the nature of the combustibles and building geometry. Although the smoke is made up mainly of entrained air, it can contain sufficient toxic substances and asphyxiates to disorientate and disable within seconds and kill within minutes.

Most fire-related deaths are due to inhalation of toxic gases in smoke, not to fire or heat it. Carbon monoxide (CO) is thought to be the most common cause of fire-related death. Because of its high affinity for hemoglobin, relatively small concentrations of CO can saturate the blood, form carboxyhemoglobin (COHb), and deprive tissues of oxygenation. In general, COHb smoke can also impede escape from fire, and thereby increase risk of death, by obscuring vision as a result of eye irritation and lacrimation, by impairing mobility, or by impairing mental acuity.

The simplest burning scenario is one in which a moderate fire begins on the furniture and does not spread preciably. If the fire size is 100 KW. i.e., about 0.6 m in diameter, it can be shown that the hot smoke will have filled the room to a depth of 1 m from the floor in about 6 min; the temperature of the hot layer will have reached 100ºC after 11 min. Hence, by the temperature criterion mentioned above, the environment will have become lethal in 11 min.

FLOODING

FLOODING – VULNERABLE ZONE

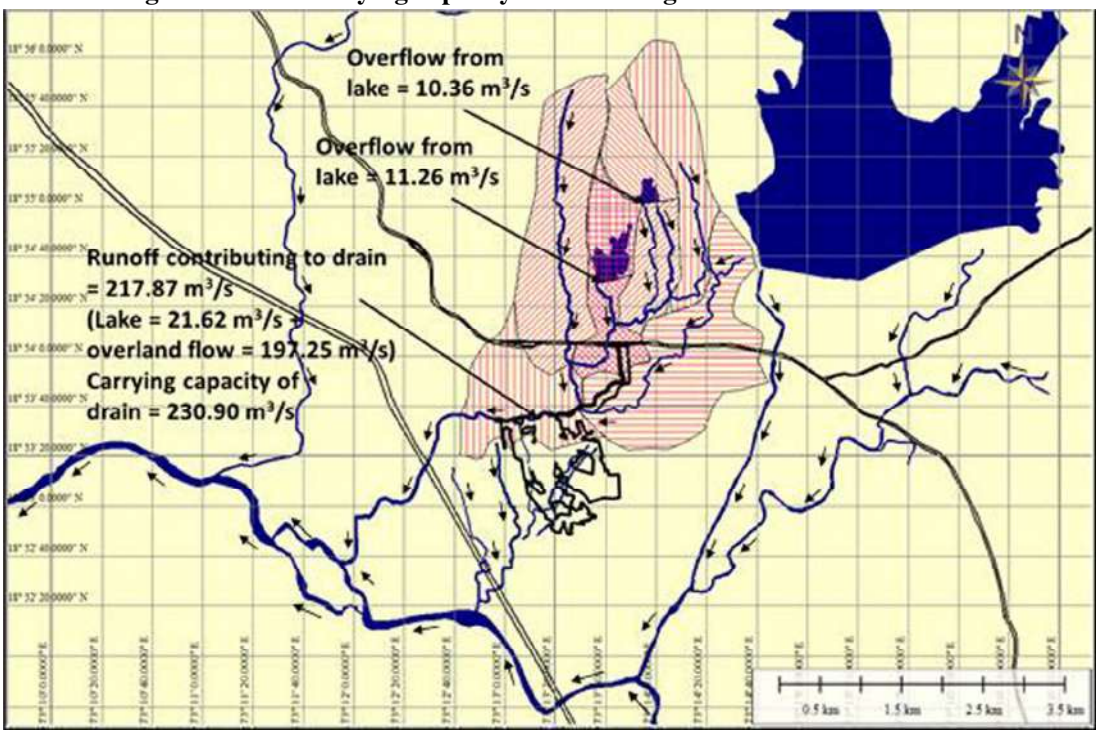


CAUSES

- **Heavy rain fall**
- **Lake break**

Storm water disposal system
Existing status

Contributing runoff and Carrying capacity of an existing drain



Risk mitigation

Storm water disposal system (Proposed)

Summary of runoff and drain carrying capacity

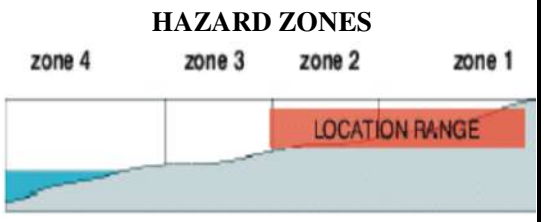
Details	M3/sec
Run off before development from plot	13.29
Run off after development from plot	26.58
Runoff from pond adjacent to the plot contributing to plot drain	1.06
Peak run off from catchment area outside plot contributing to plot drain .	0.64
Total run off from plot	28.28
Run off contributing to major drain	218.87

Details	M3/sec
Carrying capacity of internal drain	29.61
Carrying capacity of external drain including major drain	255.12

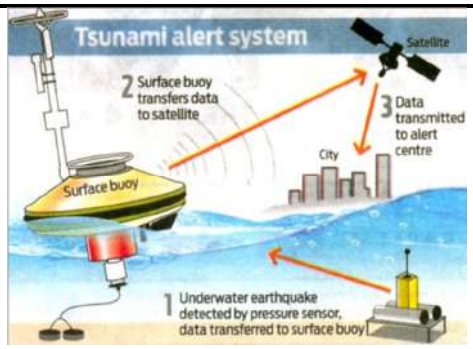
Drain sizes has been worked considering the rainfall intensity of 100 mm /hr , carrying capacity of the major drain has been computed and found to be adequate to carry the runoff contributing from plot and adjurning areas.

(Source: report by Enviro –con Urban Hydro-Environment Centre (EU-HEC) , February 2017 .

TSUNAMI



TSUNAMI FLOODING - VULNERABLE ZONE



TSUNAMI EARLY WARNING SYSTEM

Hazard Zone	1	2	3	4
Maximum Water Depth	0 to 3 m	3 to 6 m	6 to 9 m	>9 m

TABLE 6.6: MULTI HAZARD DATA FOR WEST COAST OF INDIA-MAHARASHTRA

Seismic Zone	Design Cyclonic Wind UT [IS:875 (III)] m/sec	Probable Maximum Storm Surge Heights (m)	Astronomical High Tide above Mean Sea Level (m)	Flood Proneness

IV & III	44 & 39	2.9-4.2	1.9	-

Tsunami velocity is dependent on the depth of water through which it travels, and is equal to the square root of depth times the gravitational acceleration. Tsunami Waves travel at a speed of approximately 700 km/ hr in 4000 m of water. In 10 m of water the velocity drops to about 36 km/hr.

HT Power transmission power line

- MSEB High tension line
- Tata hydro High tension line

VULNERABLE ZONE

Electric Arc flash boundary

When an arc flash hazard exists an approach limit at a distance from a prospective arch source within which a person could receive a second degree burn if an electrical arch flash were to occur .(note : a second degree burn is possible by an exposure of unprotected skin to an electric arc flash above the incident energy level of 5 J / cm2 (source : NFPA 70 E)

IMPACT

- Irreversible : trauma death
- Permanent : skeletal damage , blindness , hearing loss , third degree burns
- Reversible : minor laceration , burns , hearing damage

RISK MITIGATION

- Construction near overhead power lines (no passage)
- Ground level barriers parallel to the overhead power transmission lines at least 6 m away
- Construction near overhead power lines (passage)
- A defined passage way Approx 10 m wide in the barriers
- The surface of the passage way must be level to minimize the bouncing of the crane jibs of ' Goal posts 'Constructed from rigid insulating materials and distinctively marked shall be erected at each end of the passage way .
- Warning signs stating the cross bar clearance height shall be placed on both Goal posts .

BOMB THREAT

Bomb Threat Evacuation Guide

THREAT	DESCRIPTION	EXPLOSIVE QTY	MIN[1] (m)	MAX[2] (m)
	Pipe Bomb Small	100g	80	575
	Pipe Bomb Medium	500g	100	860
	Pipe Bomb Large	2.5kg	130	1,135
	Briefcase/Suitcase	23kg	185	1,520
	Compact Sedan	230kg	270	1,915

VULNERABLE ZONE FOR BOMB BLAST

Note: The distance estimates are indicative and for initial evacuation.

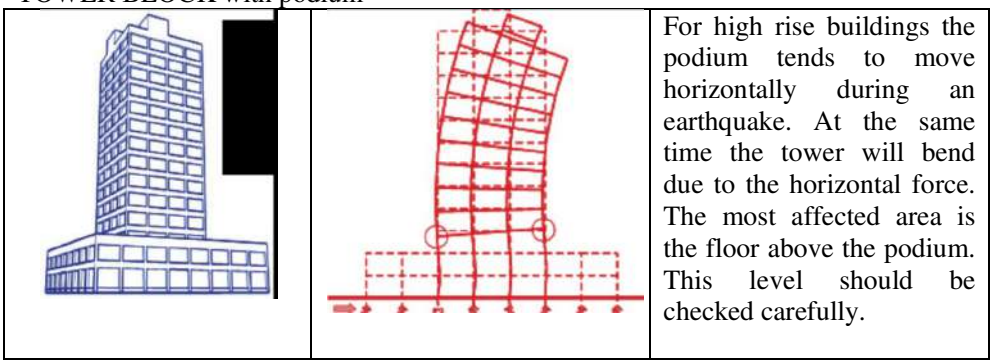
EARTHQUAKE

i) Thane city falls in seismic zone III which is Moderate Damage Risk Zone (MSK Vll). The major earthquakes that have occurred in this region in the last 400 years are given below.

Year	1594	1618	1678	1832	1854	1877
Intensity (MMI)	IV	IX	IV	VI	IV	IV

Year	1906	1926	1933	1951	1963	1966
Intensity (MMI)	VI	V	V	VIII	IV	V

ii) TOWER BLOCK with podium



For high rise buildings the podium tends to move horizontally during an earthquake. At the same time the tower will bend due to the horizontal force. The most affected area is the floor above the podium. This level should be checked carefully.

FIGURE: EARTH QUAKE EFFECT ON HIGH RISE BUILDING.

iii) In Zone III, (moderate risk zone) earthquakes of higher intensity may be felt. Earthquakes that frightens everyone, making it difficult for people to stand. Even people in moving vehicles may feel such quakes. Structures/buildings of good design and construction suffer slight damage, while poorly designed/ built ones suffer considerable damages. (*Intensity: VII).* Intensity is here considered a classification of the severity of the ground shaking on the basis of observed effects in a limited area and is measured in the MSK Scale ranging from I to XII

CLASSIFICATION OF EMERGENCY/ DISASTER

TABLE 6.7: DISASTER CATEGORY.

SN.	INCIDENCE	VULNERABILITY						CATEGORY/ LEVEL OF EMERGENCY
		Personnel			Property			
		Before Emergency	During Emergency	After Emergency	Before Emergency	During Emergency	After Emergency	
1.	Fall of structure.	Low.	High.	Moderate.	Low.	High.	Low.	1
2.	Trapped in lift.	Low.	Moderate.	Moderate.	Low.	Low.	Low.	1
3.	Fire/ Explosion.	Low.	High.	Moderate.	Low.	High.	Low.	3
4.	Bomb threat.	Low.	High.	Moderate.	Low.	High.	Low.	3
5.	Flooding.	Low.	Low.	Low.	Low.	Low.	Low.	1
6.	Cyclone.	Low.	High.	Low.	Low.	High.	Low.	3
7.	Earthquake.*	Low.	High.	Moderate.	Low.	High.	Moderate.	3

Where

Category 1:	Events can be controlled by Fire/ Security department with local resources.
Category 2:	Events action plan requires additional help from local fire brigade and evacuation.
Category 3:	Events action plan requires mobilization of external agencies, resources and evacuation.

MCA/ WORST POSSIBLE SCENARIO

The major concern of the assessment is to identify the activities falling in a matrix of high & low frequencies at which the failures occur and the degree of its impact. The high frequency, low impact activities can be managed by regular maintenance *i.e.* LDAR (Leak detection and repair) programmes. Whereas, the low frequency, high impact activities (accidents) are of major concern in terms of risk assessment. As the frequency is low, often the required precautions are not realized or maintained. However, the risk assessment identifies the areas of major concerns, which require additional preventive measures; likely consequence distances considering domino effects, which will give the possible casualties and ecological loss in case of accidents.

This risk assessment exercise for the site under consideration establishes the significance of impacts first and proceeds to delineate the associated mitigation measures. So the significance here reflects the "worst-case scenario" before mitigation is applied, and therefore provides an understanding of what may happen if mitigation fails or is not as effective as predicted.

VULNERABLE ZONE AND IMPACT

SN.	SCENARIO	VULNERABLE ZONE	IMPACT
1	Fire of combustibles LPG /PNG /AC /Fridge /vehicles fuel at the building.	Flammable vapour cloud of 60 % of lower flammability level likely up to 14 m radius from the location. Thermal radiations 11 m	Exposure to Thermal radiations burn injury, fatality likely within the vulnerable zone.
2	DG set Diesel release followed by fire/ explosion.	Dow Radius of exposure 4.7 m (proper spill control strategy considered). Thermal radiations 11 m.	Direct impact on the exposed persons in terms of Thermal radiations, burn injury and fatality within the vulnerable zone. Property Damage factor 11% within The 4.7 m radius
3	Cyclone	All structures	Direct impact in terms of Injury, fatality, loss of property and long term local and wide spread impacts on the residents.
4	Earth quake	All structures	Direct impact in terms of Injury, fatality, loss of property and long term local and wide spread impacts on the residents.

SN.	SCENARIO	VULNERABLE ZONE	IMPACT
5	Stampede during evacuation as a result of fire/explosion, bomb threat, and natural hazards like flood, cyclone and earthquake.	Stampede at staircase at School while evacuation.	Direct impact on occupants in terms of Injuries, trauma and fatality likely during evacuation. Long term trauma on the residents.
6	Full bore Rupture of gas pipeline during excavation, abuse at encroachment - flash fire , VCE	1% fatality incident radiation probit) up to 17 m away from the Natural gas pipe line	The largest fetal hazard posed by the natural gas pipeline is a torch fire following a rupture. A full rupture of the line and subsequent ignition will create a radiant impact (defined by 1% incident radiation probit) up to 17 m away from the Natural gas pipe line beyond that thermal radiation injuries are likely
7	Full bore Rupture of petroleum products transfer pipeline during excavation, abuse at encroachment - flash fire , VCE	1% fatality incident radiation probit) up to away from the petroleum products transfer pipeline	The largest fetal hazard posed by the natural gas pipeline is flash fire and pool fire following a rupture . A full rupture of the line and subsequent ignition will create a radiant impact (defined by 1% incident radiation probit) up to m away from the petroleum products transfer pipeline beyond that thermal radiation injuries are likely
8	HT Power transmission power line failure, tower collapse/ snapped power line.	Arc flashes can do kill at distance of 3 m from blast	Irreversible : trauma death Permanent : skeletal damage , blindness , hearing loss , third degree burns Reversible : minor laceration, burns , hearing damage

SECTION 3: PREVENTIVE MEASURES

SAFETY INSPECTION

Regular inspection of equipment and systems mandated by Chief Fire Officer in the NOC granted.

APPROVED PLAN

i) Scrupulous adherence to approved plan of building.
ii) Protection of system put in place to handle disaster.

MAINTENANCE OF EQUIPMENT AND SYSTEMS

Preventive maintenance of following systems

- Fire hydrant system.
- Sprinkler system.
- Detectors calibration.
- CCTV system.
- Emergency power system.
- Rescue equipments.
- Emergency communication systems.

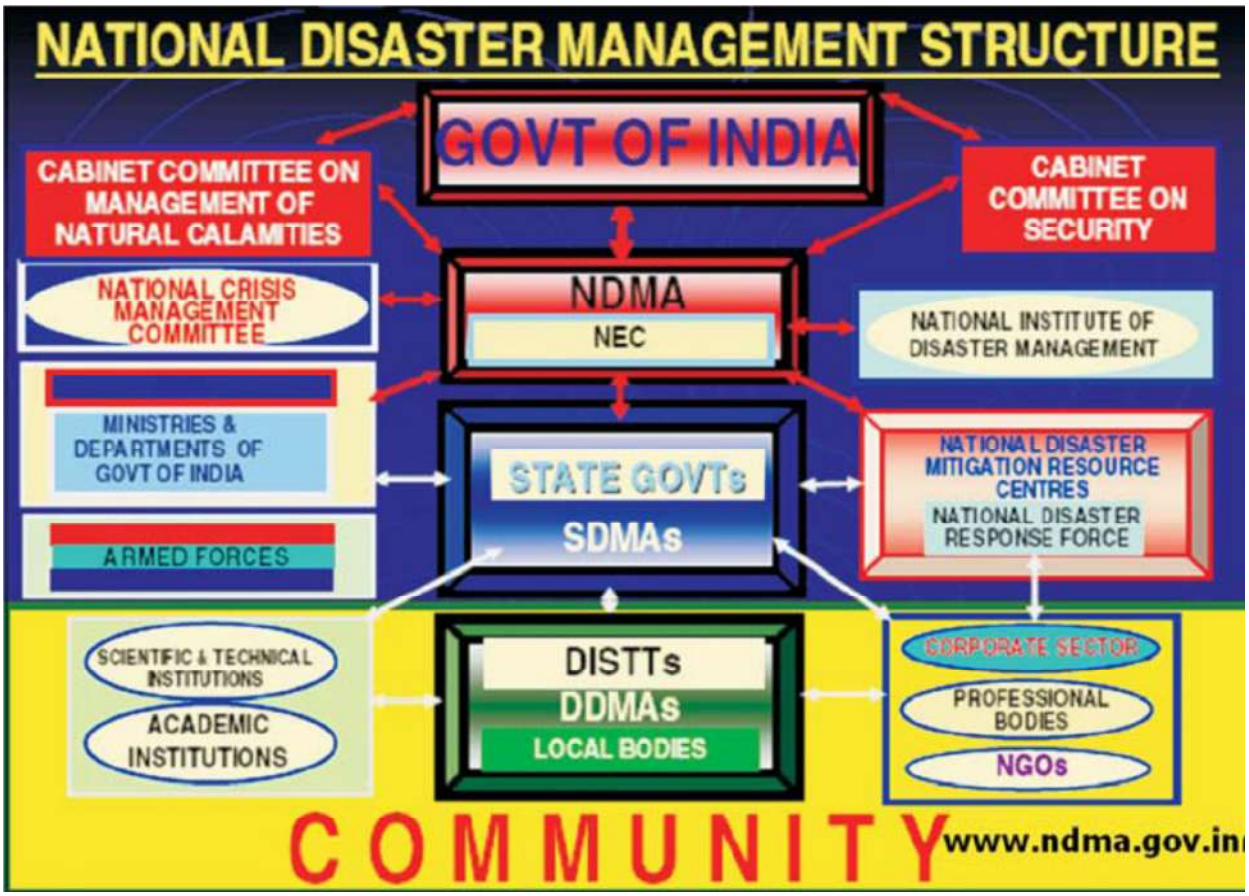
PRECAUTIONS AND PREPAREDNESS DURING CONSTRUCTION PHASE

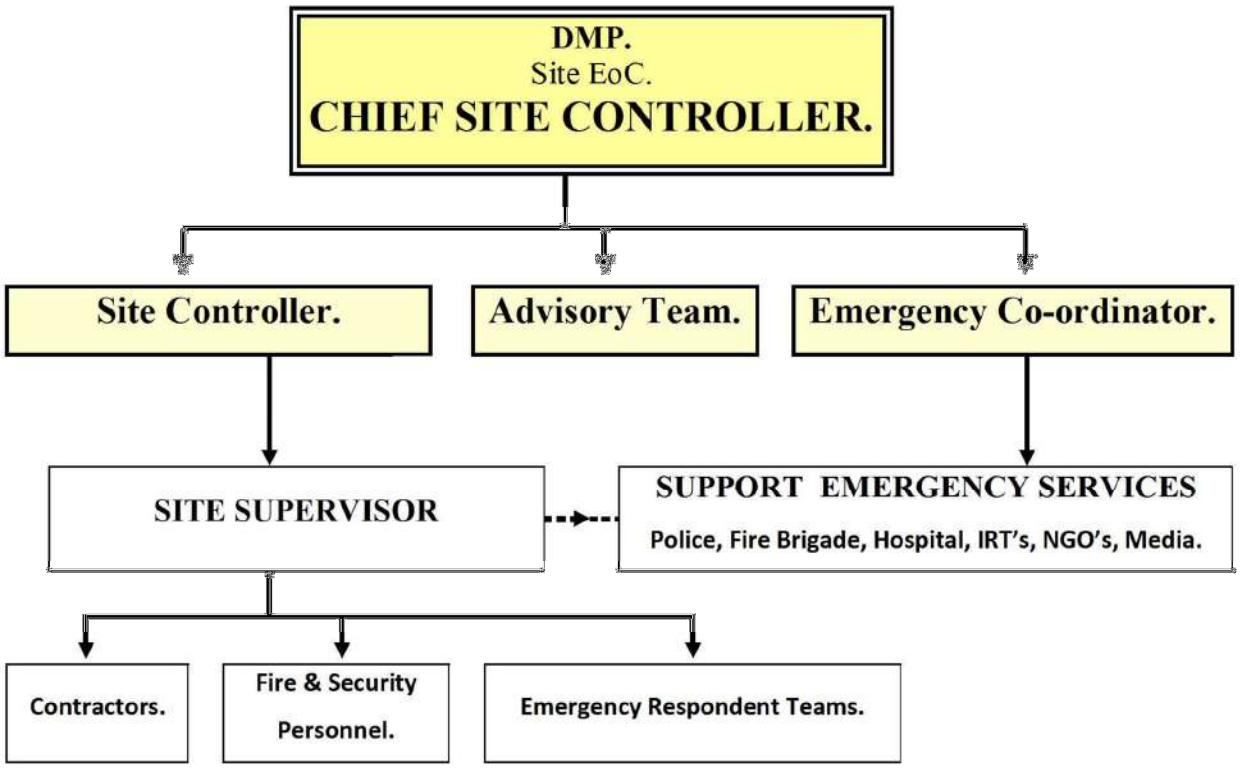
- Environment, Health & Safety Policy communication to all the employees & workmen through display boards, Posters, EHS Meetings & Pep Talk & etc.
- Appointment of OHSAS certified contactor
- Implementation of OHSAS 18001 during Construction work

Safety poster	**Railings**	**Safety nets**	**PPE**

- Observe “No Smoking" rule
- Periodical maintenance of safety construction machinery ,equipments by certified, competent person at regular intervals.
- Work Permit Systems.
- Use of Proper PPE's like Helmet, Goggles, boot & hand gloves etc
- Use of safety nets while working from heights, use of life line
- Safety trainings/ safety checks/ and use of PPE
- Storm water drain channel of adequate capacity
- Earthquake Resistant structure
- Maintaining obstruction free walkways and doorways
- Proper storage and handling of any potentially hazardous chemicals, gases.
- Educating / Training of all concerned on adoption of safe practices at construction site.
- Documentation, investigation of every dangerous occurrence and required notifications and reports to the appropriate authorities.

SECTION 4: HIERARCHY OF PLANS





SECTION 5: MITIGATION & PREPAREDNESS

RISK MITIGATION MEASURES

1 DMP (Operating Manual)

Incidents such as Fire/ Explosion, Flooding, Cyclone, Bomb Threat, Earthquake; either single or in combination are having potential for serious consequences/ disaster. In conclusion the incidence of "Earth Quake & Evacuation" the emergency level three incidence is considered as MCA/ Worst Possible Scenario. In view of these considerations this DMP operating manual is prepared. It details what measures are needed to decrease the likelihood of emergencies occurring and the associated impacts on people, installation and the environment. It also deals with measures that can reduce the impact of incidents.

2 Early warning system

Fire detection and alarm at fire Control room system, Automatic Smoke detector system especially at lift machine room & electric meter room, Auto water sprinkler with Thermal Detector. CO, LPG /PNG leak detector system. CCTV security system

3 Fire protection and fire fighting

Fire water Underground & Overhead storage tank, Fire hydrant system (fire water pumps diesel and electric, fire hydrants, wet risers, hoses), Portable Fire extinguishers CO2 , DCP , Foam , sand buckets type , Automatic Water sprinkler system, Emergency power DG set ,Mechanical Ventilation system, Two hrs. Fire Resistant Doors, Fire lift, pressurized Fire chute.

4 Emergency communication

Ensure effective emergency communication during evacuation to avoid panic and stampede. Siren / bell with clearly defined emergency alarm code for fire, evacuation and all clear. Intercoms & Cell phones , Two way radio, Hand held loud speaker, Efficient Public address system for entire building with standard Building management system. Voice evacuation system will be additional advantage.

5 Signages

Signs at lift landings, Floor numbering signs, Stair and elevator identification signs, Stair reentry signs, Floor layout plans, Escape route near each change of direction in the route, Assembly point, Emergency Control Centre (ECC), First aid, Danger at electrical rooms, Exit signs at each exit door, escape route direction signs.

6 Search & Rescue Kit

Torch with battery, Whistles, Ropes-Nylon (800 m) ,Ladder ,Search light ,Two way radio , Manual Siren ,Metal Cutting set , Hand tools (Axe, shovel) , Portable Mega Phone. Barricade tape, Flags, First Aid Box, signages, Stretcher, Portable Gas Detector, Reflective jackets.

7 Personnel Protective Equipments (PPE)

Safety Helmet, Safety Goggles, Safety Shoes/ Boots, Masks, SCBA, Life jackets Full Body Harness

8 Flood

Dewatering pump Life jackets, Floats, Ring buoys, flood contour map.

9 Cyclone

Cyclone shelter

10 DMP Management

Copy of DMP at ECC, Fire Audit, Structural audit, Mock drill , fire drill, Periodic DMP awareness programs, Construction workers , utility operators , Watch & Ward ,fire & security personnel safety training , Tenement induction process, Mock drill , and Fire drill.

11 DMP Organization

DMP organization positions are defined for installation specific requirements such as building, school, hospital, hotel, Mall. Roles and responsibilities defined for each position.

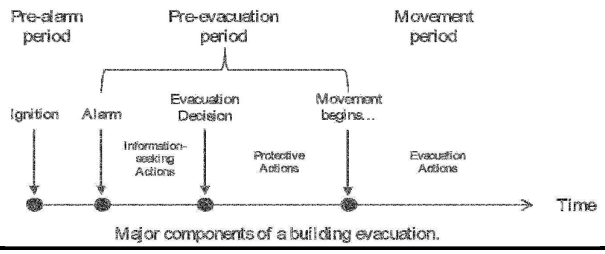
12 SOP's (Standard Operating Procedures)

SOP's are prepared for coordination of all emergency respondents and effective disaster management.

13 DMP cost

Provision/ budgetary support towards DMP Capital cost and per annum towards DMP O&M cost for the effective implementation.

14 Evacuation Time

 Major components of a building evacuation.	In order to reduce the evacuation time other than movement period following additional measures are suggested for effective and timely evacuation.

PRE ALARM PERIOD

- Automatic smoke detection at lift machine room & electric meter room.
- Round the clock trained & fire & safety , watch & ward staff

PRE EVACUATION PERIOD

- Periodic Safety Awareness programs.

MOVEMENT PERIOD

- Mock drill in consultation with fire brigade.
- Efficient PA System for entire building with standard Building management system.
- Voice evacuation system will be additional advantage.

PREPAREDNESS

1. WARNING SYSTEM

a) Nodal agencies for early warning of different natural hazards

Disasters	Agencies
Earthquakes	IMD, MERI
Floods	Meteorology Department, Irrigation Department Central Water Commission
Cyclones	IMD(Indian Meteorological Department)
Epidemics	Public Health Department
Road accidents	Police
Industrial & Chemical Accidents	Industry, Police
Fires	Fire Brigade, Police
Tsunami	Indian National Centre for Oceanic Information Services
Landslides	Geological Survey of India

b) Warning of fire or emergency received at fire &/ security department by fire call point, CCTV panel, by watch ward staff, leak detector, smoke detector, intercom in flats, mobile, bell in lifts, hooters at control room.

c) Two way communication to emergency respondents by walk, talky.

d) Warning to occupants by PAS/ hand held loudspeaker and Siren electrical/ hand operated located at strategic location and operated from at ECC by fire &/ security department.

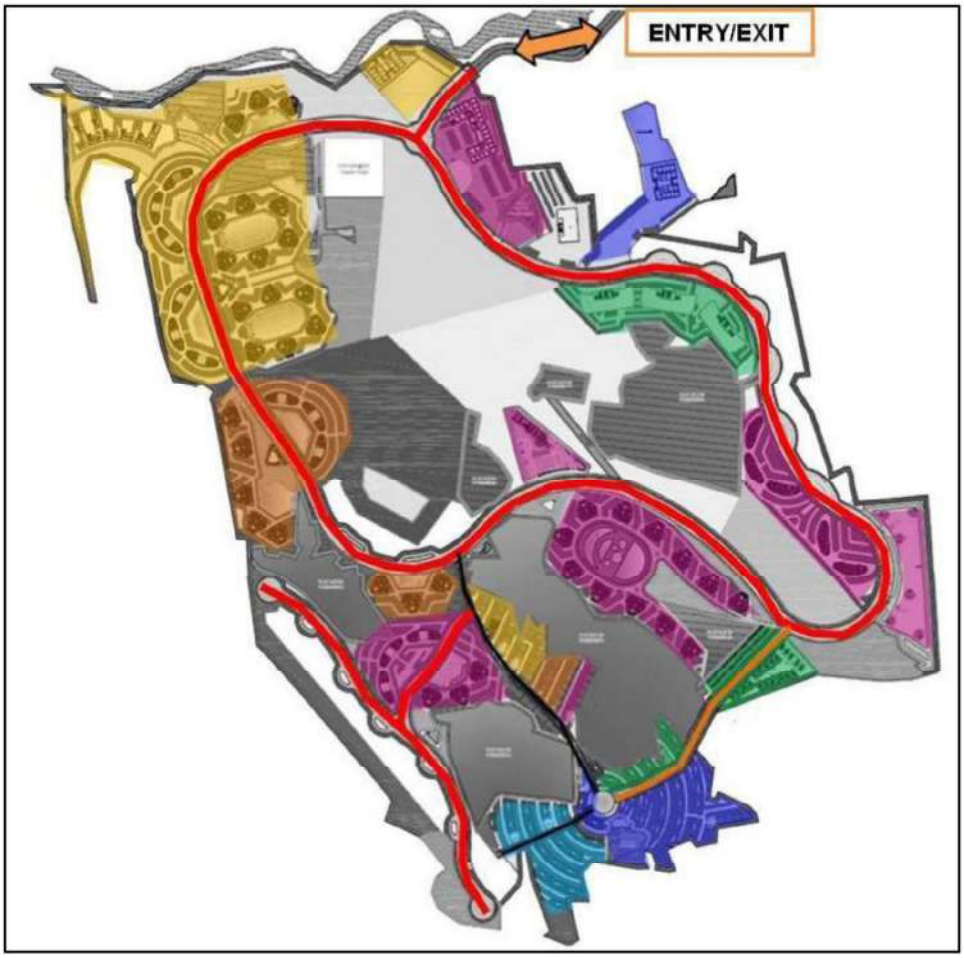
2. SIREN CODE

Emergency Level 1 & 2	:	**One continuous wailing sound of 30 seconds duration. Repeat after a minute.**
Emergency Level 3	:	**Three interrupted wailing sounds of 15 seconds duration each with a gap of 30 seconds. Repeat after a minute gap.**
All Clear	:	**Long whistle of one minute duration.**

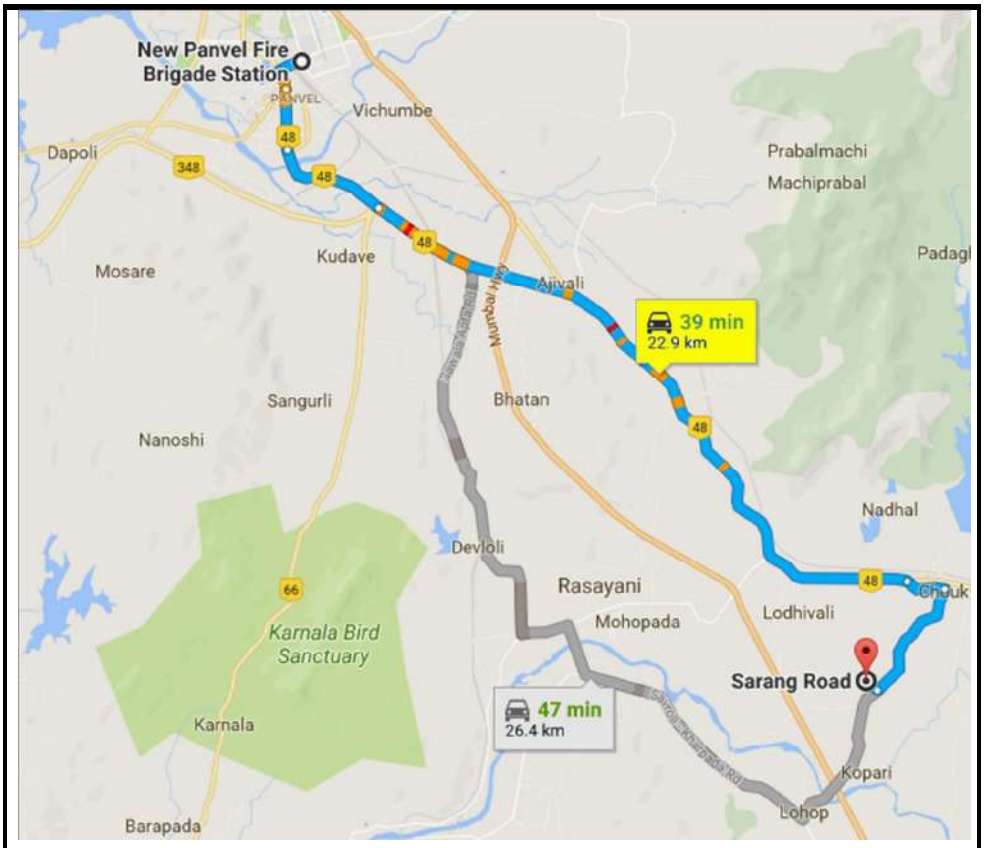
3. FIRE PROTECTION SYSTEM

Building wise Fire protection system shall be provided as per CFO NOC

4. EVACUATION ROUTE



5 FIRE STATION RESPONSE



Fire Station (Vijay Marg),
New Panvel. 022 - 2745 2337

6 EMERGENCY CONTROL CENTRE

EMERGENCY CONTROL CENTER/ ROOM		
Emergency	**CONSTRUCTION PHASE**	**OPERATION PHASE**
Level 1	Site Office.	Security office , reception
Level 2	Near Site Office.	Security office , reception
Level 3	Near Site Office.	Security /Society Office.

ECC equipped with following items;

- Copy of "DMP" and Technical Manuals on operating, maintenance procedures.
- Telephone (Internal and External).
- Networked Computer Systems, Note pads, pencil etc.
- Personal Protective Equipments (PPE). Safety helmets ,Safety shoes, Safety goggles, Reflective jackets, SCBA , Full Body Harness
- Public Address System (PAS).
- Control panels & layout drawing for CCTV, fire hydrant and water sprinkler, Fire Alarm, ventilation, electrical single line diagram.
- First aid box , stretcher Hand tools (Axe, shovel),Mega Phone, Manual siren ,Ring buoys, Explosive meter Search light/ torch, Spare Portable fire extinguishers

- Essential keys and access cards or the location details of the same.
- Television sets tuned to major news channels.
- Conference and Press Rooms and Video Conferencing Setup.
- Uninterruptible Power Supplies with Generators.
- Pantry, Dormitory and Toilet facilities.

7 LIFE SAVING MEASURES (FIRE SAFETY PLAN)

- Individual floor layouts
- Refuge floors and area
- Number and kind of exits
- Occupant load
- Evacuation diagram
- Assembly point
- Site surroundings map

8 INDIVIDUAL FLOOR LAYOUTS

Refer EIA report.

9 The Refuge Area equipped with following items;

- Copies of the DMP – Operating Manual
- First – Aid Kit.
- Communication equipment
- Requisite stationary items.
- Drinking water facility.

10. FIRE WATER

PHASES	FIRE FIGHTING WATER STORAGES	
	Underground Tank (KL)	Over Head Tank (KL)
1	2400	220
2	1700	140
3	3000	150
4	750	50
5	600	20
6	1000	80

11 ASSEMBLY POINT

ASSEMBLY POINT		
Emergency Level	**Construction Phase**	**Operation Phase**
Emergency Level 1	Site Office.	**Security office**
Emergency Level 2	Near Site Office.	Refuge floor
Emergency Level 3	Near Site Office.	Assembly point

12. PARKING STATEMENT

PHASE	Number Of Cars	Number Of TW	Number Of Bus	Number Of Cycles	Number Of Ambulance
Phase 1	5984	725	16	4338	3
Phase 2	2977	327	-	3126	-
Phase 3	7113	803	64	7852	2
Phase 4	4919	460	-	1819	-
Phase 5	521	63	-	2244	-

Phase 6	469	58	50	1390	
TOTAL	**21983**	**2436**	**130**	**20769**	**5**

13 EVACUATION TIME - BUILDING OCCUPANTS
(minimum practicable evacuation time during worst case scenario).

PHASES	OCCUPANCY
1	23851
2	12568
3	50456
4	26870
5	8160
6	13688
TOTAL	**1,35,593**

EVACUATION TIME											
TYPE OF BUILDING	**RESIDENTIAL**				**EWS RESIDENTIAL**						
Wing	A	A	B	B	A	B	C	D	E	F	G
Staircase width m											
Tenements	176	176	132	132	96	44	96	84	84	96	48
EVACUATION TIME by stair (minutes)	**13.5**	**13.5**	**9.58**	**9.58**	**6.8**	**<5**	**6.8**	**6.0**	**6.0**	**6.8**	**<5**

14 SITE SURROUNDINGS

- Note: Site surroundings map on back cover page.

DECONTAMINATION SUPPORT

- Sources of contamination such as accidental oil spills e.g. Diesel, transformer oil; paint brush washings during construction phase and floor washing collected during sprinkler operation are likely.
- The measures for handling decontamination include spill control kit for oils and Drench tank water for collection of contaminated water for checking before safe disposal.

SPECIAL POPULATION SUPPORT

Special consideration during evacuation required construction workers families at site during construction phase and differently abled persons during operational phase.

TRAINING & CAPACITY BUILDING

ORIENTATION EXERCISE: Involves bringing together the people who are involved in the emergency plan, or part of the emergency plan and orientate them to it. It can be useful in inducting new members to the Team, imparting awareness among persons having no previous experience of the plan, a new plan or new staff.

DRILLS: These test a single emergency response function and involve an actual field response. Drills are generally practiced or tested under realistic conditions.

TABLE – TOP EXERCISE: This is a means to undertake some problem solving and team building and familiarizes team members with what they might need to do as an emergency scenario unfolds. It is very useful in developing what ifs and responses.

FUNCTIONAL DRILL: This is used to assess the allocation of resources and manpower. It also

evaluates the communication between different groups and assesses the adequacy of current procedures and policies. The exercise is a simulation and while it covers the complete extent of the deployment of resources at the simulated level it does not go beyond the exercise room.

MOCK DRILL/ FULL SCALE EXERCISE: Evaluates the operational capability of the system in an interactive manner, allows for coordination of information, communication capabilities to be explored, inter-tenant and tenant landlord cooperation to be explored and for negotiation skills to be deployed. Full scale exercises will have a number of observers and invitation to the relevant government agency to attend. Observations will be recorded and actions will be implemented based on learning points that are discussed at the review session. Where necessary.

NOTE: REAL EMERGENCIES DURING EXERCISES
There is always the potential for a real emergency to arise during the conduct of a drill. This situation calls for an immediate cessation of the exercise/drill and Emergency respondents should stand by for further instructions 1.

SECTION 6: RESPONSE PLAN
DISASTER MANAGEMENT ORGANIZATION

DMP ORGANISATION			
Sr. No.	**Designation for DMP**	**Construction Phase**	**Housing Society Operation Phase**
		Designation /Agency /Group	Designation /Agency /Group
1	**Site Main Controller**	Project manager	Chairman of CHS
2	**Site Incident Controller**	**Site manager**	Secretary of CHS
3	**Emergency Coordinator**	EHS Manager	Manager CHS
4	**Supervisor**	Site Supervisor Contractor supervisor	Fire & Safety staff
5.1	**SAR Team**	Security guards ,First aiders , Fire fighters, staff & workmen, External IRTS	watch & ward personnel, Police, fire brigade; Agencies sent by district disaster control room such as Civil defense, NDRF, medical team, home guard etc.
5.2	**Engineering Team**	Electricians , operators	Pump operators Electricians
5.3	**Advisory Team**	Architect , Consultants	Active past committee members
6	**All others at site**	Contractors, Staff, Workers, Visitors, Drivers, construction workers colony	Residents Occupants Visitors

DMP ORGANISATION HOSPITAL		SCHOOL	
Sr. No.	**Designation For DMP**	**Designation / Agency/ Group**	**Designation / Agency/ Group**
1	**Site main controller**	Principal ,Chairman / Trusty	Dean ,Chairman / Trusty
2	**Site incident controller**	Department Heads	RMO , Doctors
3	**Emergency coordinator**	Vice Principal, Administration Manager	Administration Manager
4	**Supervisor**	Teachers, Security Guards ,Staff	Nurses , Security Guards ,Staff
5.1	**SAR Team**	Teachers , Students , Parents , Scouts & Guides , Security , Watch And Ward , Office Staff Trained In Fire Fighting And First Aid , Electricians , Fire Brigade , NGO's	Nurses , ward boys ,patients relatives , Security , Watch And Ward , Office Staff Trained In Fire Fighting And First Aid , Electricians , Fire Brigade , NGO's, IRTs
5.2	**Engineering Team**	Electricians , operators	Pump operators Electricians
5.3	**Advisory Team**	Active past committee members	Senior doctors , Admin . managers, Specialists , experts .
6	**All others at site**	Residents Occupants Visitors	Visitors

ROLES AND RESPONSIBILITIES

Roles and responsibilities for all the emergency respondents are detailed in respective SOP's in Section 9 of this report.

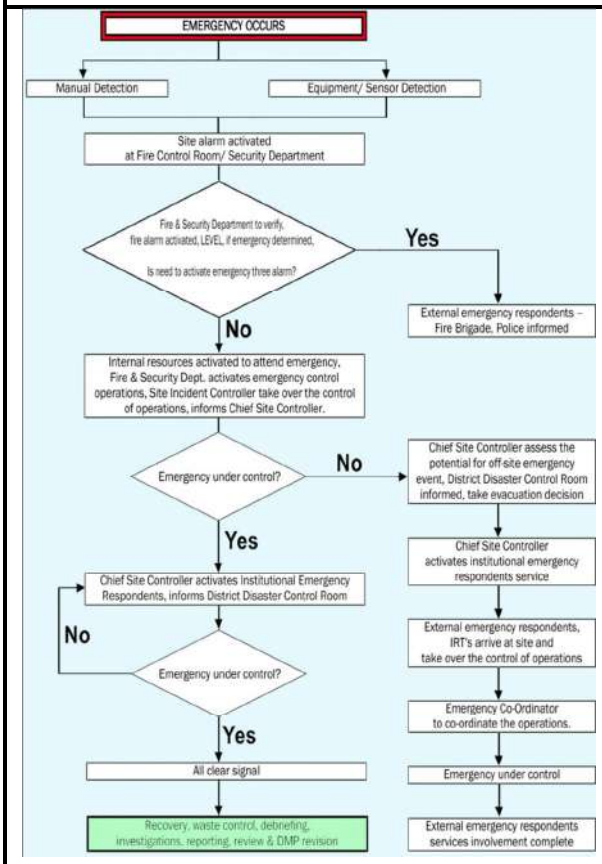
EMERGENCY RESPONSE GUIDE

TABLE 6.8: EMERGENCY RESPONSE GUIDE

Sr. No.	Emergency Respondent → / Hazards	Chief Site Controller	Site Incident Controller.	Emergency Co-Ordinator	Supervisor	Emergency Response Teams.	All Other Site Personnel.
1.	FALL OF STRUCTURE.	Task 3,8,16,17,20.	Task 1,2,4,13,14,15,19,21	Task 5,6,7,9,18.	Task 11.	Task 10.	Task 12.
2.	TRAPPED IN LIFT.	Task 3,8,16,17,20.	Task 1,2,19,21.	Task 7,18.	Task 11.	Task 10.	-
3.	FIRE/ EXPLOSION.	Task 3,8,16,17,20.	Task 1,2,4,13,14,15,19,21	Task 5,6,7,9,18.	Task 11.	Task 10.	Task 12.
4.	BOMB THREAT.	Task 3,8,16,17,20.	Task 1,2,4,13,14,15,19,21	Task 5,6,7,9,18.	Task 11.	Task 10.	Task 12.
5.	FLOODING.	Task 3,8,16,17,20.	Task 1,2,4,13,14,15,19,21	Task 5,6,7,9,18.	Task 11.	Task 10.	Task 12.
6.	CYCLONE.	Task 3,8,16,17,20.	Task 1,2,4,13,14,15,19,21	Task 5,6,7,9,18.	Task 11.	Task 10.	Task 12.
7.	EARTHQUAKE.*	Task 3,8,16,17,20.	Task 1,2,4,13,14,15,19,21	Task 5,6,7,9,18.	Task 11.	Task 10.	Task 12.

Where the numerical indicate task number detailed in the following table.

DMP FLOW CHART



S.N	Task
1	Raising the site emergency alarm.
2	Inform police, Fire brigade and Mobilizing site emergency services.
3	Determination of level of emergency, help from Advisory team, if required.
4	Mobilizing ECC and AP.
5	Mobilizing Emergency Respondent teams, IRT's, NGO's.
6	Mobilize resources for emergency response teams
7	Ensure Co -ordination between site emergency services.
8	Review situation , assess the emergency level , consult advisory team , take external help if required , inform district disaster control cell , and declare off site emergency.
9	Evacuation
10	Ensure operations as per SOP
11	Ensure proper coordination between all IRTs
12	Head count at assembly point
13	Feedback of head count to SAR
14	Ensure traffic , law & Order and crowd control
15	Withdraw the staff if the human life is in peril.
16	Ensure any conflict resolved at the earliest
17	Authorize release of information to the media
18	Release of authorized information to the media.

	19	Emergency under control , inform to CSC
	20	Authorize to raise 'All Clear ' alarm
	21	Raise 'All Clear ' alarm

RESCUE AND RELIEF OPERATION

The priority of the SAR will be to:

- Protect life;
- Maintain safety;
- Protect assets;
- Ensure security; and
- Maintain or return business continuity.

6RESPONSE ACTIVITIES SPECIFIC TO DISASTER

SOP's specific to disaster enclosed in Section 9 of this report.

REQUISITION OF SERVICES/ ASSISTANCE

Emergency coordinator to establish communication to district disaster control room for requisition of services/ assistance of IRTs /NGO's.

SECTION 7: RECOVERY

RECOVERY

- Deactivation of the ECC once the recovery operations are over as declared by chief site controller.
- Replenishment of used stocks of firefighting materials
- Follow up of injured at hospital.
- Record keeping
- Clean and rehabilitate the disaster site.
- Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.
- Contact insurers.
- Analyze the disaster and improve the plan in the light of experience.

MEDICAL

- Information and help desk at site.
- Informing the relatives of the injured.
- Follow up of injured at hospital, if any.

Damage assessment for insurance survey with following objectives.

- Reduce the loss in terms of assets if a disaster happens; and
- Reduce lost income in the event that the facility becomes unavailable or partly unavailable.

SECTION 8: FINANCIAL ARRANGEMENTS

Cost to be incurred during Construction Phase: Rs. 662.36 Lacs

Cost to be incurred during Operation Phase:

- Set Up cost: Rs. 4605.03 Lacs
- O & M cost: Rs. 138.15 lacs/annum

INVENTORY OF RESOURCES

Building wise inventory of DMP resources are detailed in the individual Building resources.

SOP NO. 1: FIRE/ EXPLOSION & EVACUATION

1	Proceed to ECC when informed of the disaster/ potential disastrous event at site.
2	On arrival at ECC the Chief Site Controller shall relieve the Site Incident Controller of responsibility of overall main control of the event.
3	In consultation with the Site Incident Controller and advisory team The Chief Site Controller will take stock of the situation like exact location, number of people and the area affected etc. decide on level of emergency, establish immediate priorities and Guide The Site Incident Controller and emrgency co-ordibnator accordingly.
4	Ensure that all the key persons are available on site/ performing the task.
5	Delegate any extra duty to relevant person depending upon the situation.
6	Ensure that adequate safety measures for responders and affected communities are in place all the time.
7	Ensure smooth working of all the emergency respondents and make sure that all conflicts (if any) are resolved.
8	Withdraw the staff in case of the human life is in peril.
9	Authorize release of information to the media.
10	Ensure financial support for the disaster control activities and relief materials.
11	Keep contact with District Disaster Control Room.
12	Get the de-warning from District Control Room and announce the same.
13	Give authorization for clearance signal to the Site Incident Controller and emergency coordinator when everything becomes normal.
14	Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.

1	On hearing of emergency alarm immediately proceed to site of incident (unless already present there) to take charge and give guidance over public address system.
2	Assume the additional responsibility of the Chief Site Controller till the arrival of the Chief Site Controller.
3	Assess the level of emergency and activate emergency services of Fire and security department, inform Fire Brigade, Police, Site Chief Controller and Site Emergency Coordinator.
4	Identify the areas likely to be affected by the emergency. Give information as required by the Fire Brigade and Police.
5	Direct out the fire fighting and evacuation operations.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especially in lifts and rooms.

7	Guide occupants on the steps being taken for evacuation in a systematic manner.
8	Account for all occupants at the assembly area and give head count, missing person's feedback to SAR team.
9	Guide the search and rescue team with geographic information and persons trapped.
10	Assist the law and order machinery.
11	Get the de-warning authorization from the Chief Site Controller and communicate the same to Security Head for giving all clear alarm.
12	Update the Record and documentation.
13	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency information Proceed to Emergency Control Centre.
2	Call Police, Fire Brigade and mobilizing site emergency services.
3	Give immediate assessment to the authority on damage, massive casualty etc.
4	Mobilizing resources required for emergency response teams working.
5	Call for participating in the emergency response and Coordinate between all emergency respondents such as various line departments, representatives of Govt. authorities/ IRT's/ NGO's and ULB's etc.
6	Release of authorized information to the media and take steps to reduce/ eliminate panic. Set up of help desk and Information centers to provide response information to the public, relatives of victims and media.
7	Assure occupants of continuous communication and take all measures to keep up their morale high.
8	Liaise with the law and order machinery.
9	Perform such other duties as assigned by Chief Site Controller.
10	Follow up of injured at hospital.
11	Mobilizing Emergency Respondent teams, IRT's, NGO's.
12	Communication with district disaster control cell and declaring off site emergency (if situation escalates).
13	Release of authorized information to the media.
14	Emergency under control report to Chief Site Controller.
15	Termination of emergency and 'All Clear Alarm'.
16	Analyze the disaster and improve the DMP in the light of experience.
17	Contact insurers.
18	Disseminate precautionary information on post disaster health hazards and remedies.
19	Replenish depleted resources such as firefighting materials, rescue materials.

20	Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.
21	Maintain the DMP resources.
22	Organize fire drill, safety audits, Mock drills and periodic training and DMP awareness program.

1	On receiving signal, information of the incident Security person to confirm and raise the site emergency alarm, Inform the Site Incident Controller.
2	On receiving emergency alert supervisor of the affected area to proceed to site (if not already at incident spot) as directed from ECC.
3	Supervisor of the non-affected area to keep attention to announcements and follow Emergency Co-Coordinator instructions.
4	Watch and ward & security persons carry out Traffic control, law and order situation and crowd control at Assembly point. Keep the fire tender routes free from obstruction.
5	Guide and assist to carry out firefighting operations.
6	Supervise and assist the search and rescue team for evacuation, search of the trapped persons and rescue of the same to assembly area.
7	Alert all occupants without further compromising life and assist those which are persons with special needs.
8	If people are buried under the debris, call for help of the rescue teams and render your help.
9	Assist in head count at assembly point and give feedback to Site Incident Controller.
10	Maintain an updated list of emergency telephone numbers at ECC.
11	Clean and rehabilitate the disaster site.
12	Perform such other duties as assigned by Chief Site Controller.
13	Ensure occupants do not attempt to re-enter the building until it is safe to do so.

1	On receiving emergency alert SAR team members to proceed to ECC, get equipped with required PPE and proceed to incident site or as directed from ECC.
2	Firefighting trained persons to Carry out Firefighting operations and try to put it out with help of people around you if safe to do so. On arrival of fire brigade; assist and provide required information.
3	Search for the trapped persons and rescue of the same to assembly area.

4	Provide first aid trained persons to provide first aid to injured where ever necessary and shift to first aid room for further action.
5	Carry out evacuation of the building as per directions from ECC. Ensure the safe evacuation of all occupants from the building.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especially in lifts and rooms.
7	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency alert proceed to respective work places or as directed from ECC.
2	Ensure uninterrupted water supply to fire hydrant system. (Water re-connection is a priority if affected in the incidence).
3	Restore power supply in case affected to emergency equipments (Loss of power will mean loss of fire systems if prolonged).
4	Ensure uninterrupted power supply to fire water pumps and emergency lighting.
5	Restore Power supply to emergency lighting.
6	Restore and maintain communication network such as PAS system, siren, phones, TV, radio systems.
7	Ensure adequate warning to Emergency Co-Coordinator before stopping power to lifts; bring the lifts to safe position.
8	Attend Lift failures.
9	Ensure working of drainage, de watering pumps.
10	Assist the search and rescue team in case of any metal cutting operation, vehicle failures etc.
11	Perform such other duties as assigned by Chief Site Controller.

1	When informed of the disaster/ potential disastrous event at site, proceed to ECC or keep available for communication.
2	Assess the relevant data received at ECC.
3	Assist the Chief Site Controller in decision making process.
4	Collect relevant information and Take stock of situation time to time and advise the Site Chief Controller.
5	Give feedback on revision of the DMP in view of the lessons learnt from the incident.

1	In Case of noticing Fire:	
	a)	Raise the raise break glass fire alert.
	b)	Dial '(101 fire brigade emergency number)'and inform fire/ security department location and incidence.
	c)	Raise verbal fire alarm to activate other persons in the area.
2	Contain the fire by closing windows and doors to minimize the danger of the fire and smoke spreading.	
3	Extinguish the fire if; you have been trained in the use of a fire extinguisher, it is safe to do so or you have someone in support.	
4	Remove or help to Rescue occupants from the area of immediate danger. To refuge area and follow further instructions from ECC regarding evacuation.	
5	On receiving emergency evacuation proceed to Assembly point.	
6	Persons of non-affected building/ area keep attention to announcements and follow Emergency Coordinator instructions.	
7	Co-operate in evacuation head count procedure at Assembly Point.	
8	Keep calm, switch on the transistor radio and obey any instructions you receive on the TV, radio, public address system, siren alarm or verbal mode of communication.	

SOP NO. 2: BOMB THREAT, SUSPECT MAIL/ PARCEL

1	Proceed to ECC when informed of the disaster/ potential disastrous event at site.
2	On arrival at ECC The Chief Site Controller Shall relieve the Site Incident Controller of responsibility of overall main control of the event.
3	In consultation with Site Incident Controller and advisory team The Chief Site Controller will take stock of the situation like exact location, number of people and the area affected etc. decide on level of emergency, establish immediate priorities and Guide The Site Incident Controller and Emergency Co-Coordinator accordingly.
4	Ensure that all the key persons are available on site/ performing the task.
5	Delegate any extra duty to relevant person depending upon the situation.
6	Ensure that adequate safety measures for responders and affected communities are in place all the time.
7	Ensure smooth working of all the emergency respondents and make sure that all conflicts (if any) are resolved.
8	Withdraw the staff in case of the human life is in peril.
9	Authorize release of information to the media.
10	Ensure financial support for the disaster control activities and relief materials.
11	Keep contact with District Disaster Control Room
12	Get the de-warning from District Control Room and announce the same
13	Give authorization for clearance signal to the Site Incident Controller and emergency coordinator when everything becomes normal.
14	Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.

1	On hearing of emergency alarm immediately proceed to site of incident (unless already present there). To take charge and give guidance over public address system.
2	Assume the additional responsibility of the Chief Site Controller till the arrival of the Chief Site Controller.
3	Assess the level of emergency and activate emergency services of Fire and security department, inform Fire Brigade, Police, Site Chief Controller and Site Emergency Co-Coordinator.
4	Identify the areas likely to be affected by the emergency. Give information as required by the Fire Brigade and Police.
5	Guide and assist the Bomb detection squad.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especially in lifts and rooms.
7	Guide occupants on the steps being taken for evacuation in a systematic manner.
8	Assist the law and order machinery.
9	Carry out firefighting and evacuation operations; keep communication with emergency teams and the affected persons in the building especially in lifts and rooms.
10	Account for all occupants at the assembly area and give head count, missing person's feedback to

	SAR team.
11	Guide the search and rescue team with geographic information and persons trapped.
12	Get the de-warning authorization from the Chief Site Controller and communicate the same to security head for giving all clear alarm.
13	Update the Record and documentation.
14	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency information proceed to Emergency Control Centre.
2	Call Police, Fire Brigade and mobilizing site emergency services.
3	Give immediate assessment to the authority on damage, massive casualty etc.
4	Inform Police, Fire Brigade and mobilizing site emergency services.
5	Mobilizing resources required for emergency response teams working.
6	Release of authorized information to the media and take steps to reduce/ eliminate panic. Set up of help desk and Information centers to provide response information to the public, relatives of victims and media.
7	Assure occupants of continuous communication and take all measures to keep up their morale high.
8	Liaise with the law and order machinery.
9	Call for participating in the emergency response and Coordinate between all emergency respondents such as various line departments, representatives of Govt. authorities/ IRT's/ NGO's and ULB's etc.
10	Release of authorized information to the media and take steps to reduce/ eliminate panic.
11	Assure occupants of continuous communication and take all measures to keep up their morale high.
12	Liaise with the law and order machinery.
13	Perform such other duties as assigned by Chief Site Controller.
14	Follow up of injured (if any) at hospital.
15	Setting up help desk and Information centers will be set up to provide response information to the public, relatives of victims and media.
16	Mobilizing Bomb detection squad.
17	Communication with district disaster control cell and declaring off site emergency (if situation escalates).
18	Release of authorized information to the media.
19	Emergency under control report to Chief Site Controller.
20	Termination of emergency and 'All Clear Alarm'.
21	Analyze the disaster and improve the DMP in the light of experience.
22	Contact insurers.
23	Disseminate precautionary information on post disaster health hazards and remedies.
24	Replenish depleted resources such as firefighting materials, rescue materials.
25	Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.
26	Maintain the DMP resources.
27	Organize Fire Drill, Safety Audits, Mock Drills and periodic training and DMP awareness program.

1	On receiving signal, information of the incident Security person to confirm and raise the site emergency alarm, Inform the Site Incident Controller.
2	On receiving emergency alert supervisor of the affected area to proceed to site (if not already at incident spot) as directed from ECC.
3	Supervisor of the non-affected area to keep attention to announcements and follow Emergency Co-Coordinator instructions.
4	Watch and ward & security persons carry out Traffic control, law and order situation and crowd control at Assembly point. Keep the fire tender routes free from obstruction.
5	Guide and assist the Bomb detection squad.
6	Supervise and assist the search and rescue team for evacuation, search of the trapped persons and rescue of the same to assembly area.
7	Alert all occupants without further compromising life and assist those which are persons with special needs.
8	If people are buried under the debris, call for help of the rescue teams and render your help.
9	Assist in head count at assembly point and give feedback to Site Incident Controller.
10	Maintain an updated list of emergency telephone numbers at ECC.
11	Clean and rehabilitate the disaster site.
12	Perform such other duties as assigned by Chief Site Controller.
13	Ensure occupants do not attempt to re-enter the building until it is safe to do so.
1	On receiving emergency alert SAR team members to proceed to ECC, get equipped with required PPE and proceed to incident site or as directed from ECC.
2	Firefighting trained persons to Carry out Firefighting operations and try to put it out with help of people around you if safe to do so. On arrival of fire brigade; assist and provide required information.
3	Search for the trapped persons and rescue of the same to assembly area.
4	Provide first aid trained persons to provide first aid to injured where ever necessary and shift to first aid room for further action.
5	Carry out evacuation of the building as per directions from ECC. Ensure the safe evacuation of all occupants from the building.
6	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency alert proceed to respective work places or as directed from ECC.
2	Ensure uninterrupted power supply in case affected to emergency equipments.
3	Ensure adequate warning to Emergency Co-Coordinator before stopping power to lifts; bring the lifts to safe position.
4	Assist the search and rescue team in case of any metal cutting operation, vehicle failures etc.
5	Attend Lift failures.
6	Ensure adequate warning to Emergency Co-Coordinator before stopping power to lifts; bring the lifts to safe position.
7	Perform such other duties as assigned by Chief Site Controller.

1	When informed of the disaster/ potential disastrous event at site, proceed to ECC or keep available for communication.
2	Assess the relevant data received at ECC.
3	Assist the Chief Site Controller in decision making process.
4	Collect relevant information and Take stock of situation time to time and advise the Site Chief Controller.
5	Give feedback on revision of the DMP in view of the lessons learnt from the incident.

1	In Case of noticing any doubtful object / threat call :
	a) Do not run, walk fast away from the object, do not create panic.
	b) Inform Site Incident Controller.
2	On receiving emergency evacuation proceed to Assembly point. If assemble point is affected by incident use alternate assembly point/ outside location as declared by site main controller. While evacuating take visitors, and physically challenged personnel along.
3	Persons of non-affected building/ area keep attention to announcements and follow Emergency Co-Coordinator instructions.
4	Co-operate in evacuation head count procedure at Assembly Point.
5	Keep calm, switch on the transistor radio and obey any instructions you receive on the TV, radio, Public Address System, siren alarm or verbal mode of communication.

SOP NO. 3: EVACUATION

1	Proceed to ECC when informed of the disaster/ potential disastrous event at site.
2	On arrival at ECC The Chief Site Controller Shall relieve the Site Incident Controller of responsibility of overall main control of the event.
3	In consultation with Site Incident Controller and advisory team The Chief Site Controller will take stock of the situation like exact location, number of people and the area affected etc. decide on level of emergency, establish immediate priorities and Guide The Site Incident Controller and emrgency co-ordibnator accordingly.
4	Ensure that all the key persons are available on site/ performing the task.
5	Delegate any extra duty to relevant person depending upon the situation.
6	Ensure that adequate safety measures for responders and affected communities are in place all the time.
7	Ensure smooth working of all the emergency respondents and make sure that all conflicts (if any) are resolved.
8	Withdraw the staff in case of the human life is in peril.
9	Authorize release of information to the media.
10	Ensure financial support for the disaster control activities and relief materials.
11	Keep contact with District Disaster Control Room.
12	Get the de-warning from District Control Room and announce the same.
13	Give authorization for clearance signal to the Site Incident Controller and emergency coordinator when everything becomes normal.
14	Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.

1	On hearing of emergency alarm immediately proceed to site of incident (unless already present there). to take charge and give guidance over public address system.
2	Assume the additional responsibility of the Chief Site Controller till the arrival of the Chief Site Controller.
3	Assess the level of emergency and activate emergency services of Fire and security department, inform Fire brigade, Police, Site Chief Controller and Site Emergency Co-Ordinator.
4	Identify the areas likely to be affected by the emergency. Give information as required by the Fire Brigade and Police.
5	Carry out fire fighting and evacuation operations.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especailly in lifts and rooms.
7	Guide occupants on the steps being taken for evacuation in a systematic manner.
8	Assist the law and order machinary.
9	Account for all occupants at the assembly area and give head count, missing persons feed back to SAR team.
10	Guide the search and rescue team with geographic information and persons trapped.

11	Get the de-warning authorization from the Chief Site Controller and communicate the same to security head for giving all clear alarm.
12	Update the Record and documentation.
13	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency information Proceed to Emergency Control Centre.
2	Call Police, Fire brigade and Mobilizing site emergency services.
3	Give immediate assessment to the authority on damage, massive casualty etc.
4	Inform Police, Fire brigade and Mobilizing site emergency services.
5	Mobilizing resources required for emergency response teams working.
6	Release of authorized information to the media and take steps to reduce/ eliminate panic. Set up of help desk and information centers to provide response information to the public, relatives of victims and media.
7	Assure occupants of contineous communication and take all measures to keep up their morale high.
8	Liaise with the law and order machinary.
9	Call for participating in the emergency response and coordinate between all emergency respondants such as various line departments, representatives of Govt. authorities/ IRT's/ NGO's and ULB's etc.
10	Perform such other duties as assigned by Chief Site Controller.
11	Follow up of injured at hospital.
12	Setting up help desk and information centers will be set up to provide response information to the public, relatives of victims and media.
13	Mobilizing Emergency Respondent teams, IRT's, NGO's.
14	Communication with district disaster control cell and declaring off site emergency (if situation escalates).
15	Release of authorized information to the media.
16	Emergency under control report to Chief Site Controller.
17	Termination of emergency and 'All Clear Alarm'.
18	Analyze the disaster and improve the DMP in the light of experience.
19	Contact insurers.
20	Disseminate precautionary information on post disaster health hazards and remedies.
21	Replenish depleted resources such as fire fighting materials, rescue materials.
22	Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.
23	Maintain the DMP resources.
24	Organize Fire Drill, Safety Audits, Mock Drills and periodic training and DMP awareness program.

1	On receiving signal, information of the incident Security person to confirm and raise the site emergency alarm, Inform the Site Incident Controller.
2	On receiving emergency alert supervisor of the affected area to proceed to site (if not already at incident spot) as directed from ECC.

3	Supervisor of the non affected area to keep attention to announcements and follow Emergency Co-Ordinator instructions.
4	Watch and ward & security persons carry out Traffic control, law and order situation and crowd control at Assembly point. Keep the fire tender routes free from obstruction.
5	Guide and assist to carry out fire fighting operations.
6	Supervise and assist the search and rescue team for evacuation, search of the trapped persons and rescue of the same to assembly area.
7	Alert all occupants without further compromising life and assist those which are persons with special needs.
8	If people are buried under the debris, call for help of the rescue teams and render your help.
9	Assist in head count at assembly point and give feed back to Site Incident Controller.
10	Maintain an updated list of emergency telephone numbers at ECC.
11	Clean and rehabilitate the disaster site.
12	Perform such other duties as assigned by Chief Site Controller.
13	Ensure occupants do not attempt to re-enter the building until it is safe to do so.

1	On receiving emergency alert SAR team members to proceed to ECC, get equipped with required PPE and proceed to incident site or as directed from ECC.
2	Fire fighting trained persons to Carry out Fire fighting operations and try to put it out with help of people around you if safe to do so. On arrival of fire brigade; assist and provide required information.
3	Search for the trapped persons and rescue of the same to assembly area.
4	Provide first aid trained persons to provide first aid to injured where ever necessary and shift to first aid room for further action.
5	Carry out evacuation of the building as per directions from ECC. Ensure the safe evacuation of all occupants from the building.
6	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency alert proceed to respective work places or as directed from ECC.
2	Ensure uninturepted water supply to fire hydrant system. (Water re-connection is a priority if affected in the incidence).
3	Restore power supply in case affected to emergency equpiments (Loss of power will mean loss of fire systems if prolonged).
4	Ensure uninturepted power supply to fire water pumps and emergency lighting.
5	Restore Power supply to emergency lighting.
6	Restore and maintain communication network such as PAS system, siren, phones, TV, radio systems.
7	Ensure adequate warning to Emergency Co-Ordinator before stopping power to lifts, bring the lifts to safe position.
8	Attend Lift failures.
9	Ensure working of dranage, de watering pumps.
10	Assist the search and rescue team in case of any metal cutting operation, vehicle failures etc.
11	Perform such other duties as assigned by Chief Site Controller.

1	When informed of the disaster/ potential disastrous event at site, proceed to ECC or keep available for communication.
2	Assess the relevent data received at ECC.
3	Assist the Chief Site Controller in decision making process.
4	Collect relevant information and take stock of situation time to time and advise the Site Chief Controller.
5	Give feed back on revision of the DMP in view of the lessons learnt from the incident.

1	In Case of noticing Fire:	
	a)	Raise the raise break glass fire alert.
	b)	Dial '(101 fire brigade emergency number)'and inform fire/ security department location and incidence.
	c)	Raise verbal fire alarm to activate other persons in the area.
2	Contain the fire by closing windows and doors to minimize the danger of the fire and smoke spreading.	
3	Extinguish the fire if; you have been trained in the use of a fire extinguisher, it is safe to do so or you have someone in support.	
4	Remove or help to Rescue occupants from the area of immediate danger. To refuge area and follow further instructions from ECC regarding evacuation.	
5	On receiving emergency evacuation evacuation proceed to Assembly point.	
6	Persons of non affected building/ area keep attention to announcements and and follow Emergency Co-Ordinator instructions.	
7	Co-operate in evacuation head count procedure at Assembly Point.	
8	Keep calm, switch on the transistor radio and obey any instructions you receive on the TV, radio, public address system, siren alarm or verbal mode of communication.	

SOP NO. 4: CYCLONE

1	Proceed to ECC when informed of the disaster/ potential disastrous event at site.
2	On arrival at ECC The Chief Site Controller Shall relieve the Site Incident Controller of responsibility of overall main control of the event.
3	In consultation with Site Incident Controller and advisory team The Chief Site Controller will take stock of the situation like exact location, number of people and the area affected etc. decide on level of emergency, establish immediate priorities and Guide The Site Incident Controller and Emergency Co-Coordinator accordingly.
4	Ensure that all the key persons are available on site/ performing the task.
5	Delegate any extra duty to relevant person depending upon the situation.
6	Ensure that adequate safety measures for responders and affected communities are in place all the time.
7	Ensure smooth working of all the emergency respondents and make sure that all conflicts (if any) are resolved.
8	Withdraw the staff in case of the human life is in peril.
9	Authorize release of information to the media.
10	Ensure financial support for the disaster control activities and relief materials.
11	Keep contact with District Disaster Control Room.
12	Get the de-warning from District Control Room and announce the same.
13	Give authorization for clearance signal to the Site Incident Controller and emergency coordinator when everything becomes normal.
14	Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.

1	On hearing of emergency alarm immediately proceed to site of incident (unless already present there) to take charge and give guidance over public address system.
2	Assume the additional responsibility of the Chief Site Controller till the arrival of the Chief Site Controller.
3	Assess the level of emergency and activate emergency services of Fire and security department, inform Fire brigade, Police, Site Chief Controller and Site Emergency Co-Ordinator.
4	Identify the areas likely to be affected by the emergency. Give information as required by the Fire Brigade and Police.
5	Carry out fire fighting and evacuation operations.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especailly in lifts and rooms.
7	Guide occupants on the steps being taken for evacuation in a systematic manner.
8	Assist the law and order machinary.
9	Account for all occupants at the assembly area and give head count, missing persons feed back to SAR team.
10	Guide the search and rescue team with geographic information and persons trapped.

11	Get the de-warning authorization from the Chief Site Controller and communicate the same to security head for giving all clear alarm.
12	Update the Record and documentation.
13	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency information Proceed to Emergency Control Centre.
2	Call Police, Fire brigade and Mobilizing site emergency services.
3	Give immediate assessment to the authority on damage, massive casualty etc.
4	Inform Police, Fire brigade and Mobilizing site emergency services.
5	Mobilizing resources required for emergency response teams working.
6	Release of authorized information to the media and take steps to reduce/ eliminate panic. Set up of help desk and information centers to provide response information to the public, relatives of victims and media.
7	Assure occupants of continuous communication and take all measures to keep up their morale high.
8	Liaise with the law and order machinery.
9	Call for participating in the emergency response and Coordinate between all emergency respondants such as various line departments, representatives of Govt. authorities/ IRT's/ NGO's and ULB's etc.
10	Perform such other duties as assigned by Chief Site Controller.
11	Follow up of injured at hospital.
12	Setting up help desk and information centers will be set up to provide response information to the public, relatives of victims and media.
13	Mobilizing Emergency Respondent teams, IRT's, NGO's.
14	Communication with district disaster control cell and declaring off site emergency (if situation escalates).
15	Release of authorized information to the media.
16	Emergency under control report to Chief Site Controller.
17	Termination of emergency and 'All Clear Alarm'.
18	Analyze the disaster and improve the DMP in the light of experience.
19	Contact insurers.
20	Disseminate precautionary information on post disaster health hazards and remedies.
21	Replenish depleted resources such as fire fighting materials, rescue materials.
22	Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.
23	Maintain the DMP resources
24	Organize Fire Drill, Safety Audits, Mock Drills and periodic training and DMP awareness program.

1	On receiving signal, information of the incident Security person to confirm and raise the site emergency alarm, Inform the Site Incident Controller.
2	On receiving emergency alert supervisor of the affected area to proceed to site (if not already at incident spot) as directed from ECC.
3	Supervisor of the non affected area to keep attention to announcements and follow Emergency Co-Ordinator instructions.
4	Watch and ward & security persons carry out Traffic control, law and order situation and crowd control at Assembly point. Keep the fire tender routes free from obstruction.
5	Guide and assist to carry out rescue operations.
6	Supervise and assist the search and rescue team for evacuation, search of the trapped persons and rescue of the same to assembly area.
7	Alert all occupants without further compromising life and assist those which are persons with special needs.
8	If people are buried under the debris, call for help of the rescue teams and render your help.
9	Assist in head count at assembly point and give feed back to Site Incident Controller
10	Maintain an updated list of emergency telephone numbers at ECC.
11	Clean and rehabilitate the disaster site.
12	Perform such other duties as assigned by Chief Site Controller.
13	Ensure occupants do not attempt to re-enter the building until it is safe to do so.

1	On receiving emergency alert SAR team members to proceed to ECC, get equipped with required PPE and proceed to incident site or as directed from ECC.
2	Search for the trapped persons and rescue of the same to assembly area.
3	Provide first aid trained persons to provide first aid to injured where ever necessary and shift to first aid room for further action.
4	Carry out evacuation of the building as per directions from ECC. Ensure the safe evacuation of all occupants from the building.
5	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency alert proceed to respective work places or as directed from ECC.
2	Ensure uninturepted water supply to fire hydrant system. (Water re-connection is a priority if affected in the incidence).
3	Restore power supply in case affected to emergency equpiments (Loss of power will mean loss of fire systems if prolonged).
4	Restore and maintain communication network such as PAS system, siren, phones, TV, radio systems.
5	Attend Lift failures.
6	Ensure adequate warning to Emergency Co-Ordinator before stopping power to lifts, bring the lifts to safe position.
7	Ensure working of dranage, de watering pumps if flooding is likely.
8	Assist the search and rescue team in case of any metal cutting operation, vehicle failures etc.
9	Perform such other duties as assigned by Chief Site Controller.

1	When informed of the disaster/ potential disastrous event at site, proceed to ECC or keep available for communication.
2	Assess the relevent data received at ECC.
3	Assist the Chief Site Controller in decision making process.
4	Collect relevant information and Take stock of situation time to time and advise the Site Chief Controller.
5	Give feed back on revision of the DMP in view of the lessons learnt from the incident.

1	In Case of receiving cyclone warning follow the instructions from ECC.
2	Remove or help to Rescue occupants from the area of immediate danger. To refuge area and follow further instructions from ECC regarding evacuation.
3	On receiving emergency evacuation evacuation proceed to Assembly point.
4	Persons of non affected building/ area keep attention to announcements and and follow Emergency Co-Ordinator instructions.
5	Co-operate in evacuation head count procedure at Assembly Point.
6	Keep calm, switch on the transistor radio and obey any instructions you receive on the TV, radio, public address system, siren alarm or verbal mode of communication.

SOP NO. 5: EARTHQUAKE

1	Proceed to ECC when informed of the disaster/ potential disastrous event at site.
2	On arrival at ECC The Chief Site Controller Shall relieve the Site Incident Controller of responsibility of overall main control of the event.
3	Analyze the available initial information on damage and needs. Verify the authentic of the incident and take decision on the level of the disaster, inform District Disaster Control Cell and mobilize external support agencies.
4	Ensure that all the key persons are available on site/ performing the task.
5	Delegate any extra duty to relevant person depending upon the situation.
6	Ensure that adequate safety measures for responders and affected communities are in place all the time.
7	Ensure smooth working of all the emergency respondents and make sure that all conflicts (if any) are resolved.
8	Withdraw the staff in case of the human life is in peril.
9	Authorize release of information to the media.
10	Ensure financial support for the disaster control activities and relief materials.
11	Keep contact with District Disaster Control Room.
12	Get the de-warning from District Control Room and announce the same.
13	Give authorization for clearance signal to the Site Incident Controller and emergency coordinator when everything becomes normal.
14	Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.

1	On hearing of emergency alarm immediately proceed to site of incident (unless already present there) to take charge and give guidance over public address system.
2	Assume the additional responsibility of the Chief Site Controller till the arrival of the Chief Site Controller.
3	Assess the level of emergency and activate emergency services of Fire and security department, inform fire brigade, Police, Site Chief Controller and Site Emergency Co-Ordinator.
4	Identify the areas likely to be affected by the emergency. Give information as required by the Fire Brigade and Police.
5	Inform the Chief Site Controller and activate DMP Activate emergency services for firefighting (if any), the search and rescue teams in the affected areas with immediate effect.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especailly in lifts and rooms.
7	Guide occupants on the steps being taken for evacuation in a systematic manner.
8	Activate first aiders to provide first aid to affected and arranges to shift injured people to hospital if required. Emergency Co-ordinator to ensure appropriate mobilization of medical services from external agencies.
9	Activate Maintenance team to reestablish communication links and restoration of critical utility

	services like water for fire fighting, restoration of access roads.
10	Assist the law and order machinary.
11	Carry out fire fighting and evacuation operations, keep communication with emergency teams and the affected persons in the building especailly in lifts and rooms.
12	Account for all occupants at the assembly area and give head count, missing persons feed back to SAR team so that rescue team knows where to concentrate their efforts in the event of building collapse.
13	Guide the search and rescue team with geographic information and persons trapped.
14	Get the de-warning authorization from the Chief Site Controller and communicate the same to security head for giving all clear alarm.
15	Update the Record and documentation.
16	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency information Proceed to Emergency Control Centre.
2	Call Police, Fire brigade and Mobilizing site emergency services.
3	Give immediate assessment to the authority on damage, massive casualty etc.
4	Mobilize emergency response teams, co ordinate with District disaster cell for IRT's. NGO's help and establish media management/ guidance to volunteers and aid agencies and for rumor control.
5	Mobilize resources required for emergency response teams working.
6	Release of authorized information to the media and take steps to reduce/ eliminate panic. Set up of help desk and Information centers to provide response information to the public, relatives of victims and media.
7	Assure occupants of contineous communication and take all measures to keep up their morale high.
8	Liaise with the law and order machinary.
9	Liaise with the law and order machinary.
10	Perform such other duties as assigned by Chief Site Controller.
11	Follow up of injured at hospital.

12	Setting up help desk and information centers will be set up to provide response information to the public, relatives of victims and media.
13	Emergency Co-coordinator to Mobilize ECC if not affected or alternate ECC if required and feasible; Assembly point and head count.
14	Communication with district disaster control cell and declaring off site emergency (if situation escalates).
15	Release of authorized information to the media.
16	Emergency under control report to Chief Site Controller.
17	Termination of emergency and 'All Clear Alarm'.
18	Provide additional security in affected areas and maintain law and order situation.
19	Analyze the disaster and improve the DMP in the light of experience.
20	Contact insurers.
21	Disseminate precautionary information on post disaster health hazards and remedies.
22	Replenish depleted resources such as fire fighting materials, rescue materials.
23	Develop situation report of the affected areas and share with all Stakeholders. Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.

24	Maintain the DMP resources.
25	Organize Fire Drill, Safety Audits, Mock Drills and periodic training and DMP awareness program.

1	Earth quake noticed manually or detected on equipment/ sensor fire department supervisor to activate at site alarm from control room.
2	Watch and ward & security persons carry out Traffic control, law and order situation and crowd control at Assembly point. Keep the fire tender routes free from obstruction
3	Guide and assist to carry out fire fighting operations.
4	Supervise and assist the search and rescue team for evacuation, search of the trapped persons and rescue of the same to assembly area.
5	Alert all occupants without further compromising life and assist those which are persons with special needs.
6	If people are buried under the debris, call for help of the rescue teams and render your help.
7	Assist in head count at assembly point and give feed back to Site Incident Controller.
8	Maintain an updated list of emergency telephone numbers at ECC.
9	Clean and rehabilitate the disaster site.
10	Perform such other duties as assigned by Chief Site Controller.
11	Ensure occupants do not attempt to re-enter the building until it is safe to do so.

1	On receiving emergency alert SAR team members to proceed to ECC, get equipped with required PPE and proceed to incident site or as directed from ECC.
2	Fire fighting trained persons to carry out Fire fighting operations and try to put it out with help of people around you if safe to do so. On arrival of fire brigade; assist and provide required information.
3	Search for the trapped persons and rescue of the same to assembly area.
4	Provide first aid trained persons to provide first aid to injured where ever necessary and shift to first aid room for further action.
5	Carry out evacuation of the building as per directions from ECC. Ensure the safe evacuation of all occupants from the building.
6	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency alert proceed to respective work places or as directed from ECC.
2	Restore essential services i.e. power, water supply, communication Facilities such as PAS system, siren, phones, TV, radio systems. etc. on priority basis.
3	Ensure working of drainage, de watering pumps.
4	Assist the search and rescue team in case of any metal cutting operation, vehicle failures etc.
5	Attend Lift failures.
6	Ensure adequate warning to Emergency Co-Ordinator before stopping power to lifts, bring the lifts to safe position.
7	Regular maintenance of lightening arrestor.
8	Perform such other duties as assigned by Chief Site Controller.

1	When informed of the disaster/ potential disastrous event at site, proceed to ECC or keep available for communication.
2	Assess the relevent data received at ECC.
3	Assist the Chief Site Controller in decision making process.
4	Collect relevant information and Take stock of situation time to time and advise the Site Chief Controller.
5	Give feed back on revision of the DMP in view of the lessons learnt from the incident.

1	Practice Drop, Cover, protect head with both hands.and Hold on to it so that it do not move away from you Wait there until the shaking stops.
2	Extinguish the fire if; you have been trained in the use of a fire extinguisher, it is safe to do so or you have someone in support.
3	Remove or help to Rescue occupants from the area of immediate danger. To refuge area and follow further instructions from ECC regarding evacuation.
4	On receiving emergency evacuation evacuation proceed to Assembly point.
5	Persons of non affected building/ area keep attention to announcements and and follow Emergency Co-Ordinator instructions.
6	Co-operate in evacuation head count procedure at Assembly Point.
7	Keep calm, switch on the transistor radio and obey any instructions you receive on the TV, radio, Public Address System, siren alarm or verbal mode of communication.
	Note: expect earthquake aftershocks be aware that items, especially those stored overhead may well have become dislodged.
8	Re-occupy when safe to do so.

SOP NO. 6: FLOOD

1	Proceed to ECC when informed of the disaster/ potential disastrous event at site.
2	On arrival at ECC The Chief Site Controller Shall relieve the Site Incident Controller of responsibility of overall main control of the event.
3	In consultation with Site Incident Controller and advisory team The Chief Site Controller will take stock of the situation like exact location, number of people and the area affected etc. decide on level of emergency, establish immediate priorities and Guide The Site Incident Controller and Emergency Co-Coordinator accordingly.
4	Ensure that all the key persons are available on site/ performing the task.
5	Delegate any extra duty to relevant person depending upon the situation.
6	Ensure that adequate safety measures for responders and affected communities are in place all the time.
7	Ensure smooth working of all the emergency respondents and make sure that all conflicts (if any) are resolved.
8	Withdraw the staff in case of the human life is in peril.
9	Authorize release of information to the media.
10	Ensure financial support for the disaster control activities and relief materials.
11	Keep contact with District Disaster Control Room.
12	Get the de-warning from District Control Room and announce the same
13	Give authorization for clearance signal to the Site Incident Controller and emergency coordinator when everything becomes normal.
14	Determine priorities for restoration work and seek the advice of a conservator as to the best methods and options, and obtain cost estimates.

1	On hearing of emergency alarm immediately proceed to site of incident (unless already present there) to take charge and give guidance over public address system.
2	Assume the additional responsibility of the Chief Site Controller till the arrival of the Chief Site Controller.
3	Assess the level of emergency and activate emergency services of Fire and security department, inform Fire brigade, Police, Site Chief Controller and Site Emergency Co-Ordinator.
4	Identify the areas likely to be affected by the emergency. Give information as required by the Fire Brigade and Police.
5	Carry out the emergency operations.
6	Use PAS, megaphone, cell phones to keep two way communication with emergency teams and the affected persons in the building especailly in lifts and rooms.
7	Guide occupants on the steps being taken for evacuation in a systematic manner.
8	Assist the law and order machinary.
9	Account for all occupants at the assembly area and give head count, missing persons feed back to SAR team.
10	Guide the search and rescue team with geographic information and persons trapped.

11	Get the de-warning authorization from the Chief Site Controller and communicate the same to security head for giving all clear alarm.
12	Update the Record and documentation.
13	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency information Proceed to Emergency Control Centre.
2	Call Police, Fire brigade and Mobilizing site emergency services.
3	Give immediate assessment to the authority on damage, massive casualty etc.
4	Inform Police, Fire brigade and Mobilizing site emergency services.
5	Mobilizing resources required for emergency response teams working.
6	Release of authorized information to the media and take steps to reduce/ eliminate panic. Set up of help desk and information centers to provide response information to the public, relatives of victims and media.
7	Assure occupants of continuous communication and take all measures to keep up their morale high.
8	Liaise with the law and order machinery.
9	Call for participating in the emergency response and Coordinate between all emergency respondants such as various line departments, representatives of Govt. authorities/ IRT's/ NGO's and ULB's etc.
10	Perform such other duties as assigned by Chief Site Controller.
11	Follow up of injured at hospital.
12	Setting up help desk and information centers will be set up to provide response information to the public, relatives of victims and media.
13	Mobilizing Emergency Respondent teams, IRT's, NGO's.
15	Communication with district disaster control cell and declaring off site emergency (if situation escalates).
16	Release of authorized information to the media.
17	Emergency under control report to Chief Site Controller.
18	Termination of emergency and 'All Clear Alarm'.
19	Analyze the disaster and improve the DMP in the light of experience.
20	Contact insurers.
21	Disseminate precautionary information on post disaster health hazards and remedies, Test drinking water for portability; wells should be pumped out and the water tested before drinking.
22	Replenish depleted resources such as fire fighting materials, rescue materials.
23	Establish a program to restore both the disaster site and the damaged materials to a stable and usable condition.
24	Maintain the DMP resources.
25	Organize Fire Drill, Safety Audits, Mock Drills and periodic training and DMP awareness program.

1	On receiving signal, information of the incident Security person to confirm and raise the site emergency alarm, inform the Site Incident Controller.
2	On receiving emergency alert supervisor of the affected area to proceed to site (if not already at incident spot) as directed from ECC.
3	Supervisor of the non affected area to keep attention to announcements and follow Emergency Co-

	Ordinator instructions.
4	Watch and ward & security persons carry out Traffic control, law and order situation and crowd control at Assembly point. Keep the fire tender routes free from obstruction
5	Guide and assist to carry out fire fighting operations.
6	Supervise and assist the search and rescue team for evacuation, search of the trapped persons and rescue of the same to assembly area.
7	Alert all occupants without further compromising life and assist those which are persons with special needs.
8	If people are trapped in flood, call for help of the rescue teams and render your help.
9	Assist in head count at assembly point and give feed back to Site Incident Controller.
10	Maintain an updated list of emergency telephone numbers at ECC.
11	Clean and rehabilitate the disaster site.
12	Perform such other duties as assigned by Chief Site Controller.
13	Ensure occupants do not attempt to re-enter the building until it is safe to do so.

1	On receiving emergency alert SAR team members to proceed to ECC, get equipped with required PPE and proceed to incident site or as directed from ECC.
2	Carry out rescue operation of the flood affected persons.On arrival of fire brigade; assist and provide required information.
3	Search for the trapped persons and rescue of the same to assembly area.
4	Provide first aid trained persons to provide first aid to injured where ever necessary and shift to first aid room for further action.
5	Carry out evacuation of the building as per directions from ECC. Ensure the safe evacuation of all occupants from the building.
6	Secure their (evacuated person's) homes/ establishments. Close and lock doors and windows.
7	Perform such other duties as assigned by Chief Site Controller.

1	On receiving emergency alert proceed to respective work places or as directed from ECC.
2	Restore power supply in case affected to emergency equpiments (Loss of power will mean loss of fire systems if prolonged).
3	Restore Power supply to emergency lighting.
4	Restore and maintain communication network such as PAS system, siren, phones, TV, radio systems.
5	Attend Lift failures.
6	Ensure adequate warning to Emergency Co-Ordinator before stopping power to lifts, bring the lifts to safe position.
7	Ensure working of dranage, de watering pumps.
8	Assist the search and rescue team in case of any metal cutting operation, vehicle failures etc.
9	Perform such other duties as assigned by Chief Site Controller.

1	When informed of the disaster/ potential disastrous event at site, proceed to ECC or keep available for communication.

2	Assess the relevent data received at ECC.
3	Assist the Chief Site Controller in decision making process.
4	Collect relevant information and Take stock of situation time to time and advise the Site Chief Controller.
5	Give feed back on revision of the DMP in view of the lessons learnt from the incident.

1	On receiving emergency evacuation evacuation proceed to Assembly point.
2	Persons of non affected building/ area keep attention to announcements and and follow Emergency Co-Ordinator instructions.
3	Co-operate in evacuation head count procedure at Assembly Point.
4	Keep calm, switch on the transistor radio and obey any instructions you receive on the TV, radio, public address system, siren alarm or verbal mode of communication.

ANNEXURE 1: DO'S & DON'T

FIRE /EXPLOSION	
DO'S	**DON'TS**
▪ On noticing fire emergency actuate nearest fire alarm button and/ or inform the Supervisor and follow further instructions and proceed to assembly point. ▪ Supervisor to inform fire brigade and mobilize firefighting trained persons, ▪ Cordon off the area, move upwind and evacuate the area. ▪ Keep the gas cylinder cool with water spray. ▪ Use AFFF (Aq. Film Forming Foam) to blanket the oil, diesel spill area. ▪ If there's a lot of smoke, crawl along the floor where the air will be cleanest. ▪ In case cloth on fire lie on ground and cover in blanket. ▪ In case of burn injury, pour water on burn for at least for 10 minutes. Remove tight items such as watch before swelling occurs. Avoid breaking the burn blisters on skin and removing pieces of burnt cloth.	▪ Do not enter the site unless instructed if you are outside and disaster alarm is heard. ▪ No smoking ▪ Avoid use of lift during fire at building. ▪ Do not panic. Avoid running all over the place prevent others from doing so. ▪

BOMB THREAT	
DO'S	**DON'TS**
▪ Cordon off the area. ▪ Evacuate the area ▪ Be careful about entering into a room in which or seat which an explosion has occurred to bring you there. It may be used to trap you. ▪ Examine carefully without moving or tilting the suspected object, its shape, size construction, finish, marking and special features, if any. Note these particulars down. Try to identify it ascertain whether the object has been moved or handled before you saw it. ▪ Consideration should be given to suspicious vehicles/packages at the ECC and Assembly points also. ▪ Follow the rule "DO NOT TAKE THE BOMB AWAY FROM THE PUBLIC. TAKE THE PEOPLE AWAY FROM THE BOMB".	▪ Do not panic. ▪ Do not open a closed room/ door/ window/ cupboard/ box in the normal way tap wood cover and open with a ling pole or in any other improvised manner. ▪ Do not switch on any electric line, if the room is dark. Use hand torch for illumination. ▪ Do not touch, lift, drag kick, hit or move the suspected object, examine room or place quickly to see, if there is any wire or string held taut, any loose pair of insulated wires connected door/ window/ cupboard/ box or any lighted fuse or lighted rope if so.

LETTERS/ PACKET/ PARCELS/ BOOKS BOMB	
Do follow those instructions intelligently and closely.	Don't bend or press hard.
Do examine all closed covers, thin or bulky, against a source of a strong light, if cover is not uniformity translucent, suspect.	Don't open a closed cover which is more than 3 mm thick until you have examined it according to the instructions.
Do handle object gently, carefully and cautiously.	Don't hastily pull out content of closed cover until you have examined them.
Do be particularly careful about letter over 3 mm in thickness and closed packets/parcels which are marked, "Personal and Confidential" or are dispatched from Post offices in the European continent.	Don't pull out contents of a closed cover if it does not come out smoothly.

EVACUATION	
DO'S	**DON'TS**
• Remain calm. • Walk out of the building quietly and orderly manner. • Follow the evacuation route only. • Follow instruction from guides on any confusion about the route and assembly area. • Switch off the machinery and power supply before leaving the area. • Help ladies and old people to safe area. • Remain in the assembly area until further instructions are given. • Check for all the employees at the assembly area. If anybody is missing, the matter should be immediately reported to the co-coordinator of Bomb Threat Committee. • Use staircase during evacuation • While Evacuation keep clear of buildings and glass in particular	• Do not run. Walk calmly. • Do not argue or try to obtain details about the bomb from anybody leading to time loss. • Do not obstruct the flow of evacuation. • Do not leave any personal belongings. • Do not obstruct passage to anybody. • Do not make noise at the assembly area. • Do not spread rumors. • Do not use lift during evacuation.

Cyclone	
DO'S	**DON'TS**
BEFORE THE CYCLONE SEASON • Check your building and roof are in good condition. • Trim tree branches well clear of your house. • Clear property of loose material that could cause injury and damage during extreme winds. **UPON A CYCLONE WARNING** • Listen to local radio/TV for further information **ON WARNING OF LOCAL EVACUATION** • Heed warnings and follow advice given. **WHEN THE CYCLONE STRIKES** • Disconnect all electrical appliances. • Stay inside and shelter well-clear of windows. • Listen to your radio for cyclone updates. • If driving, stop - clear of trees, power lines and streams. • If in a public building, get away from glass. **AFTER THE CYCLONE** • Listen to local radio for official warnings and advice. • Beware of fallen power lines, damaged buildings and trees, and flooded water courses.	**UPON A CYCLONE WARNING** • Don't ignore warnings and don't go sightseeing. **WHEN THE CYCLONE STRIKES** • Beware the calm 'eye'. Don't assume the cyclone is over if a calm period is due to the 'eye', violent winds will soon resume from the opposite direction. • If driving, stop - clear of trees, power lines and streams. • If in a public building, get away from glass. **AFTER THE CYCLONE** • Don't go outside until advised officially that it is safe. • If you had to evacuate, don't go home until advised. Use route recommended and stay calm. • Don't make unnecessary telephone calls.

EARTHQUAKE	
DO'S	**DON'TS**
DURING AN EARTHQUAKE • Keep calm and keep others calm Practice Drop, Cover, protect head with both hands and Hold on to it so that it do not move away from you Wait there until the shaking stops. • Keep away from buildings, especially old, tall buildings or detached buildings, electricity wires and poles, slopes and walls. They are liable to collapse. • Keep the roads clear for the movement of relief and rescue teams.	**DURING AN EARTHQUAKE** • Do not panic. Remain calm and self-assured and help others who are distressed. • DO NOT use the elevators. • Do not turn on switches if you have electric connection in your place. Use your torch.
INDOORS • Take cover under a sturdy desk, table, or bench or against an inside wall, and hold on. If there isn't a table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building. • Stay away from glass, windows, outside doors and walls, and anything that could fall, such as lighting fixtures or furniture. • Stay in bed—if you are there when the earthquake strikes—hold on and protect your head with a pillow, unless you are under a heavy light fixture that could fall. • In that case, move to the nearest safe place. • Use a doorway for shelter only if it is in close proximity to you and if you know it is a strongly supported, load bearing doorway. • Stay inside until the shaking stops and it is safe to go outside. Most injuries during earthquakes occur when people are hit by falling objects when entering into or exiting from buildings. • Be aware that the electricity may go out or the sprinkler systems or fire alarms may turn on. • Let younger children, elderly and disabled people leave first.	• Do not touch any metal object in contact with loose, hanging electric wires. • Do not go near damaged structures or ender badly damaged buildings • Do not go sightseeing or wandering in the streets aimlessly to see what is happening around. • Do not spread rumors. **INDOORS** • Do not rush to the doors or the exits and keep well away from windows, mirrors and furniture.
OUTDOORS • Stay there if safe. • Move away from buildings, streetlights, and utility wires. • You must keep the roads free for movement of rescue and relief teams	**OUTDOORS** • Do not run and do not wander in the street or on the roads for sightseeing. Walk towards an open place, in a calm and composed manner.
IN A MOVING VEHICLE • Move to side of the road and stop. Stop as quickly as safety permits and stay in the vehicle.	**IN A MOVING VEHICLE** • Avoid stopping near or under buildings, trees, overpasses, and utility wires.

• Proceed cautiously once the earthquake has stopped, watching for road and bridge damage.	
TRAPPED UNDER DEBRIS • Cover your mouth with a handkerchief or clothing. • Tap on a pipe or wall so rescuers can locate you. Use a whistle if one is available. Shout only as a last resort—shouting can cause you to inhale dangerous amounts of dust. • Rescue operation - Let the unconscious person lie on side position. Check for injuries and first treat yourself, then help others.	**TRAPPED UNDER DEBRIS** • Do not light a match. • Do not move about or kick up dust.

1. During earthquake

2. Escape. When you are inside building.

If you are in structurally sound building stay there.	If you are inside an old weak structurally take the fastest and safest way out.
Do not use elevators.	After the shaking stops, take the staircase to reach open space.

3. When you are outside building.

If you are not next to an exit and situated in high rise building/ upstairs stay inside, do not	If you are near an exit, leave the building as soon as possible, do not rush to the exit point,

panic, keep calm and take necessary action.	get out calmly and orderly manner.

Move away from power lines, posts, walls, false ceiling, parapet, falling flower pots and other elements that may fall or collapse.	Stay away from building with glass panes.

4. When on the road.

If you are near hillside, move away –in case land slide or falling rocks.	While driving vehicle pull to the side of the road and stop.	Do not attempt to cross bridges / flyovers which may have been damaged.

FLOOD

DO'S	DON'TS
▪ Stay away from downed power lines. ▪ In high flood-prone areas, keep materials on hand like sandbags, plywood, plastic sheeting, and plastic garbage bags. ▪ Be aware of drainage channels and areas known to flood, so that you or your evacuation routes are not cut off. ▪ Follow recommended evacuation routes. Not to take shortcuts. They may be dangerous. ▪ If you choose or are told to evacuate, move to a safe area before access is cut off by flood water. ▪ Monitor local radio/ television broadcasts. ▪ Eat something to make you feel better and more capable of helping others. When you can move out of the place carry with you essential food, water container, torch, transistor radio and medicines you normally use. ▪ Turn off the main water valve and electricity. ▪ Leave early enough to avoid being trapped.	▪ Do not panic. ▪ Avoid driving into water of unknown depth. Moving water can quickly sweep your vehicle away. ▪ Do not allow children to play in flooded areas. ▪ Do not drink water from open sources/ containers without filtering or purification. ▪ Do not use fresh food that has come in contact with floodwaters. ▪ Do not to move into flooded areas because the authorities may have removed the manholes for efficient drainage and the indicators may get shifted due to water currents. ▪ Do not walk on footpath covers may have been dislocated due to current ▪ Do not enter damaged buildings or structures ▪ Do not touch electric poles, utility wires/cables ▪ Do not use telephones except in life-threatening situations

Gas pipeline (GAIL)

Clues Of A Natural Gas Pipeline Incident.

What You See	:	1. Browning Or Discolored Vegetation That Is Otherwise Green Along A Pipeline Right-of-way. 2. Presence Of A Vapor Cloud Or Mist Around The Pipeline Right-of-way. 3. Dirt Being Blown Into The Air. 4. Bubbles Coming From A Pond Or River. 5. Fire Coming Out Of The Ground. 6. Ice Ball Around The Pipeline. 7. Collection Of Dead Insects. 8.
What You Smell	:	1. An Odorant That Smells Like Sulfur Or "Rotten Eggs" is Added To Natural Gas So That It Can Be Detected By Human Smell At Concentrations. 2. Remember That Transmission Pipeline Systems Typically Handle Unodorized Natural Gas.
What You Hear	:	Unusual Hissing Or Roaring Sound Along A Pipeline Right-of-way Leak detector alarm.

DO'S	DON'TS
▪ Contact fire brigade ▪ Inform GAIL emergency services (1800229944 or 022 24012400.) ▪ Evacuate the area	▪ **Do not** panic ▪ Avoid crowding nearby

HPCL MMPL s pipeline

What You See	:	Browning Or Discolored Vegetation That is Otherwise Green Along A Pipeline Right-of-way. Presence Of A smell /mist Around The Pipeline Right-of-way. Dirt Being Blown Into The Air. Release of containment and spreading pool of released petroleum product

DO'S	DON'TS
▪ Contact fire brigade ▪ Inform HPCL emergency services ▪ Evacuate the area	▪ Do not panic ▪ Avoid crowding nearby ▪ Do not aloe unauthorized on lookers gather to collect the spilled petroleum product as there is potential for fire/explosion hazard .

MSEB HT power transmission line

DO'S	DON'TS
▪ Contact fire brigade ▪ Inform MAHATRANSCO emergency services ▪ use a cell phone to notify emergency services for giving the exact location . ▪ Evacuate the area ▪ Stay away from drowned power lines	▪ Do not panic ▪ Avoid crowding nearby ▪ do not attempt to get out of the vehicle in case power line comes into contact with your vehicle

TATA HYDRO HT power transmission line

DO'S	DON'TS
▪ Contact fire brigade ▪ Inform Tata Hydro P. C. l. Transmission division , Kalyan (E) ▪ use a cell phone to notify emergency services for giving the exact location . ▪ Evacuate the area ▪ Stay away from drowned power lines	▪ Do not panic ▪ Avoid crowding nearby ▪ do not attempt to get out of the vehicle in case power line comes into contact with your vehicle

ANNEXURE 2 : GLOSSARY

Aftershock	An earthquake of similar or lesser intensity that follows the main earthquake.
Bomb	A device or any size or shape, which can look obvious or be camouflaged, may vary in its sophistication, and may not necessarily explode (i.e. incendiaries, toxic/noxious substances, sharps, animals/reptiles). May be referred to as an Improvised Explosive Device (IED).
Bomb Threat	A threat, written or verbal, delivered by electronic, oral or other medium, threatening to place or uses an explosive, chemical, biological or radiological device at a time, date, and place or against a specific person or organization. It is not necessary for any other action to be taken by the offender.
Cyclone	A weather system consisting of an area of low pressure, in which winds circulate at speeds exceeding 61 km/hr, also known as 'Cyclone' or Tropical Storm. These are non-frontal synoptic scale weather systems originating over tropical waters with organized convention and definite cyclonic surface wind circulation. Winds rotate around the low pressure centre in an anti-clockwise direction in the Northern Hemisphere and in a clockwise direction in the Southern Hemisphere.
Depression (low pressure area)	Region where the barometric pressure is lower relative to that in the surrounding regions at the same level and wind speed in circulation is between 17 and 27 knot (31 and 49 kmph).
Disaster	As per Disaster Management Act, 2005 "Disaster means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected areas."
Doppler Radar	Radar capable of measuring the change in frequency of a radar wave caused by the relative motion of an object in the atmosphere within the area of radar coverage.
Earthquake	A sudden slipping or movement of a portion of the earth's crust, accompanied and followed by a series of vibrations.
Emergency	An emergency is a dangerous event or circumstance that normally can be managed at the local level.
EMERGENCY RESPONSE TEAM (ERT)	Specialist or specially trained personnel to attend to specific incidents to contain control or eliminate the emergency using emergency response equipment. The ERT may be in place longer than the ECO which is primarily focused around evacuation.
Epicenter	The place on the earth's surface directly above the point on the fault where the earthquake ruptures began. Once fault slippage begins, it expands along the fault during the earthquake and can extend hundreds of miles before stopping.
Evacuation	The orderly movement of people from a place of danger.
Evacuation	Organized, phased and supervised dispersal of people from dangerous or potentially dangerous areas.
Explosion	A sudden release of energy characterized by accompaniment of a blast wave.
Eye of the Cyclone	A term used for the centre of a cyclone. It is the point where the wind rotates in a counter-clockwise direction. In the centre of eye the wind is calm or slight and rainfall and cloudiness is nil or light.

Fault	The fracture across which displacement has occurred during an earthquake. The slippage may range from less than an inch to more than 10 yards in a severe earthquake.

Fire	A process of combustion characterized by heat or smoke or flame or any combination of these. Hazard - any situation that has fire potential.
Gale	Wind with a speed between 34 and 40 knots (Beaufort scale wind force 8).
Hazard	A hazard is a dangerous event or circumstance that has the potential to lead to an emergency or disaster.
Knot	A knot is a unit of speed and used around the world for maritime and aviation purposes. 1 international knot = 1 nautical mile per hour = 1.852 kilometers per hour.
Landfall	A point on the land where a cyclone just crosses the coast.
Magnitude	The amount of energy released during an earthquake, which is computed from the amplitude of the seismic waves. A magnitude of 7.0 on the Richter scale indicates an extremely strong earthquake. Each whole number on the scale represents an increase of about 30 times more energy released than the previous whole number represents. Therefore, an earthquake measuring 6.0 is about 30 times more powerful than one measuring 5.0.
Mitigation	Activities taken to reduce the severity or consequences of an emergency.
Mitigation	Mitigation means measures aimed at reducing the risk, impact or effects of a disaster or threatening disaster situation.
Personal Emergency Evacuation Plan (Peep)	An individualized emergency plan designed for an occupant with a disability who may need assistance during an emergency.
Physically Challenged Person	The official definition of a disabled person, while helpful in determining who should have a PEEP, may not cover the full range of personnel for whom effective evacuation may be compromised. Obese personnel and those with an illness or injury that is not chronic or permanent may also need assistance in the event of an emergency. Consideration must be given in times of emergency as to the additional resource required to handle both known PEEP holders and persons for whom effective evacuation may prove problematic.
Preparedness	Activities, tasks, programs, and systems developed and implemented prior to an emergency that are used to support the prevention of, mitigation of, response to and recovery from emergencies. It is the state of readiness to deal with a threatening disaster situation or disaster and effects thereof.
Probability (P)	The expression for the likelihood of an occurrence of an event or an event sequence or the likelihood of the success or failure of an event on test or demand.
Recovery	Efforts to return to normal life and protect against future hazards.
Refuge	An area on a floor or area that is specifically designed to protect people from heat, smoke and toxic gases and which provides direct access to an exit.
Response	Immediate and ongoing activities, tasks, programs, and systems to manage the effects of an incident that threatens life, property, operations, or the environment.
Response	Conducting emergency operations to save lives and properties by positioning emergency equipments and supplies, evacuating potential victims, providing food, water, shelter and medical care to those in need and restoring critical

	services.
Seismic Waves	Vibrations that travel outward from the earthquake fault at speeds of several miles per second. Although fault slippage directly under a structure can cause considerable damage, the vibrations of seismic waves cause most of the destruction during earthquakes.
Severity (S)	The expression for the consequence seriousness associated with each deviation.
Smoke	Smoke is defined as a mixture of hot vapors and gases produced by the combustion process along with unburned decomposition, condensation matter and the quantity of air that is entrained or otherwise mixed in to the air
VISITOR	A person who is within a facility who is temporarily visiting the facility and is not employed at or for the facility, either on a permanent, casual, temporary, contracting basis, a resident or inmate or studying at the facility. Visitor implies that the person has not received an induction to the Precinct.
Vulnerability	Vulnerability is a concept which describes constraints of an economic, social, ethnic, physical or geographic nature which reduce the ability to cope with the impact of hazards.

ANNEXURE 3: DIRECTORIES (EMERGENCY CONTACT NUMBERS)

S. N.	DESCRIPTION	CONTACT NUMBER
	FIRE BRIGADE	
1	Emergency Control Room.	101 / 309-5991 / 309-5992
2	Fire Station (Vijay Marg), New Panvel.	022 - 2745 2337
3	TBIA Fire station.	022 - 27780207/ 27780208
4	ONGC, Panvel.	022 - 27451069, 27451070
	POLICE	
1	Police Control Room, Raigad.	02141 - 222 100
2	Police Head Quarter Office.	02141 – 222053
3	District Superintendent of Police, Raigad	02141 - 222 093
4	District Superintendent of Police, Raigad Office	02141 - 222 028
5	D.Y.S.P. Head Quarter, Alibaug.	02141- 222 007
6	Shri. Vijay T. Pandharpatte - S.D.P.O., Khalapur.	02192 - 275295, 269050
7	PI Shri. Vikas R. Ramgude, Khalapur Police Station.	02192 – 275033
8	PI Shri. Manoj M. Mhatre - Traffic Branch, Raigad.	8380091520
	MEDICAL ASSISTANCE (Hospitals, Ambulance).	
1	Dhirubhai Ambani Hospital, Lodhivali.	02192 - 255 141
2	Kalpataru Mother and Child Hospital, Rasayani.	02192 - 250 349
3	Indira Gandhi General Hospital, Uran (Muncipal).	022 - 27222233, 27222722
4	Lifeline Hospital, Panvel.	022 - 6156 7000
5	Unnati Hospital And ICU, Old Panvel	022 - 2746 6292
6	New Spandan Multispeciality Hospital, New Panvel.	093213 58053
7	Palvi Hospital, Uran.	022 - 2722 2561
	ADMINISTRATION/ REGULATORY AGENCIES	
1	Mantralaya Control.	022 – 2202 7990. Ext. 3551
2	District Collector & District Magistrate, Raigad.	02141 - 222 001
3	Adl. District Collector, Raigad.	02141 - 222 086
4	Sub-Divisional Officer, Panvel.	022 - 2745 2328
5	Tahasildar, Khalapur.	02192 – 275048
6	Block Development Officer, Khalapur.	02192 – 275043
7	Chief Executive Officer, Zilla Parishad, Raigad.	02141 – 222024
8	C.J.J.D., Court, Khalapur.	02192 – 275228
9	Khalapur Post Office.	02192 – 275030
10	Executive Engg. (Works Dept.), ZP, Raigad.	02141 – 222003
11	Executive Engineer (Village Water Supply).	02141 – 222211
12	Rapid Action Force Camp, Taloja.	022 – 27410710
13	Civil Defence, Uran.	022 - 27221355, 27222343
14	Home Guard.	022 - 22842423, 22831952
15	Depot Manager, ST Depot, Panvel.	022 - 27452701, 27465147
	KEY PERSONNEL CONTACT PHONE NUMBERS	
1	**Claridge SEZ Developers P. Limited.** 104, Mittal Chambers, 10th Floor, Nariman Point, Mumbai.	022 - 6508 5666

ANNEXURE 4: ABBREVIATIONS

AFFF.	Aqueous Film Forming Foam.
AP.	Assembly Point.
C.T.S.	City Survey Number.
CCTV.	Close Circuit Television.
CO.	Carbon Monoxide.
CSC.	Chief Site Controller.
DC.	Development Code.
DDMA.	District Disaster Management Authority.
DG Set.	Diesel Operated Generator Set.
DM.	Disaster Management.
ECC.	Emergency Control Center.
ERT.	Emergency Response Team.
HOD.	Head Of Department.
IAP.	Incident Action Plan.
IDRN.	India Disaster Resource Network.
IRT.	Incident Response Team.
Kmph	Kilometer Per Hour.
KW/$m^{2.}$	Kilowatt Per Square Meter.
LEL.	Lower Explosive Limit.
LPG.	Liquefied Petroleum Gas.
Max.	Maximum.
MCGM.	Municipal Corporation Of Greater Mumbai.
Min.	Minimum.
NBC.	National Building Code.
NDMA.	National Disaster Management Authority.
NDRF.	National Disaster Response Force.
NGO's.	Non-Governmental Organizations.
PAS.	Public Address System.
PEEP.	Personal Emergency Evacuation Plan.
PNG.	Piped Natural Gas.
PPE.	Personal Protective Equipment.
SAR.	Search And Rescue.
SCBA.	Self-Contained Breathing Apparatus.
SMS.	Short Message Service.
SoP's.	Standard Operating Procedures.
TV.	Tele Vision.
ULB's.	Urban Local Bodies.

ANNEXURE 5 : COMPLIANCE.
PROJECT SPECIFIC DISASTER MANAGEMENT PLAN.

1	**Risk Assessment & Vulnerability Analysis of possible disasters.**	**Section 2**
2	**Mitigation & Preparedness**	
	Prepare SOP's for each disaster and for evacuation when necessary.	**Section 9**
	Prepare Inventory of Resources (Rescue equipment, medical equipment for emergencies, ambulances, hospitals, NGO's and disaster management related material & personnel).	**Section 8.1**
	▪ Maintenance of systems/ equipment necessary for tackling disaster.	**Section 8.1, 8.2**
	▪ Warning Systems	**Section 3.4**
	▪ Devise system for two-way communication with the affected persons in the building especially in lifts and rooms.	**2 (6) of each SOP in section 9**
	▪ Organize extensive training for disaster managers and assistants.	**Section 5.6**
3	**Response Plan.**	**Section 6**
	Identify site disaster manager for handling disasters with clearly enumerated functions.	**Section 6.1** **2 of each SOP in section 9**
4	**Control Room**	
	Earmark a specific area to function as Control Room for disaster management.	**Section 5.2.1**
	Display proper maps- Telephone nos. of disaster controlling authorities showing Fire Fighting equipment's, Refuge floors, Sprinkler System etc.	**Directory in Annexure 2** **Maps in Section 1 & 5**
	Display evacuation plan in times of disaster.	**Section 5. 3**
	Prepare & disseminate pamphlets on each disaster for occupants covering Do's and Don'ts for each type of disaster.	**Annexure 1**
5	**On-Set of disaster**	
	Site disaster manager to take charge and give guidance over public address system.	**2(1) of each SOP in section 9**
	Call for outside assistance of fire brigade, Hospitals, ambulances.	**3(2) of each SOP in section 9**
	Network with State, district and ward level control rooms.	**Section 4**
	Ensure adequate warning before switching off Power.	**6(6) of each SOP in section 9**
	Assure occupants of continuous communication and take all measures to keep up their morale.	**3(7) of each SOP in section 9**
	Guide occupants on the steps being taken for evacuation in a systematic manner.	**2(7) of each SOP in section 9**
	Take steps to Reduce/eliminate panic.	**3(6) of each SOP in section 9**
	Liaise with Law & Order machinery.	**3(8) of each SOP in section 9**
6	**Preventive Measures**	
	Regular inspection of equipment and systems mandated by Chief Fire Officer in the NOC granted.	**Section 3.1**
	Scrupulous adherence to approved plan of building and protection of system put in place to handle disaster.	**Section 3.2**
	Regular maintenance of equipment and systems.	**Section 3.3**

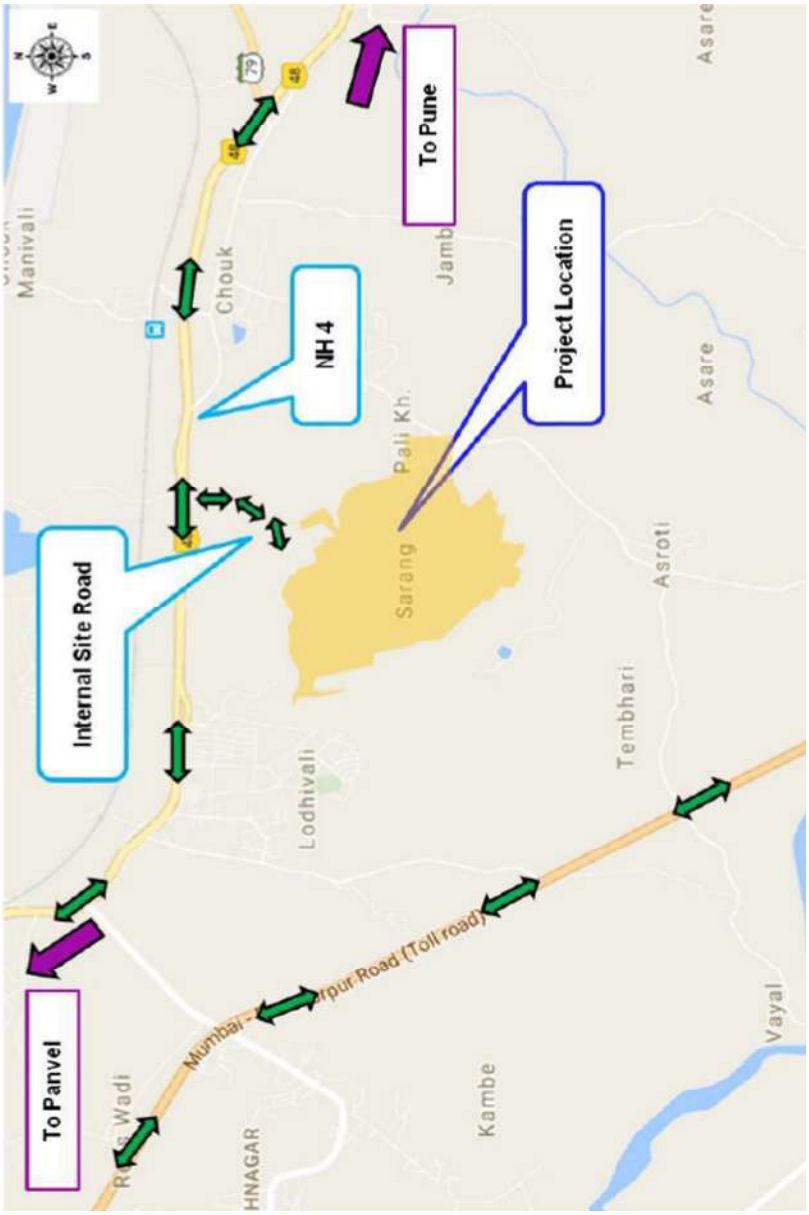
N O T E S

LIVE PAGE: This page is kept intentionally blank to add on updating information and additions visualized (if any) during Mock Drill exercises OR for notes during emergency

Any change in contact numbers, names or relevant details are to be recorded on this page from time to time.

REVISION: These notes are to be considered during subsequent DMP revision.

SITE SURROUNDING



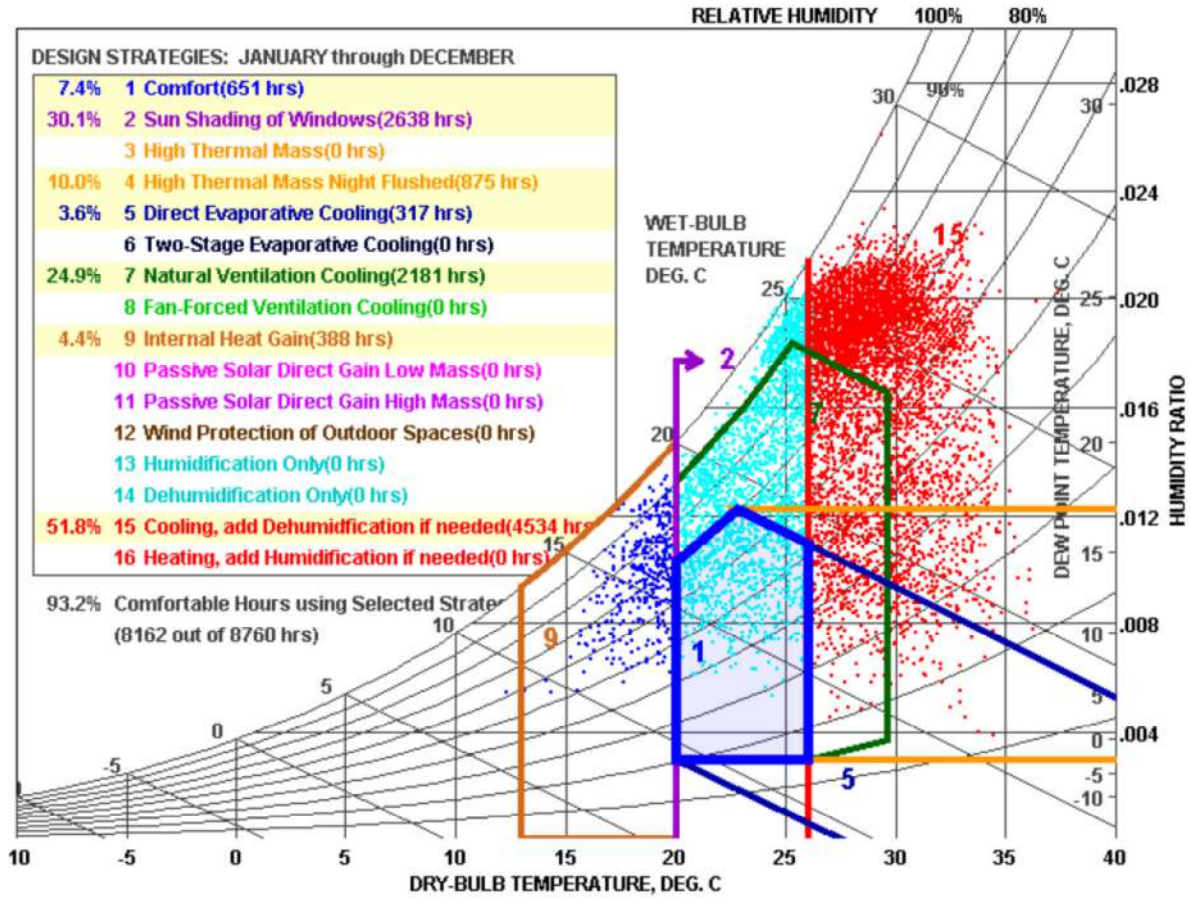
6.2 BUILDING PERFORMANCE ANALYSIS REPORT:

The specific objective of this report is to define design parameters for ECBC Compliance for maximum Energy Efficiency

The report is structured as follows:

- Climate Analysis
- Heat Island Effect (HIE) Strategies
- Shading Design
- Heat Gain Calculation
- Envelope Details
- ECBC -2007 Compliance Residential
- ECBC -2017 Compliance Commercial

- **Climatic Analysis:**

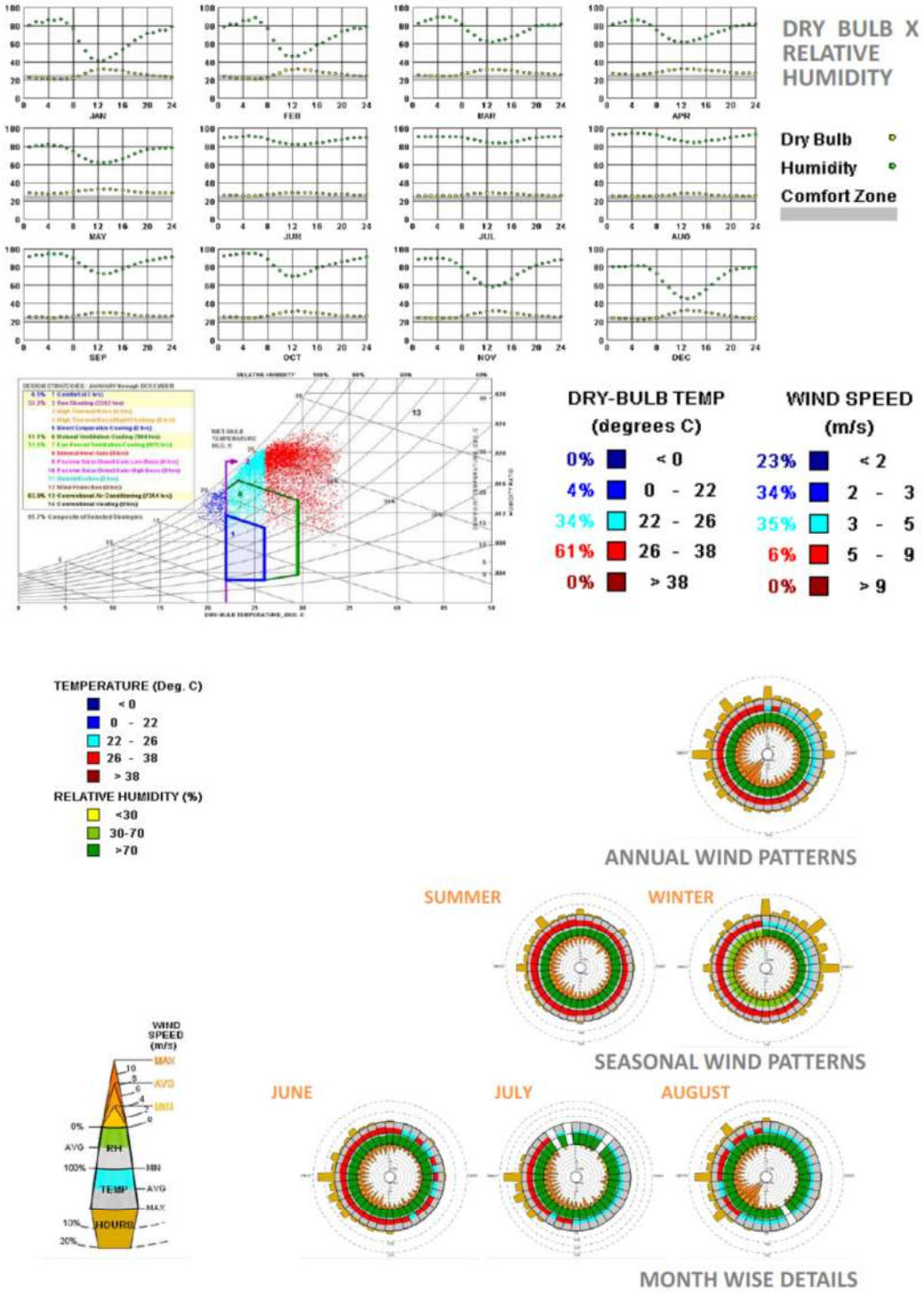


The Psychrometric Chart above explains that, no other strategy is effective for passive comfort except Shading & Ventilation. Around 20% of total comfort hours can be achieved by Sun Shading & Natural Ventilation. 10% can be achieved by ceiling fan forced ventilation & for the rest 70% of the time air conditioning may be required. For this analysis, the Comfort Criterion was set at 22 to 26 degree C for dry bulb temperature & relative humidity to 70%.

The graph plot on next page clearly shows the degree difference between the Dry Bulb Temperature & Relative Humidity. That's why strategies like Evaporative cooling, Thermal mass, Night purging etc. will not be effective at all. The Pshychrometric Chart above confirms that the only two effective strategies are Shading & Ventilation. As per the legend, at least 30% of the total hours are in comfort range with an effective wind speed of 3 to 5 m/s. Fan forced ventilation is certainly an effective strategy &

comparatively cheaper than AC..

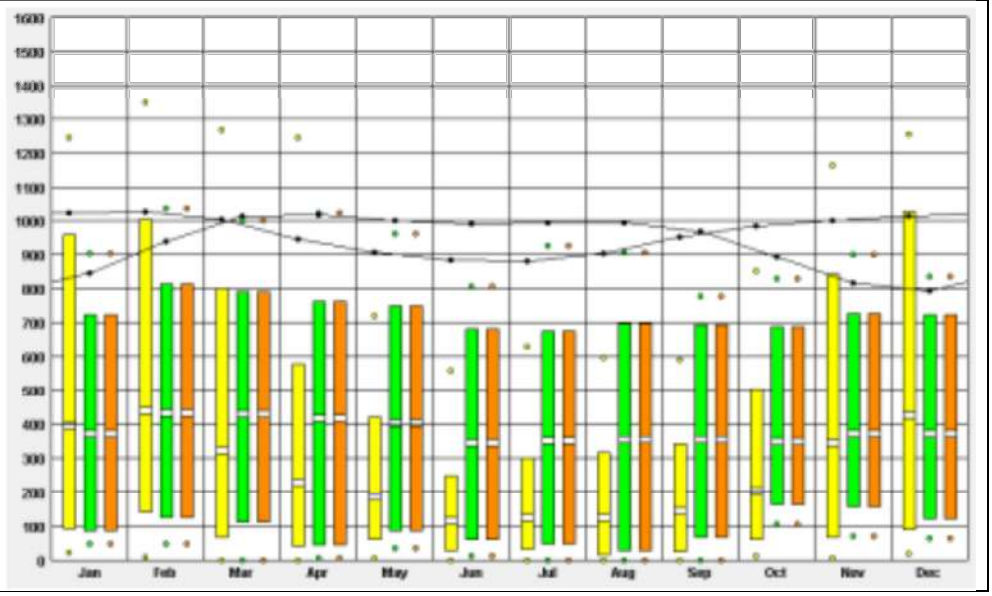
Next is he annual wind pattern of Mumbai city. The purpose is to understand this Wind Pattern. If you observe the legend carefully, you will understand that, 10% of the total annual wind is flowing from West direction, which has a temperature C, with a humidity around 70% & maximum wind speed is 8 m/s at one point of time. The predominant wind direction in Monsoon Period is West – South-West.



- **Heat Island Effect:**

Urban development has serious effects on the global environmental quality, including the quality of air, increase in temperature and traffic congestion. Construction of building itself is related to global changes in terms of increase of urban temperatures, the rate of energy consumption, the increased use of raw materials, pollution and the production of waste, conversion of agricultural land to developed land, loss of biodiversity and water scarcity. An urban heat island is a climatic phenomenon in which urban areas have higher air temperature than their rural surroundings as a result of anthropogenic modifications of land surfaces, significant energy use and its consequent generation of waste heat. Thus, this might prove to be an unsustainable factor that leads to excessive energy use for cooling and putting the urban population at great risk for morbidity and mortality. According to the above perspective and considering that rapid and huge population growth is expected in the near future, it becomes increasingly important to apply heat island mitigation strategies in order to reduce energy consumption and improve the quality of life.

Effects of Urban Heat Island

• Increase in cooling demand • Increase in energy usage; • Increased air pollution; • Increased CO2 emissions; • Climate change; • Increase Health problems • Heat related illness & death; • Impaired water quality	

Conclusion:

Strategies like High SRI paint, Solar Panels on roof, Light Coloured or Open Grid Pavers, Shaded Streets, Maximum Green Area etc. can reduce heat island effect, surface absorbed radiation resulting is reduction of cooling loads

Case 1: The case has been assumed with all the proposed buildings with convectional finish on top, asphalt road and dark colored paving on site without any green space.	**Case 2:** The case has been proposed with light coloured road surface and paver blocks with green space in open area areas which is help to reduce urban air temperature in surroundings.

High SRI Paints

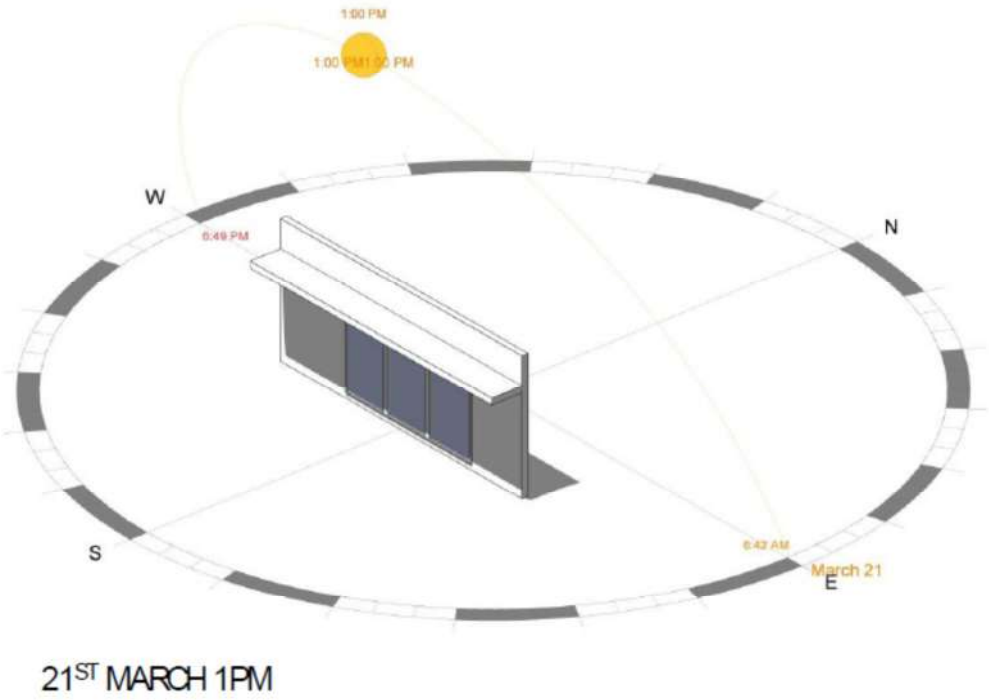
Light Colored Paver Block

Light Coloured & Shaded Roads

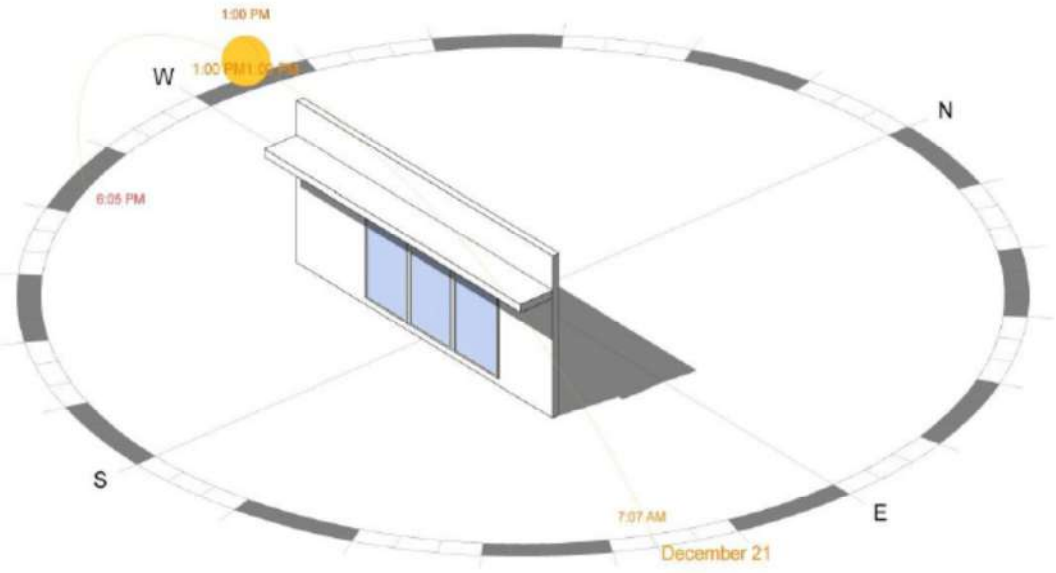
Green Open Area

Shading Design:

Following images confirm that, with the proposed shades of 600 – 750 mm deep, windows are completely shaded in summer season blocking summer heat & welcoming winter sun when it is required.



21ST MARCH 1PM

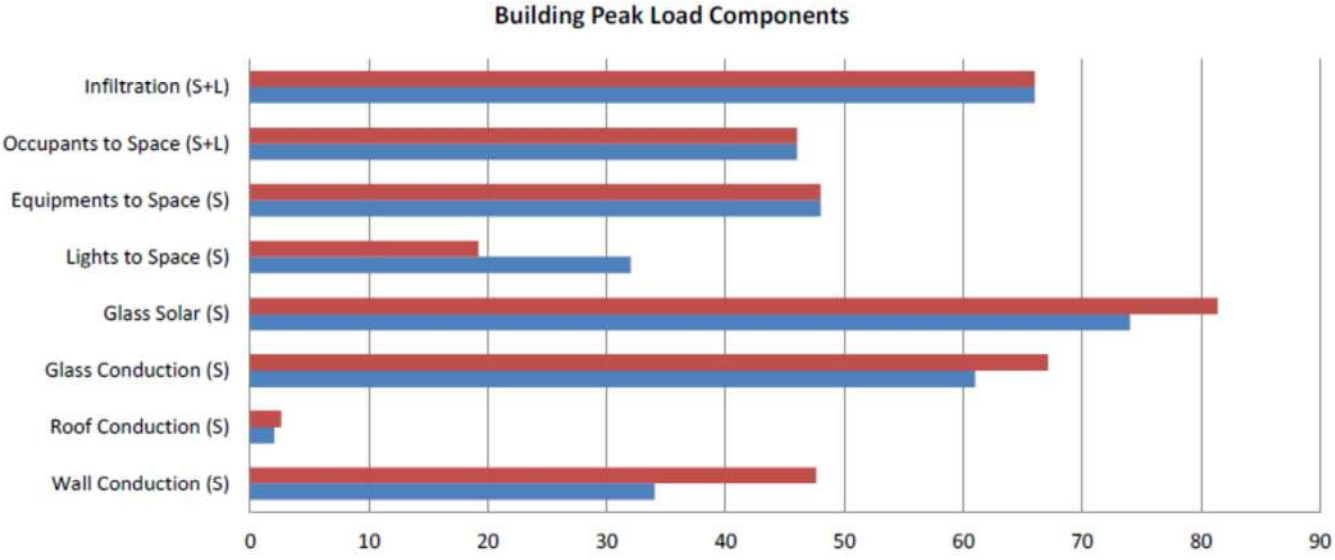


21ST DECEMBER 1PM

- **Heat Gain Calculation:**

The building heat gain comparison between base case & proposed case is as follows. It is clearly observed from the table below that, for a naturally ventilated residential building, Envelope Shading is also an effective strategy along with insulation. Though the Base case (With Insulation – Without Shading) still has a lesser heat gain as compared to Proposed case (Without Insulation – With Shading), but the difference is marginal & can be easily compensated by reducing lighting & Equipment consumptions. This is possible mainly because Reduced Sol Air Temp & Shaded Walls, Windows & Roof.

Peak Condition - 1 May 2 pm			
No.	**Description**	**Heat Gain in kW Base Case Sensible + Latent**	**Heat Gain in kW Proposed Case Sensible + Latent**
1.	Wall Conduction (S)	34	48
2.	Roof Conduction (S)	2	3
3.	Glass Conduction (S)	61	67
4.	Glass Solar (S)	74	81
5.	Lights to Space (S)	32	19
6.	Equipments to Space (S)	48	48
7.	Occupants to Space (S+L)	46	46
8.	Infiltration (S+L)	66	66
9.	**Total Load**	**363**	**378**
10.	**% Increase**	**3.94**	



	Wall Conduction (S)	Roof Conduction (S)	Glass Conduction (S)	Glass Solar (S)	Lights to Space (S)	Equipments to Space (S)	Occupants to Space (S+L)	Infiltration (S+L)
Proposed Case	48	3	67	81	19	48	46	66
Basecase	34	2	61	74	32	48	46	66

- **Envelope Details:**

Calculation of 'U' Value for A Wall Section –

No.	**Material Specification**		**R' Value**
1.	Outside Air Film	-	0.17
2.	1" Cement Plaster	-	0.20
3.	8" AAC Wall	-	8. 00

4.	1” EPS Insulation	-	4.00
5.	½” Cement Plaster	-	0.10
6.	Inside Wall Air Film	-	0.68
			13.15

Therefore,

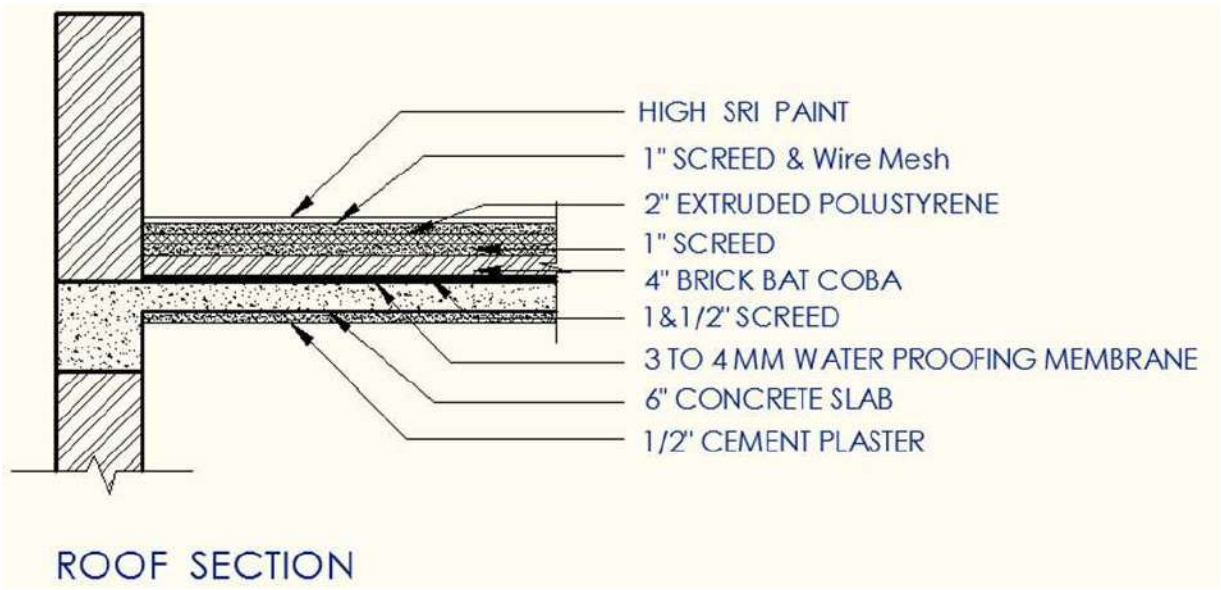
‘R’ Value of Vertical surface (Wall)	**-**	13.15 h ft^2 f/btu.
‘U’ Value - 1 / R - 1 / 13.15	**-**	0.076 btu/h ft2 f. -
Value in W/Sq.m.K	**-**	0.43 W/Sq.m.K

Calculation Of ‘U’ Value For A Roof Section -

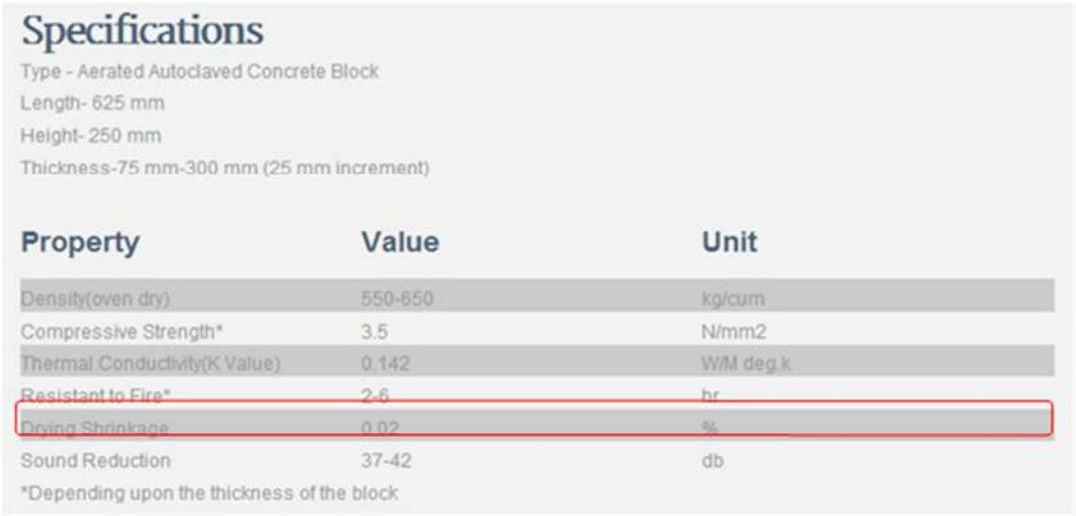
No.	**Material Specification**		**‘R’ Value**
1.	Outside Air Film	–	0.17
2.	Floor Finish	–	0.15
3.	1” Screed	–	0.20
4.	2” XPS Insulation	–	12.0
5.	1” Screed	–	0.20
6.	6” Concrete Slab	–	0.60
7.	½” Cement Plaster	–	0.10
8.	Inside Ceiling Air Film	–	0.61
			14.03 h ft2 f/btu

Therefore,

‘R’ Value of horizontal surface (Roof)	-	14.03 h ft2 f/btu.
‘U’ Value - 1 / R - 1 / 14.03	-	0.071 btu/h ft2 f.
Value in W/Sq.m.K	-	0.404 W/Sq.m.K



AAC Block Cut sheet -



Specifications

Type - Aerated Autoclaved Concrete Block
Length- 625 mm
Height- 250 mm
Thickness-75 mm-300 mm (25 mm increment)

Property	Value	Unit
Density(oven dry)	550-650	kg/cum
Compressive Strength*	3.5	N/mm2
Thermal Conductivity(K Value)	0.142	W/M deg.k
Resistant to Fire*	2-6	hr
Drying Shrinkage	0.02	%
Sound Reduction	37-42	db

*Depending upon the thickness of the block

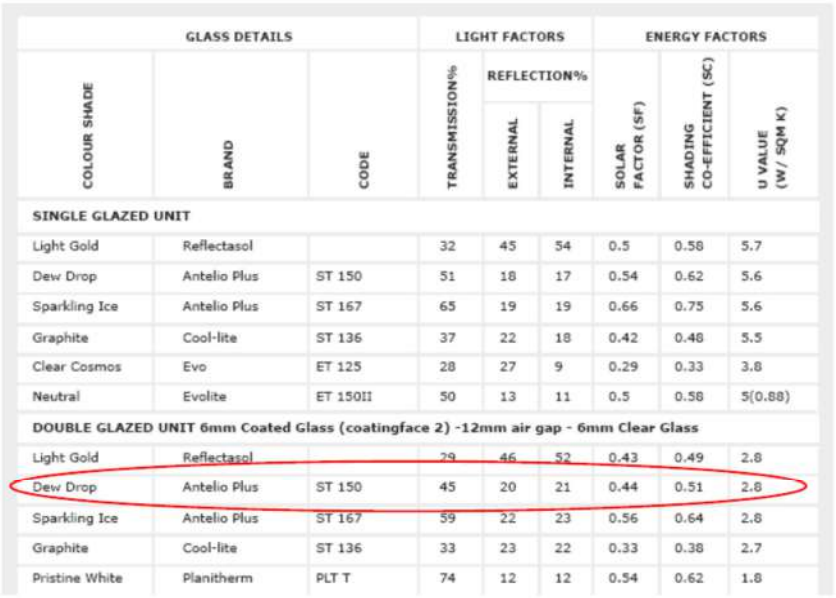
Thermal conductivity of 0.14 results is R Value of around 1.0 per inch.

- **Renewable Energy Calculation:**

Phases	Connected Load (kW)	Maximum Demand (kW)	1% of Maximum Demand	Solar PV Capacity Provided
1	68265	27027	270.47	666
2	42884	18194	181.94	480
3	94220	36946	369.46	792
4	57340	37363	373.63	257
5	26208	10195	101.95	344
6	20341	6985	69.85	318

Total Connected Load	3,09,258 kW
Total Demand Load	1,36,730 kW
Total Solar PV Proposed	2,857 kW (2.09% of Maximum Demand)

Glass Cut sheet:



GLASS DETAILS			LIGHT FACTORS			ENERGY FACTORS		
COLOUR SHADE	BRAND	CODE	TRANSMISSION%	REFLECTION% EXTERNAL	REFLECTION% INTERNAL	SOLAR FACTOR (SF)	SHADING CO-EFFICIENT (SC)	U VALUE (W/ SQM K)
SINGLE GLAZED UNIT								
Light Gold	Reflectasol		32	45	54	0.5	0.58	5.7
Dew Drop	Antelio Plus	ST 150	51	18	17	0.54	0.62	5.6
Sparkling Ice	Antelio Plus	ST 167	65	19	19	0.66	0.75	5.6
Graphite	Cool-lite	ST 136	37	22	18	0.42	0.48	5.5
Clear Cosmos	Evo	ET 125	28	27	9	0.29	0.33	3.8
Neutral	Evolite	ET 150II	50	13	11	0.5	0.58	5(0.88)
DOUBLE GLAZED UNIT 6mm Coated Glass (coatingface 2) -12mm air gap - 6mm Clear Glass								
Light Gold	Reflectasol		29	46	52	0.43	0.49	2.8
Dew Drop	Antelio Plus	ST 150	45	20	21	0.44	0.51	2.8
Sparkling Ice	Antelio Plus	ST 167	59	22	23	0.56	0.64	2.8
Graphite	Cool-lite	ST 136	33	23	22	0.33	0.38	2.7
Pristine White	Planitherm	PLT T	74	12	12	0.54	0.62	1.8

ECBC Compliance – Residential

No.	Model Input Parameter	Baseline Case (As per ECBC 2007)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.43 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 409 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 2" XPS Insulation U-factor = 0. 404 W/Sq.m.K
3.	**Glazing**	U Value: 3.3 W/Sq.m.K SHGC (All) : 0.25 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value : 2.80 W/Sq.m.K SHGC : 0.44 VLT : 45% For Fenestration Assembly
4.	**WWR**	30%	30%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	15 W/m^2	15 W/m^2
7.	**Pumps & Motors**	Standard Efficiency – 70%	High Efficiency – 85%
8.	**Lighting Power Density**	7.5 W/m^2	7.5 W/m^2
9.	**External Lighting Load**	Efficacy 60 Lumen / W	Efficacy 50 Lumen / W
10.	**Domestic Hot Water Generation**	20% on Solar (20 ltr/person/day)	20% on Solar (20 ltr/person/day)
11.	**HVAC System Type**	Packaged Single Zone (Split Unit) with COP 3.0.	Packaged Single Zone (Split Unit) with COP 3.0.
12.	**Process Loads**	As per Design	As per Design
13.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
14.	**PF Correction**	0.95	0.95
15.	**Power Distribution Losses**	<1%	<1%

ECBC Compliance – Commercial (Office/IT/Convention Centre)

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	15 W/m^2	15 W/m^2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	9.5 W/m^2	7.5 W/m^2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As Per Annexure I	As Per Annexure I
12.	**Domestic Hot Water Generation**	Not Applicable	Not Applicable
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Under Floor Air Distribution System
16.	**Ventilation Requirement As per ASHRAE 62.1**	11 cfm / Person	15 cfm / Person
17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	**VSD's on Chiller**	Not Applicable	Recommended
19.	**VFD's on Cooling Tower**	Recommended	Recommended
20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
22.	**HVAC System**	AHU with VFD	AHU with VFD
23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
24.	**Demand Control Ventilation**	Not Applicable (Applicable for ECBC + & Super ECBC)	CO2 Sensors to modulate fresh air
25.	**Heat Recovery Wheel**	Not Applicable (Applicable for Hotel & Healthcare)	Recommended to precool the fresh air
26.	**Airside Economizer**	Not Applicable for Warm	Not Recommended (No Free Cooling)

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
		Humid Climate	
27.	**CO Sensors**	Not Applicable	Recommended in Basement Areas
28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
29.	**PF Correction**	0.97	0.97
30.	**Power Distribution Losses**	<3%	<3%

ECBC Compliance – School building

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	10 W/m2	10 W/m2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	11.2 W/m2	11.2 W/m2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per Annexure I	As per Annexure I
12.	**Domestic Hot Water Generation**	Not Applicable	Not Applicable
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable
16.	**Ventilation Requirement As per ASHRAE 62.1**	10 cfm / Person	10 cfm / Person
17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	**VSD's on Chiller**	Not Applicable	Recommended
19.	**VFD's on Cooling Tower**	Recommended	Recommended
20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
22.	**HVAC System**	AHU with VFD	AHU with VFD
23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
24.	**Demand Control Ventilation**	Not Applicable (Applicable for ECBC + & Super ECBC)	Not Recommended
25.	**Heat Recovery Wheel**	Not Applicable (Applicable for Hotel & Healthcare)	Not Recommended
26.	**Airside Economizer**	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
27.	**CO Sensors**	Not Applicable	No Basement
28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
29.	**PF Correction**	0.97	0.97
30.	**Power Distribution Losses**	< 3%	< 3%

ECBC Compliance – Healthcare building

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
31.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
32.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
33.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
34.	**WWR**	<40%	<40%
35.	**Shading**	No shades	As per Design
36.	**Equipment Power Density**	25 W/m^2	25 W/m^2
37.	**Pumps & Motors**	IE2	IE3
38.	**Lighting Power Density**	9.7 W/m^2	9.7 W/m^2
39.	**Occupancy Sensors**	Recommended in all non-regularly occupied area	Recommended in all Non-Regularly occupied areas
40.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
41.	**External Lighting Load**	As per Annexure I	As per Annexure I
42.	**Domestic Hot Water Generation**	40% on solar (20 ltr/person/day & process water)	40% on solar (20 ltr/person/day & process water)
43.	**Process Loads**	As per Design	As per Design
44.	**Renewable Energy**	1% of the peak demand	Solar PV recommended equal to 1% of peak demand load
45.	**Data Server Loads**	Not Applicable	Not Applicable
46.	**Ventilation Requirement As per ASHRAE 62.1**	Patient Rooms: 10 cfm / Person Medical Procedure: 20 cfm / Person Operating Rooms: 20 cfm / Person Physical Therapy: 20 cfm / Person	Patient Rooms: 13 cfm / Person Medical Procedure: 26 cfm / Person Operating Rooms: 26 cfm / Person Physical Therapy: 26 cfm / Person
47.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
48.	**VSD's on Chiller**	Not Applicable	Recommended
49.	**VFD's on Cooling Tower**	Recommended	Recommended
50.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
51.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
52.	**HVAC System**	AHU with VFD	AHU with VFD
53.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
54.	**Demand Control**	Not Applicable	CO2 Sensors to modulate fresh air

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
	Ventilation	(Applicable for ECBC+ & Super ECBC)	
55.	**Heat Recovery Wheel**	Recommended	Recommended to precool the fresh air
56.	**Airside Economizer**	Not Applicable for warm humid climate	Not Recommended (No Free Cooling)
57.	**CO Sensors**	Not Applicable	Recommended in Basement Areas
58.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
59.	**PF Correction**	0.97	0.97
60.	**Power Distribution Losses**	<3%	<3%

ECBC Compliance – Hospitality Building

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	<40%	<40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	20 W/m^2	20 W/m^2
7.	**Pumps & Motors**	IE2	IE3
8.	**Lighting Power Density**	9.5 W/m^2	9.5 W/m^2
9.	**Occupancy Sensors**	Recommended in all non-regularly occupied area	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per table in Annexure I	As per table in Annexure I
12.	**Domestic Hot Water Generation**	40% on solar (20 ltr/person/day & process water)	40% on solar (20 ltr/person/day & process water)
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable
16.	**Ventilation Requirement As per ASHRAE 62.1**	Office/Lockers: 10 cfm / Person Dining/Kitchen: 15 cfm / Person Spa & Gym: 25 cfm / Person Bar & Lounge: 13 cfm / Person	Office/Lockers: 13 cfm / Person Dining/Kitchen: 20 cfm / Person Spa & Gym: 33 cfm / Person Bar & Lounge: 17 cfm / Person
17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	**VSD's on Chiller**	Not Applicable	Recommended
19.	**VFD's on Cooling Tower**	Recommended	Recommended
20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
22.	**HVAC System**	AHU with VFD	AHU with VFD
23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
24.	**Demand Control**	Not Applicable	CO2 Sensors to modulate fresh

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
	Ventilation	(Applicable for ECBC+ & Super ECBC)	air
25.	**Heat Recovery Wheel**	Recommended	Recommended to precool the fresh air
26.	**Airside Economizer**	Not Applicable for warm humid climate	Not Recommended (No Free Cooling)
27.	**CO Sensors**	Not Applicable	Recommended in Basement Areas
28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
29.	**PF Correction**	0.97	0.97
30.	**Power Distribution Losses**	<3%	<3%

- **External Building Lighting Power Density as per ECBC 2017:**

Exterior Building Lighting Power for ECBC Buildings

Exterior Lighting Application	Power Limits
Building Entrance (with canopy)	10 W/m^2 of canopied area
Building Entrance (w/o canopy)	90 W/linear m of door width
Building exit	60 W/lin m of door width
Building facade	5.0 W/ m^2 of vertical façade area
Emergency signs, ATM kiosks, Security area facade	1.0 W/ m^2
Driveways and parking (open/external)	1.6 W/ m^2
Pedestrian walkways	2.0 W/ m^2
Stairways	10.0 W/ m^2
Landscaping	0.5 W/ m^2
Outdoor sales area	9.0 W/ m^2

- **Building Envelope Sealing Requirement as per ECBC 2017**

- **Building Envelope Sealing**

Following area of the building envelope, of all except naturally ventilated buildings or spaces, shall be sealed, caulked, gasketed, or weather-stripped

a) Joints around fenestrations, skylights, and door frames
b) Opening between walls and foundations, and between walls and roofs, and walls and panels
c) Openings at penetrations of utility services through roofs, walls, and floors
d) Site-built fenestrations and doors
e) Building assemblies used as ducts or plenums
f) All other openings in the building envelope
g) Exhaust fans shall be fitted with a sealing device such as a self-closing damper
h) Operable fenestration should be constructed to eliminate air leakages from fenestration frame and shutter frame

6.3 Carbon Footprint Analysis:

Carbon Footprint (tCO_2e/year) = Savings in Power Consumption (in MWh/year) X Grid Emission Factor (tCO_{2e}/MWh)
Grid Emission Factor 0.977 tCO_{2e}/MWh
Carbon Footprint (tCO_2e/year) = 85,820.25 in MWh/year X 0.977 tCO_{2e}/MWh = 83,846.38 tCO_2e/year

- **Summary of Carbon Footprint and reduction**

No.	Parameter	Unit	Value
1	Total carbon footprint from diesel consumption for running DG sets	tCO_2e/year	1,077.99
2	Total carbon footprint from electricity consumption for the entire project	tCO_2e/year	7,83,595.27
3	Percentage of carbon footprint reduction by energy saving measures, use of solar energy and biogas	tCO_2e/year	83,846.38
4	Percentage of carbon footprint reduction from use of energy saving measures, solar lights and biogas for running solar lights	%	29.55%

Detailed carbon footprint analysis report is enclosed as **Enclosure 12.**

CHAPTER 7
PROJECT BENEFITS

CHAPTER 7
PROJECT BENEFITS

This chapter includes benefits accruing to the locality, neighborhood, region and nation as a whole. The foremost benefits are listed as follows;

A	**SOCIO ECONOMY**
1.	The construction of project is in 6 phases and would require 300 skilled and unskilled labours. In each phase local people would benefit the employment opportunities.
2.	Civil works for the construction of buildings may require local sub-contractors, hardware and raw material suppliers thus benefitting and providing small business opportunities to few in the nearby villages.
3.	One Hospital (150 bedded) with Doctor and other supporting staff has been planned in the project. The area with poor health care facility would benefit from this hospital as it has capacity to cater to the population.
4.	A primary and Secondary school with a capacity of 7620 students and 762 staff would benefit the nearby village population.
5.	The completion of project will eventually lead to permanent job opportunities to the local & nearby villagers as there would be increased demand for security, kitchen help, etc.
6.	There would be convenient shops which could provide livelihood opportunity to more than 200 persons after completion. The total commercial space in the project would need a staff of about 100 persons.
7.	A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary.
B	**TREE PLANTATION AND LANDSCAPING**
1.	Plantation shall reduce energy use by reducing heat island effect
2.	Pleasing aesthetic and visual impact
3.	Provide tolerance to air pollutants like PM10, PM2.5, SO2, NOx and CO
4.	Trees act as natural noise barriers
C	**WATER SAVING AND WASTE WATER MANAGEMENT**
1.	For fulfilling the construction water requirement of initial phase proponents are planning to use water tankers. After commissioning of initial phase the treated sewage from those phases shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity.
2.	By using treated sewage for flushing & gardening and minimizing the requirement of fresh water from Maharashtra Jeevan Pradhikaran (MJP).
3.	Treatment of Sewage by MBBR technology and treated sewage shall be used for gardening and flushing. For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.
4.	The stored excess treated sewage shall be given for irrigation purposes outside the plot.
D	**ENERGY SAVING**
1.	Water heating, one light and fan of flat is proposed on non-conventional solar energy which will help in energy saving.
2.	Street area lights based on Biogas generator
3.	Various energy saving measures shall ensure saving in energy
E	**SOLID AND HAZARDOUS WASTE MANAGEMENT**
1.	Provision of Bio-methanation plant for treatment of municipal solid waste.
2.	The energy generated from biogas plant will be used for lighting of street light lamps.
F	**ENVIRONMENTAL MONITORING & ENVIRONMENTAL MANAGEMENT PLAN**
1.	Environmental Management Plan and its judicious implementation with operation and maintenance of environmental facilities and proper budgetary allocations for the same will ensure long term benefits to the project and surrounding areas.

CHAPTER 8
ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER 8
ENVIRONMENTAL MANAGEMENT PLAN

8.0 INTRODUCTION:

Environmental Management Plan (EMP) deals with evaluation of significance of unavoidable or residual impacts following mitigation and the proposed monitoring.

8.1 OVERVIEW:

The Environmental Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all contractors and subcontractors, including consultants, understand the potential environmental risks arising from the project and take appropriate actions to properly manage that risk. EMP also ensures the project implementation is carried out in accordance with the design by taking appropriate mitigative actions to reduce adverse environmental impacts during its life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who are charged with the responsibility to manage the site.

8.2 ENVIRONMENT MANAGEMENT SYSTEMS:

The following components will be part of the EMS:

- Environmental Policy
- Objectives & Targets
- Structure and Responsibility
- Emergency Planning
- Environmental Monitoring Program
- Operation of and Maintenance of Environmental Management Facilities like STP, Rain water harvesting , Solar Systems, other energy saving measures, landscape development, Solid waste management system
- Non-conformance & Corrective and Preventive Action
- Short term and long term budgetary provisions for the EMP
- Submission of six monthly report to Regional office, MoEF for compliance of conditions in
- Environmental Clearance

8.3 ENVIRONMENT MANAGEMENT PLAN:

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
LOCATION SPECIFIC				
1	Disposal of excess treated sewage	•Provision of Sewage treatment facilities. Treated sewage shall be reused for gardening and flushing requirement •For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. •Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent	Project Proponents	Stringent discharge standards for STP outlet as per the EPA Act

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage • Provision of water holding pond for storage of excess treated sewage with adequate for storage of excess treated sewage • Provision of air blower with perforated PVC piping inside the pond for aeration of pond water • The stored excess treated sewage shall be given for irrigation purposes outside the plot.		
2.	Gas pipe line passing through the plot	• No Construction of building or other structure (tank, reservoir etc.) in the said area • No tree plantation in the said area • In the said land, shall not do any act/activity to cause any damage to pipeline	Architect/ Project Proponents	--
3.	High Tension Line	• No construction and tree plantation below HTL • Provision of buffer zone including both sides of HTL	Architect/ Project Proponents	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		DESIGN SPECIFIC		
1.	Building Height	Height of the building shall be in accordance with the local planning permissions	Architects	NOC from Local Authority
2.	• Increase in runoff due to increase in paved areas • Flooding on site or in the surrounding low lying areas	• Minimizing the incremental runoff from the site with the help of rain water harvesting tanks • Provision of SWD of adequate capacity (29.61 m^3/sec) to cater the runoff and avoid flooding on site	Architects and MEP consultants	--
3.	Heat gain due to building materials or design	• Use of natural light and ventilation in building design • Use of local building materials in construction	--	ASHRAE 90.1 2007

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		CONSTRUCTION PHASE		
1.	Increase in water demand due to water usage for construction, dust suppression and	• Use of polymeric spray for dust suppression instead of water wherever possible • Curing water shall be sprayed on concrete structures, free flow of water should not be allowed for	Contractor & Project Manager	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
	for workers	curing • Use of wet jute cloth/gunny bags instead of water spray for curing activity		
2.	Sewage generation and its disposal	• Provision of modular type STP for treatment of sewage • Site sanitation & good housekeeping	Contractor & Project Proponents	Water (P & CP) Act 1974 as amended
3.	Municipal solid waste generation by workers	• Segregation of wet (6 kg/day) and dry garbage (24 kg/day) • Segregated garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal	Contractor & Project Manager	--
4.	Site preparation or construction activity may lead to : ▪ Water logging or flooding on site & in surrounding ▪ Unsanitary conditions and mosquito breeding on site ▪ Sedimentation of outside drains	• Computation of the runoff from the catchment areas outside the plot and runoff within the plot. • Proper management of channelization of storm water • Designing storm water drainage with adequate capacity to cater the total runoff from site and outside catchment area and avoid flooding on site or surrounding • Use of screens and silt traps in advance of earthworks • Proper maintenance of storm water drainage to avoid choking of drains and flooding on site • Prompt completion of works relating to drainage and sediment control	Contractor & Project Manager	--
5.	Excavation/construction activity		Contractor/ Project Proponents	--
a.	Dust generation	• Use of water for dust suppression and polymeric dust suppression system (wherever possible) • Use of covering sheets shall be done for trucks carrying construction material to prevent air borne dust • All material storages shall be adequately covered to avoid dust/particulate emissions • Use of CPCB approved DG sets with proper maintenance • Adequate parking provision and proper traffic movement for smooth traffic flow • Vehicles having valid pollution under control certificate shall be allowed to ply on site • Open burning of solid waste shall be prohibited • Regular health checkup of the workers. • Use of the standard personal		--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		protective equipments like masks, goggles, etc. • Sensors to monitor air quality shall be installed. This will help to keep record daily for the air quality.		
b.	Noise & Vibration	• Provision of barricades of adequate height along the periphery of the site • During construction activities the noise will be monitored to ascertain the noise levels are within limits • All precautions for noise abatement shall be taken during the construction activities • During high noise construction activity there will be provision of ear plugs for construction labour and staff • No noise polluting work in night shifts • In-built acoustic enclosure for DG sets • It is recommended that Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise • Provision of artificial noise barrier		--
c.	Disruption of soil & runoff	Sedimentary controls to be implemented		--
d.	Oil leaks	• Regular maintenance of excavation machineries to prevent and repair leaks • Contaminated soil to authorized CHWTSDF		--
e.	Generation of Excavation earth material/Construction waste	• Designated storage for all type of waste • Proper segregation of construction waste and preparation of item wise quantification and management plan and ensuring its effective implementation • Reuse of excavated earth (18,00,000 Cum) on site for backfilling • Polymer bags used for cement and gypsum, cardboard boxes and other packaging material will be handed over to authorized recyclers. • Disposal of hazardous waste to CHWTSDF		Excavation permission from Local Authority
f.	Water logging in excavated areas	• Preparation of dewatering plan • Provision of dewatering pumps with adequate capacity as per site conditions		--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		• Suction points of the pumps will be equipped with silt screens and appropriate filters to minimize stile discharge • Collection of Subsoil water/ excess water during excavation and construction of basements in the sedimentation tank for 6 to 7 hrs • Disposal of supernatant to the drain. • Guidelines issued by Central Ground Water Authority (CGWA) shall be followed strictly and also permission from CGWA shall be obtained during construction phase before dewatering of basements • Proper drainage channel with connection to external SWD • Sedimentation controls measures shall be followed • Regular pest control • Water will be allowed to settle overnight to ensure sedimentation and minimize the silt in discharge		
6.	Vehicular movement leads to ▪ Increase in traffic ▪ Air emissions & Noise ▪ Oil leaks	• Entry to vehicles with valid PUC certificate • Proper parking arrangement for the construction vehicles • Provision of oil and grease traps to the Storm water drains • Contaminated soil (if any) found if any to authorized CHWTSDF • Regular maintenance of vehicles with suitable enclosures and intake silencers • Planning and ensuring effective implementation of the waste movement plan for loading and offsite movement in non-traffic Hours	Project Manager	--
7.	Use of DG sets	• DG sets with inbuilt acoustic enclosures • Site barricading • Regular maintenance	Project Manager	
8.	Impact on health of workers Accidents, Hazards, injuries to workers	• Adequate drinking water, toilet and bathing facilities. • First aid facility • Regular health check up of workers • Risk assessment and preparation of disaster management plan • Provision of temporary water tank for fire fighting and appropriate fire suppression measures.	Safety officer	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		• Safety educational and awareness programme • Proper security arrangements		

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
OPERATION PHASE				
1.	Increase in water demand	• Use of treated sewage for gardening (1044 KLD) and flushing (4400 KLD) • Rain water collection from terraces into 31 numbers of RWH tanks of total capacity 8981 KL and its reuse thereby reducing the fresh water demand in monsoon season up to 45% • Use of harvested rain water for domestic purpose (926 KLD) and its reuse thereby reducing the fresh water demand up to 6393 KLD in monsoon season i.e. 45 %.	Project Proponents/ Facility Management system	Water Act 1974 as amended
2.	Sewage generation and disposal of sewage	• Provision of total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL for treatment of sewage by MBBR method followed by DEWATS Phythorid technology • Proper operation and maintenance of STP and Daily analysis of general parameters like pH, BOD, COD and TSS & O & G of the STP outlet to ensure good treatment of waste water with the help of onsite sensors • Use of treated sewage for flushing and gardening • Provision of water holding pond with DEWATS phythorid technology for storage of excess treated sewage • Provision of aerators in water pond to avoid mosquito breeding. • Provision of adequate ventilation around the STP • Proper arrangements for sludge handling units and its reuse as manure • ETP is proposed for Hospital in phase 1, primary treatment shall be done for effluent and then it will be connected to STP.	Project Proponents / Society / Facility Management system	Stringent discharge standards for STP outlet as per the EPA Act

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
3.	Increment in Runoff from site	• Minimizing the incremental runoff from the site with the help of rain water harvesting tanks of adequate capacity • Proper management of channelization of storm water from site by using proper internal SWD system and discharge point of having adequate capacity (29.61 m^3/sec) • Use of screens and silt traps to SWD • Proper maintenance of storm water drainage to avoid choking of drains and flooding on site • Surface rainwater to be passed through oil & grease trap & desilting chamber and then transferred to external drain of adequate capacity (255.12 m^3/sec)	Project Proponents/ Facility Management system	--
4.	Increase in power consumption	• Provision of Solar Panels for apartment internal lighting , fan load and water heating • Street area lights based on Biogas generator • Provision of LED lights • Use of Electronic Ballast • Use of timers in buildings common lighting and external lighting • Use of Star rated geysers and AC	Project Proponents/ Facility Management system	ECBC norms
5.	Use of DG sets may lead to Air & Noise pollution	• Stack height as per CPCB norms • New trees Plantation with retention of existing trees • DG sets with inbuilt acoustic enclosures	Project Proponents/ Facility Management system	CPCB norms
6.	Vehicular movement leads to ▪ Increase in traffic ▪ Air emissions & Noise ▪ Contamination of soil leads to Oil leaks	• Proper parking arrangement for the vehicles • Provide adequate traffic signs and signages to notify residents • Install safety mirrors to aid visibility in conflict points • Prevent parking near the Entry and Exit Gate • Provide speed humps to regulate speed of vehicles • Provide pedestrian crossings and dedicated footpath to cater to the walking population • Assign traffic wardens to regulate flow of project traffic during peak hours • Adequate width of internal	Project Proponents/ Facility Management system	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		driveway • Plantation of new trees with retention of existing trees to mitigate dust and noise • Provision of oil and grease traps to the Storm water drains		
7.	Odour and unsanitary conditions due to STP and Composting of biodegradable garbage	• Proper ventilation around STP and Garbage room • Proper housekeeping and maintenance • Regular monitoring of stack/s	Project Proponents/ Society/Facility Management system	Air act 1981 as Amended
8.	Municipal waste & other solid waste generation	• Informing and educating occupants for solid waste management • Provision of adequate space for solid waste management • Proper segregation on site to biodegradable and non-biodegradable. • Non-biodegradable waste (15808 Kg/day): to be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal • Biodegradable waste (23607 kg/day) shall be treated in Biomethanation Plant • Slurry and other dry organic waste generated from Biogas plant shall be reused for landscaping and remaining shall be disposed through an authorized agency • E-waste (24895 Kg/annum) from commercial portion of Phase 3 and Phase 4 and will be stored separately and disposed through authorized recyclers • Bio Medical Waste (56.3Kg/ day) from Hospital of Phase 1 and same will be handled and disposed as per Bio-Medical Waste Management Rules, 2016	Project Proponents/ Society/Facility Management system	--
9.	Disaster like Fire, Earthquake, lightning etc.	• Preparation of Disaster Management Plan • Provision of Safety officer , Security and First aid team • Regular review of DMP and mock drill • Effective implementation of	Safety Officer	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		DMP		

8.3.1 BUDGETARY ALLOCATION FOR EMP:

Table 8.1 **& 8.2** gives the expenditure to be incurred by **M/s. Claridges SEZ Developers Pvt. Ltd.** on environmental matters during construction and operational phase.

Table 8.1: Expenditure on Environmental Matters during Construction Phase

#	Component	Description		Total Cost (Rs. In Lacs)
1	Air Environment	Dust Suppression		16.20
		Air & Noise quality monitoring	On site sensors	10.00
			By outside MOEF Approved Laboratory	13.20
2	Water Environment	Drinking water analysis		2.70
3	Land Environment	Site Sanitation		15.00
4	Socio- Economic Environment	Disinfection- Pest Control		18.00
		Health Check Up of workers		135.00
	Total Cost			**210.10**

Maintenance Cost of the Air & Noise Quality Sensors: Rs. 50,000/annum

Table 8.2: Expenditure on Environmental Matters during Operation Phase

#	Component		Description	Capital cost (Rs. In lacs.)	Operational and Maintenance cost (Rs. in lacs/yr)
1	Air Environment		Gardening	1889.37	7.20
			Ambient Air quality & Noise Monitoring	*No set up cost involved	0.28
			Cost for DG Stack Exhaust Monitoring	*No set up cost involved	1.49
2	Water Environment	Waste water /Effluent treatment	Cost for STPs	2370.70	509.66
			Cost for Phytorid technology	38.00	4.93
			Cost for pond & pipeline from STP to holding pond	150.00	15.00
			Cost for pipeline from pond to irrigation purposes outside the plot.	At actual	--
			Cost for ETP for Hospital	15.00	0.30
		Water Conservation (Rain Water Harvesting System)	Cost for Water, Waste water and Rainwater Monitoring	*No set up cost involved	4.38
			Cost for RWH tanks	898.10	44.91
			Cost for treatment unit for Rain Water	93.00	0.21
3	Land Environment (Solid Waste Management)		Cost for Treatment of biodegradable garbage (Biogas)	480.00	45.00
4	Energy conservation		Solar panels for Lighting	4225.20	422.52
			Solar panels for water heating	343.85	34.38
			Cost for Biogenset	35.00	3.50
	Total			**10538.22 + At actual Cost for pipeline from pond to irrigation purposes outside the plot.**	**1090.26**

Quantum and generation of Corpus fund:

Project proponent shall operate and maintain EMF for proposed development for 5 years after giving possession and shall also generate corpus fund during 5 years for O & M of **Rs. 1090.26 Lacs x 5 years)**

Responsibility for further O &M:
There will be formation of Phase-wise societies for the maintenance and management of environmental infrastructure. Corpus fund shall be handed over to these societies. While handing over Environmental Management Facilities M.O.U. shall be made with societies to accept responsibility of further O & M of EMF.
Apex body/ independent company will be established by Society to operate and maintain all Environmental infrastructures including green belt.

8.4 ORGANISATIONAL STRUCTURE & RESPONSIBILITY:

In addition to regular operational roles & responsibilities defined for the **M/s. Claridges SEZ Developers** team, all personnel directly or indirectly have a role to play towards effective environment management of the project. The entire project team will co-operate with government agencies and other stakeholders who may have environmental concerns with the project.
The major duties and responsibilities of **Environmental Management Cell** shall be as given below:

- To implement the environmental management plan,
- To assure regulatory compliance with all relevant rules and regulations,
- To ensure regular operation and maintenance of pollution control devices,
- To minimize environmental impacts of operations as by strict adherence to the EMP,
- To initiate environmental monitoring as per approved schedule
- Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference
- Maintain environmental related records
- Coordination with regulatory agencies, external consultants, monitoring laboratories
- Maintain of log of public complaints and the action taken

8.5 RECORD KEEPING:

Record keeping and reporting of performance is an important management tool for ensuring sustainable operation of the proposed project. Records should be maintained for regulatory, monitoring and operational issues. Typical record keeping requirements is summarized in **Table 8.3**

Table 8.3: Record Keeping Requirements

Parameter	Particulars
Air emissions	Random checks of equipment logs/ manuals to check equipments/ vehicles are operated within specified parameters
Noise	• Noise reading • Working hour records to minimize night shift • Maintenance records of vehicles to minimize noise from vehicles • Site working practices records and noise reading implement good working practices • Random checks of equipment logs/ manuals to check equipments operated within specified design parameters
Solid Waste Handling and Disposal	• Daily quantity of waste generated • Daily quantity treated and recycled • Daily quantity sent outside for disposal • Comprehensive Waste Management Plan in place and available for inspection on-site.

Parameter	Particulars
E waste /Hazardous Wastes	• Quantity of waste generated • Quantity of wastes sent out for treatment/disposal. • Waste manifests as per regulations
Wastewater Discharge	• Daily quantity of raw and treated sewage • Treated wastewater quality
Drainage	• Visual inspection of drainage and records thereof
Regulatory Licenses (Environmental)	• Environmental Permits / Consents from MPCB /Post clearance submissions to Regional office of MoEF etc. • Copy of Waste manifests as per requirement
Monitoring and Survey	• Records of all monitoring carried out as per the finalized monitoring protocol.
Accident reporting	• Date and time of the accident if any mainly during construction phase • Sequence of events leading to accident • Emergency measure taken • Step to prevent recurrence of such events • Mock drills
Others	• Log book of compliance • environmental, health and safety records for the employees during construction phase • Vehicle maintenance and inspection records

8.6 TRAINING AND CAPACITY BUILDING:

Training and human resource development is an important link to achieve sustainable operation of the facility and environmental management. For successful functioning of the project, relevant EMP's should be communicated to the following groups of people:

Occupants and Contractors*:* All occupants must be made aware of the importance of waste segregation and disposal, water and energy conservation. This awareness can be provided through leaflets and periodic housing society meetings. They should be informed of their responsibilities for successful operation of various environmental and energy management schemes inside the premises.

Site Staff*:* Relevant personnel at site must be trained for the following:

- Techniques for waste minimization, water conservation and energy conservation
- Collection, transport, treatment and disposal solid and hazardous/E waste/ Bio Medical Waste
- Operation and maintenance of Sewage Treatment Plant and reclamation system
- Requirements of the Disaster Management Plan in case of an emergency.
- Applicable environmental, health and safety regulations and compliance requirements for the same.
- Functioning of the Environmental Management System including environmental monitoring, reporting and documentation needs.

CHAPTER 9
SUMMARY AND CONCLUSIONS

CHAPTER 9
SUMMARY AND CONCLUSIONS

9.0 INTRODUCTION

The project site under reference is located at Post-Sarang, Taluka- Khalapur, District- Raigad, and State-Maharashtra. M/s. Claridges SEZ Developers Pvt. Ltd. have received Location Clearance (LC) from Urban Development Department, Mantralaya on 10th September 2015 in respect of an area which includes land admeasuring about 106.24 Ha from Village Sarang, Tal-Khalapur, District-Raigad for the purpose of development of "Special Township Project".

As per the Environment Impact Assessment (EIA) Notification dated 14th September 2006 as amended, the proposed project requires preparation of EIA Report. Project specific **ToR received from State Level Environmental Assessment Committee - 2 (SEAC 2), Maharashtra in July, 2015**

As per the amendment in EIA Notification dt. 9th December 2016, the proposed project falls under **'Category A'** with activity number **'8 (b)'**, hence has to be appraised at MoEF & CC. **Hence the project file was transferred** from Director (Environment Dept.), Government of Maharashtra **to the Member Secretary Infrastructure EAC (2), MoEF & CC with an forwarding letter dt. 06.03.2017 for the prescribed Terms of Reference, mentioning its validity upto 22th July, 2018** for the submission of EIA/EMP report.

We would like to mention here that, TOR was presented on conceptual plan (Plot area = 12,20,137.31 Sq.mt.; Total construction Built-up area = 33,88,252.49 Sq.mt.) subsequently for this project Locational clearance (LC) was received from Urban Development Department (Plot area = 10,62,500.00 Sq.mt. ; Total construction Built-up area = 23,63,400.26 Sq.mt.).Hence the EIA and EMP prepared and submitted is with the lesser areas and impacts than the prescribed ToR.

9.1 PROJECT DESCRIPTION

- **Location and Settings:**

Project site is located in village Sarang. The site is an Open Land deriving access from Existing NH4 of 30m wide Road.

The site is surrounded by the following:

- East: Tupgaon village
- West: Lodhivali village
- North: National Highway 4
- South: Tembhari village

The nearest railway station is Chowk railway station on main line of Central railway.

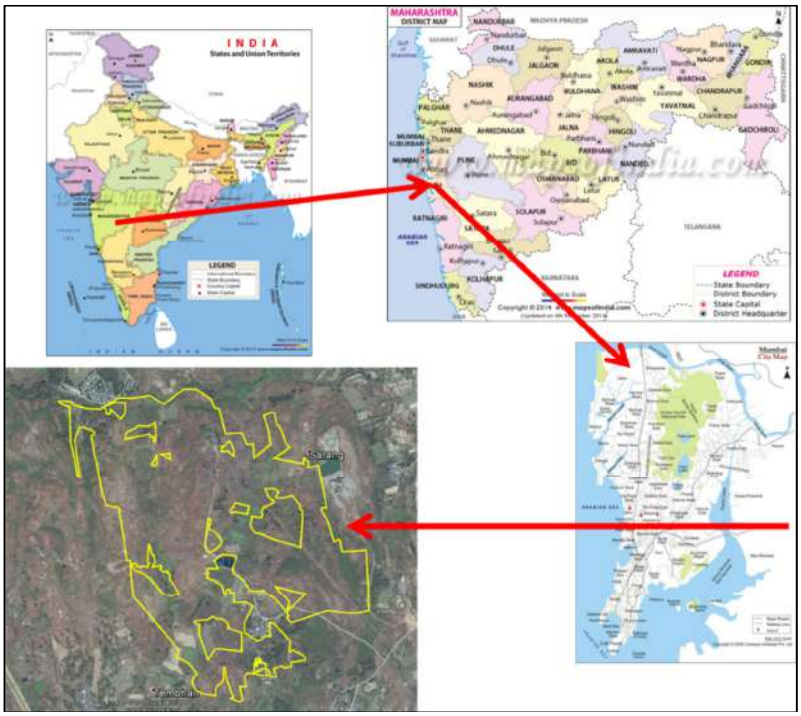


Fig. 9.1: Project Location

Fig. 9.2: Study area of Proposed Project
10 Km radius around the plot boundary

Development Strategy, Phasing of the project:

- The site is an open land; hence no demolition activities are involved.
- The proposed construction will not cause any resettlement and rehabilitation of the population.
- The construction work for proposed project has been reckoned in six phases.
- The construction period for proposed project is approximately 15 years.

- **Project Proposal:** The area statement and Phase wise area statement for the project is as follows

Table 9.1: Area Statement

No	Description	Area (Sq.mt.)
1.	Plot Area	10,62,500.00
2.	Ground Coverage Area	**2,71,235.46**
3.	Recreational Green (R.G.) Area	**3,43,571.58**
4.	Built – up Area as per FSI	**12,47,741.00**
5.	Total Construction Built – up Area (FSI + NON FSI)	**23,63,400.26**

Table 9.2: Phase wise Area Statement

No	Description	Area (Sq.mt.)						
		Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Total**
1.	Ground Coverage Area	90,929.70	49,788.81	85,392.96	31,684.15	5,990.60	7,449.24	**271,235.46**
2.	R.G. Area	93,431.89	67,541.37	20,933.05	76,886.64	24,559.49	60,219.14	**3,43,571.58**
3.	Built – up Area as per FSI	316,019.10	181,905.40	374,991.12	240,187.65	61,534.80	73,102.93	**12,47,741.00**
4.	Total Construct-ion Built – up Area (FSI + NON FSI)	5,60,383.51	3,12,790.33	6,28,322.70	7,07,982.10	71,887.20	82,034.42	**23,63,400.26**

Table 9.3: Phase wise Building Details and Occupancy

Phases	Building Details	Occupancy
1	**21 nos. of Residential Buildings:** Type A buildings : 6 buildings of Ground + Podium + 22 Upper Floors Type B buildings : total 15 buildings 12 buildings of Ground + Podia + 22 Upper Floors 3 buildings of Ground + 2 Podia + 22 Upper Floors **Total Flats: 3036 nos.**	**23851**
	Convenient Shopping : 1 building : Ground+ 1 Upper Floor **Shops: 2 units**	
	Convention Centre: 2 buildings of Ground + 2 Podia+ 15 Upper Floors	
	Primary School : Ground+ 4 Upper Floors **Classrooms: 72 nos**.	
	Hospital: Basement+ Ground+ 4 Upper Floors **Beds: 150 Nos.**	
	Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A: 7 buildings of Ground + 12 Upper Floors Type B: 2 buildings of Ground + 11 Upper Floors Type E: 1 building of Ground + 12 Upper Floors	

Phases	Building Details	Occupancy
	Total Flats: 844 nos.	
2	**11 nos. of Residential Buildings:** Type A buildings :3 buildings of Ground + Podium + 22 Upper Floors Type B buildings : 8 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 1584 nos.**	**12568**
	Convenient Shopping : 1 building : Ground+1 Upper Floor **Shops: 2 unit**	
	Hotel: 3 buildings of Ground + 2 Podia+20 Upper Floors **Rooms: 840 nos.**	
	Economical Weaker Section (EWS) scheme: 5 nos. of Residential buildings: Type A : Ground + 12 Upper Floors **Total Flats: 480 nos.**	
3	**18 nos. of Residential Buildings:** Type A buildings : 3 buildings of Ground + Podium+ 3 part podia + 22 Upper Floors Type B buildings : 15 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 2508 nos.**	**50456**
	Convenient Shopping : 1 building : Ground+ 1 Upper Floors **Shops: 2 units**	
	Secondary School : Ground+ 7 Upper Floors Classrooms: 182 nos.	
	Office building: Ground+ 5 Upper Floors	
	Office and Market Mall: 6 Buildings of Ground+ 3 Podia+ 5 Upper Floors (market mall) + 6 to 20 upper floors (offices)	
	Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A : 7 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type F : 1 building of Ground + 12 Upper Floors Type I : 1 building of Ground + 12 Upper Floors **Total Flats: 908 nos.**	
	Home for aged person, Community Centre, Library, Auditorium 1 building with 4 wings Wing A: Home for aged: 2 Basements + Ground +6 Podia + 5 Upper Floors **Rooms:110** Wing B: Community center : 2 Basements + Ground +6 Podia + 5 Upper Floor Wing C: Library: 2 Basements + Ground +6 Podia + 4 Upper Floor Wing D: Auditorium: 1 building of 2 Basements + Ground +6 Podia +5 Upper Floor	
4	**IT park:** Total 3 buildings 2 Basements+ Ground+ 4 Podia+ 24 Upper Floors	**26870**

Phases	Building Details	Occupancy
	Resort: Type A : 2 buildings of Ground + 4 Upper Floors Type B : 1 building of Ground + 3 Upper Floors Type C : 1 building of Ground + 5 Upper Floors	
	Economical Weaker Section (EWS) scheme: 12 nos. of Residential buildings: Type C : 11 buildings of Ground + 12 Upper Floors Type D : 1 building of Ground + 12 Upper Floors **Total Flats: 1140 nos.**	
	Police Station	
5	**Economical Weaker Section (EWS) scheme:** 18 nos. of Residential buildings: Type F : 16 buildings of Ground + 12 Upper Floors Type G : 2 building of Ground + 12 Upper Floors **Total Flats: 1632 nos.**	**8160**
6	**Economical Weaker Section (EWS) scheme:** 15 nos. of Residential buildings: Type A : 2 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type C : 8 buildings of Ground + 12 Upper Floors Type F : 4 building of Ground + 12 Upper Floors **Total Flats: 1388 nos.**	**13688**
	Convenient Shopping : **1 building: Ground+ 1 Upper Floor** **Unit: 2 nos.**	
	Primary School : Ground+ 10 Upper Floors Classrooms: 200 nos.	
	Total	**1,35,593**

The Infrastructure and facilities / utilities / Waste generation etc. are listed in following table.

Table 9.4: Details about utilities & environmental liabilities

<table>
<tr><th>No.</th><th>Component</th><th>During Construction Phase</th><th>During Operation Phase</th></tr>
<tr><td rowspan="2">1</td><td>Electrical Supply</td><td>Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)
As per requirement</td><td>Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)
<table><tr><th>Phases</th><th>Connected Load (KW)</th><th>Maximum Demand (KW)</th></tr><tr><td>1</td><td>68265</td><td>27047</td></tr><tr><td>2</td><td>42884</td><td>18194</td></tr><tr><td>3</td><td>94222</td><td>36946</td></tr><tr><td>4</td><td>57340</td><td>37362</td></tr><tr><td>5</td><td>26208</td><td>10195</td></tr><tr><td>6</td><td>20341</td><td>6985</td></tr></table></td></tr>
<tr><td>DG sets used during power failure for emergency services</td><td>As per requirement</td><td><table><tr><th>Phases</th><th>Capacities of DG sets</th></tr><tr><td>1</td><td>2 DG sets of 320 KVA each
2 DG sets of 500 KVA each
6 DG sets of 625 KVA each
1 DG set of 100 KVA</td></tr></table></td></tr>
</table>

<table>
<tr><th>No.</th><th>Component</th><th>During Construction Phase</th><th>During Operation Phase</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td></td><td>2 DG sets of 1000 KVA each
1 DG set of 320 KVA
1 DG set of 600 KVA</td></tr>
<tr><td>2</td><td>1 DG set of 1000 KVA
2 DG sets of 400 KVA each
1 DG set of 600 KVA
1 DG set of 500 KVA
3 DG sets of 2500 KVA each</td></tr>
<tr><td>3</td><td>7 DG sets of 1010 KVA each
1 DG set of 400 KVA
2 DG set of 750 KVA each
1 DG set of 140 KVA
2 DG sets of 1250 KVA each
6 DG sets of 2000 KVA each
5 DG sets of 1500 KVA each</td></tr>
<tr><td>4</td><td>4 DG sets of 1000 kVA each
1 DG set of 400 KVA</td></tr>
<tr><td>5</td><td>2 DG sets of 600 KVA each
2 DG sets of 350 KVA each</td></tr>
<tr><td>6</td><td>1 DG set of 380 KVA
1 DG set of 750 KVA
1 DG set of 80 KVA
1 DG set of 400 KVA</td></tr>
</table>
</td></tr>
<tr><td></td><td>Energy Saving</td><td>--</td><td>• Provision of Solar Panels for apartment internal lighting , fan load and water heating
• Street area lights based on Biogas generator
• Provision of LED lights
• Use of Electronic Ballast
• Use of timers in buildings common lighting and external lighting
• Use of Star rated geysers and AC</td></tr>
<tr><td>2</td><td>Water Supply & sources</td><td>i. For workers : 23 KLD for each phase Source : Tanker water of potable quality
ii. For construction of each phase (depending on construction activity): Source Water tankers*

(*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity</td><td>Fresh Water Supply: 7319 KLD
▪ For Domestic: MJP / RWH = 7283 KLD
▪ For Swimming pool: From tanker water of potable quality = 36 KLD

Secondary requirements: 5444 KLD
▪ Flushing = 4400
▪ Gardening = 1044</td></tr>
</table>

No.	Component	During Construction Phase	During Operation Phase
3	Sewage Generation, Collection, Treatment	i. Quantity of Sewage : 22 KLD ii. Disposal: Shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants	Sewage generation from all the phases of the project will be 10227 KLD and will be treated in 35 nos. of Sewage Treatment Plants followed by Phythorid technology. Treated sewage shall be reused for gardening (1044 KLD) and flushing (4400 KLD) requirement **Details of the Reuse Scheme:** - For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. - Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. - Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned. - The stored excess treated sewage shall be given for irrigation purposes outside the plot.
4	Solid waste Management	Segregation, storages facilities for all solid waste streams shall be practiced There will be designated storage space for excavated earth, construction waste, E wastes and hazardous wastes, Biomedical waste and solid waste.	
		• The wastes generation during construction phase shall be tried to recycled and reused to the maximum possible extent. • The excavated earth shall be reused on site only. • There will be designated storage for Hazardous wastes and its disposal shall be done to authorized common hazardous waste disposal site for further treatment and disposal. • E Waste - Separate storage space within project site and subsequently it shall be handed over to authorized recyclers.	**Municipal Solid waste:** • Segregation and storages facilities for all solid waste streams • Biodegradable garbage shall be treated in Biomethanation plant • Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal. • E-Waste will be stored separately and disposed through authorized recyclers • Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016
5	Rain Water	--	Provision of total 31 numbers of RWH

No.	Component	During Construction Phase	During Operation Phase
	Harvesting		tanks of total capacity 8981 KL.
6	Storm Water Drainage	Proper management of channelization of storm water from site by using proper internal SWD system and discharge points of total adequate capacity: 29.61 m^3/sec Capacity of external drain including major drain is 255.12 m^3/sec	

9.2 DESCRIPTION OF ENVIRONMENT:

i) Environmental sensitive places in the study Area:

As per the standard Terms of Reference (ToR) notified on 22.07.2015 for Township and area development projects by MoEF & the project specific TOR by SEAC - 2, Maharashtra, study area considered for this report is 10 Km radius around the project site:

Table 9.5: Environmental Sensitive Places within 10 km

Environmental Sensitive Places	Locations	Aerial distances (in km) from Plot boundary
Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	Project site is located at Sarang village which is not listed under ESA as per list of villages prepared by High Level Working Group (HL WG) given in Annexure A of the directions by Ministry of Environment and Forests (MoEF) dt.13.11.2013. But in the study area few villages of Khalapur Taluka are listed under Eco Sensitive Areas (ESA) of Western Ghat. The details are given as follows:	
	Warose Tarf Wankhal	9.00
	Sondewadi	9.00
	Borgaon Khurd	7.00
	Nadhal	2.00
	Palasdari	9.00
	Talawali	10.00
	Kalote Mokashi	7.00
	Ghodivali	10.00
	Kalote Rayati	6.00
	Nigdoli	4.00
	Parkhande	9.00
	Talashi	10.00
	Project site is located at Sarang village which is not listed under ESA of Matheran as per notification dt. 04.02.2003 and amended notification dt. 16.04.2004. But details of nearest boundary of Eco sensitive zone of Matheran from project boundary is given as follows:	
	Nearest boundary of Eco-sensitive Zone of Matheran	0.20
National Park/Wildlife Sanctuary/	Karnala Bird Sanctuary	9.00
Nature Park	Nil	NA
Reserved Forest	Near Karade Budrukh Manikgad Devloli Narpoli Prabhalgad Vinegaon	5.00 7.00 8.00 6.00 8.00 6.00
Habitat for migratory birds	Karnala Bird Sanctuary Patalganga River (upstream)	9.00 1.00

Environmental Sensitive Places	Locations	Aerial distances (in km) from Plot boundary
	Ulhas River	10.00
Water bodies	Nadhal Reservoir	1.00
	Bhilavle Reservoir	4.00
	Morbe Reservoir	2.00
	Jambivali Reservoir	6.00
	Pond	Adjacent to the project site
	Hatnoli Lake	5.00
	Usran Lake, Rasayani	7.00
	Vinegaon Lake	6.00
	Varne Lake	10.00
	Patalganga River (upstream)	1.00
	Ulhas River	10.00
Archaeological Sites	Karnala Fort	9.00
	Manikgad	7.00

ii) Methodology for classification of the Study Area:

Classification of the study area and generation of the baseline data is as per Guidance Manual for Building, Construction, Township and Area Development projects approved by MoEF for preparation of EIA report and as per the Standard Terms of Reference (ToR) notified dt. 10/04/2015 for Township projects by MoEF & CC. This is tabulated as follows:

Table 9.6: Methodology adopted for classification of the Study Area

No.	Study Area	Type of Baseline data collection
1	Project Site	Type of data : Primary Attributes: Ambient air quality, Ground water, Surface water, Noise levels, Flora, Fauna, Socio economic aspects, Traffic studies.
2	Area with angular distance of 2 Km surrounding the project site	Type of data : Primary Attributes: Ambient air quality, Ground water, Surface water, Flora, Fauna, Noise levels (500 m radius from site), Traffic study (at major traffic junctions around 2 Km from site.)
3	Area with angular distance of 2 Km upto 10 km surrounding the project site	Type of data: Secondary data from various reliable sources. Attributes: Meteorological data, Surface water bodies, Flora, Fauna, Socio economic aspects, Land environment. Note: Whenever the secondary data is not available primary data collection to be done for the respective attribute.

- **Generation of Baseline Data:**

Baseline information with respect to air quality, noise level, water and soil quality. Biological environment in the study area was collected by conducting primary sampling / field studies during March 2016 to May 2016 (Pre-monsoon season). Baseline status of Land and Socio-economical environment are also studied simultaneously.

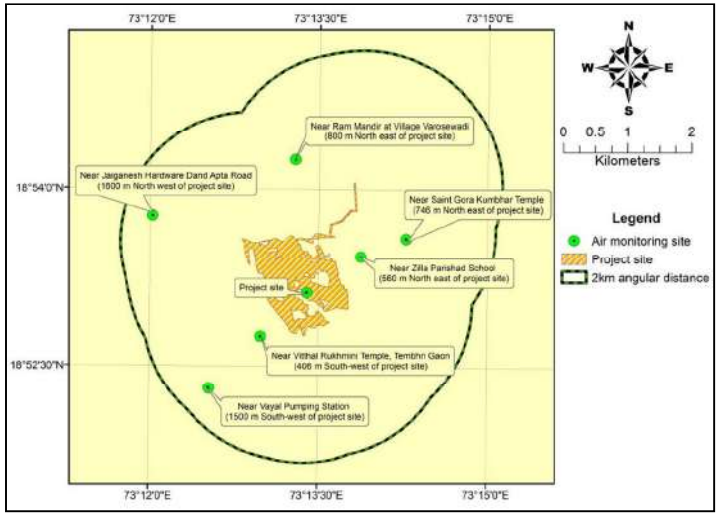
The environmental attributes studied are detailed out in **Table 9.7**.

Table 9.7: Environmental Attributes

No.	Attributes	Data Collection and Source		Results/ Major findings and Interpretation of Baseline Data
		Project Site to 2Km radius	Up to 10 Km radius from Project Site	
1	**Air Environment**			
i	**Ambient air quality**	**Sampling Locations:** Project site and 6 other locations within 2 Km radius of the project site **Period:** March 2016 to May 2016	--	

Station Code	Location of AAQM Station	$PM_{2.5}$ (24 hr) ($\mu g/m^3$)	PM_{10} (24hr) ($\mu g/m^3$)	SO_2 (24hr) ($\mu g/m^3$)	NOx (24hr) ($\mu g/m^3$)	CO (1 hr) (mg/m^3)
		Average	Average	Average	Average	Average
AAQM-1	Project Site	24	48	12	14	0.8
AAQM-2	Near Zilla Parishad School Behind Vitthal Rukmini Temple At Pali khurd Village	27	47	15	16	1.0
AAQM-3	Near Saint Gora kumbhar Temple Opposite to Tupa Gaon Bus Stop, Tupgaon	30	50	15	19	1.1
AAQM-4	Near Jaiganesh Hardware Opp to Samarth Krupa Chawl, Ris Kamba Village Dand Apta Road	40	54	19	20	1.4
AAQM-5	Near Ram Mandir at Village Entrance, Varose wadi Village North side	48	58	20	21	1.5

AAQM-6	Near Vayal Pumping Station (NMMC), Vayal Village	38	52	18	18	1.3
AAQM-7	Near Vitthal Rukhmini Temple, Tembhri Gaon	30	50	13	16	1.0



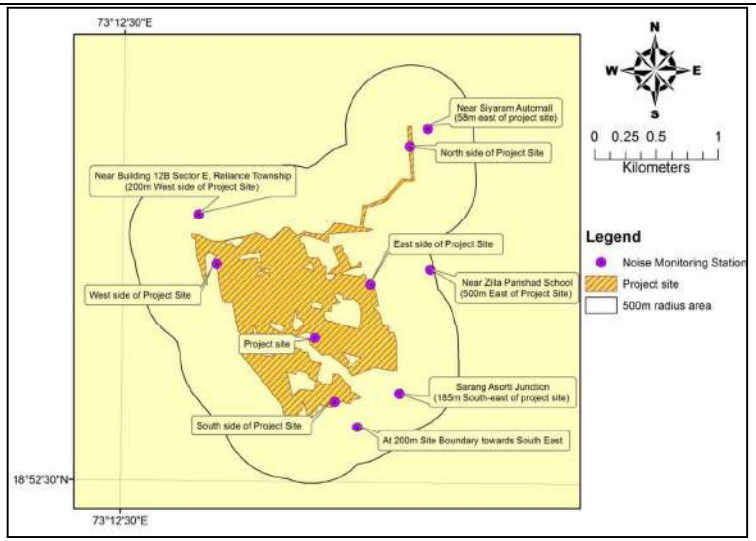
The Ambient Air Quality Monitoring (AAQM) stations at all locations have been considered as residential zones. After tabular representation of Ambient Air quality it can be observed that:

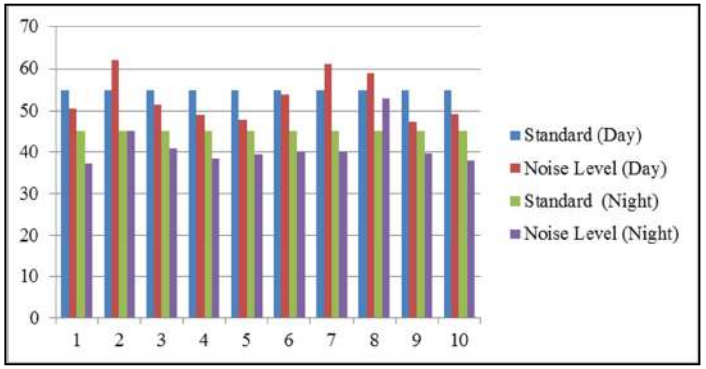
- PM_{10} ranges from 48µg/m^3 to 58µg/m^3
- $PM_{2.5}$ ranges from 24µg/m^3 to 48µg/m^3

All the parameters are found to be within range as compared with standards

ii	**Noise Level**	**Sampling Locations:** 10 locations (including project sites) within 500 m radius of the project site	--	**Station Code**	**Location of Noise Monitoring Station**	**Distances**	**Zone**	**Equivalent Noise levels in Leq**	
								Day	**Night**
				ANQM-1	Project Site	--	Residential	50.5	37.2

		Frequency: Once during the study period		ANQM-2	North side of Project Site	--	Residential	62.0	45.0
				ANQM-3	South side of Project Site	--	Residential	51.3	40.6
				ANQM-4	East side of Project Site	--	Residential	48.9	38.3
				ANQM-5	West side of Project Site	--	Residential	47.8	39.4
				ANQM-6	Near Siyaram Automall (East)	58 m	Residential	53.9	40.1
				ANQM-7	Near Zilla Parishad School	500 m	Residential	61.1	40.0
				ANQM-8	Near Building 12B Sector E, Reliance Township	200 m	Residential	59.0	53.0
				ANQM-9	At 200m Site Boundary towards South East	200 m	Residential	47.4	39.5
				ANQM-10	Sarang Asorti Junction	185 m	Residential	49.2	37.9

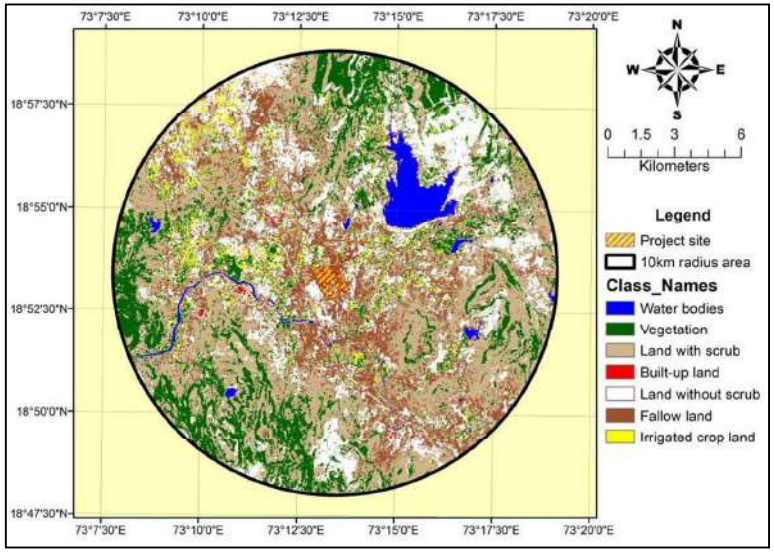




Ambient noise quality monitoring all stations has been considered as residential zones.

Comparison of the ambient noise levels with the standards specified by CPCB reveals that the day time noise readings at locations N2, N7 and N8 are exceeds CPCB standards and remaining N1, N3 to N6, N9 and N10 area within the CPCB standards. Whereas at night time all noise readings at all locations

<table>
<tr><td></td><td></td><td></td><td></td><td>founds within standards except location N8 due to vehicular movement. The Principal Rules of Noise Pollution were published in the Gazette of India, vide S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.</td></tr>
<tr><td>iii</td><td>Meteorological Data</td><td>Type of data : Secondary Meteorological data for the year 2016 from IMD, Alibaug</td><td>--</td><td>--</td></tr>
<tr><td>2</td><td colspan="3">Water Environment</td><td></td></tr>
<tr><td>i</td><td>Surface water</td><td>Surface water bodies.<table><tr><th>Location</th><th>Nos.</th></tr><tr><td>2 Km radius from the project site</td><td>4</td></tr><tr><td>2 Km to 10 km radius from the project site</td><td>7</td></tr></table>Type of data : Primary
Frequency: Once during the study period</td><td>Water bodies in the study area upto 10 km radius from project boundary are mentioned in Table 9.5.
As stated in Table 9.6 and as per the Guidance Manual for Township and Area development projects approved by MoEF, it is permissible to report the secondary data for the water bodies from 2 Km to 10 km from site. However as secondary data is not available for all these water bodies we have collected the primary data.</td><td>The Classes of the water bodies found in study area are defined as per the CPCB guidelines. Depending on the same water quality criteria have been specified to determine its suitability for particular purpose</td></tr>
<tr><td>ii</td><td>Ground water</td><td>Type of data : Primary
Sampling location: Within 2 Km
Frequency: Once during the study period</td><td>--</td><td>This being building construction project no impacts are envisaged on ground water quality outside the project site. Hence ground water investigation has been limited up to project site only.</td></tr>
<tr><td>3</td><td colspan="4">Land Environment</td></tr>
</table>

i	**Contour and Drainage Pattern of the site and surroundings**	Contour plan of project site & surrounding Drainage Map of 1KM radius from the project site		The site is contoured land. Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m).
ii	**Land use**	GIS Study for Landuse/Landcover details of 10 km radius Date of Pass: 5-Jan-2017		The land use of the study area: (10 km) Five different land use/land cover classes have been identified in the area under study. Following Settlements: 4.11%, Water Bodies: 2.97%, Vegetation: 18.33%, Irrigated Crop Land: 4.19%, Follow land: 15.18%, Waste Lands with scrub: 37.95%, Waste Lands without scrub: 17.27%.  **Land use of project site:** The site is in residential zone. The 10 km area around project site covers built up land, water bodies, vegetation, crop land and waste land.
iii	**Soil analysis**	**Sampling Location:** Project site		Results of soil analysis show that the soil is not polluted.
4	**Socio – Economic Environment**	Primary data: Project site and nearby villages	Secondary data: **Source :** Primary Census Abstract for Raigad District	**Major Findings of the Socio – economic survey:** • One Hospital (150 bedded) with Doctor and other supporting staff has been planned in the project. The area with poor health care facility would benefit from this hospital as it has capacity to cater to the

			'Census of India' 2011	population. • A primary and Secondary school with a capacity of 7620 students and 762 staff would benefit the nearby village population. • The completion of project will eventually lead to permanent job opportunities to the local & nearby villagers as there would be increased demand for security, kitchen help, etc. • There would be shops which could provide livelihood opportunity to more than 200 persons after completion. The total commercial space in the project would need a staff of about more than 100 persons. • A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary.
5	**Biological Environment**	**Primary data:** Project site and selected locations in the 2 Km radius from the project site (Period : March 2016)	**Secondary data :** From 2 Km upto 10 km radius from the project site	**Project site :** **A. Terrestrial Ecology:** **a) Flora:** The floristic survey reveals that at the project site there are different varieties of flora, such as • **Trees:** *Azadirachta indica, Syzygium cumini, Mangifera indica, Ixora coccinea, Tectona grandis, Tamarindus indica* • **Shrubs:** *Acacia torta, Euphorbia thymifolia Calatropis procera, Hyptis suaveolens* • **Herbs***; Ageratum conyzoides, Alternanthera sessilis,Cassia tora and Tridax procumbens* **b) Fauna:** The fauna observed in project site are as follows • **Mammals:** *Canis lupus familiaris, Funambulus palmarum, Rattus rattus and Herpestes edwardsii* • **Avifauna:** *Merops orientalis, Milvus migran, Columba livia, Corvus splendens, Acridotheres tristis, Eudynamys scolopacea* and *Copsychus saulari* • **Butterflies:** *Papilio polymnestor, Eurema hecabe, Euploea core* and *Junonia atlites.*

				• **Dragonflies***: Tramea basilaris* and *Ictinogomphus rapax* Details of biological environment found within 10 Km study area are given in **section 3.5.4.3 of Chapter 3 of the EIA report**
6	**Traffic study**	Traffic survey was carried out in December, 2016 by M/s. GMD Consultants		• The project traffic has been forecasted for year 2020 and 2025; this has been superimposed along with existing projected traffic to arrive at future traffic for year 2020 and 2025. • The forecast traffic on the roads adjoining the project Site access Road and Old Mumbai Pune Highway will operate at acceptable level of service in future up to 2030. • Swept Path analysis yielded that road geometry was adequate for vehicle turning maneuvers. • A Traffic Management Plan in terms of traffic calming measures and traffic control measures has been devised and proposed to maintain adequate level of service and safety of vehicles and pedestrian.

9.3 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES:

Impact identification for this project was done by using modified Delphi Technique. The modified Technique used considers 23 attributes and four weight ages. Since with the methodical working of sensitivity index and weight-ages, the total scope of pollution potential has come to **418.20**, the project site fits into "**LOW**" Pollution Potential as per the ranking system suggested in Delphi technique. The activities that take place during construction phases and operation phase of the project and the potential impacts and mitigation measures are summarized as follows.

i. Air Environment:

During construction phase, the major air pollutant of prime concern is PM_{10}, $PM_{2.5}$ as impacts of other emissions such as SO_2, NOx & CO will not be significant because the nature of sources is such that the emissions are distributed spatially and as well as temporal. Dust emissions from construction activities shall require comprehensive mitigation measures and best construction practices are explained in detail in the EIA report.
During operational period to control emissions from DG sets, stack heights of DG sets shall be as per CPCB guidelines. With regards to concern from vehicular emissions, the exhaust emissions due to rise in peak hour traffic will be mitigated by adopting traffic management measures and permitting vehicles having valid PUC. Air Quality modeling studies have been done for the prediction of impacts and explained in detail in **chapter 4.**

ii. Noise Environment:

The noise emitted from heavy duty construction equipment during construction period being high shall require occupational preventive measures and temporary noise barriers for noise attenuation. During operational period the major noise pollution source will be DG sets and surrounding traffic activity. In order to prevent adverse noise exposure to the occupants, optimal mix of mitigation measures suggested such as low noise generation units, plantation of trees as noise barriers has been planned. Noise modeling studies have been done for the prediction of impacts and explained in detail in **chapter 4 section 4.1.4.1**

iii. Water Environment:

Treated sewage shall be reused for gardening (1044 KLD) and flushing (4400 KLD) requirement. After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned. The Stored excess treated sewage shall be given for irrigation purposes outside the plot. Water conservation shall be done with the help of collecting rain water and using it for domestic purpose and thereby minimizing requirement of fresh water from MJP.

Internal drainage shall be adequately designed to take the runoff. These drains shall have silt and oil and grease traps to avoid pollution of water in drains outside the plot. Proper maintenance of storm water drainage shall be done to avoid choking of drains and flooding on site.

iv. Land Environment :

Excavated material will be fully reused on site for backfilling purpose. Construction waste shall be partly reused/recycled on site and partly will be disposed to Authorized landfill site.
During operation phase there will be onsite treatment of biodegradable waste in Biomethanation Plant. E waste shall be disposed to the authorized recyclers. Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016

v. Biological Environment:

The project will provide quality ambience with natural setting, well planned green belt and open spaces so that it not only enhances the quality of life of the occupants but also improve the micro-climatic conditions.
Adequate RG area will be maintained at ground level. Plantation of trees of various varieties shall be planted on ground.

vi. Socio-economic Environment:

- **Probable Impact**

There are trees, shrubs, herbs and climbers on project site. Due to lack of proper habitat, animal biodiversity, including insects, is meager. During construction, certain trees and shrubs will also be removed, resulting in deterioration of biodiversity.

Mitigation

Biodiversity will be increased by developing green belt (on R. G Area) by plantation of varieties of trees and shrubs, besides a remarkable area of grassland development. Plantation within the project site will remarkably enhance biodiversity of flora and fauna.

- **Probable Impact**

Due to construction activities and movement of vehicles, particulate matters in the surrounding air will be increased. Particulate matter in a form of dust may affect photosynthesis, respiration, transpiration and allow penetration of phototoxic gaseous pollutants in plants. Dusts at the levels of 2.5 to104 $\mu g/m^3$ usually block stomata, thereby reducing photosynthesis, degradation of chlorophyll-a etc. Similar effects have been reported for mango trees (*Mangifera indica*) at 4.5 to 30.0 $\mu g/m^3$ of dust. The average baseline levels of particulates of $PM_{2.5}$ & PM_{10}, up to a distance of 500m in the surrounding air of the project site are about 27 and 47 $\mu g/m^3$ respectively. It thus, appears that the trees in the locality or in the city are already in stress due to activities other than the proposed project.

Mitigation

The standard stipulated by CPCB for $PM_{2.5}$ is 60 $\mu g/m^3$ (annual average) and the same, based on the epidemiological studies, is recommended as 10 $\mu g/m^3$ (annual) by WHO. Thus predicted levels of particulate matters are well within the limits. As a precautionary measure, certain measures must be adhered to minimize the dust levels.

- Sprinkling of water and fine spray from nozzles at regular intervals to suppress the dust.
- Use of covering sheets to prevent dust dispersion from the vehicles, used for carrying construction materials at site.
- Use of covering sheets for covering construction materials, stored at site.
- Vehicles having pollution under control certificate should be allowed in the site

- **Probable Impact**

Nocturnal insects are strongly attracted to light sources that emit large amounts of UV radiation (blue fluorescent lights, black lights and mercury lamps). Behaviors, such as flight and mating are inhibited in such insects that are exposed to bright light at night. Light toxicity occurs when the retinas of compound eyes of an insect are exposed to UV radiations, damaged and structurally degenerated. Insects gather around these lamps at high densities instead of navigating naturally. Moths (Lepidoptera) are the major nocturnal pollinators of a diverse range of plant species in diverse ecosystems across the world. Artificial night lighting might in turn affect the provision of pollination by moths.

Mitigation

Unless essential, excessive light during night hours should be strictly avoided. Use of yellow lights is suggested in open areas.

- **Probable Impact**

The project proponent has a plan to treat sewage and use the treated sewage for green belt in an R. G. area. No treated sewage will be discharged outside without affecting water quality and biota of natural resources.

Mitigation

Treated sewage must be thoroughly checked with special reference to BOD, COD, TDS, Total coliform & Fecal coliform prior to utilization in green belt.

9.4 ENVIRONMENTAL MONITORING PROGRAMME:

The MoEF approved laboratory shall be appointed for the environmental monitoring during construction and operation phases. There will be one record section for recording all the sampling frequencies and analysis reports.

Water conservation shall be done with the help of collecting rain water and using it for domestic purpose and thereby minimizing requirement of fresh water from MCGM. Rainwater collection tank is proposed and the rain water collected from terraces shall be used for domestic purpose after treatment like filtration and disinfection. This treated water shall be tested monthly by MOEF approved External Laboratory during rainy season for physicochemical and bacteriological parameters to ascertain its quality for domestic use.

The costing for environmental monitoring during construction phase shall be **Rs. 15.90 Lacs** and during operation phase shall be **Rs. 44.24 Lacs**

9.5 ADDITIONAL STUDIES:

Additional Risk Assessment & Disaster Management Plan studies are carried out. Identification of Hazards has been carried out for the construction and operation phase, the safety precautions that have to be taken during construction phase and the Disaster Management Plan, Emergency Preparedness Plan Onsite and Offsite. Specific reference is given to the three components i.e. the fire protection measures, flood prevention measures and earthquake resistance of the buildings in the complex. The hierarchy of the responsibilities handled by emergency preparedness and the sequence of the operations is explained in detail and the assembly points during evacuation and route of evacuation are clearly marked on the plans.

Emergency prevention through good design, operation, maintenance and inspection are aimed in this project to reduce the probability of occurrence and consequential effect of such eventualities. The Emergency Response Plan (ERP) shall be practiced to make use of the combined resources at the site and outside services to achieve the following:-

- Localize the emergency
- Minimize effects on property and people
- Effective rescue and medical treatment
- Evacuation

Also we have studied Building Performance Analysis Report i.e. ECBC studies for defined design parameters for ECBC Compliance for maximum Energy Efficiency. We have also included Carbon footprint analysis.

9.6 PROJECT BENEFITS:

A	SOCIO ECONOMY
1.	The construction of project is in 6 phases and would require 300 skilled and unskilled labours. In each phase local people would benefit the employment opportunities.
2.	Civil works for the construction of buildings may require local sub-contractors, hardware and raw material suppliers thus benefitting and providing small business opportunities to few in the nearby villages.
3.	One Hospital (150 bedded) with Doctor and other supporting staff has been planned in the project. The area with poor health care facility would benefit from this hospital as it has capacity to cater to the population.
4.	A primary and Secondary school with a capacity of 7620 students and 762 staff would benefit the nearby village population.
5.	The completion of project will eventually lead to permanent job opportunities to the local & nearby villagers as there would be increased demand for security, kitchen help, etc.
6.	There would be convenient shops which could provide livelihood opportunity to more than 200 persons after completion. The total commercial space in the project would need a staff of about 100 persons.
7.	A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary.
B	**TREE PLANTATION AND LANDSCAPING**
1.	Plantation shall reduce energy use by reducing heat island effect
2.	Pleasing aesthetic and visual impact
3.	Provide tolerance to air pollutants like PM10, PM2.5, SO2, NOx and CO
4.	Trees act as natural noise barriers
C	**WATER SAVING AND WASTE WATER MANAGEMENT**
1.	For fulfilling the construction water requirement of initial phase proponents are planning to use water tankers. After commissioning of initial phase the treated sewage from those phases shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity.
2.	By using treated sewage for flushing & gardening and minimizing the requirement of fresh water from Maharashtra Jeevan Pradhikaran (MJP).
3.	Treatment of Sewage by MBBR technology and treated sewage shall be used for gardening and flushing. For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.
4.	The stored excess treated sewage shall be given for irrigation purposes outside the plot.
D	**ENERGY SAVING**
1.	Water heating, one light and fan of flat is proposed on non-conventional solar energy which will help in energy saving.
2.	Street area lights based on Biogas generator
3.	Various energy saving measures shall ensure saving in energy
E	**SOLID AND HAZARDOUS WASTE MANAGEMENT**
1.	Provision of Bio-methanation plant for treatment of municipal solid waste.
2.	The energy generated from biogas plant will be used for lighting of street light lamps.
F	**ENVIRONMENTAL MONITORING & ENVIRONMENTAL MANAGEMENT PLAN**
1.	Environmental Management Plan and its judicious implementation with operation and maintenance of environmental facilities and proper budgetary allocations for the same will ensure long term benefits to the project and surrounding areas.

9.7 ENVIRONMENTAL MANAGEMENT PLAN:

Adequate environmental management measures will be incorporated during the entire planning, construction and operating stages of the project to minimize any adverse environmental impact and assure sustainable development of the area. The EMP's that will be put into place consist of those during construction and operating stages of the project and includes the following elements:

- Air Pollution Control and Management
- Noise Control and Management
- Water Conservation
- Sewage Treatment and Operation and Maintenance
- Storm water management
- Solid, Hazardous and E Waste Management
- Energy Conservation and use of Non-conventional energy
- Traffic Management
- Plantation, Landscaping and Land Management
- Management of Social Issues Occupational, Safety and Health issues
- Environmental Monitoring
- Emergency Response Plans for emergency scenarios
- Environmental Management System

For the effective and consistent functioning of the project, an Environmental Management System (EMS) will be established at the site. The following components will be part of the EMS:

- Environmental Policy
- Objectives & Targets
- Structure and Responsibility
- Emergency Planning
- Environmental Monitoring Program
- Operation of and Maintenance of Environmental Management Facilities like STP, Rain Water Harvestings, Solar Systems, Landscape Development, Solid Waste Management System.
- Non-conformance & Corrective and Preventive Action
- Short term and long term budgetary provisions for the EMP
- Submission of six monthly report to Regional office, MoEF for compliance of conditions in Environmental Clearance

Budgetary allocation for Environment Management:
The expenditure to be incurred by M/s. Claridges SEZ Developers Pvt. Ltd., on environmental matters during construction and operational phase is given as follows.

Total expenditure envisaged on Environment Management:
During Construction phase total cost: approximately **Rs. 210.10 Lacs**.
During Operation Phase total set up cost: **Rs. 10538.22 Lacs + At actual Cost for pipeline from pond to irrigation purposes outside the plot** and Operation & Maintenance cost shall be **Rs. 1090.26 Lacs/ Annum x 5 years = Rs. 5451.30 Lacs/ Annum**

9.8 CSR:

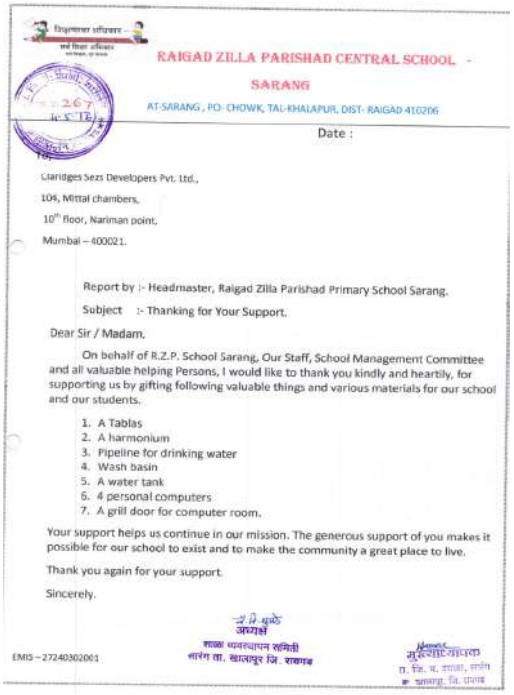
The following works have been carried out in two schools, namely the Raigad Zilla Parishad Central School at Village Sarang and the R. Z. P. Primary School at adjoining village Pali Khurd at an approx. cost of Rs. Three lacs:

- Provision of Computers
- Provision of Fans
- Grill work (as per their requirement)

- Renovation of Bathroom & Water Pipeline
- Provision of Notebooks
- Provision of musical instruments.
  The letters of appreciation from the two schools are attached.

Temple: Being an very old and historic temple given away 5 gunthas of land around the temple. We have also built a boundary wall and beautified the temple. Cost approx. Rs. 25 lacs

Vocational Training: Working with Mr. Krishna Khanna, Advisor to Government of India for Vocational Training, to set up a suitable facility to train the villagers in due course, so that they will be able to get jobs in the Special Township Project plan envisaged. Cost approx. – Rs. 30 Lacs.



RAIGAD ZILLA PARISHAD CENTRAL SCHOOL
SARANG
AT-SARANG , PO- CHOWK, TAL-KHALAPUR, DIST- RAIGAD 410206

Date :

Claridges Sezs Developers Pvt. Ltd.,
106, Mittal chambers,
10th floor, Nariman point,
Mumbai – 400021.

Report by :- Headmaster, Raigad Zilla Parishad Primary School Sarang.

Subject :- Thanking for Your Support.

Dear Sir / Madam,

On behalf of R.Z.P. School Sarang, Our Staff, School Management Committee and all valuable helping Persons, I would like to thank you kindly and heartily, for supporting us by gifting following valuable things and various materials for our school and our students.

1. A Tablas
2. A harmonium
3. Pipeline for drinking water
4. Wash basin
5. A water tank
6. 4 personal computers
7. A grill door for computer room.

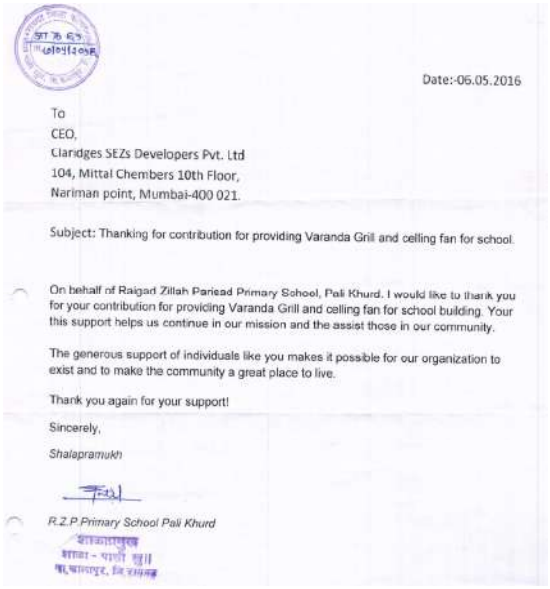
Your support helps us continue in our mission. The generous support of you makes it possible for our school to exist and to make the community a great place to live.

Thank you again for your support.

Sincerely.

अध्यक्ष
शाळा व्यवस्थापन समिती
सारंग ता. खालापूर जि. रायगड

EMIS – 27240302001



Date:-06.05.2016

To
CEO,
Claridges SEZs Developers Pvt. Ltd
104, Mittal Chembers 10th Floor,
Nariman point, Mumbai-400 021.

Subject: Thanking for contribution for providing Varanda Grill and celling fan for school.

On behalf of Raigad Zillah Parisad Primary School, Pali Khurd. I would like to thank you for your contribution for providing Varanda Grill and celling fan for school building. Your this support helps us continue in our mission and the assist those in our community.

The generous support of individuals like you makes it possible for our organization to exist and to make the community a great place to live.

Thank you again for your support!

Sincerely,

Shalapramukh

R.Z.P Primary School Pali Khurd

9.9 CONCLUSION:

Based on the environmental assessment, the associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EIA and EMPs.

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CHAPTER 10
DISCLOSURE OF CONSULTANTS

CHAPTER 10
DISCLOSURE OF CONSULTANTS

This EIA report is prepared on behalf of the proponents, taking inputs from proponent's office staff, Architects, Project Management Professionals etc. by Environmental Consultants M/s Ultra-Tech Environmental Consultancy & Laboratory, Thane.
Ultra-Tech has received Accreditation under the QCI-NABET scheme for Accreditation of EIA Consultant Organizations (Version 3)

Certificate No: NABET/EIA/1417/SA0011

ENVIRONMENTAL CONSULTANTS ORGANIZATION

ULTRA-TECH ENVIRONMENTAL CONSULTANCY & LABORATORY [Lab Gazetted by MoEF – Govt. of India] not only give environmental solutions for sustainable development, but make sure that they are economically feasible. With innovative ideas and impact mitigation measures offered, make them distinguished in environmental consulting business. The completion of tasks in record time is the key feature of Ultra-Tech. A team of more than hundred environmental brigadiers consists of engineers, experts, ecologists, hydrologists, geologists, socio-economic experts, solid waste and hazard waste experts apart from environmental media sampling and monitoring experts and management experts , strive hard to serve the clients with up to mark and best services.

Ultra-Tech offers environmental consultancy services to assist its clients to obtain environmental clearance for their large buildings, construction, CRZ, SEZ, high rise buildings, township projects and industries covering sugar and distilleries from respective authorities.

Ultra-Tech also provide STP/ETP /WTP project consultancy on turn-key basis apart from Operation and Maintenance of these projects on annual contract basis. Also, having MoEF approved environmental laboratory, Ultra-Tech provide laboratory services for monitoring and analysis of various environmental media like air, water, waste water, stack, noise and meteorological data to its clients all over India and abroad.

CREDENTIALS

- State of Art Environmental Laboratory & Trained Manpower, Gazetted by MoEF.
- Environmental Advisor for Municipal Corporation.
- Affiliated to Indian Green Building Council (IGBC), Hyderabad.
- Affiliated to United States Green Building Council (USGBC), US.
- Environmental Consultants for Federation of All India Textile Manufacturing Association (FAITMA)
- Environmental Consultants for All India Lead Manufacturing Association.
- ISO 9001:2015, Quality Management System implemented

HONORS

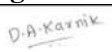
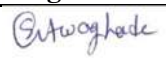
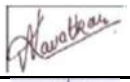
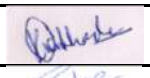
We are honored by the following reputed firms for our unflagging quality environmental & consultancy and monitoring services.

- **TECHNICAL CONSULTANT OF CRISIL, MUMBAI**
  For Common Effluent Treatment Plant issues in Gujarat, India
- **TECHNICAL CONSULTANT OF FAITMA, MUMBAI**
  [Fed. of All India Textile Manufacturer's Associations] For Environmental issues
- **TECHNICAL CONSULTANCY SERVICE, PUNE**
  For Environmental Quality Monitoring Services at Panvel-Karjat Rail-way Project
- **RASTRIYA CHEMICALS & FERTILIZERS , MUMBAI**
  For Ambient Air Monitoring in nearby villages

ISO 9001:2015 CERTIFICATION

ULTRA-TECH is one of the leading environmental consultancy and laboratory services providing companies and is ISO 9001:2015 certified.
All it means that ULTRA-TECH is certified for offering High Quality Environmental Services aiming at customer satisfaction. Its quality policy reflects its obligation to serve their customers at the best of their skills and to go extra mile to attain and exceed the expectations of valuable customers with an additional responsibility of contributing to the drive of turning this universe into greeniverse. Continuous efforts to enhance the specific skills which are critical to acquire is making ULTRA-TECH to attaining Excellency in providing environmental clearances through impact assessment.

LIST OF EIA COORDINATOR, FUNCTIONAL AREA EXPERTS & ASSOCIATES

S. No	Name of sector	Name of project	Name of Client	EIA Coordinator		Functional Area Experts involved		
				Name/s	Signature	FA	Name/s	Signature
1	Township and Area development 8 (a)	"Special Township Project" at Taluka: Khalapur, District: Raigad, Maharashtra Total Construction Built-up area: 23,63,400.26 Sq.mt.	M/s. Claridges SEZ Developers Pvt. Ltd.	Mrs. Deepa Tamhane Karnik Team member: Rekha Margam Mr. Shekhar Tamhane		LU	Mr. Swapnil Awaghade	
						AQ	Archana Sadashiva	
						AP	Mr. Shekhar Tamhane AFAE: Neha Kavatkar	 
						WP	Mrs. Rekha Margam	
						EB	Dr. T. K. Ghosh & Mrs. Padmini Shinde	
						SE	Mr. Kishor Wankhede	
						NV	Mr. Chintan Athalye	
						SC	Dr. D.S. Ramteke Team Member : Mrs. Padmini Shinde	

S. No	Name of sector	Name of project	Name of Client	EIA Coordinator		Functional Area Experts involved		
				Name/s	Signature	FA	Name/s	Signature
						HG	Basic details for the hydrology were reported by secondary data. HG expert was not involved for this project as soil report mentions about the ground water level and there is no planning for ground water withdrawal.	
						RH	Mr. Bonde AFAE: Mayuri Johari	
						SHW MSW	Ms. Deepa Tamhane Karnik Rekha Margam AFAE: Ms. Mayuri Johari	

LABORAOTRY TEAM

No.	Name of Team Member	Signature
1.	Mr. Rahul Kolhapurkar	

SOURCES OF PROJECT DETAILS, PLANNING, SERVICES & UTILITIES

NO.	DETAILS OF DATA / STUDY	DATA SOURCE / STUDY CONDUCTED AGENCY
1.	Architect (L.S.)	YMS Consultants Pvt. Ltd.
2.	Architect (Design)	Ar. Hafiz Contractor
3.	MEP Plan and Study	M/s. Amit Verma Consultants
4.	Traffic Consultants	M/s. GMD Consultants
5.	Storm water drainage pattern study	Enviro-con Urban Hydro-Environment Centre (EU-HEC)
6.	ECBC studies	M/s. Kaizen Design Solutions

TOR Reply

TERMS OF REFERENCE

No.	Particular	EIA Report reference
Project Specific points as per 34th SEAC - 2 Meeting		
1.	PP to confirm regarding ESA villages and applicability of HLWG recommendations	Project site is located at Sarang village which is not listed under ESA as per list of villages prepared by High Level Working Group (HL WG) given in Annexure A of the directions by Ministry of Environment and Forests (MoEF) dt.13.11.2013. But in the study area few villages of Khalapur Taluka are listed under Eco Sensitive Areas (ESA) of Western Ghat. Details given in Chapter 3
2.	PP to submit detailed report on carbon footprint study due to proposed development and submit measures to reduce the same	attached as Enclosure 12
3.	PP to submit 3 D plan for entire project, landscape plan for green belt and total work station map.	attached as Enclosure 3
4.	PP to study parking scenario and submit micro-planning layout for the parking	Detailed traffic report is attached as Enclosure 9
5.	PP to ensure that green concerns are addressed at the micro planning level	Tree Plantation Layout is attached as Enclosure 4
6.	PP, if applicable, to leave clear cut side margin of 6 m from the boundary of the plot and open space and non-paved RG area should be on ground as per the orders of Hon'ble Supreme Court (Civil Appeal No. 11150 of 2013 and SLP (Civil) No. 33402/2012) dated 17th December 2013.	The requirements of 6 mt. open space from the boundary of the plot and open space and non-paved RG on the ground have been provided as per the orders of the Hon'ble Supreme Court.
Points as per the TOR specified in Annexure A		
1.	Examine in detail the present status of the project site.	Ch 2, Section 2.1.3
(1)-a	Site clearance strategy	Not applicable
(1)-b	Debris quantification	Debris details is not applicable in this project, details of Excavation earth is given in Ch 4, sec 4.2.3.2
(1)-c	Segregation of the demolition waste and quantification	
(1)-d	Disposal strategy in consonance with the prevailing rules.	
(2)	Submit development strategy, phasing of the project along with infrastructure and facilities / utilities.	• For development strategy, Ch 2, sub sec 2.2.1 • For Infrastructure and facilities / utilities: Ch 2, sec 2.4 & sec 2.6 **During construction phase: Table 2.4 of Ch 2, sec 2.4** **During operation phase: Table 2.7 of Ch 2, sec 2.6**
(2)-a	Detailed total station map indication plot boundary	Enclosure 3 of the EIA
(2)-b	Construction area boundary	Enclosure 3 of the EIA
(2)-c	Green area boundary	Enclosure 4 of the EIA
(3)	Submit excavation details, quantity of excavated material, top soil quantity and its preservation.	Ch 4, sub section: 4.2.3.2
(4)	Examine in detail the proposed site with reference to impact on infrastructure covering following points: and the	

No.	Particular	EIA Report reference
	disposal of	
(4)-a	Water supply	Ch 4, Section 4.3.1
(4)-b	Storm water drainage	Ch 4, Section 4.3.2
(4)-c	Sewerage	Ch 4, Section 4.3.3
(4)-d	Power	Ch 4, Section 4.3.4
(4)-e	The disposal of treated/raw wastes from the complex on land/water body and into sewerage system.	Ch 4, Section 4.3.3
(5)	Examine in detail the carrying capacity of existing sewer line, drains etc.	Ch 4, Section 4.3.2
(6)	Examine details of land use around 2 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images.	Ch 3, Section 3.2.2
(7)	Study and submit details of environmentally sensitive places, rehabilitation of communities and present status of such activities.	Ch 3, Table 3.1
(8)	Examine baseline environmental quality along with projected incremental load due to the project. Environmental data to be considered in relation to the community development would be:	
(8)-a	Land	Ch 3, Section 3.2
(8)-b	Ground Water	Ch 3, Section 3.3, sub Sec 3.3.2
(8)-c	Surface Water	Ch 3, Section 3.3, sub Sec 3.3.1
(8)-d	Air	Ch 3, Section 3.4
(8)-e	Bio-diversity	Ch 3, Section 3.5
(8)-f	Noise due to the traffic	Ch 3, Sec 3.4.6
(8)-g	Socio economic and health etc.	Ch 3, sec 3.6
(9)	Study the socio-economic situation of the project area and its surroundings and their impact on the project design and operation.	For Study of the socio-economic situation of the project area and its surroundings Ch 3, sec 3.6
(9)-a	Socio impact Assessment studies (SIA) shall be carried out specific to the project area.	Ch 3, sec 3.6
(10)-a	Site Topography and Geographical Location of site	Ch 3, Sec 3.2, sub sec 3.2.1
(10)-b	Rainfall pattern and	Ch 3, Sec 3.4, sub sec 3.4.2
(10)-c	Soil Characteristics	Ch 3, Sec 3.1,sub sec 3.1.2
(11)	Study the hydrological and geo-hydrological conditions of the project area including a contour plan indicating slopes and showing drainage pattern and outfall. Examine in detail the carrying capacity of existing storm water drainage line. Possibility of flooding in and around the project site.	Chap 3 Sec 3.1, sub sec 3.1.1 a & b For Drainage Pattern & carrying capacity of existing storm water drainage line. Chap 4.3, sub sec 4.3.2
(12)	Storm water drainage and outfall may be described through contour map and slopes of the project area and its surroundings.	For Drainage Pattern & carrying capacity of existing storm water drainage line. Chap 4.3, sub sec 4.3.2 The layout for storm water drainage is attached as **Enclosure 10.**
(13)	Examine the details of water requirement, use of treated waste water and prepare water balance chart.	Ch 2, sec 2.6, sub sec 2.6.1
(14)	Rain water harvesting proposals should be made with due safeguards for groundwater quality, aquifer level, soil permeability, justification for suitable /appropriate rain water harvesting method and details of the selected option indicating locations on the project map.	Since the ground water table is not encountered, hence no recharging is proposed Ch 4, sub sec 4.2.1 Layout showing rain water harvesting

No.	Particular	EIA Report reference
(15)	Maximize recycling of water and utilization of rain water. Examine details	tanks is attached as **Enclosure 3.**
(16)	Examine soil characteristics and depth of ground water Table for rainwater harvesting	
(17)	STP and water treatment plant should not be near each other. Indicate their locations with area details on the map. Also provide justification for the technology selected on the site and examine sustainable operation of the infrastructure.	STP and water tanks are not near each other. For plan showing of STP: **Enclosure 3.** Ch 4, sec 4.2 and sub sec 4.2.2
(18)	Examine details of Solid waste generation, Type and quantity, Treatment and its disposal.	**During Construction Phase** : Ch 2, sub section 2.4 and Chapter 4 sub section 4.2.3 **During Operation Phase :** Ch 2, sub section 2.6 and Chapter 4 sub section 4.2.3.3
(19)	Common facilities for waste collection Treatment, Recycling, Disposal (all effluent, emission and refuse including MSW.)	For Segregation , Treatment , Recycling and Disposal of various types of solid wastes : Chap 4 ,Sec 4.2.3.3
(20)	Examine the location of solid waste treatment and disposal sites	For Segregation , Treatment , Recycling and Disposal of various types of solid wastes : Chap 4 ,Sec 4.2.3.3
(21)	Study the existing flora and fauna of the area and the impact of the project on them.	Ch 3, sub section 3.5 For impact: Ch 4, sub sec 4.1.5
(22)	Since the project is a building construction and area developmental activities, examine electrical load, energy conservation measures etc. and saving in energy.	Ch 2, sec 2.6. For energy conservation method: Ch 4, sec 4.2
(23)	Examine and submit details of use of solar energy and alternative source of energy to reduce the energy consumption.	Ch 2, sec 2.6. For energy conservation method: Ch 4, sec 4.2,
(24)	DG sets are likely to be used during construction and operational phase of the project. Emissions from DG sets must be taken into consideration while estimating the impacts on air environment. Examine and submit details.	The DG sets will have inbuilt acoustic enclosure and stack height shall be as per CPCB. Ch 4, sub sec 4.1.3.1
(25)	Provide for conservation of resources, energy efficiency and use of renewable sources of energy in the light of ECBC code. Application of renewable energy/alternate energy, such as solar energy, wind energy may be described with detailed analysis and exploring the possibility of such installations.	Ch 2, sec 2.6. For energy conservation method: Ch 4, sec 4.2, sub sec 4.2.4 For saving in energy: Table 4.14 for ECBC studied Ch. 6 sec. 6.2
(26)	A detailed traffic and transportation study should be made for existing and projected passenger and commercial traffic as the project is a mixed development including residential and commercial development.	Traffic report is enclosed as **Enclosure 9**
(27)	Examine the details of transport of materials for construction which should include source and availability.	
(28)	The evaluation of impacts should be analyzed depending upon the nature (positive and negative), duration (short term and long term) reversibility, and magnitude (negligible, low, medium, high), etc. of the impacts based the objective assessments.	
(29)	Examine road/rail connectivity to the project site and impact on the	

No.	Particular	EIA Report reference
	traffic due to the proposed project. Present and future traffic and transport facilities *for* the region should be analysed with measures for preventing traffic congestion and providing faster trouble free system to reach different destinations in the city.	
(30)	Traffic management plan including parking areas may be described. Traffic survey should be carried out on week days and week end.	
(31)	Examine and submit details of Air quality monitoring as per latest National Ambient Air Quality standards as notified by the Ministry on 16th November, 2009.	Ch 3 Sec 3.4.4
(32)	Examine and submit the details of Noise modeling studies and mitigative measures	Ch 4, sec 4.1, sub sec 4.1.4.1
(33)	Examine noise levels - present and future with noise abatement measures.	Ch 3 – Sec 3.4.6 Ch 4, sec 4.1, sub sec 4.1.4.1
(34)	Noise pollution has always been a major concern for developmental projects during the construction and operational phase. It is suggested that noise monitoring should be carried out at critical locations at the surrounding areas may be incorporated in environmental monitoring programme during the whole operational phase of the project.	Chapter 5 section 5.1 Table 5.1 & 5.2: Environmental Monitoring Plan with Costing
(35)	Natural and artificial noise barriers may be considered for critical locations.	Ch 4, Section 4.2.5
(36)	A thick green belt should be planned all around the project site to mitigate noise and vibrations to the nearby settlements. The identification of species/plants should be made based on the botanical studies.	
(37)	Landscape plan, green belts and open spaces may be described.	
(38)	Examine the details of afforestation measures indicating land and financial outlay.	
(39)	Use of local building materials should be described. The provisions of fly ash notification should be kept in view.	For Natural Resource Conservation : Ch 2, section 2.3
(40)	Risk assessment and disaster management plan should also include Fire, Earthquake, local floods, and any other natural disaster.	Ch. 6 sec 6.1
(41)-a	Environmental Management Plan should be accompanied with Environmental Monitoring Plan and environmental cost and benefit assessment.	Chap-8
(41)-b	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan.	
(42)	Make assessment of any regulatory measure in view of the environmental and social impacts of the project (such as unauthorized development in and around the area)	Proper plan of action by the proponent shall be implemented which useful in gaining public confidence depending on local requirement. The Proponent will continue regular environmental awareness programs to bring forth the benefits of development in terms of improvement in quality of life
(43)	Submit the details of CSR activities. Provisions shall be made for	Funds given to Zilla Parishad Central

No.	Particular	EIA Report reference
	education, health and vocational training programs.	School for fulfillment of infrastructures of school Funds raised for beatification of old Temple Ch 9, Section 9.8

****

MASTER PLAN

MASTER PLAN

PROFORMA 'B'

CONTENTS OF SHEET

MASTER PLAN

DESCRIPTION OF PROPOSAL & PROPERTY :-

NAME OF OWNER, ADDRESS & SIGNATURE :-

NAME OF ADDRESS & SIGNATURE ARCHITECT / LICENSED SURVEYOR :-

yms

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FORM – 1& 1A

"SPECIAL TOWNSHIP PROJECT"

At

At Post-Sarang, Taluka- Khalapur, Dist - Raigad, State: Maharashtra – 410206.

By

M/s. Claridges SEZ Developers Pvt. Ltd.

FORM – 1

"SPECIAL TOWNSHIP PROJECT"

At

At Post-Sarang, Taluka- Khalapur, Dist - Raigad, State: Maharashtra – 410206.

By

M/s. Claridges SEZ Developers Pvt. Ltd.

APPENDIX - I
(See paragraph - 6)
FORM 1

(I) Basic Information

<table>
<tr><th>Sr. No.</th><th>Item</th><th>Details</th></tr>
<tr><td>1.</td><td>Name of the project/s</td><td>“Special Township Project”, At Post Sarang, Taluka Khalapur, Dist. Raigad, Maharashtra.</td></tr>
<tr><td>2.</td><td>S. No. in the schedule</td><td>8 (b)</td></tr>
<tr><td>3.</td><td>Proposed capacity/area/length/tonnage to be handled/command area/lease area/number of wells to be drilled</td><td>Plot area: 10, 62,500.00 Sq. mt.
Built up Area as per FSI: 12, 47,741.00 Sq. mt.
Total Construction Built-up Area: 23, 63,400.26 Sq. mt.
Project Proposal:
<table>
<tr><th>Phases</th><th>Building Details</th></tr>
<tr><td>1</td><td>21 nos. of Residential Buildings:
Type A buildings : 6 buildings of Ground + Podium + 22 Upper Floors
Type B buildings : total 15 buildings
12 buildings of Ground + Podia + 22 Upper Floors
3 buildings of Ground + 2 Podia + 22 Upper Floors
Total Flats: 3036 nos.</td></tr>
<tr><td></td><td>Convenient Shopping :
1 building : Ground+ 1 Upper Floor
Shops: 2 units</td></tr>
<tr><td></td><td>Convention Centre: 2 buildings of Ground + 2 Podia+ 15 Upper Floors</td></tr>
<tr><td></td><td>Primary School : Ground+ 4 Upper Floors
Classrooms: 72 nos.</td></tr>
<tr><td></td><td>Hospital: Basement+ Ground+ 4 Upper Floors
Beds: 150 Nos.</td></tr>
<tr><td></td><td>Economical Weaker Section (EWS) scheme:
10 nos. of Residential buildings:
Type A: 7 buildings of Ground + 12 Upper Floors
Type B: 2 buildings of Ground + 11 Upper Floors
Type E: 1 building of Ground + 12 Upper Floors
Total Flats: 844 nos.</td></tr>
<tr><td>2</td><td>11 nos. of Residential Buildings:
Type A buildings :3 buildings of Ground + Podium + 22 Upper Floors
Type B buildings : 8 buildings of Ground + Podium + 22 Upper Floors
Total Flats: 1584 nos.</td></tr>
<tr><td></td><td>Convenient Shopping :
1 building : Ground+1 Upper Floor
Shops: 2 unit</td></tr>
<tr><td></td><td>Hotel: 3 buildings of
Ground + 2 Podia+20 Upper Floors
Rooms: 840 nos.</td></tr>
<tr><td></td><td>Economical Weaker Section (EWS) scheme:
5 nos. of Residential buildings:
Type A : Ground + 12 Upper Floors
Total Flats: 480 nos.</td></tr>
<tr><td>3</td><td>18 nos. of Residential Buildings:
Type A buildings : 3 buildings of Ground + Podium+ 3 part podia + 22 Upper Floors
Type B buildings : 15 buildings of Ground + Podium + 22 Upper Floors
Total Flats: 2508 nos.</td></tr>
</table></td></tr>
</table>

Sr. No.	Item	Details	
			Convenient Shopping : 1 building : Ground+ 1 Upper Floors **Shops: 2 units**
			Secondary School : Ground+ 7 Upper Floors Classrooms: 182 nos.
			Office building: Ground+ 5 Upper Floors
			Office and Market Mall: 6 Buildings of Ground+ 3 Podia+ 5 Upper Floors (market mall) + 6 to 20 upper floors (offices)
			Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A : 7 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type F : 1 building of Ground + 12 Upper Floors Type I : 1 building of Ground + 12 Upper Floors **Total Flats: 908 nos.**
			Home for aged person, Community Centre, Library, Auditorium 1 building with 4 wings Wing A: Home for aged: 2 Basements + Ground +6 Podia + 5 Upper Floors **Rooms:110** Wing B: Community center : 2 Basements + Ground +6 Podia + 5 Upper Floor Wing C: Library: 2 Basements + Ground +6 Podia + 4 Upper Floor Wing D: Auditorium: 1 building of 2 Basements + Ground +6 Podia +5 Upper Floor
		4	**IT park:** Total 3 buildings 2 Basements+ Ground+ 4 Podia+ 24 Upper Floors
			Resort: Type A : 2 buildings of Ground + 4 Upper Floors Type B : 1 building of Ground + 3 Upper Floors Type C : 1 building of Ground + 5 Upper Floors
			Economical Weaker Section (EWS) scheme: 12 nos. of Residential buildings: Type C : 11 buildings of Ground + 12 Upper Floors Type D : 1 building of Ground + 12 Upper Floors **Total Flats: 1140 nos.**
			Police Station
		5	**Economical Weaker Section (EWS) scheme:** 18 nos. of Residential buildings: Type F : 16 buildings of Ground + 12 Upper Floors Type G : 2 building of Ground + 12 Upper Floors **Total Flats: 1632 nos.**
		6	**Economical Weaker Section (EWS) scheme:** 15 nos. of Residential buildings: Type A : 2 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors

Sr. No.	Item	Details
		Type C : 8 buildings of Ground + 12 Upper Floors Type F : 4 building of Ground + 12 Upper Floors **Total Flats: 1388 nos.** **Convenient Shopping :** **1 building: Ground+ 1 Upper Floor** **Unit: 2 nos.** **Primary School : Ground+ 10 Upper Floors** Classrooms: 200 nos.
4.	New/Expansion/Modernization	New
5.	Existing Capacity/ Area etc.	Not Applicable
6.	Category of project i.e.' A' or 'B'	A
7.	Does it attract the general condition? If yes, please specify.	Not Applicable
8.	Does it attract the specific condition? If yes, please specify.	Not Applicable
9.	Location	Sarang
	Plot/Survey/Khasra No.	At plot bearing survey & Hissa nos. 2/3, 3/0, 4/1, 4/2, 4/3, 4/4, 5/1, 5/2, 5/3, 6/1, 6/2, 6/3, 6/4, 6/5, 6/9, 6/10, 6/12, 6/14, 6/15, 6/19, 6/20, 6/22, 6/23,7/0(Pt),8/4,10/1B,10/1C,10/1D,10/2A, 11/3, 12/0, 13/1, 13/2, 14/0, 15/0,16/1A,16/1B,17/0(Pt.), 18/0, 19/0(Pt), 21/0, 22/0, 47/0, 53/2A, 53/2B(Pt.), 53/4, 53/5A, 53/5B, 53/6, 53/7, 53/8, 54/1, 54/2, 55/1A, 55/2A, 55/2B, 59/0, 60/1, 60/2(Pt), 61/0, 63/0, 64/2, 65/0, 66/0(Pt), 67/0, 68/0(Pt), 69/0(Pt), 70/0(Pt), 71/1A(Pt), 71/2, 71/3(Pt), 71/4, 72/1,72/2B,72/3,72/4, 72/5, 72/6A, 72/6B(Pt), 72/6C, 72/7, 72/8, 72/9, 72/10, 73/1, 73/2, 73/3, 73/4, 73/5, 73/6, 73/7, 73/9, 74/2, 74/3, 75/0, 76/2, 76/3, 76/7, 76/8, 76/9, 76/10, 76/11, 78/0, 79/0, 80/0, 81/0, 82/0,83/1,83/2A, 83/2B,83/2C,83/3,83/4,84/0,86/0, Post-Sarang, Taluka- Khalapur, Dist – Raigad.
	Village	Sarang
	Tehsil	Khalapur
	District	Raigad
	State	Maharashtra
10.	Nearest railway station Nearest airport	Chowk Railway Station: Within 1.00 Km (Road distance) Mumbai Chhatrapati Shivaji International Airport: Within: 58.00 km. (Road distance)
11.	Nearest Town, city, District headquarters along with distance in kms.	Khalapur (Raigad)
12.	Village Panchayats, Zilla Parishad, Municipal Corporation, Local body (complete postal address with telephone nos. to be given)	**Special Planning Authority** : Navi Mumbai Airport Influence Notified Area (NAINA)
13.	Name of the applicant	**M/s. Claridges SEZ Developers Pvt. Ltd.**
14.	Registered Address	104, Mittal Chambers, 10th Floor, Nariman Point, Mumbai - 400021
	Address for correspondence	104, Mittal Chambers, 10th Floor, Nariman Point, Mumbai - 400021
	Name	Mr. Vijay Raichand
	Designation (Owner/Partner/CEO)	CEO
	Address	104, Mittal Chambers, 10th Floor, Nariman Point, Mumbai - 400021
	Pin Code	400021
	E-mail	raichandvijay@gmail.com, info@csdpl.com
	Telephone No.	022-65085666
	Fax No.	--
16.	Details of Alternative Sites examined, if any. Location of these sites should be shown on a topo-sheet.	--

Sr. No.	Item	Details
17.	Interlinked Projects	No
18.	Whether separate application of interlinked project has been submitted?	Not Applicable
19.	If yes, date of submission	Not Applicable
20.	If no, reason	Not Applicable
21.	Whether the proposal involves approval/clearance under: if yes, details of the same and their status to be given.	
	(a) The Forest (Conservation) Act, 1980?	Not applicable
	(b) The Wildlife (Protection) Act, 1972?	Not applicable
	(c) The C.R.Z Notification, 1991?	Not applicable
22.	Whether there is any Government Order/Policy relevant/ relating to the site?	Yes Received Locational clearance (LC) from Urban Development Department and same is attached herewith as **Enclosure 1.**
23.	Forest land involved (hectares)	Not Applicable
24.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up? (a) Name of the Court (b) Case No. (c) Order /directions of the Court, if any and its relevance with the proposed project.	No

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	Yes	The site is an open land; hence no demolition activities are involved and shall be developed as Special Township Project.
1.2	Clearance of existing land, vegetation and building?	Yes	Cutting of trees is involved
1.3	Creation of new land uses?	Yes	Site is an open land and shall be developed as Special Township Project.
1.4	Pre-construction investigation e.g. bore houses, soil testing?	Yes	Geotechnical Investigation report is carried out and same is enclosed as **Enclosure 2.**
1.5	Construction works?	Yes	Special Township Project
1.6	Demolition works?	No	--
1.7	Temporary sites used for construction works or housing of construction workers?	No	Facilities for workers shall be provided on site itself.
1.8	Above ground building, structures or earthworks including linear structures, cut and fill or excavations	Yes	Excavation earth (18, 00,000 Cum) shall be fully reused on site. Construction Waste shall be shall be partly reused /recycled on site and shall be partly reused on site.
1.9	Underground works including mining or Tunneling?	No	Construction of basements only - for Home for aged person, Community Centre, Library, Auditorium (in Phase 3) and for IT Building (in Phase 4)

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.10	Reclamation works?	No	--
1.11	Dredging?	No	--
1.12	Offshore structures?	No	--
1.13	Production and manufacturing processes?	No	--
1.14	Facilities for storage of goods or materials?	Yes	Temporary storage facilities to store the construction raw material
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	• STP for treatment of sewage followed by phythoroid technology • Primary treatment for Hospital waste followed by treatment in STP • Segregation and storages facilities for all solid waste streams • Biodegradable garbage shall be treated in Biomethanation plant • Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal. **The agreement between the Project proponent and Agency is attached as Enclosure 3.** • E-Waste will be stored separately and disposed through authorized recyclers • Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016 • Use of dried sludge from STP and slurry generation from Biogas plant as manure
1.16	Facilities for long term housing of operational workers?	Yes	Drinking water facility and toilet bathing facilities Health checkup facilities Personal protective and safety equipment
1.17	New road, rail, or sea traffic during construction or operation?	No	--
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	No	--
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic Movements?	No	--
1.20	New or diverted transmission lines or pipelines?	Yes	o High Tension (HT) lines: Remarks for HT lines is obtained from Maharashtra State Electricity Transmission Co. Ltd. and is attached as **Enclosure 4.** Buffer zone from HTL is marked in the layout plan and same is attached as **Enclosure 5.** o TATA hydro electronic line, GAIL pipe line and HPCL pipe line is passing through the plot and development shall be done as per specific remarks from Local Authority.
1.21	Impoundment, damming, culverting, realignment or other change to the hydrology of watercourses or aquifers?	Yes	Nallah is passing through the plot. Detailed catchment area study has done and detailed out in EIA report.
1.22	Stream crossings?	No	--
1.23	Abstraction or transfers of water from ground or surface waters?	No	--

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	Yes	By considering the run off prior to development and runoff after development we can say that there will be some increment in runoff of storm water. Incremental Runoff = 13.26 m^3/sec
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Transport of construction materials
1.26	Long-term dismantling or decommissioning or restoration works?	No	--
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	No	--
1.28	Influx of people to an area in either temporarily or permanently?	Yes	This is a special township project hence there will be influx of ~ 1, 35,593 persons (including floating population).
1.29	Introduction of alien species?	No	--
1.30	Loss of native species or genetic diversity?	No	--
1.31	Any other actions?	No	--

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

<table>
<tr><th>Sr. No.</th><th>Information/checklist confirmation</th><th>Yes / No</th><th>Details thereof (with approximate quantities /rates, wherever possible) with source of information data</th></tr>
<tr><td>2.1</td><td>Land especially undeveloped or agricultural land (ha)</td><td>Yes</td><td>Land is undeveloped land.</td></tr>
<tr><td>2.2</td><td>Water (expected source & competing users) unit : KLD</td><td>Yes</td><td>During Construction Phase -
For Workers: 23 KLD for each phase (Source : Tanker water of potable quality)
For construction of each phase (depending on construction activity): Source Water tankers*

<table>
<tr><th>Details</th><th colspan="7">Phases</th></tr>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>Total</th></tr>
<tr><td>Domestic</td><td>13</td><td>13</td><td>13</td><td>13</td><td>13</td><td>13</td><td>78</td></tr>
<tr><td>Flushing</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>60</td></tr>
<tr><td>Construction</td><td>200</td><td>100</td><td>225</td><td>250</td><td>70</td><td>80</td><td>925</td></tr>
</table>
(*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity)

During Operational Phase –
For Domestic Purposes: 7283 KLD [Source: from Maharashtra Jeevan Pradhikaran (MJP)]
For Swimming Pool: 36 KLD [Source: Tanker Water of Potable Quality</td></tr>
<tr><td>2.3</td><td>Minerals (MT)</td><td>No</td><td>--</td></tr>
<tr><td>2.4</td><td>Construction material – stone, aggregates, and / soil (expected source – MT)</td><td>Yes</td><td>Quantity : As per requirement
Sources: The material required for construction activities procured from company’s authorized / approved vendors/ open market.</td></tr>
<tr><td>2.5</td><td>Forests and timber (source</td><td>Yes</td><td>Timber required for doors sourced from local suppliers</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>Information/checklist confirmation</th><th>Yes / No</th><th>Details thereof (with approximate quantities /rates, wherever possible) with source of information data</th></tr>
<tr><td></td><td>– MT)</td><td></td><td></td></tr>
<tr><td>2.6</td><td>Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)</td><td>Yes</td><td>During Operation Phase:
Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)
<table>
<tr><th>Phases</th><th>Connected Load (KW)</th><th>Maximum Demand (KW)</th><th>DG sets (power failure for emergency services)</th></tr>
<tr><td>1</td><td>68265</td><td>27047</td><td>2 DG sets of 320 KVA each
2 DG sets of 500 KVA each
6 DG sets of 625 KVA each
1 DG set of 100 KVA
2 DG sets of 1000 KVA each
1 DG set of 320 KVA
1 DG set of 600 KVA</td></tr>
<tr><td>2</td><td>42884</td><td>18194</td><td>1 DG set of 1000 KVA
2 DG sets of 400 KVA each
1 DG set of 600 KVA
1 DG set of 500 KVA
3 DG sets of 2500 KVA each</td></tr>
<tr><td>3</td><td>94222</td><td>36946</td><td>7 DG sets of 1010 KVA each
1 DG set of 400 KVA
2 DG set of 750 KVA each
1 DG set of 140 KVA
2 DG sets of 1250 KVA each
6 DG sets of 2000 KVA each
5 DG sets of 1500 KVA each</td></tr>
<tr><td>4</td><td>57340</td><td>37362</td><td>4 DG sets of 1000 kVA each
1 DG set of 400 KVA</td></tr>
<tr><td>5</td><td>26208</td><td>10195</td><td>2 DG sets of 600 KVA each
2 DG sets of 350 KVA each</td></tr>
<tr><td>6</td><td>20341</td><td>6985</td><td>1 DG set of 380 KVA
1 DG set of 750 KVA
1 DG set of 80 KVA
1 DG set of 400 KVA</td></tr>
</table></td></tr>
<tr><td>2.7</td><td>Any other natural resources (use appropriate standard units)</td><td>No</td><td>--</td></tr>
</table>

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	No	--
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	--
3.3	Affect the welfare of people e.g. by changing living conditions?	No	--
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	--
3.5	Any other causes	No	--

4. Production of solid wastes during construction or operation or decommissioning (MT/month):

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	--
4.2	Municipal waste (domestic and or commercial wastes)	Yes	**During Construction Phase:** Total quantity of solid waste = 30 Kg/day (Biodegradable and Non-biodegradable) **During Operation Phase:** The total quantity of solid waste: 39415 Kg /day. (Biodegradable and Non-biodegradable)
4.3	Hazardous wastes (as per Hazardous waste Management Rules)	Yes	Waste oil generated from D.G. shall be stored at separate location duly marked and will be sold to the CPCB authorized recyclers. Hazardous Waste management plan shall be given**.**
4.4	Other industrial process wastes	No	--
4.5	Surplus product	No	--
4.6	Sewage sludge or other sludge from effluent treatment.	Yes	Use of dried sludge from STP and Waste generation from Biogas plant as manure
4.7	Construction or demolition wastes.	Yes	Excavation earth (18,00,000 Cum) shall be fully reused on site. Construction Waste shall be shall be partly reused /recycled on site and shall be partly reused on site.
4.8	Redundant machinery or equipment	No	--
4.9	Contaminated soils or other materials	No	--
4.10	Agriculture wastes	No	--
4.11	Other solid wastes	Yes	**E-Waste:** Office buildings and IT park are proposed in phase 3 and 4 respectively hence quantification of E-waste generation is done for these two phases only. Details are as follows: **Phase** / **Quantity (Kg /annum)** Phase 3 / 4887 Phase 4 / 20,009 **Total** / **24,896** E-Waste will be stored separately and disposed through authorized recyclers. **Biomedical Waste:** Hospital is proposed in phase 1, hence quantification is done for this phase only **-** 56.3 Kg/day Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016.

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr):

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	CPCB approved D.G. Sets will be used during power failure
5.2	Emissions from production processes	No	--
5.3	Emissions from materials handling including storage or transport	Yes	• Use of water for dust suppression and polymeric dust suppression system (wherever possible) • Use of covering sheets shall be done for trucks carrying construction material to prevent air borne dust • All material storages shall be adequately covered to avoid dust/particulate emissions

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
			• Use of CPCB approved DG sets with proper maintenance • Adequate parking provision and proper traffic movement for smooth traffic flow • Vehicles having valid pollution under control certificate shall be allowed to ply on site • Open burning of solid waste shall be prohibited • Regular health check-up of the workers. • Use of the standard personal protective equipments like masks, goggles, etc. • Sensors to monitor air quality shall be installed. This will help to keep record daily for the air quality.
5.4	Emissions from construction activities including plant and equipment	Yes / Marginal	The project may cause rise in dust levels during construction phase, following precautions taken to mitigate the impact • Use of water for dust suppression and polymeric dust suppression system (wherever possible) • Use of covering sheets shall be done for trucks carrying construction material to prevent air borne dust • All material storages shall be adequately covered to avoid dust/particulate emissions • Use of CPCB approved DG sets with proper maintenance • Adequate parking provision and proper traffic movement for smooth traffic flow • Vehicles having valid pollution under control certificate shall be allowed to ply on site • Open burning of solid waste shall be prohibited • Regular health check-up of the workers. • Use of the standard personal protective equipments like masks, goggles, etc. • Sensors to monitor air quality shall be installed. This will help to keep record daily for the air quality.
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Dust generation control as described above. For odour control: Proper ventilation shall be provided around STP and Biomethanation plant, Proper housekeeping and maintenance shall be done
5.6	Emissions from incineration of waste	No	--
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	--
5.8	Emissions from any other sources	No	--

6. Generation of Noise and Vibration, and Emissions of Light and Heat :

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
6.1	From operation of equipment e.g. engines, ventilation plant, crushers.	Yes but negligible	For control of noise following measures shall be adopted: • Provision of barricades of adequate height along the periphery of the site • During construction activities the noise will be monitored to ascertain the noise levels are within limits • All precautions for noise abatement shall be taken during the construction activities • During high noise construction activity there will be

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
			provision of ear plugs for construction labour and staff • No noise polluting work in night shifts • In-built acoustic enclosure for DG sets • It is recommended that Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise • Provision of artificial noise barrier
6.2	From industrial or similar processes.	No	--
6.3	From construction or demolition.	Yes	Noise Pollution Control : Noise pollution will be due to operation of machinery as well as transportation vehicles. This may cause nuisance to the nearby area. Following precautions shall be taken to control noise pollution : • Provision of barricades of adequate height along the periphery of the site • During construction activities the noise will be monitored to ascertain the noise levels are within limits • All precautions for noise abatement shall be taken during the construction activities • During high noise construction activity there will be provision of ear plugs for construction labour and staff • No noise polluting work in night shifts • In-built acoustic enclosure for DG sets • It is recommended that Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise • Provision of artificial noise barrier
6.4	From blasting or piling.	No	--
6.5	From construction or operational traffic.	Yes	**During Construction phase:** • Entry to vehicles with valid PUC certificate • Proper parking arrangement for the construction vehicles • Provision of oil and grease traps to the Storm water drains • Contaminated soil (if any) found if any to authorized CHWTSDF • Regular maintenance of vehicles with suitable enclosures and intake silencers Planning and ensuring effective implementation of the waste movement plan for loading and offsite movement in non-traffic Hours. **Operation Phase :** • Proper parking arrangement for the vehicles • Provide adequate traffic signs and signages to notify residents • Install safety mirrors to aid visibility in conflict points • Prevent parking near the Entry and Exit Gate • Provide speed humps to regulate speed of vehicles • Provide pedestrian crossings and dedicated footpath to cater to the walking population • Assign traffic wardens to regulate flow of project traffic during peak hours • Adequate width of internal driveway • Plantation of new trees with retention of existing trees to

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data.
			mitigate dust and noise • Provision of oil and grease traps to the Storm water drains
6.6	From lighting or cooling systems.	No	--
6.7	From any other sources.	No	--

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea :

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials.	No	--
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge).	No	**During Construction Phase:** Sewage shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants. **During Operation Phase:** For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.
7.3	By deposition of pollutants emitted to air into the land or into water.	No	Dust generation during construction phase from earthworks and movement of vehicles. Appropriate fugitive dust control measures, including watering, water sprinkling of exposed areas and dust covers for trucks, provided to minimize any impacts. DG exhaust discharged at stipulated height by providing adequate stack height to the DG sets.
7.4	From any other sources.	No	--
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	--

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment :

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	No	--
8.2	From any other causes.	No	--
8.3	Could the project be affected by natural disasters causing	Yes	Landslides are not expected in the area. Management plan for flood is as follows:

	environmental damage (e.g. floods, earthquakes, landslides, and cloudburst)?		**Floods :** • Minimizing the incremental runoff from the site with the help of rain water harvesting tanks of adequate capacity • Proper management of channelization of storm water from site by using proper internal SWD system and discharge point of having adequate capacity (29.61 m^3/sec) • Use of screens and silt traps to SWD • Proper maintenance of storm water drainage to avoid choking of drains and flooding on site • Surface rainwater to be passed through oil & grease trap & desilting chamber and then transferred to external drain of adequate capacity (255.12 m^3/sec) **Earthquake :** The structure of the building shall be designed as per IS codes for zone IV. Disaster Management Plan is given in EIA report

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality.

Sr. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting, lities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: • Supporting infrastructure (roads, power supply, waste or waste water treatment etc) • Housing development • Extractive industries • Supply industries • Other	 No Yes	 -- It is a Special Township Project
9.2	Lead to after-use of the site, which could have an impact on the environment	No	--
9.3	Set a precedent for later developments	Yes	Site shall be developed as a Special Township Project, ensuring easy accessibility and high quality of amenities for residents/ employees, safe environment in area. A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary. There would be convenient shops which could provide livelihood opportunity to more than 200 persons after completion. The total commercial space in the project would need a staff of about 100 persons. Provision of commercial spaces and IT parks will definitely lead to job opportunities for the peoples.
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	Yes	Impacts on water availability, storm water drainage, availability of electricity, traffic congestion etc.

(III) Environmental Sensitivity

Sr. No.	Areas	Name/ Identity	Aerial distance (within 15 km.) from Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	Project site is located at Sarang village which is not listed under ESA as per list of villages prepared by High Level Working Group (HL WG) given in Annexure A of the directions by Ministry of Environment and Forests (MoEF) dt.13.11.2013. But in the study area few villages of Khalapur Taluka are listed under Eco Sensitive Areas (ESA) of Western Ghat. The details are given as follows:	
		Warose Tarf Wankhal	9.00
		Sondewadi	9.00
		Borgaon Khurd	7.00
		Nadhal	2.00
		Palasdari	9.00
		Talawali	10.00
		Kalote Mokashi	7.00
		Ghodivali	10.00
		Kalote Rayati	6.00
		Nigdoli	4.00
		Parkhande	9.00
		Talashi	10.00
		Project site is located at Sarang village which is not listed under ESA of Matheran as per notification dt. 04.02.2003 and amended notification dt. 16.04.2004. But details of nearest boundary of Eco sensitive zone of Matheran from project boundary is given as follows:	
		Nearest boundary of Eco-sensitive Zone of Matheran	0.20
		Karnala Bird Sanctuary	Approx. 9.00
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Nadhal Reservoir	Approx.1.00
		Bhilavle Reservoir	Approx. 4.00
		Morbe Reservoir	Approx.2.00
		Jambivali Reservoir	Approx. 6.00
		Pond	Adjacent to the plot
		Hatnoli Lake	Approx.5.00
		Bhivpuri Reservoir	Approx. 12.00
		Usran Lake, Rasayani	Approx. 7.00
		Ransai Reservoir lake	Approx.15.00
		Gadeshwar Reservoir	Approx. 15.00
		Vinegaon Lake	Approx. 6.00
		Varne Lake	Approx.10.00
		Patalganga River (upstream)	Approx. 1.00
		Ulhas River	Approx. 10.00
		Kirki River	Approx. 12.00
		Kalundri river	Approx. 14.00
		Balganga River	Approx. 13.00
		Bogeshwar River	Approx. 14.00
		Reserved forest near Karade Budrukh	Approx. 5.00
		Reserved forest at Manikgad	Approx. 7.00
		Reserved forest at Devloli	Approx. 8.00
		Reserved forest at Narpoli	Approx. 6.00
		Reserved forest at	Approx. 8.00

Sr. No.	Areas	Name/ Identity	Aerial distance (within 15 km.) from Proposed project location boundary
		Prabhalgad	
		Reserved forest at Vinegaon	Approx. 6.00
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	Karnala Bird Sanctuary	Approx. 9.00
		Matheran	Approx. 8.00
		Patalganga River (upstream)	Approx. 1.00
		Ulhas River	Approx. 10.00
4	Inland, coastal, marine or underground waters	Nil	NA
5	State, National boundaries	Nil	NA
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	Nil	NA
7	Defence installations	Nil	NA
8	Densely populated or built-up area	--	--
9	Areas occupied by sensitive man-made land uses *(hospitals, schools, places of worship, community facilities)*	J. H. Ambani School	Approx. 1.00
		Dhirubhai Ambani Hospital	Approx. 1.00
		Kalptaru Mother and Child Hospital	Approx.2.00
10	Areas containing important, high quality or scarce resources *(Ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)*	No	--
11	Areas already subjected to pollution or environmental damage. *(those where existing legal environmental standards are exceeded)*	No	--
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (*Earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions*)	No	--

(IV) Proposed Terms of Reference for EIA studies:

As per the Environment Impact Assessment (EIA) Notification dated 14th September 2006 as amended, the proposed project requires preparation of EIA Report. Project specific **ToR received from State Level Environmental Assessment Committee - 2 (SEAC 2), Maharashtra in July, 2015**

As per the amendment in EIA Notification dt. 9th December 2016, the proposed project falls under **'Category A'** with activity number **'8 (b)'**, hence has to be appraised at MoEF & CC. **Hence the project file was transferred** from Director (Environment Dept.), Government of Maharashtra **to the Member Secretary Infrastructure EAC (2), MoEF & CC with an forwarding letter dt. 06.03.2017 for the prescribed Terms of Reference, mentioning its validity upto 22nd July, 2018** for the submission of EIA/EMP report, the same is attached as **Enclosure 6**.

CLARIDGES SEZ DEVELOPERS PVT. LTD.
104, Mittal Chambers, 10th Floor,Nariman Point, Mumbai - 400021
Tel. : 022-65085666 Email : info@csdpl.com

"I hereby give undertaking that the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance given, if any to the project will be revoked at our risk and cost."

Date: 12.10.2017

Place: Mumbai

For CLARIDGES SEZ DEVELOPERS PVT. LTD.

Signature of the applicant
With Name and Full Address
(Project proponent/s Authorised Signatory)

FORM – 1A

"SPECIAL TOWNSHIP PROJECT"

At

At Post-Sarang, Taluka- Khalapur, Dist - Raigad, State: Maharashtra – 410206.

.

By

M/s. Claridges SEZ Developers Pvt. Ltd.

APPENDIX II
(See paragraph 6)
FORM-1 A (only for construction projects listed under item 8 of the Schedule)

CHECK LIST OF ENVIRONMENTAL IMPACTS
[Project proponents are required to provide full information and wherever necessary attach explanatory notes with the Form and submit along with proposed environmental management plan & monitoring programme]

1	**LAND ENVIRONMENT [Attach panoramic view of the project site and the vicinity]**
1.1	**Will the existing land use get significantly altered from the project that is not consistent with the surroundings? (Proposed land use must conform to the approved Master Plan / Development Plan of the area. Change of land use if any and the statutory approval from the competent authority to be submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii) The site (indicating levels & contours) to appropriate scales. If not available attach only conceptual plans.**

Site Location:

- The project is " Special Township Project" (STP) located at plot bearing at village Sarang, Taluka Khalapur, District Raigad to be developed by **M/s. Claridges SEZ Developers Pvt. Ltd.**
- This Special Township Project comprises of Residential buildings & EWS (Economical Weaker Section) Housing with amenities and economic activities
- Project site falls within the limits of Mumbai Metropolitan (MMR) Region and special planning authority is Navi Mumbai Airport Influence Notified Area (NAINA).

Land Use Pattern:
Project site is an open land and falls within the limits of Mumbai Metropolitan (MMR) Region and special planning authority is Navi Mumbai Airport Influence Notified Area (NAINA). The proposed development comprises of Residential buildings along with amenities like Market Mall, Office Building above Market Mall, Convention Centre, Hotels and Resorts, IT Park and Office Building, Hospital, Primary and Secondary School, Petrol Pump, Police Station, Auditorium, Library, Community Centre, Home for Aged Person. The region has mixed land use pattern comprising of residential and commercial development.

Site levels:
Plot is sloping partially from centre to North West (20 m in 500 m) and partially from East to South West Direction (13 m in 750 m).

The following details are enclosed

1.	Site Location Map	**Enclosure 7**
2.	Surrounding features of the proposed site (within 2 Km)	**Enclosure 8**
3.	Conceptual Plan	Enclosure 5

1.2	**List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.**

➢ **Connectivity and community facilities**

The project is Special Township Project and is located at Post-Sarang, Taluka-Khalapur, Dist-Raigad. The project has direct access to NH4. Nearest railway station is Chowk railway station on main line of Central railway.

➢ **Building Details:**

Table 1: Project Proposal

Phases	Building Details	Occupancy
1	**21 nos. of Residential Buildings:** Type A buildings : 6 buildings of Ground + Podium + 22 Upper Floors Type B buildings : total 15 buildings 12 buildings of Ground + Podia + 22 Upper Floors	**23851**

		3 buildings of Ground + 2 Podia + 22 Upper Floors **Total Flats: 3036 nos.**	
		Convenient Shopping : 1 building : Ground+ 1 Upper Floor **Shops: 2 units**	
		Convention Centre: 2 buildings of Ground + 2 Podia+ 15 Upper Floors	
		Primary School : Ground+ 4 Upper Floors **Classrooms: 72 nos**.	
		Hospital: Basement+ Ground+ 4 Upper Floors **Beds: 150 Nos.**	
		Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A: 7 buildings of Ground + 12 Upper Floors Type B: 2 buildings of Ground + 11 Upper Floors Type E: 1 building of Ground + 12 Upper Floors **Total Flats: 844 nos.**	
	2	**11 nos. of Residential Buildings:** Type A buildings :3 buildings of Ground + Podium + 22 Upper Floors Type B buildings : 8 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 1584 nos.**	**12568**
		Convenient Shopping : 1 building : Ground+1 Upper Floor **Shops: 2 unit**	
		Hotel: 3 buildings of Ground + 2 Podia+20 Upper Floors **Rooms: 840 nos.**	
		Economical Weaker Section (EWS) scheme: 5 nos. of Residential buildings: Type A : Ground + 12 Upper Floors **Total Flats: 480 nos.**	
	3	**18 nos. of Residential Buildings:** Type A buildings : 3 buildings of Ground + Podium+ 3 part podia + 22 Upper Floors Type B buildings : 15 buildings of Ground + Podium + 22 Upper Floors **Total Flats: 2508 nos.**	**50456**
		Convenient Shopping : 1 building : Ground+ 1 Upper Floors **Shops: 2 units**	
		Secondary School : Ground+ 7 Upper Floors Classrooms: 182 nos.	
		Office building: Ground+ 5 Upper Floors	
		Office and Market Mall: 6 Buildings of Ground+ 3 Podia+ 5 Upper Floors (market mall) + 6 to 20 upper floors (offices)	
		Economical Weaker Section (EWS) scheme: 10 nos. of Residential buildings: Type A : 7 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type F : 1 building of Ground + 12 Upper Floors Type I : 1 building of Ground + 12 Upper Floors **Total Flats: 908 nos.**	

	Home for aged person, Community Centre, Library, Auditorium 1 building with 4 wings Wing A: Home for aged: 2 Basements + Ground +6 Podia + 5 Upper Floors **Rooms:110** Wing B: Community center : 2 Basements + Ground +6 Podia + 5 Upper Floor Wing C: Library: 2 Basements + Ground +6 Podia + 4 Upper Floor Wing D: Auditorium: 1 building of 2 Basements + Ground +6 Podia +5 Upper Floor	
4	**IT park:** Total 3 buildings 2 Basements+ Ground+ 4 Podia+ 24 Upper Floors	**26870**
	Resort: Type A : 2 buildings of Ground + 4 Upper Floors Type B : 1 building of Ground + 3 Upper Floors Type C : 1 building of Ground + 5 Upper Floors	
	Economical Weaker Section (EWS) scheme: 12 nos. of Residential buildings: Type C : 11 buildings of Ground + 12 Upper Floors Type D : 1 building of Ground + 12 Upper Floors **Total Flats: 1140 nos.**	
	Police Station	
5	**Economical Weaker Section (EWS) scheme:** 18 nos. of Residential buildings: Type F : 16 buildings of Ground + 12 Upper Floors Type G : 2 building of Ground + 12 Upper Floors **Total Flats: 1632 nos.**	**8160**
6	**Economical Weaker Section (EWS) scheme:** 15 nos. of Residential buildings: Type A : 2 buildings of Ground + 12 Upper Floors Type B : 1 building of Ground + 11 Upper Floors Type C : 8 buildings of Ground + 12 Upper Floors Type F : 4 building of Ground + 12 Upper Floors **Total Flats: 1388 nos.**	**13688**
	Convenient Shopping : **1 building: Ground+ 1 Upper Floor** **Unit: 2 nos.**	
	Primary School : Ground+ 10 Upper Floors Classrooms: 200 nos.	
	Total	**1,35,593**

Reference: National Building Code (NBC) -2005 – Part 4, Page 27, for Occupant Load

C. Area Statement:

Table 2A: Area statement

No	Description	Area (Sq.mt.)
1.	Plot Area	10,62,500.00
2.	Ground Coverage Area	**2,71,235.46**
3.	Recreational Ground (R.G.) Area	**3,43,571.58**
4.	Built – up Area as per FSI	**12,47,741.00**
5.	Total Construct-ion Built – up Area (FSI + NON FSI)	**23,63,400.26**

Table 2B: Phase wise Area statement

No	Description	Area (Sq.mt.)						
		Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**	**Phase 6**	**Total**
1.	Ground Coverage Area	90,929.70	49,788.81	85,392.96	31,684.15	5,990.60	7,449.24	**271,235.46**
2.	R.G. Area	93,431.89	67,541.37	20,933.05	76,886.64	24,559.49	60,219.14	**3,43,571.58**
3.	Built – up Area as per FSI	316,019.10	181,905.40	374,991.12	240,187.65	61,534.80	73,102.93	**12,47,741.00**
4.	Total Construct-ion Built – up Area (FSI + NON FSI)	5,60,383.51	3,12,790.33	6,28,322.70	7,07,982.10	71,887.20	82,034.42	**23,63,400.26**

D. Parking Statement:

Table 3: Parking Statement

Phase	Parking required as per Local Norms (nos.)						Parking Provision (nos.)				
	4W	**2W**	**Cycle**	**Bus**	**Ambulance**		**4W**	**2W**	**Cycle**	**Bus**	**Ambulance**
1	5609	561	4338	16	3		5984	725	4338	16	3
2	2798	280	3126	-	-		2977	327	3126	-	-
3	6396	640	7852	63	2		7113	803	7852	64	2
4	4760	476	1819	-	-		4919	460	1819	-	-
5	460	46	2244	-	-		521	63	2244	-	-
6	465	53	1390	50	-		469	58	1390	50	-
Total	**20488**	**2056**	**20769**	**129**	**5**		**21983**	**2436**	**20769**	**130**	**5**

E. Water requirement for the project:

- **During Construction Phase:**
- For workers : 23 KLD for each phase
  Source : Tanker water of potable quality
- For construction of each phase (depending on construction activity): Source Water tankers*

Details	Phases						
	1	**2**	**3**	**4**	**5**	**6**	**Total**
Domestic	13	13	13	13	13	13	**78**
Flushing	10	10	10	10	10	10	**60**

Construction	200	100	225	250	70	80	**925**

(*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity).

- **During Operational Phase:**
- **Water Consumption: (Domestic and flushing requirement)**

Table 4: Water requirement (Domestic and flushing requirement)

No.	Building	Occupancy	Domestic & Flushing Requirement (KLD)		Total (KLD)
			Domestic	Flushing	
I.	**Phase 1**	23851	1840	969	2809
II.	**Phase 2**	12568	1166	552	1718
III.	**Phase 3**	50456	1876	1275	3151
IV.	**Phase 4**	26870	909	758	1667
V.	**Phase 5**	8160	734	367	1101
VI.	**Phase 6**	13688	758	479	1237
	Grand total	**135593**	**7283**	**4400**	**11683**

Reference: National Building Code (NBC) -2005 – Part 9, Page 19, Water Requirement

The amount of water demand is calculated based on the occupancy of the building and the per capita consumption as given in MOEF Manual on norms and standards for EC of large construction projects i.e. Total quantity of water used (LPCD) = Occupancy x Quantity (LPCD)
Then Total quantity of water used for Domestic and Flushing in KLD is calculated.

- **Total water requirement for the project and source:**

Table 5: Total water requirement for the project and source

No.	Description	Quantity of water required KLD	Source of water supply
I	**Construction phase**		
1	For Workers	23 KLD for each phase	Tanker water of potable quality
2	For Construction	For construction of each phase (depending on construction activity):	Source Water tankers* (*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity).

II	Operation phase								
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total	
1.	Domestic	1840	1166	1876	909	734	758	**7283**	MJP / RWH
2.	Flushing	969	552	1275	758	367	479	**4400**	Treated sewage from STP
3.	Gardening	280	203	63	231	87	181	**1044**	Treated sewage from STP
4.	Swimming Pool	36						**36**	Tanker Water of Potable Quality

*Water requirement for gardening purpose is considered as 3 liters per square meter of gardening area on ground i.e.
Total quantity of water used (LPCD) = Gardening Area (Sq. Mt.) x Quantity (Lit /Sq. Mt.)
Then total quantity of water for gardening in KLD is calculated.

F. Sewage Generation

Table 6: Sewage Generation

No.	Description	Quantity of Sewage generated (KLD)	Treatment/ Disposal
1.	Construction Phase	22	Shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants
2.	Operation Phase	10227	Treatment in STP and reuse of treated sewage (available for recycling –9204 KLD) for flushing –4400KLD, and gardening –1044 KLD. The stored excess treated sewage shall be given for irrigation purposes outside the plot. **Details of the Reuse Scheme:** • For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. • Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. • Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.

Reference: Manual on norms and standards for EC of large construction projects MoEF.

G. Solid Wastes:

1) During Construction Phase:

Table 7: Solid Wastes During Construction Phase :

No. of workers	Criteria for Solid Waste Generation			Solid Waste Generation Kg /day		
	Total (Kg/Person/day)	Non-Biodegradable	Biodegradable	Non-Biodegradable	Biodegradable	Total
300	0.1	80%	20%	24	6	30

The wastes shall be segregated into biodegradable and non-biodegradable and shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal

2) During Operation Phase:

Table 8: Solid Wastes During Operation Phase

Phases	Solid waste generation (kg/day)		
	Biodegradable	Non-biodegradable	Total
1	6197	2963	9160
2	4079	1830	5909
3	6221	5963	12184
4	2219	2463	4682
5	2570	1102	3672
6	2321	1488	3809
Total	**23607**	**15808**	**39415**

Considerations for municipal solid waste generation:

- For offices (staff/visitors), market mall (Staff/visitors), library, school community centre, auditorium, petrol pump, Police station, convention hall, hotels and resorts, hospitals: 20 % biodegradable garbage and 80 % Non-biodegradable garbage out of total 0.10 Kg/person /day
- For residential and home for aged : 70 % biodegradable garbage and 30 % Non-biodegradable garbage out of total 0.45 Kg/person /day

The total quantity of solid waste will be 39415 Kg /day. Out of which 15808 kg/day will be non-biodegradable and 23607 kg/day will be biodegradable.

- Segregation and storages facilities for all solid waste streams
- Biodegradable garbage shall be treated by Biomethanation plant (details of Biomethanation plant is elaborated in EIA report)
- Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal. The agreement between the Project proponent and Agency is attached as Enclosure 3.
- E-Waste will be stored separately and disposed through authorized recyclers
- Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016
- STP Sludge (Dry sludge) and Waste from Biomethanation plant: Used as manure within the premises for plants

E-Waste: Office buildings and IT park are proposed in phase 3 and 4 respectively hence quantification of E-waste generation is done for these two phases only. Details are as follows:

Phase	Quantity (Kg /annum)
Phase 3	4887
Phase 4	20,009
Total	**24,896**

Table No.9: Hospital - Bio Medical Waste

Occupancy	Criteria for Bio Medical Waste Generation (Kg/day/bed)				Total (Kg/ day)			
	Total	Non Infectious	Infectious	Hazardous	Non Infectious	Infectious	Hazardous	Total
150	0.38	80%	15%	5%	45.0	8.44	2.81	56.3

Estimated generation of total waste @ 1.5 kg/bed
Estimated generation of bio-medical waste @ 25% of the total waste generated
Reference: Manual on Solid Waste Management (CPHEEO) – Chapter 7, Page 148,Waste Management System-Biomedical waste
(Web link :http://moud.gov.in/sites/upload_files/moud/files/pdf/uidssmt/swm/chap7.pdf

H. Power requirement:
During Construction Phase -
Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)
D.G. Sets: as per requirement

During Operational Phase -
Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)

Table 10: Power Requirement :

Phases	Connected Load (KW)	Maximum Demand (KW)	DG sets (For emergency services in case of power)
1	68265	27047	2 DG sets of 320 KVA each 2 DG sets of 500 KVA each 6 DG sets of 625 KVA each 1 DG set of 100 KVA 2 DG sets of 1000 KVA each 1 DG set of 320 KVA 1 DG set of 600 KVA
2	42884	18194	1 DG set of 1000 KVA 2 DG sets of 400 KVA each 1 DG set of 600 KVA 1 DG set of 500 KVA 3 DG sets of 2500 KVA each
3	94222	36946	7 DG sets of 1010 KVA each 1 DG set of 400 KVA 2 DG set of 750 KVA each 1 DG set of 140 KVA 2 DG sets of 1250 KVA each 6 DG sets of 2000 KVA each 5 DG sets of 1500 KVA each
4	57340	37362	4 DG sets of 1000 kVA each 1 DG set of 400 KVA
5	26208	10195	2 DG sets of 600 KVA each 2 DG sets of 350 KVA each
6	20341	6985	1 DG set of 380 KVA 1 DG set of 750 KVA 1 DG set of 80 KVA 1 DG set of 400 KVA

1.3	**What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing land use, disturbance to the local**

<table>
<tr><td></td><td>ecology).</td></tr>
<tr><td></td><td>There shall have some impacts on water, air environment, power requirement but it shall be mitigated by providing proper pollution control facilities. STP shall be provided for treatment of recycling of sewage there by reducing fresh water demand. Also for water conservation, rain water harvesting shall be done. Power consumption shall be reduced by using energy saving practices. Impact on air quality shall be reduced by plantation of trees on green cover area. This project will generate employment during construction phase & operation phase and there by shall have positive impact on socio economy.</td></tr>
<tr><td>1.4</td><td>Will there be any significant land disturbance resulting in erosion, subsidence & instability? (Details of soil type, slope analysis, vulnerability to subsidence, seismicity etc. may be given).</td></tr>
<tr><td></td><td>As per the Seismic Zoning Map of India, region falls under Zone IV.</td></tr>
<tr><td>1.5</td><td>Will the proposal involve alteration of natural drainage systems? (Give details on a contour map showing the natural drainage near the proposed project site)</td></tr>
<tr><td></td><td>No.
Contour map showing the natural drainage near the project site is given in EIA report</td></tr>
<tr><td>1.6</td><td>What are the quantities of earthwork involved in the construction activity-cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc)</td></tr>
<tr><td></td><td>Excavation earth (18, 00,000 Cum) shall be fully reused on site.
Construction Waste shall be shall be partly reused /recycled on site and shall be partly reused on site.</td></tr>
<tr><td>1.7</td><td>Give details regarding water supply, waste handling etc during the construction period.</td></tr>
<tr><td></td><td>For Workers: 23 KLD for each phase (Source : Tanker water of potable quality)
For construction of each phase (depending on construction activity): Source Water tankers*
<table>
<tr><th>Details</th><th colspan="7">Phases</th></tr>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>Total</th></tr>
<tr><td>Domestic</td><td>13</td><td>13</td><td>13</td><td>13</td><td>13</td><td>13</td><td>78</td></tr>
<tr><td>Flushing</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>60</td></tr>
<tr><td>Construction</td><td>200</td><td>100</td><td>225</td><td>250</td><td>70</td><td>80</td><td>925</td></tr>
</table>
(*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity)

The sewage generated approximately 22 KLD (for each phase) Shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants.</td></tr>
<tr><td>1.8</td><td>Will the low lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity)</td></tr>
<tr><td></td><td>No.</td></tr>
<tr><td>1.9</td><td>Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labour and the means of disposal)</td></tr>
<tr><td></td><td>Solid Waste Generation during Construction Phase:
Construction Waste shall be shall be partly reused /recycled on site and shall be partly reused on site.
From Construction labour :
Biodegradable garbage = 6 kg/day
Non-biodegradable garbage = 24 kg/day
Total = 30 kg/day
Wastes shall be segregated into biodegradable and non-biodegradable and shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal</td></tr>
<tr><td>2</td><td>WATER ENVIRONMENT</td></tr>
<tr><td>2.1</td><td>Give the total quantity of water requirement for the proposed project with the breakup of requirements for various uses. How will the water requirement be met? State the sources & quantities and furnish a</td></tr>
</table>

water balance statement.

Water Requirement & Source:

During Construction Phase -

For Workers: 23 KLD for each phase (Source : Tanker water of potable quality)

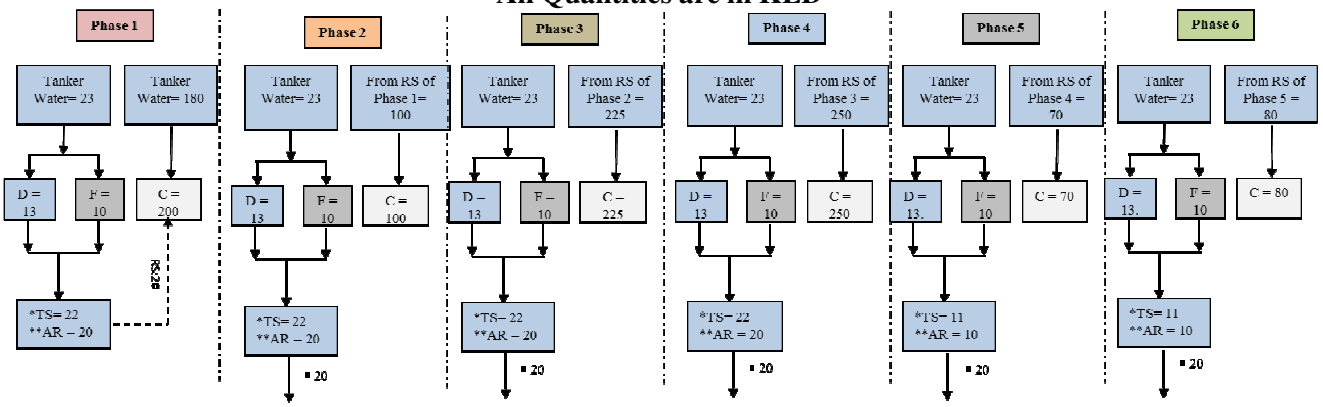
For construction of each phase (depending on construction activity): Source Water tankers*

Details	Phases						
	1	2	3	4	5	6	Total
Domestic	13	13	13	13	13	13	**78**
Flushing	10	10	10	10	10	10	**60**
Construction	200	100	225	250	70	80	**925**

(*Note: For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity).

WATER BALANCE PER DAY BASIS DURING CONSTRUCTION PHASE

All Quantities are in KLD



Legends	Particulars
D	Domestic
F	Flushing
* TS	Total Sewage
** AR	Available for Recycling
RS	Recycled Sewage

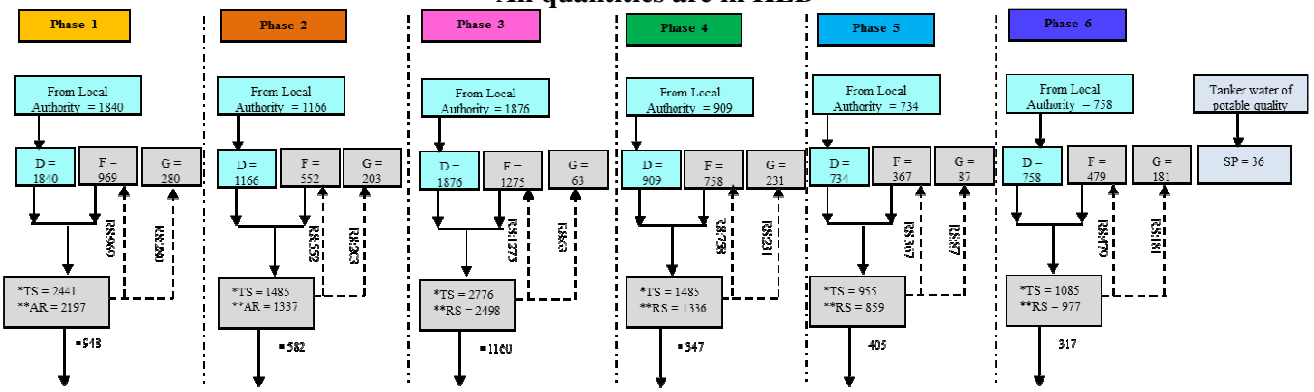
During Operational Phase -

Table 11: Total Water Requirement & Source

No.	Description	Quantity of water required (KLD)							Source of water supply
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total	
1.	Domestic	1840	1166	1876	909	734	758	**7283**	MJP / RWH
2.	Flushing	969	552	1275	758	367	479	**4400**	Treated sewage from STP
3.	Gardening	280	203	63	231	87	181	**1044**	Treated sewage from STP
4.	Swimming Pool	36						**36**	Tanker Water of Potable Quality

WATER BALANCE PER DAY BASIS DURING NON-MONSOON

All quantities are in KLD



Legend:	Particulars
D	Domestic
F	Flushing
G	Gardening
SP	Swimming Pool Makeup
*TS	Total Sewage
**AR	Available for Recycling
RS	Recycled Sewage

Please Note: All quantities are in KLD

Please Note:

*Considered 80 % sewage of total of domestic and 100 % of flushing requirement hence total sewage generation is 10227 KLD

**Considered 10 % less availability of sewage for recycling considering losses of sewage in evaporation and sludge formation hence sewage available for recycling is 9204 KLD

- The stored excess treated sewage (3759 KLD): Shall be given for irrigation purposes outside the plot.

Total water requirement = 12763 KLD

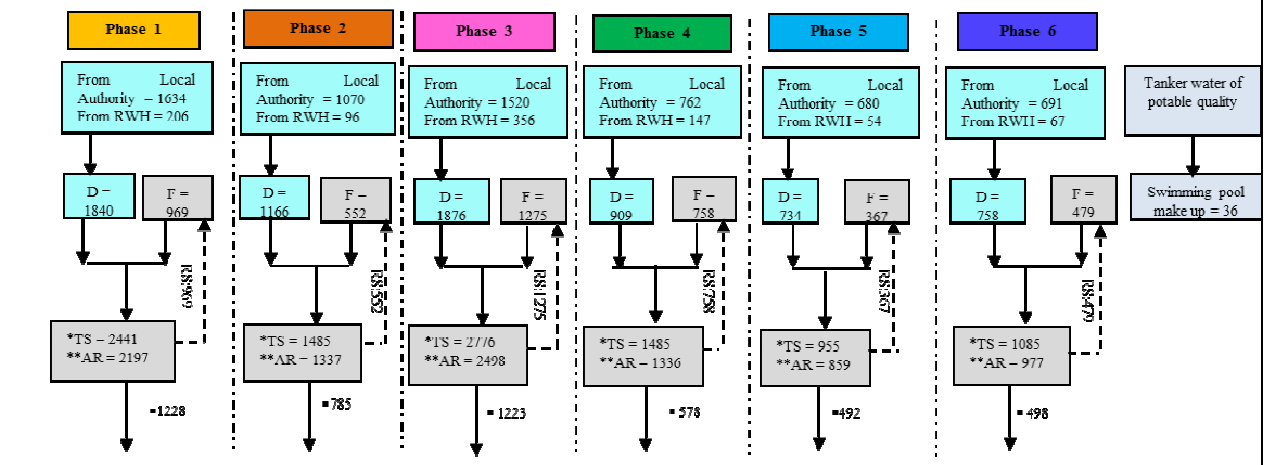
Recycling of treated Sewage (5444 KLD) shall be done for gardening (1044 KLD) and flushing (4400 KLD)

Hence Net water requirement: 12763 – 5444 = 7319 KLD [i.e. For Domestic purpose = 7283 KLD (Source: MJP) and for Swimming pool make up water = 36 KLD (Source: tanker water of potable quality)]

Reduction in Net water demand = 43%

WATER BALANCE PER DAY BASIS IN MONSOON

All quantities are in KLD



Legends	Particulars
D	Domestic
F	Flushing
SP	Swimming Pool Makeup
*TS	Total Sewage
**AR	Available for Recycling
RS	Recycled Sewage

Please Note: All quantities are in KLD

*Considered 80 % sewage of total of domestic and 100 % of flushing requirement hence total sewage generation is 10227 KLD

**Considered 10 % less availability of sewage for recycling considering losses of sewage in evaporation and sludge formation hence sewage available for recycling is 9204 KLD

- The stored excess treated sewage (4804 KLD): Shall be given for irrigation purposes outside the plot.

Daily rain water availability is calculated as per Av. 20 mm rainfall/day considering only 50 rainy days (half of season)

Total water requirement = 11719 KLD

Recycling of treated Sewage (4400 KLD) shall be done for flushing (4400 KLD)

From RWH tanks = 926 KLD (For domestic purpose)

Hence **Net water requirement**: 11719 – 4400 - 926 = 6393 KLD [i.e. For **Domestic** purpose = 6357 KLD (Source: MJP) and for **Swimming pool make up water** = 36 KLD (Source: tanker water of potable quality)]

Reduction in Net water demand = 45 %

	Details of the Reuse Scheme: • For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. • Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. • Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.
2.2	**What is the capacity (dependable flow or yield) of the proposed source of Water?**
	Domestic Water Supply from Maharashtra Jeevan Pradhikaran (MJP)
2.3	**What is the quality of water required, in case, the supply is not from a municipal source? (Provide physical, chemical, biological characteristics with class of water quality)**
	Drinking water shall be supplied by MJP
2.4	**How much of the water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)**
	All secondary requirements like flushing (4400 KLD) and gardening (1044 KLD) will be fulfilled by treated sewage 9204 KLD from STPs. Excess treated sewage will be reused for flushing and gardening and construction activities of subsequent phases till completion of construction after that the excess treated sewage shall be given for irrigation purposes outside the plot.

2.5	**Will there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption)**
	MJP has common water supply.
2.6	**What is the incremental pollution load from wastewater generated from the proposed activity? (Give details of the quantities and composition of wastewater generated from the proposed activity)**

Table 12: Capacity of Sewage Treatment Plants

Phases	Sewage (KLD)	Total STP capacity (KL)	Number of STPs and capacity of each STP
1	2441	2807	1 STP of capacity 305 KL 1 STP of capacity 665 KL 1 STP of capacity 530 KL 1 STP of capacity 530 KL 1 STP of capacity 127 KL 1 STP of capacity 80 KL 1 STP of capacity 421 KL 1 STP of capacity 64 KL 1 STP of capacity 54 KL 1 STP of capacity 27 KL 1 STP of capacity 4 KL
2	1485	1634	1 STP of capacity 332 KL 1 STP of capacity 185 KL 1 STP of capacity 250 KL 1 STP of capacity 257 KL 1 STP of capacity 304 KL 1 STP of capacity 301 KL 1 STP of capacity 5 KL
3	2776	3283	1 STP of capacity 1060 KL 1 STP of capacity 328 KL 1 STP of capacity 258 KL 1 STP of capacity 559 KL 1 STP of capacity 167 KL 1 STP of capacity 517 KL 1 STP of capacity 12 KL 1 STP of capacity 382 KL
4	1485	1624	1 STP of capacity 786 KL 1 STP of capacity 68 KL 1 STP of capacity 768 KL 1 STP of capacity 2 KL
5	955	1100	1 STP of capacity 1100 KL
6	1085	1177	1 STP of capacity 236 KL 1 STP of capacity 634 KL 1 STP of capacity 298 KL 1 STP of capacity 9 KL
Total	**10227**	11625	

Details of the Reuse Scheme:

- For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers.

- Treated sewage generated will be reused for secondary requirements like flushing (1044KLD) & gardening (4400 KLD).

- Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage.

- Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.

UNTREATED AND TREATED SEWAGE QUALITY:

Table 13: Untreated & Treated Sewage Quality

No.	Details	Values		Units
		Untreated	Treated	
1.	pH	7.0 – 8.0	6.5 – 7.5	
2.	Total Suspended solids	200 – 450	≤ 10	mg/lit
3.	Chemical Oxyge Demand	400 – 600	≤ 30	mg/lit
4.	BOD, 3 day, 27 °C	250 – 400	<5	mg/lit
5.	Oil & Grease	50	<5	mg/lit

2.7 **Give details of the water requirements met from water harvesting? Furnish details of the facilities created.**

Provision of 31 RWH tanks of total capacity 8981 KLD

Phases	RWH tanks
1	Residential Building: 4 RWH tanks of total capacity 1137 KL EWS: 1 RWH tank of capacity 275 KL School Building: 1 RWH tank of capacity 173 KL Hospital Building: 1 RWH tank of capacity 321 KL Convention Centre: 1 RWH tank of capacity 125 KL
2	Residential Building: 4 RWH tanks of total capacity 594 KL EWS Building: 1 RWH tank of capacity 153 KL Hotel Building: 1 RWH tank of capacity 187 KL
3	Residential Building: 3 RWH tanks of total capacity 959 KL EWS Building: 1 RWH tank of capacity 293 KL Institutional Building : 1 RWH tank of capacity 288 KL School Building: 1 RWH tank of capacity 173 KL Office Building: 1 RWH tank of capacity 163 KL Market Mall and Office Building: 1 RWH tank of capacity 1478 KL
4	IT park Building: 1 RWH tank of capacity 784 KL Resort (Type A, B & C): 1 RWH tank of capacity 296 KL EWS Building: 1 RWH tank of capacity 374 KL
5	EWS Building: 2 RWH tanks of total capacity 539 KL
6	EWS Building: 2 RWH tanks of total capacity 455 KL Convenient Shopping: 1 RWH tank of capacity 26 KL Primary School Building: 1 RWH tank of capacity188 KL

2.8 **What would be the impact of the land use changes occurring due to the proposed project on the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase**

on a long term basis? Would it aggravate the problems of flooding or water logging in any way?

Summary of Runoff and Carrying Capacity of Internal & External Drain

Details	m^3/sec
Runoff before development from plot	13.29
Runoff after development from plot	26.58
Runoff from pond adjacent to the plot contributing to plot drain	1.06
Peak runoff from catchment area outside plot contributing to plot drain	0.64
Total runoff from plot	28.28

Details	Capacity(m^3/sec)
Carrying capacity of internal drain	29.61
Carrying capacity of external North drain	230.90
Carrying capacity of external South drain (three streams)	24.22
Total carrying capacity of North and South drain	255.12

Precaution to avoid water logging on site:

- Minimizing the incremental runoff from the site with the help of rain water harvesting tanks of adequate capacity
- Proper management of channelization of storm water from site by using proper internal SWD system and discharge point of having adequate capacity (29.61 m^3/sec)
- Use of screens and silt traps to SWD
- Proper maintenance of storm water drainage to avoid choking of drains and flooding on site
  Surface rainwater to be passed through oil & grease trap & desilting chamber and then transferred to external drain of adequate capacity (255.12 m^3/sec)

2.9 **What are the impacts of the proposal on the ground water? (Will there be tapping of ground water; give the details of ground water table, recharging capacity, and approvals obtained from competent authority, if any)**

Ground water recharging is not proposed.

2.10 **What precautions/measures are taken to prevent the run-off from construction activities polluting land & aquifers? (Give details of quantities and the measures taken to avoid the adverse impacts).**

The runoff from the site during construction phase will be prevented as under :

i) Use of polymeric spray for dust suppression instead of water wherever possible
ii) Curing water shall be sprayed on concrete structures, free flow of water should not be allowed for curing
iii) Use of wet jute cloth/gunny bags instead of water spray for curing activity

2.11 **How is the storm water from within the site managed?(State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels)**.

- Minimizing the incremental runoff from the site with the help of rain water harvesting tanks of adequate capacity
- Proper management of channelization of storm water from site by using proper internal SWD system and discharge point of having adequate capacity (29.61 m^3/sec)
- Use of screens and silt traps to SWD
- Proper maintenance of storm water drainage to avoid choking of drains and flooding on site
  Surface rainwater to be passed through oil & grease trap & desilting chamber and then transferred to external drain of adequate capacity (255.12 m^3/sec)

Details of storm water drainage area plan with calculations, carrying capacity of external drain system in the project and natural drainage pattern of surrounding area along with layout showing storm water

	drainage system is given in EIA report
2.12	**Will the deployment of construction labourers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation)**
	• Disposal of sewage to Shall be treated in modular type STP and excess treated sewage shall be used for water sprinkling, construction of internal roads and watering nursery plants • Disposal of segregated waste shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal • First aid and medical facilities • Proper housekeeping • Regular pest control & site sanitation
2.13	**What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of wastewater generation, treatment capacities with technology & facilities for recycling and disposal).**

Design Basis of Treatment plant – MBBR (Moving Bed Bio Reactor)

Table 14: Untreated & Treated Sewage Quality

No.	Details	Values		Units
		Untreated	Treated	
1.	pH	7.0 – 8.0	6.5 – 7.5	
2.	Total Suspended solids	200 – 450	<10	mg/lit
3.	Chemical Oxygen Demand	400 – 600	<30	mg/lit
4.	BOD, 3 day, 27 °C	250 – 400	<5	mg/lit
5.	Oil & Grease	50	<5	mg/lit

➢ **Design Basis of Treatment plant – MBBR (Moving Bed Bio Reactor)**

- **Bar Screen:-**

o A bar screen is a mechanical filter used to remove large objects, such as rags and plastics, from wastewater. It is part of the primary filtration flow and typically is the first, or preliminary, level of filtration, being installed at the influent to a wastewater treatment plant. They typically consist of a series of vertical steel bars spaced between 1 to 3 inches apart.

o Bar screens come in many designs. Some employ automatic cleaning mechanisms using electric motors and chains, some must be cleaned manually by means of a heavy rake. Items removed from the influent are collected in dumpsters and disposed of in landfills. As a bar screen collects objects, the water level will rise, and so they must be cleared regularly to prevent overflow.

- **Oil & Grease Trap:-**

A grease trap is a device used for removing oil and grease from wastewaters. Grease traps perform this function very well, provided they are constructed and maintained properly. Provide sufficient capacity to slow down the passing wastewater, giving greasy waste the opportunity to separate out. A grease trap should be able to hold all the kitchen wastewater entering it during times of maximum water use for a period of 20 minutes.

- **Equalization / Collection Tank:-**

A Collection tank which is simply a well - mixed vessel with fluctuating input flow rates and / or concentration with fairly constant output flow rates and/or concentrations. Processes for waste treatment work best with uniform conditions. Shocks to the bioprocesses in the form of sudden changes in concentrations of nutrients can cause upsets. If the input flow increases suddenly, the settling patterns will be upset to lower collection efficiency. Equalization dampens fluctuations. Flow equalization can improve performance of subsequent steps significantly. Often the rest of the plant can be designed with smaller equipment (less capital investment) because of this improvement in performance. Equalization allows

reactions in the equalization tank. There may be aeration both to keep the fluid from becoming anaerobic and smelly and to biodegrade some of the organic compounds present.

- **MBBR REACTOR:-**
  - Moving Bed Biofilm Reactor (MBBR) processes improve reliability, simplify operation, and require less space than traditional wastewater treatment systems.
  - MBBR technology employs thousands of polyethylene biofilm carriers operating in mixed motion within an aerated wastewater treatment basin. Each individual bio carrier increases productivity through providing protected surface area to support the growth of bacteria within its cells. It is this high-density population of bacteria that achieves high-rate biodegradation within the system, while also offering process reliability and ease of operation.
  - This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm.

- **Settling Tank (Tube Settler):-**

Suspended/settable solids present in water having specific gravity greater than that of water tend to settle down by gravity as soon as the turbulence is retarded by offering storage. Basin in which the flow is retarded is called settling tank. Theoretical average time for which the water is detained in the settling tank is called the detention period. The PVC tube settler media provides more surface area for settling.

- **Phythoroid Zone /Area:-**

In this process the treated waste water is brought in contact with the roots of the plants which are selected and capable of utilizing/absorbing the organic matter present in the treated waste water. This zone with plantation ensures proper removal of dissolved BOD and degradation of fine suspended particles which may tend to escape from the system after secondary biological treatment.

- **Supernatant Tank:-**

This sump is used to store the treated water before passing it through the filtration system. Here the disinfectants can be dosed and a contact time can be given which shall ensure proper disinfection.

- **Filtration System (Pressure Sand Filter and Activated Carbon Filter):-**

Filtration is commonly the mechanical or physical operation which is used for the separation of solids from fluids (liquids or gases) by interposing a medium through which only the fluid can pass. The fluid that passes through is called the filtrate. Oversize solids in the fluid are retained, but the separation is not complete; solids will be contaminated with some fluid and filtrate which will contain fine particles (depending on the pore size and filter thickness). Filtration is also used to remove undesirable constituents by absorption into a carbon layer provided in the Activated Carbon Filter.

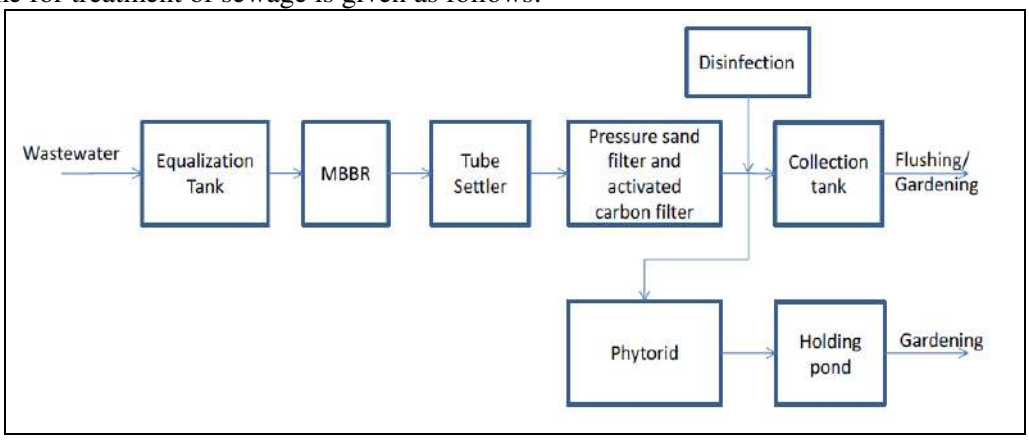
- **Filtration System (Ultrafiltration Unit):-**

Ultra filtration (UF) is a variety of membrane filtration in which forces like pressure or concentration gradients lead to a separation through a semipermeable membrane. Suspended solids and solutes of high molecular weight are retained in the so-called retentate, while water and low molecular weight solutes pass through the membrane in the permeate. UF can be used for the removal of particulates and macromolecules from raw water to produce cleaner water.

- **Sludge Dewatering Unit (Filter Press):-**
  - Sludge dewatering is, as the name clearly implies, removing water from sludge. Sludge dewatering is typically the final step for wastewater treatment processes and plants. After wastewater treatment the sludge remaining is very high in water content that can be reclaimed through sludge dewatering.

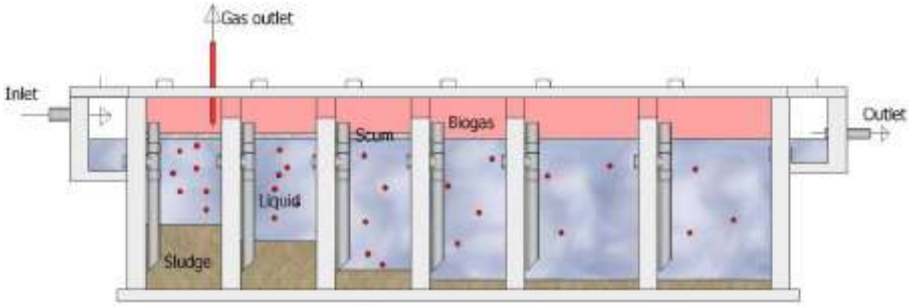
- This depends on the evaluation of your specific needs including the final disposition of your sludge cake including whether you will be applying the sludge to land applications, landfill disposal, alternative fuels, further processing and so on. Analyzing each situation is critical to optimize the wastewater sludge aspect of your wastewater treatment processes. Here we have suggested filter press for sludge dewatering as we are going to use it as manure for gardening.

The scheme for treatment of sewage is given as follows:



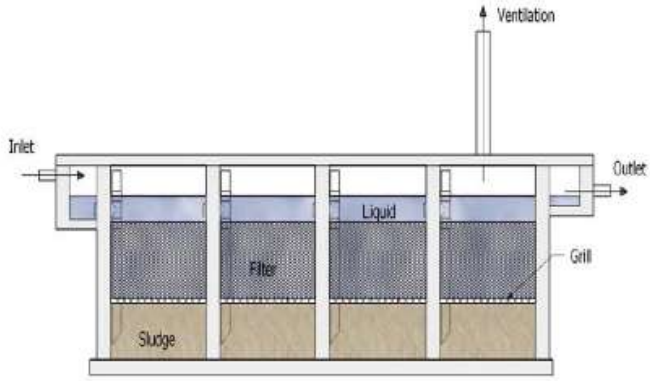
Scheme for treatment of sewage (MBBR process followed by DEWATS Phythoroid Technology)

- **Anaerobic Baffle Reactor:-**
  - The reactor consists of a series of chambers, in which the wastewater flows up stream as shown in showing Activated sludge is located at the bottom of each chamber.
  - The inflowing effluent is mixed with the sludge and is inoculated with bacterial mass which decompose the Pollutants.
  - At this stage the BOD reduction rate is 90 %. The pathogen reduction is in the range between 40 – 75 %.



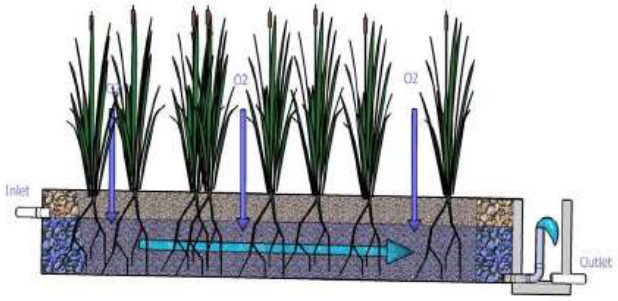
Anaerobic Baffle Reactor

- **Anaerobic Baffle Filter:-**
  - The anaerobic filter has a similar flow pattern like the Fluidized Bed Reactor as shown in Fig. Filter materials such as gravel, rocks or specially formed plastic components are used to provide additional surface area for bacteria to settle.
  - Non-settle able and dissolved solids are treated by bringing them in close contact with a surplus of active bacterial mass fixed on filter material.
  - The BOD removal rate at this stage is in the range of 70- 90%. The surplus of activated sludge produced has to be removed in intervals of 1 to 3 years.

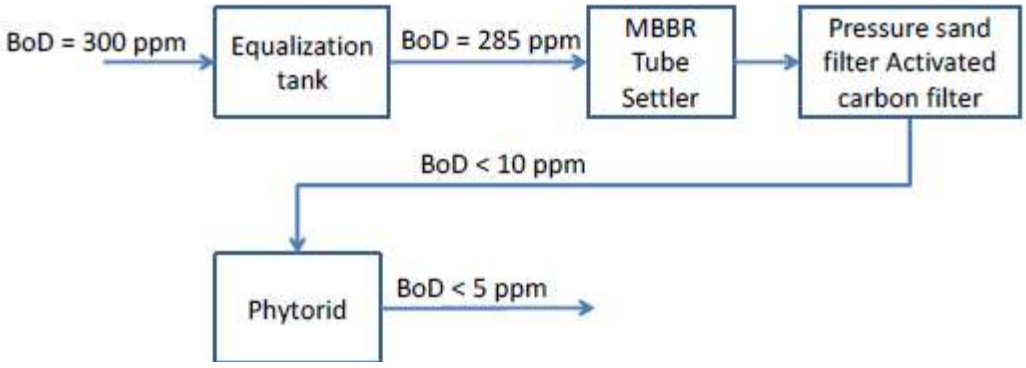


Anaerobic Baffle Filter (ABF)

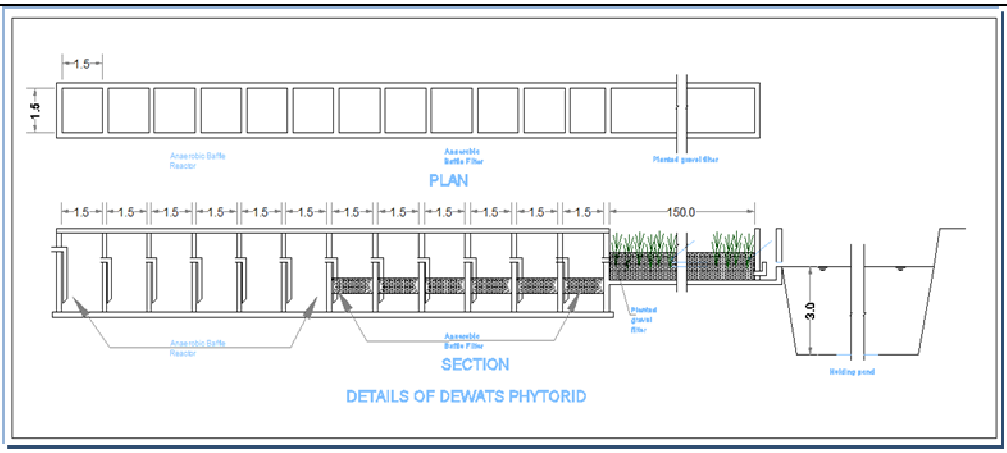
- **Planted Gravel Filter (PGF):**
  - The Planted Gravel Filter (PGF) is built of reed planted filter bodies consisting of fine gravel as shown in Fig.. The main removal mechanisms are biological conversion, physical filtration and chemical adsorption.
  - Reduction rate of BOD is between 75 - 90 %. Reduction of infective organisms is over 95 %. Operation and maintenance of the system is simple (mainly garden work). The spatial requirements are compensated by integrating it with the landscapes.



Planted Gravel Filter (PGF)



BOD reduction in STP component

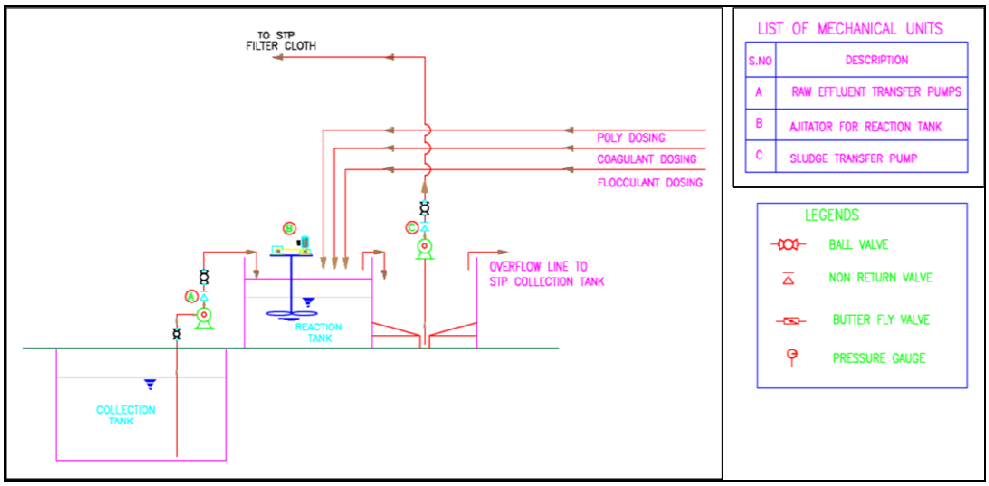


Schematic of DEWATS Phytorid and holding pond

Adequate water purification systems like aerators etc. shall be provided to keep the optimum oxygen level and avoid breeding of the mosquitoes
Coordinated services Layout is attached as **Enclosure 9.**

- **Hospital (Phase 1) Waste Pre- treatment process details:**

The effluent shall be collected in Collection Tank. The effluent from the collection Tank is pumped to the reaction tank, where Poly, Coagulant and Flocculent are added to remove the color present in the effluent and leads to clarifier. The effluent from the Clarifier tank is allowed to Settle, Where the Sludge gets settled at the bottom of the Clarifier tank and the clear water followed by ozonisation treatment shall be led in to the STP collection sump and further process is followed as per Sewage Treatment scheme mentioned above.



ETP PROCESS DIAGRAM

2.14	**Give details of dual plumbing system if treated waste used is used for flushing of toilets or any other use.**
	Color coding for dual plumbing system shall be done as per standard practices.
3	**VEGETATION**
3.1	**Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with its unique features, if any)**
	No.

3.2	**Will the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project).**
	There are existing trees (total 789 nos.). Out of which 461 nos. shall be cut and 328 nos. of trees shall be retained. Details of existing trees details are given in EIA report
3.3	**What are the measures proposed to be taken to minimize the likely impacts on important site features (Give details of proposal for tree plantation, landscaping, creation of water bodies etc along with a layout plan to an appropriate scale)**
	Plantation of trees of various varieties shall be done on ground. Tree plantation layout is enclosed as **Enclosure 10.**
4	**FAUNA**
4.1	**Is there likely to be any displacement of fauna- both terrestrial and aquatic or creation of barriers for their movement? Provide the details.**
	No.
4.2	**Any direct or indirect impacts on the avifauna of the area? Provide details.**
	No
4.3	**Prescribe measures such as corridors, fish ladders etc to mitigate adverse impacts on fauna.**
	Not applicable
5	**AIR ENVIRONMENT**
5.1	**Will the project increase atmospheric concentration of gases & result in heat islands? (Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed constructions)**
	All the predicted values of the pollutants in the operation scenario are within permissible limits of National Ambient Air Quality Standards (NAAQS) issued by Central Pollution Control Board (CPCB) dated November 18, 2009.
5.2	**What are the impacts on generation of dust, smoke, odorous fumes or other hazardous gases? Give details in relation to all the meteorological parameters.**
	Sources of Air pollution During Construction phase : • Increase in level of dust and other air pollutants due to building construction and other related activities • Emissions from vehicles carrying the construction materials • Emissions from DG sets • Open burning of solid wastes can cause air pollution **Mitigation Measures**: • Use of water for dust suppression and polymeric dust suppression system (wherever possible) • Use of covering sheets shall be done for trucks carrying construction material to prevent air borne dust • All material storages shall be adequately covered to avoid dust / particulate emissions • Use of CPCB approved DG sets • Proper maintenance of DG sets • Adequate parking provision and proper traffic movement for smooth traffic flow • Vehicles having valid pollution under control certificate shall be allowed to ply on site • Open burning of solid waste shall be prohibited • Regular health checkup of the workers • Use of the standard personal protective equipments like masks, goggles etc **Sources of Air pollution During Operational phase :** • The gaseous emissions from vehicles • Emissions from DG sets

	Mitigation Measures: • Adequate parking provision: 4W: 21983 Nos., 2W: 2436 Nos., Bus: 130 nos. and Ambulance: 5 Nos. Proper traffic management for smooth traffic flow (Detailed traffic report is enclosed in EIA) • DG sets with acoustic enclosures is to be installed and stacks height to be kept as per Central Pollution Control Board (CPCB) norms to allow effective dispersion of pollutants • Periodic monitoring of SPM and SO_2 concentration and thereby schedule and implement proper maintenance of DG sets • Plantation of trees of various varieties shall be planted on ground Generally for EIA studies of construction projects we use secondary data from nearest weather station of IMD to the project site is situated in Alibaug at a distance of 50 km (aerial distance). The parameters for which data have been collected are Wind speed, Wind direction, Temperature, Relative humidity and same is reported in EIA.
5.3	**Will the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry & exit to the project site.**
	The project proponents have proposed to provide well organized parking arrangement. Details of the present level of transport infrastructure and measures proposed for improvement including the traffic management is enclosed in EIA.
5.4	**Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc., with areas under each category.**
	• The project proponents have proposed to provide adequate well organized parking arrangement. • This project would have separate entry /exit points • Use of proper lane marking from the external road to car park • Proper directional arrows used in parking bays • Proper internal road designed for avoiding traffic Detailed traffic movement plan is given in traffic report.
5.5	**Will there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.**
	During Construction Phase: ➢ **Anticipated Impacts –** • Noise due to construction activities • Impact due to transportation activities • Nuisance to nearby areas due to noise polluting work at night • Noise generation due to DG sets ➢ **Mitigation Measures –** • During construction activities the noise monitoring will be done to ascertain the noise levels are within limit • All precautions for noise abatement shall be taken during the construction activities • It is recommended that Contractors to use well maintained & relatively newer equipments to mitigate noise generation in initial stages when excavation & earth removal is carried out • During high noise construction activity there will be provision of ear plugs for construction labour and staff • No noise polluting work in night shifts • Provision of barricades along the periphery of the site • Acoustic enclosure for DG sets

	During Operation Phase: ➢ **Anticipated Impacts –** • Impact of noise due to vehicular traffic • Noise generation due to DG sets ➢ **Mitigation Measures –** • Provision of proper parking arrangement, traffic management plan for smooth flow of a vehicle helps to abate noise pollution due to vehicular traffic • Plantation of trees of various varieties shall be planted on ground that shall act as natural noise buffer • Acoustic enclosure for DG sets Detailed Noise Modeling Studies are elaborated in EIA report
5.6	**What will be the impact of DG sets & other equipment on noise levels & vibration in & ambient air quality around the project site? Provide details.**
	D.G. Sets will be operated only in case of power failures during operational phase. The Pollutants like SPM, SO2 that may arise from emissions from D.G. Sets will be discharged through vent of proper height. D.G. sets are with inbuilt acoustic enclosures to reduce the noise of D.G. sets while in operation. Plantation of trees would act as noise barrier and will reduce the noise level.
6	**AESTHETICS**
6.1	**Will the proposed constructions in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?**
	No.
6.2	**Will there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account?**
	All precautions will be taken to mitigate the impact due to water, air and noise pollution during construction and operation phase. Environmental Management Plan is prepared and shall be implemented along with Environmental Monitoring Programme.
6.3	**Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.**
	No.
6.4	**Are there any anthropological or archaeological sites or artifacts nearby? State if any other significant features in the vicinity of the proposed site have been considered.**
	No
7	**SOCIO-ECONOMIC ASPECTS:**
7.1	**Will the proposal result in any changes to the demographic structure of local population? Provide the details.**
	This is a special township project hence there will be influx of ~ 135593 persons (including floating population).
7.2	**Give details of the existing social infrastructure around the proposed project.**
	• The construction of project is in 6 phases and would require 300 skilled and unskilled labours. In each phase local people would benefit the employment opportunities. • Civil works for the construction of buildings may require local sub-contractors, hardware and raw material suppliers thus benefitting and providing small business opportunities to few in the nearby villages. • One Hospital (150 bedded) with Doctor and other supporting staff has been planned in the project. The area with poor health care facility would benefit from this hospital as it has capacity to cater to the population. • A primary and Secondary school with a capacity of 7620 students and 762 staff would benefit the nearby

village population.

- The completion of project will eventually lead to permanent job opportunities to the local & nearby villagers as there would be increased demand for security, kitchen help, etc.
- There would be convenient shops which could provide livelihood opportunity to more than 200 persons after completion. The total commercial space in the project would need a staff of about 100 persons.
- A multiplier effect will be felt on the creation of indirect employment through the local community establishing small shops like tea stalls, supply of intermediate raw materials, repair outlets, hardware stores etc. However, these are likely to be temporary.

7.3 **Will the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?**

No

8 BUILDING MATERIALS

8.1 **May involve the use of building materials with high-embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)**

Building materials choices are important in sustainable design because of the extensive network of extraction, processing and transportation steps required to process them. Activities to create building materials pollute the air and water, destroy natural habitats and deplete natural resources.

When new materials are used in buildings, it is important to consider different sources. Salvaged materials can substitute for new materials, save on material costs and perhaps add character to the building. Recycled content materials reuse waste products that would otherwise be deposited in landfills. The use of local materials supports the local economy and reduces the impacts of transportation. Use of the building materials and products that are extracted and manufactured within the region, shall be done in this project thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.

The conservation material & resources strategy will be achieved through the following:

- Reducing and Reusing of Waste
- Using recycled material in construction
- Use of Regional Material in construction
- Pozzolana Cement containing up to 20% fly ash will be used for plaster, masonry, flooring
- Old bricks will be used for water proofing
- Brick Bat Coba water proofing will be done with old bricks
- Low VOC (volatile organic compound) paints will be used.
- Use of china mosaic for roofing
- Energy efficient materials and systems will be utilized.
- Use of single glazed glass for windows.

ECBC Compliance – Residential

No.	Model Input Parameter	Baseline Case (As per ECBC 2007)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.43 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 409 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 2" XPS Insulation U-factor = 0. 404 W/Sq.m.K
3.	**Glazing**	U Value: 3.3 W/Sq.m.K SHGC (All) : 0.25 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value : 2.80 W/Sq.m.K SHGC : 0.44

			VLT : 45% For Fenestration Assembly
4.	**WWR**	30%	30%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	15 W/m^2	15 W/m^2
7.	**Pumps & Motors**	Standard Efficiency – 70%	High Efficiency – 85%
8.	**Lighting Power Density**	7.5 W/m^2	7.5 W/m^2
9.	**External Lighting Load**	Efficacy 60 Lumen / W	Efficacy 50 Lumen / W
10.	**Domestic Hot Water Generation**	20% on Solar (20 ltr/person/day)	20% on Solar (20 ltr/person/day)
11.	**HVAC System Type**	Packaged Single Zone (Split Unit) with COP 3.0.	Packaged Single Zone (Split Unit) with COP 3.0.
12.	**Process Loads**	As per Design	As per Design
13.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
14.	**PF Correction**	0.95	0.95
15.	**Power Distribution Losses**	<1%	<1%

ECBC Compliance – Commercial (Office/IT/Convention Centre)

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	15 W/m^2	15 W/m^2
7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	9.5 W/m^2	7.5 W/m^2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As Per Annexure I	As Per Annexure I
12.	**Domestic Hot Water Generation**	Not Applicable	Not Applicable

13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Under Floor Air Distribution System
16.	**Ventilation Requirement As per ASHRAE 62.1**	11 cfm / Person	15 cfm / Person
17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	**VSD's on Chiller**	Not Applicable	Recommended
19.	**VFD's on Cooling Tower**	Recommended	Recommended
20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
22.	**HVAC System**	AHU with VFD	AHU with VFD
23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
24.	**Demand Control Ventilation**	Not Applicable (Applicable for ECBC + & Super ECBC)	CO2 Sensors to modulate fresh air
25.	**Heat Recovery Wheel**	Not Applicable (Applicable for Hotel & Healthcare)	Recommended to precool the fresh air
26.	**Airside Economizer**	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)
27.	**CO Sensors**	Not Applicable	Recommended in Basement Areas
28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
29.	**PF Correction**	0.97	0.97
30.	**Power Distribution Losses**	<3%	<3%

ECBC Compliance – School building

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	< 40%	< 40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	10 W/m2	10 W/m2

7.	**Pumps & Motors**	IE 2	IE 3
8.	**Lighting Power Density**	11.2 W/m2	11.2 W/m2
9.	**Occupancy Sensors**	Recommended in all Non-Regularly occupied areas	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per Annexure I	As per Annexure I
12.	**Domestic Hot Water Generation**	Not Applicable	Not Applicable
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable
16.	**Ventilation Requirement As per ASHRAE 62.1**	10 cfm / Person	10 cfm / Person
17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
18.	**VSD's on Chiller**	Not Applicable	Recommended
19.	**VFD's on Cooling Tower**	Recommended	Recommended
20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
22.	**HVAC System**	AHU with VFD	AHU with VFD
23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
24.	**Demand Control Ventilation**	Not Applicable (Applicable for ECBC + & Super ECBC)	Not Recommended
25.	**Heat Recovery Wheel**	Not Applicable (Applicable for Hotel & Healthcare)	Not Recommended
26.	**Airside Economizer**	Not Applicable for Warm Humid Climate	Not Recommended (No Free Cooling)
27.	**CO Sensors**	Not Applicable	No Basement
28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
29.	**PF Correction**	0.97	0.97
30.	**Power Distribution Losses**	< 3%	< 3%

ECBC Compliance – Healthcare building

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K

	3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
	4.	**WWR**	<40%	<40%
	5.	**Shading**	No shades	As per Design
	6.	**Equipment Power Density**	25 W/m^2	25 W/m^2
	7.	**Pumps & Motors**	IE2	IE3
	8.	**Lighting Power Density**	9.7 W/m^2	9.7 W/m^2
	9.	**Occupancy Sensors**	Recommended in all non-regularly occupied area	Recommended in all Non-Regularly occupied areas
	10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
	11.	**External Lighting Load**	As per Annexure I	As per Annexure I
	12.	**Domestic Hot Water Generation**	40% on solar (20 ltr/person/day & process water)	40% on solar (20 ltr/person/day & process water)
	13.	**Process Loads**	As per Design	As per Design
	14.	**Renewable Energy**	1% of the peak demand	Solar PV recommended equal to 1% of peak demand load
	15.	**Data Server Loads**	Not Applicable	Not Applicable
	16.	**Ventilation Requirement As per ASHRAE 62.1**	Patient Rooms: 10 cfm / Person Medical Procedure: 20 cfm / Person Operating Rooms: 20 cfm / Person Physical Therapy: 20 cfm / Person	Patient Rooms: 13 cfm / Person Medical Procedure: 26 cfm / Person Operating Rooms: 26 cfm / Person Physical Therapy: 26 cfm / Person
	17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
	18.	**VSD's on Chiller**	Not Applicable	Recommended
	19.	**VFD's on Cooling Tower**	Recommended	Recommended
	20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
	21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
	22.	**HVAC System**	AHU with VFD	AHU with VFD
	23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
	24.	**Demand Control**	Not Applicable	CO2 Sensors to modulate fresh air

	Ventilation	(Applicable for ECBC+ & Super ECBC)	
25.	**Heat Recovery Wheel**	Recommended	Recommended to precool the fresh air
26.	**Airside Economizer**	Not Applicable for warm humid climate	Not Recommended (No Free Cooling)
27.	**CO Sensors**	Not Applicable	Recommended in Basement Areas
28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
29.	**PF Correction**	0.97	0.97
30.	**Power Distribution Losses**	<3%	<3%

ECBC Compliance – Hospitality Building

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
4.	**WWR**	<40%	<40%
5.	**Shading**	No shades	As per Design
6.	**Equipment Power Density**	20 W/m^2	20 W/m^2
7.	**Pumps & Motors**	IE2	IE3
8.	**Lighting Power Density**	9.5 W/m^2	9.5 W/m^2
9.	**Occupancy Sensors**	Recommended in all non-regularly occupied area	Recommended in all Non-Regularly occupied areas
10.	**Daylight Sensors**	Recommended in all building perimeter habitable areas	Recommended in all building perimeter habitable areas
11.	**External Lighting Load**	As per table in Annexure I	As per table in Annexure I
12.	**Domestic Hot Water Generation**	40% on solar (20 ltr/person/day & process water)	40% on solar (20 ltr/person/day & process water)
13.	**Process Loads**	As per Design	As per Design
14.	**Renewable Energy**	1% of the Maximum Demand	Solar PV Recommended more than 1% of Maximum Demand Load
15.	**Data Server Loads**	Not Applicable	Not Applicable

	16.	**Ventilation Requirement As per ASHRAE 62.1**	Office/Lockers: 10 cfm / Person Dining/Kitchen: 15 cfm / Person Spa & Gym: 25 cfm / Person Bar & Lounge: 13 cfm / Person	Office/Lockers: 13 cfm / Person Dining/Kitchen: 20 cfm / Person Spa & Gym: 33 cfm / Person Bar & Lounge: 17 cfm / Person
	17.	**Chiller Parameter**	Water Cooled Chillers, COP 5.8	Water Cooled Chillers, COP 6.1
	18.	**VSD's on Chiller**	Not Applicable	Recommended
	19.	**VFD's on Cooling Tower**	Recommended	Recommended
	20.	**Primary, Fire, Condenser Pump Class**	Standard – 70%	Premium – 75%
	21.	**Primary, Fire, Condenser Motor Class**	Standard – 70%	Premium – 85%
	22.	**HVAC System**	AHU with VFD	AHU with VFD
	23.	**VFD's in A.H.U.'s & Secondary Pumps**	Recommended	Recommended
	24.	**Demand Control Ventilation**	Not Applicable (Applicable for ECBC+ & Super ECBC)	CO2 Sensors to modulate fresh air
	25.	**Heat Recovery Wheel**	Recommended	Recommended to precool the fresh air
	26.	**Airside Economizer**	Not Applicable for warm humid climate	Not Recommended (No Free Cooling)
	27.	**CO Sensors**	Not Applicable	Recommended in Basement Areas
	28.	**DG Set**	BEE 3 Star Rated	BEE 3 Star Rated
	29.	**PF Correction**	0.97	0.97
	30.	**Power Distribution Losses**	<3%	<3%

- **Energy Conservation Measures:**

- Provision of Solar Panels for apartment internal lighting , fan load and water heating
- Street area lights based on Biogas generator
- Provision of LED lights
- Use of Electronic Ballast
- Use of timers in buildings common lighting and external lighting
- Use of Star rated geysers and AC

8.2	**Transport and handling of materials during construction may result in pollution, noise & public nuisance. What measures are taken to minimize the impacts?**
	The material required for construction activities procured from company's authorized / approved vendors only. The vendor's performance is monitored periodically. In case of urgency or non-availability of materials from authorized/approved vendors, it is procured from the open market to maintain the pace of the work. The mode of transport for above materials will be by trucks and / or by trailers. • The construction material carried in properly covered vehicles • All the contractors / Vendors instructed to use vehicles having PUC certificates • Loading and unloading of material at site shall be done under supervision of Security staff

	• Construction material stored at identified site/ temporary Godowns at site • Suitable construction platform for vertical expansion provided at site
8.3	**Are recycled materials used in roads and structures? State the extent of savings achieved?**
	The conservation material & resources strategy will be achieved through the following: • Reducing and Reusing of Waste • Using recycled material in construction • Use of Regional Material in construction • Pozzolana Cement containing up to 20% fly ash will be used for plaster, masonry, flooring • Old bricks will be used for water proofing • Brick Bat Coba water proofing will be done with old bricks • Low VOC (volatile organic compound) paints will be used. • Use of china mosaic for roofing • Energy efficient materials and systems will be utilized. • Use of single glazed glass for windows
8.4	**Give details of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.**
	• Segregation and storages facilities for all solid waste streams • Biodegradable garbage shall be treated in Biomethanation plant • Non-biodegradable garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal. The agreement between the Project proponents**.** • E-Waste will be stored separately and disposed through authorized recyclers • Bio-medical waste will be handled and disposed as per Bio-Medical Waste Management Rules, 2016.
9	**ENERGY CONSERVATION**
9.1	**Give details of the power requirements, source of supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?**

Power Requirement

During Construction Phase -

Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)

D.G. Sets: as per requirement

During Operational Phase -

Source: Maharashtra State Electricity Distribution Company Limited (MSEDCL)

Table 15: Power Requirement

Phases	Connected Load (KW)	Maximum Demand (KW)	DG sets (power failure for emergency services)
1	68265	27047	2 DG sets of 320 KVA each 2 DG sets of 500 KVA each 6 DG sets of 625 KVA each 1 DG set of 100 KVA 2 DG sets of 1000 KVA each 1 DG set of 320 KVA 1 DG set of 600 KVA
2	42884	18194	1 DG set of 1000 KVA 2 DG sets of 400 KVA each 1 DG set of 600 KVA 1 DG set of 500 KVA 3 DG sets of 2500 KVA each

		3	94222	36946	7 DG sets of 1010 KVA each 1 DG set of 400 KVA 2 DG set of 750 KVA each 1 DG set of 140 KVA 2 DG sets of 1250 KVA each 6 DG sets of 2000 KVA each 5 DG sets of 1500 KVA each	
		4	57340	37362	4 DG sets of 1000 kVA each 1 DG set of 400 KVA	
		5	26208	10195	2 DG sets of 600 KVA each 2 DG sets of 350 KVA each	
		6	20341	6985	1 DG set of 380 KVA 1 DG set of 750 KVA 1 DG set of 80 KVA 1 DG set of 400 KVA	

9.2 **What type of, and capacity of, power back-up to you plan to provide?**

D.G sets (In case of power failure) shall be provided for emergency backup including environmental management facilities

Phases	DG sets (power failure for emergency services)
1	2 DG sets of 320 KVA each 2 DG sets of 500 KVA each 6 DG sets of 625 KVA each 1 DG set of 100 KVA 2 DG sets of 1000 KVA each 1 DG set of 320 KVA 1 DG set of 600 KVA
2	1 DG set of 1000 KVA 2 DG sets of 400 KVA each 1 DG set of 600 KVA 1 DG set of 500 KVA 3 DG sets of 2500 KVA each
3	7 DG sets of 1010 KVA each 1 DG set of 400 KVA 2 DG set of 750 KVA each 1 DG set of 140 KVA 2 DG sets of 1250 KVA each 6 DG sets of 2000 KVA each 5 DG sets of 1500 KVA each
4	4 DG sets of 1000 kVA each 1 DG set of 400 KVA
5	2 DG sets of 600 KVA each 2 DG sets of 350 KVA each
6	1 DG set of 380 KVA 1 DG set of 750 KVA 1 DG set of 80 KVA 1 DG set of 400 KVA

9.3 **What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?**

For Residential buildings	Saint Gobain ST 150 Clear Double Glazed Unit U Value : 2.80 W/Sq.m.K

		SHGC : 0.44 VLT : 45% For Fenestration Assembly
	For Commercial buildings (Office/IT/Convention Centre)	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
	For School Building	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
	For Health Care Building	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly
	For Hospitality Building (Hotel)	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

9.4	**What passive solar architectural features are being used in the building? Illustrate the applications made in the proposed project.**
	• Maximize the use of natural lighting though design. • The roof shall be insulated so that there will not be direct heat gain due to sunlight.
9.5	**Does the layout of streets & buildings maximize the potential for solar energy devices? Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.**
	• Provision of Solar Panels for apartment internal lighting , fan load and water heating • Street area lights based on Biogas generator
9.6	**Is shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of Walls on the East and the West and the Roof? How much energy saving has been effected?**

For Residential buildings:

No.	Model Input Parameter	Baseline Case (As per ECBC 2007)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.43 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 409 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 2" XPS Insulation U-factor = 0. 404 W/Sq.m.K
3.	**Glazing**	U Value: 3.3 W/Sq.m.K SHGC (All) : 0.25	Saint Gobain ST 150 Clear Double Glazed Unit

		For Fenestration Assembly	U Value : 2.80 W/Sq.m.K SHGC : 0.44 VLT : 45% For Fenestration Assembly

For Commercial buildings (Office/IT/Convention Centre):

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For School Building:

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For Health Care Building:

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K

	3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For Hospitality Building (Hotel):

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

9.7	**Do the structures use energy-efficient space conditioning, lighting and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lighting intensity and air-conditioning load assumptions? Are you using CFC and HCFC free chillers? Provide specifications.**
	No
9.8	**What are the likely effects of the building activity in altering the micro-climates? Provide a self assessment on the likely impacts of the proposed construction on creation of heat island & inversion effects?**
	Systematic design of buildings in order to assure light ventilation, open spaces, green areas, tree plantation as per requirement are considered which will help to reduce the effect of creation of heat island. Detailed building performance analysis report is given in EIA studies
9.9	**What are the thermal characteristics of the building envelope? (a) roof; (b) external walls; and (c) fenestration? Give details of the material used and the U-values or the R values of the individual components.**

For Residential buildings:

No.	Model Input Parameter	Baseline Case (As per ECBC 2007)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.43 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 409 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 2" XPS Insulation U-factor = 0. 404 W/Sq.m.K
3.	**Glazing**	U Value: 3.3 W/Sq.m.K SHGC (All) : 0.25	Saint Gobain ST 150 Clear Double Glazed Unit

		For Fenestration Assembly	U Value : 2.80 W/Sq.m.K SHGC : 0.44 VLT : 45% For Fenestration Assembly

For Commercial buildings (Office/IT/Convention Centre):

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	Exterior Wall Construction	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	Roof Construction	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	Glazing	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For School Building:

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	Exterior Wall Construction	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	Roof Construction	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	Glazing	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For Health Care Building:

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	Exterior Wall Construction	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	Roof Construction	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K

	3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For Hospitality Building (Hotel):

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

9.10 **What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans.**

Precautions and safety measures against fire hazards shall be proposed as per CFO norms.
Disaster Management Plan is given in EIA studies.

9.11 **If you are using glass as wall material provides details and specifications including emissivity and thermal characteristics.**

For Residential buildings:

No.	Model Input Parameter	Baseline Case (As per ECBC 2007)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.43 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 409 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 2" XPS Insulation U-factor = 0. 404 W/Sq.m.K
3.	**Glazing**	U Value: 3.3 W/Sq.m.K SHGC (All) : 0.25 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value : 2.80 W/Sq.m.K SHGC : 0.44 VLT : 45% For Fenestration Assembly

For Commercial buildings (Office/IT/Convention Centre):

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	Exterior Wall Construction	U-factor = 0.44 W/Sq.m.K	8" AAC wall + 1" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	Roof Construction	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 4" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	Glazing	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non-North): 0.50 For Fenestration Assembly	Saint Gobain ST 150 Clear Double Glazed Unit U Value :1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For School Building:

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	Exterior Wall Construction	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K U-factor = 0. 33 W/Sq.m.K Insulation
2.	Roof Construction	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	Glazing	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For Health Care Building:

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	Exterior Wall Construction	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	Roof Construction	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	Glazing	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

For Hospitality Building (Hotel):

No.	Model Input Parameter	Baseline Case (As per ECBC 2017)	Proposed Case
1.	**Exterior Wall Construction**	U-factor = 0.40 W/Sq.m.K	8" AAC wall + 2" EPS Insulation U-factor = 0.33 W/Sq.m.K
2.	**Roof Construction**	U-factor = 0. 33 W/Sq.m.K Insulation entirely above deck.	6" RCC slab with 3" XPS Insulation U-factor = 0. 28 W/Sq.m.K
3.	**Glazing**	U Value: 3.0 W/Sq.m.K SHGC (North) : 0.27 SHGC (Non North) : 0.50 For Fenestration Assembly	Saint Gobain KT 140 Clear Double Glazed Unit U Value : 1.80 W/Sq.m.K SHGC : 0.27 VLT : 36% For Fenestration Assembly

9.12 **What is the rate of air infiltration into the building? Provide details of how you are mitigating the effects of infiltration.**

It has not been studied

9.13 **To what extent the non-conventional energy technologies are utilized in the overall energy consumption? Provide details of the renewable energy technologies used.**

- Provision of Solar Panels for apartment internal lighting , fan load and water heating
- Street area lights based on Biogas generator

10 Environment Management Plan

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		LOCATION SPECIFIC		
1	Lack of sewerage system	• Provision of Sewage treatment facilities. Treated sewage shall be reused for gardening and flushing requirement • For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. • Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage • Provision of water holding pond for storage of excess treated sewage with adequate for storage of excess treated sewage	Project Proponents	Stringent discharge standards for STP outlet as per the EPA Act

		• Provision of air blower with perforated PVC piping inside the pond for aeration of pond water • The stored excess treated sewage shall be given for irrigation purposes outside the plot.		
2.	Gas pipe line passing through the plot	• No Construction of building or other structure (tank, reservoir etc.) in the said area • No tree plantation in the said area • In the said land, shall not do any act/activity to cause any damage to pipeline	Architect/ Project Proponents	--
3.	High Tension Line	• No construction and tree plantation below HTL • Provision of buffer zone including both sides of HTL	Architect/ Project Proponents	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		DESIGN SPECIFIC		
1.	Building Height	Height of the building shall be in accordance with the local planning permissions	Architects	NOC from Local Authority
2.	• Increase in runoff due to increase in paved areas • Flooding on site or in the surrounding low lying areas	• Minimizing the incremental runoff from the site with the help of rain water harvesting tanks • Provision of SWD of adequate capacity (29.61 m^3/sec) to cater the runoff and avoid flooding on site	Architects and MEP consultants	--
3.	Heat gain due to building materials or design	• Use of natural light and ventilation in building design • Use of local building materials in construction	--	ASHRAE 90.1 2007

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		CONSTRUCTION PHASE		
1.	Increase in water demand due to water usage for construction, dust suppression and for workers	• Use of polymeric spray for dust suppression instead of water wherever possible • Curing water shall be sprayed on concrete structures, free flow of water should not be allowed for curing • Use of wet jute cloth/gunny bags instead of water spray for curing activity	Contractor & Project Manager	--
2.	Sewage generation	• Provision of modular type STP for	Contractor &	Water (P & CP)

		and its disposal	treatment of sewage • Site sanitation & good housekeeping	Project Proponents	Act 1974 as amended
	3.	Municipal solid waste generation by workers	• Segregation of wet (6 kg/day) and dry garbage (24 kg/day) • Segregated garbage shall be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal	Contractor & Project Manager	--
	4.	Site preparation or construction activity may lead to : ▪ Water logging or flooding on site & in surrounding ▪ Unsanitary conditions and mosquito breeding on site ▪ Sedimentation of outside drains	• Computation of the runoff from the catchment areas outside the plot and runoff within the plot. • Proper management of channelization of storm water • Designing storm water drainage with adequate capacity to cater the total runoff from site and outside catchment area and avoid flooding on site or surrounding • Use of screens and silt traps in advance of earthworks • Proper maintenance of storm water drainage to avoid choking of drains and flooding on site • Prompt completion of works relating to drainage and sediment control	Contractor & Project Manager	--
	5.	Excavation/construction activity		Contractor/ Project Proponents	--
	a.	Dust generation	• Use of water for dust suppression and polymeric dust suppression system (wherever possible) • Use of covering sheets shall be done for trucks carrying construction material to prevent air borne dust • All material storages shall be adequately covered to avoid dust/particulate emissions • Use of CPCB approved DG sets with proper maintenance • Adequate parking provision and proper traffic movement for smooth traffic flow • Vehicles having valid pollution under control certificate shall be allowed to ply on site • Open burning of solid waste shall be prohibited		--

			• Regular health checkup of the workers. • Use of the standard personal protective equipments like masks, goggles, etc. • Sensors to monitor air quality shall be installed. This will help to keep record daily for the air quality.		
	b.	Noise & Vibration	• Provision of barricades of adequate height along the periphery of the site • During construction activities the noise will be monitored to ascertain the noise levels are within limits • All precautions for noise abatement shall be taken during the construction activities • During high noise construction activity there will be provision of ear plugs for construction labour and staff • No noise polluting work in night shifts • In-built acoustic enclosure for DG sets • It is recommended that Hydraulic pumps and compressors should be covered with Acoustical Enclosures with 20 dB Transmission Loss Rating in order to reduce the noise • Provision of artificial noise barrier		--
	c.	Disruption of soil & runoff	Sedimentary controls to be implemented		--
	d.	Oil leaks	• Regular maintenance of excavation machineries to prevent and repair leaks • Contaminated soil to authorized CHWTSDF		--
	e.	Generation of Excavation earth material/Construction waste	• Designated storage for all type of waste • Proper segregation of construction waste and preparation of item wise quantification and management plan and ensuring its effective implementation • Reuse of excavated earth (18,00,000 Cum) on site for		Excavation permission from Local Authority

			backfilling • Polymer bags used for cement and gypsum, cardboard boxes and other packaging material will be handed over to authorized recyclers. • Disposal of hazardous waste to CHWTSDF		
	f.	Water logging in excavated areas	• Preparation of dewatering plan • Provision of dewatering pumps with adequate capacity as per site conditions • Suction points of the pumps will be equipped with silt screens and appropriate filters to minimize stile discharge • Collection of Subsoil water/ excess water during excavation and construction of basements in the sedimentation tank for 6 to 7 hrs • Disposal of supernatant to the drain. • Guidelines issued by Central Ground Water Authority (CGWA) shall be followed strictly and also permission from CGWA shall be obtained during construction phase before dewatering of basements • Proper drainage channel with connection to external SWD • Sedimentation controls measures shall be followed • Regular pest control • Water will be allowed to settle overnight to ensure sedimentation and minimize the silt in discharge		--
	6.	Vehicular movement leads to ▪ Increase in traffic ▪ Air emissions & Noise ▪ Oil leaks	• Entry to vehicles with valid PUC certificate • Proper parking arrangement for the construction vehicles • Provision of oil and grease traps to the Storm water drains • Contaminated soil (if any) found if any to authorized CHWTSDF • Regular maintenance of vehicles with suitable enclosures and intake silencers • Planning and ensuring effective implementation of the waste	Project Manager	--

		movement plan for loading and offsite movement in non-traffic Hours		
7.	Use of DG sets	• DG sets with inbuilt acoustic enclosures • Site barricading • Regular maintenance	Project Manager	
8.	Impact on health of workers Accidents, Hazards, injuries to workers	• Adequate drinking water, toilet and bathing facilities. • First aid facility • Regular health checkup of workers • Risk assessment and preparation of disaster management plan • Provision of temporary water tank for firefighting and appropriate fire suppression measures. • Safety educational and awareness programme • Proper security arrangements	Safety officer	--

No.	Environmental Issues/Impacts	Mitigation measures	Responsibility	Legal & Other requirements
		OPERATION PHASE		
1.	Increase in water demand	• Use of treated sewage for gardening (1044 KLD) and flushing (4400 KLD) • Rain water collection from terraces into 31 numbers of RWH tanks of total capacity 8981 KL and its reuse thereby reducing the fresh water demand in monsoon season up to 45% • Use of harvested rain water for domestic purpose (926 KLD) and its reuse thereby reducing the fresh water demand up to 6393 KLD in monsoon season i.e. 45 %.	Project Proponents/ Facility Management system	Water Act 1974 as amended
2.	Sewage generation and disposal of sewage	• Provision of total 35 numbers of Sewage Treatment Plants of total capacity 11625 KL for treatment of sewage by MBBR method followed by DEWATS Phythorid technology • Proper operation and maintenance of STP and Daily analysis of general parameters like pH, BOD, COD and TSS &	Project Proponents / Society / Facility Management system	Stringent discharge standards for STP outlet as per the EPA Act

			O & G of the STP outlet to ensure good treatment of waste water with the help of onsite sensors • Use of treated sewage for flushing and gardening • Provision of water holding pond with DEWATS phythorid technology for storage of excess treated sewage • Provision of aerators in water pond to avoid mosquito breeding. • Provision of adequate ventilation around the STP • Proper arrangements for sludge handling units and its reuse as manure • ETP is proposed for Hospital in phase 1, primary treatment shall be done for effluent and then it will be connected to STP.		
	3.	Increment in Runoff from site	• Minimizing the incremental runoff from the site with the help of rain water harvesting tanks of adequate capacity • Proper management of channelization of storm water from site by using proper internal SWD system and discharge point of having adequate capacity (29.61 m^3/sec) • Use of screens and silt traps to SWD • Proper maintenance of storm water drainage to avoid choking of drains and flooding on site • Surface rainwater to be passed through oil & grease trap & desilting chamber and then transferred to external drain of adequate capacity (255.12 m^3/sec)	Project Proponents/ Facility Management system	--
	4.	Increase in power consumption	• Provision of Solar Panels for apartment internal lighting , fan load and water heating • Street area lights based on Biogas generator • Provision of LED lights • Use of Electronic Ballast	Project Proponents/ Facility Management system	ECBC norms

			• Use of timers in buildings common lighting and external lighting • Use of Star rated geysers and AC		
	5.	Use of DG sets may lead to Air & Noise pollution	• Stack height as per CPCB norms • New trees Plantation wih retention of existing trees • DG sets with inbuilt acoustic enclosures	Project Proponents/ Facility Management system	CPCB norms
	6.	Vehicular movement leads to ▪ Increase in traffic ▪ Air emissions & Noise ▪ Contamination of soil leads to Oil leaks	• Proper parking arrangement for the vehicles • Provide adequate traffic signs and signages to notify residents • Install safety mirrors to aid visibility in conflict points • Prevent parking near the Entry and Exit Gate • Provide speed humps to regulate speed of vehicles • Provide pedestrian crossings and dedicated footpath to cater to the walking population • Assign traffic wardens to regulate flow of project traffic during peak hours • Adequate width of internal driveway • Plantation of new trees with retention of existing trees to mitigate dust and noise • Provision of oil and grease traps to the Storm water drains	Project Proponents/ Facility Management system	--
	7.	Odour and unsanitary conditions due to STP and Composting of biodegradable garbage	• Proper ventilation around STP and Garbage room • Proper housekeeping and maintenance • Regular monitoring of stack/s	Project Proponents/ Society/Facility Management system	Air act 1981 as Amended
	8.	Municipal waste & other solid waste generation	• Informing and educating occupants for solid waste management • Provision of adequate space for solid waste management • Proper segregation on site to biodegradable and non-biodegradable. • Non-biodegradable waste (15808 Kg/day): To be handed	Project Proponents/ Society/Facility Management system	--

			over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal • Biodegradable waste (23607 kg/day) shall be treated in Biomethanation Plant • Slurry and other dry organic waste generated from Biogas plant shall be reused for landscaping and remaining shall be disposed through an authorized agency • E-waste (24895 Kg/day) from commercial portion of Phase 3 and Phase 4 and will be stored separately and disposed through authorized recyclers • Bio Medical Waste (56.3 Kg/ day) from Hospital of Phase 1 and same will be handled and disposed as per Bio-Medical Waste Management Rules, 2016		
	9.	Disaster like Fire, Earthquake, lightning etc.	• Preparation of Disaster Management Plan • Provision of Safety officer , Security and First aid team • Regular review of DMP and mock drill • Effective implementation of DMP	Safety Officer	--

LIST OF ENCLOSURES

No.	Enclosure	Remarks
1.	Locational clearance (LC) from Urban Development Department	Not possible to upload due to size limitation, but submitted in hard copy
2.	Geotechnical Investigation report	
3.	A. The agreement between the Project proponent and Agency for waste management B. The agreement between the Project proponent and owners of adjacent lands, for usage of excess waste water	
4.	Remarks for HT lines from Maharashtra State Electricity Transmission Co. Ltd.	
5.	Conceptual Plan	
6.	Forwarding letter from Government of Maharashtra to the Member Secretary Infrastructure EAC (2), MoEF & CC dt. 06.03.2017 for the prescribed Terms of Reference, mentioning its validity upto 22nd July, 2018	
7.	Site Location Map	
8.	Surrounding features of the proposed site (within 2 Km)	
9.	Coordinated Layout	
10.	Tree plantation layout	

O/C

CLARIDGES SEZ DEVELOPERS PVT. LTD.

104, Mittal Chambers, 10th Floor,Nariman Point, Mumbai - 400021
Tel. : 022-65085666 Email : info@csdpl.com

22nd September 2017

To,
The Director and Member Secretary, Expert Appraisal Committee (EAC),
Ministry of Environment, Forest and Climate Change
Jor Bagh Road, New Delhi-110003.

Subject : **Request for Correction in Minutes of 22nd EAC Infra*-2 meeting for "Special Township Project" at Post-Sarang, Taluka- Khalapur, Dist - Raigad, State- Maharashtra by M/s. Claridges SEZ Developers Pvt. Ltd.**

Reference : **1. MOM of 22nd EAC Infra-2 meeting (Item no. 22.4.19)**
2. [IA/MH/NCP/65986/2015; F. No. 21- 285/2017-IA-III]

Respected Sir,

With reference to the above subject, we would like to bring to your kind attention that there are a few minor corrections to be made in the MOM of 22nd EAC Infra-2 meeting for our project.

We request therefore for the corrections to be made at the following places;

Particulars	Mentioned in MOM of 22nd EAC Infra- 2 meeting	Correction to be made as per application
Plot Area (Sq. mt.)	1,10,62,500.00	10,62,500.00

We would like to mention here that at Point no. (ii) Page no. 74 you have mentioned correct Plot area i.e. 10, 62,500.00 Sq. mt., hence we request your good office for the needful rectification in the minutes of meeting.

We would also like to mention here that in our submission of annexure IV we have inadvertently mentioned no. of total flats as 11888 nos instead of 13520 nos. However correct numbers of flats are given in other submittals like EIA report, Form 1 and 1A and same can be verified in your records. Corrected Annexure IV is attached herewith for your reference and record.

Hence we request your good office to do the needful rectification in your records also.

Please do the needful and oblige.

Thanking you,

Yours faithfully,
For CLARIDGES SEZ DEVELOPERS PVT. LTD.

AUTHORISED SIGNATORY

Encl: As above

28/9/17
सी. आर. अनुभाग द्वारा प्राप्त किया
Received by CR Section
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Ministry of Environment, Forests & Climate Change
Govt. of India
इंदिरा पर्यावरण भवन/Indira Paryavaran Bhawan
जोरबाग रोड, अलीगंज/Jorbagh Road, Aliganj
नई दिल्ली/New Delhi-110003

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ANNEXURE IV

EC for building construction projects

i. The project is located at Latitude of 18°52'45.902"N to 18°54'4.004"N and Longitudes of 73°12'54.266"E to 73°13'56.908"E

ii. This is a Special Township Project

iii. Earlier Clearance details, Constructions status, if any: Not Applicable

iv. The plot area is 10,62,500.00 Sq. mt. FSI area is 12,47,741.00 Sq. mt. and total construction area of 23,63,400.26 Sq. mt. The Project will comprise 148 buildings (having 6 phases). Total 13520 nos. flats (Sale and EWS) shall be developed (along with development of amenities like Market Mall, Convention Centre, Hotels and Resorts, IT Park and Office Building, Hospital, Primary and Secondary School, Police Station, Auditorium, Library, Community Centre, Home for Aged Person). Maximum height of the building up to terrace level is 131.40 mt (IT Park Building in Phase 4).

v. During construction phase, total water requirement is expected to be 23 KLD for workers (for each phase) and 925 KLD for construction activity which will be met by tanker water of potable quality for Workers and water tankers for construction activity, for fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water sourced from tankers After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity. During construction phase the waste water shall be treated in modular type STP and Excess treated sewage from STPs of the Construction phase shall be used for water sprinkling, construction of internal roads and watering nursery plants. Temporary sanitary toilets will be provided during peak labor force.

vi. During operational phase, total water demand of the project is expected to be 12763 KLD and the same will be met by the 9204 KLD recycled water, 7283 KLD fresh water from MJP. Wastewater generated (10227 KLD) will be treated in 35 numbers of Sewage Treatment Plants of total capacity 11625 KL. 5444 KLD of treated wastewater will be recycled (4400 KLD for flushing, 1044 KLD for gardening). For fulfilling the construction water requirement of initial phase (Phase -1) proponents are planning to use water tankers. Reuse of excess treated sewage for construction activity of subsequent phases: After commissioning STPs of Phase -1, the excess treated sewage from Phase-1 shall be used for the construction activity of the subsequent phases. This will help to reduce the fresh water demand for construction activity and further reduce the quantity of excess treated sewage. Provision of pond of adequate capacity for storage of excess treated sewage with water purification systems like aerators to keep the optimum oxygen level and avoid breeding of the mosquitoes is planned.

vii. About 39.41 TPD solid wastes will be generated in the project. The biodegradable waste (23.60TPD) will be processed in Biomethanation plant and the non-biodegradable waste generated (15.80 TPD) will be handed over to an Agency named as Thane Waste-Tech & Recyclers Private Limited for further disposal.

viii. The total power requirement during construction phase is 150 KW and will be met from Maharashtra State Electricity Distribution Company Limited (MSEDCL) and total power requirement during operation phase is 136729 KW and will be met from MSEDCL.

ix. Rooftop rainwater of buildings will be collected in 31 nos. of RWH tanks of total 8981 KLD capacity for harvesting after filtration.

x. Parking facility for 21983 four wheelers and 2436 two wheeler, 20769 Cycle, 130 Bus, 5 Ambulance is proposed to be provided against the requirement of 20488, 2056, 20769, 129 and 5 respectively. (according to local norms)

xi. Proposed energy saving measures would save about % of power. : Energy saving: 16 %

xii. It is located within 10 km of Eco Sensitive areas: Yes

xiii. **There is no court case pending against the project**

xiv. Investment/ Cost of the project is Approx. Rs. 7500 (In Crores)

xv. Employment Potential:

During construction phase: The construction of project is in 6 phases and would require 300 skilled and unskilled labours. In each phase local people would benefit the employment opportunities.
Civil works for the construction of buildings may require local sub-contractors, hardware and raw material suppliers thus benefitting and providing small business opportunities to few in the nearby villages.

During operation phase: The completion of project will eventually lead to permanent job opportunities to the local & nearby villagers as there would be increased demand for security, kitchen help, etc.
One Hospital (150 bedded) with Doctor and other supporting staff has been planned in the project. The area with poor health care facility would benefit from this hospital as it has capacity to cater to the population. A primary and Secondary school with a capacity of 7620 students and 762 staff would benefit the nearby village population.

xvi. **Benefits of the project:** This Special Township Project comprises of Residential buildings & EWS (Economical Weaker Section) Housing Scheme along with amenities like Market Mall, Convention Centre, Hotels and Resorts, IT Park and Office Building, Hospital, Primary and Secondary School, Police Station, Auditorium, Library, Community Centre, Home for Aged Person.

NAME OF PROPONENT: CLARIDGES SEZ DEVELOPERS PVT. LTD.

AUTHORIZED SIGNATORY