

To,

Date: 06.07.2019

The Member Secretary,
SEIAA,
Dept. of Ecology Environment & Forest,
7th Floor, M.S. Building,
Bangalore -560 001.

Respected Sir,

Subject: Submission of Environmental Impact Assessment (EIA) report for "Modification and expansion of Residential Apartment, Commercial building and Marq School" by M/s. **Assetz Whitefield Homes Pvt. Ltd** at Survey Nos. 159/1, 159/2, 160/1, 167/1, 167/2, 167/3, 167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District.

Ref. No.: 1. TOR vide letter No. SEIAA 30 CON 2019 dated 28.05.2019
2. Proceedings of 167th SEIAA meeting held on 04.03.2019

With reference to the above subject, we are herewith submitting EIA report along with necessary documents for your perusal both in hardcopy and sot copy as required for Environmental clearance under EIA notification, 2006.

We hope that the project information provided is in accordance with your requirement and further looking to receive the date for the project presentation at the earliest.

Kindly accept and acknowledge the receipt of the same.

Thanking You,

Yours faithfully,
For M/s. **Assetz Whitefield Homes Pvt. Ltd**



Authorized signatory

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR

ASSETZ MARQ

**Modification and Expansion of Residential apartment,
Commercial and School buildings.**

At

**SURVEY NOS. 159/1, 159/2, 160/1, 167/1, 167/2,
167/3, 167/4, 168, 169/1, 169/2, 169/3, 169/4 &
171 OF KANNAMANGALA VILLAGE, BIDARAHALLI HOBLI,
BENGALURU EAST TALUK AND BENGALURU DISTRICT.**

PROMOTER:



M/S. ASSETZ WHITEFIELD HOMES PVT LTD.

**#2/1, Embassy Icon Annexe, Infantry Road,
Bengaluru-560 001**

**PREPARED BY,
AM ENVIRO ENGINEERS,
NO 14/1, 2ND FLOOR, HARIKRUPA,
PATTALAMMA TEMPLE STREET,
BASAVANGUDI,
BENGALURU 560004**

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State Level Environment Impact Assessment Authority-Karnataka

(Constituted by MoEF, Government of India, under section 3(3) of E(P) Act, 1986)

No. SEIAA 30 CON 2019

Date: 28-05-2019

To,

Mr. Ananddeep K Chadha,
Chief Financial Controller,
M/s. Assetz Whitefield Homes Pvt. Ltd.,
2nd Floor, Embassy Icon Annexe Infantry Road,
Bengaluru- 560 001.

Sir,

Sub: Modification and Expansion of "ASSETZ MARQ" Residential Apartment and Commercial Building Project at Sy.No.159/1, 159/ 2, 160/1, 167/1,167/2, 167/3, 167/ 4, 168, 169/1, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District by M/s. Assetz Whitefield Homes Pvt. Ltd., - issue of ToRs and additional ToRs Regarding.

Ref: Proceedings of the 220th SEAC meeting held on 9th April 2019
Proceedings of the 167th SEIAA meeting held on 4th May 2019

This has reference to your online application dated 15th February 2019 bearing proposal No.SIA/KA/NCP/31382/2019 addressed to SEIAA, Karnataka on the subject mentioned above along with Form-1, Form-1A, conceptual plan as per the EIA Notification, 2006.

2. It is inter-alia noted that Environmental Clearance has been issued by SEIAA, Karnataka to this project vide letter No. SEIAA 146 CON 2017 dated 5th February 2018 for Modification and Expansion of Residential Building Project on a plot Area of 1,13,680 Sqm. The Total built up area was 1,28,605 Sqm. The proposed project under expansion consisted of 5 Wings with total of 547 Number of Units , with building configurations as tabulated below:

Sl. No.	Building Name	Building Configuration
1	Wing 1	2B + GF +13 UF + TF
2	Wing 2	2B + GF +9 UF + TF
3	Wing 3	B + GF + 26 UF + TF
4	Wing 4	2B + GF+8 UF+ TF
5	Wing 5	B + GF + 7UF + TF
6	Club House	2B + GF +2UF



State Level Environment Impact Assessment Authority-Karnataka

(Constituted by MoEF, Government of India under section 3(3) of E(P) Act, 1986)

SEIAA 30 CON 2019

Modification and Expansion of "ASSETZ MARQ"
Residential Apartment and Commercial Building
Project by M/s. Assetz Whitefield Homes Pvt. Ltd.,

The Total parking space proposed is for 762 of cars. Total water consumption is 392 KLD (Fresh water + Recycled water). The total wastewater discharge is 334 KLD. It is proposed to construct Sewage Treatment Plant with a capacity of 350 KLD

3. It is a proposal seeking Environmental clearance for proposed Modification and Expansion of "ASSETZ MARQ" Residential Apartment and Commercial Building Project at Survey Numbers Sy.No.159/1, 159/ 2, 160/1, 167/1, 167/2, 167/3, 167/ 4, 168, 169/1, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District by M/s. Assetz Whitefield Homes Pvt. Ltd., This is a project covered under SLNo.8(b) of the Schedule Under EIA Notification 2006 and amendments made there on.

4. It is inter-alia, noted that M/s. Assetz Whitefield Homes Pvt. Ltd., have proposed for Modification and Expansion of "ASSETZ MARQ" Residential Apartment and Commercial Building Project on a plot area of 1,14,526.04 Sqm. The total built up area is 4,38,971.66 Sqm. The proposal consists of 1,927 Numbers of Units with Building Configuration as tabulated below along with Commercial Building and School:

Sl. No.	Building Name	Building Configuration
1	Building 1 (EC obtained)	
	Tower -1/ Wing 1	2B + G + 13UF
	Tower - 2/ Wing 2	2B + G + 9UF
	Tower - 3 / Wing 3	2B + G + 26UF
	Tower - 4 / Wing 4	2B + G + 8UF
	Club House	G + 2F
2	Building - 2 (EC obtained and Under Modification)	
	Tower - 5 / Wing 5	B + G + 28UF
	Club House	G + 1 UF
3	Building - 3 (Proposed)	
	Tower - 6 / Wing 6	B + G + 28UF
	Club House	B + GF
4	Building - 4 (Proposed)	
	Tower - 7/ Wing 7	B + G + 29UF
	Tower - 8/ Wing 8	B + G + 29UF
5	Commercial Building (Proposed)	3B + G + 15UF
6	School (Proposed)	G + 3UF

Total parking space proposed is for 3,321 Numbers. Total water consumption is 1975 KLD (Fresh water + Recycled water). The total wastewater discharge is 1777 KLD. It is proposed to construct Sewage Treatment Plant with a capacity of



State Level Environment Impact Assessment Authority-Karnataka

(Constituted by MoEF, Government of India under section 3(3) of E(P) Act, 1986)

SEIAA 30 CON 2019

Modification and Expansion of "ASSETZ MARQ"
Residential Apartment and Commercial Building
Project by M/s. Assetz Whitefield Homes Pvt. Ltd.,

1800 KLD.

5. The State Expert Appraisal Committee (SEAC), Karnataka has considered the proposal during its meeting held on 9th April 2019. Based on the consideration of the documents submitted and the presentation made by you and the environment consultant the Committee prescribed the following Terms of Reference (ToR) for preparing EIA/EMP report with latest one season baseline data for the above mentioned project.

6. The SEIAA Karnataka after due consideration of the relevant documents submitted by the project proponent, and the recommendation of the SEAC have in its meeting held on 4th May 2019 and decided to accord the Standard Terms of Reference (TOR) along with additional Terms of Reference, in accordance with the provisions of Environmental Impact Assessment Notification-2006 and its subsequent amendments made there on.

- 1) Examine details of land use as per Master Plan and land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.
- 2) Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/ villages and present status of such activities.
- 3) Examine baseline environmental quality along with projected incremental load due to the project.
- 4) Environmental data to be considered in relation to the project development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise and vibrations, (g) socio economic and health.
- 5) Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area. Any obstruction of the same by the project
- 6) Submit the details of the trees to be felled for the project.
- 7) Submit the present land use and permission required for any conversion such as forest, agriculture etc.
- 8) Submit Roles and responsibility of the developer etc for compliance of environmental regulations under the provisions of EP Act.
- 9) Ground water classification as per the Central Ground Water Authority.
- 10) Examine the details of Source of water, water requirement, use of treated waste water and prepare a water balance chart.
- 11) Rain water harvesting proposals should be made with due safeguards for ground water quality. Maximize recycling of water and utilization of rain water.



State Level Environment Impact Assessment Authority-Karnataka

(Constituted by MoEF, Government of India under section 3(3) of E(P) Act, 1986)

SEIAA 30 CON 2019

Modification and Expansion of "ASSETZ MARQ"
Residential Apartment and Commercial Building
Project by M/s. Assetz Whitefield Homes Pvt. Ltd.,

Examine details.

- 12) Examine soil characteristics and depth of ground water table for rainwater harvesting.
- 13) Examine details of solid waste generation treatment and its disposal.
- 14) Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption. Energy conservation and energy efficiency.
- 15) 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.
- 16) Examine road/rail connectivity to the project site and impact on the 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.
- 17) A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.
- 18) Examine the details of transport of materials for construction which should include source and availability.
- 19) Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.
- 20) Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.
- 21) Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.
- 22) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
- 23) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "<http://moef.nic.in/Manual/Townships>".

Additional Terms of References :

- 1) Details of the Kharab land and its position on the village survey map may be detailed and submitted.
- 2) Ground water potential and level in the study area may be studied.



State Level Environment Impact Assessment Authority-Karnataka

(Constituted by MoEF, Government of India under section 3(3) of E(P) Act, 1986)

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- 3) Scheme for waste to energy plant to process the entire organic waste generated from the entire project.
- 4) Management plan to utilise the entire earth generated within the site may be worked out and submitted.
- 5) Utilization of the entire terrace for solar power generation may be worked out and submitted along with layout, efficiency of panels, and cost estimation.
- 6) Scheme for utilising maximum treated sewage water to reduce the demand on the fresh water may be worked out and submitted.
- 7) Surface hydrological study of surrounding area may be carried out and the carrying capacity of the natural nalas may be worked out in order to ascertain the adequacy in the carrying capacity of the nalas.
- 8) To submit the Details of trees to be felled and the scheme for development of greenery with the number and kind of tree species as per the norms.
- 9) The applicability of the recent NGT order on buffer zone for water bodies and nalas may be studied and submitted.
- 10) ECBC norms to be fully complied with for design and choice of equipments. Simulation modeling studies to be conducted and quantify the energy savings. Indicate the energy utilization intensity $= (\text{total KWH/year}) / \text{BUA}$, bench mark this value for similar commercial buildings.
- 11) Carbon footprint to be estimated for construction and operation phase. Suitable offsets to be implemented, quantified and detail calculation to be submitted to try and achieve near zero carbon foot print.
- 12) Traffic simulation studies to be conducted for present and projected traffic densities along with transportation study for construction phase. Traffic plan to be prepared in order to reduce vehicular emissions and project the vehicular emissions through linear air modeling.
- 13) Provide baseline studies of indoor air quality at each floor level and basement of other commercial buildings developed by the proponent. Detail the measures to monitor indoor air quality during operation phase.
- 14) The NOC from the Airport authority regarding the height of the building permitted may be obtained and submitted.
- 15) Ground Water analysis shall be conducted for heavy metal parameters such as Mercury, Lead, Cadmium, & Uranium also.

The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this



State Level Environment Impact Assessment Authority-Karnataka

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regard in the EIA/EMP reports prepared by them and the data provided by other Organization(s)/Laboratories including their status of approvals etc. In this regard Office Memorandum No. F. No. J-11013/77/2004-IA.II(I) dated 30th June, 2011 available on the MoEF, GoI website <http://www.moef.nic.in> may please be referred.

The Terms of Reference (ToR) prescribed by the State Expert Appraisal Committee (SEAC), Karnataka should be considered for the preparation of EIA / EMP report for the above mentioned project in addition to all the relevant information as per the Generic Structure of ELA given in Appendix III and IIIA in the EIA Notification, 2006.

The ToRs prescribed will be valid for a period of three years for submission of the EIA/EMP report.



Member Secretary

State Level Environment Impact Assessment Authority,
Karnataka.

Copy to:-

1. Chairman, Karnataka State Pollution Control Board, KSPCB, Parisara Bhavan, 4th & 5th Floor, church street, Bangalore for information.
2. Guard File.



TERMS OF REFERENCE FOR EIA STUDIES**COMPLIANCE TO TOR CONDITIONS**

Sl. no.	Terms of reference	Compliance
1.	Examine details of land use as per Master plan and land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.	Land use and Land cover around 10 Kms of the study area is examined based on latest satellite imagery. Details are incorporated in Chapter-3 of Page No. 47 & 48.
2.	Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/ villages and present status of such activities.	Project is a modification and expansion of residential apartment and commercial buildings. The project site is located. Environmental settings of the site given in Chapter-2 of Page no.14
3.	Examine baseline environmental quality along with projected incremental load due to the project.	Baseline study conducted for the period of March to May 2019 and complete details are incorporated in Chapter-3. The incremental load due to the project is given in Chapter 4 of Page no.101-103
4.	Environmental data to be considered in relation to the project development would be (a) land (b) ground water (c) surface water (d) air (e) bio-diversity (f) noise and vibrations (g) socio economic and health	Details of environmental data with relation to the project development are incorporated in Chapter-3 of EIA report.
5.	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area. Any obstruction of the same by the project	Contour plan enclosed as ANNEXURE 7 and drainage pattern of the study area showed in Chapter 3 of Page No. 50
6.	Submit the details of the trees to be felled for the project	Project is a modification and expansion of residential apartment and commercial buildings which is developed partially and the area reserved for future development will be developed whether there are no tree located, hence no trees to be felled in the project. Details of existing tree species are mentioned in Chapter 4 of page No. 109
7.	Submit the present land use and permission required for any conversion such as forest,	The proposed project situated in residential zone and copy of the CDP map provided in

TOR COMPLIANCE

	agriculture etc.	Chapter 2 of Page No. 17
8.	Submit roles and responsibility of the developer etc for compliance of environmental regulations under the provisions of EP Act	Responsibility of the developer covers development of the system which is sustainable to the environment which will be implemented by obtaining and complying all the statutory clearances conditions. With respect to the Environmental clearance, Once EC has been accorded, Half yearly compliance to EC conditions will be submitted to the concerned office with monitoring results as per norms.
9.	Ground water classification as per the Central Ground Water Authority.	The project site is located at Bangalore North region which is declared as notified area as per CGWA Notification dated 27/11/2012.
10.	Examine the details of source of water, water requirement, use of treated waste water and prepare a water balance chart.	Source of water, quantity, wastewater disposal and reuse explained along with water balance chart in chapter 2 of page no. The water requirement for the project is from Grampanchayath/Borewell
11.	Rain water harvesting proposals should be made with due safeguards for ground water quality. Maximize recycling of water and utilization of rain water. Examine details.	Storm water management with 43 Nos. of recharge pit details given in Chapter 2 of page No.32-35
12.	Examine soil characteristics and depth of ground water table for rain water harvesting.	Soil characteristics given in Chapter 3 of page no. 54-55. Rain water harvesting details given in Chapter 2 of Page No.32-35
13.	Examine details of solid waste generation treatment and its disposal	Solid waste collection, segregation, treatment and disposal method along with organic waste composter detailed in chapter 2 of page no.37-39 The OWC layout plan enclosed as ANNEXURE 5
14.	Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption. Energy conservation and energy efficiency.	Solar details and energy saving details provided in Chapter 2 of Page No. 39-42 The terrace area showing solar panel installation plan enclosed as ANNEXURE 6
15.	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	Proposed 1X2500KVA, 3X2000KVA, 8X750KVA, 2X500KVA, 1X320KVA, 1X100KVA during operation phase and 1X100 kVA during construction phase taken into consideration and examined in chapter 4

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	submit details.	of page No. 101-103
16.	Examine road/ rail connectivity to the project site and impact on the traffic due to the proposed project. Present and future traffic and transport facilities for the region should be analyzed with measures for preventing traffic congestion and providing faster trouble free system to reach different destinations in the city	Traffic management study report is enclosed as ANNEXURE 11
17.	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic	Explained in traffic study report study.
18.	Examine the details of transport of materials for construction which should include source and availability	Materials for construction will be sourced from local vendors and transported through trucks during day time. Raw materials quantification has been done and detailed in Chapter-2 of Page No. 27
19.	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Environmental management plan cost given in chapter 9 of page no. 180 and Monitoring plan cost and parameters for both the phases given in Chapter 6 of page no.134
20.	Submit details of the comprehensive Disaster management plan including emergency evacuation during natural and man-made disaster	Risk assessment and disaster management plan details are incorporated in Chapter 7
21.	Details of litigation pending against the project, if any, with direction/ order passed by any Court of law against the project should be given.	No litigation/court case against this proposed project in any court of law.
22.	The cost of the project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out	The estimated project cost is Rs.725 Crores. EMP cost given in Chapter 9 of Page No.180
23.	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measures, project proponent can refer to the model TOR available on Ministry website http://moef.nic.in/manual/Townships	Model TOR referred.

COMPLIANCE TO ADDITIONAL TOR CONDITIONS

Sl. no.	Additional Terms of reference	Compliance
1.	Details of the Kharab land and its position on the village survey map may be detailed and submitted.	Kharab land details is presented in Chapter 2 of Page No. 24.
2.	Ground water potential and level in the study area may be studied.	Ground water level study has been done and map showing the ground water level along with geotechnical investigation report is attached as ANNEXURE 9
3.	Scheme for waste to energy plant to process the entire organic waste generated from the entire project.	The agreement has been made with the Gail Ltd to supply the domestic PNG to the apartment and we will install the OWC to treat the organic waste and same will be used as manure. Copy of the agreement is enclosed as ANNEXURE 13.
4.	Management plan to utilize the entire earth generated within the site may be worked out and submitted.	The excavated earth quantity will be utilized completely within the plant for various purposes. The breakup details given in Chapter 2 of Page No.
5.	Utilization of the entire terrace for solar power generation may be worked out and submitted along with layout, efficiency of panels and cost estimation.	The available terrace area will be provided with Solar panels for power generation and hot water generation. The area calculations and cost estimation is explained in chapter 2 of Page No. 36
6.	Scheme for utilising maximum treated sewage water to reduce the demand on the fresh water may be worked out and submitted.	The available treated water will be utilized for various purposes. The water balance chart is given in Chapter 2 of Page No.30-31.
7.	Surface hydrological study of surrounding area may be carried out and the carrying capacity of the natural nalas may be worked out in order to ascertain the adequacy in the carrying capacity of the nalas.	Hydrology study has been done and report is enclosed as ANNEXURE 8
8.	To submit the Details of trees to be felled and the scheme for development of greenery with the number and kind	Project is a modification and expansion of residential apartment and commercial buildings which is developed partially and the area reserved for future development will be developed where

TOR COMPLIANCE

	of tree species as per the norms.	there are no tree located, hence no trees to be felled in the project. The green belt development plan enclosed as ANNEXURE 12.
9.	The applicability of the recent NGT order on buffer zone for water bodies and nalas may be studied and submitted.	There is small water tank (Kunte) located adjacent to the project site in east direction for which sufficient buffer of 75 meter has been considered. There is tertiary nala located at the project site in the CA site for which required buffer has been considered. The NGT order dated 04/05/2016 which was super seeded by the order of Honorable supreme court of India dated March 5 2019, distance from the respective nala are considered as per the local planning authority guidelines.
10.	ECBC norms to be fully complied with for design and choice of equipments. Simulation modeling studies to be conducted and quantify the energy savings. Indicate the energy utilization intensity = (total KHW/year)/BUA, bench mark this value for similar commercial buildings.	The ECBC norms is complied with design and equipments and simulations studies is presented in ANNEXURE 10
11.	Carbon footprint to be estimated for construction and operation phase. Suitable offsets to be implemented, quantified and detail calculation to be submitted to try and achieve near zero carbon foot print.	Carbon foot print for construction and operation phase is estimated and detailed in Chapter 5 of page No. 125-127 along with offsets.
12.	Traffic simulation studies to be conducted for present and projected traffic densities along with transportation study for construction phase. Traffic plan to be prepared in order to reduce vehicular emissions and project the vehicular emissions through linear air modelling.	Traffic study has been done for the project and explained in detail in ANNEXURE 11

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13.	Provide baseline studies of indoor air quality at each floor level and basement of other commercial buildings developed by the proponent. Detail the measures to monitor indoor air quality during operation phase.	Indoor air quality has been done at 4 locations and results are given in Chapter 3 of Page no.69
14.	The NOC from the Airport authority regarding the height of the building permitted may be obtained and submitted.	NOC from Airport Authority has been obtained and enclosed as ANNEXURE 2
15.	Ground Water analysis shall be conducted for heavy metal parameters such as Mercury, Lead, Cadmium, & Uranium also.	Ground water analysis has been conducted at 8 locations including project site and results are presented in Chapter 3 of Page No. 58 Analysis has been done as per the IS standards 10500-2012.

EXECUTIVE SUMMARY

1. PREAMBLE

M/s. Assetz Whitefield Homes Pvt. Ltd. proposed for modification and expansion of Residential Apartment, Commercial building and Marq School in the name of “ASSESTZ MARQ” at Survey Nos. 159/1, 159/2, 160/1, 167/1,167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District.

Environmental Clearance had obtained for construction of residential development with vide letter no. SEIAA 174 CON 2013 dated 03.10.2013 for the built up area of 1,15,624.0 Sqm. And then obtained EC for modification and expansion of residential apartment vide file no. SEIAA 146 CON 2017 dated 05.03.2018 for the total built-up area of 1,28,605.46 Sqm and now proposed for modification and expansion of residential apartment, commercial building and Marq school with the total built up area of 4,38,971.66 Sqm. The building configuration is as below.

Description	Building configuration	Height m	Units
Building-1 (EC obtained)			Total units after Expansion 1927 No's
Wing-1	2B+G+13F	43.60	
Wing-2	2B+G+9F	31.80	
Wing-3	2B+G+26F	81.95	
Wing-4	2B+G+8F	28.85	
Clubhouse	G+2F	10.80	
Building -2 (EC obtained and under modification)			
Wing-5	B+G+7F(EC Obtained) B+G+28F (Proposed)	89.05	
Clubhouse	G+1F	08.90	
Building -3 (Proposed)			
Wing-6	B+GF+28F	89.05	
Clubhouse	B+GF	09.70	
Building -4 (Proposed)			
Wing-7	B+GF+29F	91.05	
Wing-8	B+GF+29F	91.05	
Commercial building (proposed)	3B+G+15F	58.00	
School (proposed)	GF+3F	14.95	

BACKGROUND

M/s. Assetz Whitefield Homes Pvt. Ltd. obtained Environmental clearance vide file no. SEIAA 174 CON 2013 dated 03.10.2013 for construction of residential development with the total built-up area of 1,15,624.0 Sqm and proposed for modification and expansion of residential apartment with the total built-up area of 1,28,605.46Sqm clearance obtained vide file no. SEIAA 146 CON 2017 dated 05.03.2018.

CURRENT PROPOSAL

M/s. Assetz Whitefield Homes Pvt. Ltd is proposing the modification and expansion of the project with total built up area of 4,38,971.66 Sqm inclusive of the proposed expansion of 3,54,886.96 Sqm. Accordingly online application to SEIAA made on 15.02.2019 bearing proposal No. SIA/KA/NCP/31382/2019 with Form 1, Form 1A, proposed Tor and other documents as per EIA notification 2006 and Based on the information furnished and presentation done before the State Expert Appraisal Committee (SEAC) members, proposal was appraised in the 167thState Expert Appraisal Committee (SEAC) meeting, held on 09.04.2019. Subsequently Committee has issued the TOR (Terms of Reference) for preparing Environmental Impact Assessment (EIA) report vide letter no. SEIAA 30 CON 2019 dated on 28.05.2019

2. PROJECT DESCRIPTION

In the total site area of 1,14,526.04 Sq.m (28 A 12 G) Assetz proposed for modification and expansion of Residential area on an plot area of 90750.75 Sqm, Commercial area on an plot area of 21306.70 Sqm and Marq school on an plot area of 4540.0 Sqm. The Kharb land involved is about 1416.4 Sqm. The site is abutting to 24.7 m existing wide road towards west side. The maximum height of the building considered is 91.05 m. and the total investment cost involved in setting up of the project is estimated to be about Rs. 725 Cr.

Total water requirement during construction phase will be around 59 KLD. The water for construction will be tertiary treated water which will be met by outside

water supply. And water for domestic use will be sourced from outside tanker suppliers. It has been estimated that around 300 workers will be employed for construction activities and amount of water is to be 14 KLD and wastewater would be 12 KLD which will be treated in mobile STPs. The water for construction activities is estimated around 45 KLD. Hence, there will be no wastewater generation from curing or mixing processes

Likewise water requirement for the operation phase of the project is estimated around 1977 KLD by considering 135 litres per capita consumption per day. Water will be sourced from BWSSB. And it has been estimated that wastewater generation would be around 1777 KLD which will be treated in sewage treatment plant by installing 290 KLD, 510 KLD, 570 KLD, 50 KLD, 360 KLD of STP capacities in the premise using SBR technology.

Construction waste will be generated during construction activity same will be reused for backfilling and road formation within the site premises. Apprx. earth excavation quantity of construction waste is estimated i.e., around 1,25,730 cum. There will not be any labour colonies as labors hired locally residents. Hence there will not be much of organic or inorganic waste generation. However, generated waste will be collected and disposed off to local body for further processing. During construction period, solid waste of about 30 kg/d will be collected manually and handed over to local body for further processing.

During operation stage, solid waste of about 7.26 MTD will be collected in separate bins from each block and will be separated as Organic and In-Organic waste in the respective bins within the units. And will be composted in organic waste converter.

Apart from this energy efficient devices are also used and the energy saving details explained in Chapter 2. The overall energy savings from the proposed project is around 23.76%.

3. DESCRIPTION OF THE ENVIRONMENT

For the preparation of EIA, baseline study has been carried out as per the generic structure provided in the Appendix III of the EIA notification 2006 of MoEF & as per

the EIA GUIDANCE MANUAL for Building, Construction, Township and Area Developmental Projects prepared by Administrative Staff College of India, Hyderabad dated February 2010 and as per the CPCB standard references.

Baseline study was conducted in the pre monsoon season during the month of March to May 2019, for an area covering 10km radius with project site as center. Secondary data/ Micrometeorological data have been collected from IMD, Bengaluru to assess the base line environmental status. Collection & analysis of baseline environmental data have been done on ambient air quality, noise quality, surface & ground water quality attributes.

In addition to the baseline environmental monitoring, field inspection in the study area, collection of secondary information for the environmental components and discussion with the officials and local public were also conducted.

A total of 8 samples were collected from the study area. The samples have been analyzed for physio-chemical parameters. At the monitoring locations, 2 kg of soil samples were collected by means of augur, filled in polythene bags and sent to the laboratory for analysis. The soil samples were collected at a depth of 10-15 cm (top soil).

Secondary information on meteorological conditions for the project study region was collected from the IMD station at Bangalore. Wind rose diagram shows that during the study period, average wind speed of 3.3m/s was observed. Wind direction is also studied during different time of the day, during the study period; indicate that maximum windblown was from East direction; down wind direction is west side.

Ambient air quality monitoring (AAQM) was carried at 8 locations. The result of AAQM reveals that, measured values for all the 12 parameters are well within the NAAQ, 2009 standards. This indicates that the ambient air quality of the study area is satisfactory in nature. Ambient noise levels monitoring was carried at 8 locations and results were found to be within the CPCB standards.

From the reconnaissance survey information on flora and fauna in the study area and project site was collected. Further, conservation status of the same was evaluated referring to IUCN website & Red Data Books of the Botanical Survey of

India. Information on various groups of animal species found in the study area was collected by both direct and indirect observations. Later, by using IUCN Red List/ Wildlife (Protection) Act, 1972 Schedules was referred to know their conservation status. Trees, shrubs, herbs found at the site are common and native to the region. There are no rare, endangered, threatened species found in the study area and also at site.

4. ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURE

Land Environment:

During construction phase, site clearing activities and formation of approach roads will lead to air pollution due to dust and also cause minor secondary impact such as decreasing the water infiltration, loosening of soil. To mitigate the same, water sprinkling will be undertaken to reduce fugitive load and measures such as reuse of excavated top soil for greenery development, slope stabilization and construction of embankments, balanced cut and fill operations will be undertaken for effective area development.

During operation phase, if the sewage is not properly treated to the discharge norms of KSPCB and if used for greenery development or due to over usage will result in filthy/unaesthetic/odour nuisance conditions and indirectly affects soil and ground water of the region. Hence to mitigate the above impacts, the sewage will be treated in scientifically designed STP that enables to treat in compliance to KSPCB discharge standards for secondary reuse applications.

Air Environment:

Site clearing, excavation work, transportation of raw materials, emissions from construction vehicles, etc., will result in generation of dust. Ambient air quality impacts from emissions during construction of the project are estimated using air quality dispersion modeling analysis. The modeling analysis considers the construction site location and the sources of emissions during construction, including vehicle and equipment exhaust and fugitive dust.

As part of the mitigation measures, periodic water sprinkling will be carried out in all the dust generating activities like site clearing, leveling, excavation, material handling, etc. to suppress the dust. Also, vehicles delivering loose and fine materials like sand and fine aggregates will be covered with tarpaulin to reduce spills on the roads and also to reduce fugitive emissions.

During operation phase of the project, the source of emission will be from DG sets, will be used as a backup power only during power failure and vehicular emissions.

As part of the mitigation measures, height of the Stacks/chimneys to D.G. Set as per KSPCB norms for effective dispersion of pollutants into atmosphere with HSD with sulphur content of <0.05%. Further trained security will take care of smooth entry/exit of vehicles to avoid traffic congestion within and near entry/exit. As advisory in nature, instructions will be displayed to the employers of the projects to undergo their vehicles for pollution control check time to time, which is also a mandatory under the Motor Vehicles Act, 1988.

Noise Levels:

During construction phase, various sources of noise pollution will be mainly from operation of machineries like compactors, concrete plant, cranes, batch plants, material lifting operations, communication noise, DG sets, honking etc.,

As part of the mitigation measures, barricades will be erected all along the site boundary to avoid noise nuisance on the surrounding population, acoustic enclosures to DG sets will be ensured & trained security will be deployed for smooth entry/exit in & around the construction sites/blocks which also helps in reducing unnecessary honking. As a health measure, Ear plugs will be provided to the workers exposed to high noise prone activities.

Surface and Ground Water Quality:

During Construction phase, impacts are anticipated through disposal of sewage generated from the labour in the site if not managed properly. Also, improper treatment of sewage from labour in the site leads to infiltration into the subsurface

soil and finally affects the ground water of the region. As part of the mitigation measures, sewage from the labour in the site is being treated in mobile STP & implemented as per the guidelines.

During operation phase, if the sewage is not properly treated to the discharge norms of KSPCB and used for greenery development or due to over application will result in filthy/unaesthetic/odour nuisance conditions and indirectly affects soil and ground water of the region. To mitigate the above impact, the sewage from the proposed project will be collected through an internal network of sewerage system and discharged into the STPs and treatment method is based on sequential Batch Reactor Technology. Treated wastewater will be reused for greenery development, toilet flushing, within the site premises.

Solid and Hazardous Waste Management:

During Construction Phase, improper management of solid waste generated from the labour in the site leads to leachate formation under moisture conditions or when layers comes in contact with water will affect groundwater through percolation of leachate into subsurface soil. Improper disposal of construction debris, used oil from DG sets and biomedical waste will result in causing ground water contamination and chances of spread of infectious diseases and increased health risks to labour force. As part of the mitigation measure, solid waste generated from labour in the site will be collected in separate bins and dispose to authorized vendors for further processing.

Entire earth excavation waste of 1,25,730 Cum. will be utilized for various purposes within the site. Also, used oil/waste oil generated from DG sets & biomedical wastes will be collected/ stored in leak proof drums/barrels/bins and disposed to the KSPCB authorized re-processors/recyclers.

During operation phase: Solid Waste - Domestic solid waste from the proposed project will 7.26 MT/day. If this quantum of solid waste is not handled scientifically and disposed improperly will result in leachate formation and affects the ground water through percolation of leachate into subsurface soil. Out of which, organic wastes contributes to 40% i.e., 2.91 MT/day will be composted using organic waste converters and compost will be reused within the project site & excess will be

sold in the market and inorganic wastes contribute around 60% i.e, 4.35 MT/day will be handed over to authorized recycler. Apart from the above, STP sludge will be dewatered and reused as manure within the project site.

Ecology and Biodiversity:

Construction Phase - No protected areas, eco sensitive areas, etc are present within 5km of the project site. Impact on biological environment (flora and fauna) will be anticipated due to changes occurring on air, water and land environment. Impacts that are anticipated during construction phase on biological environment are due to clearing of vegetation, transportation of raw materials, disposal of raw materials and generation of noise from construction activities.

Operation Phase - No major impacts will be anticipated during operation phase of the project on biological environment. However, with the development of greenery within the project with various indigenous species (flowering, fruit bearing) will attract many birds, butterflies, etc. Maintenance of greenery will be undertaken throughout the year.

Socio-economics:

During construction period, socio-economic impacts are identified as

- Health impact due to dust, noise, improper sanitation during construction activities. Same will be mitigated through proper implementation of EMP.
- Generation of employment will benefit the local population. More than 200 labors including technical staff, workers etc will get employment
- Increase in commercial activities: Many small shops/vendors can offer their services to construction workers and people visiting the project site.
- Since, traffic density is very thin in the surrounding road network; therefore the increased traffic on the main road to the project will be very easily absorbed. Proper maintenance of construction vehicles will minimize health impacts due to noise, dust, emissions.

During operation phase, socio-economic impacts are identified as

- Generation of employment will benefit the local population. More than 100 persons will get employment for day to day maintenance activities in the project.
- Increase in commercial activities: Many small/medium/large shops/vendors can offer their services to residents/occupants of the project.
- Since, traffic density is very thin in the surrounding road network, therefore the increased traffic on the main road to the project will be very easily absorbed. More than sufficient parking will be provided, therefore no piling of vehicles near the entry/exit.

5. ALTERNATIVE TECHNOLOGIES AND SPECIFIC STUDIES

Following are the specific studies carried out with respect to the proposed project which are as follows:

- Transportation (Traffic studies and Management measures)
- Building material and technologies
- Energy conservation analysis

The conventional practice of clay, brick consumes large quantity of energy in terms of coal and other fuels which are primarily non-renewable and highly polluting. Water requirements of building industry are also very high. Steel which is used in the construction process is manufactured by non-renewable resource. Normally conventional materials used for construction are non-renewable sources. Use of alternative technologies for each component of the buildings of envelope, superstructure, finishes and the road and surrounding areas are discussed in detail.

The appearance of a Green Building will be similar to any other building. However, the difference is in the approach, which revolves around a concern for extending the life span of natural resources; provide human comfort, safety and productivity. This approach results in reduction in operating costs like energy and water, besides several intangible benefits.

Construction of the buildings will require additional power and energy requirement. To minimize the energy consumption, buildings will be designed and constructed according to Energy Conservation Building Code 2007 which sets

minimum energy standards for buildings. The following methods could be implemented to the proposed buildings.

Movement of heavy traffic loads and operation of construction machinery should be considered. Construction machinery due to its operation produces smoke, dust and noise and vibration. Internal road design should be done with due consideration for environment, and safety of the people residing or working near the roads. Proper sidewalk should be provided for the residence to commute. The width of sidewalk depends upon the expected pedestrian flows and should be fixed with the help of guidelines given by IRC in IRC: 103-1988.

Carbon footprint is the total sum of greenhouse gas (GHG) emissions caused by an organization, event, product or person. As we are aware, the increasing concentration of GHGs in the atmosphere can accelerate climate change and global warming, it is very necessary to measure these emissions from our day to day activities. Energy and pollutant emissions such as carbon dioxide (CO₂) may be regarded as being 'embodied' within materials. Thus, embodied energy can be viewed as the quantity of energy required to process, and supply to the construction site, the material under consideration. In order to determine the magnitude of this embodied energy, an accounting methodology is required that sums the energy inputs over the major part of the material supply chain or life-cycle.

6. ENVIRONMENTAL MONITORING PROGRAMME

Regular monitoring of environmental parameters is more importance to assess the status of the environment during operation of the project. Baseline conditions will serve as an indicator for any deterioration in environmental conditions due to operations of the project. Environmental monitoring programme as given in below table will be conducted.

Sl. no	Particulars	Monitoring frequency	Duration of sampling	Important monitoring parameters
1.	Stack Monitoring			
	DG stacks at project premises	Once in three months	As per the standard procedure	SO ₂ , NO _x , SPM, CO, Temperature, Flow Rate

2.	Ambient air quality Monitoring			
	Project premises	Once in three months	24 hours Continuous	PM ₁₀ & PM _{2.5} , NO ₂ , SO ₂
3	Ground/Drinking Water Quality Monitoring			
	Ground water at project site	Once in three months	Grab sample	Parameters specified under As per IS -10500, 1993
4	Sewage Quality Monitoring			
I	Treated sewage prior to discharge	Monthly once	Composite	pH, BOD ₅ , COD, Turbidity, E-Coli, Res.Cl ₂
5	Ambient noise levels			
	Project premises in 2 locations	Once in a month	8hr continuous with 1hr interval	Ambient Noise Standards
6	Greenbelt development			
	Project premises	Continues	Continues	--
7	Indoor air quality			
	Inside building	Once in 6 months	Continuous	ASHREE standards

7. ADDITIONAL STUDIES

Risk assessment refers to identifying and evaluating hazards identified within the system. Risk assessment is the determination of quantitative or qualitative value of risk related to an actual situation and a recognized threat (also called hazard). In all types of engineering of complex systems sophisticated risk assessments are often made within safety engineering and reliability engineering when it concerns threats to life, environment or machine functioning.

The major risk identified due to the probable hazards in the project site during construction and operation phase of the project and precautionary measures as a part of emergency response plan are discussed in detailed. However, Bengaluru and surrounding regions are considered to be low damage zones as far as Earthquake (Risk Zone-II), Flooding, Landslides and Cyclone are concerned (Source: BMTPC Risk Zone Maps).

8. PROJECT BENEFITS

- Generation of employment will benefit the local population. More than 300 construction labors including technical staff, workers etc will get employment.
- More than 100 persons will get employment during operation phase for day to day maintenance activities in the project.
- Development of greenery in an area of 34218.06 Sqm on earth 4121.14 Sqm on podium in the project with various indigenous species (flowering, fruit bearing) will attract many birds, butterflies, etc
- Eco friendly handling of domestic solid waste, resulting in the organic manure, therefore minimizing the dependency on inorganic fertilizers.
- Excess organic manure can be given to nearby farmers/agricultural lands.
- Conservation of water by utilizing the treated wastewater for urban secondary reuse applications in the project.

9. ENVIRONMENTAL MANAGEMENT PLAN

During construction, as part of the EMP, erection of barricades around the periphery, water sprinkling, sewage management through mobile STP, storm water management through drainage arrangements, traffic management and scientific management of solid waste, hazardous waste, bio medical waste and e-waste measures will be undertaken towards better implementation of the project.

During operation phase, use of STPs, organic waste converters, energy conservation features, rain water harvesting and recharging, scientific disposal of hazardous waste, bio medical waste and e-waste, greenery development and corporate social activities around the project site will benefit the environment.

The total cost of implementing above EMP works out to Rs. 2021.0 Lakhs. The operational cost of the same is estimated to be Rs. 235.0 Lakhs per annum.

Overall, the project will have minimum impact on the environment, if the recommended/ suggested various environmental mitigation & management measures as stated in this report are implemented by the project proponents inspirit.

CHAPTER - 1

INTRODUCTION

1.1 PREAMBLE

M/s. Assetz Whitefield Homes Pvt. Ltd proposed for modification and expansion of Residential Apartment, Commercial building and Marq School in the name of “ASSESTZ MARQ” at Survey Nos. 159/1, 159/2, 160/1, 167/1,167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District.

The total site area of the project is 28 acres 12 guntas i.e., 1,14,526.04 Sq.m as per document and as per ground 28 acres and 1.6 guntas i.e., 1,13,473.85 Sqm. Initially EC had obtained for construction of residential development with vide letter no. SEIAA 174 CON 2013 dated 03.10.2013 for the built up area of 1,15,624.0 Sqm. And then obtained EC for modification and expansion of residential apartment vide file no. SEIAA 146 CON 2017 dated 05.03.2018 for the total built-up area of 1,28,605.46 Sqm.

Assestz planned to expand the project by considering additional buildings and proposing for modification and expansion of residential apartment, commercial building and Marq school with the total built up area of 4,38,971.66 Sqm inclusive of the proposed expansion of 3,54,886.96 Sqm and height of the building 91.05 m (Maximum). The building configuration is as below.

Table1.1 Building configuration

Description	Building configuration	Height m	Units
Building-1 (EC obtained)			Total units after Expansion 1927 No's
Wing-1	2B+G+13F	43.60	
Wing-2	2B+G+9F	31.80	
Wing-3	2B+G+26F	81.95	
Wing-4	2B+G+8F	28.85	
Clubhouse	G+2F	10.80	
Building -2 (EC obtained and under modification)			
Wing-5	B+G+7F(EC Obtained) B+G+28F (Proposed)	89.05	
Clubhouse	G+1F	08.90	

Building -3 (Proposed)			
Wing-6	B+GF+28F	89.05	
Clubhouse	B+GF	09.70	
Building -4 (Proposed)			
Wing-7	B+GF+29F	91.05	
Wing-8	B+GF+29F	91.05	
Commercial building (proposed)	3B+G+15F	58.00	
School (proposed)	GF+3F	14.95	

1.2 BACKGROUND OF THE PROJECT

- M/s. Assetz Whitefield Homes Pvt. Ltd. entered joint development agreement with Sai Lakshmi industries Pvt Ltd to develop residential apartment with land measuring 28 A and 12 Guntas at Survey Nos. 159/1, 159/2, 160/1, 167/1, 167/2, 167/3, 167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru east taluk,, Bengaluru District.
- Initially EC had obtained vide file no. SEIAA 174 CON 2013 dated 03.10.2013 for construction of residential development with the total built-up area of 1,15,624.0 Sqm.
- M/s. Assetz Whitefield Homes Pvt. Ltd. obtained Environmental clearance vide file no. SEIAA 146 CON 2017 dated 05.03.2018 for modification and expansion of residential apartment with the total built-up area of 1,28,605.46Sqm.
- M/s. Assetz Whitefield Homes Pvt. Ltd is proposing the modification and expansion of the project with total built up area of 4,38,971.66 Sqm inclusive of the proposed expansion of 3,54,886.96 Sqm
- Accordingly online application to SEIAA made on 15.02.2019 bearing proposal No. SIA/KA/NCP/31382/2019 with Form 1, Form 1A, proposed TOR and other documents as per EIA notification 2006 and Based on the information furnished and presentation done before the State Expert Appraisal Committee (SEAC) members, proposal was appraised in the 167th State Expert Appraisal Committee (SEAC) meeting, held on 09.04.2019. Subsequently authority has issued the TOR

(Terms of Reference) for preparing Environmental Impact Assessment (EIA) report vide letter no. SEIAA 30 CON 2019 dated on 28.05.2019

Table1.2 COMPARATIVE STATEMENT

Sl. No.	Features	Unit	EC obtained	Present Proposal
1	Subject number	File No.	SEIAA 146 CON 2017	SEIAA 30 CON 2019
2	Project Name	--	ASSETZ MARQ	ASSETZ MARQ
3	Developer	--	M/s Assetz Whitefield Homes Private Limited	M/s Assetz Whitefield Homes Private Limited
4	Type of Development	--	Modification and expansion of Residential Apartment	Modification and expansion of Residential Apartment, commercial building and Marq school
5	Project address	--	Survey Nos. 159/1, 159/2, 160/1, 167/1, 167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru east taluk, Bengaluru District.	Survey Nos. 159/1, 159/2, 160/1, 167/1, 167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru east taluk, Bengaluru District.
6	Plot Area	Sqm	1,14,526.04 Sq.m	1,14,526.04 Sq.m
7	Built up Area	Sqm	1,28,605.46	4,38,971.66 (Total)
8	Landscape Area	Sqm	35,691 (33.05%)	38339.2 Sqm (34.79%)
9	Number of units	Nos.	547	1927
10	Water requirement	KLD	259	1975
11	Source of water	--	Borewell	Grampanchayath/Borewell
12	Waste water generation	KLD	280 & 54	1777
13	STP capacity	KLD	290 & 60	1780 (total)
14	Solid waste	MT/day	1.32	7.26
15	Power requirement	KW	3479	18,693.92
16	Power source	--	BESCOM	BESCOM

17	Backup Power (DG sets)	KVA	2×750 KVA, 1×500 KVA, 1X250KVA	1X2500, 3X2000, 8X750, 2X500, 1X320, 1X100 KVA
18	Car parking	PCU	762	3321
19	Roof rain water collection tank capacity	Cum	70 cum	320 cum
20	Recharge pits	Nos.	19	43
21	Project cost	Rs.	210 Crores	725 Crores

1.3 PURPOSE AND NEED OF THE PROJECT

As per the schedule of EIA Notification - 2006; the proposed project comes under item 8(b) and appraised as B1 since BUA ≥ 1 , 50,000 sqm ++.

Therefore, in order to assess the potential environmental impacts arising due to the proposed residential project, **M/s. Assetz Whitefield Homes Pvt. Ltd.** has appointed Consultants in Bengaluru to undertake Environmental Impact Assessment (EIA) study which covers a wide range of technical disciplines and incorporates baseline data for various environmental components, viz. air, noise, land, water quality & hydrology, ecology & biological parameters along with the parameters of human interest for the Environmental Impacts Assessment and to prepare Environmental Management Plan (EMP) for mitigating the adverse impacts along with improvement and alternatives including delineation of post project Environmental Monitoring Programme.

An Environmental Impact Assessment (EIA) is prepared, based on the standard terms of reference along with accorded additional terms of reference and studies carried out during the month of March 2019 to May 2019 for an environmental attributes like ambient air, water, noise, land including biological and socio-economic components of environment for an area covering 10km radius with project site as a centre and results are incorporated in preceding chapters.

1.4 BACKGROUND OF THE PROMOTERS

Assetz Property Group is one of the top real estate property developers in Bangalore, India and founded in 2006. They are the front-runner amidst multinational developers in India with over 10 million square feet under development. Assetz, headquartered in Singapore, is a multi-faceted real estate development and asset management company with four business verticals: Commercial, Residential, Warehousing and Fund Management. Assetz has established itself as one of the leading names amongst the builders and developers in Bangalore.

They have built two world-class IT tech parks in Bangalore;

1. Vrindavan Tech Village (now Embassy Tech Village) - India's first Platinum LEED certified IT SEZ, and
2. Global Technology Park. And, its residential portfolio includes ten projects in prominent locations across Bangalore.

Over the past half a decade, Assetz Property Group has built and operated a wide range of state-of-the-art projects. Assetz projects are renowned for their innovation, award winning design & build approach and adherence to the most contemporary global standards. Today Assetz Property Group involved in a series of most promising projects in the world across a variety of sectors. Their approach to service delivery is characterized by the scientific and skill-driven approach for real estate development. With several years of cross-geographical experience in professional real estate services with leading multinational corporations, they are constantly delivering developments of the highest global standards.

1.5 BRIEF DESCRIPTION OF THE PROJECT

The project is modification and expansion of Residential apartment, commercial building and Marq School at Survey Nos. 159/1, 159/2, 160/1, 167/1,167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk and Bengaluru District. Latitude and Longitude of the project site are 13°01'28.63" N and 77°45'51.32"E respectively.

1.6 OBJECTIVE S OF THE EIA STUDY

The purpose of Environmental Impact Assessment (EIA) is to assist in the decision making process and to ensure that the projects under consideration are environmentally sound and sustainable. EIA identifies the ways of improving project environmentally by preventing, minimizing, mitigating or compensating for adverse impacts.

Urban development projects including housing and office complexes do have the potential in altering environmental resources of any urban area. They cause stress on local environmental assets of the urban area and could become the potential source for limiting the growth of the city. Unplanned construction and operation of such projects usually result in impacts on various facets of Environment keeping above issues under considerations, an Environmental Impact Assessment (EIA) study is conducted which incorporates into development and planning process, a plan for environmental protection and conservation. The procedure identifies the possible positive and negative impacts on the environment likely to emanate as a result of construction and operation of a project. The EIA thus, provides for a plan which, upon implementation, will reduce or offset the negative impacts of a project resulting in a minimum level of environmental degradation. This minimization may be a result of implementation of a project modifications or environmental protection measures which simply reduces the severity or number or magnitude of negative impacts. The plan may also result in utilization of positive impacts for enhancement measures which offset negative impacts.

To measure the level of plan implementation and the degree of effectiveness of the above environmental protection provisions, the EIA provides a monitoring programme. This programme is so designed that it identifies the parameters of uncertainty and measures the related impacts.

It is necessary that there is close integration of EIA with various aspects of a project including financial and engineering aspects which ensures environmental consideration are given due weight in project selection, sitting design and operation.

Analysis of past experiences indicate that it is necessary to examine a number of problem areas in order to ensure that environmental concerns can be effectively

integrated in the development process. Similar approach has been adopted while conducting the EIA study for the proposed residential apartment.

1.7 STAGES IN THE EIA STUDY

The purpose of this section is to itemize the methodology for Environmental Impact Assessment (EIA) which has been followed for this study. Any activity relating to construction and operation is expected to cause impacts on surrounding environment. The impacts may be adverse or beneficial, short term or long term, and reversible or irreversible. In order to assess the significance of impacts, various steps that are used in conducting an EIA within core and buffer zone around the proposed project construction site are divided into the following phases:

- Identification of significant environmental parameters and assessing the existing status within the impact zone with respect to air, water, noise, land, biological, and socioeconomic components of environment.
- Study of various activities of the proposed project components to identify the area's leading to impact/change in environmental quality.
- Identification of potential impacts on various environmental components due to the activities envisaged during pre-construction, construction, and operational phases of the proposed project.
- Prediction of significant impacts on the major environmental components using qualitative / quantitative techniques.
- Preparation of environmental impact statement based on the identification, prediction and evaluation of impacts.
- Delineation of environmental management plan (EMP) outlining preventive and curative strategies for minimizing adverse impacts during pre-construction, construction and operational phases of the proposed project.
- Formulation of environment quality monitoring programme for construction and operational phases to be pursued by the project proponent.

The environmental impact assessment in India was started in the year 1976-77 when the Planning Commission asked the Department of Science and Technology to examine the

river-valley projects from environmental angle. This was subsequently extended to cover those projects, which required approval of the Public Investment Board. These were administrative decisions, and lacked the legislative support. The Government of India enacted the Environment (Protection) Act on 23rd May 1986. To achieve the objectives of the Act, one of the decisions that were taken is to make environmental impact assessment statutory. After following the legal procedure, a notification was issued on 27th January 1994 and subsequently amended on 4th May 1994, 10th April 1997, 27th January 2000, 7th July 2004 and 14th September 2006 making environmental impact assessment statutory for 32 projects /activities. This is the principal piece of legislation governing environmental impact assessment. As per the EIA Notification, 14th September 2006 published in the Gazette of India, Extraordinary, Part-II and Section-3, Sub-section (ii) Ministry of Environment and Forests, proposed project is listed as Category B1 as per Item No.8 (b) mentioned in the schedule (Covering an area = 50 ha and or built up area = 1,50,000 Sq. mtrs). So, the category B1 Projects requires preparation of EIA Report.

In order to get an idea about the existing state of the environment, various environmental attributes such as meteorology, air quality, water quality noise level, soil quality, ecology and socio-economic environment were studied / monitored. Details of Flora and fauna were identified in the study area comprising of core and buffer zone for identification of existing species and classifying them as per Wildlife (Protection) Act, 1972.

1.8 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT

EIA study includes determination of baseline conditions, assessment of the impacts on the environment due to operation of the project and making recommendations on the preventive measures to be taken, to minimize the impact on the environment to acceptable levels. A suitable post-study monitoring program will be outlined. Scope has been so evolved that the data meets all MoEF requirements for conducting Environmental Impact Assessment (EIA). Various components covered in the baseline environmental studies & methodologies adopted are given below.

EIA study shall cover the following aspects,

- Evaluation of present environmental factors through analysis of generated and collected baseline data for one complete non-monsoon season (3 months).
- Assess the probable impact on the environmental factors due to implementation of the project with respect to existing scenario.
- A thorough study of the process including provisions of pollution control, and Environmental Management Plan that includes prediction of impacts and relevant mathematical modelling.
- Assess the probable risk at the proposed plant.
- Preparation of Environmental monitoring program.
- Develop an Environmental Management Plan and on site Disaster Management Plan for the proposed project to mitigate the negative significant impacts that would arise from the proposed project and controlling the pollution levels
- Environmental Monitoring Plan is suggested for monitoring the pollution loads at various facilities in the premises and to ensure compliance with the statutory requirements.
- The baseline data has been collected for the following environmental components, during March to May 2019
 - ♣ Air quality
 - ♣ Meteorology
 - ♣ Noise environment
 - ♣ Water use & quality
 - ♣ Soil quality
 - ♣ Land use, crop pattern, Agricultural practices
 - ♣ Demographic aspects
 - ♣ Ecology & Biodiversity

An Environmental Impact Assessment and Environment Management Plan comprising an overall assessment of the impact due to project activity over baseline condition of the existing environment and a mitigating action plan to counter the adverse impact as defined. An environmental monitoring program is also prepared to provide scientific support to future actions of environmental protection.

1.9 STRUCTURE OF EIA REPORT

The EIA report has been structured covering various aspects like project description, baseline conditions, environmental impacts, mitigation measures, environmental management plan as directed by SEIAA vide letter of awarded ToR. Copy of ToR and its compliance is provided at the beginning of this report. Further, the present EIA report has been prepared chapter-wise in accordance with generic structure suggested by MoEF in EIA notification 2006.

TABLE-1.3 STRUCTURE OF ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Sr. No.	EIA structure	Contents
Chapter - 1	Introduction	<ul style="list-style-type: none"> ➤ Identification of project and project proponent ➤ Need, objectives & purposes of EIA study ➤ EIA structure & Regulatory frame work
Chapter - 2	Project Description	<ul style="list-style-type: none"> ➤ Description & Justification of the project ➤ Project location & salient features of the project site ➤ Maps showing project location, plant layout & Description of facilities, infrastructure need, resource requirement, pollution potentials & management
Chapter - 3	Description of the Environment	<ul style="list-style-type: none"> ➤ Approach & methodology of baseline study ➤ Establishment of baseline status for valued environmental parameters as identified in scope ➤ Maps of study area showing sampling & monitoring locations and land use pattern
Chapter - 4	Anticipated Impacts and Mitigation Measures	<ul style="list-style-type: none"> ➤ Identification & prediction of environmental impacts during construction as well as operation phases of the proposed project ➤ Evaluation of impacts on air environment using mathematical model ➤ Mitigation measures for minimizing and/or avoiding adverse impacts during construction as well as operation phase
Chapter - 5	Analysis of site alternatives	<ul style="list-style-type: none"> ➤ Alternative technologies ➤ Justification of site selection

Chapter - 6	Environmental Monitoring Program	Technical aspects of monitoring the effectiveness of mitigation measures including measurement methodologies, frequency, location, data analysis, reporting schedules
Chapter - 7	Additional Studies	Environmental risk assessment and disaster management plan
Chapter - 8	Project Benefits	<ul style="list-style-type: none"> ➤ Employment opportunity and corporate social responsibility CSR ➤ Socio-economic development and improvements in the physical & social infrastructure ➤ Employment & other tangible benefits
Chapter - 9	Environmental Management Plan	<ul style="list-style-type: none"> ➤ Environmental Management Plan for various project activities ➤ Illustration of greenbelt development plan, rain water harvesting system ➤ Budgetary allocation for environment protection
Chapter - 10	Summary and Conclusion	<ul style="list-style-type: none"> ➤ Salient features of the project covering, project description, location, mitigation measures, costing, etc., ➤ Overall conclusion for the proposed project
Chapter - 11	Disclosure of Consultant Engaged	Details of the EIA consultant, laboratory engaged
Chapter - 12	Corporate Environmental responsibility	Details of initiative planned under Corporate Environmental responsibility.

1.10 APPLICABLE ENVIRONMENTAL REGULATIONS AND STANDARDS

With respect to prevention and control of environmental pollution, the proposed project is governed by the following Acts and Rules.

- ☞ Water (Prevention and Control of Pollution) Act, 1974 as amended in 1978 and 1988;
- ☞ Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987;
- ☞ Environment (Protection) Act, 1986 amended 1991 and Environment (Protection) Rules, 1986 and amendments thereafter;
- ☞ Hazardous Waste (Management & Handling) Rules, 1989, as amended in 2000, 2003.

- ☞ The Noise Pollution (Regulation and Control) Rules, 2000 and as amended in 2002, 2006 and 2010.
 - ☞ EIA notification dated 07.07.2004 as amended in 14.09.2006 and 01.12.2009 and amended as on 9th December 2016.
- Stating that for any project or activity specified in category 'B' in the item 8 of schedule i.e. building/construction projects/area development projects and townships crossing the built up area of more than 1,50,000 Sqmt TOR should be conveyed to SEIAA, based on the approved TOR, EIA studies should be conducted which also includes an Environmental Management Plan for the mitigation of these impacts.

CHAPTER - 2

PROJECT DESCRIPTION

This chapter encompasses the details of the proposed project, material and resource requirement during construction and operation phases, utilities, sources of waste generation, estimation of pollution loads and associated infrastructures etc.

2.1 TYPE OF THE PROJECT

M/s. Assetz Whitefield Homes Pvt. Ltd proposed for modification and expansion of Residential Apartment, Commercial building and Marq School in the name of “ASSETZ MARQ” at Survey Nos. 159/1, 159/2, 160/1, 167/1,167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District.

2.2 NEED FOR THE PROJECT

Bengaluru is a major city of India and a great place to live. As Bengaluru is teeming with cash-rich young professionals with a considerable amount of disposable incomes; the retail sector has smelt a great opportunity and has increased the demand for residential property even more. Keeping in mind this rise in demand, property builders are making various types of accommodations including apartments, villas and townships to cater to the needs of these clients.

- The project will provide dwelling spaces of about 1927 units, which will meet the demand of the region for growing population in Bengaluru.
- Socio-economic status of the site and site surrounding region will improve.
- Around 300 employees during construction phase and around 150 employees during operational phase of the project will get employment opportunity
- Aesthetic view of the surrounding area enhances.

2.3 CRITERIA FOR SITE SELECTION

The project is in initial stage. However, the following criteria were followed during site selection of the proposed project;

- The land proposed for the development is free from litigations.
- The proposed area designated as residential zone as per CDP map.
- Speedy developing area.
- Sub-soil strata suitable for laying foundation for buildings.

2.4 PROJECT SITE

The proposed residential development project is located at Survey Nos. 159/1, 159/2, 160/1, 167/1, 167/2, 167/3, 167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk and Bengaluru District. The environmental setting of the project site, location map and photography of the project site are as follows;

TABLE-2.1: ENVIRONMENTAL SETTING OF THE SITE

SL No	Particulars	Details
1.	Present land use	Residential zone
2.	Survey of India top sheet No.	57 H/9, 57 H/13, 57G/12, 57 G/16
3.	Site topography	Project site sloping towards South east direction
4.	Nearest Highway	SH 35 Whitefield Hoskote Main road- Adjacent to project site (W) NH 4 Old Madras road 2.4 km (NW)
5.	Nearest Railway station	White field railway station 2.98 km (N)
6.	Nearest Airport	Kempegowda International Airport 18.55 Km (N)
7.	Nearest Lakes	Chikkbanahalli lake – 0.6 km (W) Hoskote lake 4.2 km (N) Yellamma lake 2.9 km (W) Varthur lake 4.6 Km (S)
8.	Nearest fire station	Hoskote fire station – 5.5km (N)
9.	Nearest Town/City	Bengaluru 19 km (SW)
10.	Nearest Villages	Kannamangala 0.5 Km(E)
11.	Seismic Zone	Seismic Zone – II as per IS-1893(Part-1) 2002
12.	Interstate Boundary	None within 10 Km

Note: All distances mentioned are aerial distance

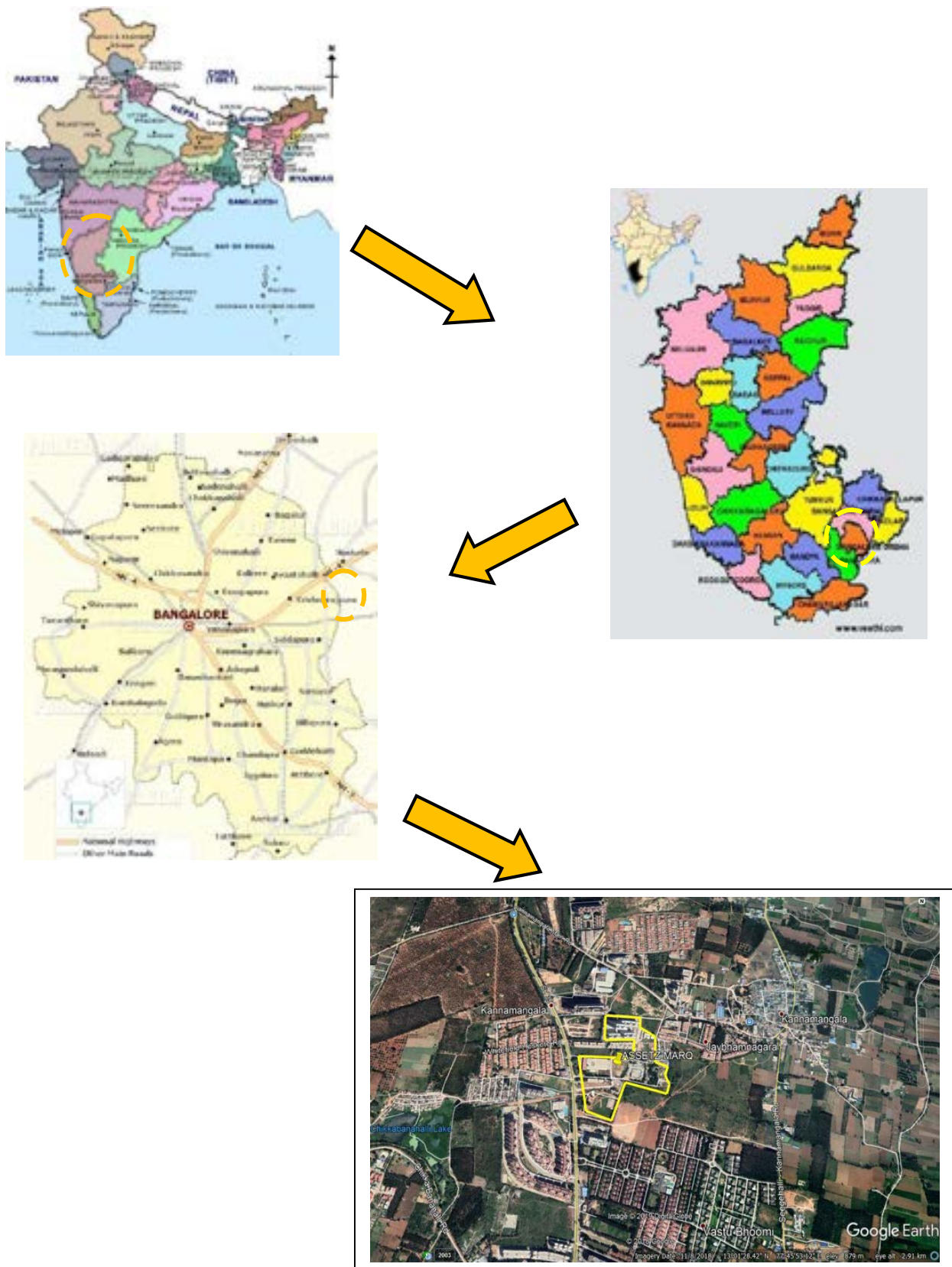


FIGURE-2.1 VICINITY OF THE PROJECT SITE



FIGURE-2.2 AERIAL VIEW OF THE PROJECT SITE



FIGURE-2.3 PROJECT SITE SHOWING ON CDP MAP

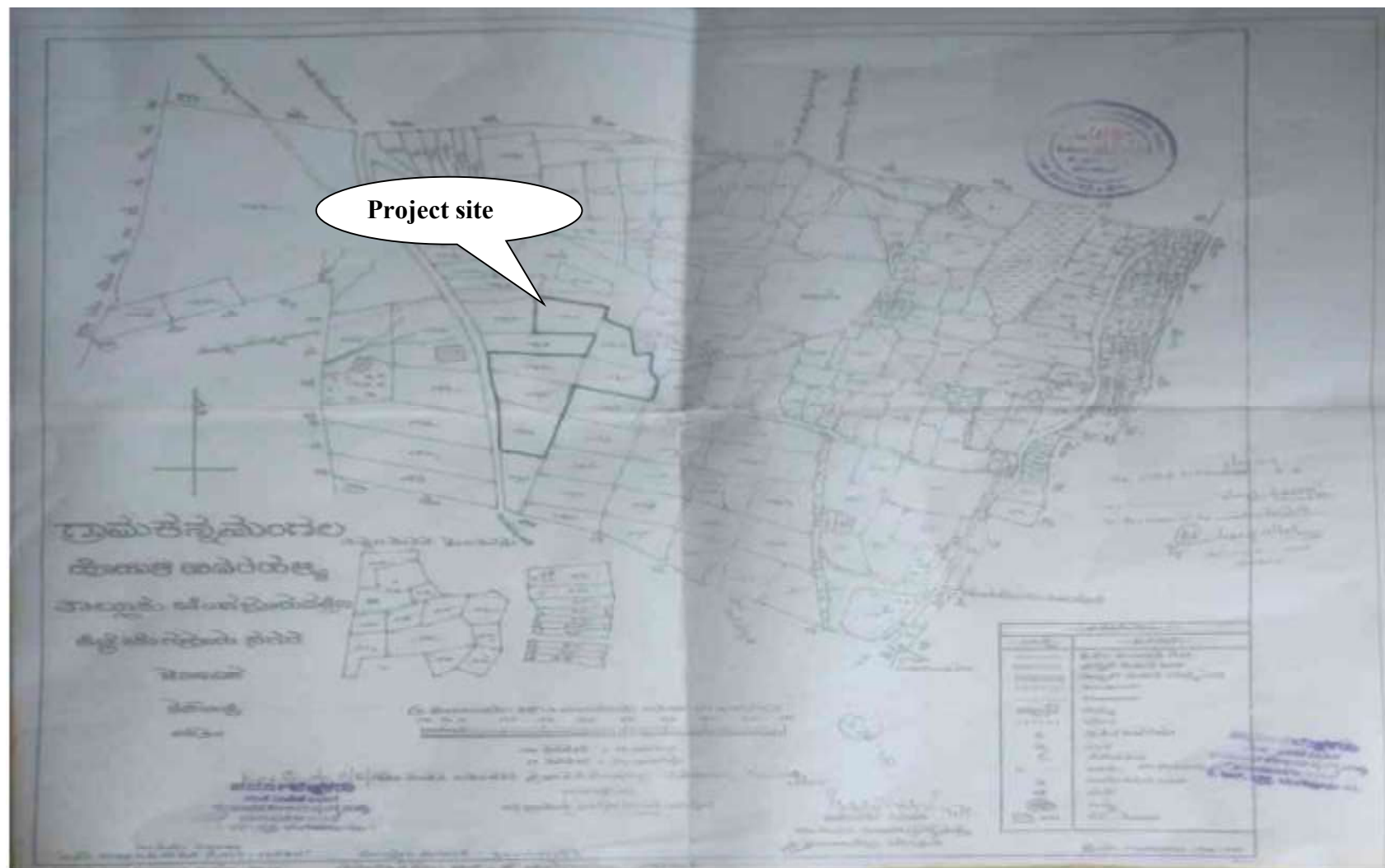


FIGURE-2.4 PROJECT SITE SHOWING ON VILLAGE MAP

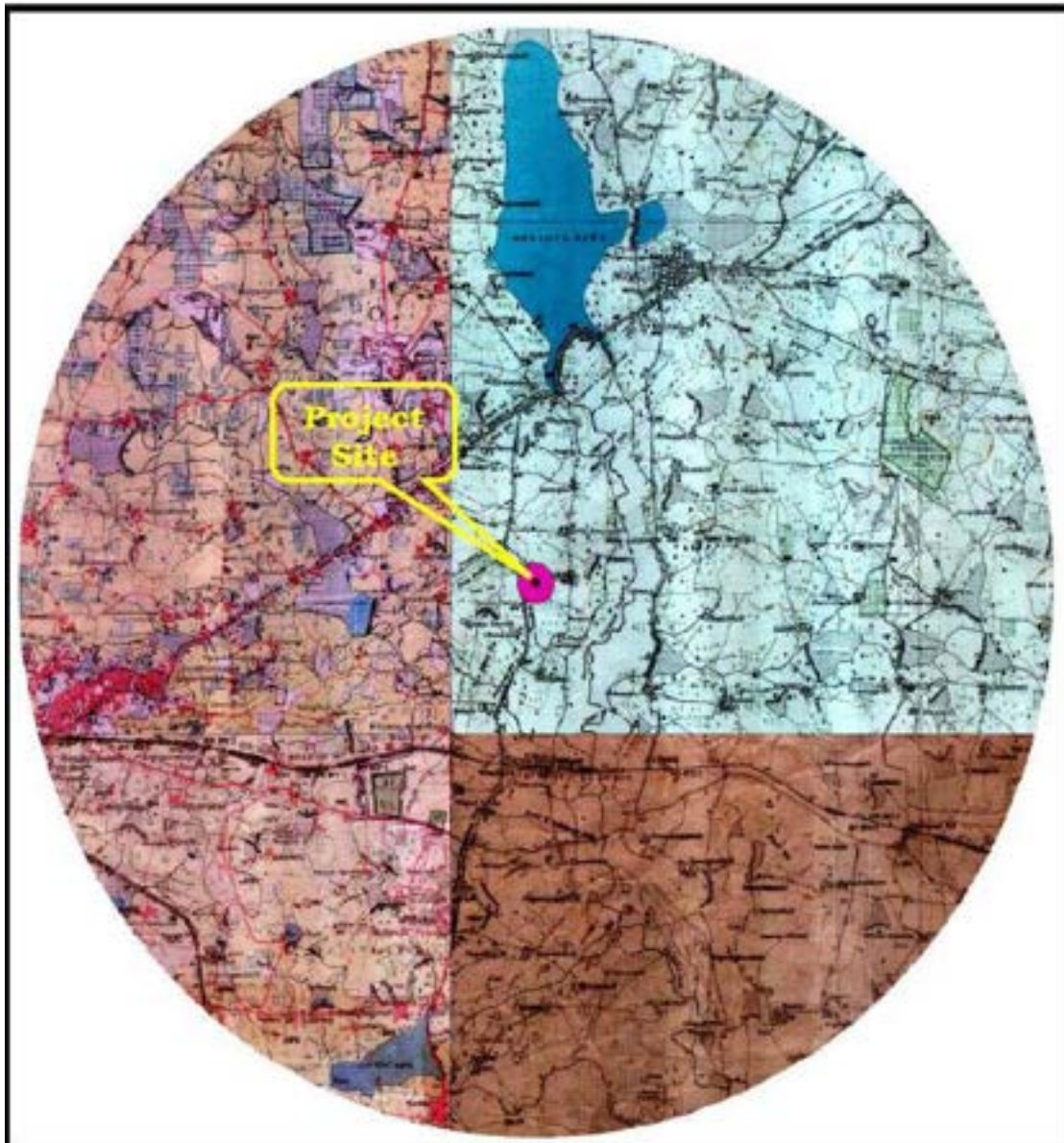
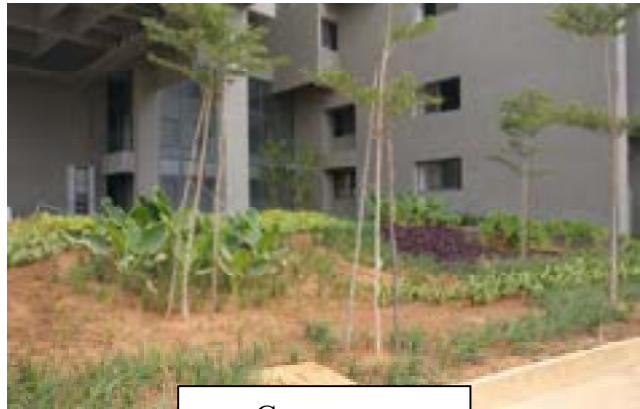


FIGURE-2.5 TOPOMAP SHOWING 10 KM RADIUS AROUND SITE AREA.

TOPO SHEET NO.: 57 H/9, 57 H/13, 57G/12, 57 G/16



Building 1- Existing



Green area



Building 2 - Under modification

FIGURE-2.6 PHOTOGRAPHS OF THE PROJECT SITE

TABLE-2.2: COMPARATIVE STATEMENT OF THE EXISTING AND PROPOSED PROJECT

Sl. No	Features	Unit	EC obtained	Present Proposal
1	Subject number	File No.	SEIAA 146 CON 2017	SEIAA 30 CON 2019
2	Project Name	--	Assetz Marq	Assetz Marq
3	Developer	--	M/s Assetz Whitefield Homes Private Limited	M/s Assetz Whitefield Homes Private Limited
4	Type of Development	--	Modification and expansion of Residential Apartment	Modification and expansion of Residential Apartment, commercial building and Marq school
5	Plot Area	Sqm	1,14,526.04	1,14,526.04
6	Built up Area	Sqm	1,28,605.46	4,38,971.66
7	Landscape Area	Sqm	35,691 (33.05%)	38339.2 Sqm (35.16%)
8	Number of units	Nos.	547	1927
9	Water requirement	KLD	259(fresh water)	1975
11	Source of water	--	Borewell	Grampanchayath/Borewell
12	Waste water generation	KLD	280 & 54	1777
13	STP capacity	KLD	290 & 60	290 KLD, 510 KLD, 570 KLD, 50 KLD, 360 KLD (total 1780 KLD)
14	Solid waste	MT/day	1.32	7.26
15	Power requirement	KW	3479	18,693
16	Power source	--	BESCOM	BESCOM
17	Backup Power (DG sets)	KVA	2×750 KVA, 1×500 KVA, 1X250KVA	1X2500KVA, 3X2000KVA, 8X750KVA, 2X500KVA, 1X320KVA, 1X100KVA
18	Car parking	PCU	Required :762	Required: 3321 Provided: 3329
19	Roof rain water collection tank capacity	Cum	70 cum	320 cum
20	Recharge pits	Nos.	19	43
21	Project cost	Rs.	210 Crores	725 Crores

2.5 DESCRIPTION OF THE PROJECT

In the total site area of 1,14,526.04 Sqm (28 A 12 G) Assetz proposed for modification and expansion of Residential area on an plot area of 90 750.75 Sqm, Commercial area on an plot area of 21 306.70 Sqm and Marq school on an plot area of 4 540.0 Sqm. The Kharb land involved is about 1416.4 Sqm. The site is abutting to 24.7 m existing wide road towards west side. The maximum height of the building considered is 91.05 m.

Layout of the project components have been optimized within the site premises, considering the space requirement for all the services, buildings, structures, raw water storage tank, fire water storage tank, wastewater treatment plants, solid waste management yard etc. the detailed land use breakup and building configuration of the project is mentioned below. The site plan with building area statement enclosed as ANNEXURE- 1 and obtained height clearance certificate from Airport authority of India enclosed as ANNEXURE- 2.

TABLE-2.3 PROJECT DETAILS

Project Planning	Details
Name of the project	<i>Assetz Marq</i>
Type of the project	Modification and expansion of Residential Apartment, commercial building and Marq school
Location of the project	Survey Nos. 159/1, 159/2, 160/1, 167/1, 167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru east taluk,, Bengaluru District.
Total Site area	1,14,526.04 Sqm (28 A 12 G)
Total Built Up area	4,38,971.66 Sqm
Height of Building	91.05 m
No. of units	1927
Set back provided	18 m
Cost of the project	725.0 Cr
Width of the approach road	24.7 m (W)
DG set during construction	100 KVA
DG sets during operation	1X2500, 3X2000, 8X750, 2X500, 1X320, 1X100 KVA
Roof rain water collection capacity	320 cum

Recharge pits	43 nos.
Latitude	13° 01' 28.63" N
Longitude	77° 45' 51.32" E
Car Parking required	3321
Car Parking provided	3329

TABLE 2.4 TOTAL LAND ALLOCATION DETAILS

	DESCRIPTION	AREA (ACRES & GUNTAS)	AREA (SQM)	Percentage %
A	TOTAL SITE AREA (AS PER DOCUMENT)	28A 12G	114526.04	
B	SITE AREA AS PER GROUND (28A 1.6G)		113473.85	
C	DIGGERENCE IN AREA		1052.19	0.96
D	SITE AREA ALLOCATED FOR RESIDENTIAL	22A 23G	91357.38	
E	KHARAB AREA (RESIDENTIAL)	6G	607.03	
F	KHARAB AREA FOR CALCULATION	22A 17G	90750.35	
G	CIVIC AMENITIES (5% OF RESIDENTIAL AREA)		4537.52	
H	CIVIC AMENITIES PROVIDED		4540	
I	SITE AREA ALLOCATED FOR COMMERCIAL DEVELOPMENT	5A 18.6G	22116.07	
J	KHARAB AREA (COMMERCIAL)	8G	809.37	
K	NET LAND AREA FOR GREEN AREA CALCULATION(COMMERCIAL)	5A 10.6G	21306.7	
L	AREA RESERVED FOR ROAD WIDENING		1959	
M	TOTAL LAND AREA FOR GREEN AREA CALCULATION (F+K-C-L)		109045.86	
N	LANDSCAPE ON GROUND		34218.06	31.38
O	LANDSCAPE ON PODIUM		4121.14	3.78
P	SURFACE PARKING		3886.39	3.56
Q	GROUND COVERAGE		35354.95	32.42
R	SERVICES		3162.55	2.90
S	DRIVEWAYS & PATHWAYS		27250.58	24.99
	TOTAL		109045.86	100.00

TABLE 2.5 KHARAB LAND DETAILS

Sy. Nos.	Extent in acres and G	Kharab	Total extent
159/1,	01-38	--	01-38
159/2,	03-17	--	03-17
160/1	01-38	00-01	01-37
167/1	01-17	00-02	01-15
167/2	01-16	00-02	01-14
167/3	01-12	00-02	01-10
167/4	01-16	00-01	01-15
168	05-10	00-02	05-08
169/1	02-21	--	02-21
169/2	00-28	--	00-28
169/3	00-28	--	00-28
169/4	01-02	--	01-02
171	05-09	--	05-09
Total	28-12 G	14 G	27-38

TABLE-2.6 BUILDING -WISE DISTRIBUTION OF WINGS

Description	Units	Building configuration	Occu pants	Height in m	Total BUA, Sqm
Existing building 1					
Wing-1	469	2B+G+13F	2345	43.60	84084.70
Wing-2		2B+G+9F		31.80	
Wing-3		2B+G+26F		81.95	
Wing 4		2B+G+8F		28.85	
Club house		G+2F	234	10.80	
Proposed building 2					
Basement, GF , 1st floor for wings 5,6,7 and 8					62771.46
Wing 5	345	B+G+7F(EC Obtained) B+G+28F (Proposed)	1980	89.05	45307.82
Club house		G+1F	198	8.9	3014.58
Proposed building 3					
Wing-6	345	B+GF+28F	1980	89.05	45437.55
Clubhouse		B+GF	198	09.70	-
Proposed building 4					
Wing-7	384	B+GF+29F	2216	91.05	51742.49
Wing-8	384	B+GF+29F	2216	91.05	52002.38
Club house (7&8)		B+GF	443	09.70	-

Commercial building (proposed)	--	3B+G+15F		58.00	90333.48
School (proposed)	--	GF+3F		14.95	4277.20

TABLE 2.7 PARKING REQUIREMENT CALCULATIONS

Description	Existing building 1		Proposed building 2,3 & 4		Commercial development	School building
	Units	Car parks	Units	Car parks	57523/50 sqm	40444/150 Sqm
2 nos/4BHK	0	0	28	56	1150	27
1 no/3BHK	211	211	1238	1238		
1 no/2BHK	258	258	0	0		
1 no/2EWS	0	0	192	96		
Total		469		1390		
Visitors (10%)		47		139		
Club house		39		60		
Grand total		555		1589		
Total number of car parking Required						3321

TABLE-2.8 PARKING PROVIDED DETAILS

	Existing building 1	Proposed building 2,3 & 4	Commercial development	School building
Basement	542	700	1150	0
Ground floor	0	360	0	0
First floor	0	330	0	0
Surface parking	16	204	0	27
Total	558	1594	1150	27
Total number of car parking provided				3329

2.6 COST OF THE PROJECT:

The total investment cost involved in setting up of the proposed project except building 1 (Existing building) is estimated to be about Rs. 515 Crores. Details with expenditure on structural works, finishing work including services such as electrification, utilities along with miscellaneous and contingencies cost breakup given in below table.

TABLE-2.9 COST BREAKUP OF THE PROJECT

Sl. No.	Budget description	Budgeted cost in Rs.
	STRUCTURAL WORKS	
1	Excavation, Filling ,Soling & Anti-termite Treatment	5,05,39,899
2	RCC & PCC (Including RMC) + Formwork	56,55,41,468
3	Formwork	85,10,91,896
4	Reinforcement Steel - Labour Only	23,70,32,125
5	Masonry	5,81,20,884
6	Internal & External Plaster	5,30,66,894
7	Waterproofing	12,73,60,545
8	Cost of Cement	35,37,79,292
9	Cost of Reinforcement Steel	53,31,95,933
	Total:	2,82,97,28,935
	FINISHES	
10	Flooring works	37,39,95,251
11	Wood Work (Material + Labour)	16,52,65,469
12	Painting & Polishing (Material + Labour)	22,84,40,343
13	Aluminium / UPVC Works / Structural Glazing Works (Material + Labour)	12,43,28,151
14	Miscellaneous works (Staircase railing, counter slabs, False Ceiling, Cornice and Fire Doors)(Material + Labour)	12,07,90,358
15	Client Supplied Materials (other than Cement & steel)	-
	Total:	1,01,28,19,572
	SERVICES	
16	Electrical Works (Material + Labour)	40,07,81,398
17	Fire Fighting Works	17,38,57,252
18	Plumbing Works & WTP Works (Material + Labour)	23,24,83,535
19	Lifts	9,45,09,611
	Total:	90,16,31,795
	MISCELLANEOUS WORKS	
20	Compound Wall & Security Cabin	4,80,12,904
21	Landscaping Works, Roads & Swimming Pool (Material + Labour)	14,60,60,308
22	Borewell Drilling (Material + Labour)	40,00,000
23	Signages (Material + Labour)	1,56,67,369
24	Soil Testing / Survey Works	12,00,000
25	Temporary Power Supply	53,00,000
	Total:	22,02,40,580
	CONSULTANCY CHARGES	
26	Architectural / Structural / Services	8,85,24,803
	Total:	8,85,24,803

	CONTINGENCY	
27	Variation in Quantities & Contingencies @ 2 %	10,10,79,798
	Total:	10,10,79,798
	Grand Total:	5,15,40,25,483

2.7 RESOURCE REQUIREMENTS DURING CONSTRUCTION PHASE

2.7.1 CONSTRUCTION MATERIAL REQUIREMENTS

Construction materials will be procured from local vendors and transported through trucks to the construction site. All procured materials shall be stored properly to ensure no impact releases on the environment. And for easy vehicular movements separate entry and exit gates will be provided which in turn reduces the traffic congestion. Approximate material consumption details with time frame for completions given in below table.

TABLE 2.10 MATERIAL CONSUMPTION DETAILS

Material description	Units	Quantity of Building 2 & 3	Quantity of Building 4	Commercial & school building	Total Quantity
RCC/RMC	Cum	64007	75000	50529	189536
Reinforcement Steel	MT	6500	7200	4980	18680
Glass - UPVC windows / doors	Sqm	13270	14750	10185	38205
Painting - internal & External	Kgs	391300	434500	300179	1125979
Timber - Wooden Doors for the apartments	Nos	4386	5024	3420	12830

TABLE 2.11 TIME FRAMES FOR COMPLETION OF PROJECT

Months	Apr to Jul 19	Aug to Dec 19	Jan 20 to Dec 20	Jan 21 to Apr 21
Site clearance and excavation process	6 months			
Footings to Basement up to podium		8 months		
Structure development			16 months	
MEP works				6 months
Total			3 years	

2.7.2 WATER REQUIREMENTS:

Water is one of the main requirements for construction purpose and for domestic usage of labours. Total water requirement will be around 59 KLD. The water for construction will be tertiary treated water which will be met by outside water supply. And water for domestic use will be sourced from outside tanker suppliers. It has been estimated that around 300 workers will be employed for construction activities and amount of water is to be 14 KLD and wastewater would be 12.6 KLD which will be treated in mobile STPs. The water for construction activities is estimated around 45 KLD out of which 90% of the water gets consumed or goes evaporation. Hence, there will be no wastewater generation from curing or mixing processes. Below table shows the No. of workers employed and water requirement for domestic and construction usage and its source to procure.

TABLE-2.12 WATER REQUIREMENT DURING CONSTRUCTION PURPOSE

No. of labours	300
Apprx. Water Consumption (for Construction)	45 KLD
Water Consumption (Domestic)	14 KLD
Total water requirement during construction phase	59 KLD
Discharge of domestic wastewater	Mobile STP
Source of water for Construction	Treated water
Source of water for Domestic	Outside water supplier

2.7.3 ENERGY REQUIREMENTS:

Power requirement for the project sourced from 1 no. of DG of capacity 100 KVA.

2.7.4 MANPOWER REQUIREMENT

Around 300 labours are required on a daily basis for construction activity. People will be hired locally to provide job opportunities. The basic facilities for workers such as drinking water and mobile STPs shall be made available.

2.8 RESOURCE REQUIREMENTS DURING OPERATION PHASE**2.8.1 WATER REQUIREMENT**

The total water requirement for the project is estimated around 1975 KLD by considering 135 litres per capita consumption per day. Water will be sourced from BWSSB and from outside tankers during crisis. And it has been estimated that wastewater generation would be around 1777 KLD (90% of water consumption) which will be treated in sewage treatment plant of capacities 290 KLD, 510 KLD, 570 KLD, 50 KLD and 360 KLD in the premise using SBR technology. The below water balance chart shows treated water utilization for flushing about 698 KLD, for landscaping about 185 KLD, for HVAC 160 KLD and 643 KLD is excess water. The water balance chart for monsoon and non-monsoon season is given in below figures. The treatment mechanism along with design details of STP is enclosed as ANNEXURE 3. The plan of sewage treatment plant enclosed as ANNEXURE 4

FIGURE 2.7 WATER BALANCE CHART MONSOON SEASON

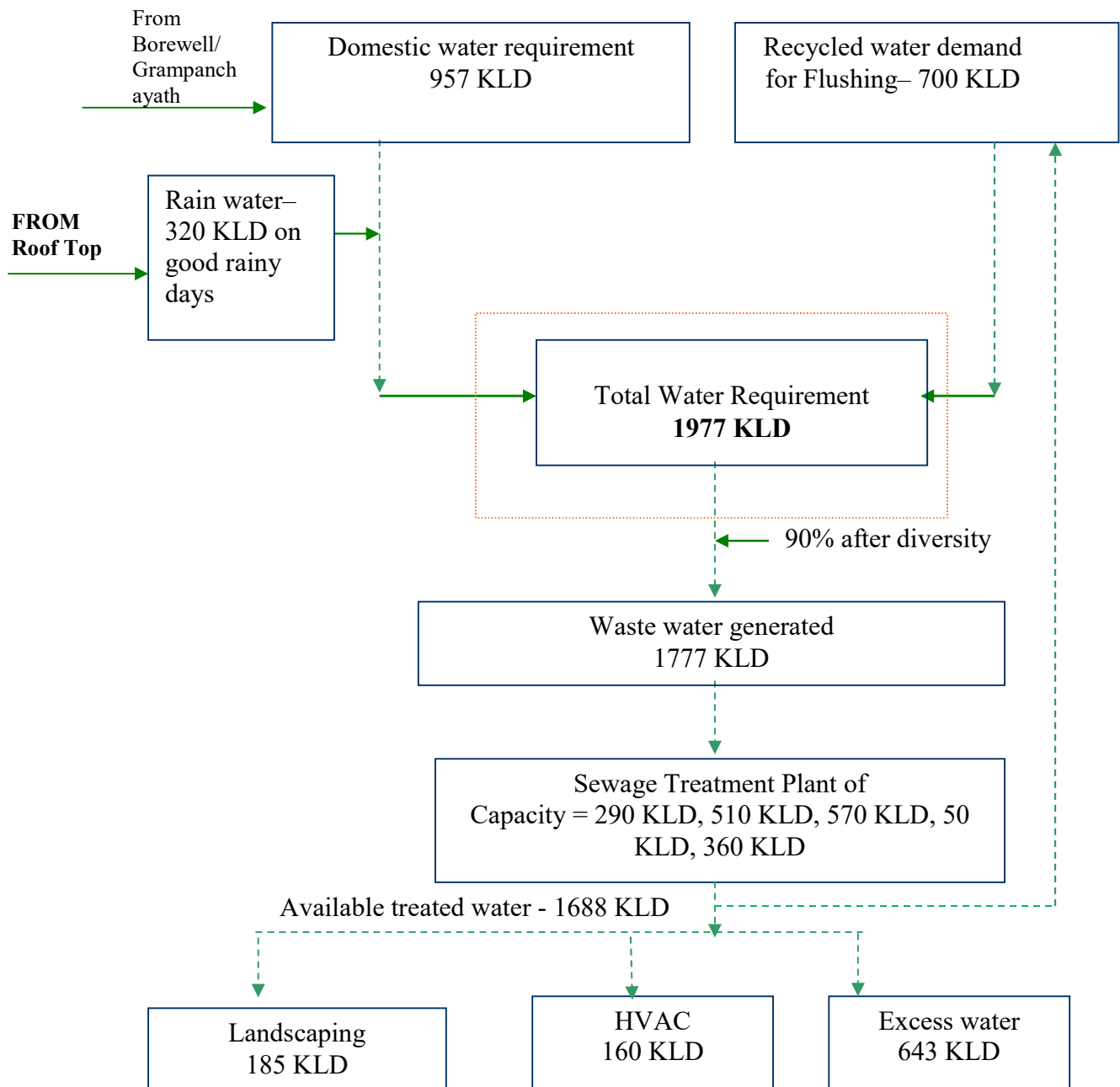
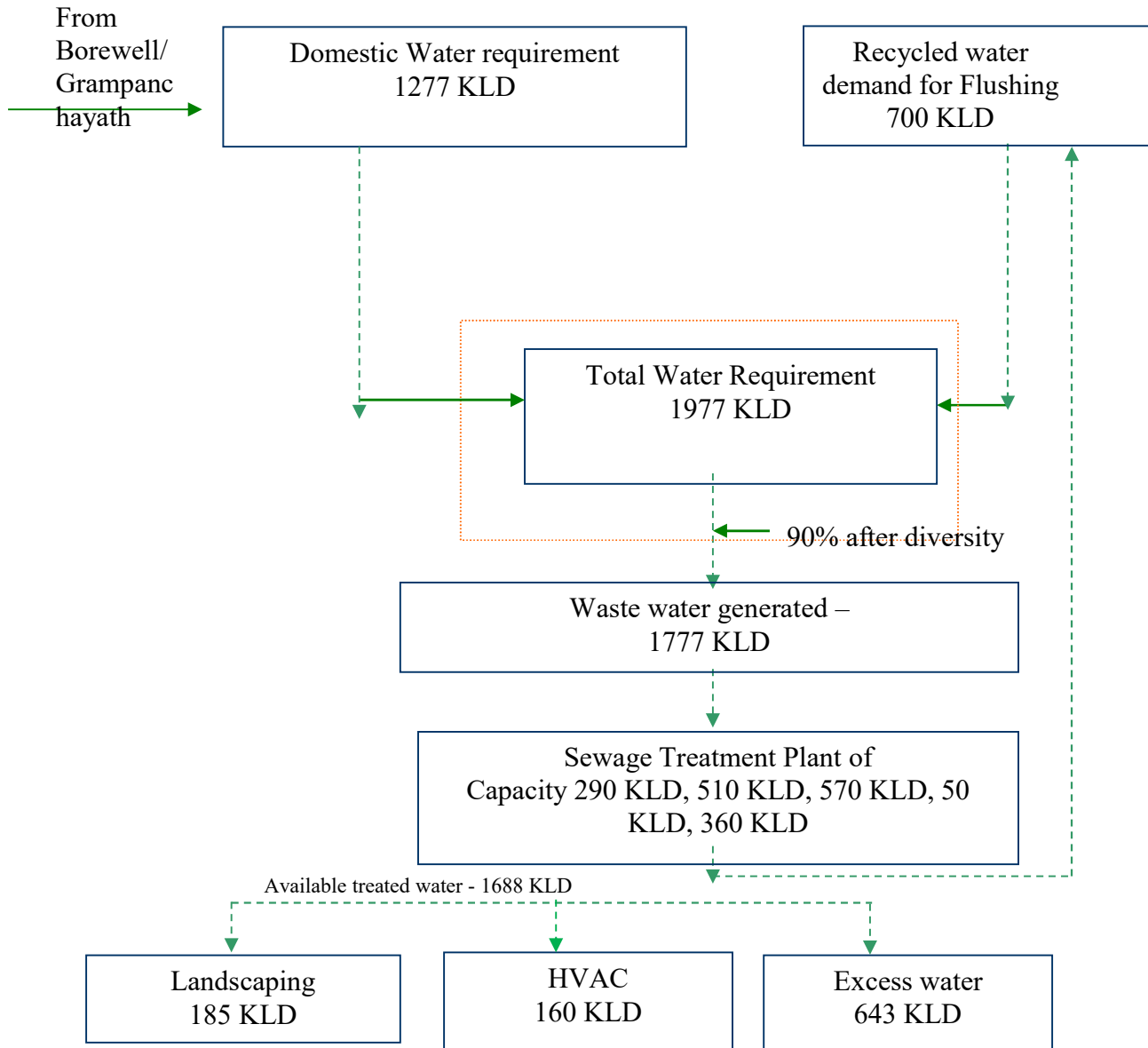


FIGURE 2.8 WATER BALANCE CHART- NON MONSOON SEASON



2.8.2 RAIN WATER HARVESTING

As the project location is blessed with fairly good rainfall, it is planned to collect the storm water at different gradients of the location. There will be rainfall runoff from building roof-tops, roads, pavements and greenbelt area. Necessary provision has been made to collect the quantity of rainfall runoff during the most rainy day of season. Necessary rain harvesting pit / recharge pit at regular intervals have been envisaged. Internal garland drain with RCC precast perforated cover and a RCC precast recharge pit will be provided around the periphery of property.

As the growth of Bengaluru city is far ahead of the rate at which the water supply system is being upgraded, it becomes necessary to think of alternative source of water for the daily needs for secondary purposes like washing, gardening etc. In these lines, rain water harvesting is gaining importance and has been a part of building by-laws. The facilities to be established for rainwater harvesting include carriage (piping) system, pre-treatment unit (filtration) and a storage tank. To supplement the ever growing shortage of protected, pure and safe water supply for human consumption rain water is an ideal source which can be conserved and used in a useful manner by the people. Rain water harvesting technique has been adopted as per NBC Part-9, 5.5.12.1

The rational method is to be preferred to calculate the Storm water run-off.

Rational formula for calculating runoff = $Q = (C I A) / 360$

Q = Runoff in m³/sec

I = Intensity of rainfall in mm/ hr.

A = Drainage area in hectares.

C = Co-efficient of run off as below

Run-off co-efficient for various types of surfaces

Open grounds, unpaved street	0.30
Parks, lawns, gardens	0.20 to 0.50
Macadam roads, pavements	0.70
Asphalt pavements	0.85 to 0.70
Water tight roof surface	0.95

Total Run-off: ROOF TOP

Q = Runoff	0.166 m ³ /sec
I = Intensity of rainfall	30 mm/hr
A = Drainage area in hectares	2.09 Ha
C = Co-efficient of run off	0.95

Data assumed:

Considering 30 min of rainfall

This run-off is being diverted to roof top rain water collection sump, which shall be used for domestic purposes after the necessary treatment.

Provided Roof top rain collection sump of capacity of all blocks 320 cum

It is essential to catch the runoff and use it for augmentation of ground water reservoir by modifying the natural movement of surface water by recharging it by artificial means for example, construction of recharge structures. Rain water recharging technique has been adopted as per NBC Part-9, 5.5.12.2

Total Run-off: PODIUM AREA / HARDSCAPE & DRIVEWAY

Q = Runoff	0.321 m ³ /sec
I = Intensity of rainfall	30 mm/hr
A = Drainage area in hectares.	5.51 Ha
C = Co-efficient of run off	0.70

Data assumed:

Considering 15 min of rainfall

Volume of rainwater available for recharging is 289 Cum

Total Run-off : GARDEN AREA

Q = Runoff	0.078 m ³ /sec
I = Intensity of rainfall	30 mm/hr
A = Drainage area in hectares.	3.74 Ha
C = Co-efficient of run off	0.25

Data assumed:

Considering 15 min of rainfall

Volume of rainwater available for recharging is 70 Cum

Therefore the total Run-off from the site is 360 Cum

RECHARGE PIT CALCULATION AND SCHEMATIC DIAGRAM

Data assumed:

Infiltration rate considered 10 cms/hr. i.e., 0.1 m/hr

Recharge pit diameter considered 1.2 m

Area of bottom surface of Recharge pit 1.13112 Sqm

Area of wetted perimeter of Recharge pit (3m depth considered) 11.3112 Sqm

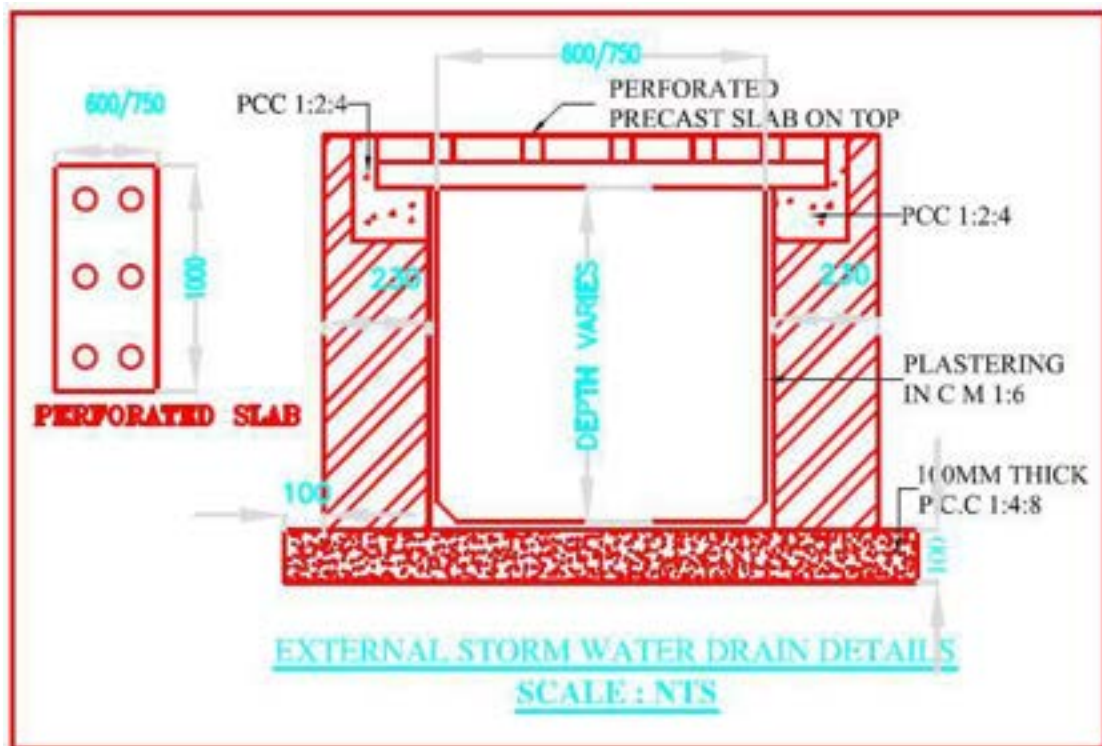
Total area of per Recharge pit 12.44232 Sqm

Total water permeability/pit/hour 1.244232 Cum/hr

Total number of Recharge pits provided 43 Nos

Amount of water percolating through the Recharge pits 54 Cum

Excess water is find its way to external public drains/nala in worst rainfall 306 Cum



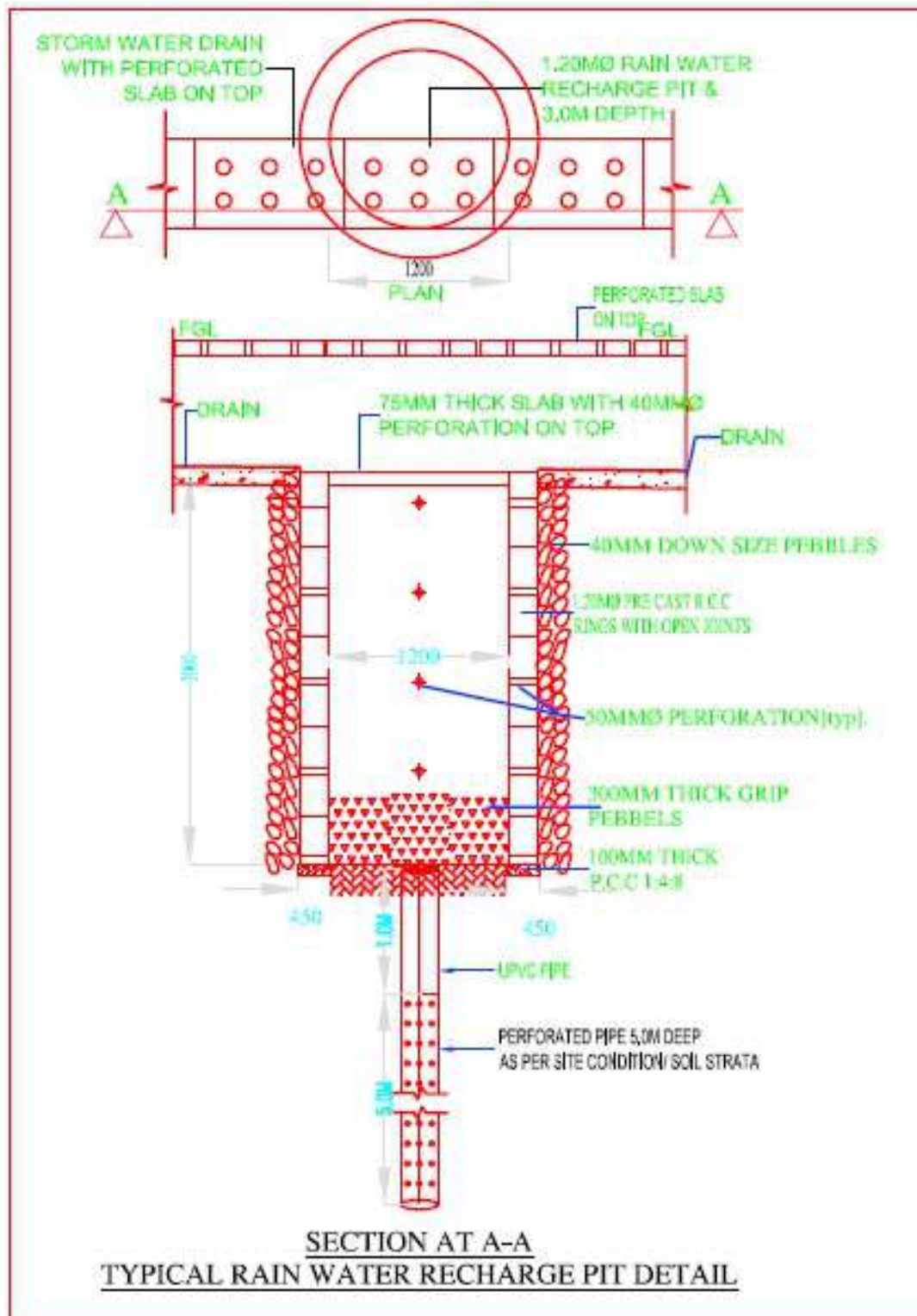


FIGURE 2.9 DESIGN OF RAIN WATER RECHARGE PITS

2.8.3 POWER REQUIREMENT

The power requirement during operation phase is estimated about 18693.92 KW which will be met by supply from BESCO, High speed diesel generators will be proposed as a source of backup power supply as shown in below.

Sl. No	Description	Capacity
1.	Power requirement	18693.92 kW
2.	DG Sets	1X2500, 3X2000, 8X750, 2X500, 1X320, 1X100 KVA
3.	Transformer ratings	1X2500, 8X1000, 6X500, 1X250, 1X160

2.9 WASTE GENERATION DURING CONSTRUCTION PHASE

2.9.1 SOLID WASTE GENERATION:

Construction waste will be generated during construction works and it mainly comprises of earth, stones, bricks, inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics etc & small quantity of domestic solid waste. The retrievable items such as bricks, wood, metals are recycled. Wherein the domestic waste will be segregated and will not be allowed to mix with the construction waste. The construction earth and other wastes will be reused for backfilling and road formation within the site premises. Apprx. earth excavation quantity estimated and given in below table. There will not be any labour colonies as labours hired locally residents. Hence there will not be much of organic or inorganic waste generation. However, generated waste will be collected and disposed off to local body for further processing.

TABLE 2.13 CONSTRUCTION WASTE ESTIMATION

Total excavated earth	1,25,730 Cum	100 %
Backfilling between foundations	44,005 Cum	35 %
Excavated earth preserved for landscaping	31,433 Cum	25 %
For paved area formation	25,146 Cum	20 %
Internal Road Formation	25,146 Cum	20 %

TABLE-2.14 SOLID WASTE GENERATION DURING CONSTRUCTION

No. of Labourers	300
Solid waste generation	$300 \times 0.1 = 30 \text{ kg/day}$
Quantity of organic waste generated	18 kg/day (60%)
Quantity of inorganic waste generated	12 kg/day (40%)
Disposal	Solid waste will be collected manually and handed over to local body for further processing

2.9.2 HAZARDOUS WASTE GENERATION

Hazardous waste mainly of used oil or coolant coil from operation and maintenance of DG sets. The generated oil will be collected and stored in leak proof containers and will be taken back by vendors.

2.10 WASTE GENERATION DURING OPERATION PHASE

2.10.1 SOLID WASTE GENERATION:

The solid wastes generated during operation phase can be categorized under four groups:

- ◆ Wet Garbage like Food waste, Lawn mowing wastes etc.
- ◆ Dry Garbage such as Paper, Plastic, Bottles, etc.
- ◆ Sludge from Sewage Treatment Plant (STP).
- ◆ Hazardous waste like CDs, used batteries etc.

This category of waste comprises the solid wastes that originate from individual residential units. These wastes are generated as a consequence of domestic activities such as food preparation, cleaning, repairs, hobbies, redecoration, empty containers, packaging, clothing, old newspapers, writing/new paper, and old furnishings etc. A nominal value estimated for Bengaluru is **0.45 kg/person/day** and the same has been considered to estimate the quantity of domestic solid waste generated due to this proposed project.

TABLE-2.15 SOLID WASTE GENERATION DURING OPERATION

Sl. No.	Description	Units	Occupants	Total Waste in MT/day	Organic Waste MT/day (40%)	In-Organic Waste MT/day (60%)
1	Residential	1927	11,811 @0.45	5.32	2.13	3.19
	STP Sludge		68.5 Kg/ d			
2	Commercial		11,787 @ 0.15	1.77	0.71	1.06
	STP Sludge		27.5 Kg/ d			
3	School		1,100 @0.15	0.17	0.07	0.10
	STP Sludge		2.5 Kg/ d			
	Total	1927	24,698	7.26	2.91	4.35
		STP sludge 0.0985 MT/d				

2.10.2 SOLID WASTE MANAGEMENT SYSTEM

Segregation

- Segregation of wastes into wet, dry/ recyclables and household hazardous waste.
- Familiarizing users about the solid waste management system adopted.
- Training program for retrievers regarding importance of segregation, proper handling of waste and its hazards due to improper handling.
- Littering of waste to be banned.

Primary Collection & Secondary Storage

- Door to door waste collection system will be carried out.
- Waste will be collected in two bins, one for Organic biodegradable waste & other for Inorganic one.

Processing & Disposal

- Biodegradable fed through "Organic Waste Converter".
- The segregated waste is pulverized and mixed with bacterial seed.

- This homogenized mixture stored in racks for 14 days with moisture controlled environment.
- Ultimately this convert as odor manure, the same may be sold outside.

Non-biodegradable inorganic waste shall be either disposed to municipal land fill or to recyclers. The Organic waste converter layout plan enclosed as ANNEXURE 5

2.10.3 HAZARDOUS WASTE GENERATION

It is estimated that the amount of waste oil generated from the DG sets would sum up to about 1 litre per running hour of DG. These wastes generated are stored in identified location in a closed leak proof containers under roof within the building premises for its safe disposal. The same is disposed to KSPCB authorized waste recyclers.

2.11 ENERGY SAVING DETAILS:

The proposed project will use the non-conventional energy source i.e. use of solar energy, which will comprise of solar heating, hence utilizing maximum solar energy. Solar water heaters will be provided for the top floors in each and every tower. The layout plan showing solar panel installation details is attached as ANNEXURE- 6

TABLE 2.16 ENERGY SAVINGS DETAILS

Total energy consumption of the project per year 600.45 Lakh units		
	Energy savings in lakhs Kwh units	% saving
Total energy saving using CU wound transformer	7.2	1.2
Total Energy saving using Solar Heater and Street Lighting	18.9	3.1
Total Energy saving by using with HF Ballast	3.1	0.5
Total Energy saving by using With LED	38.2	6.4
Saving using Pumps with efficiency of 80% - 85%	12.5	2.1
Saving using High Efficiency Motors used for Lifts	9.9	1.7
Saving Using Water cooled chillers against Air cooled Chillers	52.9	8.8
Total % energy saving	142.7	23.76

TABLE-2.17 SOLAR POWER GENERATION DETAILS

Sl. No.	Description	Wp of Each module	No Of Panels	Total KW	Area Required to install Solar PV Cells in Sq.ft
1	No. of solar panels For Phase 1	325	64	20.8	2080.0
2	No. of solar panels For Phase 2	325	64	20.8	2080.0
3	No. of solar panels For School	325	32	10.4	1040.0
4	No. of solar panels For Phase 3	325	64	20.8	2080.0
5	No. of solar panels For Commercial	325	830	269.8	26975.0
	Total		1054	342.6	34255.0

Load Summary		
Power generation / solar Panel	325	Watts peak
Total Generation for 7 Hours / Day/Panel	2398	kWH
Total Units Generated / year / Panel (275 days per year considered for solar power generation)	659409	Units
Total units generated per annum For 1054 Panels.	6,59,409	Units

Cost Summary		
Cost estimated for solar panels to generate 1kW power is	Rs. 40,000.00	
Cost estimated for solar panels to generate 343 kW power is	Rs.1,37,20,000.00	

TABLE-2.18 SOLAR PANEL HOT WATER DETAILS

DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SOLAR PANEL HOT WATER SYSTEM				
Designing, manufacturing, supplying, installing, testing and commissioning of approved make Pressurized (max. working pressure 5kg) solar hot water system consisting of insulated hot water drum, solar flat plate collectors, inter connected piping, NRV, ARV, pressure & temperature valves and fittings within the system, supporting stands for drum and collectors as specified in the technical specifications for the following capacities.				
a) 1no. Solar tank of 125 Liters with 1no. collector panel (Lot-01)	Sets	150	35,000	52,50,000
b) 400 LPD - 1no with 4nos. collector panels (Lot-02)	Sets	200	85,000	1,70,00000
c) 600 LPD - 1no with 6nos. collector panels (Lot-02)	Sets	60	1,20,000	72,00,000
TOTAL - A				2,94,50,000

2.19 TERRACE AREA CALCULATIONS FOR SOLAR POWER GENERATION -RESIDENTIAL

Total terrace area available	20,900 Sqm
Lift cut-outs and other service area under FAR area	6270.0 Sqm
Shaded area at boundary of the roof and services structures	2300 Sq.m
Area reserved for Emergency assembly at terrace	6270.0 Sqm
Area available for solar panels	6060 Sq.m
Area considered for solar power generation	728 .0 Sqm
Area considered for hot water panels	3690 Sqm
Size of individual panel	3.0 m X 3.0 m
73% of the total available terrace area is used for solar power harvesting	

2.20 TERRACE AREA CALCULATIONS FOR SOLAR POWER GENERATION -COMMERCIAL

Total terrace area available	7,700 Sqm
Lift cut-outs and other service area under FAR area	1540.0 Sqm
Shaded area at boundary of the roof and services structures	750 Sq.m

Area reserved for Emergency assembly at terrace	2310.0 Sqm
Area available for solar panels	6060 Sq.m
Area considered for solar power generation	3100 .0 Sqm
Number of panels	830
Area occupied by solar panels	2697 Sqm
87% of the total available terrace area is used for solar power harvesting	

2.12 FIRE SAFETY MANAGEMENT SYSTEM

Fire Protection scheme has been designed based on all the relevant fire safety as per NBC norms. The proposed project is a development of residential units comprising of 3 Residential buildings, commercial & school buildings. The maximum height of the building is 91.05 m.

The project has been designed based on all the relevant fire safety as per NBC norms.

- * Fire extinguishers systems are deployed throughout the residential building.
- * Fire hydrants all around the building will be provided.
- * Fire hose cabinets will be provided at every floor.
- * Sprinkler System, Automatic fire detection & Alarm system will be provided.

CHAPTER – 3**DESCRIPTION OF THE ENVIRONMENT****3.1 INTRODUCTION**

Baseline data describes the existing environmental status of the identified study area with reference to the prominent environmental attributes. An area covering 10km radius, with project site as centre, is considered as the study area. The study area of 10km radius around project is covered in Survey of India topo sheet no. 57 H/9, 57 H/13, 57G/12, 57 G/16. The existing environmental setting is considered to establish the baseline conditions which are described with respect to geology, hydrogeology, climatic & atmospheric conditions, water quality, noise quality, soil quality, vegetation pattern, ecology, land use and socioeconomic profile of people.

Collecting the baseline environmental status of the project helps to predict the magnitude of impacts that are likely to be caused due to the proposed project on different environmental components of the project in the study area. It also helps to identify critical environmental attributes required to be monitored during and after the proposed development. The site-specific primary data were monitored for the identified parameters and supplemented by the available secondary data. Baseline Environmental status is the most important study based on which probable impacts from the project are predicted. The Baseline study was conducted in the pre monsoon during the month of March to May 2019

In addition to the baseline environmental monitoring, field inspection in the study area, collection of secondary information for the environmental components and discussions with the officials and local public were also conducted. The baseline environmental status presented below comprises the following.

a. Description of study area: The project site is in Residential area. The study area is 10km radius from the project site comprising of mixed land use-residential and commercial activities considered and baseline environmental status of the study area are presented in the below sections.

- ✓ Physical Environment
- ✓ Biological Environment
- ✓ Socio – Economic Environment

b. Physical Environment: The Components of physical environment discussed in this section includes,

TABLE-3.1: ENVIRONMENTAL ATTRIBUTES & FREQUENCY OF MONITORING

Attribute	Parameters	Frequency of Monitoring
Climatology & Meteorology	Surface: Wind Speed, direction, temperature, relative humidity and rainfall	Surface continuous monitoring station for entire study period and also data collection from secondary sources.
Water Quality	Physical, Chemical and Bacteriological Parameters	Once during the study season
Ambient Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , O ₃ , Pb, CO, NH ₃ , C ₆ H ₆ , BaP, As & Ni	24 hourly twice a week for three months during study period
Noise Levels	Noise Levels in db (A)	Hourly observations for 24 hours per location.
Ecology	Existing terrestrial Flora and Fauna within the study area	Through field visit during the study period and substantiated through secondary sources.
Soil Characteristics	Physical & Chemical	Once during the study season.
Land Use	land use change for different categories	Data from various Government agencies
Socio-economic aspects	Socio-economic characteristics	Census Handbooks, 2011.

3.2. LAND ENVIRONMENT

The first feature which influence the development of a project is the existing land use pattern of the project site and neighborhood of the project, whether the proposed development conform to the development for that area or not. An area covering 10km radius, with project site as centre, is considered as the study area. The detail study of the land environment will includes the following study areas.

- Study of land use pattern, habitation, cropping pattern, forest cover, environmental sensitive places etc, employing remote sensing techniques (if available) and ground truth and also secondary data sources.
- Study about trend of change in land use pattern, if any, with reasons thereof for the last 10 years and its extrapolation to future 10 years with and without the project.

3.2.1 LAND USE PATTERN

The main objective of this section is to provide an environmental baseline status of the study area covering 10km radius around the proposed project site so that the temporal changes due to the proposed residential activity on the surroundings can be assessed.

The main objectives of land use studies are:

- * To determine the present land use pattern.
- * To ascertain the temporal changes in land use pattern due to construction and operation phase and
- * To scrutinize the impacts on land use due to proposed project in the study area.

The use of land is determined both by physical factors such as topography, climate, and soil types as well as human factors such as population density, technological capability, culture & tradition etc. Land use has a major impact on natural resources including water, soil, nutrients, plants and animals.

3.2.2 Topography of the study area:

The project site is located at the North east side from the Bengaluru city centre with the distance of 19 km. Portion of the land has been developed and portion of the land is vacant and sloping towards east direction. An area covering 10km radius, with project site as centre, is considered as the study area.

The important features within the study area are listed in table 3.2.

TABLE-3.2: IMPORTANT FEATURES WITHIN STUDY AREA

Sl no.	Features	Location	Distance Km	Direction
1	Streams/ Rivers	Chikkbanahalli lake	0.6	W
		Hoskote lake	4.2	N
		Yellamma lake	2.9	W
		Varthur lake	4.6	S
2	State Boundary	Karnataka-Tamilnadu Inter State boundary	19.17	SE
3	Highways	SH 35 Whitefield Hoskote Main road	Adjacent	W
		NH 4 Old Madras road	2.4	NW
4	Airports	Kempegowda International Airport	18.55	N
5	Railway	White field railway station	2.98	N

Landuse Land Cover Map of Project Site with 10KM Buffer
Satellite Image Used - Resourcesat-2 LISS-IV - April 2019

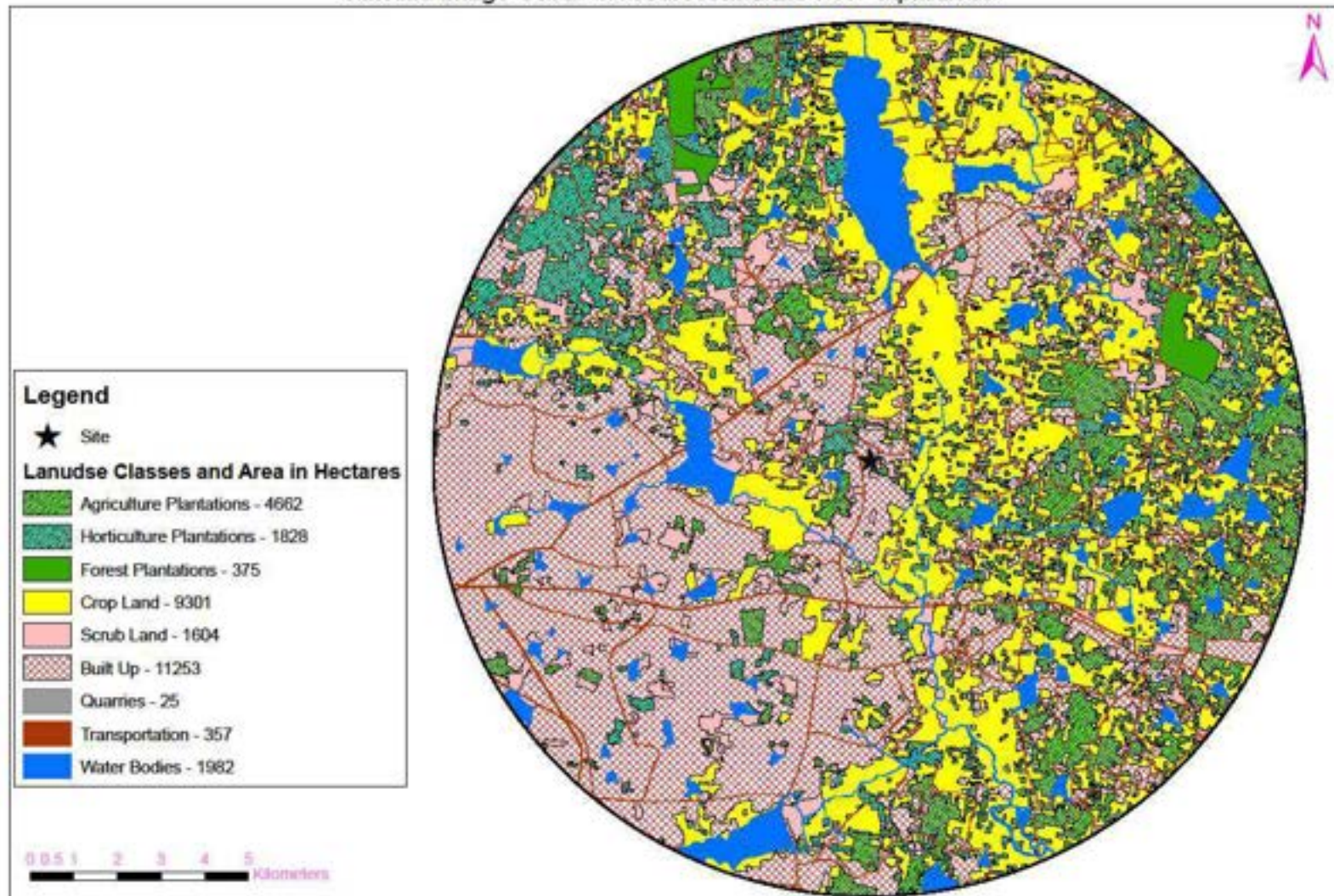


FIGURE-3.1: LAND USE AND LAND COVER MAP OF STUDY AREA

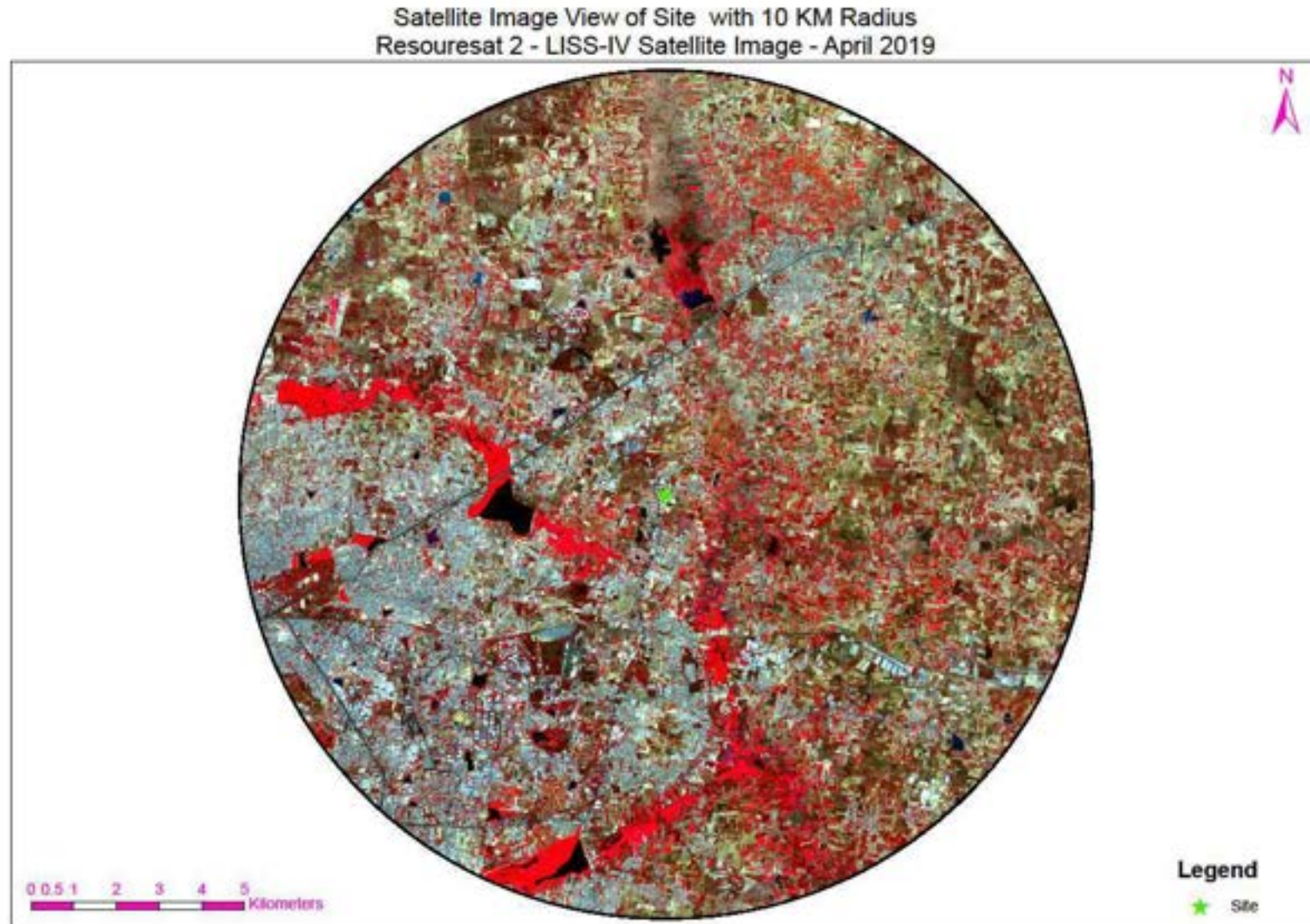


FIGURE-3.2: SATTILITE IMGERY MAP OF THE STUDY AREA

DIGITAL ELEVATION MODEL - SITE WITH 10 KM RADIUS

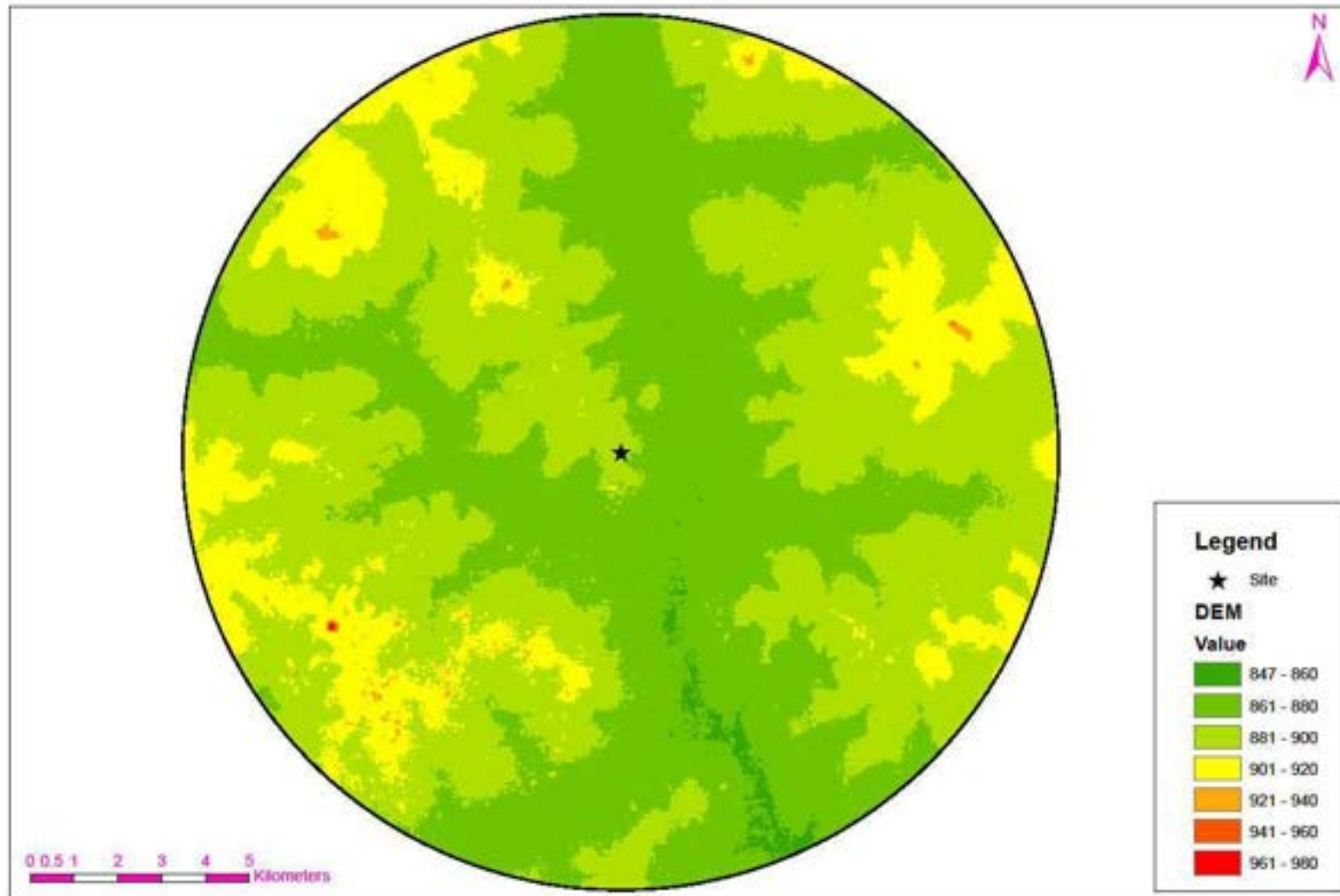


FIGURE-3.3: DIGITAL ELEVATION MODEL

Drainage and Waterbody Map - Site and Its Surroundings (10 KM Buffer)

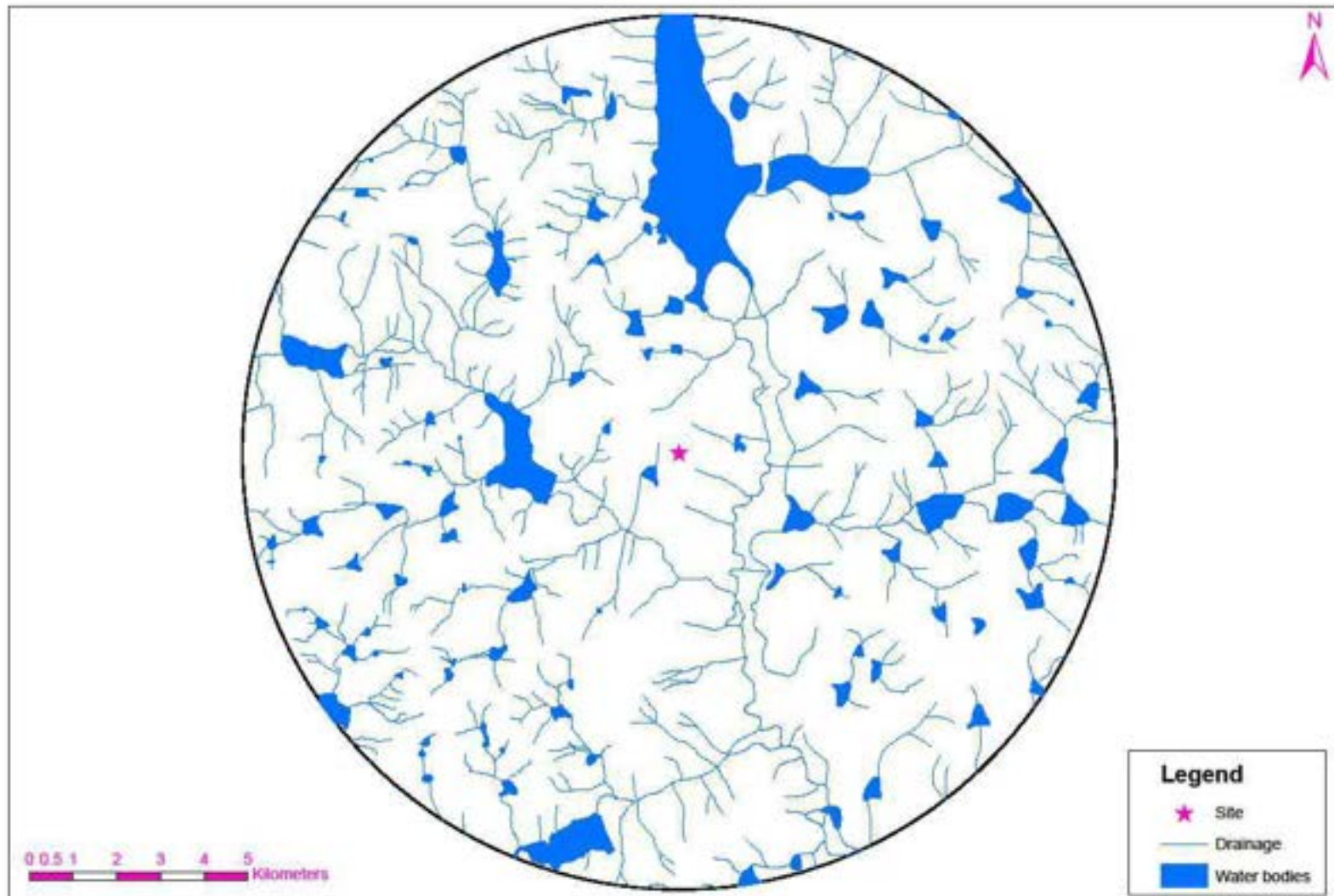


FIGURE-3.4: DRAINAGE PATTERN

3.3 HYDROLOGY AND HYDROGEOLOGY

Granites and Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Ground water level is essentially controlled by physiography, lithology and rainfall. Ground water occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations. The occurrence of Ground water movement and recharge to aquifers are controlled by various factors like fracture pattern, degree of weathering, geomorphological setup and amount of rainfall received. Generally the depth of weathering varies, being more in the valley, and often extending up to 30 m in the dug wells. However the yield in the bore well is dependent upon factors like degree of weathering, presence of joints and fractures and its connectivity and the presence of intrusive bodies. The hydrology report enclosed as ANNEXURE 8.

3.4 GEOLOGICAL SETTINGS

Physiographically the district can be divided into rocky upland, plateau & flat topped hills at a general elevation of about 900amsl with its major part sloping towards south and south east forming pediplains interspersed with hills all along the western part. The pediplains form the major part of the district underlain by granites and gneisses with the highest elevation of 850 to 950 m.amsl. Major part of the pediplain constitute low relief area having matured dissected rolling topography with erosional land slope covered by a layer of red loamy soil of varied thickness. Major part of the pediplains is dissected by streamlets flowing in southern direction.

The geotechnical investigation report enclosed as ANNEXURE 9

3.4.1 SOIL STRATA

The soils of the districts can be broadly grouped into red loamy soil and lateritic soil. Red loamy soils generally occur on hilly to undulating land slope on granite and gneissic terrain. It is mainly seen in the eastern and southern parts of Bangalore north and south taluks.

Laterite soils occur on undulating terrain forming plain to gently sloping topography of peninsular gneissic region. It is mainly

3.4.2 PHYSICO-CHEMICAL CHARACTERISTICS OF THE SOIL:

The primary objective of this investigation is to establish the Geotechnical conditions at the site, the soil sample from the proposed project site was analyzed for important parameters and the results were compared with standard classification and to evaluate the net safe bearing capacities and other geotechnical design parameters through the various field and laboratory tests.

3.4.3 LABORATORY ANALYSIS

Following laboratory tests were conducted on the soil samples collected from boreholes at the project site.

Tests conducted on soil samples:

- ✓ Standard Penetration test
- ✓ Gran size analysis by sieve analysis
- ✓ Determination of Specific gravity
- ✓ Crushing strength of rock

TABLE 3.4 SOIL TEST VALUES

Description	Ranges		
	Acidity (<6)	Neutral(6-8)	Alkaline(>8)
pH of soil	Acidity (<6)	Neutral(6-8)	Alkaline(>8)
Electrical conductivity	Normal (<1000)	Critical (1000-2000)	Injurious (>2000)
Organic carbon	Low(<0.5)	Medium (0.5- 0.75)	High (>0.75)
Available phosphorous	Low(<22)	Medium(22-54)	High(>0.75)
Available potassium	Low(<123)	Medium(123-296)	High(>296)

Ground studies were conducted to identify the land use in and around 10 km radius of the site. Representative soil samples were collected from- eight sampling locations within an area of 10 km radius in and around the proposed project site for analysis of

the physico chemical characteristics to assess the cropping pattern, microbial growth etc. standard procedures were followed for sampling and analysis.

Soil samples were collected at different locations within the Study area. The marked soil sampling locations on Topo sheet are shown in figure 3.6

(Monitoring stations are fixed based on IS-5182 Part (14) 2000)

TABLE-3.5 SOIL SAMPLING LOCATIONS AROUND THE STUDY AREA

Sample No.	Name of Sampling station	Distance Km	Direction	Latitude	Longitude
S1	Project Site	--		13°01'31.3" N	77°45'52.6"E
S2	Kannamangala	0.4	NE	13°01'38.6" N	77°46'12.9"E
S3	Goravigare colony	1.8	N	13°02'37.9" N	77°45'45.0"E
S4	Chikkabanahalli	1.5	W	13°01'26.23" N	77°44'51.0"E
S5	Seegehalli	1.1	S	13°00'43.0" N	77°45'54.0"E
S6	Bhaktharahalli	3.0	E	13°01'17.9" N	77°47'43.9"E
S7	Mallasandra	2.5	SE	13°00'30.4" N	77°47'2.1"E
S8	Domsandra	2.8	SW	13°00'35.9" N	77°44'22.5"E

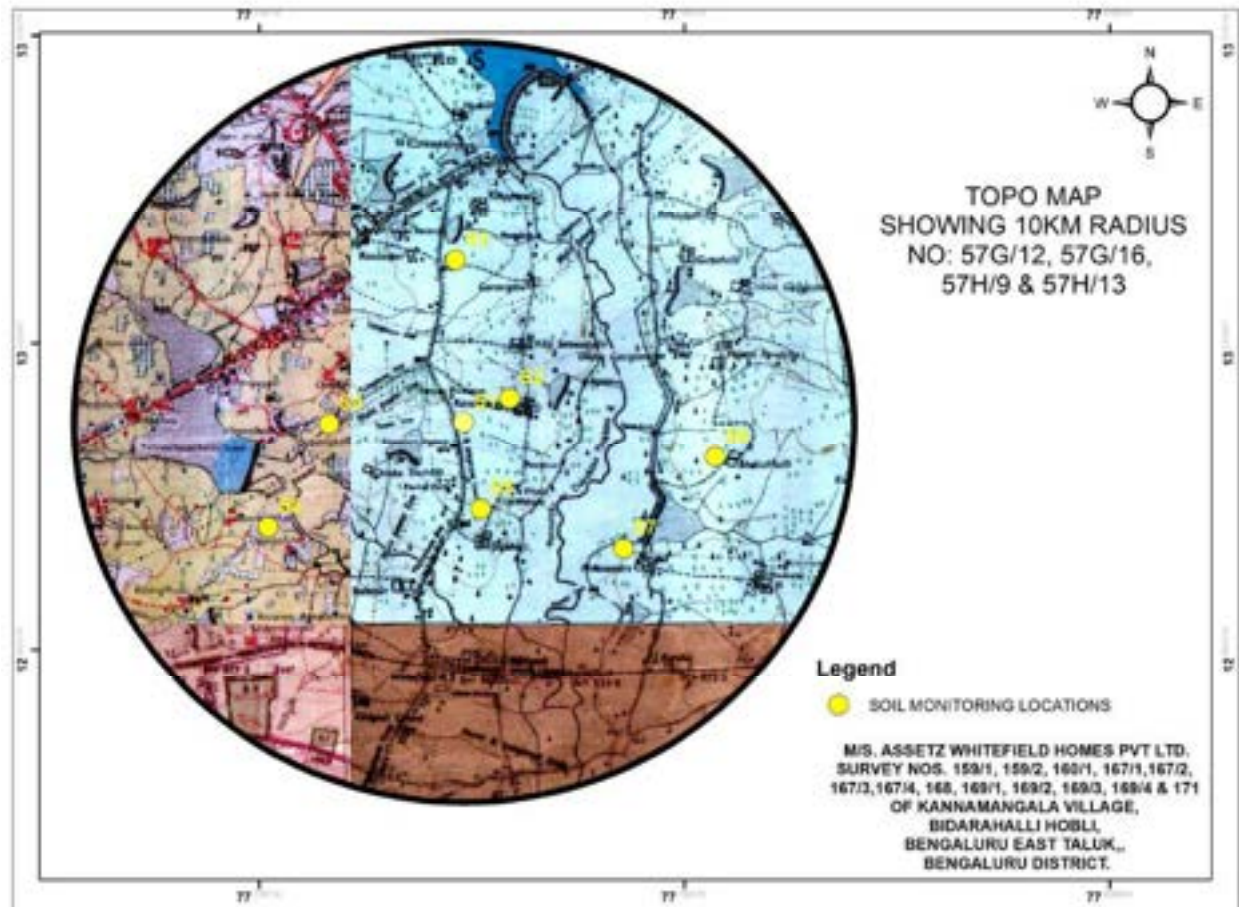


FIGURE-3.5 SOIL SAMPLING LOCATION

TABLE-3.6 SOIL RESULTS

Sl. No	Parameters	Units	S1	S2	S3	S4	S5	S6	S7	S8
1	pH Value	--	7.9	7.5	8.1	7.8	7.2	7.9	7.7	7.2
2	Color	--	Reddish brown	Light brown	Light brown	Light Brown	Light Brown	Reddish brown	Light Brown	Light Brown
3	Sand	%	63	42	42	37	42	56	39	40
4	Silt	%	21	32	28	33	33	25	33	31
5	Clay	%	16	26	30	30	25	19	28	29
6	Conductivity	μS/cm	380.0	510.0	480.0	460.0	390.0	420.0	490.0	387.0
7	Moisture Content	%	3	3.4	2.9	2.7	3.7	4.1	4.3	3.5
8	Organic Matter	%	2.34	2.62	2.5	2.53	2.41	2.67	2.34	2.41
9	Calcium as Ca	(meq/L)	322.1	304.8	298.7	271.3	268.1	287.6	318.5	292.3
10	Chlorides as Cl	(meq/L)	387.2	401.2	341.4	358.6	324.1	345.6	413.4	338.1
11	Magnesium as Mg	(meq/L)	191.2	189.7	187.7	184.5	175.2	189.8	198.2	170.8
12	Nitrogen as N	Kg/Ha	0.013	0.016	0.013	0.015	0.014	0.013	0.016	0.013
13	Phosphorus	Kg/Ha	81.2	69.9	72.1	76.8	92.2	78.4	0.81	93.8

14	Potassium as K	Kg/Ha	254.6	235.6	274.2	262.1	224.3	281.7	28.9	208.7
15	Sulphur as S	mg/100g	87.2	92.4	88.7	78.9	87.1	90.4	82.7	97.6
16	Iron as Fe	mg/kg	0.7	0.66	0.62	0.67	0.62	0.69	0.71	0.73
17	Copper as Cu	mg/kg	28.5	24.1	27.8	26.2	25.1	24.2	28.9	23.7
18	Mercury as Hg	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
19	Cadmium as Cd	mg/kg	1.22	1.3	1.21	1.25	1.28	1.2	1.18	1.25
20	Selenium as Se	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Arsenic as As	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Lead as Pb	mg/kg	5.5	4.9	5.6	5.72	4.7	4.56	5.1	4.4
23	Zinc as Zn	mg/kg	201.8	265.4	212.3	224.5	235.1	225.4	205.4	224.7
24	Manganese as Mn	mg/kg	22.8	23.5	26.8	24.1	21.3	23.3	25.4	22.1
25	Cyanide as Cn	mg/kg	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

3.5 WATER ENVIRONMENT

Water environment includes two environmental settings, i.e. ground water and surface water. Baseline data with regard to these environmental settings should be generated. Selected water quality parameters of ground water resources and surface water resources within 10Km radius of the study area have been studied for assessing the hydrological environment to evaluate anticipated impact of the proposed residential development. It also assists to identify critical issues with a view to suggest appropriate mitigation measures for implementation.

The significant representative sampling locations for ground water and surface water are chosen through reconnaissance of project area to determine the pre-project status of the water quality in the study area. Physico-chemical and biological parameters having relevance to public health and aesthetic significance are selected to assess the water quality status with special attention to raw water resources for proposed project. The standard methods prescribed for surface, groundwater sampling as well as the analytical procedures for individual parameters is followed in this study.

3.5.1 GROUND WATER QUALITY

Ground water in the eight monitoring locations have been collected and analyzed for various parameters to know the condition of the baseline environment. The sampling

locations are depicted in below table and the results obtained from laboratory. In compared with results with standards, all locations of ground water found well within the standards and fit for domestic use.

TABLE 3.7 GROUND WATER SAMPLE AROUND THE STUDY AREA

Sample No.	Name of Sampling station	Distance Km	Direction	Latitude	Longitude
GW 1	Project Site	--		13°01'31.3" N	77°45'52.6"E
GW 2	Kannamangala	0.4	NE	13°01'38.6" N	77°46'12.9"E
GW 3	Goravigare colony	1.8	N	13°02'37.9" N	77°45'45.0"E
GW 4	Chikkabanahalli	1.5	W	13°01'26.23" N	77°44'51.0"E
GW 5	Seegehalli	1.1	S	13°00'43.0" N	77°45'54.0"E
GW 6	Bhaktharahalli	3.0	E	13°01'17.9" N	77°47'43.9"E
GW 7	Mallasandra	2.5	SE	13°00'30.4" N	77°47'2.1"E
GW 8	Domsandra	2.8	SW	13°00'35.9" N	77°44'22.5"E

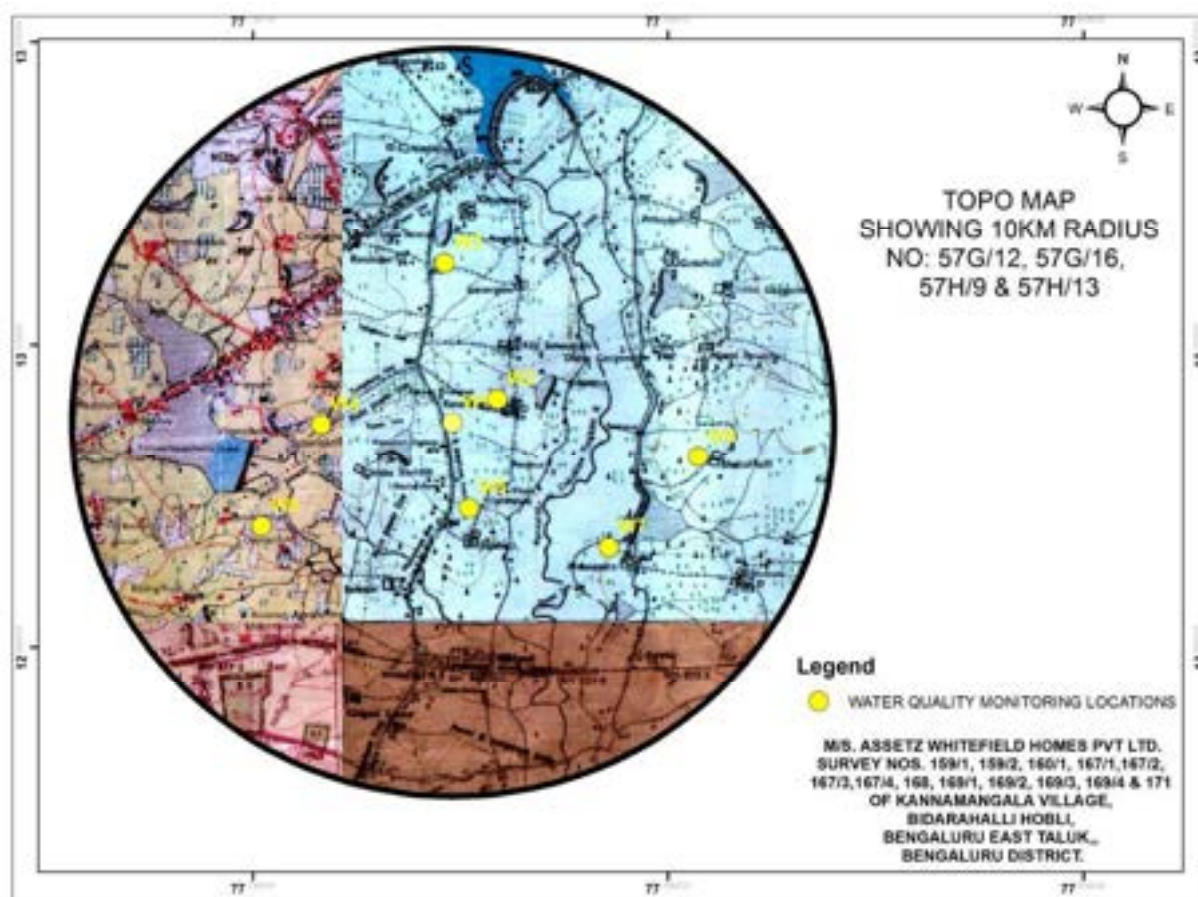


FIGURE-3.6 WATER SAMPLING LOCATION

TABLE-3.8 GROUND WATER QUALITIES STANDARDS

Sl. No	Parameter	Maximum Desirable Limit IS 10500: 2012	Maximum Permissible Limit IS 10500: 2012	Protocol
1	Colour (Hazen units)	5	15	IS 3025 (Part- 4): 1983
2	Odour	Unobjectionable	Unobjectionable	IS 3025 (Part- 5): 1983
3	Taste	Agreeable	Agreeable	IS 3025 (Part- 8): 1984
4	pH Value	6.5 to 8.5	No Relaxation	IS 3025 (Part- 11): 1983
5	Turbidity, NTU	1	5	IS 3025 (Part- 10): 1984
6	Chlorides as Cl, mg/l	250	1000	IS 3025 (Part- 32): 1988
7	Total Hardness as CaCO ₃ , mg/l	200	600	IS 3025 (Part- 21): 2009
8	Calcium as Ca, mg/l	75	200	IS 3025 (Part- 40): 1991
9	Magnesium as Mg, mg/l	30	100	IS 3025 (Part- 46): 1994
10	Dissolved solids mg/l	500	2000	IS 3025 (Part- 16): 1984
11	Sulphate as SO ₄ , mg/l	200	400	IS 3025 (Part- 24): 1986
12	Fluoride as F, mg/l	1.0	1.5	APHA 22 nd Edition
13	Chromium as Cr ⁺ , mg/l	0.05	No relaxation	IS 3025 (Part- 52): 2003
14	Residual free chlorine, mg/l	0.2	1	IS 3025 (Part- 26): 1986
15	Alkalinity as CaCO ₃ , mg/l	200	600	IS 3025 (Part- 23): 1986
16	Nitrate as NO ₃ , mg/l	45	No Relaxation	IS 3025 (Part- 34): 1988
17	Copper as Cu, mg/l	0.05	1.5	IS 3025 (Part- 42): 1992
18	Iron as Fe, mg/l	0.3	No Relaxation	IS 3025 (Part- 53): 2003
19	Manganese as Mn, mg/l	0.1	0.3	IS 3025 (Part- 59): 2006
20	Phenolic Compounds as C ₆ H ₅ OH, mg/l	0.001	0.002	IS 3025 (Part- 43): 1992
21	Mercury as Hg, mg/l	0.001	No relaxation	IS 3025 (Part- 48): 1994
22	Cadmium as Cd, mg/l	0.003	No relaxation	IS 3025 (Part- 41): 1992
23	Selenium as Se, mg/l	0.01	No relaxation	IS 3025 (Part- 56): 2003
24	Arsenic as As, mg/l	0.01	No relaxation	IS 3025 (Part- 37): 1988
25	Cyanide as CN, mg/l	0.05	No relaxation	APHA 22 nd Edition
26	Lead as Pb, mg/l	0.01	No relaxation	IS 3025 (Part- 47): 1994
27	Zinc as Zn, mg/l	5	15	IS 3025 (Part- 49): 1994
28	Anionic detergents as MBAS, mg/l	0.2	1.0	Annex K of IS: 13428: 2005
29	Aluminium as Al, mg/l	0.03	0.2	IS 3025 (Part- 55): 2003
30	Boron as B, mg/l	0.5	1.0	APHA 22 nd Edition

TABLE-3.10 GROUND WATER QUALITY RESULTS

Sl.No	Parameter	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8
1	Colour (Hazen units)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	p ^H Value	7.4	7.4	7.0	7.2	7.2	6.75	8.0	7.3
5	Turbidity, NTU	0.3	0.3	0.4	0.8	0.6	2.1	2.9	0.4
6	Chlorides as Cl, mg/l	224.0	261.3	331.8	452.1	215.7	315.2	132.7	165.9
7	Total Hardness as CaCO ₃ , mg/l	295.2	202.2	384.1	485.2	242.6	295.2	182.0	202.2
8	Calcium as Ca, mg/l	61.5	42.1	80.9	102.0	51.8	63.1	37.2	40.5
9	Magnesium as Mg, mg/l	34.4	23.6	44.2	56.0	27.5	33.4	21.6	24.5
10	Dissolved solids mg/l	752.0	562.0	742.0	958.0	502.0	692.0	634.0	402.0
11	Sulphate as SO ₄ , mg/l	63.4	44.6	54.8	47.7	35.3	60.9	154.0	13.2
12	Fluoride as F, mg/l	0.78	0.65	0.87	0.92	0.81	0.66	0.82	0.61
13	Chromium as Cr ⁺ , mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14	Residual free chlorine, mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
15	Alkalinity as CaCO ₃ , mg/l	443.1	286.5	362.9	466.0	213.9	236.8	362.9	160.4
16	Nitrate as NO ₃ , mg/l	15.8	12.6	28.4	31.1	15.2	16.3	24.2	15.2
17	Copper as Cu, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
18	Iron as Fe, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19	Manganese as Mn, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20	Phenolic Compounds as C ₆ H ₅ OH, mg/l	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
21	Mercury as Hg, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
22	Cadmium as Cd, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23	Selenium as Se, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
24	Arsenic as As, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
25	Cyanide as CN, mg/l	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
26	Lead as Pb, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
27	Zinc as Zn, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
28	Anionic detergents as MBAS, mg/l	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
29	Aluminium as Al, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
30	Boron as B, mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31	Coliform organism/ 100ml	11 cfu	18 cfu	11 cfu	14 cfu	8 cfu	17 cfu	10 cfu	9 cfu
32	Escherichia coli/ 100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

3.6 AIR ENVIRONMENT

3.6.1 MICRO METEOROLOGY

The meteorological data recorded during the study period is very useful for proper interpretation of the baseline information and selection of air quality monitoring locations. Historical data on meteorological parameters will also play an important role in identifying the general meteorological regime of the region. To understand meteorological scenario primary and secondary data are collected. This data is used in the interpretation of wind scenario. Primary data collected during March to May 2019 for the parameters like wind speed, wind direction, temperature, humidity and precipitation. And Secondary information on meteorological conditions for the project study region was collected from the IMD station at Bangalore. Data of previous years have been collected and analyzed.

The representative months for climate are divided into four seasons winter lasts from January to February, summer lasts from March to May, South-West monsoon rains from June to September and North-East monsoon rains from October to December. (Ref: Assessment of Impact to Air Environment: Guidelines for Conducting Air Quality Modelling, Central Pollution Control Board).

METHODOLOGY:

The methodology adopted for monitoring surface weather parameters is as per the norms laid down by Bureau of Indian Standards (IS:8829) and India Meteorological Department (IMD). The study of micro-meteorological conditions of a particular region is of utmost importance to understand the variations in ambient air quality status in that region. The prevailing micrometeorology at project site plays a crucial role in transport and dispersion of air pollutants released from the pollution sources. The persistence of the predominant wind direction and wind speed at the project site will decide the direction and extent of the air pollution impact zone.

Meteorological parameters such as wind speed, wind direction, maximum, and minimum temperatures, Relative humidity recorded on monthly basis continuously covering the entire study period. Wind speed & Wind direction data recorded during the study period were used for computation of relative percentage frequencies of

different wind directions. The meteorological data thus collected has been used for interpretation of the existing Ambient Air Quality status, and the same data has been used for prediction of impacts of future scenario due to the activities of the proposed scheme.

The wind rose generated from the Meteorological data collected from IMD Bengaluru is shown in the following figure 3.6. From the wind rose diagram it can be observed that the predominant wind direction is blowing East South East to West North West direction with the average wind speed between 2.1 to 3.6 m/s.

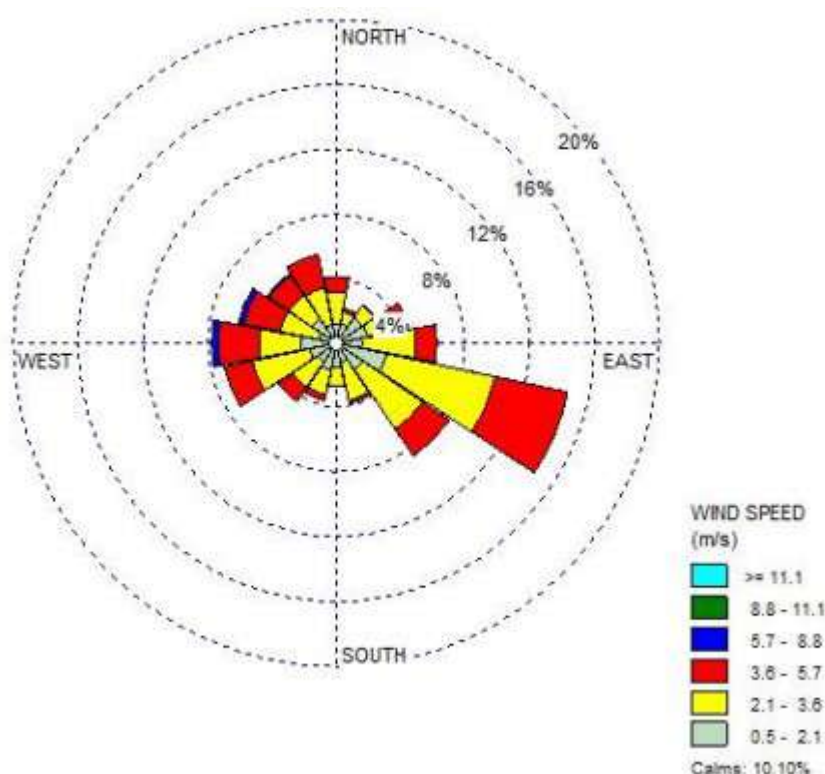


FIGURE-3.7: WIND ROSE DIAGRAM

3.6.2 RAINFALL:

The average annual rainfall observed based on the 10 years IMD data is 979.8mm. Bengaluru has three different rainy periods covering eight months of the year followed closely one after the other. Of these, June to September is the principal rainy season. The annual variation of rainfall shows two maxima and two minima. The principal maximum is in September and the secondary maximum in May. These are also the months with the maximum frequency of thunderstorms. Bengaluru receives 54% of the total annual rainfall in the south-west monsoon period (June to September) with a

rainfall of 496 mm and 34 rainy days. The rainfall increases from June to September. During the north-east monsoon period, the mean rainfall is 241 mm which is a quarter of the annual total rainfall and the mean number of rainy days is 14. Thus about 80% of the annual rainfall falls during the six months June to November. In April- May, the mean rainfall is 156 mm and the number of rainy days is 10. December to March is a comparatively rainless period, with a mean rainfall of 33mm and about 3 rainy days.

The records of the City Central Observatory may be taken as representative of the meteorological conditions in the district in general as they pertain to long period. The mean monthly values of air temperature were obtained by taking the half-sums of the mean maximum and mean minimum temperatures. On the basis of mean monthly temperatures, April is usually the hottest month with the mean daily maximum temperature at 33.40C and the mean daily minimum at 21.20C. On individual days, in hot seasons, the temperatures often go above 36.0C. With the onset of the monsoon early in June, there is appreciable drop in the day temperatures but that in night temperature is only slight. In October, the temperatures are as in the south-west monsoon season. Thereafter temperature decreases. December is generally the coolest month with the mean daily maximum temperature at 25.70C and the mean daily minimum at 15.30C. Nights during January are however slightly colder than during December. On individual days during the period December to February, the minimum temperature drops down to about 8.0C. The highest maximum temperature recorded at Bengaluru is 38.90C on 1931 May, 22. The lowest minimum was 7.80C on 1884 January, 13. The mean annual range of temperature (defined as mean temperature of the warmest month minus the mean temperature of the coolest month) is only about 7.0C. The curves of mean monthly maximum and minimum temperature indicate that the mean maximum temperature is the highest in April (36.20C) and the mean minimum temperature is the lowest in January (11.40C). Thus the mean of the extreme annual range of the temperature is i.e. of the difference between the highest and lowest temperature recorded in a year is about 24.0C. The monthly mean diurnal range of temperature is maximum (about 15.0C) in February-March and minimum in July-August (about 9.0C). The maximum temperature of the day occurs at about 3 p.m. and the minimum

temperature at about 6 a.m. except from May to July when it occurs about an hour or so earlier. The temperature at 9-30 a.m. and 9 p.m. is the mean temperature of normal day within half a degree Celsius.

TABLE 3.12 RAINFALL PATTERN, BENGALURU URBAN DISTRICT

Month	Avg Min temp.	Avg Max temp.	Avg rainfall, mm	Relative humidity
January	15	27	3	59
February	17	30	10	47
March	19	32	6	43
April	21	33	46	51
May	21	33	117	61
June	20	29	80	73
July	19	27	117	78
August	19	27	147	77
September	19	28	143	75
October	19	28	185	74
November	17	26	54	69
December	15	26	16	65

Source* Sourced from gazetteer of India & IMD, Bengaluru district

3.7 AMBIENT AIR QUALITY MONITORING

The major objective of baseline air monitoring is to evaluate the existing air quality of the area. Formulation of baseline Ambient Air Quality (AAQ) data of the study area occupies a significant role in the Environmental Impact Assessment studies in assessing the conformity to standards of the ambient air quality during the construction and operation of the proposed project.

RECONNAISSANCE:

The predominant monsoon winds persisting in India dictates the transport and dispersion of air pollutants during different seasons. As per the Climatological conditions prevailing in India, the seasons accounted for carrying out air pollution studies are winter, summer and post-monsoon seasons. After reconnaissance of the area and observing the topographical features and review of the available meteorological data and local conditions the sampling sites were selected.

A preliminary survey was conducted at 8 AAQM locations along with the project site (within the radius of 10 Kms) that were chosen based on the well-designed ambient

air quality stations network. The baseline status of air environment has been assessed through ambient air quality monitoring (AAQM) network covering 8 sampling locations considered based on the following criteria:

- Micrometeorological conditions-Persistence of wind direction and speed, atmospheric stability
- Predominant upwind and downwind directions
- Identification of regional background
- Location of industries, their emission magnitude and topography of the study area.
- Determination of sensitive receptors such as hospitals, schools, thickly populated residential localities.
- Consideration of all the major conventional air pollution parameters as per latest NAAQS (National Ambient Air Quality Standards)

An intensive monitoring was carried out as per CPCB guidelines (twice a week sampling and 24 hour continuous sampling) to generate the baseline monitoring status of air environment within the study area during the period of March to May 2019

The ambient air quality has been monitored for all the parameters as per NAAQS notified on 16th September, 2009. The major air pollutants monitored on 24 hourly bases are, Particulate matter (PM₁₀ and PM_{2.5} µg/m³), Sulfur dioxide and oxides of Nitrogen, Ozone, Lead, Carbon Monoxide, Ammonia, Benzene, Benzo (a) Pyrene, Arsenic and Nickel. Sampling and analysis of the above variables is according to the guidelines of Central Pollution Control Board. Following are the air quality monitoring stations which were identified during the study period.

3.7.1 AMBIENT AIR QUALITY STATUS

The prime objective of baseline air quality survey was to assess the existing air quality of the project site. This study will also be useful for conformity to standards of the ambient air quality during the project operations.

This section describes the selection of sampling locations, methodology & analytical techniques adopted for sampling. The ambient air quality was monitored at five

locations in and around the proposed project site. The air quality monitoring was conducted as per revised NAAQ standards 2009.

3.7.2 SAMPLING AND ANALYTICAL TECHNIQUES:

Following methodology adopted for the analysis of the various parameters at the sampling locations:

TABLE-3.13 AIR QUALITY ANALYSIS METHOD

Sl. No.	Test Parameters	Test Method
1.	Sulphur dioxide (SO ₂)	Modified West and Gaeke method
2.	Nitrogen dioxide (NO ₂)	Modified Jacob & Hochheiser method
3.	Particulate Matter 10 µg/m ³	Gravimetric method
4.	Particulate Matter 2.5 µg/m ³	Gravimetric method
5.	Ozone (O ₃)	Direct Instrument Reading
6.	Lead (Pb)	AAS method
7.	Carbon Monoxide (CO)	Direct Instrument Reading
8.	Ammonia (NH ₃)	Spectrophotometric method
9.	Benzene (C ₆ H ₆)	Gas Chromatography method
10.	Benzo (a) Pyrene (BaP) – particulate phase only	Solvent extraction by GC method
11.	Arsenic (As)	AAS method
12.	Nickel (Ni)	AAS method

Note: AAS – Atomic Absorption Spectro-photometric Method

Following are the air quality monitoring stations which were identified for the AAQ study within the study area.

3.8 INDOOR AIR QUALITY MONITORING

IAQ has been identified by the EPA as one of the top five most urgent environmental risks to public Health. Each building has its own set of circumstances. Air quality may be determined by the site of the building, its original design, renovations, occupant densities and activities conducted within the building.

People are exposed to air pollutants both outdoors and indoors is obvious. Globally, people are spending an increasing amount of time indoors. There they are exposed to

pollutants generated outdoors that penetrate to the indoor environment and also to pollutants produced indoors, for example as a result of space heating, cooking and other indoor activities, or emitted from products used indoors.

Good IAQ in buildings is an important component of a healthy indoor environment. It contributes to a favorable and productive environment for building occupants, giving them a sense of comfort, health, and well-being. Significant increases in worker productivity have also been demonstrated when the air quality was adequate.

3.8.1 SOURCES OF INDOOR AIR POLLUTANTS

- Building site or Location
- Building Design
- Building Systems Design and Maintenance
- Renovation Activities
- Local Exhaust Ventilation
- Building Materials
- Building Furnishings
- Building Maintenance
- Occupant Activities

3.8.2 ASSESSMENT OF IAQ

- Assessing of the building envelope, including the roof, walls, and foundation, and promptly respond to identified problems. Routinely check the building for water leaks, seals around doors and windows and any visible damp or moist parts of the building. Clean and dry any damp or wet building materials and furnishings within 24 to 48 hours after detection to prevent the growth of mold.
- Ensure and validate that the building is maintained under a slight positive pressure (i.e., air comes out of the building when exterior doors are opened).
- Check whether the temperature and humidity are maintained in a recommended comfort range (temperature: 68 to 78 degrees and relative humidity: 30% to 60%)
- Ensure that good housekeeping practices are being applied.

- Ensure that routine preventive maintenance and upkeep of buildings is being performed. A preventive maintenance program provides the care to all building systems and components that keeps them operating at peak performance according to manufacturer's specifications, and also allows for early detection of problems
- Ensure that scheduled renovations are isolated from the building's general dilution ventilation system when occupants are in the building.
- Monitor carbon dioxide (CO₂) levels. The carbon dioxide levels can be used as a rough indicator of the effectiveness of ventilation and excessive population density.

3.8.3 CONTROL METHODS

- Source management includes removal, substitution and enclosure of sources.
- Local exhaust, such as a canopy hood, is very effective in removing point sources of pollutants before they can be dispersed into the building's indoor air.
- Eliminate or reduce the amount of time a worker is exposed to a pollutant (i.e., scheduling maintenance or cleaning work to be accomplished when other building occupants are not present).

TABLE-3.14 AMBIENT AIR QUALITY MONITORING LOCATIONS

Sample No.	Name of Sampling station	Distance Km	Direction	Latitude	Longitude
A 1	Project Site	--		13°01'31.3" N	77°45'52.6"E
A 2	Kannamangala	0.4	NE	13°01'38.6" N	77°46'12.9"E
A 3	Goravigare colony	1.8	N	13°02'37.9" N	77°45'45.0"E
A 4	Chikkabanahalli	1.5	W	13°01'26.23" N	77°44'51.0"E
A 5	Seegehalli	1.1	S	13°00'43.0" N	77°45'54.0"E
A 6	Bhaktharahalli	3.0	E	13°01'17.9" N	77°47'43.9"E
A 7	Mallasandra	2.5	SE	13°00'30.4" N	77°47'2.1"E
A 8	Domsandra	2.8	SW	13°00'35.9" N	77°44'22.5"E

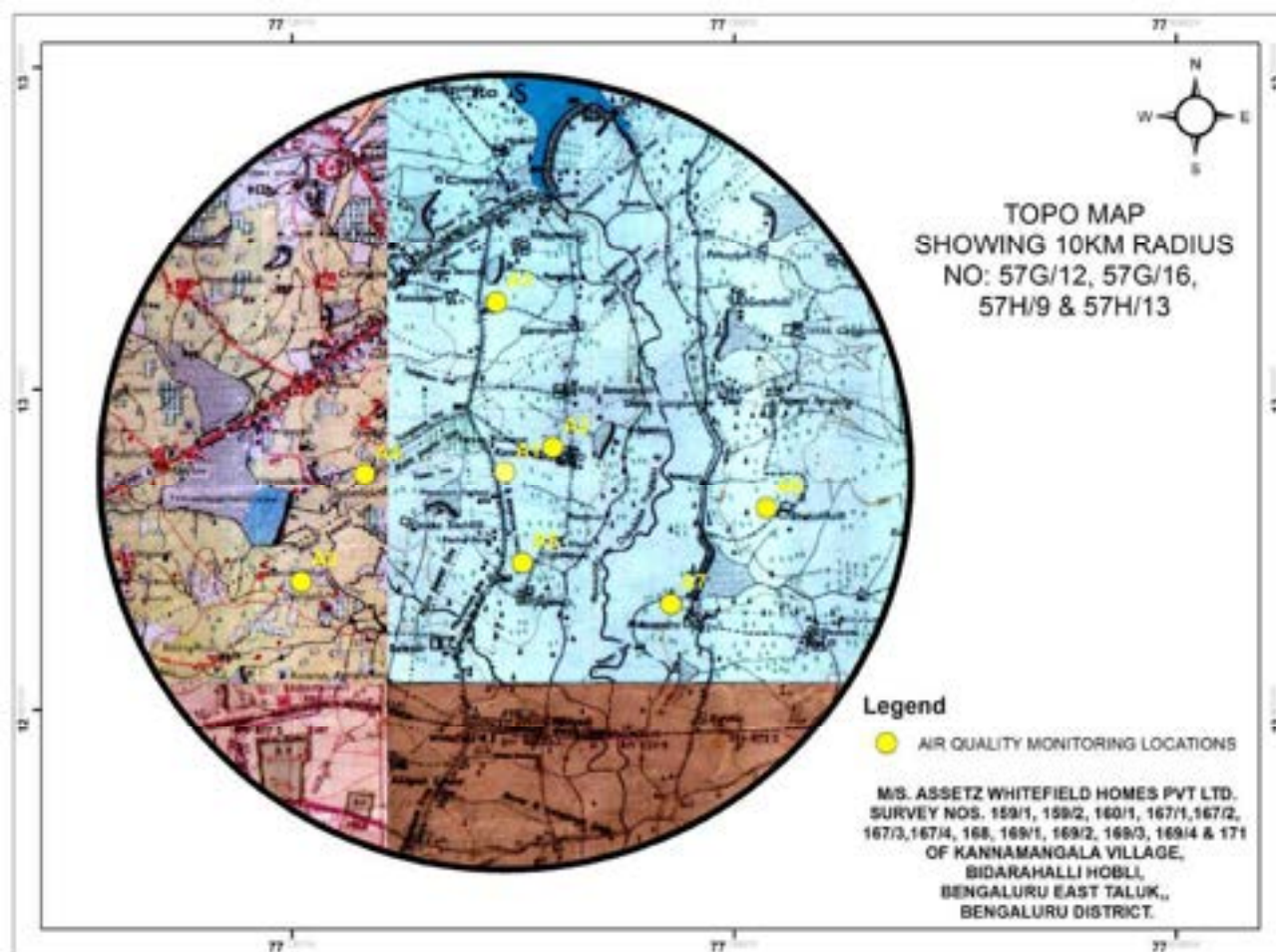


FIGURE-3.8 AIR SAMPLING LOCATIONS

TABLE-3.15 NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant	Units	Time Weighted Average	Concentration in Ambient Air ($\mu\text{g}/\text{m}^3$)		Methods of Measurement
			Industrial, Residential, Rural And Other Area	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur dioxide (SO_2)	$\mu\text{g}/\text{m}^3$	Annual*	50	20	- Improved West and Gaeke - Ultraviolet fluorescence
		24 Hours**	80	80	
Nitrogen dioxide (NO_2)	$\mu\text{g}/\text{m}^3$	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
		24 Hours**	80	80	
Particulate Matter (Size < $10\ \mu\text{m}$) or PM_{10}	$\mu\text{g}/\text{m}^3$	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
		24 Hours**	100	100	
Particulate Matter (Size < $2.5\ \mu\text{m}$) or $\text{PM}_{2.5}$	$\mu\text{g}/\text{m}^3$	Annual*	40	40	- Gravimetric - TOEM - Beta attenuation
		24 Hours**	60	60	
Ozone (O_3)	$\mu\text{g}/\text{m}^3$	8 Hours**	100	100	- UV photometric

		1 Hour**	180	180	- Chemiluminescence - Chemical Method
Lead (Pb)	$\mu\text{g}/\text{m}^3$	Annual*	0.5	0.50	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
		24 Hours**	1.0	1.0	
Carbon monoxide (CO)	mg/m^3	8 Hours**	02	02	- Non Dispersive Infra-Red (NDIR) spectroscopy
		1 Hour**	04	04	
Ammonia (NH_3)	$\mu\text{g}/\text{m}^3$	Annual*	100	100	- Chemiluminescence - Indophenol blue method
		24 Hours**	400	400	
Benzene (C_6H_6)	$\mu\text{g}/\text{m}^3$	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
Benzo (a) Pyrene (BaP) - particulate phase only	ng/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
Arsenic (As)	ng/m^3	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni)	ng/m^3	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

TABLE-3.16 AMBIENT AIR QUALITY MONITORING RESULTS

Details	A1	A2	A3	A4	A5	A6	A7	A8
PM_{10} , $\mu\text{g}/\text{m}^3$	68	71	64	62	70	62	63	60
$\text{PM}_{2.5}$, $\mu\text{g}/\text{m}^3$	30	31	23	23	25	23	27	26
NO_x , $\mu\text{g}/\text{m}^3$	19	19	19	19	20	19	22	21
SO_2 , $\mu\text{g}/\text{m}^3$	14	16	13	13	16	16	16	14
Carbon Monoxide, as CO, mg/m^3	0.42	0.92	0.37	0.46	0.47	0.67	0.46	0.46
Lead as Pb, $\mu\text{g}/\text{m}^3$	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)
Ozone as O_3 , $\mu\text{g}/\text{m}^3$	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)
Ammonia as NH_3 , $\mu\text{g}/\text{m}^3$	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)
Benzene as C_6H_6 , $\mu\text{g}/\text{m}^3$	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)	BDL (<0.5)
Benzo (a) Pyrene as BaP, ng/m^3	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)
Arsenic as As, ng/m^3	BDL (<0.2)	BDL (<0.2)	BDL (<0.2)	BDL (<0.2)	BDL (<0.2)	BDL (<0.2)	BDL (<0.2)	BDL (<0.2)
Nickel as Ni, ng/m^3	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)	BDL (<2)

TABLE-3.16 INDOR AIR QUALITY MONITORING RESULTS

Parameters	Tower 1	Tower 2	Tower 3	Tower 4	Standards
PM ₁₀ , µg/m ³	18.6	15.6	17.3	14.9	50
PM _{2.5} , µg/m ³	3.4	2.8	3.7	3.3	10
SO ₂ , ppm	0.01	0.03	0.01	ND	2.0
NO _x , ppm	0.04	0.06	0.3	0.04	1.0
CO, ppm	0.3	ND	ND	ND	9

3.9 NOISE ENVIRONMENT

The source of most outdoor noise worldwide is mainly evolved from industries, constructions and transportation systems, including motor vehicle noise, aircraft noise and rail noise, poor urban planning may give rise to noise pollution.

The noise generated due to operation of individual process units at project site cause significant impacts on the surrounding environment including nearby human habitats. There are also some secondary noise sources associated with almost all types of large scale projects, which are mainly vehicles and DG sets equipment at the project site. However, such sources could be categorized as intermittent/continuous noise sources depending on frequency/intensity.

A reconnaissance survey was conducted with a view to establish the baseline status of the environment with respect to the noise levels in the region particularly with respect to industrial activity in the region, sound pressure levels (SPL) were measured using precision sound level meter.

Survey was carried out in the following steps:

- Reconnaissance
- Measurement of background noise levels in the study area
- Identification and characterization of noise sources
- Measurement of prevailing noise levels due to vehicular movements

The impact of noise on the health of an individual depends on physical dose of noise viz. Noise level, frequency spectrum, annoyance etc and human factors viz sex, age

health status, type of activity, occupational exposure etc. The impacts also depends on psychological and physiological status of individuals, the impact due to noise do not undergo seasonal variations except some directional changes depending upon the environmental wind direction.

The environmental impact assessment w.r.t noise for the proposed project was carried out by taking various factors into consideration like potential physiological responses, annoyance and general community responses and also the existing status of noise levels within the study area. Existing noise levels have been monitored at different places within the study area. Ambient noise monitoring was carried out in residential, commercial, silence zones and roadside in the study area. Sound Pressure Level (SPL) measurements were undertaken at the project area & surrounding 10 km study area.

The prevailing ambient noise levels were monitored using precision noise level meter in and around 10Km distance in 8 locations during March to May 2019. The detailed of sampling locations are depicted in figure 3.10 and described in table 3.17

TABLE-3.17 NOISE QUALITY MONITORING LOCATIONS

Sample No.	Name of Sampling station	Distance km	Direction	Latitude	Longitude
N 1	Project Site	--		13°01'31.3" N	77°45'52.6"E
N 2	Kannamangala	0.4	NE	13°01'38.6" N	77°46'12.9"E
N 3	Goravigare colony	1.8	N	13°02'37.9" N	77°45'45.0"E
N 4	Chikkabanahalli	1.5	W	13°01'26.23" N	77°44'51.0"E
N 5	Seegehalli	1.1	S	13°00'43.0" N	77°45'54.0"E
N 6	Bhaktharahalli	3.0	E	13°01'17.9" N	77°47'43.9"E
N 7	Mallasandra	2.5	SE	13°00'30.4" N	77°47'2.1"E
N 8	Domsandra	2.8	SW	13°00'35.9" N	77°44'22.5"E

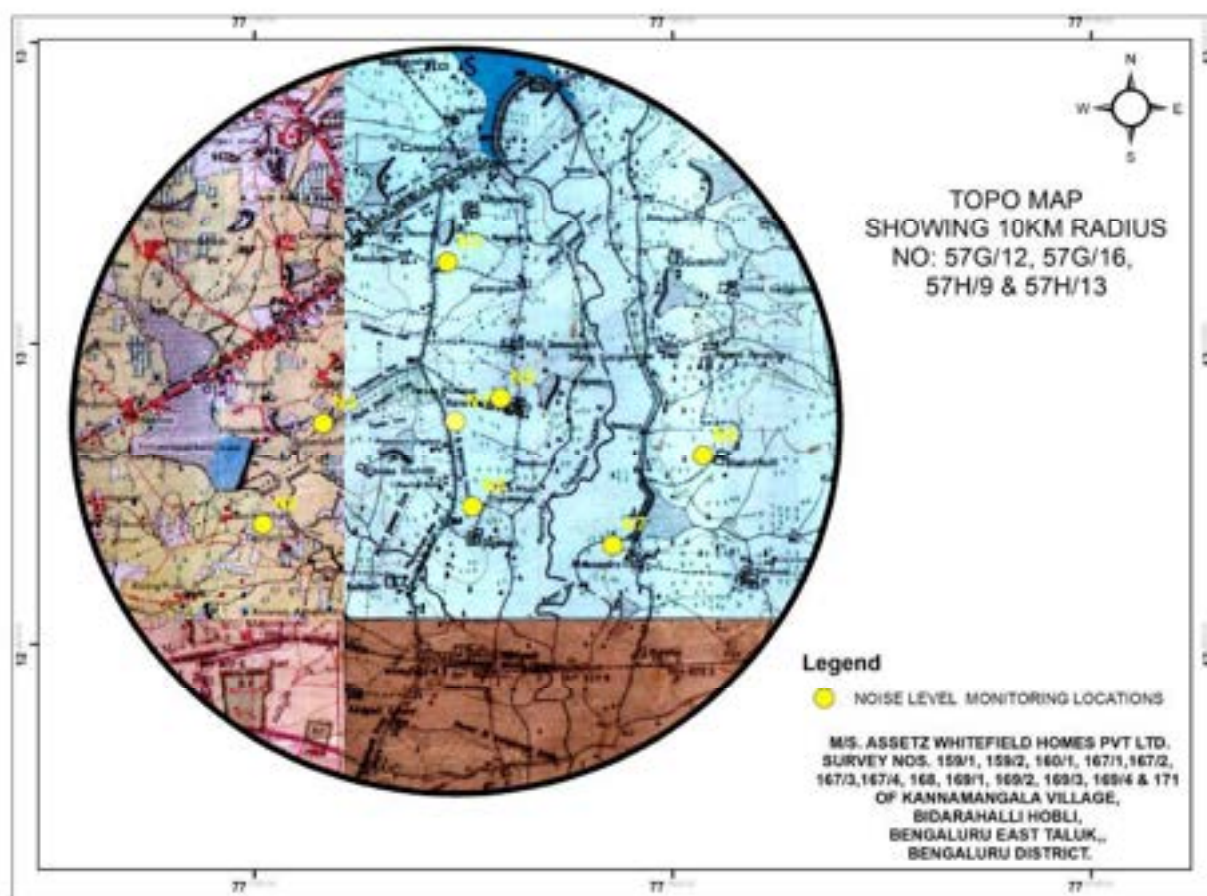


FIGURE-3.9 NOISE SAMPLING LOCATIONS

3.9.1 PARAMETERS CONSIDERED DURING MONITORING

For noise levels measured over a given period of time interval, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels are exceeded during the time interval. The notation for the statistical quantities of the noise levels are described below:

The computed noise level parameters for the project site are presented in below table.

TABLE-3.18 AMBIENT NOISE STANDARDS

Area Code	Category of Area	Noise Levels dB(A) L_{eq}	
		Day Time*	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

Source: CPCB

Note:

- * Day time is from 6 am to 10 pm.
- ** Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.

TABLE-3.19 MEASURED AMBIENT NOISE LEVELS dB (A)

Sample No.	Locations	Leq (day) in dB (A)	Leq (night) in dB (A)	Result dB (A)
N 1	Project Site	54.2	66.7	60.1
N 2	Kannamangala	49.5	57.1	53.2
N 3	Goravigare colony	51.8	58.2	54.9
N 4	Chikkabanahalli	49.3	56.7	52.9
N 5	Seegehalli	50.8	58.3	54.4
N 6	Bhaktharahalli	49.6	56.7	53.0
N 7	Mallasandra	50.3	57.4	53.7
N 8	Domsandra	51.4	60.4	55.7

FIGURE 3.11 GLIMPSES OF MONITORING OF POLLUTION AT SELECTED LOCATIONS



Project site: AAQ monitoring



Project site: Soil sample collection



Project site: Noise level monitoring



Project site: Water sampling



Kannamangala: AAQ monitoring



Kannamangala: Water sampling



Kannamangala: Soil sampling



Kannamangala: Noise monitoring



Goravigare colony: AAQ monitoring



Goravigare colony: Noise level



Goravigare colony: Soil sampling



Goravigare colony: water sampling



Chikkabanahalli: AAQ monitoring



Chikkabanahalli: Soil sampling



Chikkabanahalli: Water sampling



Chikkabanahalli: Noise level monitoring



Seegehalli: AAQ monitoring



Seegehalli: Noise monitoring



Seegehalli: Water sampling



Seegehalli: Soil monitoring



Bhaktharahalli: AAQ monitoring



Bhaktharahalli: Water sampling



Bhaktharahalli: Soil sampling



Bhaktharahalli: Noise monitoring



Mallasandra: AAQ monitoring



Mallasandra: Soil sampling



Mallasandra: water sampling



Mallasandra: Noise monitoring



Domsandra: AAQ monitoring



Domsandra: Water sampling



Domsandra: Noise monitoring



Domsandra: Soil sampling

FIGURE INDOOR AIR QUALITY MONITORING PHOTOS



3.10 BIOLOGICAL ENVIRONMENT

Study of biological environment is one of the most important aspects for Environmental Impact Assessment, in view of the need for conservation of environmental quality and biodiversity. Ecological systems show complex inter-relationships between biotic & abiotic components including dependence, competition and mutualism. Biotic components comprises of both plant and animal communities which interact not only within and between themselves but also with the abiotic components viz. Physical and Chemical components of the environment.

Generally, biological communities are the good indicator of climatic and edaphic factors. Studies on biological aspects of ecosystems are important in environmental impact assessment for safety of natural flora and fauna information on the impact of environmental stress on community structure serves as an inexpensive and efficient early warning system to check the damage to a particular ecosystem. The biological environment includes mainly terrestrial ecosystem and aquatic ecosystem.

3.10.1 OBJECTIVES AND METHODOLOGY

The present study was undertaken with following objectives:

- To assess the distribution of animal life spectra;
- To assess the biodiversity and to understand the resource potential.
- To assess the nature and distribution of vegetation in and around the existing project site;

Methodology of Data Collection:

Following methods are being adopted for the ecological study:

- Generation of primary data through systematic ecological studies in the study area;
- Secondary data collected from publications of various Government agencies like Forest Department, Agriculture Department etc.; and
- Consulting local people for gathering information on ethnobotany, local plants and animals.

3.10.2 BASELINE ECOLOGICAL DATA OF FLORA AND FAUNA DETAILS

The main objective behind gathering information about the ecology and biodiversity of the study area is to assess the existing baseline ecological conditions in the study area and correlate it with the data available with the Dept. of Forests to develop mitigation measures for the possible impacts from the project to the existing ecology.

FLORA:

The natural vegetation of the area may be broadly grouped into two types: the hilly vegetation, pond and riverbed vegetation apart from the roadside and avenue trees which are planted. The vegetation in general is regarded as deciduous jungle type with the exception of the valleys and a majority of species inhabiting these areas exhibit xeromorphy. Most of the area is under cultivation for several centuries and now there has been felling of all woody plants for fuel, resulting in growth of scrub vegetation. Vast areas are covered by thickets of extensive growth of *lanthana* (*bonthegali* / *rojan havu*) and other xeromorphic thorny shrubs rendering the area impenetrable and forming a most striking feature of the vegetation.

The hilltop plateau is not rich in tree forms and most of the area consists of barren rocks and huge tors. A few tree forms are scattered here and there and attain considerable height. The common species found on the hilltop are *Acacia nilotica* (*Karijali*), *Alangium salvifolium* (*Kalu Mavu*) etc. The ground vegetation consists of herbaceous forms and a covering of grasses and others like *Apluda mutica* (*Kaduhauchikadi*), *Argemone Mexicana* (*Datura*) etc. The hill slopes are poor in soil content and consists of steep rocks and have continuous erosion resulting in the formation of channels and streams. The valleys are transverse by small streams supporting on either side thick vegetation stimulating the evergreen type of vegetation. The riverbeds have thick growth of vegetation on either side. The most important flora and families that exist in Bangalore Rural district are Fabaceae, Poaceae, Cyperaceae, Asteraceae, Euphorbiaceae etc. Floriculture is very predominant in Devanahalli taluks.

FAUNA:

Early reports indicate that the ancient forests which covered the district had the lion, the tiger, the elephant, the cheetah, the jackal, wild buffalo, the yak, bison, etc. As the thick forests are almost vanished due to deforestation, the lion, the elephant, wild buffalo, the Bison, etc., are said to occasionally appear in the district. Domestic animals consist principally of horses, cows, bullocks, buffaloes, sheep, goat, asses, dogs, pigs, cats, cocks, etc., are plentiful. Apart from bullocks, the animals like cows and buffaloes are also occasionally used for agricultural operations. Below table represents list of flora and fauna observed during study period.

TABLE-3.20 LIST OF FLORA SIGHTED IN THE REGION

Sl No.	Common name	Botanical Name
1	Neem Tree	Azadirachta indica
2	Aarali Tree	Ficus religiosa
3	Aala Tree	Ficus benghalensis
4	Mango Tree	Mangifera indica
5	Akasha mallige	Millingtonia hortensis
6	Sampige Tree	Michelia champaca
7	Singapore cherry	Muntingia calabura
8	Nerale Tree	Syzygium cumini
9	Honge Tree	Terminalia Catappa
10	Silver Oak	Grevillea Robusta
11	Silver Trumpet Tree	Tabebuia argentea
12	African Tulip Tree	Spathodia companulata
13	Jacaranda Tree	Jacaranda Mimosifolia
14	Indian Laburnum	Cassia Fistula
15	Muttuga Tree	Butea monosperma
16	Queens Crape-Myrtle	Lagerstromia speciosa
17	Green bamboo	Bambusoideae
18	Yellow bamboo	Bambusa vulgaris
19	Acacia species	
20	Flame of the florests	Ixora coccinea
21	Senegal date palm	Phoenix reclinata
22	Oleander	Nerium oleander
23	Madagascar periwinkle	Catharanthus roseus
24	Basil	Ocimum basilicum
25	Pagoda tree	Plumeria indica
26	Cassava	Manihot esculenta
27	Malayan banyan	Ficus benjamina
28	Paper flower	Bougainvillea glabra
29	Screwpie	Pandanus utilis

30	European fan palm	<i>Chamaerops humilis</i>
31	Sago cycas	<i>Cycas revolta</i>
32	Hibiscus	<i>Hibiscus syriacus</i>
33	Barbados aloevera	<i>Alovera</i>
34	Beach spiderlily	<i>Hymenocallis littoralis</i>
35	Song of India	<i>Dracaena reflexa</i>
36	Parakeet flower	<i>Heliconia psittacorum</i>
37	Common guava	<i>Psidium guajava</i>
38	Valencia orange	<i>Citrus sinensis</i>
39	Eucalyptus	<i>Eucalyptus globulus</i>
40	Purple false eranthemum	<i>Pseuderanthemum carruthersii</i>

TABLE-3.21 LIST OF FAUNA SIGHTED IN THE REGION

Sl No.	Common name
1	Cow and its variety
2	Buffalo
3	Goat
4	Pig
5	Crows
6	King fisher
7	Hare
8	White ants
9	Dogs
10	Horses
11	Cat
12	Bees
13	Ox
14	Sheep
15	Parrot
16	Eagle
17	Pigeon
18	Snakes
19	Sparrow
20	Spotted dove
21	Duck
22	Black kite
23	Shikra
24	Cuckoo
25	Owl

3.11 SOCIO-ECONOMIC ENVIRONMENT

Major developmental activities in residential sector are to meet the basic as well as luxurious requirements of civilized modern society, economical development, creation of employment opportunities (direct as well as indirect), which ultimately results in improvement of quality of life through upliftment of social, economical, health, education, infrastructure etc. status in the project region. Almost all residential developments are also expected to generate/discharge different forms of pollutants in the surrounding environment. This may cause natural resource degradation, ecological and human health risks, unless the development is planned and implemented in a sustainable manner through implementation of pollution prevention and control measures. In this manner all developmental projects have direct as well as indirect relationship with socioeconomic aspects. Thus the study of socio-economic component incorporating various facets related to social & cultural conditions and economic status in the project region is an important part of EIA study. The study includes demographic structure, population dynamics, infrastructure resources, status of human health and economic attributes like employment, per-capita income, agriculture, trade and industrial development etc. The aesthetic environment refers to the scenic value of the area, tourist attraction, forest and wildlife, historic and cultural monuments. The studies of these parameters help in identifying, predicting and evaluating the likely impacts on socioeconomic aspects due to proposed project developments.

The **Methodology** adopted for the study mainly includes review of published secondary data of the study area of 10km radial distance from the periphery of the proposed project site, which comes under Bidarahalli hobli of Bengaluru Urban district in Karnataka state.

The study of socio-economic component of environment incorporating various facets related to socio-economic conditions in the area forms an integral part of EIA process. The study includes demographic structure, population dynamics, infrastructure, resources and economic attributes refers to employment, industrial development and financial sustainability of the project. The aesthetic environment

refers to scenic value of the area, tourist attraction, forest and wild life, historic and cultural monuments.

RECONNAISSANCE:

The proposed developmental projects will be commissioned within the residential zone. The study area covering 10 Km radial distances around the project site fall under Bangalore urban district. Besides the study area covers both urban settlements and rural region. Major part of study area is covered with highly undulated/hilly terrain mostly covered with natural vegetation as well as agro forestry especially in lower parts of hill slopes. In the study area, this is covered with number of small/medium scale industries. The infrastructure facilities including road network consisting Bengaluru - Hyderabad road, Bengaluru Airport and Bengaluru Railway (network) are well developed in project region. Keeping in view the existing residential activities, this belt has been merged into urban agglomeration of Bengaluru city in 2011 census.

3.11.1 BASELINE STATUS:

The latest available data has been complied to delineate the baseline socio- economic profile in study area. The data base thus compiled from secondary sources of various official records, viz. Census records, District statistical abstract, Primary Health Centres etc. and primary data collection through field survey as well as the observations by survey team study period include:

- Demographic structure
- Infrastructure base road network, communication, electricity,
- Education
- Health Status
- Economic attributes
- Socio economic status with reference to quality of life
- Awareness and opinion of people about the proposed project

The sample villages identified for socioeconomic survey in study area are shown in while they are listed in subsequent sections.

3.11.2 DEMOGRAPHIC STRUCTURE:

An official Census 2011 detail of Bengaluru, a district of Karnataka has been released by Directorate of Census Operations in Karnataka. Enumeration of key persons was also done by census officials in Bengaluru District of Karnataka.

TABLE 3.22 DEMOGRAPHIC STRUCTURES

	No. of House holds	Total population	Total Literates	Total Illiterates	Total Workers	Total Male Workers	Total Female Workers
Bandebommasandra	199	883	631	252	383	263	120
Bidarahalli	624	2621	1925	696	917	716	201
Chandapura	1240	4562	3428	1134	2252	1677	575
Doddabanahalli	310	1224	844	380	483	400	83
Gundur	307	1498	1036	462	714	439	275
Hancharahalli	257	1200	841	359	476	361	115
Hosahalli	315	1427	1033	394	706	499	207
Kammasandra	145	649	428	221	264	189	75
Kannamangala	1146	4381	3114	1267	2091	1613	478
Kattugollahalli	214	966	561	405	397	287	110
Kumbarahalli	357	1459	1087	372	563	444	119
Kurubarahalli	322	1378	869	509	688	457	231
Mallasandra	193	830	536	294	439	266	173
Rampura	598	2680	1752	928	1128	830	298
Sompura	311	1160	784	376	545	398	147
Varthur	284	1347	877	470	613	355	258
Alappanahalli	184	904	454	450	540	364	417
Bisanahalli	214	1004	520	484	597	407	442
Arlemakanahalli	4	15	9	6	11	4	14
Vadigehalli	21	103	41	62	69	34	32
Vagata	239	1098	557	541	796	302	426
Bisanahalli	223	1020	528	492	769	251	481
Alappanahalli	214	1103	565	538	772	331	514
Upparahalli	206	978	501	477	631	347	389
Chikka Amanikere	28	174	101	73	131	43	63
Sarakariguttahalli	263	1095	568	527	673	422	317
Doddagattiganabbe	79	335	176	159	240	95	129
Appajipura	21	89	50	39	71	18	43
Naduvathi	463	2197	1127	1070	1588	609	978
Chikkagattiganabbe	181	777	385	392	460	317	286
Cheemandahalli	145	606	322	284	380	226	228
Samethanahalli	999	4102	2067	2035	2972	1130	1707

CHAPTER - 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 INTRODUCTION

Environmental impact is the term applied to the systematic examination of the likely impacts due to the proposed modification and expansion of residential, commercial and School development of “*Assetz Marq*” project on the surrounding environment due to different project activities during construction and operation phase of the project.

This chapter deals with the Environmental Impacts due to project location, possible accidents, project design, project construction, regular operations, final decommissioning or rehabilitation of a completed project. The environmental impacts may be direct, indirect and cumulative impacts.

Environmental Impact study describes identification and appraisal of various impacts due to the proposed residential project. Environmental Impact can be defined as any alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration. Environmental impact assessment is one of the tools available with the planners to understand the impacts that would emanate from the proposed project.

The impacts on environment have been predicted for the proposed project assuming that the pollution due to the existing activities have already been covered under baseline environmental monitoring. Impact prediction is a way of ‘mapping’ the environmental consequences of the significant aspects of the project and its alternatives. Environmental impact can never be predicted with absolute certainty and this is all the more reason to consider all possible factors and take all possible precautions for reducing the degree of uncertainty.

The objective of study of Environmental Impacts is to foresee and address the potential environmental problems at an early stage of planning and design of the project. This study covers up to 10 km radius around the project location.

Generally, the environmental impacts can be categorized as either primary or secondary. Primary impacts are those which are attributed directly by the project

wherein secondary impacts are those which are indirectly induced and typically include the associated investment and changed patterns of social and economic activities by the proposed action. Some of these impacts would have long term and short term intuition on the surrounding environment.

4.2 IMPACT IDENTIFICATION MATRIX

From the table-4.1 significant environmental impacts are identified. They are further elaborated with characterization and assessment. Table-4.2 and Table-4.3 provide the characteristics of impacts from construction and operational activities of the project respectively.

TABLE-4.1: IMPACT IDENTIFICATION MATRIX

Activities	Environmental attributes							
	Air	Noise	Surface water	Ground water	Land & Soil	Ecology	Socio-Economics	Aesthetics
Site Clearing	0	0	0	0	0	0	0	1
Transportation of Raw materials	-1	-1	0	0	0	0	1	0
Construction Activities on land	-1	-1	0	0	-2	0	1	-1
Laying of Roads	-1	-1	0	0	-1	0	1	-1
Labor camps	0	0	0	0	0	0	0	0
Operation of DGs	-1	-1	0	0	0	0	0	0
Solid waste disposal	-1	0	-1	-1	-1	0	-1	-1
Wastewater disposal	-1	0	-1	-1	-1	0	-1	-1
Buildings and Landscape	0	0	0	1	1	1	0	1
Transportation	-1	-1	0	0	0	0	1	0
Recreation Activities	0	0	0	0	0	0	1	0

Grading of Impacts:

2-Most Positive, 1-Positive, 0-No Impact, -1 -Negative, -2-Most Negative

TABLE-4.2: ENVIRONMENTAL IMPACTS DUE TO CONSTRUCTION ACTIVITIES

Activity	Environmental Attributes	Cause
Site clearing	Air quality (SPM and RPM)	Dislodging of particles from the ground.
	Noise levels	Noise generation arises usually from earth excavating equipment and transportation vehicles.
	Land & Soil	Removal of vegetation cover and reduced soil stability.
	Aesthetics	Removal of weeds.
Transportation of Construction materials	Air quality (PM, SO ₂ , NO _x , CO)	Transport of construction material in trucks; exhaust emission from vehicles.
	Noise levels	Noise generation from vehicles.
	Risk	Risk of accidents during transport, loading and unloading.
Construction activities / Laying of roads	Air quality (PM, SO ₂ , NO _x , CO)	Operation of construction machinery, welding activities and others.
	Noise levels	Noise generation from use of machinery.
	Land & Soil	Reduced Soil Stability.
	Aesthetics	All Construction activities.
Construction Labours	Water quality (BOD, TSS, Fecal Coli form)	Discharge of untreated sewage.
	Land and Soil	Generation of solid wastes from construction activity.
	Socio-economics	Employment opportunities to local people & skilled & semi skilled labors.

TABLE-4.3: ENVIRONMENTAL IMPACTS DURING OPERATION PHASE

Activity	Environmental Attributes	Cause
Afforestation/ Landscaping	Ground Water	Ground Water Recharge.
	Land & Soil	Abatement of Erosion.
	Ecology	Afforestation.
	Aesthetics	Scenic views.
Vehicular traffic for conveyance of people	Air quality (SPM SO ₂ , NO _x , CO, HC)	Vehicle operation and fuel combustion.
	Noise levels	Noise generation from vehicles.
	Socio-Economic	Employment for local transport services.
Solid-Waste Disposal	Air Quality	Odour Nuisance.
	Water Quality	Surface runoff contamination and ground water contamination due to leachate.
	Land & Soil	Soil contamination due to leachate.

	Socio Economics	Objections from the local community.
	Aesthetics	Scenic blights.
Wastewater discharge	Water quality	Contamination of water resources due to untreated wastewater.
DG set, operation	Air quality	Exhaust emissions.
	Noise levels	Noise generation.

The impacts on each environmental component due to the proposed project activities are separately identified and suitable mitigation measures are recommended for the same. The likely to be affected six basic environmental components due to the above project activities are as follows.

1. Air Environment
2. Water Environment
3. Noise Environment
4. Land Environment
5. Socio-economic Environment
6. Ecology

The Environmental impacts on above environmental parameters due to the proposed project activities are discussed in detail in the following sections. The potential significant impacts due to proposed project activities on each environmental component are studied under mainly two phases,

- During Construction phase
- During Operation phase.

4.3 ANTICIPATED IMPACT AND MITIGATION MEASURES DURING CONSTRUCTION PHASE:

The impacts poses during construction phase will be temporary and restricted to small area for short duration. Depending upon the availability of the site details and impact characterization for the construction phase, it is identified that the construction phase impacts were low, short term and reversible. The impact on the environment arising during the construction phase are discussed in detail in the below sections.

4.3.1 AIR ENVIRONMENT

The impact causing project activities on Air Environment during construction phase are leveling of site, demolition work if any, construction and erection of buildings etc., and associated equipments in operation. Apart from this, activities also include dismantling of unwanted existing structures, site clearance, storage and haulage of construction materials and disposal of surplus earth, debris and refuse.

Air pollution due to the proposed project activities will mainly include gaseous pollution SO_2 , NO_x , CO and suspended particulate matter. The sources of air emissions during construction phase will include site clearing, emission from vehicles used for transportation of man and material to the site, emission from DG sets and from construction equipment. These emissions are expected to have temporary adverse impact on ambient air quality of surroundings of the construction site only on construction phase. Traffic at the site during construction will be more intensive and much heavier than normal operating conditions. In turn, it will subject roads to more stress. The prevailing soil surface particles within the proposed area shall have a tendency to become airborne by vehicular tyres once the area is disturbed by construction activities. This dust will lead to an increase in the background SPM concentration of the area. The building material carrying vehicles as well as the construction machinery generate emissions and pollute the environment. Dusts include brick and silica dusts, wood dust from joinery and other wood working and from earth moving and other vehicular movements within the site. Construction machinery poses a special threat to air quality. It is estimated that construction machinery emits toxic pollutants and are sources of fine particulate matter ($\text{PM}_{2.5}$) which lodges deeply in the human lung. Detail baseline study has been conducted for the air environment parameters and the same are recorded in the **Chapter - 3**.

Mitigation Measures: To mitigate these impacts, regular sprinkling of water will be done at the construction site. Approach roads will be black carpeted/asphalted and this will help to reduce the fugitive emissions. The vehicles, which are involved in construction activity, will be kept in good condition to minimize automobile exhaust.

4.3.2 LAND ENVIRONMENT

4.3.2.1 SOIL SUBSTRATA

The removal of soil cover will disturb the soil stability and texture. During construction, care will be taken to retain the present soil cover to the extent possible by proper construction management/planning. The stability of the soil will be re-established by proper preparation and better landscaping techniques. The substrata of this area are not rocky and as such no blasting is envisaged for either leveling or during foundation work.

Mitigation Measures: To conserve the soil substrata; soil disturbing activities will be restricted and will be minimum, preliminary landscape development will be done before construction and at the time of construction also. Top soil will be stored and reused for landscape development.

4.3.2.2 CONSTRUCTION WASTES

Construction wastes are the waste materials generated by the construction refurbishment of buildings and other structures. It mainly consists of earth, stones, concrete, bricks, lumber, roofing materials, plumbing materials, heating systems and electrical wires and parts of the general municipal waste stream.

Characteristics of Construction Wastes:

This category of waste is complex due to the different types of building materials being used but in general may comprise the following materials:

Major Components:

- Cement concrete
- Bricks
- Cement plaster
- Steel (RCC, door/window frames, roofing support, railings of staircase etc.)
- Rubble
- Stone (marble, granite, sand stone)
- Timber/wood (especially demolition of old buildings)

Minor Components:

- Conduits (iron, plastic)
- Pipes (GI, iron plastic,)
- Electrical fixtures (copper/ Aluminum wiring, wooden baton, Bakelite/ plastic switches, wire insulation)
- Panels (Wooden, laminated)
- Other (glazed tiles, glass panes)

Storage of Construction Waste:

These wastes are best stored at source, i.e., at the point of generation. All attempts will be made to stick to the following measures.

- All construction wastes will be stored within the site itself. A proper screen will be provided wherever necessary so that the waste does not get scattered and does not become an eyesore.
- Attempts will be made to keep the waste segregated into different heaps as far as possible so that their further gradation and reuse is facilitated.
- Material, which can be reused at the same site for the purpose of construction, leveling, making road/ pavement etc. shall also be kept in separate heaps from those, which will be sold or land filled.

Recycling and Reuse:

The use of these materials basically depends on their separation and condition of the separated material. A majority of these materials are durable and therefore, have a high potential of reuse. It would however, be desirable to have quality standards for the recycled materials. Construction waste can be used in the following manner:

Reuse (at site) of bricks, stone slabs, timber, conduits, piping railings etc. to the extent possible and depending upon their condition:

- Concrete and masonry waste can be recycled by sorting, crushing and sieving into recycled aggregate. This recycled aggregate can be used to make concrete for road construction and building material.
- Sale/ auction of materials, which cannot be used at the site due to design constraint or change in design.
- Plastics, broken glass, scrap metal etc. can be used by recycling industries.

- Rubble, brick bats, broken plaster concrete pieces etc. can be used for building activity, such as, leveling under coat of lanes where the traffic does not constitute of heavy moving loads.

Disposal:

Being predominantly inert in nature, construction waste does not create chemical or biochemical pollution. Hence maximum effort should be made to reuse and recycle them as indicated above and same will act as mitigation measure.

4.3.2.3 LAND USE

The construction of proposed residential apartment would bring in certain immediate changes in the land use pattern of the area as well as in the vicinity. The construction activities would attract a sizable labour population and the influx of population (skilled and semiskilled labours) is likely to be associated within the site premises. This however, would be temporary, especially during construction phase.

4.3.2.4 NATURAL DRAINAGE SYSTEM

As per the site scenario project site slopes towards South east direction with a higher contour level of 885 m in west and lower contour level of 876 m in the south east direction of the site as indicated in the contour plan. The contour map of the project site enclosed as ANNEXURE-7.

4.3.3 WATER ENVIRONMENT

The average water requirement for the construction work is estimated to be about 59 KLD. This water is drawn from treated water suppliers, hence there won't be any surface and ground water tapping for construction water requirement & there won't be any wastewater generation due to the construction activity.

The domestic water requirement during construction phase is estimated to be about 14 KLD and the source of water for this purpose is external water supplier. The sewage generated from the labours will be treated in mobile STPs.

Wastewater generation due to construction activity is nil and generated domestic wastewater from construction labours will be managed properly as said,

hence there won't be any adverse impact on ground and surface water during construction.

4.3.4 NOISE ENVIRONMENT

The sources of noise during construction phase are as follows:

- Handling of construction equipments
- Vehicular movements
- DG Sets for power back up

The major source of noise during construction phase are due to vehicular traffic and the operation of construction equipments like Dozers, Scrapers, Concrete Mixers, Pneumatic Tools, Vibrators, etc. The operation of these equipments will generate noise ranging from 85 to 95 dB (A) near source. The noise produced during the construction will have significant impact on the ambient noise levels. The construction equipment may have high noise levels, which can affect the personnel who are operating the machines. These noises will be generated within the existing site boundary and will be transient in nature.

Mitigation Measures

- Provision of insulating caps and enclosures at the exit of noise sources on the machinery
- Construction equipment generating minimum noise and vibration were chosen
- Internal speed limit for vehicles carrying construction materials are maintained with 15 kmph.
- Trained security men deployed for guiding smooth entry/exit without traffic congestion which will help in reducing honking conditions.
- Ear plugs provided to the workers exposed to high noise prone activities and it was enforced to be used by the workers
- DG sets with acoustic enclosures complying to Environment (protection) Rules provided
- 2 stage barricades will be provided all long the site boundary to avoid noise nuisance on the surrounding population

- Use of proper personal protective equipment will mitigate any significant impact of the noise generated by such equipment.
- Also, the utility of the noisy equipments will be restricted only during the day time; hence the impact on the neighbourhood due to the activity will be negligible.
- Construction activities will be carried out only during day time between 6AM-6PM to avoid psychological distress to nearby people and impacts on ecology.
- Noise levels will be periodically monitored to ensure stipulated standards as per CPCB norms.

4.3.5 ECOLOGY

There is no interference of the project on Terrestrial Ecology. The initial construction works at the project site involves no significant land clearance, cutting of trees, filling and levelling. So the construction activity will not result in any major loss of vegetation. And also the site is an unused land therefore there won't be any loss/effect on potential agricultural productive land.

The species identified within the terrestrial study area are not endangered, rare or protected; in addition, they will not be affected by the project. The increased construction vehicular traffic coupled with higher noise level due to various construction activities will drive away the fauna from the project site to the neighboring area. Therefore the impact of construction activities on terrestrial ecology will be negligible and mean while the project site will be extensively landscaped with the development of green belt consisting of variety of plant species which would enrich the ecology of the area and add to the aesthetics.

The sewage generated from labors will be treated in mobile STPs and domestic solid wastes generated will be handed over to outside vendors for further processing. Care will be taken that untreated wastes will not be discharged on to the land. Hence no major impacts are envisaged on ecology.

4.3.6 SOCIO-ECONOMIC ENVIRONMENT

There will be employment generation to the local people during the construction phase, as a significant proportion of the labour force is likely to be sourced from the local area. There will be employment opportunities for several skilled and unskilled workers in the area. There will be migration of labour force from outside the study area during construction phase which may put some pressure on the local settlement and resources. However, this impact is envisaged to be marginal and a temporary phenomenon.

4.4 OTHER CUMULATIVE MEASURES

Depending upon the availability of the site details and impact characterization for the construction phase it is identified that, the construction phase impacts will be low, short term and reversible. The construction activity will be restricted within the proposed plot premises only. Some of the mitigation measures adopted during construction phase of the project are:

- During construction phase, operations such as leveling, transportation, construction works, etc will be planned for most optimum schedule to reduce the impacts.
- Stockpiles of the fine materials should be wetted or covered with tarp during windy conditions.
- The dispersal of dust beyond the construction site will be reduced by erecting barricades around the site.
- By reducing the speed of a vehicle can reduce emissions by a large extent.
- Proper upkeep and maintenance of vehicles used for the purpose of transportation of construction materials.
- Workers on the site should be issued with dust masks during dry and windy conditions.
- Use of covering sheet should be done for construction trucks to prevent dust dispersion from the trucks.
- Sprinkling of water on construction site in order to suppress the dust.

- Maintenance of DG sets should be such that emissions shall comply with the norms notified by MoEF.
- By retaining sufficient vegetation at the construction site, since plants are good absorbers of Sulphur dioxide.
- Use of cleaner fuel for the construction vehicles.
- The construction activities will be carried out only during daytime in order to control noise pollution during night time.
- Schedule construction to avoid breeding times for fauna, or important recreation times for people.
- PPE will be provided to workers at site and construction machinery will be maintained properly to check on noise and emission levels within prescribed limits.
- The domestic wastewater will be collected in collection tank and Sprinkling of water on construction site in order to suppress the dust.
- The construction and domestic solid waste will be segregated and will not be allowed to mix with the construction waste.
- The generated domestic solid waste from labours and workers will be collected and handed over to authorized vendors.
- The excavated earth will be made use for refilling and landscaping within the site premises.
- The domestic solid and liquid wastes generated during the construction phase shall be properly handled such that there will not be direct discharge of untreated effluent on the land or water.

4.5 ANTICIPATED IMPACTS AND MITIGATIVE MEASURES DURING OPERATION PHASE

As the impacts during operational phase are long-term in nature, the activities related to the operational phase are identified and the impacts due to the same have been assessed and quantified. The details on impact of the project activity on each of the environmental attributes are discussed in subsequent sections.

4.5.1 LAND ENVIRONMENT**LAND USE PATTERN:**

The total land of the proposed project is about 113473.85 Sqm and the project site is designated as residential area as per CDP map.

IMPACTS ON SOIL: The soil quality in and around the site is likely to be affected by the disposal of untreated sewage. However, as the sewage will be treated to the urban re-use standards as stipulated by the KSPCB, no deterioration of soil quality is expected due to the utilization of the same for gardening. The generated solid waste will be collected separately as biodegradable and recyclables, stored in the storage yard. Biodegradable wastes will be processed in organic waste converter and the recyclables will be given to waste recyclers for further processing. Fuel for DG sets and waste oil from DG sets will be stored in leak proof containers on impervious floors. Hence, no significant impact on soil is envisaged during operation phase. However, the project site will witness additional tree plantation in the form of green belt development during operation phase, such plantation will stabilize the soil and helps to recover from the adverse impacts of the construction phase.

MITIGATION MEASURES: Impact on land use pattern from the proposed project is nil, following are the few mitigation measures will be adopted to prevent the impact on soil:

- Domestic solid wastes will be properly managed which comprises of organic and inorganic wastes. Since it is a residential project majority of the waste comprises of organic fraction which will be converted in to compost through organic waste converter and shall be used as manure.
- The inorganic wastes generated will be handed over to authorized recyclers for further processing.
- The container and bins used for collection of solid waste will be of closed type so that the waste is not exposed and thus the possibility of spreading of disease through flies and mosquitoes is minimized.
- By proper supervision of solid wastes collection system so that quick and regular removal of waste from the dustbin is practiced.

- Separate collection bins are provided at each block to collect the solid waste generated by residents.
- Hazardous wastes like waste oil from DG sets, used batteries etc shall be handed over to KSPCB authorized hazardous waste recyclers for further processing.
- The sludge from STP shall be used as manure for landscaping.
- The DG oil/ fuel, used oil/ fuel shall be stored at the designated place on the impervious floor in a closed container.

4.5.2 AIR ENVIRONMENT

The impact on air quality is assessed based on emissions of the proposed residential development. During operation phase of the project, various daily activities may have impact on air environment and its parameters. Operation phase will involve emission from vehicular movement, from diesel generators and negligible emissions from sewage and solid waste handling and disposal.

The project is not significant from air pollution angle as there are no continuous air pollution sources. DG set which is used purely as standby and shall be operated only in case of power outage/failure which are the only significant sources of air pollution during operational phase. As these DG sets are provided with adequate stack height as prescribed by CPCB, no impact of the same on air quality is envisaged. The emissions from the operation of DG sets will be in compliance with Environment (Protection) Second Amendment Rules, 2002.

MITIGATION MEASURES: Following are the few mitigation measures, adopted to prevent the impact on Air Environment:

- Usage of low-sulfur fuels to DG sets in order to reduce emissions. DG will be used as stand-by unit and usage will be restricted and will be used only in case of power failure.
- Emissions from DG sets shall comply with emission norms notified by CPCB.
- Regular monitoring and maintenance of ambient air quality parameters will be done, which shall be within the norms notified by CPCB (NAAQS), in order to check the surrounding air quality.

- Usage of speed limits will be adopted to reduce airborne fugitive dust caused by vehicular traffic from the project.
- Developments of greenbelt to a greater extent within the project site since plants are the good absorbers of SO₂.
- The vehicles used should have pollution under control certificate.

4.5.2.1 AIR QUALITY DISPERSION MODELING

Dispersion model is an essentially a computational procedure for predicting concentrations downwind of a pollutant source, based on knowledge of the emissions characteristics (stack exit velocity, plume temperature, stack diameter, etc.), terrain (surface roughness, local topography, nearby buildings) and state of the atmosphere (wind speed, stability, mixing height, etc.). The basic problem is to predict the rate of spread of the pollutant cloud, and the consequent decrease in mean concentration. The model has to be able to predict rates of diffusion based on measurable meteorological variables such as wind speed, atmospheric turbulence and thermodynamic effects. The algorithms at the core of air pollution models are based upon mathematical equations describing these various phenomena which, when combined with empirical (field) data, can be used to predict concentration distributions downwind of a source.

The Ground level concentrations of different pollutants such as PM, NO_x and CO have been calculated using an EPA recommended air quality model. The model used is the Lakes Environmental AERMOD View of Gaussian dispersion models.

Following data has been considered for the modeling.

- DG emissions: Totally 3X2000, 8X750, 2X500, 1X320, 1X100 KVA capacities of DGs.
- Diameter and height of the stack.
- Baseline ambient air quality monitoring data.
- Meteorological data.
- Traffic density as per the traffic study report.

TABLE 4.4 INCREMENTAL POLLUTANTS LOAD CALCULATION

			PM ₁₀ , µg/m ³			SO ₂ , µg/m ³			NO ₂ , µg/m ³		
	Direction	Dist. Km	Base line	Incremental	Resultant	Base line	Incremental	Resultant	Base line	Incremental	Resultant
A1	-	-	68	0.377	68.377	14	1.13	15.13	19	9.72	28.72
A2	NE	0.4	71	0.1	71.1	16	0.5	16.5	19	3.0	22.0
A3	N	1.8	64	0.1	64.1	13	0.5	13.5	19	3.0	22.0
A4	W	1.5	62	0.2	62.2	13	0.6	13.6	19	5.0	24.0
A5	S	1.1	70	0.1	70.1	16	0.5	16.5	20	3.0	23.0
A6	E	3.0	62	0.1	62.1	16	0.2	16.2	19	3.0	22.0
A7	SE	3.5	63	0.04	63.04	16	0.2	16.2	22	1.0	23.0
A8	SW	2.8	60	0.2	60.2	14	0.6	14.6	21	5.0	26.0

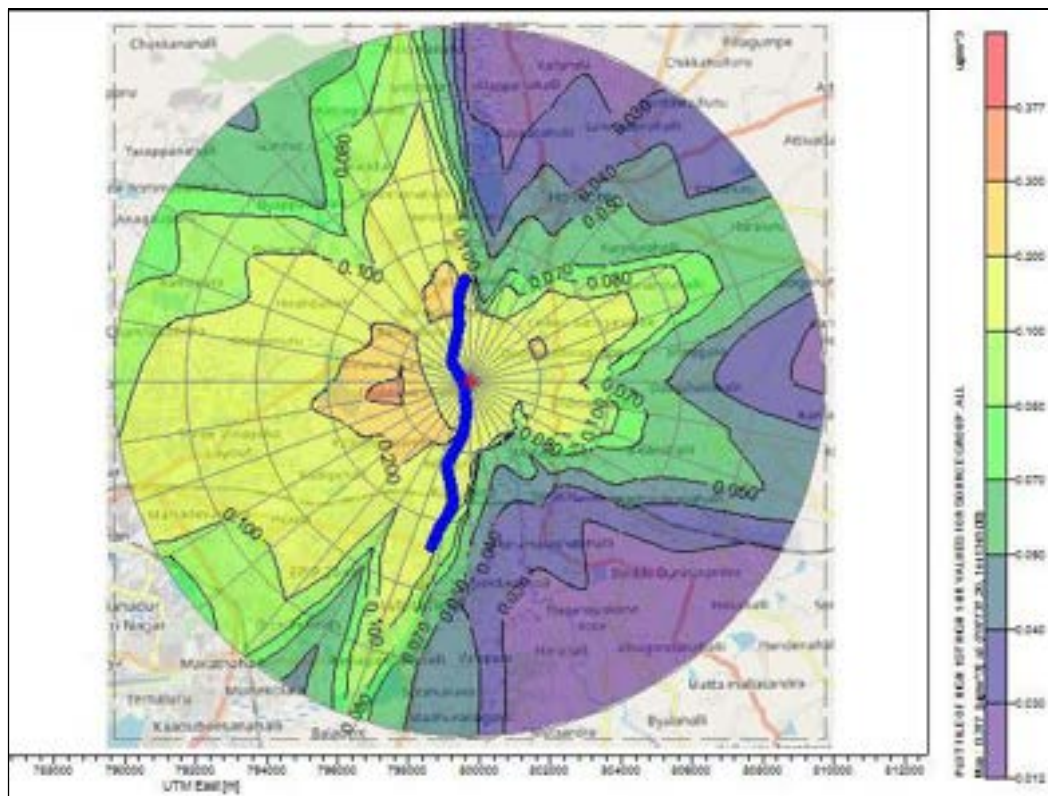
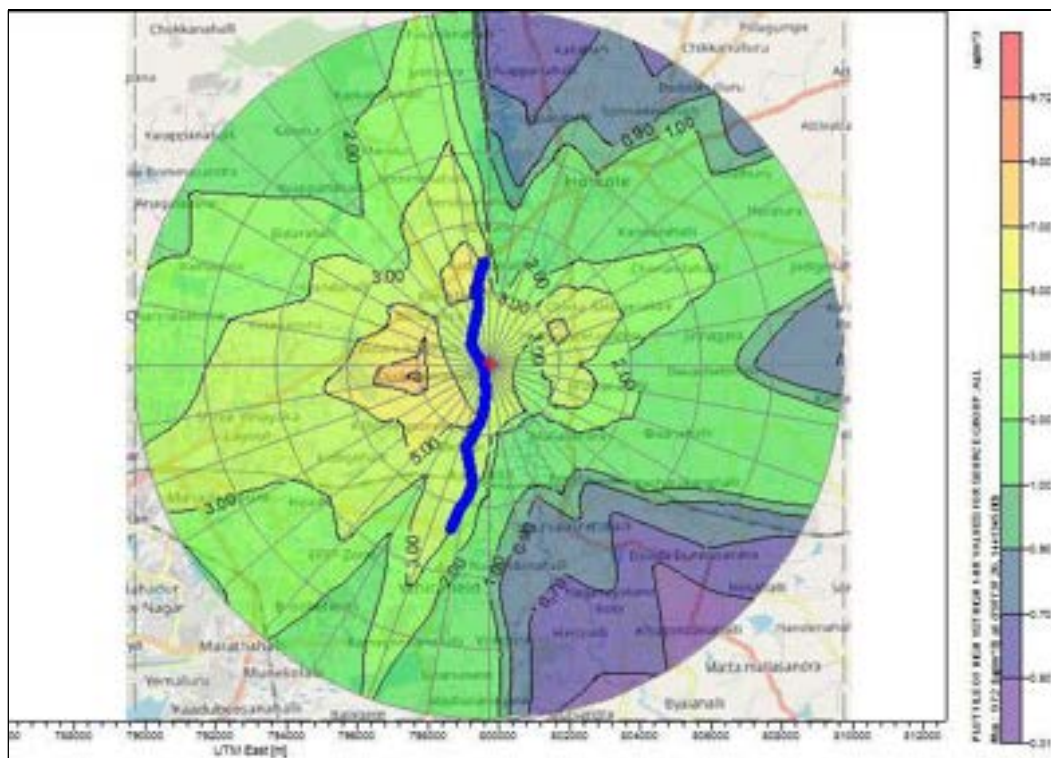


FIGURE 4.1 PREDICTED SPM CONCENTRATION

FIGURE 4.2 PREDICTED NO_x CONCENTRATION

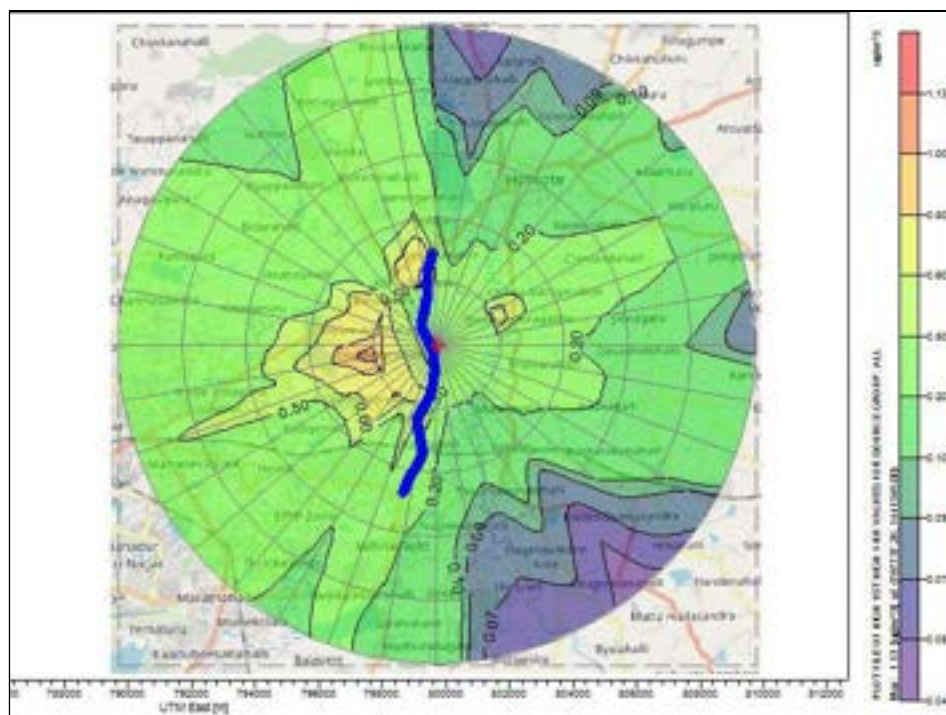


FIGURE 4.3 PREDICTED SO₂ CONCENTRATION

M/s. Assetz proposed residential apartment with the total site area of 1,14,526.04 Sqm with the total built up area of 4,38,971.66 Sqm. The project consisted of 1927 nos. of residential units. In the present study, Environmental impact assessment and air quality modeling predictions have been done by considering the baseline data collected during the period of March to May 2019. The predicted maximum ground level concentration of 1 hour average values are superimposed on the baseline data obtained during the study season to estimate the post project scenario and obtained resultant concentrations are all well within the NAAQS.

4.5.3 WATER ENVIRONMENT

The total water requirement for the proposed project is 1977 KLD which will be met from BWSSB and from tankers during crisis. The wastewater generated to the amount of 1777 KLD from the project which will be treated to the urban reuse standards stipulated by KSPCB. The wastewater from the proposed project involves wastewater from kitchen, civic amenities, residents etc which will be treated to the urban reuse standards and used for secondary purposes such as flushing and for gardening purposes. The STP report has been enclosed as ANNEXURE- 3.

The total land available for greenbelt and Park development is about 34218.06 sqmt (31.38%) and on podium 4121.14 Sqm (3.78 %) and in total comes around 35.16% landscape area. As per the observation of the soil, the category of the soil can be identified as sandy soil. With a minimum STP treated water application for landscape area including park and open space, for such soil types, it has been estimated that nearly 185 KLD of treated sewage can be applied on this soil.

As the total sewage generated from the project is around 1777KLD. Out of which 1688.0 KLD available as treated water. Therefore, 185 KLD will be utilized for gardening and about 700 KLD will be sent for flushing and for HVAC 160 KLD will be used and excess treated water is of 643 KLD.

As the sewage will be treated to meet the urban reuse standards and the same would be reused, we can say there is no adverse impact on ground and surface water is envisaged.

MITIGATION MEASURES: Following are the few mitigation measures will be adopted to prevent the impact on Water Environment.

- The sewage generated during operation phase will be collected through an internal network of sewerage system and discharge into the STP based Sequential Batch Reactor (SBR) technology and the treated water quality shall be conformed to the standards laid by KSPCB. Treated water will be reused for toilet flushing and for landscape development.
- Provision of dual piping system in order to utilize the treated sewage water for non potable purposes such as flushing and for landscaping etc.
- Installation of flow meters at water inlet points in order to monitor the consumption of water
- Use of water efficient fixture units which consume less amount of water compared to conventional type of units.
- Regular analysis of the STP treated water before using it for secondary purposes, which should comply with the KSPCB standards.

- By adopting rain water harvesting system with recharge pits and the reuse of roof top harvested rain water to the maximum extent to reduce the consumption of fresh water considerably after necessary treatment through softener.
- By the proper maintenance of sewer and storm water drainage system.
- Immediate attention towards the leaky plumbing fixtures.

TABLE-4.5 QUALITY OF TREATED SEWAGE FOR URBAN REUSE

Sl.No.	Parameters	Standards
1	p ^H	6-9
2	BOD ₅ mg/l	≤ 10
3	Turbidity, NTU	≤ 2
4	E-Coli	None
5	Res. Cl ₂ , mg/l	≥ 1

Note: Urban reuse includes landscape irrigation, vehicle Washing, toilet flushing, use in fire protection

4.5.3.1 STORM WATER MANAGEMENT

As the project location is blessed with fairly good rainfall, it is planned to collect the storm water at different gradients of the location. There will be rainfall runoff from building roof-tops, roads, pavements and greenbelt area. Necessary provision of will be made to collect the quantity of rainfall runoff during the most rainy day of season. Necessary rain harvesting pit / recharge pit at regular intervals have been envisaged. Internal garland drain with RCC precast perforated cover and a RCC precast recharge pit will be provided around the periphery of property.

RAINWATER HARVESTING FACILITIES:

As the growth of Bengaluru city is far ahead of the rate at which the water supply system is being upgraded, it becomes necessary to think of alternative source of water for the daily needs for secondary purposes like washing, gardening etc. In these lines, rain water harvesting is gaining importance and has been a part of building by-laws. The facilities to be established for rainwater harvesting include carriage (piping) system, pre-treatment unit (filtration) and a storage tank.

Roof rain water will be collected in roof rain water collection tank of capacity 320 Cum and same will be utilized after prior treatment. 43 nos of recharge pits will be

provided to recharge the ground water within the site. Hence excess runoff finds its way to storm water drain running near the project site.

4.5.4 NOISE ENVIRONMENT

The noise impacts are analyzed depending upon the people likely to be affected viz., people who are working near sources. People working near the source need damage risk threshold criteria for hearing, while the people who stay nearby need annoyance and psychological damage as the criteria for noise impact analysis. The noise levels in the work environment are compared with the standards prescribed by CPCB.

The major noise generating units in a proposed plant will be mainly from utility section such as DG. However, DG is proposed as standby arrangement. Besides, it will be located in closed and acoustically designed compartment (noise attenuating enclosure) hence no impact due to noise is envisaged.

MITIGATION MEASURES: Following are the few mitigation measures will be adopted to prevent the impact on Noise Environment

- DG sets will be provided with acoustic enclosure.
- Regular monitoring of noise level will be carried out and corrective measures in concerned activity and machinery will be adopted accordingly.
- Vehicles and machinery will be maintained properly.
- Sufficient green belt development will be done to help in reducing noise levels in the campus.

4.5.5 SOLID WASTE

Total quantum of solid waste generated from the proposed project will be of 7.26MT/day. Out of which, organic waste contributes to 40% i.e, 2.91MT/day and In-organic waste contributes to 60% i.e, 4.35MT/day, if this quantum of waste is not scientifically handled and discarded improperly which leads to leachate formation under moisture conditions or when layers come in contact with water, affecting ground water through leachate percolation slowly into subsurface soil. Also, this leads to losing the fertility of soil and intern odour nuisance / foul smell and attracts flies

and helps in breeding of mosquitoes/flyes/rats and may resulting in diseases causing serious health concern.

Improper maintenance of used oil from the operation of DG sets will have an impacts on the groundwater on long term through seepage into subsurface soil layers and indirectly aids in losing the fertility of the area. The waste oil when in contact with human skin leads to irritation to eyes/skin/nose causing health concern.

The generated STP sludge of about 98.5 Kg/d needs to be properly disinfected, as this may pose health concern for operating staff and resident's exposure to these areas will feel uncomfortable and experience the odour nuisance/ foul smell.

Open burning of solid waste leads to emissions escaping into the atmosphere resulting air pollution and also affects the in-house & neighborhood residents. Generation of household hazardous wastes like expired cosmetics bottles, batteries, cleaning agents, paints, mosquito/cockroach spray containers, and insecticides. If these are not disposed properly, there will be chances of contamination of groundwater through percolation of toxic constituents into subsurface soil layers especially during monsoon period and when it contact with human due to touch/inhalation/ingestion or by any means will seriously lead to health problems.

E-waste from the entire project will be generated includes used mobiles/batteries, expired CFLs, tube lights, electrical wires, used/old computers, CDs. E-wastes mainly contain heavy metals & toxic constituents and if unscientifically handled/managed, will leads to serious health concerns especially when they are burnt & discarded improperly.

MITIGATION MEASURES: Following are the few mitigation measures will be adopted to prevent the impact on Environment

- Implementation of Organic Waste Converter for treating organic solid wastes wherein the end product (manure) can be reused within the site premises for horticulture/ landscape development. Inorganic waste will be handed over to waste collector for recycling.
- Sludge generated from STP will be reused as manure for greenery development purposes.

- Waste oil generated from the DG sets will be collected in leak proof barrels and handed over to the authorized waste oil recyclers.
- Bio medical waste will be collected and stored in different colored bins as per the BMW rules, 1998 and dispose of the same to KSPCB authorized reprocessor.
- E-Wastes will be collected & stored in bins and disposed to the authorized & approved KSPCB E-waste processors.

4.5.5.1 COMPOSTING PROCESS USING “ORGANIC WASTE CONVERTER”

PROCESS:

The Organic Waste is converted into homogenized odour free output within 15 minutes through Bio Mechanical Process and is converted into COMPOST within two weeks which can be used in kitchen gardens and landscape applications.

Treatment Process Description:

- The Organic Waste is collected from each apartment, and is segregated for removal of plastics, glass etc. The Organic waste is fed into a mechanical unit which converts this into homogenized, crushed odor free output with in fifteen minutes.
- This homogenized odour free output will go to the curing system for stabilization.
- The process is controlled aerobic microbial decomposition which includes initial low p^H levels then high p^H levels and stabilizes.

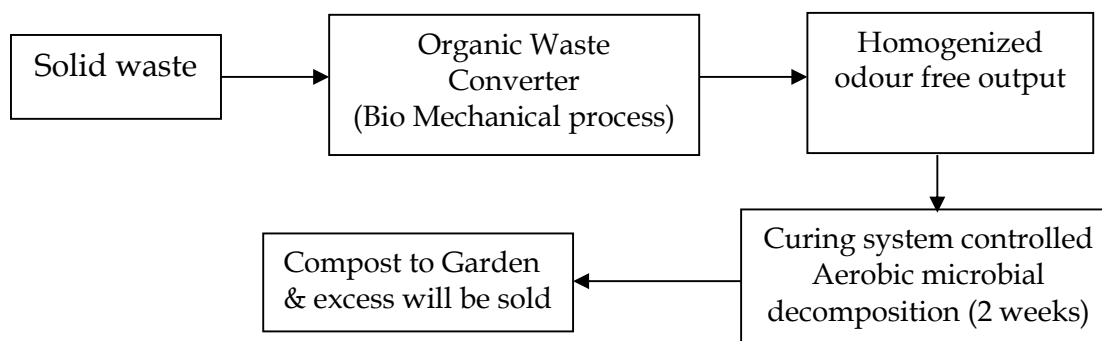
Special Advantage of the system:

- **Power Requirement:** - The Power required for operating this plant is lowest as the power is for 15 minutes for each batch. And the balance 14 days is natural aerobic microbial process.
- **Garbage Disposal:** - The storage, transportation and disposal of wet garbage is not required as it is safely treated at source and converted to high quality manure.

Advantages over other systems:-

- The manure is weed free and pathogen free as the process is aerobic.
- The surplus manure will be sold out for revenue generation.

Process of Organic Waste Converter:



4.5.6 ECOLOGY

The ambient air concentration of the pollutants released within the site viz. SO₂, SPM, RSPM, HC, & CO are well below the prescribed NAAQS and the sewage generated is also treated and recycled in compliance with the prescribed standards, no adverse impact of air pollutants and wastewater on the ecology is envisaged. On the other hand, extensive plantation and landscaping within the site will enhance its existing ecological value.

Proposed project is a residential development and is presently surrounded with other similar project and expected the same in future, therefore there won't be any adverse impact on the ecology.

TABLE-4.6 LIST OF EXISTING SPECIES IN THE PROJECT

Sl No	Common name	Total number
1.	Banana tree	8
2.	Maple Tree	4
3.	Acacia tree	5
4.	Eucalyptus	2
5.	Neem tree	5
6.	Coconut tree	5
7.	Date palm	3
8.	Citrus plant	4

MITIGATION MEASURES:

Vegetation is the natural extension of the soil ecosystem on a site. It can provide summer shade, wind protection, and a low-maintenance landscape that is adapted to the local environment. Unfortunately, the common practice is to remove the existing landscape cover and replace with a generic, water and maintenance-intensive lawn.

It is proposed to develop a minimum 31.38% of the total site area as greenbelt area which amounts to about 34218.0 Sqmt. Most trees proposed in the design are indigenous trees and native type of trees. Annual budget of require amount shall be allocated for this purpose. The plantation schedule shall be completed within construction period of the project.

Following approach will be adopted for Vegetation and Ground Management.

- It is planned to include an ecologically knowledgeable landscape architect as an integral member of the design team.
- Preservation of existing vegetation, especially native plants. Avoid fencing off property where possible to make landscape available to community increasing project integration.
- Avoid replacing mature trees with young seedlings.
- Protect existing plants during construction. Delineate the “drip line” around trees and demark or fence off areas to avoid damage.
- Contain heavy equipment and stockpiling areas to predefined areas.
- Design new plantings as diverse communities of species well adapted to the site. Plant native species of varying ages. Select vegetation that attracts wildlife.

TABLE-4.7 LIST OF SPECIES FOR THE PROPOSED PROJECT

Sl. No	TREE VARIETY		Approx. Nos./ Qty
	Common Name	Botanical Name	
1.	Devil tree	alstonia scholaris	20
2.	Burflower-tree	anthocephalus kadamba	20
3.	neem tree	azadirachta indica	20
4.	silk-cotton	bombax malabaricum	10
5.	Bottle brush	callistemon	20

6.	apple blossom tree/ rainbow shower tree	cassia fistula	20
7.	Indian laburnum / Golden shower cassia	cassia javanica	10
8.	Whip Tree	cassia marginata	10
9.	Scarlet Cordia/ Orange Geiger Tree	colvillea racemosa	10
10.	Indian laburnum / Golden shower cassia	cordia sebestena	20
11.	Indian coral tree	erythrina blakeana	30
12.	cockspur coral tree	erythrina cristagalli	20
13.	Neeli gulmohur	jacaranda mimoseaefolia	10
14.	Pride of India	lagerstroemia flos reginae	20
15.	Common Crape Myrtle	lagerstroemia thorelli	20
16.	Chinaberry tree/ Bead tree	millingtonia hortensis	10
17.	Champa	melia azadarach	20
18.	Moulmein Rosewood	micrelia champaca	10
19.	Indian Cork Tree, Tree Jasmine	milletia ovalifolia	25
20.	spanish cherry / Bullet wood	mimusops elengi	20
21.	Copperpod	peltophorum inerme	10
22.	frangipani/ Temple tree	plumeria acutifolia	20
23.	white frangipani	plumeria obtusifolia	10
24.	Pongam tree/Indian beech tree	pongamia glabra	20
25.	Sita Ashok, Sorrowless tree	saraca indica	10
26.	Mahogany	sweitena microphylla	20
27.	Jamun tree	sygium cumenii	10
28.	Rose apple	sygium jambos	10
29.	Silver trumpet tree	tabebuia argentea	25
30.	Pink trumpet tree	tabebuia avellandae	25
31.	Rosy trumpet tree	tabebuia rosea	25
32.	Indian almond tree	terminalia catappa	20
TOTAL			600

TABLE 4.8 LISTS OF GROUND COVERS, SHRUBS AND CREEPERS

GROUND COVERS	Nos.	SHRUBS	Nos.
arachis pinto	20	allamanda spp	50

ferns	40	alocasia spp	40
haemerocallis	20	alpina spp	40
hymenocallis	20	bauhinia sulphurica	50
lantana selloviana	30	brunfelsia americana	30
liriope	20	ceasalpinia pulcherrima	30
maranta	30	clerodendron spp	40
ophiopogon	20	crinium	30
pilea	40	euphorbia spp	30
portulaca	20	fransiscea bicolour	20
reinwardtia	20	galphima glauca	20
spathyphyllum	30	gardenia jasminoides	50
symgonium	25	schefflera	50
wadelia	25	tabernamontana spp	20
zephranthus spp	40		
TOTAL	400	TOTAL	500

4.5.7 SOCIO-ECONOMIC ASPECTS

The proposed development is in a favorable position to generate and sustain stable levels of employment, wage levels, continued improvements in living standards and the quality of life in the project surrounding area.

As the proposed project brings employment generation, both skilled and unskilled, it is obvious to assume that, all the economic activities in the project area would induce considerable improvement in the socio-economic levels of people. The occupational phases of the project will have a potentially positive impact on local economy and society. Additionally, it has an affirmative impact and induces development of other sectors like school, colleges, health centers recreational centers etc. The impact of human settlement is expected to be positive, as rises the living standards of the people, literacy rate, and working class of people and also generates indirect employment.

4.5.8 NATURAL HAZARDS

There will be no impact of natural hazards on the proposed project, since the proposed project site comes under seismic zone – II, which is a low damage risk zone. Hence possibility of any natural hazard and risk would be nil. Due to the susceptibility of the project area to natural hazard such as cyclones/storm, flooding, earth quake, tsunami

etc which would result on substantial damage and loss to the proposed project. Hence consideration must be given to these possibilities. Proper emergency response and action plan and disaster management plan should be followed in order to control any type of disaster from these natural hazards.

4.6 OTHER CUMULATIVE MITIGATION MEASURES

Following are the other cumulative mitigation measures adopted in the proposed project

- Renewable energy will be used throughout the residents, wherever it is possible and practical to do so.
- Regular inspections of drainage systems will be performed to ensure that the drains remain clear of blockages to safeguard against flooding.
- Selection of plants for landscaping should consider the local habitat suitability, feeding trees, trees of national interest, flowering trees and shrubs.
- Preventing direct channelling of storm water to the existing lake.
- Public health and safety in the event of predictable events.
- Establish regulations and promote environmental awareness amongst the residents, visitors and staff e.g. using posters or signs.
- By establishing EMP cell.

CHAPTER - 5

ALTERNATIVE TECHNOLOGIES AND SPECIFIC STUDIES

5.1 GENERAL

This chapter deals with the consideration of alternative site and alternative technologies to be used in building materials, in energy conservation. And in transport, which details the traffic impact study, and its management measures and other alternatives if any for the proposed project.

The proposed project involves mainly two phases i.e. construction phase and operation phase. Since it is a residential apartment project, there will be general activities, during construction phase and operation phase of the project; hence there will not be much alternative option exists. However some optimum alternatives can be applied for the proposed development which is discussed in this chapter.

5.2 NEED OF ALTERNATIVES

A good part of the world's energy is consumed by the construction related projects. Building is dependent on endless supply of high quality materials and energy resources. Buildings on a global scale consume about 40% of the raw stone, gravel and sand, 40% of energy and 16% of the water each year. This result in depletion of non-renewable materials and resources, production of waste bi-products, release of pollutants and deterioration of the air, water, soils and the habitat that surrounds it.

It is necessary that one should try to find various alternatives and what is environmentally best being preferred. Hence we are in a great need of saving energy consumption through the adoption of alternative technologies for the upcoming projects.

The present time demands use of sustainably managed materials. These are the materials that are environmentally preferable and have a mitigated degree of adverse impact on environment and human ecosystem when compared with equivalent products for the same application. Use of sustainably managed materials is an environmental responsibility in contributing towards a sustainable habitat. Their basic characteristics that are required in the present scenario are, ability of natural resource

conservation, low embodied energy, potential of recyclability and reuse and low emission levels of toxic substances or pollutant release in each stage of material life cycle.

5.3 ALTERNATIVE TECHNOLOGIES

5.3.1 BUILDING MATERIALS

The conventional practice of clay, brick consumes large quantity of energy in terms of coal and other fuels which are primarily non-renewable and highly polluting. Water requirements of building industry are also very high. Steel which is used in the construction process is manufactured by non-renewable resource. Normally conventional materials used for construction are non-renewable sources.

Use of alternative technologies for each component of the buildings of envelope, superstructure, finishes and the road and surrounding areas are discussed in detail.

Some of proposed building materials are given below:

- Brick and block products with waste and recycled contents such as fly ash, blast furnace slag, sewage sludge, waste wood fiber etc.
- Fly ash based lightweight aerated concrete blocks can be used for walls.
- Perforated bricks can be used for wall structures.
- Use of precast walls, roof, staircase, etc.
- Use of renewable timber for doors and windows
- Use of steel manufactures from recycled content
- Saw dust based doors and window frames
- Ferro-cement shutters, PVC doors and windows, Rice husk boards, Natural fibre-reinforced polymer composite door panels
- Alternatives for finishes include Fly ash, Ceramic tiles, Terrazzo floors

The use of the alternatives for building materials will help reduce the use of non-renewable resources and impact on natural resources.

5.3.2 GREEN BUILDINGS

The appearance of a Green Building will be similar to any other building. However, the difference is in the approach, which revolves around a concern for extending the life span of natural resources; provide human comfort, safety and productivity. This approach results in reduction in operating costs like energy and water, besides several intangible benefits. Some of the salient features of a Green Building are:

- Minimal disturbance to landscapes and site condition
- Use of Recycled and Environmental Friendly Building Materials
- Use of Non-Toxic and recycled/recyclable Materials
- Efficient use of Water and Water Recycling
- Use of Energy Efficient and Eco-Friendly Equipment
- Use of Renewable Energy
- Indoor Air Quality for Human Safety and Comfort
- Effective Controls and Building Management Systems

Issues in Green Building:

- Energy Efficiency and Renewable Energy
- Building orientation to take advantage of solar access, shading, and natural lighting
- Effects of micro-climate on building
- Thermal efficiency of building envelope and fenestration
- Properly sized and efficient heating, ventilating and air-conditioning system
- Alternative energy sources
- Minimization of electric loads from lighting, appliances, and equipment
- Utility incentives to offset costs

Direct and Indirect Environmental Impact:

- Integrity of site and vegetation during construction
- Use of integrated pest management
- Use of native plants for landscaping

- Minimization of disturbance to the watershed and additional non-point-source pollution
- Effect of materials choice on resource depletion and air and water pollution
- Use of indigenous building materials
- Amount of energy used to produce building materials

Resource Conservation and Recycling:

- Use of recyclable products and those with recycled material content
- Reuse of building components, equipment, and furnishings
- Minimization of construction waste and debris through reuse and recycling
- Easy access to recycling facilities for building occupants
- Minimization of sanitary waste through reuse of grey water and water-saving devices
- Use of rainwater for irrigation
- Water conservation in building operations
- Use of alternative wastewater treatment methods

Indoor Environmental Quality:

- Volatile organic compound content of building materials
- Minimization of opportunity for microbial growth
- Adequate fresh air supply
- Chemical content and volatility of maintenance and cleaning materials
- Minimization of business-machine and occupant pollution sources
- Adequate acoustic control
- Access to daylight and public amenities

Community issues:

- Access to site by mass transit and pedestrian or bicycle paths
- Attention to culture and history of community
- Climatic characteristics as they affect design of building or building materials
- Local incentives, policies, regulations that promote green design

- Infrastructure in community to handle demolition-waste recycling
- Regional availability of environmental products and expertise

Building Green concentrates on one key aspect of the greening process: the use of plants in and around urban buildings. Green buildings and green spaces together define an integrated approach to plant life in cities that is central to any green programme. Trees and shrubs can help reduce overall energy use in buildings. The amount of energy saved depends on the building type, choice of tree species, positioning around the building and the prevailing climate.

Balconies and small terraces have become standard architectural features for multiple dwelling developments. The balcony garden is a natural development of the balcony's role as a link between interior and exterior environments.

Green walls - Modern cities provide enormous areas of wall space, in many cases stretching high above the street. Not all of this space is appropriate for growing plants, but much of it is - certainly much more than has been utilized in recent years.

Roofs present by far the most significant opportunities for the greening of buildings. Many cities have millions of Sqmt of unused and unattractive roofs. They represent enormous wasted opportunities for improving the quality of city life. Some of the advantages for green roof include:-

- Protection of roof surface from ultra-violet radiation and mechanical damage
- Thermal insulation
- Acoustic insulation
- Lower maintenance costs for roofing materials
- Reduction of storm water runoff
- Gardens for inhabitants of buildings
- Masks ugly rooftops
- Complements building forms
- Absorption of CO₂, some air pollutants and dust

The basics benefits of Green Building systems are,

- Up to 23.76% reduction in energy consumption
- Limited waste generation due to recycling
- Less consumption of water
- Reduced pollution load & liability

5.3.3 ENERGY CONSERVATION

There is a need to adopt energy efficient technologies for conservation of energy. The proposed project is a development of residential apartment project and few energy conservation measures are adopted by using energy efficient devices and through solar energy. The details of power requirement and energy savings would be achieved is as detailed below:

Construction of the buildings will require additional power and energy requirement. To minimize the energy consumption, buildings will be designed and constructed according to Energy Conservation Building Code 2007 which sets minimum energy standards for buildings. The following methods could be implemented to the proposed buildings.

Some of the energy saving options which will be informed to all the occupants and Maintenance staffs;

- Turn off all lights when not in use, especially in common rooms.
- Clean or replace your air-conditioner filters.
- Usage of Solar water heating systems
- Usage of energy efficient equipment and appliances.
- Usage of CFL/LED lamps.
- Use of glazed windows with proper sealing to minimize infiltration
- Planting deciduous varieties of trees on the south and on the west will help keep buildings cool in the summer and allow sun to shine in the windows in the winter.
- Shade trees will save up to 40% on your summer cooling costs when the trees mature.

Followings are the Energy conservation measure which will be adopted by M/s. Assetz in proposed project:

- Use of hollow concrete block masonry with high thermal resistance to reduce cooling load
- Use of copper wound transformer
- Use of under deck insulation in the roofs to reduce cooling load
- Use of high efficiency lamps CFL/LED
- Use of occupancy sensors and dimmers for lights in the parking areas
- Use of LED light fittings or star rated light fittings in common areas
- Use of Variable frequency drives motors in the diesel generators and pumps.

As the proposed project is a development of residential apartment, no walls are made of glass; wherein only windows have glazed doors. Clear glasses are used for the windows, which is of low emission & low solar heat gain characteristics.

The ECBC norms is fully complied with design and equipments and same is enclosed as ANNEXURE 10.

5.3.5 TRANSPORTATION

Some of the factors are important and must be taken into the consideration, while planning, are the movement of heavy traffic loads and operation of construction machinery. Construction machinery due to its operation produces smoke, dust and noise and vibration. Internal road design should be done with due consideration for environment, and safety of the people residing or working near the roads. Proper sidewalk should be provided for the residence to commute.

The width of sidewalk depends upon the expected pedestrian flows and should be fixed with the help of guidelines given by IRC in IRC: 103-1988.

- For the proposed residential development 10% additional Car Parking facility is proposed as per NBC 2005.
- Parking facilities at basement, ground and first floors is proposed to reduce the heat island effect.

- Internal circulation to provide for movement of fire tender, paving that permits infiltration of rain water, avoidance of very sharp and blind corners
- Elimination of risks to children and old people in crossing the internal roads to reach play areas and recreational facilities.

The complete traffic study report has been enclosed as ANNEXURE- 11 to this report.

5.4 ALTERNATIVE SITE

No alternative sites were selected as the proposed project is an expansion of residential apartment, commercial building & Marq School. The location of the site is well situated with proper drainage and approach roads and other infrastructural facilities, also sufficient land is available for the proposed development including landscape area.

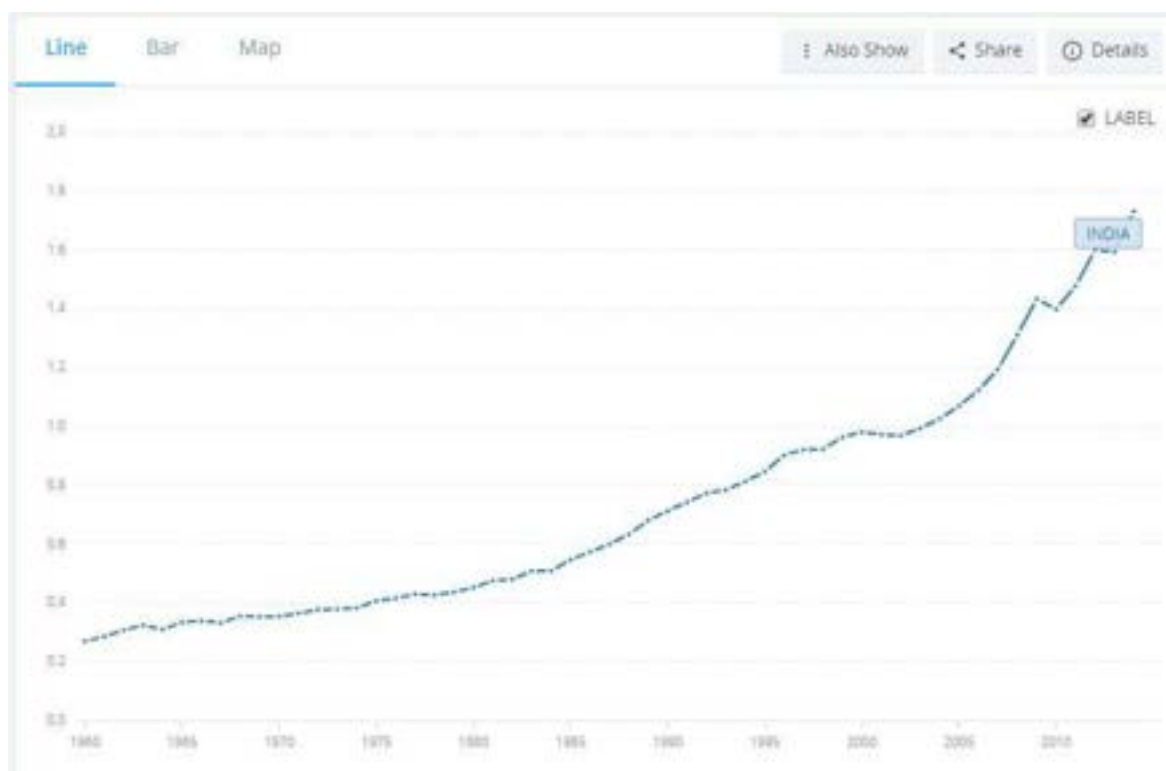
The development of the proposed project will be under taken as per applicable statutory guidelines and accordingly required statutory clearances will be obtained for the proposed development of the project. The important supporting factors which made the proponent to select the particular site are:

- Due to availability and easy accessibility of all basic facilities like water, power, man power, fuel, raw materials etc.
- Availability of workers in nearby places, during construction as well as in operation.
- Availability of good communication and transportation facilities.
- Proposed project site is around 19 km from Bengaluru city railway station and bus terminal, which is well connected with the other parts of the state.
- Proposed project site is around 18.5 km from Kempegowda International Airport.
- The project site is situated in Bangalore city.
- No ecologically sensitive area falls within 10 km radial distance around the proposed project site.

By considering all these criteria's, selection of the project site has been done, hence for the proposed project selection of the alternative site is not required.

5.5 ESTIMATION OF CARBON FOOT PRINT FOR CONSTRUCTION AND OPERATION PHASE ALONG WITH OFFSET DETAILS.

A carbon footprint is the total sum of greenhouse gas (GHG) emissions caused by an organization, event, product or person. As we are aware, the increasing concentration of GHGs in the atmosphere can accelerate climate change and global warming, it is very necessary to measure these emissions from our day to day activities.



Source: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States.

The infrastructure requirement is increasing considerably due to different phases of development. Hence, different types of infrastructure are to be constructed to meet this scenario. This necessitates utilization of different types of materials for construction. Infrastructure interacts with the environment resulting in higher Carbon dioxide emission into the atmosphere and ultimately resulting in Global Warming.

Life Cycle of a building comprises of four phases namely-Pre construction, Construction, Operative and Recycling. Estimates show that about 80 percent of energy gets consumed during the operative phase and remaining will get consumed in other phases like indoor air quality, HVAC. The entire process in the Life Cycle of a building gives rise to complex interaction phenomena between the Construction Materials, Embodied Energy footprint and Global warming

The construction sector is a substantial area for mitigation efforts because of its economic importance and its involvement with indirect GHG emissions, i.e. those embodied in construction supply chains, including construction materials and electricity use. While the majority of policies and regulations focus on reducing direct emissions from buildings, more attention needs to be paid to the embodied emissions of the whole sector as these can take up anywhere between 10% and 97% of the whole life-cycle carbon emissions.

The construction industry requires the extraction of vast quantities of materials and this, in turn, results in the consumption of energy resources and the release of deleterious pollutant emissions to the biosphere. Each material has to be extracted, processed and finally transported to its place of use. The energy consumed during these activities is critically important for human development, but also puts at risk the quality and longer term viability of the biosphere as a result of unwanted or 'second' order effects. Many of these side-effects of energy production and consumption give rise to resource uncertainties and potential environmental hazards on local, regional or national scales. Energy and pollutant emissions such as carbon dioxide (CO₂) may be regarded as being 'embodied' within materials. Thus, embodied energy can be viewed as the quantity of energy required to process, and supply to the construction site, the material under consideration. In order to determine the magnitude of this embodied energy, an accounting methodology is required that sums the energy inputs over the major part of the material supply chain or life-cycle.

Present context, this is taken to include raw material extraction, processing and transportation to the construction site 'cradle to- site' approach. Likewise the emission

of energy-related pollutants (like CO₂), which is a concern in the context of global warming and climate change, may be viewed over their lifecycle. This gives rise to the notion of 'embodied carbon'.

TABLE 5.1 EMBODIED ENERGY OF MATERIALS

Sl. No.	Material	Percentage contribution to EE
1.	Cement	41.6 %
2.	Stone chips	1.32 %
3.	Sand	1.6 %
4.	Bricks	7.64 %
5.	Steel	46.9 %
6.	6 mm Glass	0.03 %
7.	Anodised Al	0.11 %
8.	Stone finishing	0.8 %

Total Embodied Energy (EE) of the materials 100%

Source: Embodied energy analysis of multi storied residential buildings in urban India., S. Bardhan., Dept. of Architecture, Jadaopur University, India.

TABLE 5.2 CARBON FOOT PRINT DURING CONSTRUCTION PHASE

Description	Quantity	Units	Embodied energy, MJ/Kg	EC, KgCO ₂ /Kg	Total CO ₂ in Tonnes
RCC	189536	cum	1.39	0.148	91.5
Cement	102421	MT	4.6	0.62	63501.1
20mm Jelly	147200	MT	2	0.056	8243
12.5 mm Jelly	98134	MT	2	0.056	5265
Sand	171019	MT	0.85	0.005	1427
Steel	18680	MT	24	1.7	7226
concrete for flooring works	16015	Bags	4.5	1.21	152
Glass	38205	Sqm	15	0.85	32.1
Timber	12830	Nos	8.5	0.46	7.9
Paint	1125979	Kgs	30	1.25	1406
TOTAL					87352

Source: Hammond, G. P. and Jones, C. I. (2008) Embodied energy and carbon in construction materials. Proceedings of the Institution of Civil Engineers - Energy, 161 (2). pp. 87-98. ISSN 1751-4223.

5.5.1 OFFSETS DURING CONSTRUCTION PHASE

The following effective measures will be adopted to reduce the present carbon footprint values.

1. Incorporating the most efficient heating, ventilation and air conditioning systems, along with operations and maintenance of such systems to assure optimum performance.
2. Using recycled content building and interior materials
3. Use eco friendly construction materials with low emission co-efficient.
4. Using locally produced building materials
5. Implementing proper construction waste management
6. Use energy efficient fuels for transportation
7. Use vehicles adhering to emission norms.
8. Remove unnecessary weight from vehicles.
9. Avoid burning of paper waste.
10. Reuse resources whenever possible.

TABLE 5.3 CARBONFOOT PRINT DURING OPERATION PHASE.

Description	Quantity	Units	Tonnes CO2 emissions per flat/year	Tonnes of CO2 emissions
Electricity	18693.92	kW	0.89	1715
LPG Cylinders	14.2	Per house	0.2	386
Vehicular movement	1927	Per house	1.5(Considering 25km/day)	2891
Composting	2.91	MT	0.15	289
Food usage	Avg		3	5781
DG sets	1420	KVA	0.05	96
Others			3	5781
TOTAL			8.79	16939

5.5.2 OFFSETS DURING OPERATION PHASE

The following effective measures will be adopted to reduce the present carbon footprint values.

	Best management practices	CO2 offset during operation phase per flat.	Tonnes of CO2 offset
1.	Adopt proper waste management techniques like composting	0.35	1018
2.	Plantation of more trees.	0.06	152
3.	Reducing potable water usage	0.5	964
4.	Using renewable energy	0.05	96
5.	Use solar power	0.1	195
6.	Reduction in food waste	0.1	193
7.	Switching to organic foods	0.4	771
8.	Adopting Rain water harvesting	0.005	10
			3399

The total carbon emission from the project in operation phase will be 16939 tonnes/year and by adopting the best management practices the amount of carbon offset that could be achieved will be 3399 tonnes/year which is almost reduction of 20%. As per the Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States, the amount of carbon emission per person would be 1.75 tonnes/year and by practicing the sustainable practices it is possible to achieve carbon reduction more than 20%.

Sources & References

Calculation Methodology;

Electricity: Input value (in KWh/Yr) X 0.85 (Emission Factor) = Output value in (Kg of CO2)

Petrol: Input Value (In Litres/Yr) X 2.296(Emission Factor) = Output value in (Kg of CO2)

Diesel: Input Value (In Litres/Yr) X 2.653 (Emission Factor) = Output value in (Kg of CO2)

LPG: Input Value (In Kg/Yr) X 2.983 (Emission Factor) = Output value in (Kg of CO2)

Your Carbon Footprint: Add (1+2+3+4) = Output value in (Kg of CO2)

Divide final value (no 5) with 1000 so that you get total carbon footprint in ton of CO2.

Final Carbon footprint should be in tons of CO2 (tCO2.).

Know more about the source of emission factors;

Electricity = 0.85 kg CO2 per KWh, Source: CO2 emission factor database, version 06, CEA (Government of India), http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm.

Motor gasoline/ Petrol = 2.296 kg CO2 per liter, Source: Emission factors are taken from the file "Emission factors from across the sector -tool", extracted from <http://www.ghgprotocol.org/calculation-tools/alltools>

Diesel= 2.653 kg CO2 per litre, Source: Emission factors are taken from the file "Emission factors from across the sector -tool", extracted from <http://www.ghgprotocol.org/calculation-tools/alltools>

Liquefied petroleum gas (LPG) = 2.983 kg CO2 per kilogram, Source: Emission factors are taken from the file "Emission factors from across the sector -tool" extracted from <http://www.ghgprotocol.org/calculation-tools/alltools>.

CHAPTER – 6

ENVIRONMENTAL MONITORING PROGRAM

6.1 INTRODUCTION

Environmental monitoring is important parameter to assess the status of environment during construction and operation phases of the project. Environmental monitoring program includes the technical aspects of monitoring and monitoring the effectiveness of mitigation measures (including measurement methodologies, frequency, location, data analysis, reporting schedules, emergency procedures, detailed budget and procurement schedules). The details include summary matrix of environmental monitoring, location of monitoring stations, frequency of sampling, method of sampling analysis, parameters of monitoring and data evaluation during construction and operation stages; requirement of monitoring facilities; comparison with base line data and compliance to accepted norms & reporting system including plantation monitoring programme.

An impact assessment study comprises of two main phases, in relation to that, Environmental Monitoring Program will be carried out in the same two main phases and are:

- Assessment of the present environmental condition, (Baseline).
- Prediction of the impact of future development.

Regular monitoring of environmental parameters is more importance to assess the status of the environment during operation of the project. Baseline conditions will serve as an indicator for any deterioration in environmental conditions due to operations of the project.

As the impact assessment study is carried out for a short period of time and the collected data cannot bring out all variations persuaded by the natural & human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environmental quality. The objectives of monitoring are:

- To verify the results of the impact assessment study in particular with regards to new development.
- To follow the trend of parameters which have been identified as critical;
- To check or assess the efficiency of the controlling measures.
- To establish a data base for future Impact assessment studies for new projects.
- To ensure that new parameters, other than those identified in the impact assessment study, do not become critical through the commissioning of new development.
- To check assumption made with regard to the development and to detect deviations in order to initiate necessary measures; and
- To establish a data base for future Impact assessment studies for new projects.

The attributes, which merit regular monitoring, are specified underneath:

- Ambient air quality
- Ambient noise quality
- Water and wastewater quality
- Landscape development

The post project monitoring to be carried out at the project is discussed in the following sections.

6.2 MONITORING AND REPORTING PROCEDURE

Regular monitoring of important and crucial environmental parameters is of immense importance to assess the status of environment during operation of the project. With the knowledge of baseline conditions, the monitoring programme can serve as an indicator for any deterioration in environmental condition due to the construction of residential apartment and its operation and suitable mitigatory steps could be taken in time to safeguard the environment. Monitoring is as important as that of control of pollution since the efficiency of control measures can only be determined by monitoring.

The monitoring program would be a comprehensive monitoring programme as suggested underneath. Environmental attributes should be monitored as given below:

6.2.1 AMBIENT AIR QUALITY

CONSTRUCTION PHASE:

During baseline study, i.e. before construction of proposed building; air monitoring has been carried out at eight locations, including project site and the results are discussed in chapter-3. The ambient air quality monitoring shall be carried out during the construction phase of the project. Once the construction activity starts, regular monitoring of the ambient air, once in three months will be carried out at project site.

The parameters to be monitored are Particulate Matter-2.5 $\mu\text{g}/\text{m}^3$, Particulate Matter-10 $\mu\text{g}/\text{m}^3$, Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Ozone, Lead, Carbon monoxide, Ammonia, Benzene, Benzo (a) Pyrene (BaP), Arsenic, and Nickel.

OPERATION PHASE:

Once the proposed residential apartment would start operation, regular monitoring of the ambient air, once in six months will be carried out at the site.

The parameters to be monitored are Particulate Matter-2.5 $\mu\text{g}/\text{m}^3$, Particulate Matter-10 $\mu\text{g}/\text{m}^3$, Sulphur Dioxide (SO_2), and Nitrogen Dioxide (NO_2).

6.2.2 AMBIENT NOISE QUALITY

CONSTRUCTION PHASE:

During baseline study, i.e. before construction; ambient noise monitoring has been carried out at eight locations, including project site and the results are discussed in chapter-3. Noise emissions from vehicular movement, operation of various construction equipments shall be monitored during construction phase. The frequency of monitoring will be once in three months at two stations within in the premises of the project site.

OPERATION PHASE:

Ambient noise level within the project site will be monitored at two locations once in six months during the operation phase of the project in order to ensure that noise levels are within the permissible limits as prescribed by the Board.

6.2.3 WATER AND WASTEWATER QUALITY**CONSTRUCTION PHASE:**

During baseline study, i.e. before construction; ground water quality analysis has been carried out at eight locations including project site, within the study area of 10 km and the results are discussed in chapter-3.

Similarly, during baseline study; 2 lake water quality analysis has also been carried out at surface water (lake) within the study area of 10 km and the results are discussed in chapter-3. Once the construction of the project starts, the groundwater quality analysis will be carried out once in three months within the project site.

The parameters to be monitored are physical, chemical and biological characteristics.

OPERATION PHASE:

During operation phase of the project, ground water quality analysis will be carried out once in six months within the project site. Along with this, regular analysis (monthly once) of sewage treatment plant (STP) treated water will be carried out for the following parameters, which will be maintained within the prescribed KSPCB limits.

And also water conservation methods used are to be done regularly which includes,

- Use of water meter conforming to ISO standards will be installed at the inlet point & at the discharge point to monitor the daily water consumption.
- Implementation of dual piping system.
- Awareness among the occupants regarding optimal usage of water & reuse.
- Rainwater harvesting facilities are proposed.
- Immediate attention towards the leaky plumbing fixtures.

6.2.4 LANDSCAPE DEVELOPMENT

CONSTRUCTION PHASE:

Initial landscape development will be started during construction phase itself, and landscape activities will be carried out on setback area, on walk ways etc.

OPERATION PHASE:

Once project starts operation, other landscape activities will be done and maintenance of the same will be carried out by maintenance staff.

Landscape maintenance activities include

- Fertilizer dosing
- Repotting
- Watering etc.

6.3 INFRASTRUCTURE FOR ENVIRONMENTAL PROTECTION

In the proposed residential apartment project the infrastructure facility for environmental protection will be established. This cell shall be head by project manager supported by junior staff and maintenance staff; this cell will be framed to monitor the environmental status periodically in operation phase.

Following table depicts the list of equipments used; test method and monitoring schedule for environmental parameters.

TABLE: 6.1 LIST OF EQUIPMENTS USED AND TEST METHOD

Sl No	Attributes		Equipment Used	Test Method
1.	Ambient Air		High Volume air sampler	IS 5182
2.	Ambient Noise		Noise dosimeter/Sound level meter	Lab Method
3.	Stack Monitoring		Stack Monitoring kit	IS 5182
4.	Water (Ground & Surface)	Chemical	Manually - Standard Procedure	IS 3025
		Micro biological	Manually- Standard Procedure	IS 1622
5.	Waste Water		Manually- Standard Procedure	IS 3025
6.	Soil		Manually- Standard Procedure	Lab Method
7	Indoor Air quality		Handy Sampler	ASHREE

TABLE: 6.2 MONITORING SCHEDULE FOR ENVIRONMENTAL PARAMETERS

Sl. no	Particulars	Monitoring frequency	Duration of sampling	Important monitoring parameters
1.	Stack Monitoring			
	DG stacks at project premises	Once in three months	As per the standard procedure	SO ₂ , NO _x , SPM, CO, Temperature, Flow Rate
2.	Ambient air quality Monitoring			
	Project premises	Once in three months	24 hours Continuous	PM ₁₀ & PM _{2.5} , NO ₂ , SO ₂
3	Ground/Drinking Water Quality Monitoring			
	Ground water at project site	Once in three months	Grab sample	Parameters specified under As per IS -10500, 1993
4	Sewage Quality Monitoring			
I	Treated sewage prior to discharge	Monthly once	Composite	pH, BOD ₅ , COD, Turbidity, E-Coli, Res.Cl ₂
5	Ambient noise levels			
	Project premises in 2 locations	Once in a month	8hr continuous with 1hr interval	Ambient Noise Standards
6	Greenbelt development			
	Project premises	Continues	Continues	--
7	Indoor air quality			
	Inside building	Once in 6 months	Continuous	ASHREE standards

TABLE: 6.3 ENVIRONMENTAL MONITORING PLAN & COST DURING OPERATION PHASE

Sl. No.	Item	Parameter	Frequency	Location	Unit cost per sampling & Analysis (Rs)	Samples per year (No)	Cost per year (Rs)
1	Air quality	PM ₁₀ & PM _{2.5} , NO ₂ , SO ₂	Half yearly	5 sites around periphery of site	3500	10	35000
2	Indoor Air quality	PM ₁₀ & PM _{2.5} , NO ₂ , SO ₂	Half yearly	5 nos.	3500	10	35000
3	Ambient Noise	Equivalent noise level	Half yearly	5 sites around periphery of site	500	10	5000
4	Exhaust from DG set	SO ₂ , SPM	Half yearly	Stacks of 1X2500, 3X2000, 8X750, 2X500, 1X320, 1X100 KVA DG	3500	32	112000
5	Insertion loss of DG set	Equivalent noise level	Half yearly	Nearby DG sets (16 Nos.)	350	32	11200
6	Waste water analysis	p ^H , BOD, COD, TSS, TDS	Monthly	STP 290 KLD, 510 KLD, 570 KLD, 50 KLD, 360 KLD	2500	60	150000
Total Cost During Operation Per Year							2,78,200

CHAPTER – 7

ADDITIONAL STUDIES

7.1 ENVIRONMENTAL RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

7.1.1 RISK ASSESSMENT

Risk assessment refers to identifying and evaluating hazards identified within the system. Risk assessment is the determination of quantitative or qualitative value of risk related to an actual situation and a recognized threat (also called hazard). In all types of engineering of complex systems sophisticated risk assessments are often made within safety engineering and reliability engineering when it concerns threats to life, environment or machine functioning.

And it is also an orderly way of studying and analysing the project, more than simply designing it and a clear understanding of the project objectives, all alternatives, and all issues that need to be considered during the design and construction.

The purpose of risk assessment is:

- To ensure that potential safety problems are properly understood or not.
- To check whether existing control measures (including emergency plans) are adequate or not.
- To determine what is necessary to reduce risks to a reasonable level.
- To prioritize unacceptable risks identified by the assessment and determine further action.

7.1.2 RISK MANAGEMENT

A risk management plan was developed to address the risk identified in the risk assessment process. Risk management is a structural approach to managing uncertainty related to threat, a sequence of human activities including: risk assessment, strategies development to manage it, and mitigation of risk using managerial resources.

The strategies include transferring the risk, avoiding the risk, reducing the negative effect of the risk.

7.1.3 STEPS IN THE RISK MANAGEMENT PROCESS

- ✓ Identification of risk in a selected domain of interest.
- ✓ Planning the remainder of the process.
- ✓ Mapping out the following
 - The social scope of risk management.
 - The identity and objectives of stake holders.
 - The basis upon which risks will be evaluated, constraints.
- ✓ Defining a frame work for the activity and an agenda for identification.
- ✓ Developing an analysis of risk involved in the process.
- ✓ Mitigation of risks using available technological, human and organizational resources.

The major risk identified due to the probable hazards in the project site during construction and operation phase of the project and precautionary measures as a part of emergency response plan is discussed in the below sections.

- Failure of machinery
- Working at heights
- Transport vehicles
- Loading and unloading
- Hazards pertaining to fires in buildings.
- Fire in diesel storage areas, garbage storage and disposal area.
- LPG gas leak
- Electrical Accidents
- Spills
- Occupational Noise Exposure
- Housekeeping
- Bio hazards
- Ergonomics hazard

7.1.4 SAFETY ASPECTS PROPOSED DURING CONSTRUCTION:

The project authorities must recognize the causes of safety hazards in construction site and establish programs, rules, regulations, guidelines, whatever else might be necessary to reduce accidents.

1. Management:

- The management structure and responsibilities of the various members of the project team, whether based at site or elsewhere.
- Arrangements for the principal contractor to give directions and co- ordinate other contractors.

2. Standard setting: The health and safety standards to which the project will be carried out. These may be set in terms of statutory requirements or higher standards that the client may require in particular circumstances.

3. Information for contractors: Informing contractors about risks to their health and safety arising from the environmental in which the projects are to be carried out and the construction work itself.

4. Communications and co-operation: Communicating and passing information between the project team, the designers, the planning supervisor, the principal contractor, other contractors, workers on site and others whose health and safety may be affected.

5. Selection procedures: Machinery and other plant supplied for common use will be properly selected, used and maintained; and that operator training will be provided.

6. Information and training for people on site: Arrangements need to be made by which the principle contractor will check that people on site have been provided with:

- Health and safety information
- Health and safety training
- Information about the project (e.g relevant parts of the health & safety plan)

SAFETY MEASURES:

The safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 - Constructional practices and safety, 2005, National Building code of India, Bureau of Indian Standards shall be complied with.

- Provide clean drinking water to all workers.
- Provide adequate number of decentralized latrines and urinals to construction workers.
- Guarding all parts of dangerous machinery.
- Precautions for working on machinery.
- Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition.
- Durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.
- Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.
- Provide Personal Protective Equipments (PPEs); helmets etc..
- Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area and elsewhere.
- Dangers, health hazards, and measures to protect workers from materials of construction, transportation, storage etc.
- Employment of Fire/Safety officer at project site

The following needs to be implemented:

1. Fall Protection

- * The Contractor is required to provide fall protection to employees who are working at heights equal to or greater than 2.0 m. Fall protection can be in the form of perimeter protection such as guardrails and toe rails, personal protective equipment (PPE), or a fall protection plan.
- * Where scaffolds are not used, safety nets will be installed and maintained whenever the potential fall distance exceeds two storeys.

- * The PPE standard should cover occupational foot, hand, head, hearing, and eye protection.
- * To the greatest extent possible, working surfaces must be kept dry to prevent slips and falls and to reduce the chance of nuisance odours.
- * All equipment and materials would be stored in designated storage areas that are labelled as such.

2. Ladders and Stairs

- * Portable ladders used for access to an upper landing surface must extend a minimum of 1.5 m above the landing surface, or where not practical, be provided with grab rails and be secured against movement while in use.
- * The Contractor is required to inspect and maintain all ladders and temporary/portable steps to ensure that they are in good working condition.
- * All ladders must be used only on stable and level surfaces.
- * All access points must be kept clear.

3. Scaffolds

- * Access to Scaffolds - access to and between scaffold platforms more than 0.6m above or below the point of access will be made by portable/attachable ladders or ramps.
- * Employees must never use makeshift devices, such as boxes and barrels, to increase the scaffold platform working level height.

4. Excavation

- * The area around the excavation must be protected with barrication and kept clear of surface encumbrances.
- * Water would not be allowed to accumulate in the excavation.
- * Guardrails or some other means of protecting people from falling into the excavation would be present.

5. Electrical Safety

- * If work has to be done near an overhead power line, the line must be de-energized and grounded before work is started.
- * Fuses and circuit breakers would be used to protect motherboards, conductors and equipment
- * Extension cords for equipment or as part of a temporary wiring system will not be damaged or compromised in any way and insulation must be of the highest grade.
- * Temporary lights would not be suspended by their cords.
- * All the necessary safety equipment and monitoring equipment to be provided
- * Anytime electrical equipment is deactivated for repair, or circuits are shut off, the equipment will be locked out and tagged at the point where it can be energized.

6. Occupational Noise Exposure

- * The Contractor would implement engineering controls to reduce noise levels.
- * The Contractor would provide hearing protection to employees that are exposed to noise levels above the permissible limit.

7. Cranes

- * A competent person has been designated to supervise activities that require the use of cranes.
- * Cranes would not be operated near any power lines.
- * All picks would be carefully planned to ensure that the crane adequately hoist the load.

8. Welding and Cutting

- * The Contractor's employees would be trained in hot work procedures.
- * There must be adequate ventilation to reduce the build up of metal fume.
- * The hot work operators would use proper personal protective equipment (i.e., welding helmet, burning goggles, face shield, welding gloves, and apron).

- * There would be a fire extinguisher present at all welding and burning activities.

9. Sign Boards/ Caution Boards

- * Signs and symbols would be visible during any construction activity that presents a hazard. Upon completion of such activity, the postings must be removed immediately.
- * The Contractor would post specific DANGER signs when an immediate hazard exists and specific CAUTION signs when the potential for a hazard exists.
- * Danger signs are posted at all immediate hazards (i.e. Danger: Open Hole).
- * Caution signs are posted at all potential hazards (i.e. Caution: Construction Area, Caution: Buried Cable).
- * Every floor, working place and passageway would be kept free from protruding nails, splinters, holes or loose boards.

10. Fire Fighting

- * All new building construction will ensure compliance with applicable state, local, and national fire and life safety standards.
- * Portable fire extinguishers will be installed
- * Measures will be proposed to reduce the incidence of fires by eliminating opportunities for ignition of flammable materials
- * Extinguishers must be noticeably located and readily accessible for immediate use in the event of fire.
- * Extinguishers should be clearly visible. In locations where visual obstruction cannot be completely avoided, directional arrows will be provided to indicate the location of extinguishers and the arrows will be marked with the extinguisher classification.
- * In the event of a fire emergency, a fire alarm would be provided for the building
- * Inspection, maintenance, and testing of fire extinguishers will be ensured so that they are in proper working condition.
- * Fire Hose would be provided at identified places and it should be free from any obstructions.

Following are the recommendations:

- Exclusive UGR of capacity 200cum of 2 Nos, 100cum of 1 No for Buildings – 1, 2 and 3, below ground level and OHT of each 10,000 Lts for each towers and capacity on Terrace floor level is envisaged.
- Total no of hydrant valves for the proposed building would be as per NBC-2016 for every 100 nos hydrant valves 1 set of fire fighting pumps to be provided.
- As per NBC-2016 requirement, for every 100 no's of hydrants one set (1No. sprinkler & 1No. hydrant + 1No. Diesel + 2Nos. Jockey = 1 set) pump shall be provided, But 2 sets of pumps are provided for this building.
- 1 no's. Main electrical driven hydrant pump of duty 2850 LPM @ 130 m head.
- 1 no. Diesel Pump of duty 2850 LPM @ 130 m head.
- 2 no's. Jockey pump of duty 180 LPM @ 130 m head shall be provided.
- 1 no. Sprinkler Pump exclusively for Sprinkler system with a capacity of 2850 LPM @ 130m Head.
- 1 no's. Water curtain nozzles Pump of capacity of 1620 LPM @ 50m Head.

Alternative secondary set of pumps:

- 1 no. Diesel Pump of duty 2850 LPM @ 130 m head.
- 1 no. Jockey pump of duty 180 LPM @ 130 m head shall be provided.
- One No. Wet riser of 150 mm dia is provided for every 1000 m² of floor area/each stair case core.
- Fire Hose Cabinet is envisaged with double headed hydrant valve and hose reel at each staircase landing level.
- Portable fire extinguishers are proposed to be placed at strategic locations.
- Fire Brigade Inlet Connection for external pumping arrangement is envisaged.
- Automatic Sprinkler System is envisaged for entire building.
- Automatic smoke detection system is envisaged for entire building.
- All service shafts to be sealed at alternate floor level to prevent passage of smoke.

- Yard hydrants @ 45.0 m c/c of building peripheral length are provided.
- Automatically Operated Electric Fire alarm System and P.A. System is envisaged for the entire building.
- A two-way communication system is envisaged for the project enabling proper communication from different floors to the control room. Two-way speakers are installed at all floors landing and strategic locations connected with the P.A Console at the Ground Floor lobby / Security.
- Stair Cases - staircase from upper floors would be terminated at ground floor level and separate staircase from ground floor to basement is envisaged.
- Fire tender drive way- Fire driveway of 8.0m width is envisaged all round the building as per CFO Requirements.
- Travel Distance-maximum permissible travel distance as per local CFO/NBC-2016 would be 30.0mts without sprinkler system and 45.0mts with sprinkler system.
- Types of system proposed- Fire Hydrant System, portable fire Extinguishers and automatic Sprinkler, electrical fire alarm, public address and automatic detection system.
- Fire hydrant system
 - Internal system-Wet riser/ down comer
 - External system – yard hydrants.

Fire Extinguisher system- Includes

- Mechanical foam type fire Extinguisher – 9 Lts provided in DG and transformer areas.
- Multipurpose ABC fire Extinguisher -6 Kgs provided in transformer yard electrical room and same providing for every 8 car parks.
- Carbon Dioxide Type-2 Kgs provided in kitchen area and lift area.
- Carbon Dioxide Type-4.5 Kgs provided in Electrical panel room.
- Water mist and fire cabs fire Extinguisher -9Lts provided at each staircase landing.

- Multipurpose ABC fire Extinguisher -6 Kgs and Portable hand held Water mist and fire cafs fire Extinguisher -9Lts provided at every 8 cars and Diesel Generator areas.
- Fire buckets-Capacity 9 Lts where 2 buckets filled with clean water and sand kept in a common stand provided at each stair case landing.

Precautions & safety measures proposed are:

- ◆ Nearby Fire Station contact numbers will be displayed
- ◆ Fire water tank will be provided for immediate action to arrest the fire accident
- ◆ Portable fire extinguishers are proposed to be placed at Strategic locations.
- ◆ Electrical Fire Alarm system is placed at Strategic locations.
- ◆ Public Address system.
- ◆ Landing Hydrants on all floors near each staircase with necessary accessories.

11. First Aid

- * First-aid supplies approved by the consulting physician would be easily accessible when required.
- * The first-aid kit would consist of materials approved by the consulting physician in a weather proof container with individual sealed packages for each type of item. The contents of the first-aid kit would be checked periodically to ensure that the expended items are replaced.
- * Provisions would be made for prompt medical attention in case of serious injury.
- * Proper equipment for prompt transportation of the injured person to a physician or hospital, or a communication system for contacting necessary ambulance service, would be provided.
- * All the Emergency telephone numbers of the first Aider, physicians, hospitals, or ambulances would be posted.

7.1.5 SAFETY MEASURES DURING OPERATION PHASE:

- * Proper fire exit plan and well planned fire hydrant facilities will be provided.
- * All floors will be provided with Fire Alarm systems.
- * Fire detectors will be provided in each room, passages of all floors.
- * Each floor will be provided with portable fire extinguisher.
- * Emergency Exit plan with Emergency contact numbers will be displayed at various locations.
- * Occupants will be given training for emergency situations.
- * DG oil and DG waste oil will be stored in leak proof containers at designated locations.
- * Well planned traffic movement and parking facilities will be provided to prevent the accidents.
- * Proper maintenance of Sewage treatment plant and Solid waste management plan to prevent the health hazards.
- * Fire/Safety officer will be employed at project site.
- * Onsite maintenance engineer and maintenance team will be there during operation phase.

7.2 DISASTER MANAGEMENT PLAN (DMP)

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."

It is also an unexpected event due to sudden failure of the system, external threats, internal disturbances, earth quakes, landslides, floods, fire and accidents etc. Disaster management plan is nothing but the preparedness in case of emergency situations in order to limit the impact of disaster events.

Types of Disasters:-

Broadly there are two types of disasters namely:-

- (i) Natural Disasters and
- (ii) Man-Made Disasters

Types of Natural Disasters:

- Floods, Droughts, Cyclones, Tsunami
- Heat and Cold waves, Global warming, Sea Level Rise, Ozone Depletion
- Landslides, Snow avalanches
- Earthquakes, Volcanic eruptions

Types of Man-Made Disasters:

- Accidents: - Road, Rail, Air, River, Sea, Transport of hazardous material, Building Collapse.
- Fires: - Buildings, oil fires.
- Poisoning: - Food, Water,
- Civil Conflicts: - Arson, sabotage, terrorist and other criminal activities.

Emergency plan deals with the strategic organizational management processes used to protect life and critical assets of an organization from hazard risks thereby decrease the financial loss to the organisation and to save lives as a result of the incident.

Bengaluru and surrounding regions are considered to be low damage zones as far as Earthquake (Risk Zone-II), Flooding, Landslides and Cyclone are concerned (Source: BMTPC Risk Zone Maps).

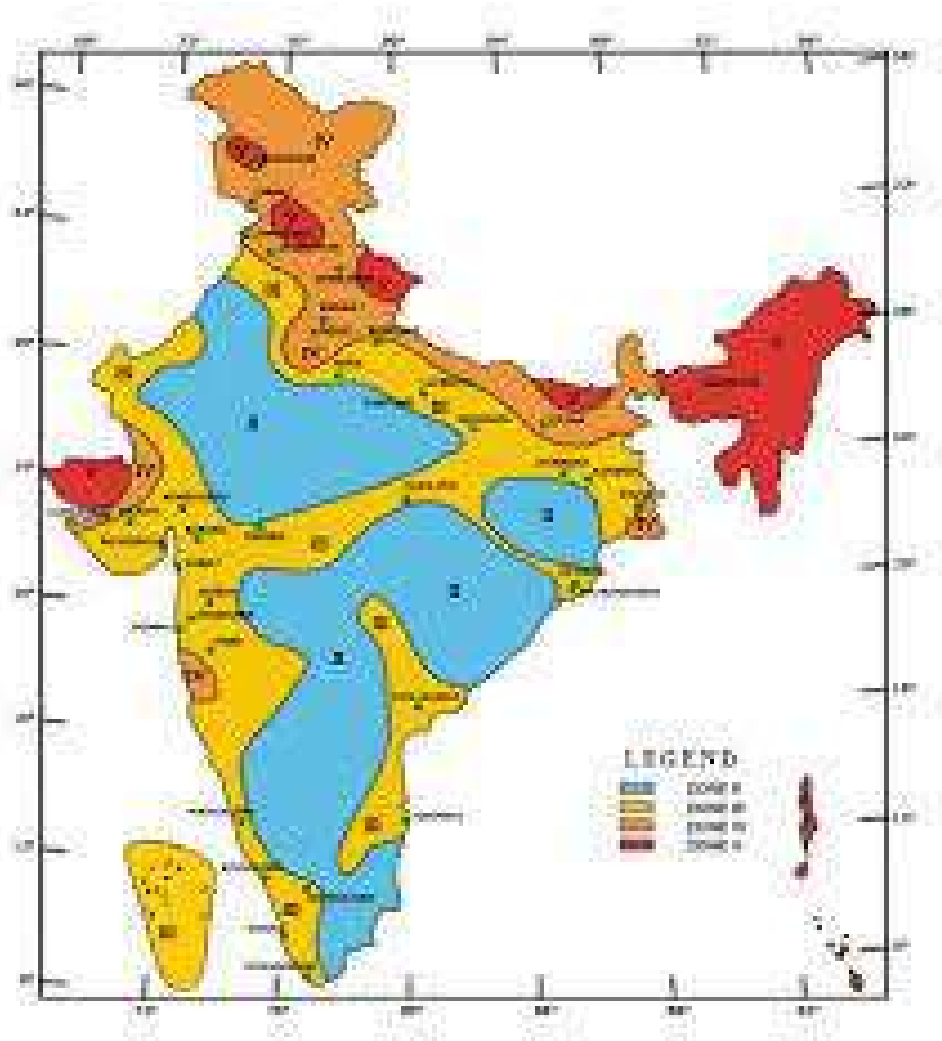


FIGURE 7.1 SEISMIC ZONE MAP OF INDIA

However, in case of any eventual disasters, it is proposed to draw guidelines for reporting procedures, communication system and emergency action committee as follows:

- Earthquake resistant structures as per the standards applicable for Risk Zone II.
- Emergency action committee: To ensure coordinated action, an Emergency Action Committee shall be constituted to interact with:
 - Police officer of the area.
 - Transport corporation representatives.
 - Home guard representative.
 - Department of information and publicity.
 - Nearest medical facilities.

- Safe route to be used, adequacy of transport for evacuation and traffic control.
- Fire protection: The building materials would be of appropriate fire resistance standard. The fire resistance period would be at least 4 hours. Usage of wood will be minimum and restricted to only for door panels and shall not be used for any purposes, excluding artificial wood products, which are flame – resistant.

The extent of damage would be reduced by proper emergency response by the inhabitants. Awareness programs shall be organized to educate the general residents and train the members of emergency response group.

7.3 PRECAUTIONS:

7.3.1 DURING CONSTRUCTION:

- Use of water sprinklers to prevent dust from being air borne
- Providing suitable personal protective equipment (PPE) like mouth mask with filters, nose mask, helmets etc
- Periodic health check-up camp for the labourers will be arranged.
- Provision of safety belts
- In case of injury, on site medical treatment and transport will be organized.
- Employing a safety engineer

7.3.2 DURING OPERATION:

- Once the likelihood of the disaster is suspected, preventive actions should be undertaken by the project in-charge.
- Conditional maintenance of equipments, materials and expertise for use during emergency.
- The electrical systems shall be provided with automatic circuit breakers activated by over current.
- Fire extinguishers are provided at pre-notified locations inside the apartments.
- Proper escape routes are planned and displayed in the public domain.
- Selected representatives are given proper training to guide other inhabitants during fire accidents.

- Periodic awareness programme will be conducted for the occupants on their roles during emergency situations.
- Important telephone numbers like police authorities, fire department and hospitals etc. of use during emergency situations are made available.
- First aid kit with primary medicines will always be available in the medical centre.

7.1 EMERGENCY DETAILS NEAR TO THE PROJECT SITE:

Nearest Bus stand	Kannamangala	0.4 km
Nearest Railway station	Whitefield Railway Station	2.9 km
Nearest Airport	Kempegowda International Airport	18.0 km
Nearest Fire station	Whitefield fire station (EPIP)	5.1 Km
	Hoskote fire station	5.5 Km
	Mahadevpura fire station	7 Km
Nearest hospital	Govt. primary health care, Kannamangalal	0.7 km
	Bangarupalyam Govt hospital	3.0 km
Nearest Police station	Avalahalli police station	2.4 km
	Kadugodi police station	3.0 Km

7.4 NATURAL RESOURCE CONSERVATION

Following are the few resource conservation measures will be adopted during construction as well as operation.

7.4.1 DURING CONSTRUCTION:

- Water requirement of construction will be minimized by using the ready mix concrete and other curing agents.
- Generated construction debris will be reused within the site for internal roads and walk way formation.
- Excavated topsoil will be conserved and reused for backfilling, landscaping and for road and driveway within the site.
- Storm water pollution prevention plan will be proposed, accordingly the storm water will be conserved through construction of catch pits and the same has been used for construction activities.
- Temporary seeding will be done like planting of fast growing grasses to hold down the soils in disturbed areas so that they are less apt to be carried offsite by storm water runoff or wind.

- Permanent seeding like use of permanent vegetation (grass, trees or shrubs) to stabilize the soil by holding soil particles in place.
- Building materials of low embodied energy and high strength are recommended as an alternative to the conventional building materials.
- Optimal transportation routes will be suggested for construction vehicles.
- Compensatory landscape will be done towards site clearance.

7.4.2 DURING OPERATION:

- Fresh water requirement of the project will be minimized by using the treated water for flushing and for landscaping.
- Generated STP sludge will be used as manure for landscaping.
- Usage of energy will be minimized by using energy efficient devices and controllers.
- Solar energy will be utilized for Solar lighting and provision is made of using solar geysers in the top two floors of each building.
- Generated organic waste will be processed in organic waste converter and manure will be used for landscaping.
- Utilization of DG sets will be restricted and will be used only during power failure, where it minimizes the fuel requirement.
- Roof rainwater collection will be done and the same will be used for domestic purposes after pre-treatment.
- Runoff from landscape and hardscape will be routed to recharge pits for ground water recharge.
- Extensive landscape will be done within the project site.
- Construction debris will be reused/ recycled for backfilling/ sub base works for roads, pavements and drains within the project site.
- Earth work excavated is managed through backfilling between foundations on the backside of retaining walls and also reused for filling up the low lying areas at site. Top soil will be reused for landscaping purposes.

7.5 PUBLIC CONSULTATION

The proposed project is an expansion of residential apartments, commercial and school building; as per the EIA Notification 2006, the proposed project comes under item 8(b) i.e Township and area development projects covering an area >50 ha with a built up area $\geq 1,50,000$ Sqmt++ and excluded from public consultation, hence public consultation is not required for the proposed project.

7.6 RESETTLEMENT & REHABILITATION (R&R) ACTION PLAN

Since the proposed project is a residential apartment and also presently project site is vacant land, the additional study does not involve resettlement and rehabilitation (R&R) action plan for the proposed developmental project.

CHAPTER – 8**PROJECT BENEFITS**

The proposed project will bring overall improvements in the locality, neighborhood and to the state by bringing industry, roads, water supply, drainage facility, power supply, employment for skilled, semi-skilled and unskilled labor, thereby uplifting the living standards of local communities and economic growth as well as it also stimulates the growth in small and medium scale industries like residential developments, hotels, shopping complexes, retail shops, health centers, educational institutes, recreational centers etc., may be further developed as a consequence.

Below are the some of the benefit from the projects.

8.1 IMPROVEMENT IN THE PHYSICAL INFRASTRUCTURE

The beneficial impact of proposed project on the civic amenities will be substantial after the commencement of project activities. The basic requirement of the community needs will be strengthened by extending healthcare, educational facilities to the community, building/strengthening of existing roads in the area, providing water with drainage system, power supply, transportation facility etc., which will help in uplifting the living standards of local communities.

The construction of new roads/strengthening of existing roads in the project area and in surroundings will enhance the transportation facilities. Roads will be laid to facilitate the movement of materials and equipment during construction and operation of the units. However, permanent roads would be built on the basis of plant layout. With improved transportation facilities there is always a scope for development. The proposed project will create the demand on the existing transportation infrastructure and stimulates for new developments and also generate economic benefits to these sectors.

8.2 IMPROVEMENT IN WATER SUPPLY & DRAINAGE SYSTEM:

Water supply to the Bengaluru city is majorly sourced from BWSSB and Water requirement for the proposed project will also be sourced from BWSSB.

The study area is well connected with natural drainage system and well planned storm water management is proposed. i.e., all along the boundary of the site storm water drains will be provided. They would be adequately sized to prevent over flooding of the site. The storm water collection system will be designed in such a manner so that clean storm water from garden, parking areas, roadways and lawns will be used for recharging of ground water through recharge pits. The excess run off will be discharged in to the nearest storm water drain.

8.3 IMPROVEMENT IN THE SOCIAL INFRASTRUCTURE

Social infrastructure will improve by means of Civilization, standard of living, education, Vocational Training, and Basic Amenities. Additional benefits will be arrived from the proposed project like: healthcare, educational facilities to the community, community hall, sports Centres, recreational centers, industrial developments, shopping malls, public services in the surrounding area.

Due to this project development adaptation of new technologies and other infrastructural facilities will improve which will indirectly boost the civilization of the surrounding people.

8.4 EMPLOYMENT POTENTIAL

As the proposed project bring employment generation for skilled, semi-skilled and unskilled, it is obvious to assume that, all the economic activities in the project area would induce considerable improvement in the socio-economic levels of people. The impact of human settlement is expected to be positive, as apart from some people being directly employed; many others will get indirect employed.

8.5 OTHER TANGIBLE BENEFITS

➤ Recycling process

Wastewater from the proposed project shall be treated in STP and treated water reused for flushing, car washing, landscaping etc., which reduces the burden on fresh water demand.

➤ Rain water harvesting

Asseztz property projects proposed rain water harvesting systems in place to conserve fresh water and to improve ground water table level by providing recharge pits.

➤ **Landscape Development**

Proposed project will have a well-planned Landscape, which will enhance the beauty of the aesthetics and were committed to delivering environmental-friendly quality buildings with state-of-the-art technology; which enhance the beauty of the area. Improve the avi-faunal population of the area and also helps in reducing the heat island effect.

➤ **Use of Renewable Resources**

All the Assetz properties projects will make use of renewable source of energy like solar street lights, solar heater etc, which will conserve the energy and reduces the load on the project.

➤ **Road & Drainage**

Well planned internal roads and drive way facilities and internal drainage systems improves the better management and maintenance.

➤ **Sewage treatment plant**

Residential development will have well planned STP facilities of adopting efficient cum advanced technologies, which improve the sanitation facilities and sludge will be used as manure for gardening.

➤ **Organic waste converter**

Project proposed organic waste composter to handle waste management scientifically and composted waste will be used as manure for gardening.

CHAPTER - 9**ENVIRONMENTAL MANAGEMENT PLAN****9.1 INTRODUCTION**

The Environmental Management Plan (EMP) is aimed at mitigating the possible adverse impact of a project and ensuring the existing environmental quality. The EMP converse all aspects of planning, construction and operation of the project relevant to environment. It is essential to implement the EMP right from the planning stage continuing throughout the construction and operation stage. Therefore the main purpose of the Environmental Management Plan (EMP) is to identify the project specific activities that would have to be considered for the significant adverse impacts and the mitigation measures required.

The identification and characterization of impacts has been presented in chapter-4, which dealt with Impact Assessment. It has been evaluated that, the project area will not be affected significantly with proposed project. Mitigation measures at the source level and an overall management plan at the site level are elicited so as to improve the surrounding environment. The Environmental Management Plan (EMP) is the road map for implementing mitigation measures to prevent the impacts arising from a particular project.

The construction phase impacts are mostly short term, restricted to the plot area and not envisaged on the larger scale. In the operational phase the environmental impacts are due to continuous operation of the project, hence, the emphasis in the Environment Management plan (EMP) is to minimize such impacts. The following mitigation measures are recommended in order to synchronize the economic development of the project area with the environmental protection of the region.

The emphasis on the EMP development is on the followings,

- Incorporating Green Building concept from the design to execution stage.
- Mitigation measures for each of the activities causing the environmental impact.
- Monitoring plans for checking activities and environmental parameters and monitoring responsibilities.
- Role responsibilities and resource allocation for monitoring; and

- Implementation of the scheduled plan.

Environmental management plan has been discussed in the following sections separately for construction phase and operational phase.

9.2 EMP DURING CONSTRUCTION PHASE

The Construction Environmental Management Plan is one of the most important documents for managing and monitoring the environmental impact of a construction site.

The EMP describes the proposed measures to be implemented to help, achieve and maintain acceptable levels of environmental impact. Proponents having the responsibility and will ensure the relevant employees are fully cognizant of and abide by the Environmental Management Plan. In order to measure the performance of our environment management system the following environmental goals have been stated for the project implementation.

- Training of all employees in environmentally relevant activities of the environmental management system.
- Reduction of the noise at the construction sites.
- Reduction of lost-time accidents at the construction sites.
- Prevention of environmental incidents at the construction sites.
- Implementation of project procedure for environmental requirements.

9.2.1. OBJECTIVES

The primary objective of environmental management plan is to initially limit the amount of generated construction wastes on this project by requiring all subcontractors and material suppliers to limit the quantities of materials and to supply only required materials those necessary for the project. The secondary objective is to divert 50 to 75% of the total wastes on this jobsite from area landfills at no cost premium to the project.

Every effort will be made to limit, separate, sort, collect and properly dispose of all construction waste materials generated on this project site during construction phase. EMP includes the following management programs for the construction activities, which need to be monitored and managed during its construction phase.

9.2.2. ENVIRONMENTAL AWARENESS TRAINING PRIOR TO COMMENCING WORK

The proponent shall ensure that all construction personnel, including senior site staff, sub-contractors and suppliers, etc attend an environmental awareness information session prior to commencing work on site. Additional staff, sub-contractors and suppliers coming onto the site must be made aware of the requirements of the EMP.

9.2.3. DEMARCATION OF THE SITE

The 'site' here refers to all areas required for construction purposes. The proponent shall demarcate the boundaries of inner limits of the site. Netting should be provided preventing building material from falling. The proponent shall maintain the demarcation line and ensure that materials used for construction site do not blow on or move outside the site and environs, or pose a threat to flora/fauna of that area.

9.2.4. LEVELING AND SITE CLEARANCE

Vegetation clearing to allow for site establishment as well as construction purposes will sometimes be required. Vegetation can be cleared mechanically with a bulldozer, but should be cleared by hand on other areas. All alien vegetation shall be eradicated from site during the site preparation. Indigenous vegetation that does not pose any risks to the operation of the project upon completion of the contract should be retained for esthetical purposes. Such vegetation shall be identified during design and clearly indicated on the site plans. Protected or endangered species of plants shall be retained where possible.

TABLE 9.1: ENVIRONMENTAL MANAGEMENT DURING LEVELLING AND SITE CLEARANCE

Environmental Impacts	Mitigation	Remarks
Noise generation: Caused due to Excavators and Bulldozers	<ul style="list-style-type: none"> • Most optimum no. of operation by the heavy equipment. • Selection of equipment with less noise generation to be used. • The earth moving equipment shall be periodically checked and maintained for noise levels. • The workers shall be provided with adequate PPE such as ear plugs to reduce impact of high noise levels. 	To reduce noise level; equipment provided with noise control devices is only used.
Dust generation: Levelling operations results in the emission of the dust.	<ul style="list-style-type: none"> • The site cleared shall be periodically watered to reduce emission of dust particles • Barricades like metal sheets should be provided all round the premises to avoid fugitive dust emission in to the neighbouring area apart from water sprinkling. • The workers shall be provided with PPE such as nose masks and goggles to reduce impact on health. 	The construction water requirement will be sourced from external tanker water suppliers.

9.2.5. TRANSPORTATION OF CONSTRUCTION MATERIALS

During the transportation of construction materials, minimum no. of vehicles will be used. Most optimum route is planned to reduce the impact of transportation activity on the environment. The proponent shall ensure that all suppliers and their delivery drivers are aware of procedures and restrictions in terms of this EMP.

TABLE 9.2: ENVIRONMENTAL MANAGEMENT DURING TRANSPORTATION

Environmental Impacts	Mitigation
Noise generation	<ul style="list-style-type: none"> • Quality fuel is used. • Periodic maintenance of vehicles is required.
Dust generation	<ul style="list-style-type: none"> • Quality packaging of the construction materials. • Construction materials shall be covered with tarpaulin sheets to prevent the material from being air borne.

	<ul style="list-style-type: none"> Material shall be appropriately secured to ensure safe passage between destinations during transportation. The vehicle speed shall be regulated. The workers transporting materials shall be provided with PPE such as nose masks to reduce impact of air borne dust on their health.
Vehicular emissions	<ul style="list-style-type: none"> Periodic emission check for vehicles is required. Clean fuel shall be used for vehicles.

9.2.6. CONSTRUCTION ACTIVITIES

CEMENT AND CONCRETE MIXING

- Unused cement bags shall be stored out of the rain where runoff won't affect it.
- Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent windblown cement dust and water contamination.
- Concrete mixing directly on the ground shall not be allowed and shall take place on impermeable surfaces.
- All excess concrete shall be removed from site on completion of concrete works and disposed off at an appropriate disposal site.
- Wastewater from the concrete mixer after washing should be properly disposed to drainage.

During the construction work, the following impacts are identified to monitor and mitigate the level of impact.

TABLE 9.3: ENVIRONMENTAL MANAGEMENT DURING CONSTRUCTION

Environmental impacts	Mitigation	Remarks
Noise generation	<ul style="list-style-type: none"> Selection of Less noise generating equipments. Personnel Protective Equipment (PPE) such as ear plugs and helmets shall be provided for construction workers The working hours shall be imposed on construction workers. 	Implementation responsibility: Contractor – Civil Works
Dust generation	<ul style="list-style-type: none"> PPE in the form of nose masks shall be provided for construction workers. Use of water sprays to prevent the dust from 	Implementation responsibility: Contractor

	being air borne. • Barricades like metal sheets should be provided all around the premises to avoid fugitive dust emission in to the neighboring area apart from water sprinkling.	
Water Discharge from construction works	• Sewage generated from the construction labors will be collected in collection tank & will be treated in septic tank	Implementation responsibility: Contractor
Air Emissions from construction machinery	• Periodic check and regular maintenance of construction machinery for emissions. • Clean fuel shall be used in equipments.	Implementation responsibility: Contractor

9.2.7. NOISE POLLUTION & CONTROL

Noise will be generated by construction activities such as vehicular movement, hammering, drilling, cement concrete mixing, welding etc. The proponent shall take all reasonable measures to minimize noise disturbance as a result of construction activities. These measures must comply with rules and regulations of the concerned Board and shall be limited to daylight hours.

Following are the control measures for noise pollution,

- Selection of less noise generating construction equipment.
- Quality fuel is used for vehicles.
- Personnel Protective Equipment (PPE) such as ear plugs shall be provided for construction workers.
- Periodic maintenance of vehicles is required.
- DG sets with acoustic enclosures complying to Environment (Protection) Rules is provided.
- Barricades are erected all along the site boundary to avoid noise nuisance on the surrounding population.
- Trained security men are deployed for smooth guiding entry/exist without traffic congestion which helps in reducing honking conditions.

9.2.8. DUST POLLUTION & CONTROL

Dust will be generated by construction activities such as excavation, filling, mixing, hammering, drilling, cutting, vehicular movement etc; the proponent shall take all reasonable measures to minimize the generation of dust as a result of construction activities.

Following control measures shall be used for dust suppression,

- Covering of material loads during transportation.
- Sprinkling of water on the material during transportation particularly in dry and wind season.
- Construction vehicles shall comply with speed limits.
- Haul distances shall be minimized.

9.2.9. SOIL EROSION & SEDIMENTATION AND ITS CONTROL

Construction activities such as earthmoving operations that disturb land areas depending on construction area affect the surrounding air and generate noise and vibration. During construction phase, a range of activities on construction sites has the potential to pollute surface water, these include earthworks, and construction works etc, that result in erosion and sedimentation. This erosion may result in a significant increase in sediment loads to receiving waters. Sediment, which results from the excessive erosion of disturbed soils, is the main sources of pollutants.

Following control measures shall be used for soil erosion and sedimentation.

- Before construction, care should be taken to keep vegetation clearing at a minimum.
- Re-vegetation of construction sites during and after construction is the most effective way to permanently control erosion.
- Mulching is used primarily to reduce the impact of rainfall on bare soil, to retain soil moisture, to reduce runoff, and often to protect seeded slopes.
- During construction, the proponent shall protect all areas susceptible to erosion by installing necessary temporary and permanent drainage works and by taking any other measures necessary to prevent storm water from concentrating in streams and scouring slopes.

9.2.10. MATERIALS HANDLING AND STORAGE

FUEL STORAGE

During construction, fuels required for use shall be stored in a central depot at the construction camp at a location agreed upon by the concerned authority. The proponent shall take all the necessary precautions to prevent fires or spills at the fuel stores.

Following precautions will be taken during fuel storage:

- Tanks containing fuels shall have lid and shall remain firmly shut.
- Gas and liquid fuel shall not be stored in the same storage area.
- No smoking shall be allowed inside the stores and within 3m of the boundary.
- The proponent shall ensure that there is adequate fire-fighting equipment at the fuel stores.

LUBRICANT STORAGE

Lubricants will be stored in drums or tins that are either sealed or have tightly fitting caps. Decanting of lubricants must be carried out in a specific area that has been previously identified and suitably protected. Lubricants shall be stored under cover in a no smoking area. All lubricant impregnate cotton waste and rags shall be promptly disposed off and handled as hazardous waste.

9.2.11. WASTE MANAGEMENT

9.2.11.1 WASTEWATER FROM CONSTRUCTION ACTIVITIES

Construction water refers to all water affected by construction activities. The proponent shall construct and operate the necessary collection facilities to prevent pollution. The proponent shall adopt below mentioned measures in order to manage the construction wastewater.

- The proponent may discharge “clean” slit laden water overland and allow this water to filter into the ground.
- Proponent shall not cause erosion as a result of any overland discharge.
- All washing of plant/equipment/concreting equipment etc. shall take place within the construction camp.
- All washing operations shall take place off-site at a location where wastewater can be disposed of in an acceptable manner.

To prevent the contamination of water by materials used during construction:

- Materials are prepared and stored away from watercourses.
- Implement measures to prevent seepage of liquid materials into ground where it could contaminate groundwater.
- Ensure prompt cleaning up of accidental spillages.
- The machinery/equipment is maintained in a good operating condition.

9.2.11.2 WASTE WATER FROM CONSTRUCTION LABOURERS

The sewage generated from the labors during the construction is estimated to be about 12 KLD. This will be collected in collection tank and will be treated in Mobile STPs

9.2.11.3 SOLID WASTE MANAGEMENT

Solid waste here refers to all construction debris and domestic waste. The organic wastes collected and shall be handed over to the local body for further processing and recyclable wastes such as bricks, stone, metal, plastic, etc., will be handed over to the authorized waste recyclers. Hazardous wastes like waste oil from DG sets, used batteries, paint waste etc; will be handed over to the authorized hazardous waste recyclers.

The solid waste management includes the following mitigation measures.

- The proponent shall not dispose of any waste or construction debris by burning or by burying.
- On completion of construction, all leftover construction materials are to be removed from the working area.
- The proponent shall supply waste bins/skips throughout the site at locations where construction personnel are working.
- The bins shall be provided with lids and an external closing mechanism to prevent their contents blowing out.
- Bins shall be emptied on a daily basis. The bins shall not be used for any purposes other than waste collection.
- Collection system should be properly supervised so that quick and regular removal of waste from the dustbin is practice.

9.2.11.4 DISPOSAL OF EXCAVATED EARTH

The generated materials such as bricks, stone, concrete will be used for site levelling and for back filling.

The excavated earth which is generated during construction will be used for back filling, for development of landscape and for road formation and therefore there will not be any solid waste problem from the generation of excavated earth.

9.2.12. PERSONNEL SAFETY SYSTEM

It is planned to adopt the safe working practices which shall govern all construction works undertaken throughout the project.

Following Safety Aids to all labourers will be provided:

- Safety Helmets
- Safety Belts/ Harness
- Safety Shoes
- Hand gloves
- Gumboots while concreting
- Safety Goggles while welding/ Stone dressing etc.
- Face masks and full body kit while Pest control

Implementation of Safety procedures such as:

- Using proper lifting techniques
- Using Safe Scaffold
- Hot work permits for Fabrication and Welding
- Height work permit

9.2.13. HUMAN HEALTH AND SAFETY MANAGEMENT PLAN

The objective is to ensure that the health and safety of on-site personnel is proactively managed during the construction stage of the project. Below are given the proposed project related human health and safety environmental concerns and its management

- The primary concern on potential health risks for the construction workers and employees on site during construction are associated with drinking water quality.
- Construction site will be provided with readily available first aid kits including adequate supply of sterilized dressing materials and appliances. An ambulance-on-call shall be provided to take injured or sick person to the nearest hospital.
- Each construction worker will be provided with safety gadgets and compulsorily made to wear them during the construction work. This will include protective footwear, helmets & gloves to all workers employed for the work on mixing, cement, lime mortars, concrete etc.; the welders protective eye-shields to workers who are engaged in welding works; ear plugs to workers exposed to loud noise; safety belts to the labours working at higher platforms; and masks to avoid dust.
- The project will strictly follow the statutory child labour act.
- The project will also ensure that no paint containing lead or lead products is used. The project will comply with all regulations & follow good construction & safety practices for scaffolding, ladders, working platforms, gangway, stairwells, excavations, etc.
- The project will take adequate precautions to prevent danger from electrical equipments. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public.
- All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Indian standard codes, will be free from patent defect, will be kept in good working order, will be regularly inspected & properly maintained as per IS provision.
- Regular health check-ups for the labourers will be conducted at site and also at the labour camp for free of cost. Mock-up fire drills and first aid training will be conducted at site at regular intervals.

- Work permit will only be given to labourers who are fit/capable to work at heights, handle heavy machineries, etc.

9.2.14. EMERGENCY PROCEDURES

The proponent shall comply with the Occupational Health and Safety Act, National Building Regulations and other national, regional or local regulations with regard to safety on site. The proponent shall ensure that contact details of the local medical services are available to the relevant construction personnel prior to commencing work.

The Emergency plans should include the following procedures:

- Identification of key escape routes, how people can gain access to them and escape from them to a place of total safety.
- Arrangements for the safe evacuation of people identified as being especially at risk, such as those with disabilities, lone workers and young persons.
- Any machines/appliances/processes/power supplies that need to be stopped or isolated if there is a fire.
- Specific arrangements, if necessary, for high-fire-risk areas.
- Contingency plans for when life safety systems such as evacuation lifts, fire-detection and warning systems, sprinklers or smoke control systems are out of order.
- How the fire and rescue service and any other necessary services will be called and who will be responsible for doing this.
- Procedures for meeting the fire and rescue service on their arrival and notifying them of any special risks, e.g. the location of highly flammable materials.
- Plans to deal with people once they have left the premises.

9.3 EMP DURING OPERATION PHASE

In the operational phase the environmental impacts are due to continuous operation of the project; hence, the emphasis in the Environment Management Plan (EMP) is to minimize such impacts. Following are the identified operational phase activities in the impact assessment, which may have impact on the environment.

1. Air quality management
2. Water quality management
3. Noise quality management
4. Solid waste management
5. Storm water management
6. Transport management
7. Landscape development

9.3.1. AIR QUALITY MANAGEMENT

The air pollutants likely to be emanated from the proposed project are PM, SO₂, NO₂, HC and CO mainly due to burning of liquid fuel in DG. Exhaust from DG set will be emitted from stack of adequate height for dispersion of gaseous pollutants. The green belt development is also proposed covering about 38.0% of the plot area will reduce PM levels. Following table presents the EMP for air quality management during operation phase.

TABLE 9.4: AIR QUALITY MANAGEMENT DURING OPERATION PHASE

Environmental Impacts	Mitigation
DG set	<ul style="list-style-type: none"> • Equipment selected will ensure the exhaust emission standard as prescribed as per the latest amendments from the CPCB. • DG will be used as stand-by unit. • Periodic check and maintenance. • Use of ultra-low sulphur diesel. • Use of clean fuel by the DG sets will reduce the emission of pollutants.
Ambient air quality	<ul style="list-style-type: none"> • Ambient air quality monitoring as per the guidelines at regular intervals.

9.3.2. WATER QUALITY MANAGEMENT

Operational phase water requirement of project will be met by BWSSB. Water balance is presented in the earlier section. Following are some of the water quality management measures that would be adopted during the operation phase of the project.

- Ground water should not be abstracted without prior permission of the competent authority.
- Use of water meter conforming to ISO standards should be installed at the inlet point of water uptake to monitor the daily water consumption.
- Use of water efficient devices/fixtures and appliances should be promoted.
- Installation of dual flushing system should be considered to conserve water.
- Rainwater harvesting will be put into practice on regular basis.
- Practice of surface runoff harvest through recharge pits on regular basis.
- Sewage Treatment Plants should be monitored on a regular basis.

The sewage generated from the proposed project will be about 1777 KLD which will be treated in the Sewage treatment plant capacity of 290 KLD, 510 KLD, 570 KLD, 50 KLD, 360 KLD using Sequencing Batch Reactor (SBR) technology. Treated water will be reused for flushing, gardening. Following Table 9.5 presents the EMP for water quality.

TABLE 9.5: WATER QUALITY MANAGEMENT DURING OPERATION PHASE

Environmental impacts	Mitigation
Effluent from domestic water consumption	<ul style="list-style-type: none"> • Treated with existing sewage treatment plant to produce tertiary treated water which is ultimately reused for domestic purposes such as flushing, landscaping and excess treated water used for Public park maintenance. • Following water conservation measures will be encouraged <ul style="list-style-type: none"> ▲ Awareness among the residents regarding optimal usage of water and reuse. ▲ Implementation of dual piping system: Use of treated sewage for domestic purposes like flushing, gardening after prior treatment. ▲ Rainwater harvesting facilities are proposed.

	<ul style="list-style-type: none"> ◆ Roof top rain water will be harvested and it will be treated and reused after prior treatment. ◆ Surface runoff will be harvested and it will be used for ground water recharge through recharge pits within the site
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TABLE 9.6: WASTEWATER DISPOSAL

Total Landscape Area available	38339.2 Sqm (34.79%)
Quantity of Sewage that can be disposed on land	185 KLD
Total quantity of treated sewage to be managed	1777 KLD
Treated sewage water used for flushing	700 KLD
Excess treated water will be sent to	643 KLD

9.3.3. NOISE QUALITY MANAGEMENT

High noise generating units such as DG set will be provided with integral acoustic enclosure. Noise barriers will be provided to the DG sets at appropriate locations so as to ensure that the noise levels do not exceed the prescribed standards.

Green belt on the project boundary will further act as noise barrier and helps in attenuation of noise. Following table presents the EMP for noise levels.

TABLE 9.7: NOISE MANAGEMENT DURING OPERATION PHASE

Environmental Impacts	Mitigation
Noise from DG set operation & vehicular traffic	<ul style="list-style-type: none"> ▪ Acoustic enclosures will be provided to DG set. ▪ DG set will be installed in an area (utility section) where the access will be restricted. ▪ The use of PPE (ear plugs) will be mandatory in this area. ▪ Selection of equipment to ensure that the residential noise level of < 55 dB (A), Commercial < 65 dB (A) and School <45 dB ▪ Noise levels will be checked periodically using a noise pressure level meter. ▪ Landscape development within the proposed site will act as a noise attenuator & will be implemented gradually in parallel with the construction.

9.3.4. SOLID WASTE MANAGEMENT

The solid wastes generated during operation phase can be categorized under the following three types:

- Municipal Solid Wastes
- Hazardous wastes
- E- Wastes

Municipal Solid Wastes:

The municipal solid wastes include food leftovers, vegetable peels, plastic, house sweepings, paper, cardboard clothes, ash etc. The municipal solid wastes generated in the premises are estimated to be about 7.26MT/day. Out of which, 2.91MT/day is Organic waste & 4.35MT/day is recyclable wastes.

- * Further this organic biodegradable waste will be segregated and will be processed in organic waste converter.
- * The recyclable wastes such as plastic materials, glass & metal wastes are handed over to the authorized waste recyclers for further processing.
- * The Sludge from the STP will be used as manure for gardening purpose.

Hazardous Wastes:

Hazardous wastes like waste oil generated from the DG sets will be stored in barrels and handed over to the authorized waste oil recyclers/processors & the generated used batteries, battery cells etc., will be handed over to the authorized hazardous waste recyclers.

E- Wastes:

E- Wastes like electrical wastes such as wires, bulbs, tube lights and electronic wastes such as used PC, calculators, CD's, Xerox machine components etc., will be collected separately & handed over to the authorized & approved by KSPCB E-waste processors.

The various mitigation measures to be adopted for the solid waste management during operation phase are as follows:

- Different colored bins will be provided for different categories of waste and ensure complete segregation of biodegradable and non-biodegradable wastes.

The biodegradable wastes will be processed in organic waste converter and recyclable wastes such as plastic materials, glass & metal wastes are handed over to the waste recyclers.

- Separate compartments shall be provided for each type of recyclables.
- Collection and storage of hazardous wastes during pre-construction and post-construction activity should be planned properly.
- The expected hazardous wastes should be disposed off separately as per the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.
- Separate bins shall be provided in each building to collect the solid wastes.
- Collection system should be properly supervised so that quick and regular removal of waste from the dustbin is practice.
- It is preferable that the container and bins used for collection of waste should be of closed type so that the waste is not exposed and thus the possibility of spreading of disease through flies and mosquitoes is minimized.

9.3.5. STORM WATER MANAGEMENT

As the project location is blessed with fairly good rainfall, it is planned to collect the storm water at different gradients of the location. There will be rainfall runoff from building roof-tops, roads and pavements and greenbelt area. Necessary provision will be made to collect the quantity of rainfall runoff during the most rainy day of season.

- Necessary rain harvesting pit/ recharge pit at regular intervals around the periphery of the site have been envisaged.
- Storm drains with RCC precast perforated cover will be provided around the periphery of property.
- The details of the rain water harvesting facilities are interpreted in the early section and it is depicted in the enclosed layout plan.

9.3.6. TRANSPORT MANAGEMENT

- Use of public mode of transportation should be encouraged.
- Use of the least polluting type of transportation should be promoted.
- Adequate parking space should be provided as per norms.

- Use of pathways covered or shadowed by tree canopy as far as practicable.

9.3.7. GREENBELT DEVELOPMENT

Vegetation is the natural extension of the soil ecosystem on a site. It can provide summer shade, wind protection, and a low-maintenance landscape that is adapted to the local environment. Unfortunately, the common practice is to remove the existing landscape cover and replace with a generic, water and maintenance-intensive lawn.

The greenbelt development in the project site area not only functions as landscape features resulting in harmonizing and amalgamating the physical structures of proposed buildings with surrounding environment but also acts as pollution sink / noise barrier. In addition to augmenting present vegetation, it will also check soil erosion, make the ecosystem more diversified and functionally more stable, make the climate more conducive and restore balance.

It is planned to include an ecologically knowledgeable landscape architect as an integral member of the design team. Preservation of existing vegetation, especially native plants, will possibly be incorporated. Avoid fencing off property where possible to make landscape available to community increasing project integration. Besides this, the visual aesthetic of the proposed site will be enhanced by developing lawn with local ornamental plants in open spaces. The landscape development plan of the project site attached as ANNEXURE 12 to this report.

9.3.8. FIRE PROTECTION

The fire fighting requirements depend on occupancy classification and height of the proposed building. The proponent shall comply with the Occupational Health and Safety Act and regional or local regulations with regard to safety on site. Depending upon the occupancy heights, buildings should be protected by wet riser, automatic sprinkler system, and fire water tanks as applicable.

The Project has been designed based on all the relevant fire safety as per NBC norms.

- * Fire extinguishers systems are deployed throughout the residential building.
 - ✓ ABC powder Extinguisher - 5 kg should be provided in transformer yard electrical room and same should provide for every 8 car parks.

- ✓ ABC powder extinguisher - 2 kg should be provided in kitchen area and lift area
- ✓ Fire buckets filled with clean water and sand kept in a common stand provided at each stair case landing.
- * Fire hydrants around the building.
 - ✓ Internal system - Wet riser cum down comer
 - ✓ External system – yard hydrants.
- * Fire hose cabinets provided at every floor.

Precautions & safety Measures proposed are:

- Sufficient capacity of Fire water tank will be provided for immediate action to arrest the fire accident.
- Nearby Fire Station contact numbers will be displayed
- Sprinkler System, Automatic fire detection & Alarm system will be provided.
- Smoking should be strictly prohibited.
- Provision of helipad for the proposed building in case of emergency.

9.3.9 HEALTH, RISK AND DISASTER MANAGEMENT

PUBLIC HEALTH AND SAFETY

Since all the construction related activities shall be confined to the project site, minimal health related impacts are envisaged within the project influenced area during the construction stage.

The persons engaged at project site will face direct exposure to dust and noise generated from the construction activity. This is likely to cause health related affects such as asthma, bronchitis etc. and hearing impairments respectively.

To minimize these anticipated impacts, suitable actions like

- Use of water sprinklers to prevent dust from being air borne.
- Providing suitable personal protective equipments (PPE) like mouth mask with filters, nose mask, helmets etc.
- Periodic health check up camp for the labourers will be arranged.

- Provision of safety belts.
- In case of injury, on-site medical treatment and transport will be organized.
- Employing a safety engineer.

Due to operation of the proposed project, there will be enhancement in public health and safety.

- Regular visit of resident medical officer to take care of the first aid and primary medication in case of emergency for occupants and labourers.
- First aid kit with primary medicines will always be available in the medical centre.
- Display of action plan and preparedness measures during emergency situations.

RISK AND DISASTER MANAGEMENT PLAN

Disaster is an unexpected event due sudden failure of the system, external threats, internal disturbances, earth quakes, fire and accidents. Thus an appropriate management plan shall be incorporated.

PRECAUTIONS

- Once the likelihood of the disaster is suspected, preventive actions should be undertaken by the project in-charge.
- Conditional maintenance of equipments, materials, and expertise for use during emergency.
- The electrical systems shall be provided with automatic circuit breakers activated by over current.
- Fire extinguishers are provided at pre-notified locations inside the buildings.
- Proper escape routes are planned and displayed in the public domain.
- Selected representatives are given proper training to guide other inhabitants during fire accidents.
- Periodic awareness program is conducted for the occupants on their roles during emergency situations.

Important telephone numbers like police stations, fire department and hospitals etc. of use during emergency situations are made available.

9.4 EMP IMPLEMENTATION SCHEDULE

Phased according to the priority, the implementation schedule is presented in below table.

TABLE 9.8: IMPLEMENTATION SCHEDULE FOR EMP

Sl.No	Recommendations	Requirement
1.	Air pollution control measures	Before commissioning of respective building
2.	Water pollution control measures	Before commissioning of the project
3.	Noise control measures	Along with the commissioning of the project
4.	Solid waste management	During commissioning of the project
5.	Green belt development	Stage-wise implementation

The responsibility of EMP implementation lies with the project promoter for a period of 5 year (approximate Construction Period). Once project is established, the EMP responsibility will be properly handed over with clearly defined procedures and guidelines.

9.5 ENVIRONMENTAL LEGISLATIONS

There are many Environmental Acts & Rules which are formulated by Ministry of Environment and Forests (MoEF) for the prevention of Environmental squalor and are to be complied by the Industry. All the regulations are not applicable to all. The Act and Rules which are to be constantly perused and followed by the Industry are enumerated in the following section.

TABLE 9.9: PARTICULARS OF ENVIRONMENTAL LEGISLATIONS

YEAR OF ENACTMENT	LEGISLATION
1974	The Water (Prevention and Control of pollution) Act.
1975	The Water (Prevention and Control of pollution) Rules.
1977	The Water (Prevention and Control of pollution) Cess Act.
1978	The Water (Prevention and Control pollution).
1988	The Water (Prevention and Control of pollution) as amended.
1981	The Air (Prevention and Control of pollution) Act.
1987	The Air (Prevention and Control of pollution) and as amended.
1986	The Environment (Protection) Rules.
1991	The Environment (Protection) Rules (Amended).

9.6 ENVIRONMENT PROTECTION ACT & RULES

Among the various notifications coming under the Environment (Protection) Act, following are the notifications applicable to this project:

TABLE 9.10: NOTIFICATIONS UNDER ENVIRONMENTAL PROTECTION ACT & RULES

YEAR OF NOTIFICATION	RULES
1989	The Hazardous Waste (Management & Handling) Rules
2000 & 2003	The Hazardous Waste (Management & Handling) Rules (amended)
1992/1993	Environmental Statement
2002	DG Rules
2000	Noise Pollution (Regulation & Control) Rules and Amendment Rule 2006
2000	Municipal Solid Wastes (Management & Handling) Rules
2001	Batteries (Management & Handling) Rule, 2001 and Amendment Rule, 2010
2008	The Hazardous Wastes (Management, Handling & Transboundary Movement) Rules
2011	The Plastic Waste (Management & Handling) Rules
2011	The e-Waste (Management & Handling) Rules implementation from 1-5-2012.

9.7 THE HAZARDOUS WASTE (MANAGEMENT & HANDLING) RULES 2016 (LATEST AMENDMENT 2018)

The DG Sets, waste/used oil is included in the schedule-1 of list of Hazardous Waste under Serial No.5 which states as under:

- ❖ Used/spent oil (category No.5.1) generated from industrial operations.
- ❖ Using mineral/synthetic oil as lubricant in hydraulic systems or other applications.

Used oil defined under Rule 3 (34) means any oil derived from crude oil or mixtures containing synthetic oil including used engine oil, gear oil, hydraulic oil, turbine oil, compressor oil, industrial gear oil, heat transfer oil, transformer oil, spent oil and their tank bottom sludge and suitable for re-refining, if it meets the specifications laid down in Schedule 5, but should not include waste oil.

Responsibility of the occupier and operator of a facility for handling of the wastes is delineated as under:

1. The Occupier and the operator of a facility shall be responsible for proper collection, reception, treatment, storage and disposal of hazardous wastes listed in schedule -1, 2 and 3 { Rule 4(1)}.
2. It shall be the responsibility of the occupier and the operator of a facility, to take all steps to ensure that the wastes listed in schedule 1, 2 and 3 are properly handled and disposed of without any adverse effects to the environment {Rule 4(3)}.
3. Hazardous wastes shall be collected, treated, stored and disposed of only in such facilities as may be authorized for this purpose {Rule 5(1)}.
4. Every occupier handling, or a recycler recycling, hazardous wastes shall make application in Form-1 to the Member Secretary, State Pollution Control Board or committee, as the case may be or any Officer designated by the State Pollution Control Board of committee for the grant of authorization for any of the said activities{ Rule 5(2)}.
5. The Occupier or operator of a facility shall ensure that the hazardous wastes are packaged, based on the composition in the manner suitable for handling, storage, and transport and the labeling and packaging shall be easily visible and be able to withstand physical conditions and climatic factors { Rule 7(1)}
6. Packaging, labeling and transport of hazardous wastes shall be in accordance with provisions of the rules made by the Central Government under the Motor Vehicles Act 1988 and other guidelines issued from time to time { Rule 7(2)}.
7. The occupier or an operator of a facility shall send annual reports to the State Pollution Control Board or committee in Form-4 {Rule 9(2)}.
8. All Hazardous waste containers shall be provided with a general label as given in Form-8 of Hazardous Waste (Management Handling) Rules 1989 as amended there after { Rule 7(3)}
9. The Occupier shall prepare six copies of the manifest in Form 9 comprising of colour code indicated below (all six copies to be signed by transporter) {Rule 7(4)}:

10. The Occupier generating hazardous waste and operator of a facility for collection, reception, treatment, transport, storage and disposal of hazardous waste shall maintain records of such operations in Form-3 {Rule 9(1)}.
11. Where an accident occurs at the facility or on a hazardous waste site or during transportation of hazardous waste the occupier or Operator of a facility shall report immediately to the State Pollution Control Board or committee about the accident in Form-5 {Rule 10}.
12. No owner or occupier generating non-ferrous metal waste specified in schedule 4 or generating used oil or waste oil of ten tons or more per annum shall sell or auction such non-ferrous metal wastes, used oil or waste oil to a registered re-refiner or recycler, as the case may be, who undertakes to re-refine or recycle the waste within the period of validity of his certificate of registration (Rule 20(1)).

TABLE 9.11: COLOUR CODE FOR THE MANIFEST COPIES

Copy Number With Colour Code	Purpose
Copy 1 (White)	To be forwarded by the occupier to the State Pollution Control Board or committee.
Copy 2 (Yellow)	To be retained by the occupier after taking signature on it from the transporter and rest of the four copies to be carried by the transporter.
Copy 3 (Pink)	To be retained by the operator of the facility after Signature.
Copy 4 (Orange)	To be returned to the transporter by the operator of Facility after accepting waste.
Copy 5 (Green)	To be returned by the operator of the facility to State Pollution Control Board/Committee after treatment and disposal of wastes.
Copy 6 (blue)	To be returned by the operator of the facility to the occupier after treatment and disposal of wastes.

9.8 ENVIRONMENTAL STATEMENT

Under rule 14 of the Environmental protection Rules 1986, every person carrying on an industry, operation or process requiring consent under Section 25 of Water (Prevention and control of Pollution) Act, 1974 (6 of 1974) or under Section 21 of the Air (Prevention and control of Pollution) Act, 1981 (14 of 1981 or both or authorization under the

hazardous Waste (Management & Handling) Rules 1989 issued under the Environment (Protection) Act, 1986 (29 of 1986) shall submit an Environmental Statement report for the financial year ending the 31st March in Form-V to the concerned State Pollution Control Board on or before 15th Day of September every year.

9.9 COST PROVISION FOR ENVIRONMENT MANAGEMENT

Total capital cost allocated towards environmental pollution control measures is about Rs. 2021.0 Lakhs and operation and maintenance cost will be around Rs.235.0 Lakhs per annum. The break - up of Environment Management cost for the project is given in the below table.

TABLE: 9.12 BUDGETARY PROVISIONS FOR ENVIRONMENTAL MANAGEMENT PLAN

Sl. No.	Description	Capital Cost (Rs. In Lakhs)	Operating Cost (Rs. In lakhs/ annum)
1.	Sewage Treatment Plant	300	90
2.	Landscape Development	200	25
3.	Solid waste Management	50	25
4.	Rainwater harvesting facilities	50	20
5.	Solar water Heaters with power panels	431	25
6.	Fire safety & protection	750	25
7.	DG set installation (16 Nos.)	240	25
Total Cost		2021	235

CHAPTER - 10

SUMMARY & CONCLUSION

M/s. Assetz Whitefield Homes Pvt. Ltd proposed modification and expansion of residential, commercial and school building in the name of Assestz Marq at Survey Nos. 159/1, 159/2, 160/1, 167/1,167/2, 167/3,167/4, 168, 169/1, 169/2, 169/3, 169/4 & 171 of Kannamangala Village, Bidarahalli Hobli, Bengaluru East Taluk, Bengaluru District.

In the total site area of 1,14,526.04 Sqm (28 A 12 G) Assetz proposed for modification and expansion of Residential area on an plot area of 90750.75 Sqm, Commercial area on an plot area of 21306.70 Sqm and Marq school on an plot area of 4540.0 Sqm at a cost of 725 Crores. The Kharb land involved is about 1416.4 Sqm and the site is abutting to 24.7 m existing wide road towards west side. The maximum height of the building considered is 91.05 m.

As per the TOR prescribed by the State Level Environment Impact Assessment Authority- Karnataka dated on 28.05.2019, EIA (Environmental Impact Assessment) study has been carried out for the period of March to May 2019 towards the proposed project and presented in EIA report in chapter wise from Chapter 1 to Chapter 9. On concluding the EIA study of the proposed modification and expansion of Residential Apartment, Commercial and School building Project named “Assetz Marq” is identified with no major impacts on the site and on to the surrounding environment. Since project involves the construction activity, there might be a chance of minor risks for which all necessary precautions and preventive management plans have been proposed and same will be implemented.

And while in operation, the proposed development does not involve any processing/manufacturing activities and it is nil, whatever the impacts like generation of domestic wastewater, solid waste, waste oil etc., for that proper well planned Environmental Management Plan has been proposed along with environment management cell to monitor environmental issues. Other permanent Environmental Management Plans like storm water management, internal transportation

management, sufficient parking provision, sewage treatment plant, organic waste converter, green belt development plan has also been proposed and the same will be effectively implemented and for the implementation of the same approximate budgetary allocations is also estimated.

However, development of this proposed residential apartment project has certain beneficial impacts/effects during the course of its construction and as well as in operational phase of the project.

Some of the beneficial impacts/effects are:-

- It will result in considerable benefits on physical infrastructures like transportation system, water supply & drainage system, power supply and social infrastructures like health centers, banking, education as well as small and medium scale industries like residential developments, hotels, shopping complexes, retail shops etc.,.
- Improvement to the general aesthetics of the surrounding area.
- It will also bring employment generation to skilled, semiskilled and unskilled; it is obvious to assume that, all the economic activities in the project area would induce considerable improvement in the socio-economic levels of people. The impact of human settlement is expected to be positive, as apart from some people being directly employed, many others will get indirect employment.
- The impacts are identified and evaluated to reduce their negative impacts and maximize the positive effects on the surrounding environment.
- It raises the living conditions of the citizens of the country.
- During construction, erection of barricades around the periphery, traffic management, scientific management of solid waste, hazardous waste, bio medical waste and e-waste measures were undertaken towards better implementation of the project.
- During operation phase, use of eco-friendly methods such as sewage treatment plant, organic waste converter, energy conservation features, rain water harvesting & recharging, scientific disposal of hazardous waste, bio medical

waste and e-waste, green belt development and corporate social activities around the project site will benefit the environment.

- Overall, the proposed project will have positive impact on the Environment if, the recommended Environmental Monitoring, Health & Safety and Environmental Management aspects are fully implemented by the project proponents.

The project proponent believes in the concept of eco-friendly developments comprising of eco-friendly operations with as assurance of implementing all the commitments which are been illustrated in the EIA report. "M/s. Assetz Whitefield Homes Pvt. Ltd." have started construction of Building 2, which is under modification and will start commercial and school building construction once after obtaining expansion clearance.

Overall impact from this project is minimal and will not reach 1 km of the surrounding area. Proper mitigation measures will be adopted to ensure no impacts. Thus, implementing this project will not have any appreciable negative impacts. Hence, the proposed project is a welcoming development and request to accord Environmental clearance.

CHAPTER - 11

DISCLOSURE OF CONSULTANT ENGAGED

We, AM ENVIRO ENGINEERS is a high-flying provider of environmental consulting to wide range of clients. Our comprehensive range of diversified services includes obtaining environmental clearance from SEIAA/MoEF, preparation of EIA/EMP and approval/authorization from KSPCB.

TABLE-11.1: PROJECT DESIGN TEAM

Sl. no	Consultancy Services	Name & address of the consultants
1.	Environmental Consultants	AM ENVIRO ENGINEERS No. 14/1, 2nd Floor, HARIKRUPA, Pattalamma Temple Street, Basavanagudi, Bengaluru - 560 004 Tel Phone. : 080 2657 6577
2.	Architects Consultants	M/S. Khan Global Engineering Consultants Pvt. Ltd. Indiranagar, Bangalore-560038 KGD, #3790, 7th main, HAL 2nd stage, Email: info@kgd-architecture.com
3.	Structural Consultants	M/s. Design Tree Service Consultants Pvt Ltd 7, Laxmi Narasimha Complex, 100 Feet Ring Road, 15th Cross Rd, JP Nagar 4th Phase, Bengaluru, Karnataka 560078 Email-info@designtreeconsultants.com
4.	PHE & Fire Consultants & Electrical Consultants	M/s. Design Tree Service Consultants Pvt Ltd 7, Laxmi Narasimha Complex, 100 Feet Ring Road, 15th Cross Rd, JP Nagar 4th Phase, Bengaluru, Karnataka 560078 Email-info@designtreeconsultants.com
5.	Traffic Impact Studies & Management Measures Consultants	M/s. Intelligent Traffic Solutions Vijayanagar, Bengaluru -40 Email: intellitrafficsol@gmail.com
6.	Landscape consultant and ecological planning	M/S. Khan Global Engineering Consultants Pvt. Ltd. Indiranagar, Bangalore-560038 KGD, #3790, 7th main, HAL 2nd stage, Email: info@kgd-architecture.com

7.	Lab Analysis Services	<p>M/S. ROBUST MATERIALS TECHNOLOGY PVT. LTD No.94, 2nd Floor, Thirumala Complex, NGEF Layout, Nagarabhavi,, Bengaluru-560 072, Bengaluru, Karnataka 560072 (Environmental Laboratory)</p> <p>M/s. NEXUS TEST LABS PVT. LTD. No.29, 2nd Floor, 3rd Main, Singaiahnapalya, Mahadevapura - post, Bangalore - 560048 (Environmental Laboratory)</p>
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CHAPTER - 12

CORPORATE ENVIRONMENTAL RESPONSIBILITY

Environment and natural resources are the prime source of all material inputs to economic activities. The environment also acts as a receiver and sink of the various kinds of waste generated through human activity. A proper balance between the developmental needs and environmental concerns is necessary in order to pursue the path of sustainable development which involves an enduring and balanced approach to economic growth, social protection and justice, and environmental conservation.

Sustainable development has many important facets/components like social, economic, environmental, etc. All these components are closely interrelated and mutually re-enforcing.

The cost of CER is to be in addition to the cost envisaged for the implementation of the EIA/EMP which includes the measures for the pollution control, environmental protection measures including, required, if any, and any other activities, to be derived as part of the EIA process.

Some of the activities relating to: –

- 1) Promotion of education and skill development
- 2) Infrastructure development
- 3) Supply of drinking water
- 4) Improving sanitation and health;
- 5) Development of roads and cross drains.
- 6) Providing electricity facility
- 7) Improving solid waste management
- 8) Rain water harvesting facility
- 9) Scientific support and awareness to local farmers to increase yield of crop and fodder,
- 10) Improve Solar power facility
- 11) soil moisture conservation works, avenue plantation, plantation in community areas,

The entire activities proposed under the CER shall be treated as project and shall be monitored. The monitoring report shall be submitted to the regional office as a part of half-yearly compliance report, and to the District Collector. It should post on the website of the project proponent.

Capital investment of the brown field project of M/s. Assetz Whitefield Homes Pvt. Ltd. falls under >500 crores <1000 crores. Hence the fund allocation for the CER shall be of 0.5% i.e., 3.625 cr.

The following are the expected corporate Environmental responsibility where Assetz will implement once after obtaining EC.

12.1 IMPLEMENT PLAN OR INITIATIVES PROPOSED ON CORPORATE ENVIRONMENTAL RESPONSIBILITY

- Environmental cell will be framed to manage/maintain all environmental aspects, such as sewage treatment plant, solid waste management, maintenance of landscape and environmental monitoring of the project premises during the operation phase of the project. In addition, sufficient fund will be fixed for maintenance of EMP cell.
- Environmental Compliance study with respect to EC conditions will be carried out during the construction phase twice in a year by considering the study periods from April to September and October to March and the report of the same will be submitted to concerned department.
- Similarly compliance study will be carried out by the maintenance team during operation phase. All other required statutory clearances will be obtained from the concerned department; therefore there won't be any violation/non compliance in the proposed project.
- Technical Clearance such as Consent for Establishment (CFE) and consent for operation shall be applied to Karnataka State pollution Control board (KSPCB)
- Landscape development as proposed in the project
- Providing jobs for local people as committed.