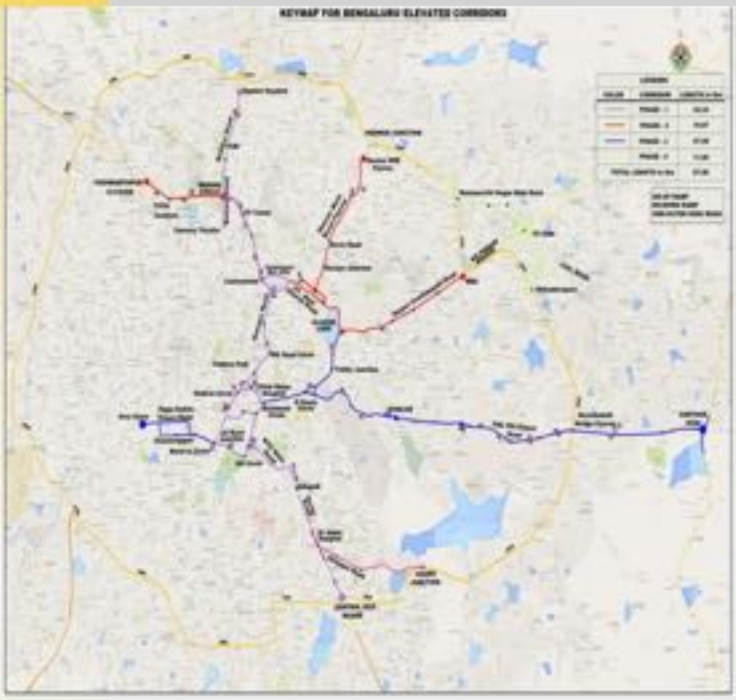
KARNATAKA ROAD DEVELOPMENT CORPORATION LIMITED

Consultancy Services for Preparation of **Detailed Feasibility Report (DFR)** for the Construction of **Proposed Elevated Corridors** within Bengaluru Metropolitan Region, Bengaluru



FINAL FEASIBILITY REPORT

VOLUME-IV : ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FEBRUARY, 2019

AECOM Asia Co. Ltd.

in association with

Deloitte Touché Tohmatsu India LLP &
Infra Support Engineering Consultants Pvt. Ltd

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Adherence to Terms of Reference

The State Expert Appraisal Committee (SEAC), Karnataka has considered the Elevated Corridor proposal by Karnataka Road Development Corporation Limited (KRDCL) during its meeting held on 28th September 2018, and the Committee prescribed the following Terms of Reference (TOR) for preparing EIA/EMP report with latest one season baseline data other than monsoon for the proposed elevated corridor project.

The SEIAA Karnataka after due consideration of the relevant documents submitted by the project proponent and recommendation of the SEAC, has decided to accord the Standard Terms of Reference (TOR) along with additional Terms of Reference, in its meeting held on 12th October 2018, in accordance with the provisions of Environmental Impact Assessment Notification-2006 and its subsequent amendments made there on.

An Environment Impact Assessment (EIA) study has been undertaken for the proposed elevated corridor project in Bengaluru Metropolitan Region in accordance with the Terms of Reference (TOR) by the State Environmental Appraisal Committee (SEAC).

Point wise compliance with ToR provided by MoEF for the Project is as follows.

Sl. No.	Items	Section
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 type.	Refer to Section 4.10
2	Submit details of environmentally sensitive place, land acquisition status, rehabilitation of communities/ villages and present status of such activities.	Refer to Section 4.7, Section 5.2.3 & 5.2.5 and Table No 5.10
3	Examine baseline environmental quality along with projected environmental road due to the project.	Refer to Section Chapter 4
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.	Refer to Section Chapter 4
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	Refer to Section Section 4.7
6	Submit the details of the trees to be felled	Refer to Section Annexure 5

Sl. No.	Items	Section
	for the project.	
7	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	Refer to Section 4.10
8	Submit Roles and responsibility of the developer etc. for compliance of environmental regulations under the provisions of EP Act.	Refer to Section 8.6
9	Ground water classification as per the Central Ground Water Authority.	Refer to Section 4.9
10	Examine the details of Source of water, water requirement, use of treated waste water and prepare a water balance chart.	Refer to Section 5.2.1
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.	Refer to Section 6.1.1
12	Examine soil characteristics and depth of ground water table for rain water harvesting.	Refer to Section 4.9
13	Examine details of solid waste generation treatment and its disposal.	Refer to Section 5.2.2
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.	Refer to Section 6.6
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 submit details.	Refer to Section 5.2.5
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.	Refer to Section 5.2.4
17	A detailed traffic and transportation study	Refer to Section 2.7, 2.8 & 2.10

Sl. No.	Items	Section
	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.	Refer to Section 2.11
19	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Refer to Section Chapter 8
20	Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.	Refer to Section 8.1.3 & 8.1.4
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 pending Litigation
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.	Refer to Section 8.10 & Table 8.6
23	Any further clarification on carrying of 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.	Refered
Sl. No.	Additional TOR:	Section
1	The applicability of the Hon'ble National Green Tribunal order dated 4th May 2016 in O.A No.222 of 2014 on buffer zone for water bodies and nalas may be studied and submitted.	Refer to Section 3.11 and 4.7
2	As per the proposal about 12 Lac cum of earth required to be brought from outside. The proponent should work out the alternative scheme to reduce the earthwork requirement.	Refer to Section 5.2.2, 8.1 and Apendix 1
3	Scientific handling of earthwork generated during construction may be detailed and	Refer to Section Apendix 1

Sl. No.	Items	Section
	submitted keeping in view best possible mitigation measures for dust.	
4	Scheme for treating Rain water harvested from the carriage way in order to arrest oil and grease entering into the soil / water bodies.	Refer to Section 6.1
5	Impact on the nearest water body and archeological structures may be studied properly and submit.	Refer to Section 4.7, 5.2.3, 5.2.10, 3.1 & Table 8.1
6	The scheme for vertical garden on the pillars in order to reduce the heat effect & vehicular emissions may be worked out and submitted.	Refer to Section 6.4
7	Quantification of solar energy harvesting potential from the structure railings as well as carriage was to be worked out.	Refer to Section 6.6
8	Scheme to reuse the demolition debris after proper recycling.	Refer to Section 5.2.2 & Table 8.1
9	Carbon foot print to be studied and suitable offsets may be suggested.	Refer to Section 6.7
10	Steps taken to reduce the energy embodiment of the materials used may be detailed.	Refer to Section 6.8
11	Changes to the micro climate to be modeled and simulation studies to be submitted.	Refer to Section 4.5.2
12	List of trees to be felled, pruned, retained along with details of locality along with budget backup for plantation and its maintenance at least for 10 years.	Refer to Section Annexure 5 Section 8.10
13	To propose suitable location details to take up compensatory plantation with budget details.	Refer to Section 6.3 & 8.10
14	Propose suitable ornamental plants in the medians at ground level to improve the aesthetic view.	Refer to Section 6.5
15	Examine the possibility of transplanting at least 20% of trees that are proposed to be felled.	Refer to Section 6.2
16	Land use land cover analysis of project corridor area using high resolution satellite data.	Refer to Section 4.10

1. INTRODUCTION

1.1 Background

Bengaluru is one of the fastest growing cities in India. The city is also known as Silicon Valley of India. It is in forefront supporting the growth of Information Technology and several other service based industries attracting people and business from across the nation. This has led to the unpredicted and uncontrolled growth of population and traffic forcing city to face tough challenges in providing and extending basic infrastructure and services. Road transport is one such infrastructure which has been facing severe stress in the recent past.

Bengaluru being a multi-nodal city lacks wider roads connectivity to different parts and suffers from traffic congestion due to narrow roads. In addition, Bengaluru roads are too narrow and highly developed all along the roads for widening to cater for the growing numbers of vehicles. There are no good transit corridors between southern and northern, and eastern and western parts of the city.

Bengaluru's vehicle population has been growing day by day and the city roads are being added roughly 5 lakh vehicles every year. By February 2016, the number of non-transport vehicles such as two-wheelers and cars in the city had reached 54.67 lakh. According to State Transport Department, two-wheelers are numbering over 41.86 lakh followed by cars numbering 11.8 lakh. Number of transport vehicles stands at over 5.91 lakh. These numbers exclude the vehicles that come in and go out of the city. This out growing numbers vehicles are choking the city roads with frequent traffic jams and have made traffic police helpless.

Further, for various known reasons public is using the independent modes of transportation for commuting on existing limited road network adding to the congestion, accidents, noise and air pollution. As per the report on Comprehensive Traffic and Transportation Plan for Bangalore (CTTP) – 2011, an average Bangalorean spends more than 240 hours stuck in traffic every year and such delays are resulting in loss of productivity, in addition to deterioration of air quality, reduced quality of life, and increase in costs for services and goods.

The concept of elevated corridor evolved to counter the traffic woes of the city in the form of traffic congestion and provide solution for many of the traffic related problems. The initial idea on the proposed elevated corridor was through Centre for Smart Cities in late 2014 in the form of pre-feasibility report. This project plan was initially proposed and presented before BBMP's Technical Advisory Committee and the Urban Development Department (UDD) directed the BBMP to prepare a Detailed Feasibility Report. Given the scale and complexity of the project, UDD then decided to hand over the project to Karnataka Road Development Corporation Ltd.

The project is envisaged to separate the cross-city traffic and the neighborhood traffic, with an aim to decongest the core city and provide easy access to suburban towns and Bengaluru International Airport. The project is planned based on two traffic directions of the city - North-South and East-West, with interconnecting and loop elevated corridors. The basic idea is to decongest at grade roads by creating an additional capacity in the form of elevated corridors. This enhances the traffic carrying capacity of the roads at grade. As the widening of Bengaluru city roads is not possible, we are only left with the option of going vertical by elevated corridors. In this context, Government of Karnataka has planned for elevated corridors to ensure safe, fast and congestion free connectivity to different parts of city by three main corridors (North-South and East-west (1&2)) and three connecting corridors. This project was announced by GoK in year 2015 and further included in the budget speech for the year 2016-17.

Following paragraphs are brought out from the report on Comprehensive Traffic and Transportation Plan for Bangalore (CTTP) – 2011. The analysis of collected data from primary and secondary sources has identified the following major issues regarding the transport system of Bangalore:

Road network capacity is inadequate. Most of the major roads are with four lane or less with limited scope for widening. The junctions are closely spaced on many roads. Many junctions in core area are with 5 legs. This makes traffic movement difficult. There is a need to optimize the available capacity by adopting transport system management measures and by making use of intelligent transportation systems.

Traffic composition on roads indicates very high share of two wheelers. The share of cars is also growing. This indicates inadequate public transport system. V/C ratios on most of the roads are more than 1. Overall average traffic speed is about 13.5 kmph in peak hour. This not only indicates the need of augmenting road capacity but also to plan high capacity mass transport systems on many corridors.

Outer cordon surveys indicate high through traffic to the city. This, points to the need of road bypasses not only for Bangalore Metropolitan Area (BMA) but also for Bangalore Metropolitan Region (BMR). High goods traffic also indicates the need of freight terminals at the periphery of the city.

The household travel surveys indicate high share of work trips. This segment of travel demand needs to be mostly satisfied by public transport system. Considering the large employment centres being planned in the BMA, the public/mass transport system needs to be upgraded/ extended substantially.

At present, modal split in favour of public transport is about 46% (exclusive of walk trips). The trends show a decline in this share over the last two decades. This is further expected to fall unless adequate and quality public transport system is provided to the people of Bangalore. Share of two wheelers and cars in travel demand is disturbingly high. This trend needs to be arrested.

There is high pedestrian traffic in core area and some other areas in Bangalore. Footpath facilities are generally not adequate and their condition is deteriorating. Therefore up gradation of their facilities is very important. Share of cycle traffic has declined over the years. This mode of transport needs to be promoted by providing cycle tracks along the roads.

Parking is assuming critical dimensions in Bangalore. Parking facilities need to be augmented substantially. In the long run, city-wide public transport system needs to provide not only to reduce congestion on roads but also to reduce parking demand.

Area of the BMA has been increased as per Revised Master Plan-2015. This plan has provided for densification of existing areas, Mutation corridors, hi-tech areas etc. in various parts of the city. This is likely to have a major impact on traffic demand. The transport network including mass transport system needs to be planned taking the proposed development in to consideration.

Major developments have been proposed in the suburban towns of Bangalore by BMRDA in the BMR. This is likely to increase interaction between Bangalore and these suburban towns. There will be need to provide commuter rail services to these towns from Bangalore.

Thus while planning for the transport system of Bangalore, the above problems and issues need to be kept in consideration. The issues relating to traffic and transportation in a large and growing city like Bangalore need to be viewed in the larger perspective of urban planning and development. Issues relating to land use planning and development control, public-private transportation policy and industrial location would need to be integrated at the perspective planning level. With Metro Rail under implementation there is the need to coordinate inter modal transport issues.

1.2 Objective of Environmental Impact Assessment

The main objective of the study is to identify, predict and evaluate the nature, magnitude and significance of the potential adverse environmental and social impacts of the proposed elevated corridor project on environment to ensure that the project implementation is sustained with minimal impacts on environment; to help for decision making by providing information on the environmental consequences by the project and to promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.

The Environment impact assessment report is prepared in order to achieve the following objectives:

- Understanding the requirements of proposed project.
- Review information about the general environmental settings along the project corridor as baseline data;
- Review the applicability of National and State framework and relevant guidelines and policies to the project implementation.
- Identify significant potential impacts of the project and characteristic of the impacts, magnitude, distribution, project affected group, and their duration to ensure that environmental considerations are given adequate importance in the selection and design of proposed improvements.
- Develop a broad frame work of mitigation measures and environmental management plan addressing identified impacts.

1.3 Methodology and Scoping

The scope of environmental impact assessment includes screening and scoping, environmental assessment and environmental management plan for the proposed project in line with EIA Notification 2006 and subsequent amendments. Scope as determined by detailed and comprehensive Terms of Reference (TOR) issued on 23.10.2018 by SEAC/SEIAA to address significant environmental concerns in respect of the proposed project or activity for preparing Environment Impact Assessment (EIA) Report.

The scope of EIA / EMP studies are as follows.

- Collection of baseline data on various components of the environment such as Physical (Air, Water, soil & noise) parameters Biological components along with socioeconomic scenario of the project area.
- Review of policies and legal framework.
- Determination of the magnitude of environmentally significant impacts so that due consideration is given to them during planning, construction and operational phases of the project implementation.
- Identification and categorization of the potential impacts during pre-construction, construction and operation phases.
- Developing mitigation measures to sustain and maintain the environmental scenario. Providing compensatory developments wherever necessary, including plans for tree plantation.
- Preparation of Environmental Management Plan and Monitoring Plan.

1.4 Structure of the Report:

Chapter 1: Introduction - The section gives a brief background of the project and presents the scope of the study and the structure of the report.

Chapter 2: Project Description - Salient features of the proposed project such as project location, packages, design standards followed, construction methodology, proposed right of way (RoW), by passes for the built-up areas or congested stretches, etc. along with delineation of study area (Impact zone and influence zone) are discussed in this section.

Chapter 3: Policy, Legal & Administrative Framework - The policy, legal and administration framework within which the project is set. The major stakeholder departments of the State and Central Governments with their specific roles and the applicable acts and laws are described. This section includes the clearance requirements at various stages of pre-construction, construction and operation phases of the project implementation.

Chapter 4: Description of Environment - Describes the existing environmental scenario in detail. The section on meteorological baseline, components of the biophysical and natural environments along the corridor are described. Comprehensive pictures of the existing environmental features have been highlighted in this chapter

Chapter 5: Environmental Impact Assessment - The focus of this section is on the adverse impacts and their evasion, mitigation and enhancement measures. The beneficial impacts on the environment due to project have been detailed. The enhancement measures for environmental sustainability and good engineering practices in addition to mitigation measures are presented.

Chapter 6: Additional Studies – In this section, additional studies have been done as per the some of the recommended TOR

Chapter 7: Environmental Management and Monitoring Plan - Details comprehensive and coherent environmental management plan along with an elaborate environmental monitoring plan for construction and operation phases of the project implementation.

Chapter 8: Project Benefits – Benefits of the project is discussed in this section.

Chapter 9 Conclusion - Conclusions and recommendations, on the basis of present study, past experiences and sensitivity of project corridors to improve the proposed corridor project.

Chapter 10: Disclosure of Consultants -

2. PROJECT DESCRIPTION

The project consists of total 6 corridors extending to an approximate length of 102.04 km with three main corridors running north to south (NS-1) and two corridors running east to west (EW-1 & EW-2). The other three corridors are connecting corridors (CC-1, CC-2 & CC-3) which provide access to EW corridors. The proposed elevated corridors attempts to connect the National Highways, (Tumkur – Old Madras Road (NH 4) (AH 47; Bellary - Hosur Road/Electronic City Road (NH 7) (AH 43); Sarjapur Main Road (SH 35); Kanakapura Main Road (NH 209); Mysore Road (SH 275); Doddaballapura Road and Singahalli road (SH 104).

Table 2-1: List of proposed elevated corridors

Sl No.	Name of the Corridor	Length (Km)
1	NS-1: North-South Corridor-1 connecting Hebbal (Esteem Mall) to Central Silk Board (i.e., NH-7 towards Bellary to NH-7 towards Hosur)	26.89
2	EW-1: East-West Corridor-1 connecting K.R. Puram to Gorguntepalya (i.e., NH-4 towards Tumkur Road) including Rammurthynagar (Ring road) to ITPL Stretch	31.94
3	EW-2: East-West Corridor-2 connecting Varthur Kodi to Deepanjali nagar and NICE Link Road (Mysore Road, NH - 275)	29.48
4	CC-1: Connecting Corridor-1 Connecting East-West Corridor-2 at Kalasipalya to Agara on Outer Ring Road	4.48
5	CC-2: Connecting Corridor-2 Connecting East-West Corridor-1 at Ulsoor to East-West Corridor-2 at D'souza circle.	2.80
6	CC-3: Connecting Corridor-3 Connecting East-West Corridor-1 at Wheeler's road jn.to Kalyan Nagar at Outer Ring Road	6.46
	Total Length	102.04

The corridors are described in the following sections.

2.1 North - South Corridor Connecting Mekhri Circle and Silk Board Junction:

The corridor starts from Hebbal Flyover along Airport Road Esteem Mall at Airport Flyover and ends before Silk Board flyover via Jayamahal main road - Queen's Road-Indian Express Junction - Infantry Road Junction - Minsk Square - Kasturba Road - Hudson Circle - Audugodi Nala - Audugodi main road.

2.2 East - West Corridor - 1: Connecting NH48 (earlier NH-4) at Battarahalli and Gorguntepalya on Tumkur Road

The project corridor starts at Bhattrahalli on Old Madras Road and ends at Gorguntapalya junction on Tumkur road via Devasandra Main Road - Ramamurthy Nagar Main Road Junction (ITI) – KR Puram cable stayed bridge - Suranjandas Road Junction - 80 Feet Road junction - 100 feet Indiranagar road Junction - D Bhaskaran Road Junction - Kensington Road Junction (Philips buildings) – Ulsoor lake - St. John's Road – Millar's Road - Jayamahal Main Road – Mekhri Circle - CV Raman Road – Yeswanthapur flyover - Yeshwanthpur Railway Station - Outer Ring Road junction Central Manufacturing Technology Institute (CMTI).

2.3 East - West Corridor - 2: Connecting SH-35, Varthur Kodi to Deepanjanli Nagar (West of Chord Road) NICE link road on Mysore road

The corridor takes off at Varthur kodi junction on SH-35 and ends at Deepanjanli Nagar on Mysore road (at NICE link road on Mysore road) via. Kundala halli gate junction – Marathahalli underpass - Suranjandas Road Junction - Old Airport road – Wind tunnel road junction - Domlur Junction - Trinity Church Junction - D'Souza circle - General K S Thimmaiah Road - Vellara Junction - Richmond Circle - K.H.Road - Lalbagh Main Road – Minerva junction - Chamarajpet 5th Main Road - 9th Cross Road - 1st Main Road Junction - Alur Venkata Rao Road - Sirsi Circle - Satellite Bus Station - Bapuji Nagar - Deepanjali Nagar - NICE Link Road (Mysore Road, NH - 275).

2.4 Connecting Corridor-1:

This corridor creates connectivity between North-South corridor and Sarjapura Road, corridor starts at Sarjapur Bridge at Agara and traverses via Jakkasandra - Madiwala Market Junction - Koramangala 100 Feet Road Junction

2.5 Connecting Corridor-2:

This corridor creates connectivity between East-West Corridor-1 and East-West Corridor-2, corridor starts from D'souza circle on Richmond road Junction and ends at Ulsoor Lake via General KS Thimmaiah Road - Trinity Junction & Ulsoor Lake Junction (connecting East West Corridor-1)

2.6 Connecting Corridor-3:

This corridor creates connectivity between St. Johns Church Road and Outer Ring Road (ORR) at Kalyan Nagar (The location where new airport expressway starts as in Master Plan), corridor starts from St. Johns Church Road Junction (East-West Corridor 1) and ends at Kalyan Nagar at Outer Ring Road via. Wheeler Road - ITC factory – Sevanagar - Banaswadi Main road.

As described above the corridors were studied and extensive walkover studies are made to ascertain first-hand information on the suitability in terms of adequate road widths, bottlenecks that may arise for planning, critical points which are to be considered, etc.

Further, the lane configuration of 6 lanes and 4 lanes has been relooked depending upon the traffic volumes, circulation plans and most importantly availability of RoW for construction, traffic diversions during construction. At locations, corridors have been split into two directions and taken on different routes as independent carriageways so that the structure can be accommodated within the available roadway widths and multilevel or Double Decker structures may be avoided.

Most of the abutting land on either side of the project corridors is either commercial or community holdings. Certain sections of Project corridors abutting land belongs to Defence

(Military), Railways, Public sectors like HAL and educational institutions. Few Religious structures are also exists.

There are bus stops with shelters along the corridors, there exists skywalks/foot over bridges, gantry sign boards, street lighting like high mast lamps etc. are also located at places. The project corridors are flanked by important community structures such as schools, colleges, and places of religious importance like temples, masjids and churches, etc. Implementation of the project may impact these structures and might have to be shifted to avoid the impact.

Phasing for Implementation of Elevated Corridor: After several rounds of discussion with the Technical Committee on the ease of implementation of the elevated corridor project, decision was taken to conveniently split different project corridors in to different phases, based on the stretches between critical obligatory junctions which are significant in decongesting the roads; type and area of land to be acquired; number of trees to be cut/pruned; etc. Total five phases are planned as presented in the table below.

Table 2-2: Phasing for Implementation of Elevated Corridor

<table>
<tr><th rowspan="2">Corridor Packages</th><th rowspan="2">From</th><th rowspan="2">To</th><th colspan="3">Length (km)</th></tr>
<tr><th>Main Line</th><th>One Way</th><th>TOTAL</th></tr>
<tr><td colspan="6">PHASE I</td></tr>
<tr><td rowspan="2">Package 1</td><td>Baptist Hospital</td><td>Mekhri Circle</td><td rowspan="2">7.60</td><td rowspan="2">0.00</td><td rowspan="2">7.60</td></tr>
<tr><td>Mekhri Circle</td><td>Cantonment</td></tr>
<tr><td rowspan="2">Package 2</td><td>Cantonment loop</td><td>Vital Mallya Junction</td><td rowspan="2">4.47</td><td rowspan="2">2.17</td><td rowspan="2">6.64</td></tr>
<tr><td>Vital Mallya Junction</td><td>ITC Hotel</td></tr>
<tr><td rowspan="2">Package 3</td><td>Adugodi (Hosur Road)</td><td>Silk Board</td><td rowspan="2">8.54</td><td rowspan="2"></td><td rowspan="2">8.54</td></tr>
<tr><td>Agara</td><td>St Johns Circle</td></tr>
<tr><td>Package 4</td><td colspan="2">Mekhri Circle Interchange</td><td>1.70</td><td>1.70</td><td>0.00</td></tr>
<tr><td colspan="3">Total Length of Phase – I Corridors</td><td>22.31</td><td>2.17</td><td>24.47</td></tr>
<tr><td colspan="6">PHASE II</td></tr>
<tr><td rowspan="3">Package 1</td><td>Bhattarahalli</td><td>K.R.Puram Bridge</td><td rowspan="3">10.79</td><td rowspan="3">0.00</td><td rowspan="3">10.79</td></tr>
<tr><td>Gopalan Mall</td><td>Ulsoor lake</td></tr>
<tr><td>Ulsoor Lake Interchange</td><td></td></tr>
<tr><td rowspan="3">Package 2</td><td>Ulsoor Lake</td><td>Millers Road Junction</td><td rowspan="3">11.91</td><td rowspan="3">1.21</td><td rowspan="3">13.12</td></tr>
<tr><td>Ulsoor Lake</td><td>D 'souza Circle</td></tr>
<tr><td>Wheelers Road</td><td>Kalyan Nagar Flyover</td></tr>
<tr><td>Package 3</td><td>Mekhri Circle</td><td>Peenya (Metro Station)</td><td>6.30</td><td>0.00</td><td>6.30</td></tr>
<tr><td rowspan="3">Package 4</td><td>Rammurthy Nagar (ORR)</td><td>NH 4</td><td rowspan="3">9.84</td><td rowspan="3">1.15</td><td rowspan="3">10.99</td></tr>
<tr><td colspan="2">Old Madras Road to ORR (Mahadevpura) Loop</td></tr>
<tr><td colspan="2">ITI Interchange</td></tr>
<tr><td colspan="3">Total Length of Phase – II Corridors</td><td>38.84</td><td>2.36</td><td>41.20</td></tr>
</table>

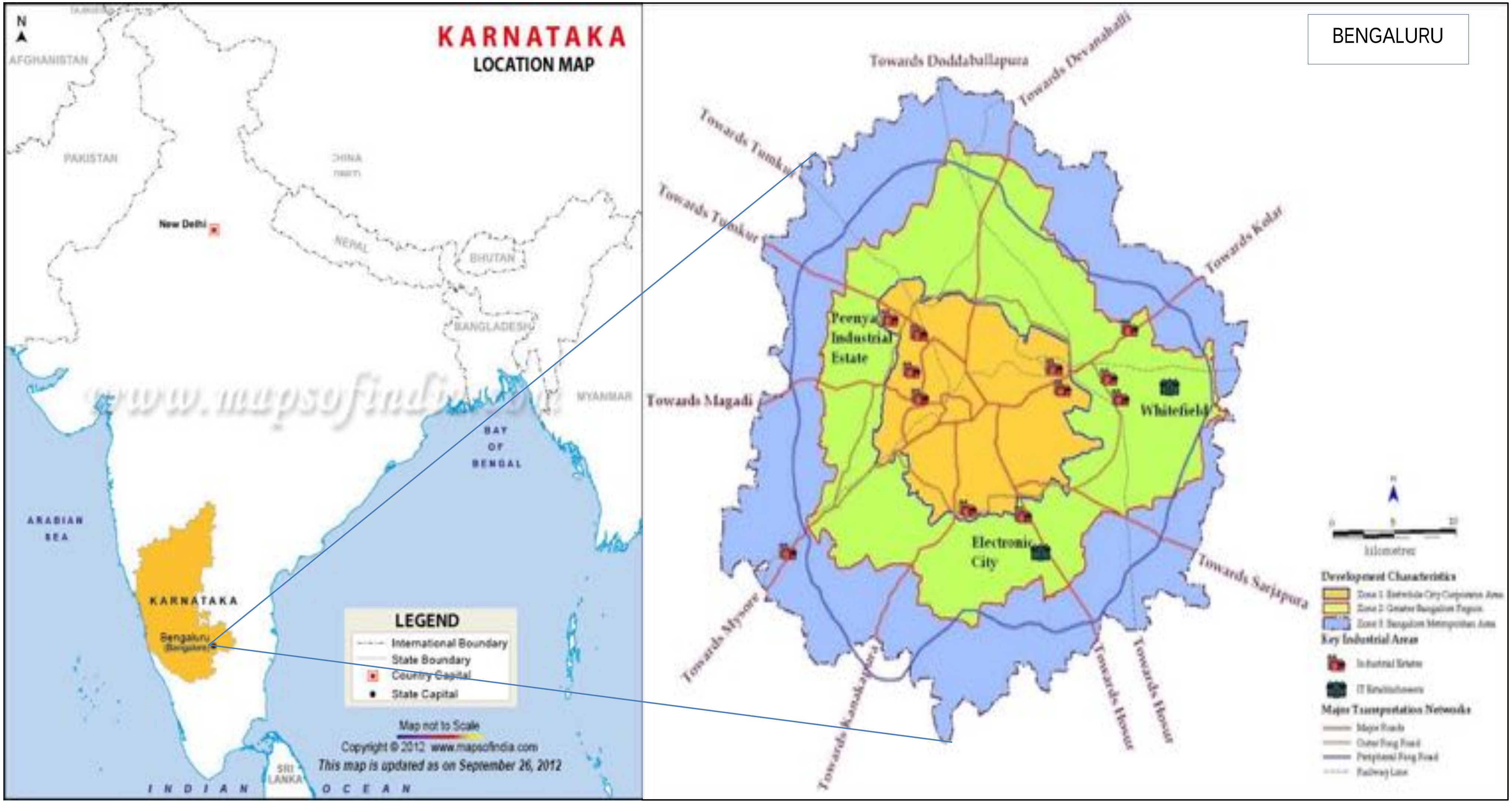
Corridor Packages	From	To	Length (km)		
			Main Line	One Way	TOTAL
PHASE III					
Package 1	CBD Area Stretch Over Shanthinagar SWD		4.88	5.20	10.08
Total Length of Phase – III Corridors			4.88	5.20	10.08
PHASE IV					
Package 1	Minerva Circle	Deepanjalinagar on Mysore Road	6.60	2.65	9.25
Total Length of Phase – IV Corridors			6.60	2.65	9.25
PHASE V					
Package 1	Varthur Kodi	After Marathahalli Junction	7.10	0.00	7.10
Package 2	After Marathahalli Junction	Richmond Circle	9.94	0.00	9.94
Total Length of Phase – V Corridors			17.04	0.00	17.04
TOTAL LENGTH (Km)			89.66	12.38	102.04

2.7 Proposals for the elevated corridor

The broad proposals for the elevated corridor project includes

- Elevated road along the major at-grade roads within Bangalore city
- Propose interchanges, ramps (entry and exit) and loops to provide acces to different arterial roads and at-grade roads
- Integration of elevated corridors with multi modal transportation systems such as BMRCL, BMTC, Mono Rail, etc. which are in various stages of implementation.
- Design road furniture, median separation, provide road safety and traffic control features
- Design of drainage to facilitate easy flow of surface run off water to nearby major drains

Figure 2-1: Location of proposed elevated corridors, Bengaluru



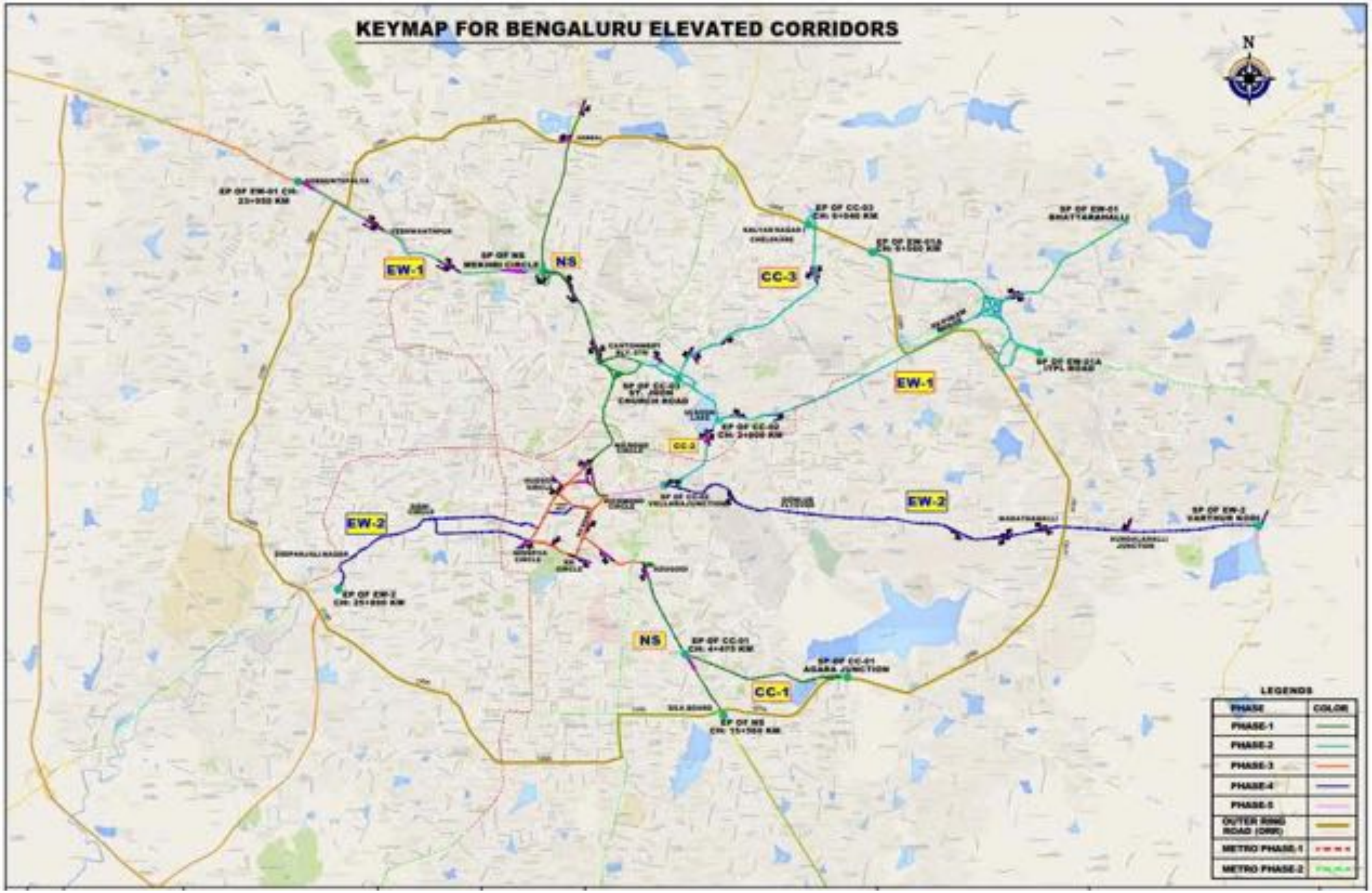


Figure 2-2: Location of proposed elevated corridors, Bengaluru

Table 2-3: Present and Future Traffic along the proposed project stretches

Sl . No.	Corridors /Sections	Section Length (in KM)	Without Corridors : Present Scenario				All Corridors Operational		
			2016				2037		
			Base Year Assigned Traffic (Vehicles)				Vehicles		
			Two Wheeler	Autos	Buses	Cars	Two Wheeler	Buses	Cars
NS									
1	Jayamahal Road	2.6	37,309	9,066	2,750	37,225	107000	141	51,791
2	Queens Road	3.13	24,860	6,475	1,277	25,005	58,350	148	40,179
3	Kasturba Road	2	40,068	10,428	5,658	52,001	65,100	164	40,226
4	Richmond Road- St. Joseph Jn.	1.8	23,669	4,689	1,915	19,943	81,098	125	42,940
5	St. Joseph Jn. - Siddaiah Road	1.8	21,907	5,166	3,181	20,260	83,229	233	44,735
6	Siddaiah Road - Wilson Garden	1.6	13,192	2,223	1,247	12,152	89,044	253	44,016
7	Hosur Road - Sarjapur Junction	2.3	34,004	8,166	4,515	24,891	99,866	254	52,083
8	Sarjapur Jn. - Orr	1.2	15,988	4,198	895	14,437	79,012	201	32,533
	TOTAL		210,997	50,411	21,438	205,914	662,699	1,519	348,503
EW -1									
1	Jalahalli - Yashwanthpur	3.35	55,163	10,710	7,131	44,766	37,908	36	8,492
2	Yashwanthpur - Iisc	1.5	44,561	8,754	4,095	36,837	64,089	115	24,854
3	Tumkur Road: Iisc - Mekhri Circle	2.5	55,391	11,855	7,486	45,686	88,978	160	43,006
4	Millers Road - St. Johns Church Road	1.6	23,071	6,160	2,424	32,199	77,099	139	42,386
5	Kensington Road - Murphy Road	2	32,552	9,047	3,817	37,635	83,570	117	39,386
6	Old Madras Road - Kr Puram Junction	3.64	84,671	14,367	6,584	83,626	89,207	219	40,543
7	Kr Puram Junction - Bhattarahalli	13.6	73,724	12,958	4,725	40,530	72,232	177	24,347
	TOTAL		369,133	73,851	36,262	321,279	513,083	963	223,014
EW-II									

Sl. No.	Corridors /Sections	Section Length (in KM)	Without Corridors : Present Scenario				All Corridors Operational		
			2016				2037		
			Base Year Assigned Traffic (Vehicles)				Vehicles		
			Two Wheeler	Autos	Buses	Cars	Two Wheeler	Buses	Cars
1	Deepanjali Nagar - Sultan Road	3	43,845	9,247	6,586	45,633	49,583	33	26,113
2	Kr Market - Richmond Circle	6.27	23,669	4,689	1,915	19,943	35,080	133	12,920
3	Chamrajapete - Kh Circle		11,564	1,902	810	11,861	32,485	35	17,462
4	Richmond Road - Hal Airport Road	2.5	34,913	8,224	1,567	35,361	95,883	226	45,461
5	Hal Airport Road - Domlur Flyover	3.5	34,913	8,224	1,567	35,361	81,888	162	44,434
6	Old Airport Road - Marathahalli (Orr)	6.5	45,823	8,313	3,175	41,752	74,119	144	39,702
7	Varthur Road	5.2	25,613	4,771	1,612	18,988	57,910	50	21,705
	TOTAL		220,340	45,370	17,232	208,899	426,948	783	207,797
CC-I									
1	Sarjapur Road	4.48	18,235	5,871	649	17,695	57,115	57	21,291
CC-II									
1	D'souza Circle - Bhaskaran Road	2.8	64,985	12,092	4,285	54,675	82,031	160	34,459
CC-III									
1	Banaswadi Road	6.46	19,079	4,228	1,698	19,240	30,602	76	17,118

2.8 Traffic Forecast:

Traffic growth rates have been estimated for the traffic flowing on the primary network within the city of Bangalore. The overall traffic growth rates have been estimated considering the growth rate used for passenger trip forecast as per the recommendations of Comprehensive Traffic and Transportation Plan (CTTP) for Bangalore, 2025 and the DPR for Bangalore Metro Phase I and II. The growth also considers the impact of Metro expansion in the city of Bangalore. Present and future traffic along the proposed project stretches is given in Table 2-3.

In order to analyze the vehicle growth in the city of Bangalore, the vehicle registration data of the city has been collected. The annual growth rates and Compound Average Growth Rate (%) of different vehicle types is presented below in Table 2-4.

Table 2-4: Growth of Registered vehicles in Bangalore (In Lakhs)

Year	TW	Cars	Autos	Buses	Trucks	Taxi Cab	Tractors /Trailers	Others	Total Vehicles
1980	1.12	0.36	0.10	0.05	0.08	0.00	0.04	0.01	1.75
1985	2.16	0.60	0.10	0.05	0.12	0.00	0.01	0.02	3.07
1990	4.59	0.91	0.17	0.05	0.19	0.00	0.04	0.04	5.98
1995	6.49	1.26	0.37	0.11	0.29	0.02	0.06	0.10	8.71
2000	10.67	2.14	0.61	0.21	0.42	0.04	0.12	0.17	14.38
2001	11.62	2.36	0.64	0.23	0.48	0.05	0.13	0.16	15.66
2002	12.92	2.61	0.68	0.25	0.53	0.05	0.15	0.20	17.39
2003	14.19	2.87	0.72	0.28	0.59	0.07	0.16	0.24	19.12
2004	15.86	3.36	0.74	0.34	0.68	0.10	0.20	0.28	21.57
2005	18.11	3.87	0.80	0.37	0.85	0.13	0.23	0.31	24.67
2006	20.74	4.54	0.91	0.39	0.92	0.16	0.29	0.46	28.41
2007	22.32	5.27	0.95	0.48	1.10	0.18	0.31	0.45	31.07
2008	22.64	5.53	0.96	0.49	1.19	0.19	0.32	0.54	31.85
2009	26.08	6.46	1.06	0.42	1.29	0.21	0.32	0.69	36.53
2010	25.47	7.24	0.93	0.73	1.38	0.20	0.13	0.78	36.86
2015	41.11	11.59	1.59	0.88	0.96	0.99	0.16	0.43	59.49
CAGR	10.75%	10.32%	8.10%	8.33%	7.27%	14.06%	5.10%	11.29%	10.51%

Source: Comprehensive Traffic and Transportation Plan for Bangalore, 2025; RTA Karnataka.

2.9 Typical Cross Sections proposed

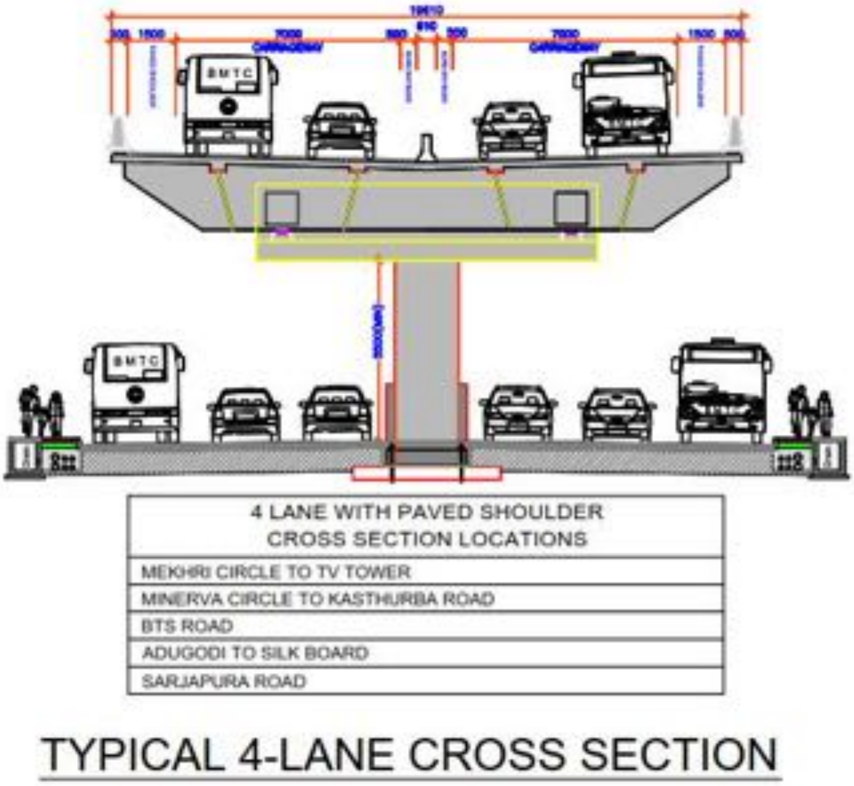


Figure 2-3: Typical Cross Section for four lane elevated corridor

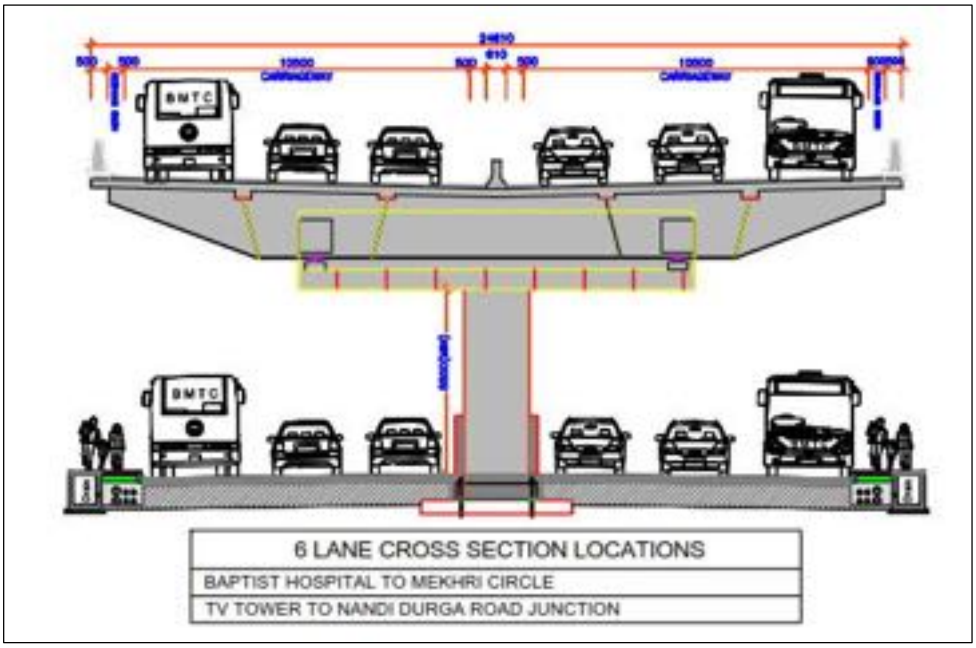


Figure 2-4: Typical Cross Section for six lane elevated corridor

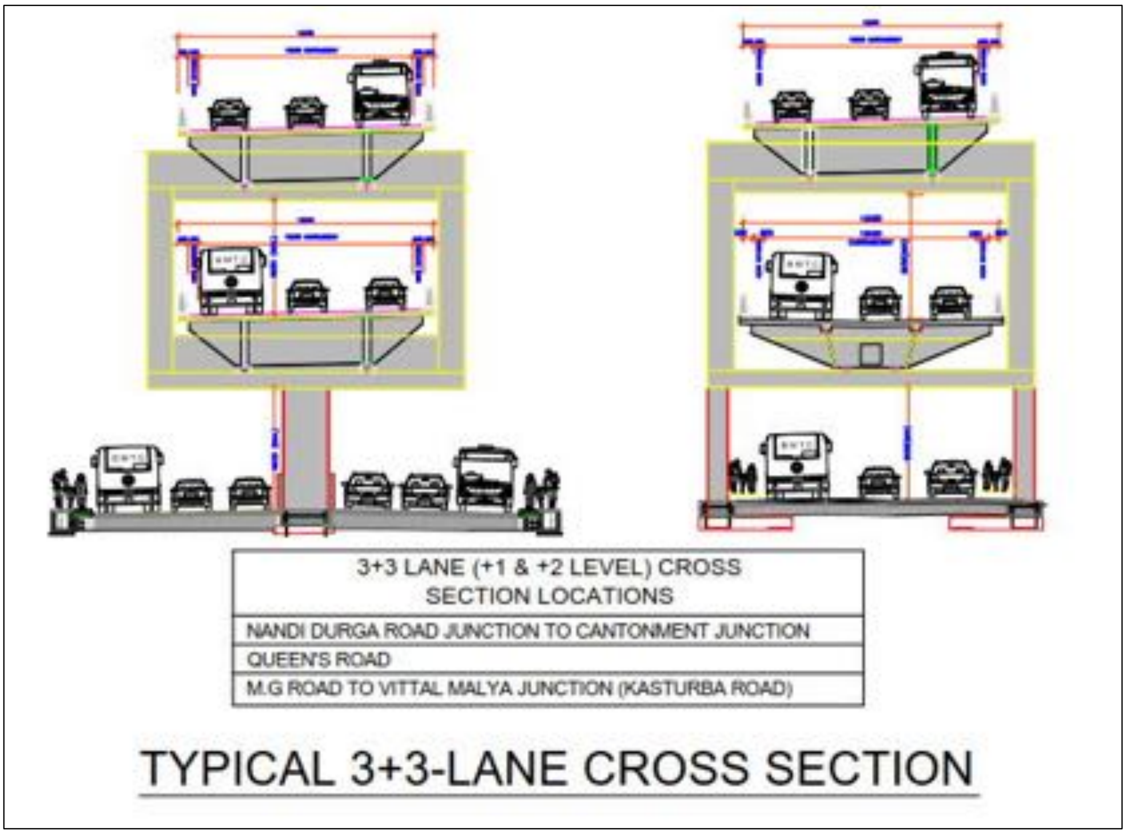


Figure 2-5: Typical Cross Section for six lane (3+3) elevated corridor

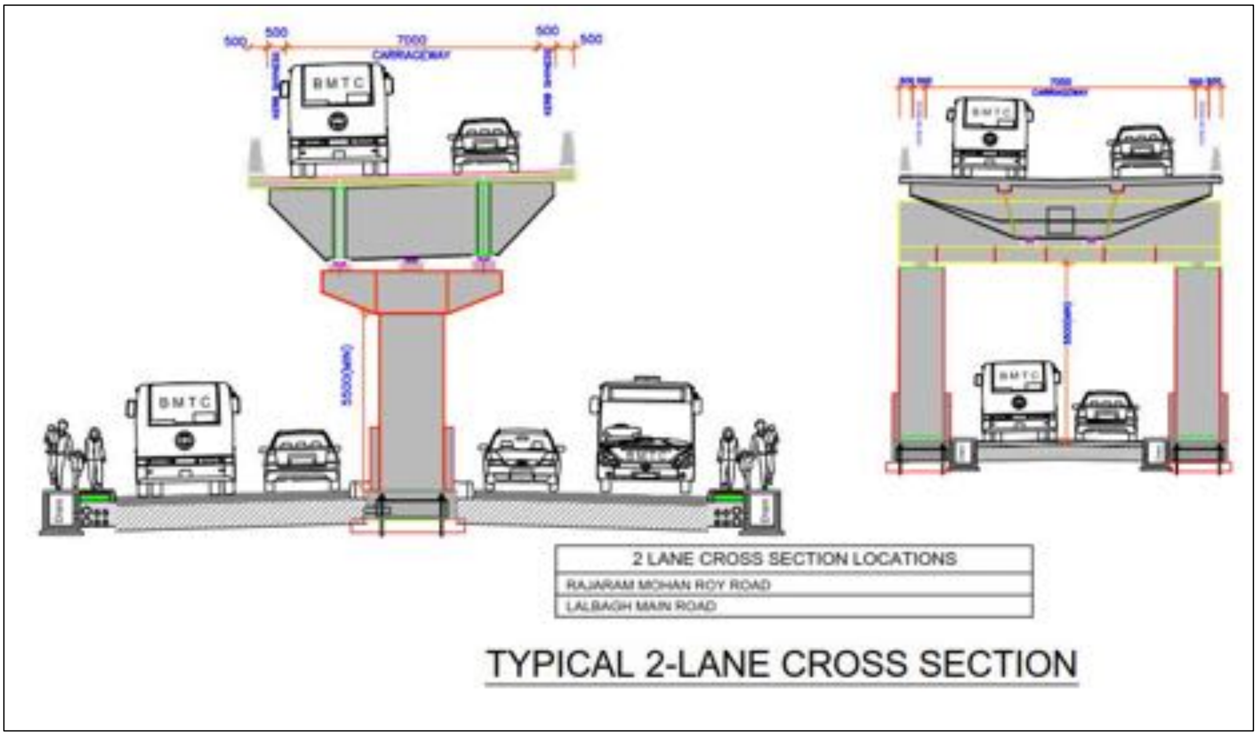


Figure 2-6: Typical Cross Section for two lane elevated corridor

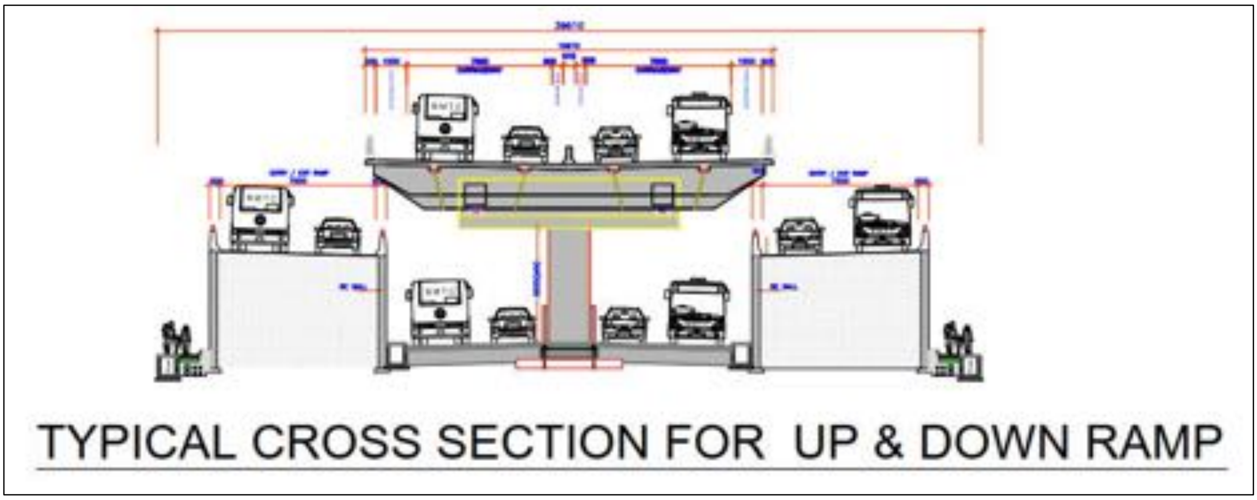


Figure 2-7: Typical Cross Section for up and down ramps of elevated corridor

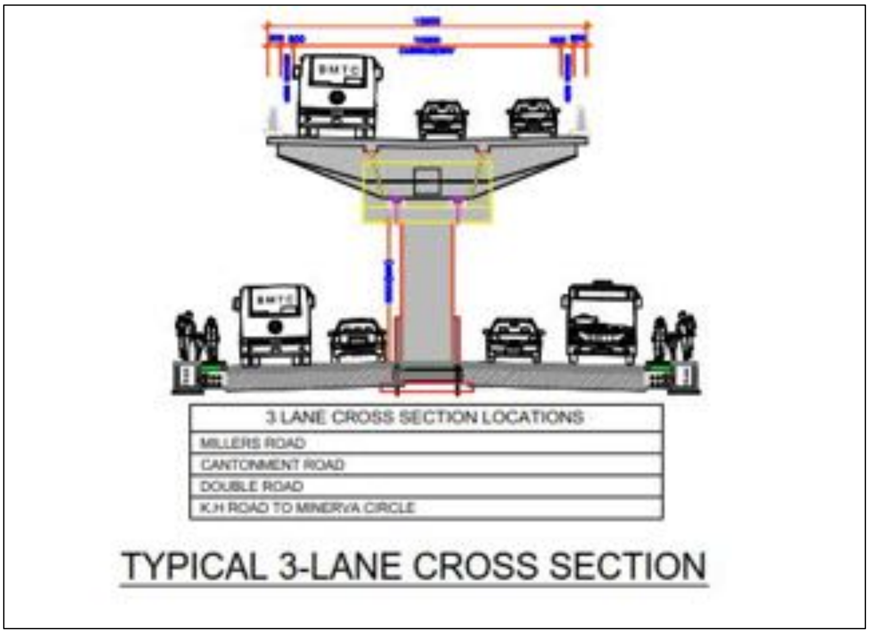


Figure 2-8: Typical Cross Section for three lane elevated corridor

2.10 Corridor of Impact (COI)

The alignment of the proposed elevated corridors improvement proposal is for two/four/six lanes depending on the requirement and the availability of the space. The width of the elevated corridors may vary from 18 m to 62 m. Stretch wise Corridor of Impact (COI) for the project road is given in Table 2-5. Considering the requirements of working space required during construction and safety of the adjacent tenancies, at grade COI will be 2 m (one m on either sides of the corridor) more than the COI of elevated structure.

Table 2-5: Corridor of Impact (CoI) for the Project Corridor

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
North-South Corrdior-1 connecting Hebbal to Central silk board						
(Hebbal (Baptist Hospital) to Kaveri junction)						
1	0+000	0+190	190	2-lane	6-lane (3L+3L) S R (2L+2L)	10
2	0+190	0+477	287	2+2 lane	6-lane (3L+3L) S R (2L+2L)	18.61
3	0+477	0+775	298	2+2 lane LHS & RHS Ramp	6-lane (3L+3L) S R (2L+2L)	31.61
4	0+775	2+663	1888	3+3 lane	6-lane (3L+3L) S R (2L+2L)	25.61
5	2+663	2+740	77	2+2 lane LHS & RHS Ramp (taper section)	6-lane (3L+3L)	25.61 to 30.68
6	2+740	2+875	135	2+2 lane LHS & RHS Ramp	6-lane (3L+3L) S R (2L+2L)	31.3
7	2+875	3+110	235	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L) S R (2L+2L)	46.5
8	3+110	3+240	130	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L) S R (2L+2L)	46.5 to 32.5
9	3+240	4+090	850	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L) S R	30.8
10	4+090	4+165	75	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L) S R	31.3 to 37.6
11	4+165	4+420	255	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L) S R	37.6
(Mekhri circle to Cantonment Railway station)						
12	0+000	0+360	360	Mekhri circle Trumphet interchange	6-lane (3L+3L) S R (2L+2L)	38.6
13	0+360	0+400	40	5+5 lane	6-lane (3L+3L) S R (2L+2L)	36.5
14	0+400	0+540	140	5+5 lane	6-lane (3L+3L) S R (2L+2L)	32.3
15	0+540	0+610	70	5+5 lane LHS Ramp (Taper section)	6-lane (3L+3L) S R (2L+2L)	31.8
16	0+610	0+830	220	3+3 lane LHS Ramp	6-lane (3L+3L) S R (2L+2L)	31.6
17	0+830	0+860	30	3+3 lane LHS & RHS Ramp	6-lane (3L+3L) S R (2L+2L)	33
18	0+860	0+905	45	3+3 lane RHS Ramp	6-lane (3L+3L) S R (2L+2L)	31
19	0+905	1+210	305	3+3 lane RHS Ramp	6-lane (3L+3L) S R (2L+2L)	32.1
20	1+210	1+550	340	3+3 lane	6-lane (3L+3L) S R (2L+2L)	25.6
21	1+550	1+600	50	3+3 lane	6-lane (3L+3L) S R (2L+2L)	25.6 to 22.6
22	1+600	1+650	50	3+3 lane	6-lane (3L+3L) S R (2L+2L)	22.6 to 18.2

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
23	1+650	1+720	70	3+3 lane	6-lane (3L+3L) S R (2L+2L)	18.2 to 13.5
24	1+720	2+000	280	3+3 lane	6-lane (3L+3L) S R (2L+2L)	13.5
25	2+000	2+360	360	3+3 lane RHS Ramp	6-lane (3L+3L) S R (2L+2L)	19.5
26	2+360	2+425	65	3+3 lane LHS Ramp	6-lane (3L+3L) S R (2L+2L)	19.5 to 13.5
27	2+425	2+445	20	3+3 lane LHS Ramp	6-lane (3L+3L) S R (2L+2L)	13.5
28	2+445	2+670	225	3+3 lane LHS Ramp	6-lane (3L+3L) S R (2L+2L)	20
(Cantonment Railway station to Richmond circle)						
29	2+670	2+780	110	3-lane	Follow existing	12.5
30	2+780	2+900	120	3-lane	Follow existing	12.5
31	3+765	3+840	75	2-lane	4 lane (2L+2L)	9
32	3+840	4+750	910	3-lane	Follow existing	12.5
33	4+750	5+800	1050	3+3lane (Double decker)	2-lane	12.5
34	5+800	6+340	540	3+3lane (Double decker)	6-lane (3L+3L)	
35	6+340	7+060	720	3+3lane (Double decker)	4-lane (2L+2L)	
36	0+000	0+195	195	3-lane	2-lane	12.5
37	0+195	0+495	300	2-lane RHS Ramp	2-lane	16
38	0+495	0+710	215	2-lane	2-lane	9
39	2+500	2+700	200	3-lane	2-lane	12.5
40	2+700	17+095	60	2-lane	2-lane	9
41	17+095	17+710	615	3-lane	3-lane	12.5
42	17+710	18+110	400	3-lane LHS Ramp	3-lane	16
43	18+110	18+200	90	3-lane	3-lane	12.5
44	0+000	0+300	300	2-lane (Ramps)	-	10
45	0+000	0+335	335	2-lane (Ramps)	-	10
46	0+195	0+495	300	5.5m (Ramps)	-	7
47	17+710	18+110	400	5.5m (Ramps)	-	7
(Minerva circle to Kasturba road)						
48	0+000	1+435	1435	4-lane	4-lane (2L+2L)	16
49	1+435	(7+865)	245	4-lane	4-lane (2L+2L)	16
50	(7+865)	7+725	140	3-Lane	4-lane (2L+2L)	12.5
51	7+725	7+440	285	3-lane LHS Ramp	6-lane (3L+3L)	19.5
52	7+440	7+060	380	3-Lane	6-lane (3L+3L)	12.5
53	0+000	0+250	250	5.5m (Ramps)	-	7
54	0+000	0+235	235	5.5m (Ramps)	-	7

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
55	0+000	0+285	285	5.5m (Ramps)	-	7
56	0+000	0+370	370	5.5m (Ramps)	-	7
(Town Hall to Richmond road)						
57	0+000	1+230	1230	2-lane	6-lane (3L+3L)	10
(Corporation to Richmond road)						
58	1+700	1+930	230	2-lane	4-lane (2L+2L)	10
59	1+930	2+275	345	2-lane LHS Ramp	4-lane (2L+2L)	17
60	2+275	2+500	225	2-lane	4-lane (2L+2L)	10
(KH circle to Minerva circle)						
61	18+200	18+740	540	3-lane	4-lane (2L+2L)	12.5
62	18+740	18+810	70	3-lane RHS Ramp	4-lane (2L+2L)	19.5
63	18+810	19+900	1090	3-lane	4-lane (2L+2L)	12.5
(KH road to Silk board flyover)						
64	9+120	10+680	1560	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
65	10+680	10+980	300	2+2 lane with 1.5m P S on both sides, LHS Ramp	4-lane (2L+2L) S R LHS (2L)	24.61
66	10+980	11+030	50	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
67	11+030	11+100	70	2+2 lane with 1.5m P S on both sides, LHS Ramp	4-lane (2L+2L)	24.61
68	11+100	12+840	1740	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
69	12+840	13+200	360	2+2 lane with 1.5m P S on both sides,RHS Ramp	4-lane (2L+2L)	27.61
70	13+200	13+300	100	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
71	13+300	13+650	350	2+2 lane with 1.5m P S on both sides, Ramp-LHS & RHS	4-lane (2L+2L)	37.61
72	13+650	13+765	115	2+2 lane with 1.5m P S on both sides, Ramp-LHS & RHS (taper section)	4-lane (2L+2L)	17.61
73	13+765	14+400	635	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
74	0+000	0+260	260	2-lane (Ramp)	-	10
East-West Corrdior-1 connecting K.R.Puram to Goraguntapalya						
(Swami Vivekananda road)						
1	7+125	9+150	4050	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
2	9+150	9+450	600	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61
3	9+450	9+790	680	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61
4	9+790	10+140	700	2+2 lane with 1.5m P S on both sides LHS Ramp	6-lane (3L+3L)	27.61
5	10+140	11+150	2020	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61
6	11+150	11+430	560	Ulsoor Trumphet interchange	6-lane (3L+3L)	20.61 to 30
7	11+430	11+820	780	2+2 lane with 1.5m P S on both sides LHS & RHS Ramp	6-lane (3L+3L)	36.61
8	11+820	12+555	1470	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61
9	12+555	12+620	130	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61
10	12+620	13+550	1860	3-lane	6-lane (3L+3L)	13.5
11	13+550	13+670	240	3-lane	6-lane (3L+3L)	13.5
12	13+670	13+960	580	2+2 lane with 1.5m P S on both sides	6-lane (3L+3L)	20.61
13	13+960	14+045	170	2-lane	6-lane (3L+3L)	10
14	6+755	7+125	740	2+2 lane with 1.5m P S on both sides LHS Ramp	4-lane (2L+2L)	20.61
15	9+790	10+140	700	5.5m (Ramps)	-	7
(St.Johns road to millers road)						
16	12+600	13+900	2600	3-lane	6-lane (3L+3L)	
17	0+000	0+240	240	2-lane (Ramps)	-	10
(Mekhri circle to Yeswantpur)						
18	18+000	19+035	1035	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
19	19+035	19+345	310	2+2 lane with 1.5m P S on both sides LHS Ramp	4-lane (2L+2L)	27.61
20	19+345	20+200	855	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
21	20+200	20+450	250	2+2 lane with 1.5m P S on both sides LHS Ramp	4-lane (2L+2L)	27.61
22	20+450	20+665	215	2+2 lane with 1.5m P S on both sides LHS Ramp	4-lane (2L+2L)	27.61
23	0+000	0+270	270	2-lane	-	10
24	19+035	19+345	310	5.5m (Intermediate lane)	-	7
25	20+200	20+450	250	5.5m (Intermediate	-	7

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
				lane)		
East-West Corrdior-2 connecting SH-35 to SH-17 from Varthur kodi on SH-35 to Jnanabharathi on SH-17 (upto Deepanjalai nagar)						
(HAL Airport road)						
1	0+750	3+760	3010	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
2	3+760	4+010	250	2+2 lane with 1.5m P S on both sides, LHS Ramp	4-lane (2L+2L)	27.61
3	4+010	4+350	340	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
4	4+350	5+030	680	2+2 lane with 1.5m P S on both sides (+2 level)	Follow existing RoB	20.61
5	5+030	5+660	630	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
6	5+660	5+945	285	2+2 lane with 1.5m P S on both sides, LHS & RHS Ramp	4-lane (2L+2L) S R LHS	34.61
7	5+945	6+590	645	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
8	6+590	7+055	465	2+2 lane with 1.5m P S on both sides, LHS & RHS Ramp	4-lane (2L+2L) S R LHS	34.61
9	7+055	7+865	810	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
10	7+865	8+135	270	2+2 lane with 1.5m P S on both sides, LHS Ramp	4-lane (2L+2L) S R LHS	27.61
11	8+135	8+550	415	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
12	8+550	8+890	340	2+2 lane with 1.5m P S on both sides,RHS Ramp	4-lane (2L+2L)	27.61
13	8+890	11+600	2710	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
14	11+600	11+885	285	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
15	11+885	12+260	375	2+2 lane with 1.5m P S on both sides, LHS & RHS Ramp	4-lane (2L+2L)	34.61
16	12+260	12+500	240	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
17	12+500	12+940	440	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
18	12+940	13+235	295	2+2 lane with 1.5m P S on both sides LHS Ramp	4-lane (2L+2L)	27.61

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
19	13+235	13+890	655	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
20	13+890	14+285	395	2+2 lane with 1.5m P S on both sides RHS Ramp	4-lane (2L+2L)	27.61
21	14+285	15+155	870	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
22	15+155	15+230	75	Junction converging and diverging	4-lane (2L+2L)	20.61 to 45
23	15+230	15+450	220	3-lane	4-lane (2L+2L)	13.5
24	15+450	15+530	80	Junction converging and diverging	4-lane (2L+2L)	20.61 to 45
25	15+530	17+025	1495	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
26	0+000	0+460	460	2-lane (Ramps)	-	10
27	0+000	0+275	275	2-lane (Ramps)	-	10
28	0+000	0+315	315	2-lane (Ramps)	-	10
(Minerva circle to chord road junction)						
29	19+940	20+780	840	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
30	20+780	22+255	1475	2-lane	4-lane (2L+2L)	9
31	22+255	24+880	2625	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
32	24+880	25+190	620	2+2 lane with 1.5m P S on both sides (Ramps)	4-lane (2L+2L)	20.61
(Tipu Sultan Palace road)						
33	3+015	4+442	1427	2-lane	4-lane (2L+2L)	9
Connecting corrdior-1 connecting North-South at St Johns junction to Agara junction on ORR						
1	0+000	250	250	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
2	0+250	3+800	540	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
3	3+800	4+100	70	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	17.61
4	0+000	0+250	500	4-lane with 1.5m P S (Ramps)	4-lane (2L+2L)	20.61
Connecting corrdior-3 connecting East-west corrdior-1 at Wheelers road junction to Kalyan Nagar Outer Ring Road						
(Dsouza circle to Ulsoor lake)						
1	0+060	0+175	115	2-lane	4-lane (2L+2L)	10
2	0+175	0+470	295	2+2 lane, LHS Ramp	4-lane (2L+2L)	17
3	0+470	0+530	60	2-lane	4-lane (2L+2L)	10
4	0+530	1+150	620	2+2 lane with 1.5m P S on both sides (+2 level)	4-lane (2L+2L)	20.61

Sl. No	Chainage		Length	Proposed lane configuration		Row of Elevated Corridor (m)
	From	To	(m)	Elevated corridor	At-grade road	
5	1+150	1+500	350	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
6	1+500	1+690	190	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
7	1+690	2+050	360	2+2 lane with 1.5m P S on both sides, LHS & RHS Ramp	4-lane (2L+2L)	34.61
8	2+050	2+195	145	2+2 lane with 1.5m P S on both sides	4-lane (2L+2L)	20.61
9	2+195	2+315	120	Tapered portion from 4-lane to 6-lane	4-lane (2L+2L)	20.61 to 25.6
10	0+175	0+470	295	2-lane (Ramps)	-	10
11	1+690	2+050	720	4-lane with 1.5m P S (Ramps)	4-lane (2L+2L)	20.61
(Victoria Layout)						
12	0+000	0+270	270	2-lane	2-lane	10
Connecting corrdior-2 connecting East-west corrdior-1 at Ulsoor to East-west corrdior-2 on Dsouza circle						
(Wheelers road to Kachakarnahalli)						
1	0+000	4+120	4120	6-lane (3L+3L)	4-lane (2L+2L)	25.6
2	2+930	0+180	180	5.5m (Ramps)	-	7
3	3+220	0+160	160	5.5m (Ramps)	-	7

The very Objective of the elevated corridors in Bangalore will only be achieved if the proposal is integrated with development of Peripheral Ring Road (PRR) to avoid the through traffic from entering the City Core central area, development of Mass transit system including new Metro and Mono rail feeder corridors. The anticipated Mass Rail Transport System (MRTS) of Bangalore city could be strategically integrated with the Metro rail and Mono rail combinations to connect all the arterial and sub arterial roads with the potential Production and Attraction zones to meet the growing travel demand of the city. Policy level decisions are required to integrate the upcoming metro corridors / Mono rail corridors with the proposed elevated corridors so as to provide last mile connectivity and generate substantial shift of passengers from private to public modes. Access to MRTS is required to be optimized in both central as well as peripheral areas of the city of Bangalore to maximize its utility. Promoting public transit and strengthening mass transit network in the city can be a holistic way forward to solve the ever growing congestion impacts on the streets of Bangalore and thereby substantially improve the deteriorating quality of urban life as a whole.

Considering the above the GOK has envisioned constructing elevated corridors connecting North-South and East-West of Bangalore city to ensure fast and hassle free connectivity. However, the problem of traffic congestion can be solved only by reducing the traffic on roads either by restriction of usage of vehicles, providing mass transport facilities which encourage people to shift to public transport along with capacity augmentation of existing road network. Reducing vehicles on roads by policy or through encouragement is difficult and is possible only by a massive capacity augmentation of roads which are sustainable for longer duration. Since widening of roads is limited due to non-availability of land for road right of way (RoW) widths, the only solution is to build road over roads, i.e. to add elevated roads over the existing major roads as a part of capacity augmentation. A detailed traffic study report has been prepared specially for the proposed elevated project.

2.11 Materials of Construction and its availability:

Materials such as Cement, aggregate stone, manufactured sand (Course & Fine), borrow soil, steel, Bitumen, emulsion, etc. will be used in construction of elvat4ed corridor project. The quantity of materials used in construction is given in following Table 2-6.

All the materials required for construction shall be sourced from nearest possible locations to avoid long distance transportation. Construction of deck slabs of elevated structure will be cast ex-situ in construction camps / casting yards to avoid carrying huge quantities of raw material and also in avoiding any large casting in situ activities.

Table 2-6: Construction materials required per Kilometer

Corridor	Aggregate/Base materials (mt/km)	Cement (mt/km)	Bitumen (mt/km)	Steel Reinforcement (mt/km)	Emulsion (mt/km)	Borrow Earth
North-South Corridor	39592	8944	405	14356	16	35114
East-West Corridor-1	17524	4728	155	7099	5	10968
East-West Corridor-2	13318	3622	176	6753	6	10599
Connecting Corridor-1	18715	5072	229	9190	10	2742
Connecting Corridor-2	21111	5557	181	10484	8	13898
Connecting Corridor-3	11973	3104	141	5900	6	1902

Figure 2-9: Quarry Locations Map

The Table 2-7 below gives the details of source and distance for aggregate.

Table 2-7: Aggregate quarries and the distance

Aggregate Source	Distance from Project Location
Hosur Bande and Yerappanahalli	< 20 Km from Connecting corridor 03 of the project
Muddanayakana Halli near Chickballapur	50 Km from North – South Corridor (Mekhri Circle)
Tumkur	60 Km from End point of East – West 01 Corridor
Bidadi / Ramnagar at Ivagilu / Harohalli	45 Km from end point of East West Corridor 02
Alur near Hosur	50 km from the end point of North and South Corridor

Sand sources are available near Malavalli at a distance of about 80 Km from Bangalore city. Manufactured sand production units are available within 80 Km distance from Project location.

3. POLICIES AND THE REGULATORY FRAMEWORK AND ITS APPLICABILITY

3.1 Constitutional Provisions

The Constitution of India, in Article 48, of Directive Principles of the State provides for the protection and preservation of the environment and it states that "the state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country".

Further Article 51-A (g), of fundamental duties, emphasizes that, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures."

These two provisions of the constitution form the guiding principles for the environmental legislation in India. The Government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to sustainability and protection of the environment and its various components.

3.2 Environment Impact Assessment Notification and it's applicability to the project:

As per the EIA Notification, prior Environmental Clearance (EC) is required for certain types of projects. All developmental projects can be categorized under Category 'A' and Category 'B', subject to certain considerations listed in the Schedule.

Elevated corridors do not have a mention in the list of projects qualifying for environmental clearance as per EIA Notification and its amendment. Though, certain stretches of alignment of elevated corridor forms a part National Highways (NH 4 & NH 7) and State Highways, elevated corridors cannot be classified as NH or SH looking at their functional and locational roles.

As the elevated corridors are proposed for decongesting Bengaluru city roads projects can be classified under transportation sector, and considering these elevated corridors as a part of national and state highways which do have mention in the schedule of Notification, the total length of the main elevated corridor is 102.04 km, but it involves additional right of way or land acquisition less than 40 m along the existing alignments. The proposed six elevated corridors having a length of 102.04 km is to decongest the internal city roads and to give access controlled connectivity to the arterial roads which are connecting important neighbouring towns and cities. The elevated corridors are not continuous in nature to be considered as one project, but it constitutes of 6 different corridors connecting different parts of the city, hence the total length of all six corridors need not be considered as length to be qualified for environmental clearance.

The elevated corridor will be supported by pier structures from the median and all possible efforts will be made to limit width of the corridor within the available Right of Way (ROW). Hence, additional right of way or total width of acquisition along the proposed alignments does not exceed 40 m. In fact, one of the main objectives is, to minimise the land acquisition except for junction improvements and at entry and exit points to link proposed elevated corridors with the existing roads beneath (at grade). Hence considering both length and width of the project corridor do not qualify for environmental clearance.

However, an elevated corridors project is being considered under Townships and Area Development Projects (Item 8(b) of the Notification as per the NGT judgement in case of steel flyover project from Basaveshwara Circle to Hebbal, Bangalore (Application Nos. 243 & 245 of 2016 (SZ) for environmental clearance under Area Development projects and Townships, Category 8 (b) of EIA Notification, 2006 and subsequent amendments.

Proposed elevated corridor project has total built-up area of approximately 21,89,000 sqm and as it exceeds 3,00,000 sq. mtrs. qualifying under Schedule 8(b) of EIA Notification,.

The elevated corridor project is significantly different from building and construction projects in terms of project requirements, construction activities, environmental impacts and mitigation measures. The excerpts from EIA Notification for Highways and Area Development projects and Townships are given in the following table for reference.

Project or Activity		Category with threshold limit		Condition if any
		A	B	
8	Building / Construction projects / Area Development projects and Townships			
8(b)	Townships and Area Development projects		≥1,50,000 sq. mtrs and < 3,00,000 sq. mtrs built up area or covering an area ≥ 50 ha and < 150 ha ≥ 3,00,000 sq. mtrs of built up area or covering an area ≥ 150 ha[1]	Note - General Condition shall not apply".

[1] Amendment made through Notifications dated 9th December 2016; 13th March 2018; & 3rd April 2018.

3.3 The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements existing environmental regulations. Empowered by the EP Act, MoEF, the Government of India has issued the EIA Notification (as discussed in section 8.2.2) regulating the siting of industry and operations, procuring clearances to establish industries and development of projects with appropriate EIA studies, coastal zone regulations and other aspects of environment protection:

This Act, empowers the Government of India (section 6) to formulate rules to regulate environmental pollution by stipulating standards and maximum allowable limits to prevent air, water, noise, soil and other environmental pollutants.

Prohibits operations that emit pollutants in excess of standards (section 7); Regulates handling of hazardous substances and identifies persons responsible for discharges and pollution prevention (section 9); Section 17 deals with offences committed by Government Departments

Formulated Environmental (Protection) Rules, 1986, Hazardous Wastes (Management and Handling) Rules, 1989 and Manufacture, Storage & Import of Hazardous Chemical Rules, 1989 in accordance with the sections 6,8 and 25 of EP Act.

3.4 Water (Prevention and Control of Pollution) Act, 1974

The Water Act is the first environmental regulation that was brought to the state and central levels, with pollution control boards to control / regulate environmental pollution in India. Amended twice in 1978 and 1988, the Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish, and enforce, standards for industries and local authorities discharging effluents.

This provides for the prevention and control of water pollution, and the maintaining and restoring of the wholesomeness of water. ‘Pollution’ means such contamination of water, or such alteration of the physical, chemical or biological properties of water, or such discharge of any sewage, or trade effluent, or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance for health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.

The act resulted in the establishment of the Central and State level Pollution Control Boards, whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of certain facilities.

The project requires getting No-Objection Certificate/Consent from the Karnataka State Pollution Control Board (KSPCB) under the Water (Prevention and Control of Pollution) Act of 1974, the Cess Act of 1977. KSPCB reviews and accords consent for establishment by stipulating certain specific and general conditions after accepting the application for the project.

3.5 Air (Prevention and Control of Pollution) Act, 1981

Similar to the Water Act, the Air Act vests regulatory authority on the State Pollution Control Boards and empowers them to enforce air quality standards to prevent air pollution in the country. Section 21 of the act requires an application to be made to the state board to establish or operate any industrial operation and project activity.

The project requires getting No-Objection Certificate/Consent from the Karnataka State Pollution Control Board (KSPCB) under the Air (Prevention and Control of Pollution) Act of 1981; the Air (Prevention and Control of Pollution) Rules of 1982 and Air (Prevention and Control of Pollution) Amendment Act, 1987. As in the case of the Water Act, the KSPCB reviews and accords consent for establishment by stipulating certain specific and general conditions after accepting the application for the project.

3.6 The Hazardous Wastes (Management and Handling) Rules, 2016

The Central Government formulated these rules under the Environment (Protection) Act, 2016. Under these rules it is required that the operator or occupier of a facility dealing with hazardous waste ensures that the hazardous waste is packaged in a suitable manner for storage and transport and the labelling and packaging shall be easily visible and be able to withstand physical conditions and climatic factors. Packaging, labelling and transport of hazardous wastes shall be in accordance with the provision s of the rules issued by the Central Government under the Motor Vehicles Act, 1988, and other guidelines issued from time to time. These Rules also requires that in case of an accident during transportation of hazardous wastes, the operator or occupier of a facility shall immediately report to the State Pollution Control Board in the prescribed form.

This statute applies to the elevated corridor project as it involves handling (including storing) and transhipment of hazardous bituminous materials for pavement construction.

3.7 Wildlife Protection Act, 1972

This act is promulgated to provide for the protection of wild animals, birds and plants and for matters connected therewith. The act is not applicable to the elevated corridor project as none of the corridors are either passing through or adjacent to the wild life sensitive areas.

3.8 The Indian Forest Act, 1927

This statute provides power to the Government to classify forestland and declare an area to be a reserved forest, a protected forest or a village forest. The act prohibits a number of activities including making fresh clearings, tree felling, lopping, burning, grazing, quarrying, manufacturing activities, hunting, shooting, etc. in the forest. Violation of provisions of Section 26 specifically with regards to creating fire, felling, girdling, lopping, etc. of trees, quarrying and manufacturing operations or clearing up of any forest land for construction projects is punishable with imprisonment with a fine.

This Act is not applicable as none of the corridors are located adjacent to the forest land.

3.9 Forest (Conservation) Act, 1980 (as Amended In 1988)

As per Section 26 of the Indian Forest Act, 1927 a number of activities are prohibited in forest areas, and prior approval is required from the Central Government to use /divert forest land for non-forest purposes. The project corridor is not adjacent to or passing through forest sections.

3.10 The Ancient Monuments and Archaeological Sites and Remains Act 2010

The archaeological sites/remains/monuments in the country are protected by ASI (Archaeological Survey of India) or the State Directorate of Archaeology.

Under the Act, areas within the radii of 100m and 300m from the “Protected Property” are designated as “Protected Areas” and “Controlled Areas” respectively. Development activities (including building, mining, excavating, blasting) is not permitted in the “Protected Areas”. Development activities likely to damage the protected property are not permitted in the “Controlled Areas” without prior permission from the Archaeological Survey of India (ASI).

Tipu Sultan's Palace: the palace of Tipu Sultan was begun by Haider Ali in 1781 AD and completed by Tipu Sultan in 1791 AD. This is a splendid structure now present within the old fort. It is of two storeys with a large open courtyard in front originally with a fountain and small, ornamental garden.

Old Dungeon Fort & Gates: Old Dungeon Fort & Gates or Bengaluru Fort began in 1537 as a mud fort by Sri Kempe Gowda I, a vassal of the Vijaynagar Empire and the founder of Bengaluru. Haider Ali in 1761 replaced the mud fort with a stone fort. The army of the British East India Company, led by Lord Cornwallis on 21st March 1791 captured the fort in the siege of Bengaluru during the Third Mysore War (1790–1792). Today, the fort's Delhi gate, on Krishna Rajendra (KR) Road and two bastions are the primary remains of the fort.

In addition to the above notified monuments, there are a few heritage buildings listed as per Bangalore Development Authority’s Revised Master Plan (RMP) – Volume I 2031 imposing development restrictions in 12 heritage zones, apart from listing out 558 heritage sites. The proposed heritage zones in the city are Central Administrative Heritage Zone, Pete & Bengaluru Fort Heritage Zone, Gavipuram, Basavanagudi and VV Puram Heritage Zone, MG Road Heritage Zone, Shivajinagar Heritage Zone, Cleveland Town Heritage Zone, Richards Town Heritage Zone, Malleswaram Heritage Zone, Ulsoor Heritage Zone, Whitefield Inner Circle Heritage Zone, Begur Temple Heritage Zone and Bengaluru Palace Heritage Zone. In addition, 558 sites have been further classified under built heritage value (533), natural heritage value (16) and cultural heritage value (9). An NOC from the committee is must for most development activities in these zones and the listed heritage sites. The draft plan allows no new development on Queens Road, and no building taller than 12 m in Basavanagudi. No flyovers and other infrastructure are allowed in any of the zones.

Other statutory requirements applicable for the project include Public Liability Insurance Act, 1991, The Motor Vehicles Act, 1988, Minimum Wages Act, 1948; Contract Labour Act, 1970; Child Labour (Prohibition and Regulation) Act 1996 along with Rules, 1988; etc.

3.11 National Green Tribunal (NGT) Order dated 4th May 2016 in O.A. No. 222 of 2014

The National Green Tribunal was constituted in 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal rights relating to environment and giving relief and compensation for damages to persons and property. The tribunal will have jurisdiction over all civil cases relating to implementation of The Water Act 1974; The Water Cess Act 1977; The Forest Conservation Act 1980; The Air Act 1981; The Environment Protection Act 1986; The Public Liability Insurance Act 1991; and The Biological Diversity Act 2002.

Applicability: Vide its Order, NGT has fixed the distance from water bodies (lakes and Rajakaluves) to prohibit construction activities. The distance in the case of Water bodies, wetlands and Rajakaluves shall be maintained as below.

- 75m from the periphery of water body or Lakes, to be maintained as green belt and buffer zone.
- 50m from the edge of the primary Rajakaluves.
- 35m from the edges in the case of secondary Rajakaluves
- 25m from the edges in the case of tertiary Rajakaluves

The buffer/green belt zone would be treated as no construction zone for all intent and purposes. This is absolutely essential for the purposes of sustainable development particularly keeping in mind the ecology and environment of the areas in question.

This Tribunal order is applicable for all the construction projects which are within buffer zone from the periphery of water bodies like Ulsoor Lake, Varthur Lake, Agara Lake and Vrishabhavathi Stream/River.

3.12 The Right to Fair Compensation and Transparency in Land Acquisition and Rehabilitation and Resettlement Act, 2013 (RFCTLARR Act 2013)

This is an act which replaces both the Land Acquisition Act 1894 and National Resettlement and Rehabilitation Policy 2007. This is an Act to ensure, in consultation with institutions of local self-government and Gram Sabhas established under the Constitution, a humane, participative, informed and transparent process for land acquisition for development of essential infrastructural facilities, industrialisation and urbanisation with the least disturbance to the owners of the land and other affected families and provide fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make adequate provisions for such affected persons for their rehabilitation and resettlement.

Government of Karnataka has issued Rules as provided in Section 109 of RFCTLARR Act 2013 namely "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Karnataka) Rules, 2015". These Rules, inter-alia, provide for the following.

Chapter II deals with the matters pertaining to Social Impact Assessment (SIA) Study and all matters concerning the same including its publication, (Rules.3 to 13).

Chapter III deals with the Process of Obtaining the Prior Consent (Rules 16-19)

Chapter IV deals with the Preliminary Notification For Acquisition (Rule 20)
Chapter V deals with the Rehabilitation and Resettlement Scheme and matters relating thereto (Rules 21- 38)

Rule 40 empowers the government for removal of difficulties either in the interpretation of the provisions of the Rules and implementation of the provisions

This act is applicable for the proposed project as it involves land acquisition, demolition of properties thus affecting families which are adjacent to proposed alignment.

3.13 Karnataka Industrial Area Development Board Act

The project will adopt the KIADB Act for implementation.

Salient Features of the Section 28 of KIADB Act

- If at any time, in the opinion of the State Government, any land is required for development by the Board, or for any other purpose in furtherance of the objects of this Act, the State Government may by notification, give notice of its intention to acquire such land.
- On publication of a notification under sub-section (1), the State Government shall serve notice upon the owner or where the owner is not the occupier, on the occupier of the land and on all such persons known or believed to be interested therein to show cause, within thirty days from the date of service of the notice, why the land should not be acquired.
- After considering the cause, if any, shown by the owner of the land and by any other person interested therein, and after giving such owner and person an opportunity of being heard, the State Government may pass such orders as it deems fit.
- After orders are passed under sub-section (3), where the State Government is satisfied that any land should be acquired for the purpose specified in the notification issued under sub-section (1), a declaration shall, by notification in the official Gazette, be made to that effect.
- On the publication in the official Gazette of the declaration under sub-section (4), the land shall vest absolutely in the State Government free from all encumbrances.
- Where any land is vested in the State Government under sub-section (5), the State Government may, by notice in writing, order any person who may be in possession of the land to surrender or deliver possession thereof to the State Government or any person duly authorized by it in this behalf within thirty days of the service of the notice.
- If any person refuses or fails to comply with an order made under sub-section (5), the State Government or any officer authorized by the State Government on it's behalf may take possession of the land, and may for that purpose use such force as may be necessary.

- Where the land has been acquired for the Board, the State Government, after it has taken possession of the land, may transfer the land to the Board for the purpose for which the land has been acquired.

Section 29 of KIADB Act - 2007 compensation

- Where any land is acquired by the State Government under this Chapter, the State Government shall pay for such acquisition compensation in accordance with the provisions of this Act.
- Where the amount of compensation has been determined by agreement between the State Government and the person to be compensated, it shall be paid in accordance with such agreement.
- Where no such agreement can be reached, the State Government shall refer the case to the Deputy Commissioner for determination of the amount of compensation to be paid for such acquisition as also the person or persons to whom such compensation shall be paid.
- On receipt of a reference under sub-section (3), the Deputy Commissioner shall serve notice on the owner or occupier of such land and on all persons known or believed to be interested herein to appear before him and state their respective interests in the said land

3.14 Clearances required for the project corridors

After reviewing various applicable acts and statutes mentioned above, it is understood that following clearances or permissions are required. A summary of clearances required for the project is shown in Table 3-1.

Table 3-1: List of Clearances Required for the Project Road

Sl. No.	Subject	Relevant Act	Authority Granting Clearance/ In charge	When required	Responsibility	Remarks
1	Environmental Clearance	EIA Notification, 2006 (including amendments) issued under Environment Protection Act, 1986	SEAC, GOK	Before Construction	Project Implementation Unit (PIU), KRDCL	Supported by EIA, EMP and Project Reports.
2	Consent / NOC for sub-projects	Air (Prevention and Control of Pollution) Act, 1974 Water (Prevention and control of Pollution) Act, 1981	KSPCB, Karnataka	Before Construction	PIU, KRDCL	Appropriate forms, (Form I & Form XIII) with requisite fees, to be completed
3	Permission for cutting, pruning and transportation of trees	Karnataka Tree Preservation Act, 1976 & Forest Conservation Act, 1980	State Forest Department, Govt of Karnataka	Before Construction	PIU, KRDCL	Exact number and location of trees to be furnished
4	Permission for construction of elevated corridor within protected area of protected Monuments and Heritage structures of Bangalore.	The Ancient Monuments and Archaeological Sites and Remains Act 1958 and subsequent amendments. listed in Revised Master Plan	National Monument Authority, G0I.	Before Construction	PIU, KRDCL	Appropriate forms, (Form VII with requisite Annexures, to be completed
5	No Objection Certificate (NOC) for Crushers, Batching Plants,	Air (Prevention and Control of Pollution) Act, 1981 and Noise Pollution (Regulation	KSPCB, Karnataka	During Construction	Contractor / Supplier	Appropriate forms, (Form I & Form XIII) with requisite fees, to be completed

Sl. No.	Subject	Relevant Act	Authority Granting Clearance/ In charge	When required	Responsibility	Remarks
	Wet Mix Macadam plants, Hot mix plants	and Control) Rules, 2000				
6	Storage, handling and transport of hazardous materials	Hazardous Waste (Management and Handling) Rules, 1989 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	KSPCB, Karnataka	During Construction	Contractor	If bituminous is used for the pavement.
7	Traffic Management and Regulation during operation	Local Traffic Police instructions/Regulations	Bangalore Traffic Police	During Construction	Contractor	Prior permission from the Traffic Department
8	Installation of Generators	Air (Prevention and Control of Pollution) Act, 1974	KSPCB	Before Installation	Contractor	
9	License for storing Diesel/Fuel	Petroleum Rules, 2002 (Amended in the year 2011) of the Petroleum Act, 1934.	Commissioner of Explosives	During Construction	Contractor	
10	Location/ layout of workers camp, equipment and storage yards	Environment Protection Act, 1986 The Building and Other Constructions Workers' (Regulation of employment &	KSPCB, District Health Officer	During Construction	Contractor	

Sl. No.	Subject	Relevant Act	Authority Granting Clearance/ In charge	When required	Responsibility	Remarks
		Conditions of Service) Act, 1996. International Labour Organisation (ILO)				
11	Employing Labour / workers	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	District Labor Commissioner	Before Construction	Contractor	
12	Permission for withdrawal of groundwater for construction	Environment (Protection) Act, 1986	Central Ground Water Board, Ahmedabad	During Construction	Contractor	
13	Rehabilitation & Resettlement of Displaced families	KIADB Act with compensation at par with RFCTLARRA 2013.	GoI	Before start of construction	PIU, KRDCL	The project will adopt the KIADB Act for acquisition and compensation will be paid at par with RFCTLARRA 2013

4. DESCRIPTION OF ENVIRONMENT

Assessment of the impacts of the proposed elevated corridor project is done after site visits undertaken by the consultants. An attempt has been made to understand the environmental profile of the project implementation area and baseline environmental condition of the study area with respect to physical and biological environment along the project corridor. The data presented on the base line environmental components in the vicinity of project corridor was collected through field inspection and secondary sources of information for the environmental attributes supplementing with relevant maps. Study area for baseline data is based on corridor of impact upto 100 M and corridor of influence upto 10 km from the elevated structure. Discussion on the environmental profile has been made considering the proposed alignment of the project corridors within the city of Bengaluru.

4.1 Location:

Bengaluru (Urban) District is located (Figure 1-1) in the south eastern portion of Karnataka State with geographical area of nearly 2190 sq. km. It is bounded by Bengaluru (Rural) district on the south-western, western, northern and north-eastern sides and bordered by Tamil Nadu State on the south-eastern direction. District lies between 12^{0} 39' to 13^{0} 14' N Latitude and 77^{0} 19' to 77^{0} 51' E Longitude. Greater Bengaluru is a metropolitan area consisting of the metropolis of Bengaluru and its neighbouring regions. In January 2007, the Karnataka Government issued a notification to merge 100 wards of the erstwhile Bengaluru Mahanagara Palike with seven City Municipal Councils (CMC)s, one Town Municipal Council (TMC) and 111 villages around the city to form a single administrative area. Administrative map of Bengaluru Urban district is presented in Figure 1-5.

Proposed elevated project corridors are located within Bangalore city. The alignment of each corridor is explained in the paragraphs below.

The North - South Corridor - starts from Baptist Hospital along Airport Road and ends at Silk Board flyover via Mekhri circle - Jayamahal Main Road - Queen's Road-Indian Express Junction - Infantry Road Junction - Minsk Square - Kasturba Road - Hudson Circle - Audugodi - Audugodi main road & Silk Board .

East - West Corridor - 1 (EW - 1): starts at Batrahalli on Old Madras Road and ends at Gorguntapalya junction on Tumkur road via. Devasandra Main Road - Ramamurthy Nagar Main Road Junction (ITI) – KR Puram cable stayed bridge - Suranjandas Road Junction - 80 Feet Road junction - 100 feet Indiranagar road Junction - D Bhaskaran Road Junction - Kensington Road Junction (Philips buildings) – Ulsoor lake - St. John's Road – Millars road - Jayamahal Main Road – Mekri circle - CV Raman road – Yeswanthapur flyover - Yeshwanthpur Railway Station - Outer Ring Road junction (CMTI).

East - West Corridor - 2 (EW - 2): The corridor takes off at Varthur kodi junction on SH-35 – ends at NICE link road on Mysore road via. Kundala halli gate junction – Marathahalli underpass - Suranjandas Road Junction - Old Airport road – Wind tunnel road junction - Domlur Junction - Trinity Church Junction - D'Souza circle - General K S Thimayya Road - Vellara Junction - Richmond Circle – K H Road - Lalbagh Main Road – Minerva junction - Chamarajpet 5th Main Road - 9th Cross Road - 1st Main Road Junction - Alur Venkata Rao

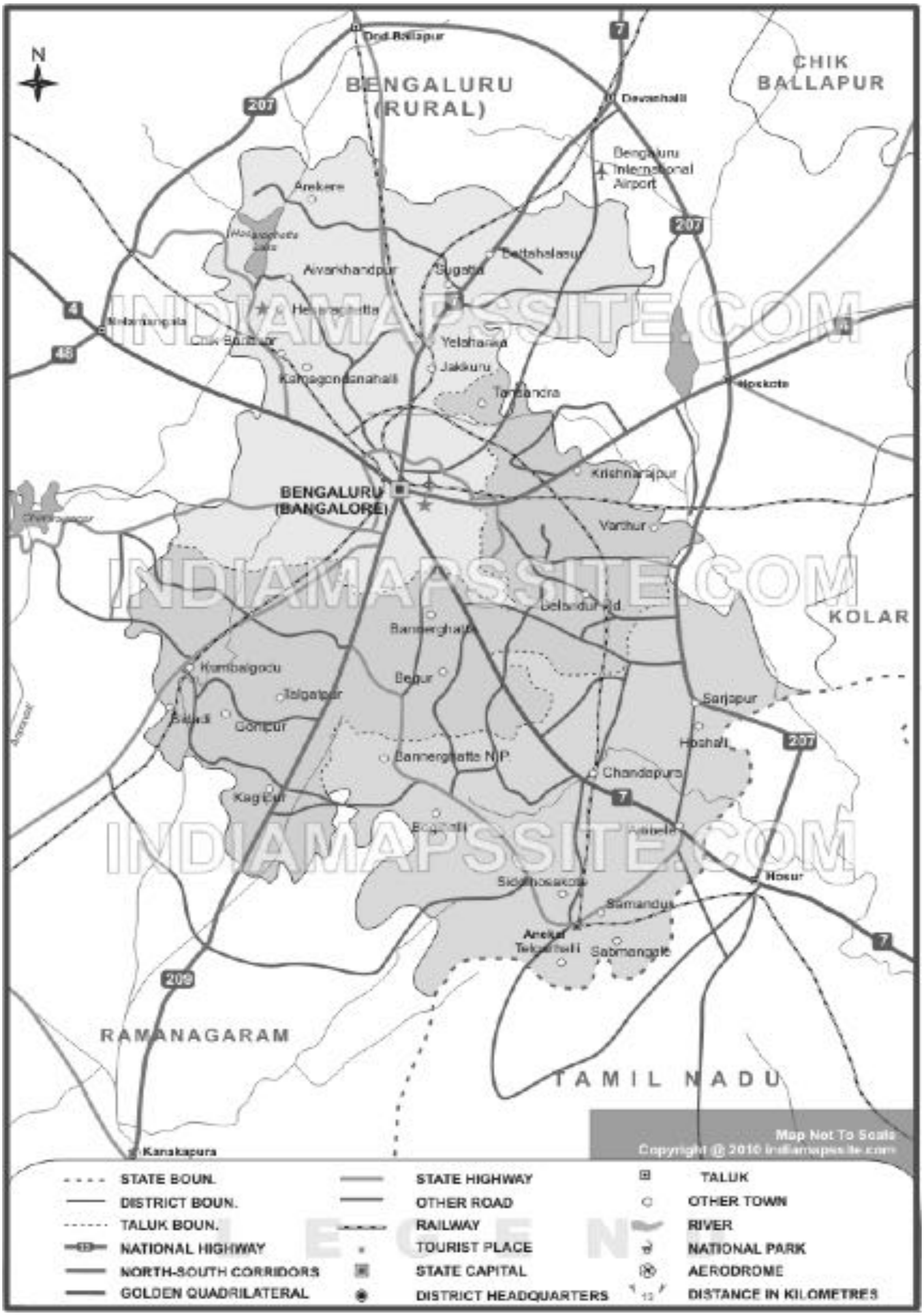
Road - Sirsi Circle - Satellite Bus Station - Bapuji Nagar - Deepanjali Nagar, -Nayandahalli Junction - Rajarajeshwari Nagar Gate.

Connecting Corridor - 1 (CC-1): This corridor creates connectivity between North-South corridor and Sarjapura road, corridor starts at Sarjapur bridge at Agara and traverses via Jakkasandra - Madiwala Market Junction - Koramangala 100 Feet Road Junction

Connecting Corridor - 2 (CC-2): This corridor creates connectivity between East-West Corridor-1 and East-West Corridor-2, corridor starts from D'souza circle on Richmond road Junction and ends at Ulsoor Lake via General KS Thimmaiah Road - Trinity Junction & Ulsoor Lake Junction (connecting East West Corridor-1)

Connecting Corridor-3 (CC-3): This corridor starts from St. Johns Church Road Junction (East-West Corridor 1) and ends at Kalyan Nagar at Outer Ring Road via. Wheeler Road - ITC factory – Sevanagar - Banaswadi Main road.

Figure 4-1: Administrative map of Bengaluru Urban district



4.2 Physiography

Physiographically, Bengaluru Urban district can be divided into rocky upland, plateau & flat topped hills at a general elevation of about 900 amsl (above mean sea level) 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 839 to 962 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.

4.3 Topography

Bengaluru lies on top of south Karnataka Plateau (Mysore Plateau) and has two types of unique topographies. The North Bengaluru taluk is a relatively more level plateau and lies between an average of 839 to 962 meters above mean sea level. Prominent ridge runs in the middle of taluk in NNE-SSW direction and lies east of the Vrishabhavathi River. The highest point in the city, Doddabettahalli, (954 m above Mean Sea Level) is on this ridge. There are gentle slopes and valleys on either side of this ridge. The low-lying area is marked by a series of water tanks varying in size from a small pond to those of considerable extent, but all fairly shallow. The South Bengaluru taluk has an uneven landscape with a combination of hills and valleys. The southern and western portions of the city consist of granite and gneissic masses. The eastern portion is a plane, with intermittent minor undulations.

4.4 Climate

Bengaluru has a tropical Savanna climate (Koppen climate classification Aw) with distinct wet and dry seasons. Due to its elevation, Bengaluru enjoys a pleasant and equable climate throughout the year. The highest temperature recorded was 39.2 °C on 24 April 2016 and the lowest was 7.8 °C in 1884. Winter temperatures rarely drop below 14 °C and summer temperatures seldom exceed 36 °C.

Rainfall - Bengaluru receives about 970 mm of rain annually, the wettest months being August, September, and October. The heaviest rainfall recorded in a 24-hour period was 159.7 mm recorded on 1 October 1997. November 2015 (290.4 mm) was recorded as one of the wettest months in Bengaluru with heavy rains causing severe flooding in some areas.

Data on rainfall for Bangalore urban district is given in the following Figure and the Table

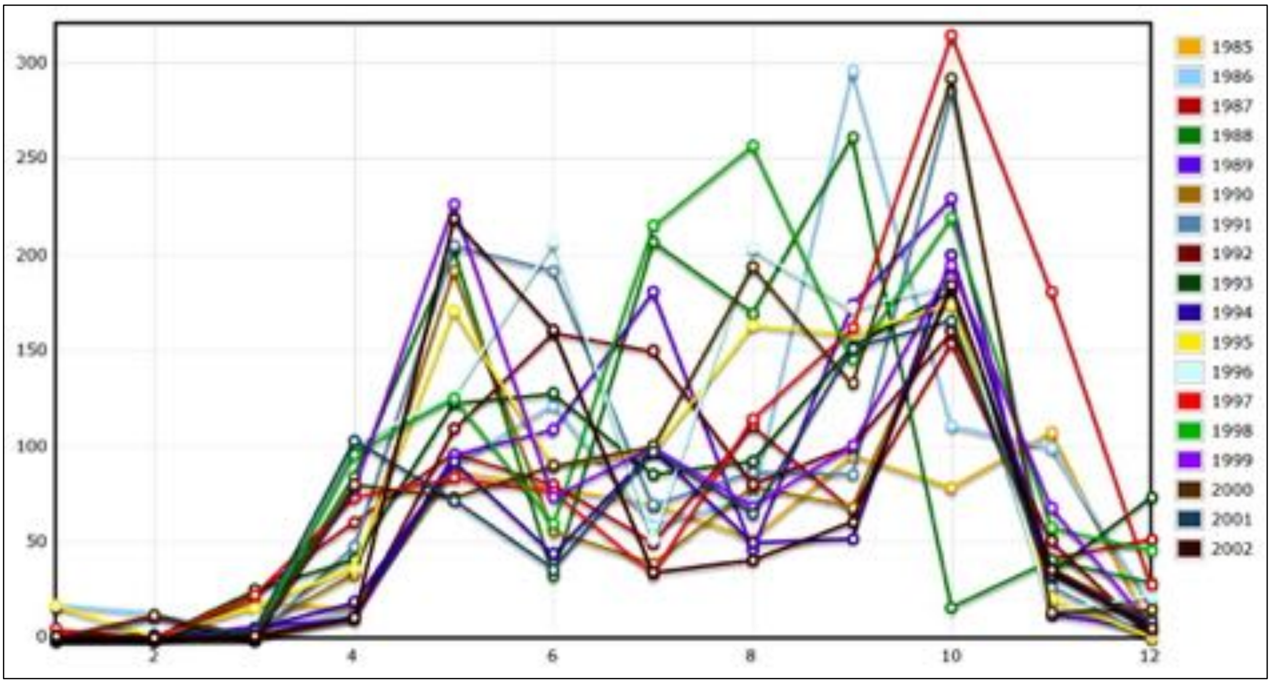


Figure 4-2: Graphical representation of variation in rainfall through 1985 to 2002 (Bengaluru Urban district)

Table 4-1: Month wise rainfall and Annual total rainfall data for Bangalore urban district

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall (in mm)
1985	2.96	0.09	18.42	14.41	86.58	77.57	69.11	51.41	94.86	77.87	106.82	4.58	604.69
1986	16.72	12.42	0.26	13.45	90.12	121.30	58.53	72.59	295.45	110.34	98.76	16.81	906.76
1987	0.20	0.00	22.42	60.15	95.83	79.41	49.26	110.25	66.28	153.86	40.91	50.75	729.31
1988	0.00	1.54	0.43	84.22	202.75	32.38	206.16	169.13	261.10	15.69	39.93	28.42	1041.76
1989	0.06	0.00	5.49	9.87	95.21	108.34	180.46	45.99	173.79	229.16	12.12	4.15	864.63
1990	0.98	0.19	4.55	32.72	191.15	55.36	38.32	78.44	68.04	183.54	35.81	9.38	698.49
1991	0.03	0.02	0.26	47.80	204.38	191.57	69.05	86.44	85.20	285.12	26.57	0.32	996.75
1992	0.07	0.00	0.00	10.61	108.71	159.07	149.41	80.33	100.15	159.65	50.40	1.04	819.44
1993	0.00	0.02	24.73	40.83	122.39	127.30	85.22	92.28	152.13	180.65	34.26	73.32	933.13
1994	0.43	1.41	4.87	18.34	92.14	43.56	98.22	49.76	51.71	199.81	35.93	6.67	602.85
1995	16.37	0.10	15.62	36.34	170.96	90.00	96.59	162.77	158.10	174.22	19.97	0.25	941.28
1996	0.03	0.04	0.70	101.24	126.53	206.44	51.53	203.06	171.74	184.89	13.34	21.87	1081.41
1997	4.44	0.00	22.58	73.29	83.37	76.10	33.48	114.25	161.38	314.38	180.44	27.50	1091.20
1998	0.03	0.18	0.19	95.81	125.06	59.41	214.57	256.60	144.88	219.25	57.15	45.44	1218.56
1999	0.04	10.57	0.56	77.58	226.05	73.12	99.26	68.21	100.09	194.14	67.57	5.65	922.83
2000	0.04	11.83	0.07	80.11	73.29	89.69	99.86	193.46	132.48	291.84	13.41	14.70	1000.77
2001	0.46	0.12	3.65	102.72	71.60	35.69	97.21	64.21	150.75	165.14	32.04	8.25	731.83
2002	0.61	0.12	0.71	10.39	218.10	160.31	33.81	40.27	60.21	183.97	35.17	4.54	748.19
2004	5.40	1.20	5.50	47.50	205.30	75.70	210.40	65.20	186.90	197.30	25.70	0.00	1026.10
2005	1.60	4.40	13.40	75.10	115.70	127.90	136.40	194.00	173.50	446.00	56.50	6.30	1350.80

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Rainfall (in mm)
2006	0.30	0.00	62.70	25.20	133.90	190.50	53.60	44.20	31.50	48.90	48.00	0.30	639.10
2007	0.00	0.20	0.00	104.90	79.50	57.20	154.00	146.50	223.70	163.00	21.10	34.50	984.60
2008	0.10	9.90	115.40	30.40	87.10	59.20	182.50	247.40	105.60	210.90	47.60	0.30	1096.40
2009	0.10	0.00	15.20	63.90	123.80	125.40	30.20	162.20	335.30	35.20	66.80	17.50	975.60
2010	5.40	0.00	17.40	97.50	123.90	67.30	112.30	121.10	149.90	95.80	166.80	2.70	960.10

Source: http://www.indiawaterportal.org/met_data/

Humidity - The average annual relative humidity in Bengaluru is 65.2% and average monthly relative humidity ranges from 45% in March to 79% in August. On an average, July is the most humid and January is the least humid month.

Temperature - The coolest month in Bengaluru is January with an average low temperature of 15.1 °C and the hottest month is April with an average high temperature of 35 °C. The highest temperature ever recorded in Bengaluru is 39.2 °C as there was a strong El Nino in 2016, The lowest ever recorded is 7.8 °C in January 1884. Winter temperatures rarely drop below 14 °C and summer temperatures seldom exceed 36 °C.

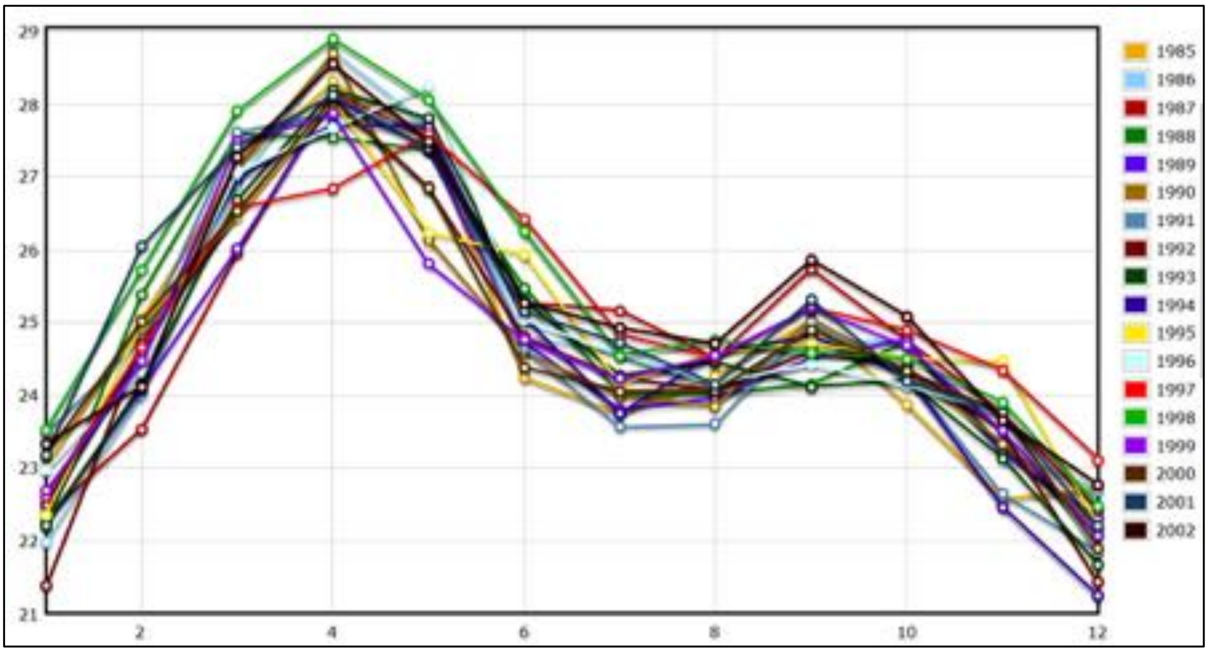


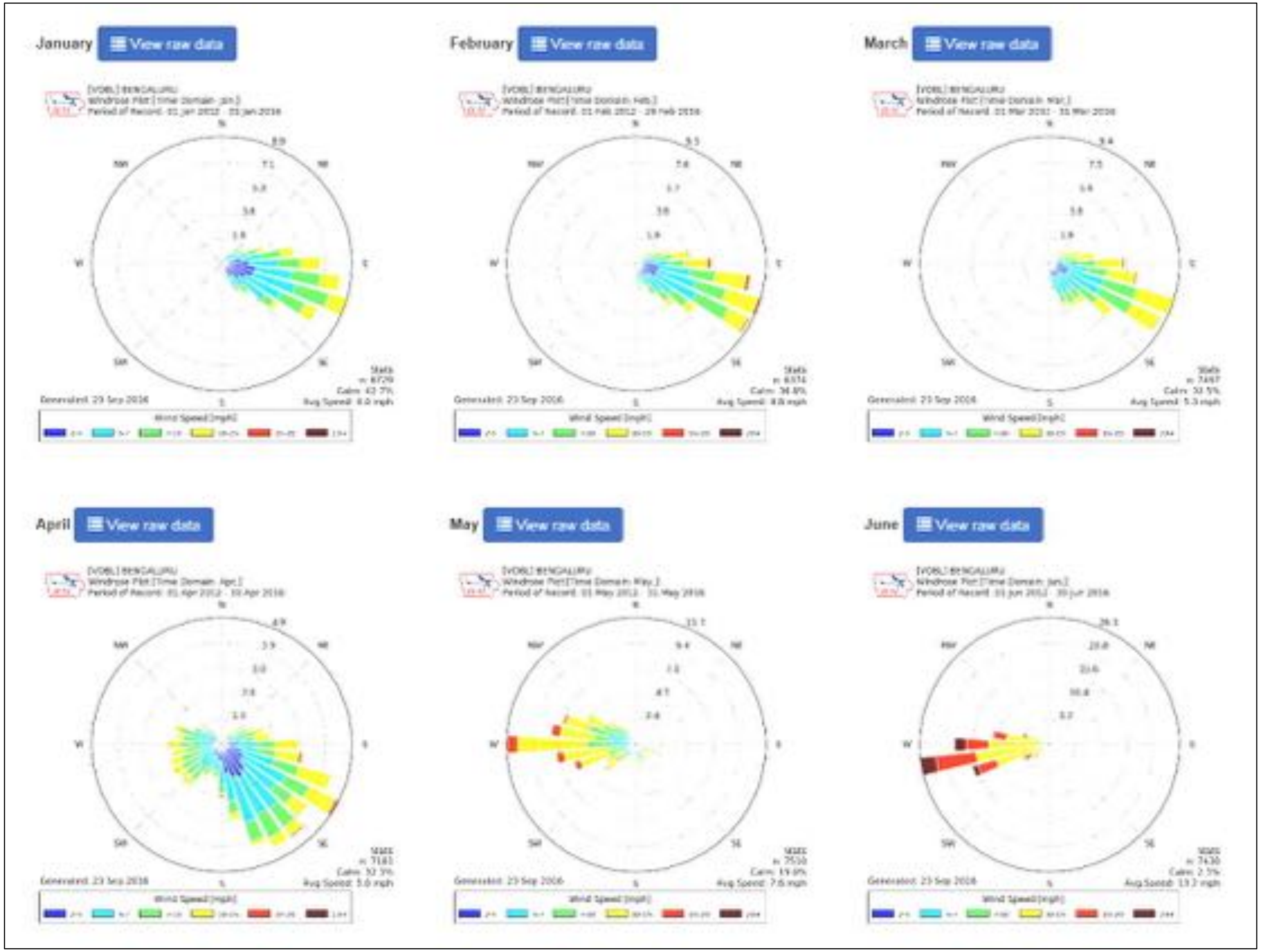
Figure 4-3: Graphical representation of variation in monthly average temperature from 1985 to 2002 (Bengaluru Urban district)

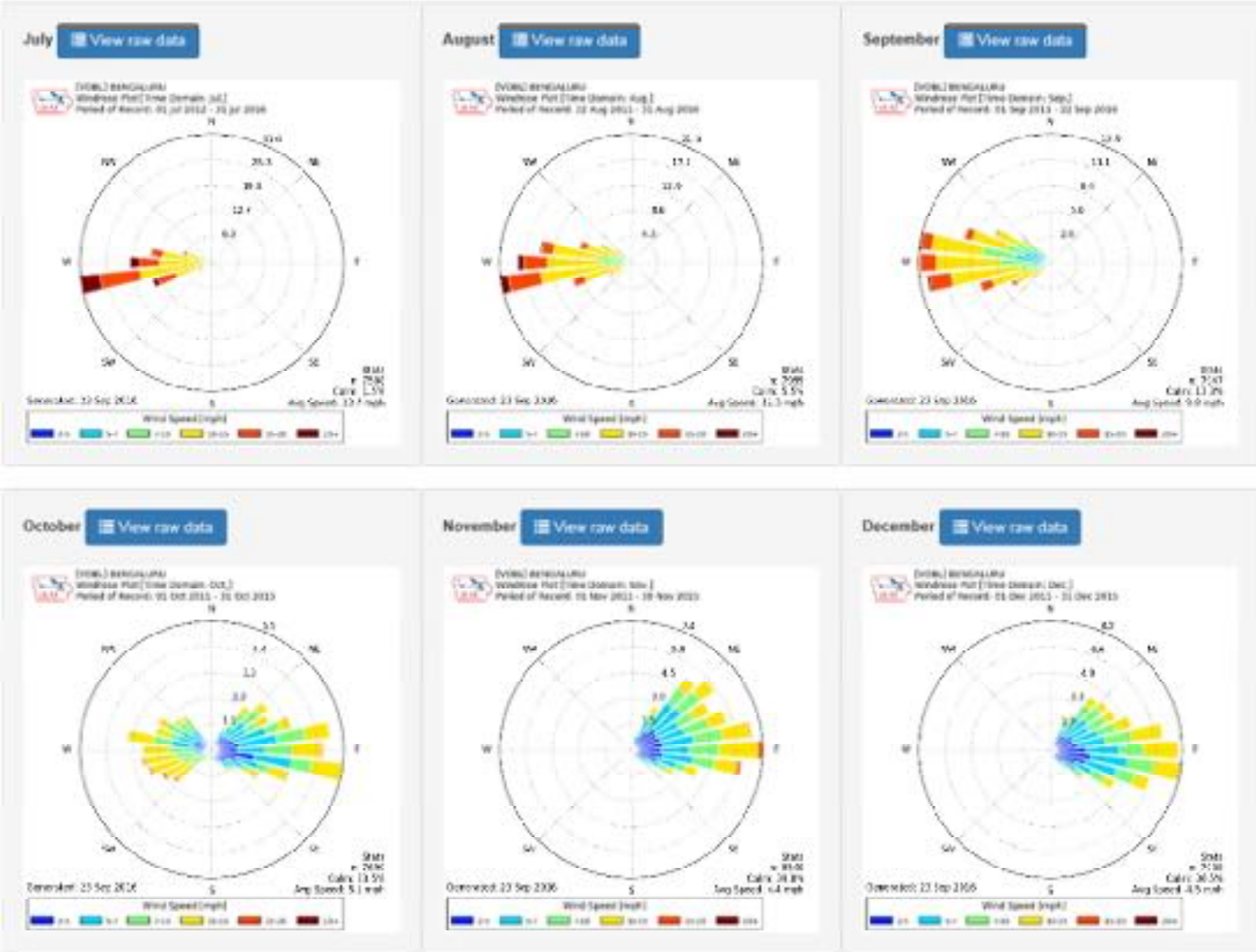
Table 4-2: Month wise annual average temperature data for Bangalore urban district

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average Temperature (⁰Celsius)
1985	23.02	25.07	27.18	28.32	27.62	24.26	23.76	24.28	25.06	23.88	22.58	22.72	24.81
1986	21.99	24.02	26.91	28.74	27.71	24.82	24.58	24.05	24.73	24.76	23.24	22.71	24.85
1987	22.34	23.54	25.96	28.18	27.53	25.28	25.17	24.51	25.74	24.76	23.75	22.42	24.93

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average Temperature (⁰Celsius)
1988	22.21	25.39	27.60	27.55	27.38	25.49	24.02	24.01	24.16	24.74	23.29	22.09	24.83
1989	22.25	24.09	26.02	28.09	27.40	24.72	23.81	23.96	24.51	24.77	23.20	22.31	24.59
1990	22.40	24.70	27.15	28.71	26.14	24.60	23.99	23.85	25.06	24.33	23.35	22.20	24.71
1991	23.50	24.78	27.64	27.91	27.73	24.66	23.58	23.62	25.02	24.29	22.66	21.87	24.77
1992	21.39	24.74	26.48	28.10	26.87	24.81	24.26	24.09	24.63	24.39	23.54	21.44	24.56
1993	22.22	24.16	26.69	28.20	27.82	25.30	24.28	24.46	24.13	24.20	23.14	21.67	24.69
1994	22.50	24.59	26.98	27.74	27.69	25.07	23.75	24.59	24.82	24.27	22.47	21.25	24.64
1995	22.37	24.98	26.47	28.07	26.25	25.95	24.17	24.61	24.73	24.52	24.48	22.23	24.90
1996	22.98	24.35	27.08	27.69	28.27	25.05	24.58	24.17	24.44	24.14	23.75	21.86	24.86
1997	22.61	24.66	26.58	26.85	27.60	26.43	24.84	24.52	25.21	24.90	24.35	23.12	25.14
1998	23.53	25.72	27.92	28.91	28.08	26.26	24.55	24.76	24.59	24.51	23.91	22.48	25.43
1999	22.71	24.47	27.49	27.89	25.82	24.77	24.24	24.56	25.22	24.70	23.53	22.09	24.79
2000	23.17	25.03	26.54	28.09	26.86	24.39	24.06	24.07	24.91	24.34	23.75	21.90	24.76
2001	23.20	26.06	27.43	28.13	27.40	25.16	24.73	24.16	25.32	24.21	23.77	22.21	25.15
2002	23.35	24.13	27.28	28.56	27.50	25.29	24.93	24.72	25.87	25.09	23.67	22.78	25.26

Figure 4-4: Monthly Climatology of Bengaluru





Source: http://mesonet.agron.iastate.edu/sites/windrose.phtml?station=VOBL&network=IN__ASOS

Baseline air quality data was collected for three months from November 2018 to January 2019 at various identified representative locations. Noise levels, water quality and soil quality were analysed for representative locations in the project area.

4.5 Ambient Air Quality

The air quality was monitored at 10 locations along the study area to assess the baseline ambient air status of the area, and also to check its conformity with the ambient air quality standards specified by Central Pollution Control Board (CPCB). The monitoring locations were selected based on the potential sensitive receptors, predominant wind direction and topography of the study area. Other factors considered while selection of the monitoring stations includes representative nature of the sample; accessibility; availability of power.

Ambient Air Quality Monitoring (AAQM) stations were set up at 10 locations with due consideration to the above mentioned points. Ambient Air Quality Monitoring Locations are shown in Figure 4-5 and details of the monitoring stations are given in Table 4-3.

Table 4-3: Details of Ambient Air Monitoring Stations

Location Code	Air & Noise Sampling Locations
A-1	Mekhri Circle
A-2	Wheeler Road Junction
A-3	ITI Campus Junction along NH4
A-4	Indian Express
A-5	Lifestyle Junction, Richmond Road
A-6	Domlur SAARC Park
A-7	Marathhalli Junction
A-8	St John Medical College & Hospital
A-9	Minerva Circle (Bangalore Medical College)
A-10	Deepanjalinagar, Mysore Road

The sampling and analysis of ambient air quality parameters was carried out as per the procedures detailed in relevant Parts of IS-5182 (Indian Standards for Ambient Air Quality Parameters). The applied testing procedures are given in brief in Table 4-4.

Table 4-4: Details of Ambient Air Monitoring Stations

Parameter	Method/ Protocol Followed	Analysis Procedure
PM_{10}	IS-5182 (Pt-23)	- Sample collection for PM-10 with fine dust sampler NPM-FDS 2.5A without PM-2.5 inlet. - Sample collection for PM-2.5 with fine dust sampler NPM-FDS 2.5A with impactor. - Analysis by gravimetric method.
$PM_{2.5}$	IS-5182 (Pt-23)	
SO_2	IS:5182 (Pt.-2)	- Sample collection in multi-gas sampler, absorption in Potassium tetrachloromercurate solution. - The absorbance of the intensely colored para-rosaniline methyl sulphonic acid was measured and the amount of SO2 in the sample was computed.
NO_x	IS:5182 (Pt.-	- Sample collection carried out through orifice-tipped Impinger

Parameter	Method/ Protocol Followed	Analysis Procedure
	6)	containing solutions of sodium hydroxide and sodium arsenite. - The ambient NOx concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the Impinger and the procedure, and the volume of air sampled.
CO	IS:5182 (Pt.10)	- Collection of air in rubber bladder and aspirator. - Analysis by electrochemical sensor

Figure 4-5: Air and Noise Sampling Locations

Table 4-5: Ambient Air Quality at Mekhri Circle

A1 - Mekhri Circle							
November 2018							
Dates	Sample No	PM_{10}, µg/ m³	$PM_{2.5}$, µg/ m³	SO_2, µg/ m³	NO_2, µg/ m³	CO, mg/ m³	Pb, µg/ m³
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	96.7	39.2	7.32	30.18	0.97	0.082
08-11-2018	II	97.2	52.2	6.96	27.82	0.95	0.044
14-11-2018	III	101.6	53.1	7.72	29.21	0.91	0.041
17-11-2018	IV	95.8	45.8	7.91	27.86	0.98	0.092
20-11-2018	V	93.6	53.6	8.11	28.89	0.86	0.105
23-11-2018	VI	99.4	46.6	8.43	28.29	1.07	0.117
26-11-2018	VII	97.7	52.3	8.01	28.24	0.079	0.990
29-11-2018	VIII	104.7	48.8	7.77	27.70	0.056	1.020
December 2018							
03-12-2018	I	100.6	44.4	7.68	28.54	1.00	0.043
7-12-2018	II	99.7	44.7	8.48	27.96	0.93	0.063
11-12-2018	III	98.1	49.6	7.27	29.56	0.91	0.090
14-11-2018	IV	103.4	50.5	8.07	28.08	0.98	0.071
17-12-2018	V	101.3	43.2	7.89	28.37	0.86	0.030
21-12-2018	VI	98.9	50.9	8.69	28.75	1.07	0.063
24-12-2018	VII	97.1	43.9	7.45	27.68	0.95	0.039
28-12-2018	VIII	102.6	50.1	8.25	28.18	1.02	0.044
January 2019							
01-01-2019	I	99.5	36.6	6.34	27.61	0.81	0.078
04-01-2019	II	101.5	35.1	8.11	29.24	0.90	0.101
07-01-2019	III	97.3	38.4	6.50	31.24	0.84	0.083
10-01-2019	IV	98.2	40.2	6.86	30.79	0.75	0.090
16-01-2019	V	102.1	37.9	7.53	32.15	0.80	0.074
19-01-2019	VI	100.7	41.2	8.34	28.59	0.96	0.105
21-01-2019	VII	99.8	43.6	7.98	28.08	0.82	0.137
25-01-2019	VIII	92.8	44.2	7.67	27.62	0.68	0.079

NAAQS: National Ambient Air Quality Standards

Table 4-6: Ambient Air Quality at Wheeler Road Junction (Opp to HQ MEG Centre)

A2 - Wheeler Road Junction(Opp to HQ MEG Centre)							
November 2018							
Dates	Sample No	PM_{10}, µg/ m³	$PM_{2.5}$, µg/ m³	SO_2, µg/ m³	NO_2, µg/ m³	CO, µg/ m³	Pb, µg/ m³
NAAQ Standards		100	60	80	80	4	1
11-05-2018	I	90.3	43.3	7.15	27.26	0.42	0.091
11-08-2018	II	91.5	41.1	6.79	28.12	0.42	0.042
14-11-2018	III	88.5	44.7	7.55	28.44	0.35	0.018
17-11-2018	IV	91.9	43.5	7.35	26.76	0.6	0.116
20-11-2018	V	85.9	42.5	7.94	27.97	0.3	0.111
23-11-2018	VI	94.1	45.4	7.75	27.37	0.64	0.157
26-11-2018	VII	82.6	41.9	7.90	26.02	0.043	0.41
29-11-2018	VIII	89.4	42.8	7.19	27.78	0.016	0.47
December 2018							
03-12-2018	I	91.1	44.3	7.51	27.62	0.44	0.021
07-12-2018	II	88.0	44.6	7.80	26.86	0.37	0.018
11-12-2018	III	90.5	40.3	7.10	28.46	0.35	0.073
14-12-2018	IV	87.4	41.2	7.39	26.98	0.42	0.062
17-12-2018	V	91.3	43.1	7.72	27.45	0.30	0.029
21-12-2018	VI	88.2	41.6	8.01	27.83	0.51	0.037
24-12-2018	VII	90.7	43.8	7.28	26.58	0.39	0.022
28-12-2018	VIII	87.6	40.8	7.57	27.26	0.46	0.011
January 2019							
01-01-2019	I	89.8	32.9	8.21	33.43	0.41	0.082
04-01-2019	II	90.8	26.4	8.73	34.63	0.48	0.102
07-01-2019	III	95.4	39.5	8.06	37.81	0.52	0.026
10-01-2019	IV	83.4	36.4	8.56	38.36	0.51	0.076
16-01-2019	V	87.6	28.8	9.23	39.72	0.50	0.02
19-01-2019	VI	89.6	39.00	8.96	36.98	0.58	0.095
21-01-2019	VII	81.9	35.80	8.57	35.90	0.57	0.127
25-01-2019	VIII	87.5	38.90	8.33	35.44	0.44	0.047

Table 4-7: Ambient Air Quality at ITI Campus Junction along NH4

A3 - ITI Campus Junction along NH4							
November 2018							
Dates	Sample No	PM_{10}, µg/ m^3	$PM_{2.5}$, µg/ m^3	SO_2, µg/ m^3	NO_2, µg/ m^3	CO, µg/ m^3	Pb, µg/ m^3
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	88.6	37.2	5.98	27.04	0.03	0.053
08-11-2018	II	85.2	32.5	5.62	26.68	0.36	0.037
14-11-2018	III	90.1	33.9	6.38	27.67	0.27	0.065
17-11-2018	IV	93.7	36.6	6.49	26.32	0.32	0.174
20-11-2018	V	88.1	35.5	6.77	27.05	0.21	0.189
23-11-2018	VI	89.5	40.7	7.70	27.15	0.45	0.082
26-11-2018	VII	95.0	34.8	6.67	26.70	0.051	0.30
29-11-2018	VIII	96.8	39.6	6.41	26.57	0.094	0.39
December 2018							
03-12-2018	I	85.4	39.7	6.34	27.40	0.35	0.102
07-12-2018	II	90.7	40.0	7.12	26.42	0.27	0.027
11-12-2018	III	88.6	34.9	5.93	28.02	0.26	0.060
14-12-2018	IV	89.1	35.8	6.71	26.54	0.32	0.051
17-12-2018	V	92.4	38.5	6.55	27.23	0.21	0.053
21-12-2018	VI	91.1	36.2	7.33	27.61	0.41	0.043
24-12-2018	VII	89.7	39.2	6.11	26.14	0.30	0.070
28-12-2018	VIII	91.7	35.4	6.89	27.04	0.36	0.084
January 2019							
01-01-2019	I	85.8	40.1	7.59	26.28	0.39	0.186
04-01-2019	II	86.6	28.2	8.16	25.43	0.40	0.324
07-01-2019	III	88.9	33.2	7.85	26.74	0.45	0.138
10-01-2019	IV	82.1	30.5	8.02	27.29	0.37	0.126
16-01-2019	V	90.3	34.4	8.69	28.65	0.28	0.125
19-01-2019	VI	86.3	32.60	8.39	24.78	0.36	0.177
21-01-2019	VII	80.6	29.90	8.00	26.75	0.49	0.209
25-01-2019	VIII	83.4	30.40	7.69	26.29	0.35	0.301

Table 4-8: Ambient Air Quality at Indian Express

A4 - Indian Express							
November 2018							
Dates	Sample No	PM_{10}, µg/ m³	$PM_{2.5}$, µg/ m³	SO_2, µg/ m³	NO_2, µg/ m³	CO, µg/ m³	Pb, µg/ m³
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	94.2	38.5	5.84	26.45	0.56	0.125
08-11-2018	II	89.6	35.4	6.48	26.09	0.52	0.024
14-11-2018	III	93.8	36.9	6.24	27.18	0.44	0.035
17-11-2018	IV	95.5	39.1	6.10	25.83	0.49	0.096
20-11-2018	V	92.9	34.6	6.93	28.16	0.4	0.097
23-11-2018	VI	102.3	41.6	6.30	26.56	0.58	0.135
26-11-2018	VII	92.6	32.9	6.53	25.09	0.075	0.49
29-11-2018	VIII	99.6	37.7	7.64	28.97	0.219	0.52
December 2018							
03-12-2018	I	92.6	37.8	6.20	26.81	0.50	0.036
07-12-2018	II	89.7	38.1	6.35	25.93	0.43	0.032
11-12-2018	III	90.9	33.9	5.79	27.53	0.41	0.073
14-12-2018	IV	91.8	34.8	5.94	26.05	0.48	0.030
17-12-2018	V	93.4	36.6	6.41	26.64	0.47	0.019
21-12-2018	VI	94.5	35.2	6.56	27.02	0.57	0.031
24-12-2018	VII	91.0	37.3	5.97	25.65	0.45	0.026
28-12-2018	VIII	90.3	34.4	6.12	26.45	0.52	0.023
January 2019							
01-01-2019	I	88.3	37.3	6.97	27.37	0.43	0.088
04-01-2019	II	93.5	38.9	7.54	30.36	0.56	0.081
07-01-2019	III	115.7	35.5	7.95	34.09	0.60	0.072
10-01-2019	IV	103.9	33.7	7.83	35.04	0.63	0.073
16-01-2019	V	98.4	41.3	8.50	36.40	0.49	0.044
19-01-2019	VI	100.4	34.90	6.77	29.71	0.51	0.096
21-01-2019	VII	97.7	30.10	7.38	27.84	0.63	0.103
25-01-2019	VIII	102.4	34.60	7.07	27.38	0.53	0.087

Table 4-9: Ambient Air Quality at Lifestyle Junction, Richmond Road

A5 - Life Style Junction on Richmond Road							
November 2018							
Dates	Sample No	PM_{10}, µg/ m³	$PM_{2.5}$, µg/ m³	SO_2, µg/ m³	NO_2, µg/ m³	CO, µg/ m³	Pb, µg/ m³
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	102.6	53.9	6.91	23.79	0.51	0.077
08-11-2018	II	96.1	43.7	6.55	23.43	0.5	0.059
14-11-2018	III	94.4	45.3	7.31	26.5	0.55	0.124
17-11-2018	IV	95.6	47.6	7.52	25.15	0.61	0.145
20-11-2018	V	100.9	46.7	7.70	24.5	0.4	0.128
23-11-2018	VI	93.3	44.3	8.14	23.9	0.70	0.093
26-11-2018	VII	95.2	41.5	7.60	25.53	0.067	0.48
29-11-2018	VIII	96.3	47.7	7.38	27.31	0.186	0.65
December 2018							
03-12-2018	I	90.6	46.2	7.27	24.15	0.56	0.074
07-12-2018	II	91.5	46.5	8.09	25.25	0.56	0.034
11-12-2018	III	95.9	42.6	6.86	26.85	0.47	0.056
14-12-2018	IV	93.4	43.5	7.68	25.37	0.61	0.043
17-12-2018	V	94.8	45.0	7.48	23.98	0.42	0.047
21-12-2018	VI	92.2	43.9	8.30	24.36	0.70	0.054
24-12-2018	VII	92.6	45.7	7.04	24.97	0.51	0.096
28-12-2018	VIII	94.5	43.1	7.86	23.79	0.65	0.028
January 2019							
01-01-2019	I	94.0	45.4	7.12	21.48	0.57	0.137
04-01-2019	II	122.7	40.6	8.22	24.55	0.66	0.105
07-01-2019	III	109.7	38.1	9.10	23.78	0.70	0.080
10-01-2019	IV	116.4	44.5	9.22	26.13	0.69	0.068
16-01-2019	V	102.8	43.0	9.89	27.49	0.45	0.075
19-01-2019	VI	98.7	37.60	8.49	23.90	0.77	0.02
21-01-2019	VII	97.0	43.90	8.10	21.95	0.59	0.098
25-01-2019	VIII	99.9	41.50	7.79	29.49	0.55	0.081

Table 4-10: Ambient Air Quality at Domlur SAARC Park

A-6 Domlur SAARC Park							
November 2018							
Dates	Sample No	PM_{10}, µg/ m^3	$PM_{2.5}$, µg/ m^3	SO_2, µg/ m^3	NO_2, µg/ m^3	CO, µg/ m^3	Pb, µg/ m^3
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	91.2	40.2	6.39	28.61	0.62	0.068
08-11-2018	II	98.7	47.9	6.03	28.25	0.26	0.098
14-11-2018	III	96.4	46.5	6.81	28.69	0.47	0.115
17-11-2018	IV	94.7	43.8	6.87	27.34	0.38	0.131
20-11-2018	V	95.7	48.4	7.18	29.37	0.31	0.165
23-11-2018	VI	97.8	42.1	7.07	28.72	0.48	0.087
26-11-2018	VII	96.5	45.9	7.08	26.60	0.107	0.43
29-11-2018	VIII	97.5	36.8	7.25	28.13	0.212	0.40
December 2018							
03-12-2018	I	84.0	43.4	6.75	28.97	0.52	0.097
07-12-2018	II	82.3	43.7	7.12	27.44	0.31	0.047
11-12-2018	III	80.9	44.3	6.34	29.04	0.43	0.121
14-12-2018	IV	81.7	45.2	6.71	27.56	0.36	0.088
17-12-2018	V	84.8	42.2	6.96	28.80	0.38	0.149
21-12-2018	VI	82.9	45.6	7.33	29.18	0.45	0.104
24-12-2018	VII	83.6	42.9	6.52	27.16	0.47	0.139
28-12-2018	VIII	81.9	44.8	6.89	28.61	0.40	0.083
January 2019							
01-01-2019	I	107.2	44.6	7.43	26.98	0.49	0.122
04-01-2019	II	112.7	47.8	7.91	23.56	0.50	0.141
07-01-2019	III	91.0	35.0	7.74	24.22	0.47	0.104
10-01-2019	IV	94.7	26.7	7.56	25.77	0.42	0.093
16-01-2019	V	83.6	39.8	8.43	27.13	0.41	0.076
19-01-2019	VI	97.1	33.50	8.13	22.91	0.54	0.095
21-01-2019	VII	93.9	26.10	7.75	27.45	0.46	0.101
25-01-2019	VIII	86.9	26.60	7.44	25.99	0.38	0.097

Table 4-11: Ambient Air Quality at Marathhalli Junction

A-7 Marathalli Junction							
November 2018							
Dates	Sample No	PM_{10}, µg/ m^3	$PM_{2.5}$, µg/ m^3	SO_2, µg/ m^3	NO_2, µg/ m^3	CO, µg/ m^3	Pb, µg/ m^3
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	95.3	47.2	6.63	26.55	0.79	0.054
08-11-2018	II	89.7	39.7	6.27	26.33	0.7	0.112
14-11-2018	III	92.1	40.3	7.03	28.59	0.73	0.127
17-11-2018	IV	90.5	41.8	6.78	27.24	0.68	0.114
20-11-2018	V	94.3	37.4	7.42	27.71	0.69	0.156
23-11-2018	VI	91.7	39.4	7.43	26.27	0.77	0.149
26-11-2018	VII	98.9	38.6	7.44	27.62	0.119	0.71
29-11-2018	VIII	91.6	41.4	6.64	26.07	0.164	0.72
December 2018							
03-12-2018	I	89.7	41.1	6.99	26.91	0.82	0.062
07-12-2018	II	92.1	41.4	7.35	27.34	0.63	0.080
11-12-2018	III	89.1	37.2	6.58	28.94	0.73	0.137
14-12-2018	IV	91.5	38.1	6.94	27.46	0.68	0.112
17-12-2018	V	89.9	39.9	7.20	26.74	0.68	0.059
21-12-2018	VI	92.3	38.5	7.56	27.12	0.77	0.117
24-12-2018	VII	89.3	40.6	6.76	27.06	0.77	0.149
28-12-2018	VIII	91.7	37.7	7.12	26.55	0.72	0.051
January 2019							
01-01-2019	I	91.8	38.5	7.07	26.63	0.70	0.121
04-01-2019	II	89.8	27.6	8.19	27.62	0.68	0.148
07-01-2019	III	84.4	34.7	8.48	23.67	0.61	0.132
10-01-2019	IV	88.1	36.1	8.27	28.22	0.54	0.096
16-01-2019	V	90.2	35.7	8.94	29.58	0.47	0.428
19-01-2019	VI	92.2	36.20	8.65	26.97	0.56	0.148
21-01-2019	VII	94.5	35.50	8.26	27.10	0.58	0.095
25-01-2019	VIII	100.3	37.50	8.15	26.64	0.49	0.102

Table 4-12: Ambient Air Quality at St. John's Medical College & Hospital

A-8 St. John's Medical College & Hospital (junction)							
November 2018							
Dates	Sample No	PM_{10}, µg/ m^3	$PM_{2.5}$, µg/ m^3	SO_2, µg/ m^3	NO_2, µg/ m^3	CO, µg/ m^3	Pb, µg/ m^3
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	94.5	38.2	7.45	29.11	0.33	0.085
08-11-2018	II	93.9	39.9	7.09	28.75	0.28	0.040
14-11-2018	III	97.1	40.5	7.85	29.56	0.22	0.102
17-11-2018	IV	96.6	43.6	7.90	28.21	0.29	0.108
20-11-2018	V	94.9	41.2	8.24	29.82	0.17	0.081
23-11-2018	VI	98.2	44.6	7.19	29.22	0.39	0.153
26-11-2018	VII	93.5	42.7	8.71	27.47	0.146	0.23
29-11-2018	VIII	92.8	46.9	7.47	28.63	0.118	0.39
December 2018							
03-12-2018	I	94.9	41.8	7.81	29.47	0.31	0.084
07-12-2018	II	90.8	42.1	8.15	28.31	0.22	0.124
11-12-2018	III	92.3	38.1	7.40	29.91	0.22	0.034
14-12-2018	IV	95.2	39.0	7.74	28.43	0.27	0.130
17-12-2018	V	93.1	40.6	8.02	29.3	0.17	0.033
21-12-2018	VI	91.6	39.4	8.36	29.68	0.36	0.046
24-12-2018	VII	92.5	41.3	7.58	28.03	0.26	0.099
28-12-2018	VIII	90.4	38.6	7.92	29.11	0.31	0.025
January 2019							
01-01-2019	I	95.1	37.8	7.28	30.61	0.32	0.119
04-01-2019	II	99.3	42.8	8.32	22.58	0.38	0.086
07-01-2019	III	95.0	32.5	7.85	21.59	0.35	0.058
10-01-2019	IV	97.2	31.7	7.88	23.41	0.30	0.053
16-01-2019	V	97.4	45.2	8.06	24.77	0.29	0.041
19-01-2019	VI	88.4	36.80	8.55	21.93	0.44	0.076
21-01-2019	VII	96.7	32.40	7.64	31.08	0.48	0.129
25-01-2019	VIII	91.7	31.80	7.33	35.62	0.37	0.078

Table 4-13: Ambient Air Quality at Minerva Circle

A-9 Minerva Circle							
November 2018							
Dates	Sample No	PM_{10}, µg/ m³	$PM_{2.5}$, µg/ m³	SO_2, µg/ m³	NO_2, µg/ m³	CO, µg/ m³	Pb, µg/ m³
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	100.5	41.7	8.04	29.68	0.60	0.110
08-11-2018	II	94.6	48.7	7.68	29.32	0.46	0.084
14-11-2018	III	96.2	49.6	8.44	30.21	0.54	0.151
17-11-2018	IV	99.1	43.4	8.22	28.86	0.53	0.071
20-11-2018	V	97.3	45.7	8.83	30.39	0.56	0.062
23-11-2018	VI	97.9	42.4	8.34	29.79	0.67	0.129
26-11-2018	VII	99.0	44.9	8.73	29.24	0.126	0.60
29-11-2018	VIII	90.2	43.6	8.08	30.12	0.123	0.63
December 2018							
03-12-2018	I	93.3	45.9	8.40	30.04	0.65	0.016
07-12-2018	II	96.2	46.2	8.79	28.96	0.48	0.041
11-12-2018	III	92.7	45.7	7.99	30.56	0.56	0.019
14-12-2018	IV	95.6	46.6	8.38	29.08	0.53	0.039
17-12-2018	V	93.5	44.7	8.61	29.87	0.51	0.041
21-12-2018	VI	96.4	47.0	9.00	30.25	0.62	0.075
24-12-2018	VII	92.9	45.4	8.17	28.68	0.60	0.043
28-12-2018	VIII	95.8	46.2	8.56	29.68	0.57	0.008
January 2019							
01-01-2019	I	89.2	42.3	7.68	29.74	0.64	0.065
04-01-2019	II	90.7	37.1	8.58	21.26	0.58	0.051
07-01-2019	III	94.3	35.3	8.37	34.42	0.65	0.077
10-01-2019	IV	91.9	34.2	7.73	35.97	0.53	0.095
16-01-2019	V	85.4	39.6	7.40	37.33	0.65	0.059
19-01-2019	VI	87.5	38.20	8.81	20.61	0.57	0.152
21-01-2019	VII	93.6	33.60	8.42	30.21	0.60	0.150
25-01-2019	VIII	89.7	35.90	8.29	31.75	0.59	0.116

Table 4-14: Ambient Air Quality at Deepanjali Nagar, Mysore Road

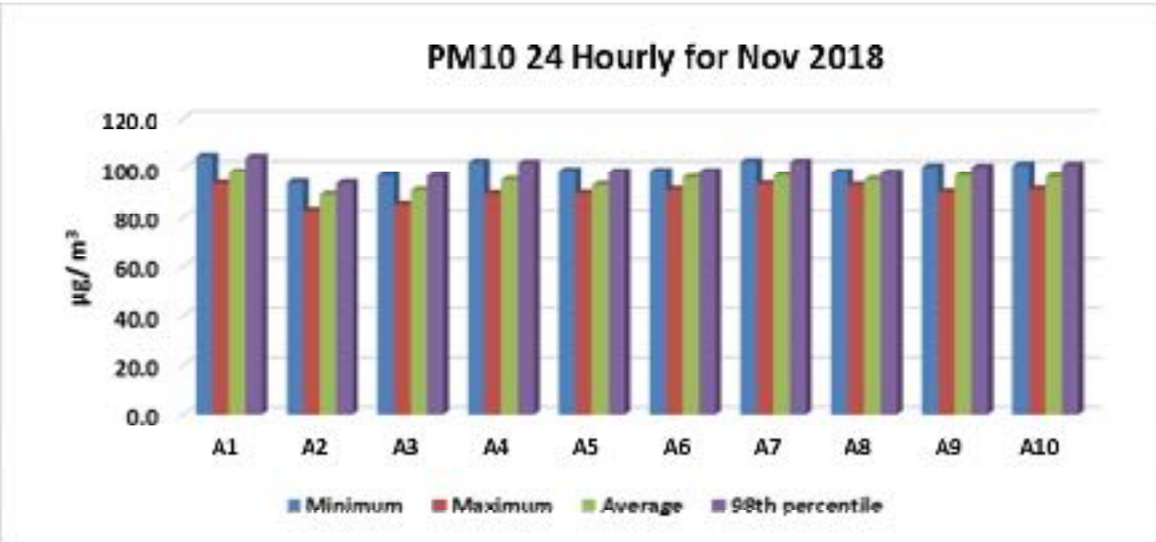
A - 10 Deepanjalinagar ,Mysore Road							
November 2018							
Dates	Sample No	PM_{10}, µg/ m^3	$PM_{2.5}$, µg/ m^3	SO_2, µg/ m^3	NO_2, µg/ m^3	CO, µg/ m^3	Pb, µg/ m^3
NAAQ Standards		100	60	80	80	4	1
05-11-2018	I	99.8	49.8	7.16	28.46	0.63	0.060
08-11-2018	II	91.2	41.3	6.71	28.26	0.4	0.090
14-11-2018	III	92.3	43.9	8.07	30.93	0.61	0.142
17-11-2018	IV	100.8	39.5	7.74	29.58	0.54	0.101
20-11-2018	V	94.8	44.8	7.86	29.17	0.37	0.083
23-11-2018	VI	92.7	37.6	7.84	29.03	0.64	0.190
26-11-2018	VII	98.3	42.4	7.76	28.84	0.121	0.59
29-11-2018	VIII	101.2	40.9	7.88	29.98	0.159	0.57
December 2018							
03-12-2018	I	90.3	37.9	7.43	28.82	0.56	0.080
07-12-2018	II	91.9	39.7	7.89	29.68	0.49	0.137
11-12-2018	III	89.7	38.1	8.02	31.28	0.47	0.072
14-12-2018	IV	88.3	41.2	7.58	29.8	0.54	0.079
17-12-2018	V	90.5	38.2	7.64	28.65	0.42	0.077
21-12-2018	VI	91.1	40.4	8.10	29.03	0.63	0.093
24-12-2018	VII	89.9	38.9	7.20	29.40	0.51	0.071
28-12-2018	VIII	90.5	39.6	7.66	28.46	0.58	0.026
January 2019							
01-01-2019	I	86.9	30.3	7.49	31.13	0.55	0.108
04-01-2019	II	92.6	35.5	8.00	24.79	0.650	0.056
07-01-2019	III	98.8	39.4	7.59	23.35	0.67	0.075
10-01-2019	IV	95.9	32.6	8.05	24.89	0.50	0.062
16-01-2019	V	92.0	28.9	8.72	26.25	0.74	0.019
19-01-2019	VI	97.8	34.50	8.23	24.12	0.64	0.093
21-01-2019	VII	91.2	33.40	7.90	31.60	0.71	0.125
25-01-2019	VIII	91.3	24.80	7.59	33.22	0.75	0.088

Table 4-15: Ambient Air Quality at different AAQ stations for November 2018

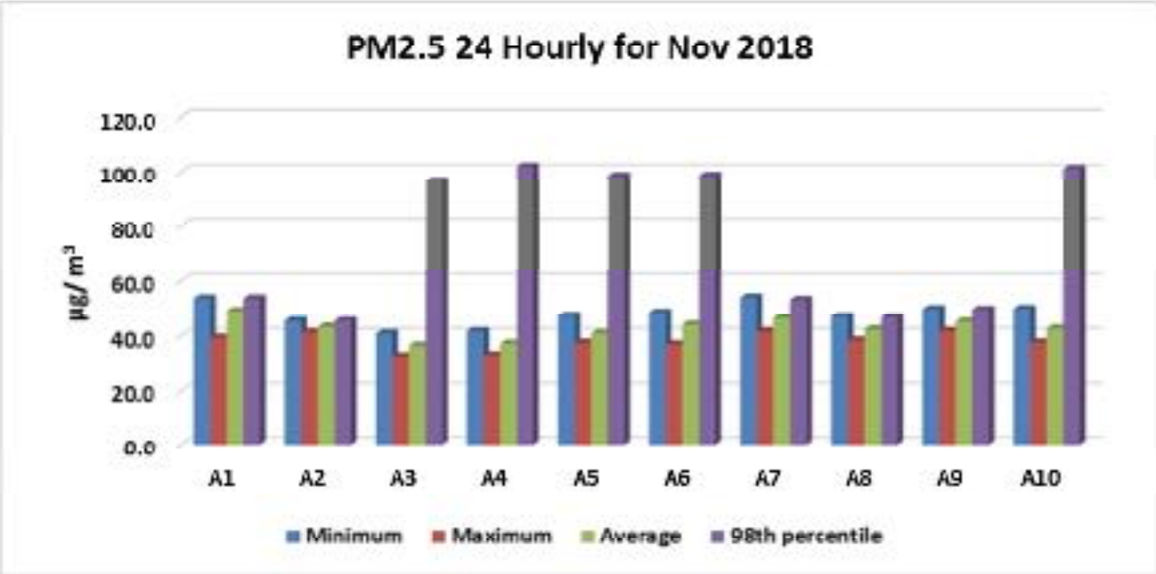
Parameters	Observed	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
PM10 24 Hourly (in µg/m^3)	NAAQS	100	100	100	100	100	100	100	100	100	100
	Minimum	93.6	82.6	85.2	89.6	89.7	91.2	93.3	92.8	90.2	91.2
	Maximum	104.7	94.1	96.8	102.3	98.9	98.7	102.6	98.2	100.5	101.2
	Average	98.3	89.3	90.9	95.1	93.0	96.1	96.8	95.2	96.9	96.4
	98th Percentile	104.3	93.8	96.5	101.9	98.4	98.6	102.4	98.0	100.3	101.1
PM 2.5	NAAQS	60	60	60	60	60	60	60	60	60	60

Parameters	Observed	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
24 Hourly (in µg/m³)	Minimum	39.2	41.1	32.5	32.9	37.4	36.8	41.5	38.2	41.7	37.6
	Maximum	53.6	45.4	40.7	41.6	47.2	48.4	53.9	46.9	49.6	49.8
	Average	49.0	43.2	36.4	37.1	40.7	44.0	46.3	42.2	45.0	42.5
	98th Percentile	53.5	45.3	96.5	101.9	98.4	98.6	53.0	46.6	49.5	101.1
SO2 24 Hourly (in µg/m³)	NAAQS	80	80	80	80	80	80	80	80	80	80
	Minimum	6.96	6.79	5.62	5.84	6.27	6.03	6.55	7.09	7.68	6.71
	Maximum	8.43	7.94	7.7	7.64	7.44	7.25	8.14	8.71	8.83	8.07
	Average	7.78	7.45	6.50	6.51	6.96	6.84	7.39	7.74	8.30	7.63
	98th Percentile	8.39	7.93	7.57	7.54	7.44	7.24	8.08	8.64	8.82	8.04
NOX 24 Hourly (in µg/m³)	NAAQS	80	80	80	80	80	80	80	80	80	80
	Minimum	27.7	26.02	26.32	25.09	26.07	26.6	23.43	27.47	28.86	28.26
	Maximum	30.18	28.44	27.67	28.97	28.59	29.37	27.31	29.82	30.39	30.93
	Average	28.52	27.47	26.90	26.79	27.05	28.21	25.01	28.85	29.70	29.28
	98th Percentile	30.04	28.40	27.60	28.86	28.47	29.28	27.20	29.78	30.36	30.80
CO 8 Hourly (in mg/m³)	NAAQS	4	4	4	4	4	4	4	4	4	4
	Minimum	0.06	0.02	0.03	0.08	0.12	0.07	0.07	0.12	0.12	0.12
	Maximum	1.07	0.64	0.45	0.58	0.79	0.7	0.7	0.39	0.67	0.64
	Average	0.73	0.35	0.22	0.41	0.58	0.44	0.44	0.24	0.45	0.43
	98th Percentile	1.06	0.63	0.44	0.58	0.79	0.60	0.69	0.38	0.66	0.64
Pb, µg/ m3	NAAQS	1	1	1	1	1	1	1	1	1	1
	Minimum	0.04	0.02	0.04	0.02	0.05	0.07	0.06	0.04	0.06	0.06
	Maximum	1.02	0.47	0.39	0.52	0.72	0.43	0.65	0.39	0.63	0.59
	Average	0.311	0.177	0.161	0.190	0.268	0.187	0.220	0.149	0.230	0.228
	98th Percentile	1.02	0.46	0.38	0.38	0.52	0.43	0.63	0.37	0.63	0.59

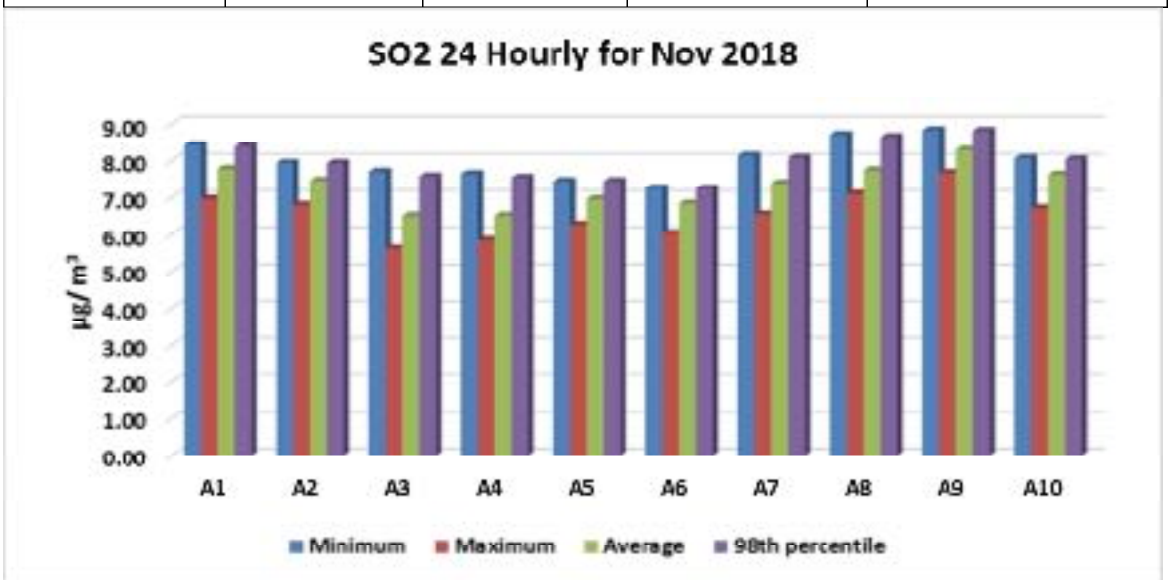
PM 10 for Nov 2018				
Location	Max	Min	Avg	98th Percentile
A1	104.7	93.6	98.3	104.3
A2	94.1	82.6	89.3	93.8
A3	96.8	85.2	90.9	96.5
A4	102.3	89.6	95.1	101.9
A5	98.9	89.7	93.0	98.4
A6	98.7	91.2	96.1	98.6
A7	102.6	93.3	96.8	102.4
A8	98.2	92.8	95.2	98.0
A9	100.5	90.2	96.9	100.3
A10	101.2	91.2	96.4	101.1



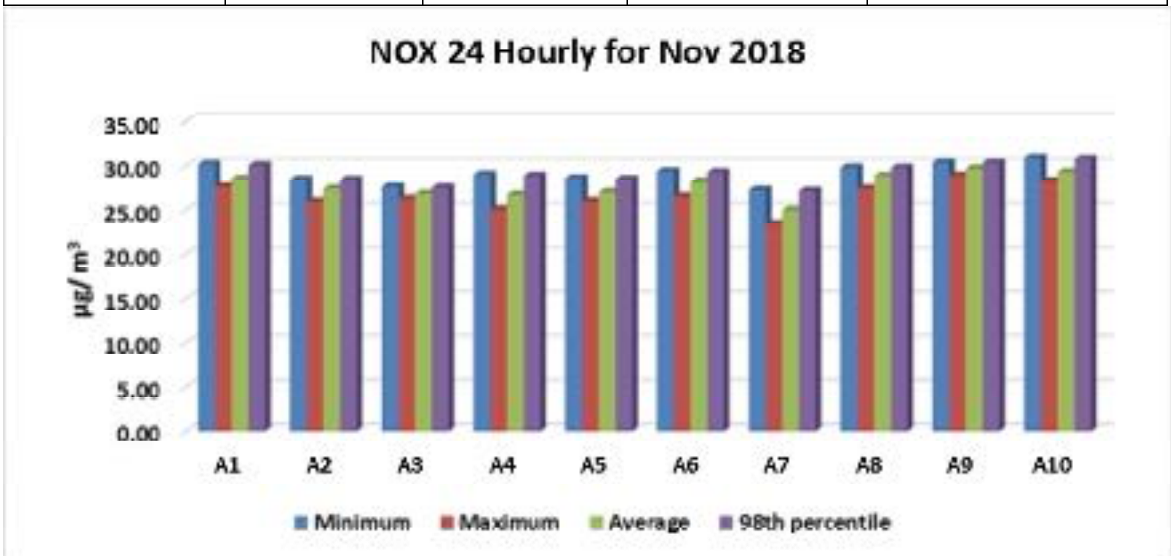
PM 2.5 for Nov 2018				
Location	Max	Min	Avg	98th Percentile
A1	53.6	39.2	49.0	53.5
A2	45.4	41.1	43.2	45.3
A3	40.7	32.5	36.4	96.5
A4	41.6	32.9	37.1	101.9
A5	47.2	37.4	40.7	98.4
A6	48.4	36.8	44.0	98.6
A7	53.9	41.5	46.3	53.0
A8	46.9	38.2	42.2	46.6
A9	49.6	41.7	45.0	49.5
A10	49.8	37.6	42.5	101.1



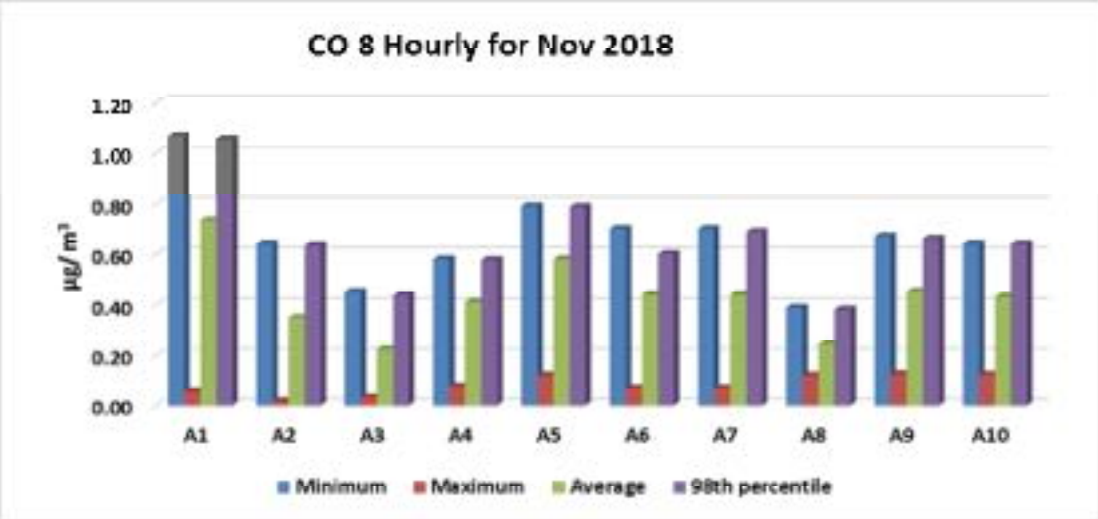
SO2 for Nov 2018				
Location	Max	Min	Avg	98th Percentile
A1	8.43	6.96	7.78	8.39
A2	7.94	6.79	7.45	7.93
A3	7.70	5.62	6.50	7.57
A4	7.64	5.84	6.51	7.54
A5	7.44	6.27	6.96	7.44
A6	7.25	6.03	6.84	7.24
A7	8.14	6.55	7.39	8.08
A8	8.71	7.09	7.74	8.64
A9	8.83	7.68	8.30	8.82
A10	8.07	6.71	7.63	8.04



NOX for Nov 2018				
Location	Max	Min	Avg	98th Percentile
A1	30.18	27.70	28.52	30.04
A2	28.44	26.02	27.47	28.40
A3	27.67	26.32	26.90	27.60
A4	28.97	25.09	26.79	28.86
A5	28.59	26.07	27.05	28.47
A6	29.37	26.60	28.21	29.28
A7	27.31	23.43	25.01	27.20
A8	29.82	27.47	28.85	29.78
A9	30.39	28.86	29.70	30.36
A10	30.93	28.26	29.28	30.80



CO for Nov 2018				
Location	Max	Min	Avg	98th Percentile
A1	1.07	0.06	0.73	1.06
A2	0.64	0.02	0.35	0.63
A3	0.45	0.03	0.22	0.44
A4	0.58	0.08	0.41	0.58
A5	0.79	0.12	0.58	0.79
A6	0.70	0.07	0.44	0.60
A7	0.70	0.07	0.44	0.69
A8	0.39	0.12	0.24	0.38
A9	0.67	0.12	0.45	0.66
A10	0.64	0.12	0.43	0.64



Pb for Nov 2018				
Location	Max	Min	Avg	98^{th} Percentile
A1	1.02	0.04	0.311	1.02
A2	0.47	0.02	0.177	0.46
A3	0.39	0.04	0.161	0.38
A4	0.52	0.02	0.190	0.38
A5	0.72	0.05	0.268	0.52
A6	0.43	0.07	0.187	0.43
A7	0.65	0.06	0.220	0.63
A8	0.39	0.04	0.149	0.37
A9	0.63	0.06	0.230	0.63
A10	0.59	0.06	0.228	0.59

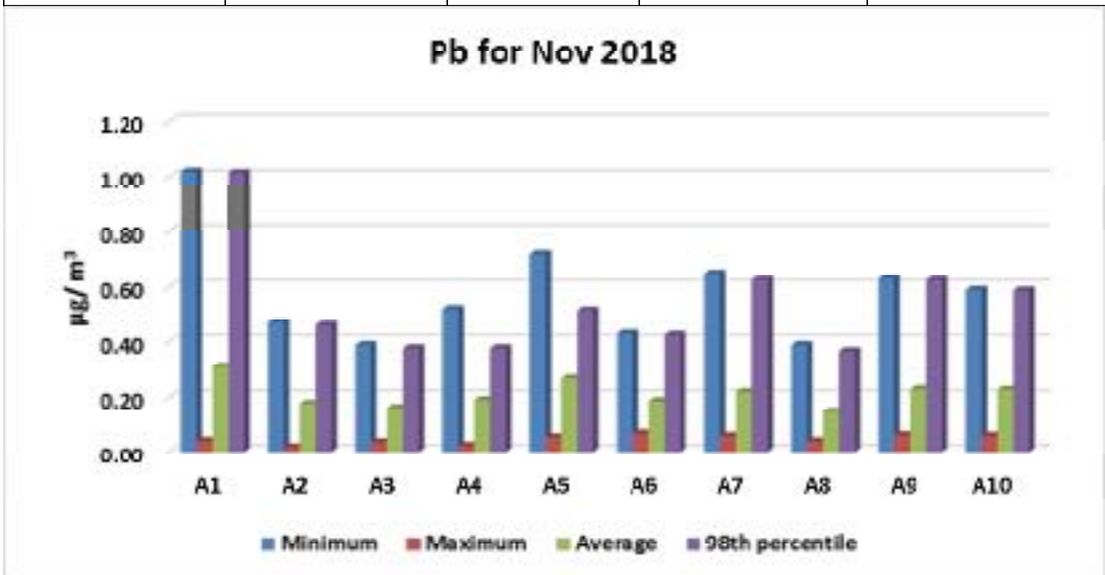
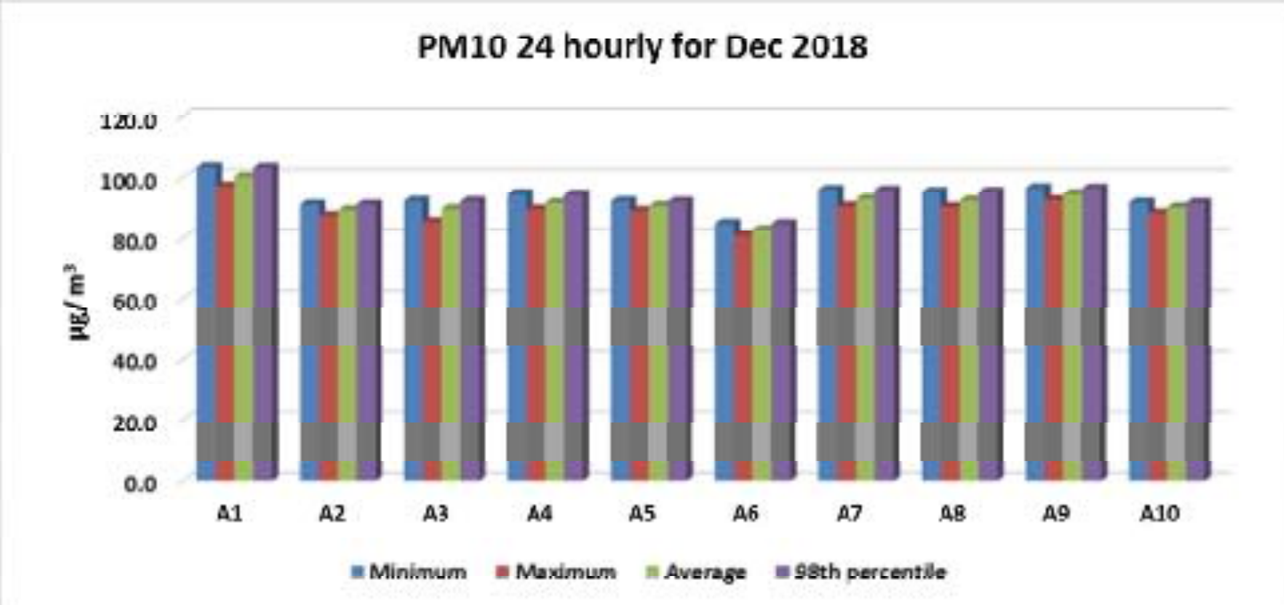


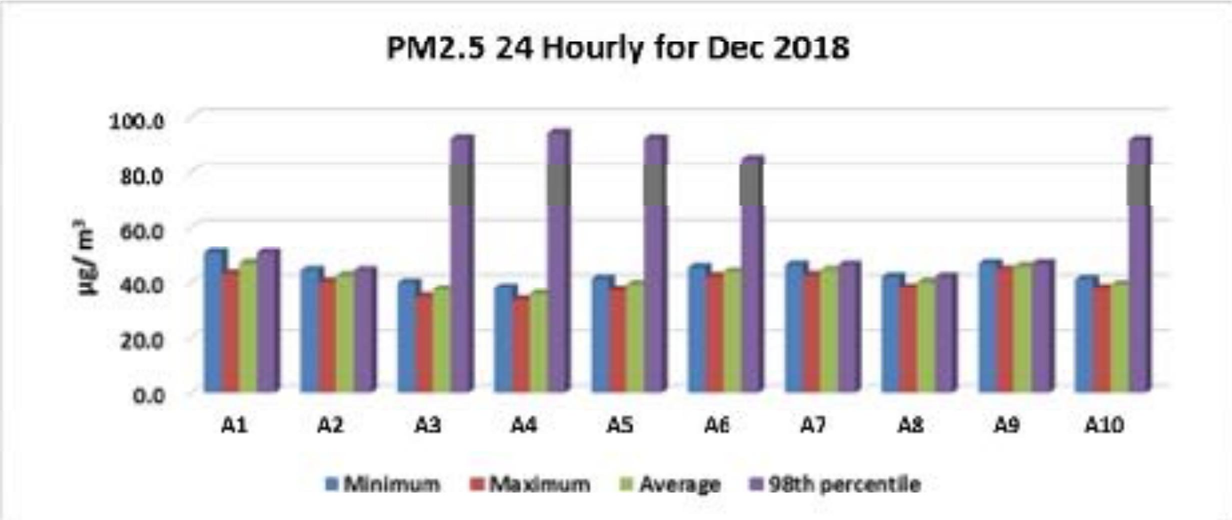
Table 4-16: Ambient Air Quality at different AAQ stations - December 2018

Parameters	Observed	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
PM10	NAAQS	100	100	100	100	100	100	100	100	100	100
24 Hourly	Minimum	97.1	87.4	85.4	89.7	89.1	80.9	90.6	90.4	92.7	88.3
(in µg/m³)	Maximum	103.4	91.3	92.4	94.5	92.3	84.8	95.9	95.2	96.4	91.9
	Average	100.2	89.4	89.8	91.8	90.7	82.8	93.2	92.6	94.6	90.3
	98th Percentile	103.3	91.3	92.3	94.3	92.3	84.7	95.7	95.2	96.4	91.8
PM 2.5	NAAQS	60	60	60	60	60	60	60	60	60	60
24 Hourly	Minimum	43.2	40.3	34.9	33.9	37.2	42.2	42.6	38.1	44.7	37.9
(in µg/m³)	Maximum	50.9	44.6	40.0	38.1	41.4	45.6	46.5	42.1	47.0	41.2
	Average	47.16	42.46	37.46	36.01	39.31	44.01	44.56	40.11	45.96	39.26
	98th Percentile	50.88	44.53	92.30	94.35	92.27	84.69	46.43	42.03	46.98	91.79
SO2	NAAQS	80	80	80	80	80	80	80	80	80	80
24 Hourly	Minimum	7.27	7.1	5.93	5.79	6.58	6.34	6.86	7.4	7.99	7.20
(in µg/m³)	Maximum	8.69	8.01	7.33	6.56	7.56	7.33	8.3	8.36	9	8.1
	Average	7.97	7.55	6.62	6.17	7.06	6.83	7.57	7.87	8.49	7.69
	98th Percentile	8.66	7.98	7.30	6.54	7.53	7.30	8.27	8.33	8.97	8.09
NOX	NAAQS	80	80	80	80	80	80	80	80	80	80
24 Hourly	Minimum	27.68	26.58	26.14	25.65	26.6	27.16	23.79	28.03	28.68	28.46
(in µg/m³)	Maximum	29.56	28.46	28.02	27.53	28.94	29.18	26.85	29.91	30.56	31.28
	Average	28.39	27.38	27.05	26.51	27.27	28.35	24.84	29.03	29.64	29.39
	98th Percentile	29.45	28.37	27.96	27.46	28.73	29.16	26.64	29.88	30.52	31.07
CO	NAAQS	4	4	4	4	4	4	4	4	4	4
8 Hourly	Minimum	0.9	0.3	0.21	0.41	0.63	0.42	0.42	0.2	0.48	0.42
(in mg/m³)	Maximum	1.07	0.51	0.41	0.57	0.82	0.7	0.7	0.36	0.65	0.63
	Average	0.97	0.41	0.31	0.48	0.73	0.56	0.56	0.27	0.57	0.53
	98th Percentile	1.06	0.50	0.40	0.56	0.81	0.51	0.69	0.35	0.65	0.62
Pb, µg/ m3	NAAQS	1	1	1	1	1	1	1	1	1	1
	Minimum	0.03	0.01	0.03	0.02	0.05	0.05	0.03	0.03	0.01	0.03
	Maximum	0.09	0.07	0.10	0.07	0.15	0.15	0.10	0.13	0.08	0.14
	Average	0.06	0.03	0.06	0.03	0.10	0.10	0.05	0.07	0.04	0.08
	98th Percentile	0.09	0.07	0.10	0.10	0.07	0.15	0.09	0.13	0.07	0.13

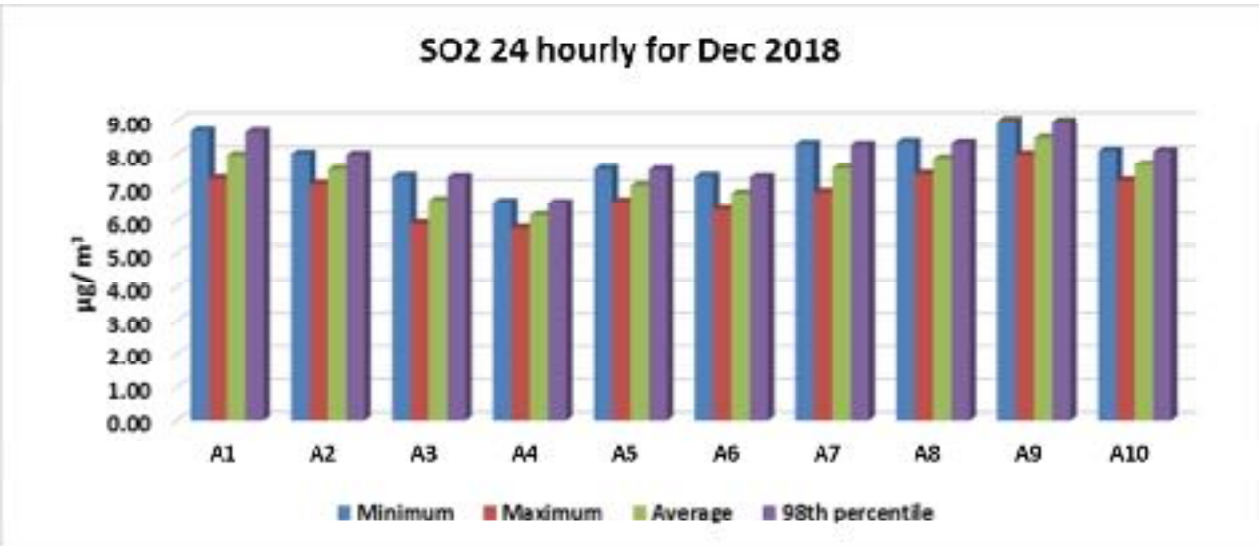
PM10 for December 2018				
Location	Max	Min	Avg	98th Percentile
A1	103.4	97.1	100.2	103.3
A2	91.3	87.4	89.4	91.3
A3	92.4	85.4	89.8	92.3
A4	94.5	89.7	91.8	94.3
A5	92.3	89.1	90.7	92.3
A6	84.8	80.9	82.8	84.7
A7	95.9	90.6	93.2	95.7
A8	95.2	90.4	92.6	95.2
A9	96.4	92.7	94.6	96.4
A10	91.9	88.3	90.3	91.8



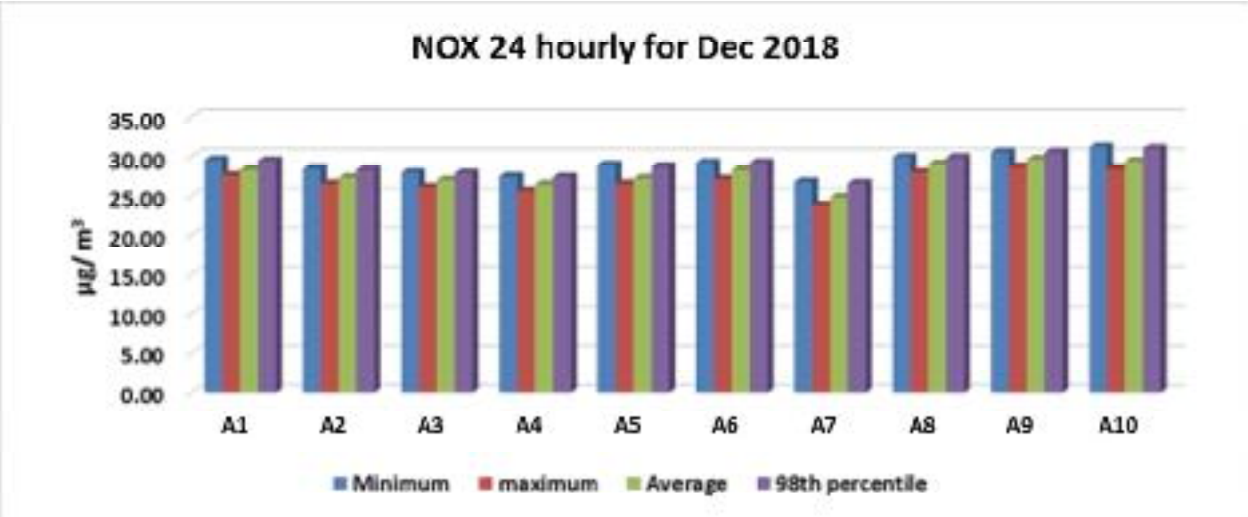
PM2.5 for December 2018				
Location	Max	Min	Avg	98th Percentile
A1	50.9	43.2	47.2	50.9
A2	44.6	40.3	42.5	44.5
A3	40.0	34.9	37.5	92.3
A4	38.1	33.9	36.0	94.3
A5	41.4	37.2	39.3	92.3
A6	45.6	42.2	44.0	84.7
A7	46.5	42.6	44.6	46.4
A8	42.1	38.1	40.1	42.0
A9	47.0	44.7	46.0	47.0
A10	41.2	37.9	39.3	91.8



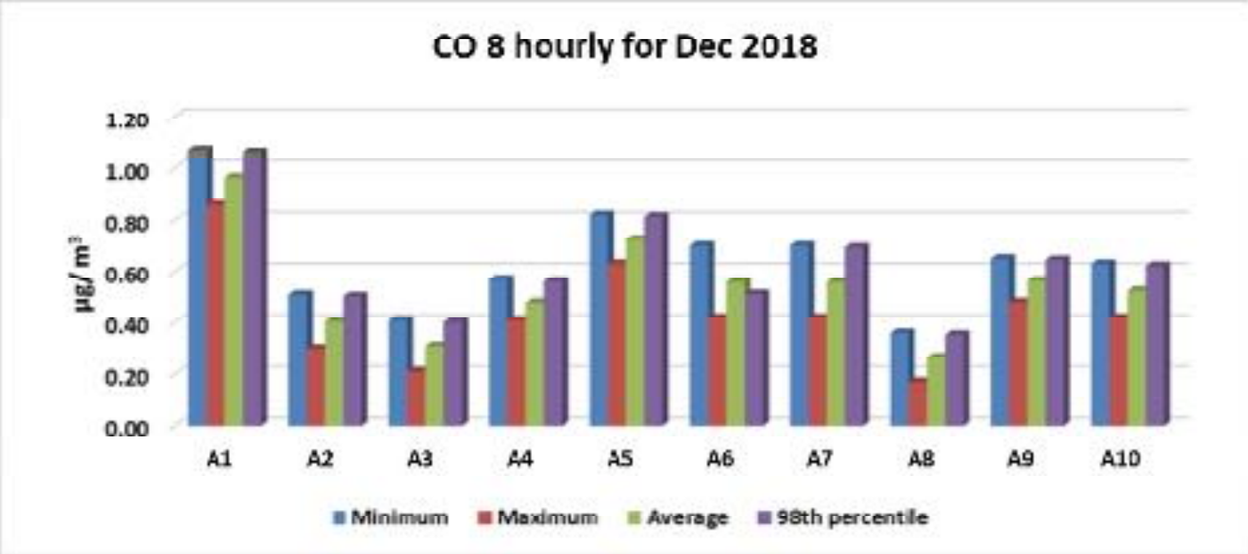
SO2 for December 2018				
Location	Max	Min	Avg	98th Percentile
A1	8.69	7.27	7.97	8.66
A2	8.01	7.10	7.55	7.98
A3	7.33	5.93	6.62	7.30
A4	6.56	5.79	6.17	6.54
A5	7.56	6.58	7.06	7.53
A6	7.33	6.34	6.83	7.30
A7	8.30	6.86	7.57	8.27
A8	8.36	7.40	7.87	8.33
A9	9.00	7.99	8.49	8.97
A10	8.10	7.20	7.69	8.09



NOX for Dec 2018				
Location	Max	Min	Avg	98th Percentile
A1	29.56	27.68	28.39	29.45
A2	28.46	26.58	27.38	28.37
A3	28.02	26.14	27.05	27.96
A4	27.53	25.65	26.51	27.46
A5	28.94	26.55	27.27	28.73
A6	29.18	27.16	28.35	29.16
A7	26.85	23.79	24.84	26.64
A8	29.91	28.03	29.03	29.88
A9	30.56	28.68	29.64	30.52
A10	31.28	28.46	29.39	31.07



CO for Dec 2018				
Location	Max	Min	Avg	98th Percentile
A1	1.07	0.86	0.97	1.06
A2	0.51	0.30	0.41	0.50
A3	0.41	0.21	0.31	0.40
A4	0.57	0.41	0.48	0.56
A5	0.82	0.63	0.73	0.81
A6	0.70	0.42	0.56	0.51
A7	0.70	0.42	0.56	0.69
A8	0.36	0.17	0.27	0.35
A9	0.65	0.48	0.57	0.65
A10	0.63	0.42	0.53	0.62



Pb for Dec 2018				
Location	Max	Min	Avg	98th Percentile
A1	0.090	0.030	0.055	0.087
A2	0.073	0.011	0.034	0.071
A3	0.102	0.027	0.061	0.099
A4	0.073	0.019	0.034	0.099
A5	0.149	0.051	0.096	0.068
A6	0.149	0.047	0.104	0.148
A7	0.096	0.028	0.054	0.093
A8	0.130	0.025	0.072	0.129
A9	0.075	0.008	0.035	0.071
A10	0.137	0.026	0.079	0.131

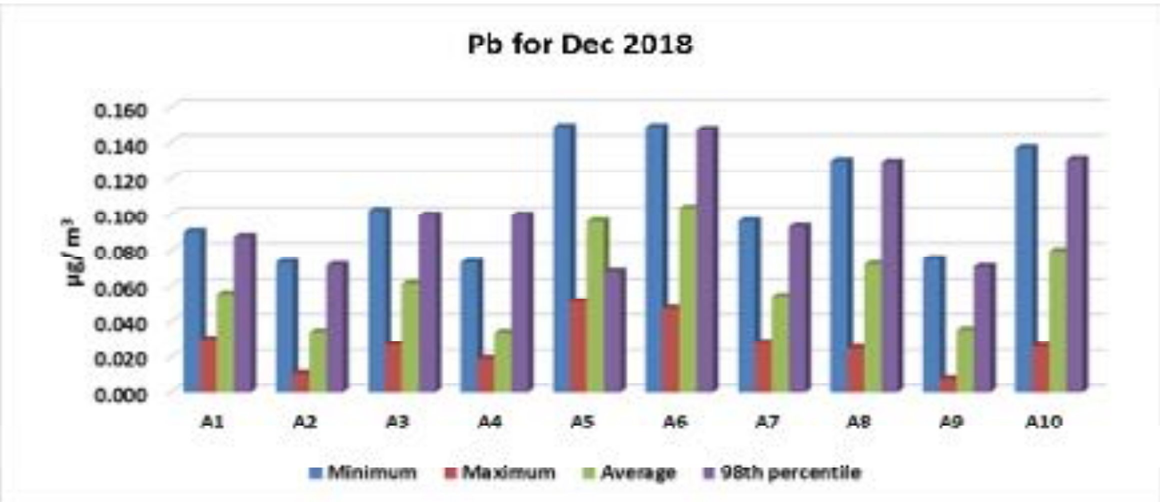
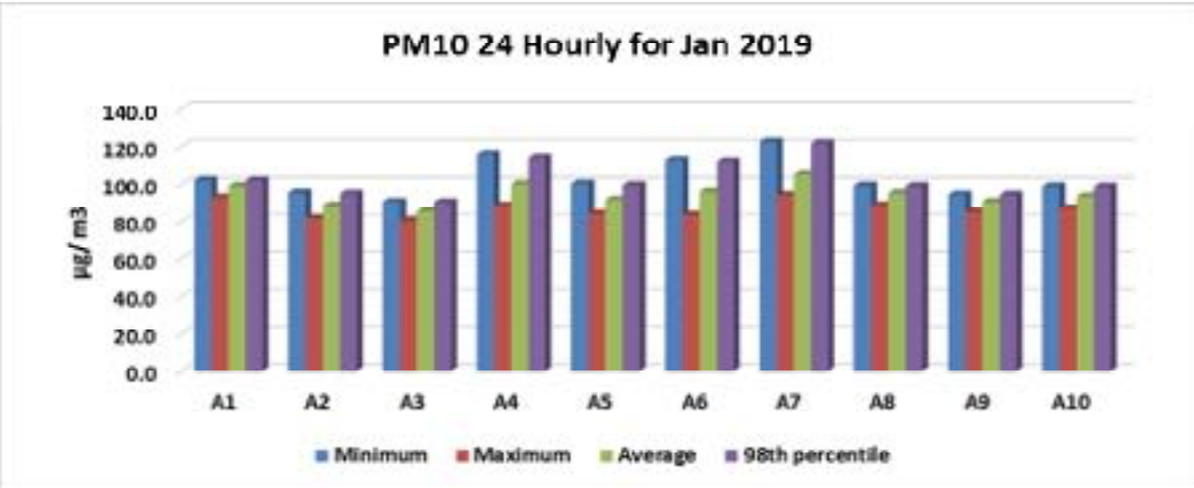


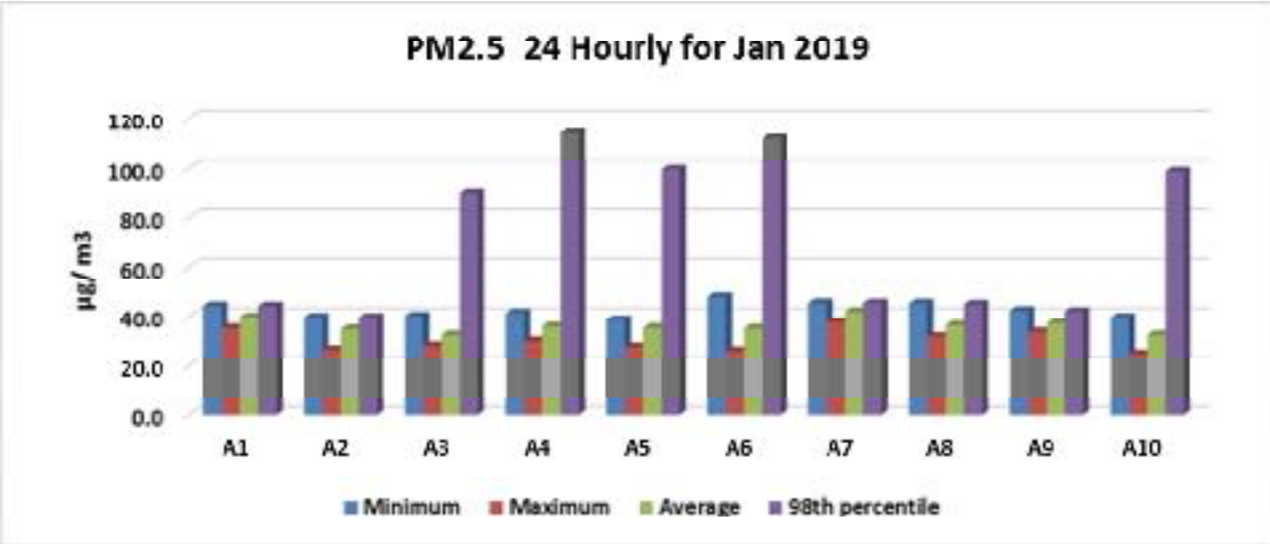
Table 4-17: Ambient Air Quality at different AAQ stations – January 2019

Parameters	Observed	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
PM10 24 Hourly (in µg/m³)	NAAQS	100	100	100	100	100	100	100	100	100	100
	Minimum	92.8	81.9	80.6	88.3	84.4	83.6	94.0	88.4	85.4	86.9
	Maximum	102.1	95.4	90.3	115.7	100.3	112.7	122.7	99.3	94.3	98.8
	Average	99.0	88.2	85.5	100.0	91.4	95.9	105.1	95.1	90.3	93.3
	98th Percentile	102.0	94.7	90.1	114.0	99.5	112.0	121.8	99.0	94.2	98.7
PM 2.5 24 Hourly (in µg/m³)	NAAQS	60	60	60	60	60	60	60	60	60	60
	Minimum	35.13	26.42	28.16	30.10	27.63	26.10	37.60	31.70	33.60	24.80
	Maximum	44.2	39.5	40.1	41.3	38.5	47.8	45.4	45.2	42.3	39.4
	Average	39.7	34.7	32.4	35.8	35.2	35.0	41.8	36.4	37.0	32.4
	98th Percentile	44.1	39.5	90.1	114.0	99.5	112.0	45.3	44.9	41.9	98.7
SO2 24 Hourly (in µg/m³)	NAAQS	80	80	80	80	80	80	80	80	80	80
	Minimum	6.34	8.06	7.59	6.77	7.07	7.43	7.12	7.28	7.40	7.49
	Maximum	8.34	9.23	8.69	8.5	8.94	8.43	9.89	8.55	8.81	8.72
	Average	7.42	8.58	8.05	7.50	8.25	7.80	8.49	7.86	8.16	7.95
	98th Percentile	8.31	9.19	8.65	8.42	8.90	8.39	9.80	8.52	8.78	8.65
NOX 24 Hourly (in µg/m³)	NAAQS	80	80	80	80	80	80	80	80	80	80
	Minimum	27.61	33.43	24.78	27.37	23.67	22.91	21.48	21.59	20.61	23.35
	Maximum	32.15	39.72	28.65	36.40	29.58	27.45	29.49	35.62	37.33	33.22
	Average	29.41	36.54	26.53	31.02	27.06	25.50	24.85	26.45	30.16	27.42
	98th Percentile	32.02	39.53	28.46	36.21	29.39	27.41	29.21	34.98	37.14	32.99
CO 8 Hourly (in mg/m³)	NAAQS	4	4	4	4	4	4	4	4	4	4
	Minimum	0.68	0.41	0.28	0.43	0.47	0.45	0.45	0.29	0.53	0.5
	Maximum	0.96	0.58	0.49	0.63	0.7	0.77	0.77	0.48	0.65	0.75
	Average	0.82	0.50	0.39	0.55	0.58	0.62	0.62	0.37	0.60	0.65
	98th Percentile	0.95	0.58	0.48	0.63	0.70	0.53	0.76	0.47	0.65	0.75
Pb, µg/ m3	NAAQS	1	1	1	1	1	1	1	1	1	1
	Minimum	0.074	0.02	0.13	0.044	0.095	0.076	0.02	0.04	0.051	0.02
	Maximum	0.137	0.127	0.324	0.103	0.428	0.141	0.137	0.129	0.152	0.125
	Average	0.093	0.072	0.198	0.081	0.159	0.104	0.083	0.080	0.096	0.078
	98th Percentile	0.133	0.124	0.321	0.321	0.102	0.138	0.133	0.128	0.152	0.123

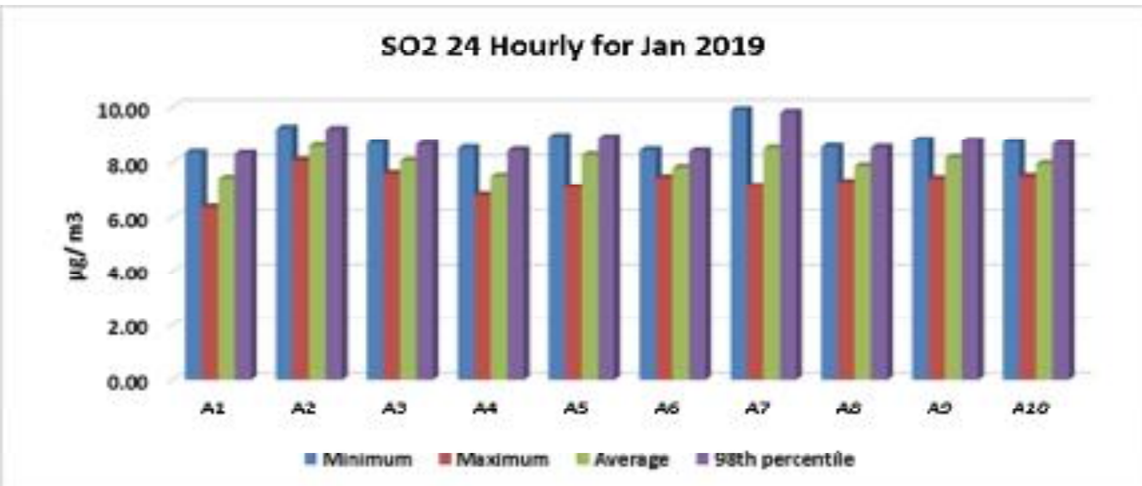
PM10 for Jan 2019				
Location	Max	Min	Avg	98th Percentile
A1	102.1	92.8	99.0	102.0
A2	95.4	81.9	88.2	94.7
A3	90.3	80.6	85.5	90.1
A4	115.7	88.3	100.0	114.0
A5	100.3	84.4	91.4	99.5
A6	112.7	83.6	95.9	112.0
A7	122.7	94.0	105.1	121.8
A8	99.3	88.4	95.1	99.0
A9	94.3	85.4	90.3	94.2
A10	98.8	86.9	93.3	98.7



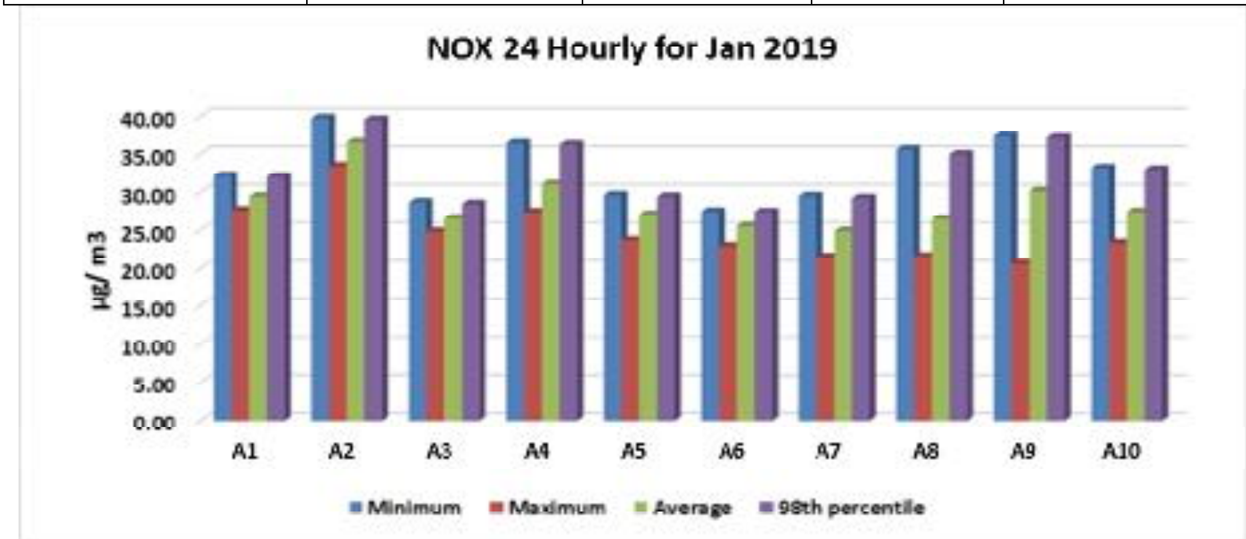
PM 2.5 for Jan 2019				
Location	Max	Min	Avg	98th Percentile
A1	44.2	35.1	39.7	44.1
A2	39.5	26.4	34.7	39.5
A3	40.1	28.2	32.4	90.1
A4	41.3	30.1	35.8	114.0
A5	38.5	27.6	35.2	99.5
A6	47.8	26.1	35.0	112.0
A7	45.4	37.6	41.8	45.3
A8	45.2	31.7	36.4	44.9
A9	42.3	33.6	37.0	41.9
A10	39.4	24.8	32.4	98.7



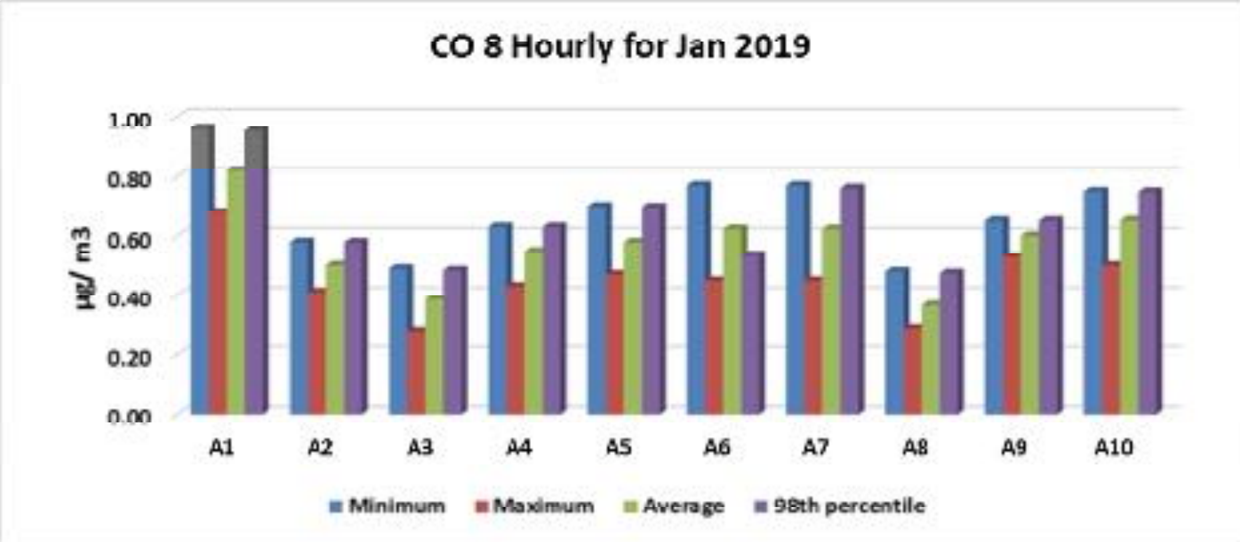
SO2 for Jan 2019				
Location	Max	Min	Avg	98th Percentile
A1	8.34	6.34	7.42	8.31
A2	9.23	8.06	8.58	9.19
A3	8.69	7.59	8.05	8.65
A4	8.50	6.77	7.50	8.42
A5	8.94	7.07	8.25	8.90
A6	8.43	7.43	7.80	8.39
A7	9.89	7.12	8.49	9.80
A8	8.55	7.28	7.86	8.52
A9	8.81	7.40	8.16	8.78
A10	8.72	7.49	7.95	8.65



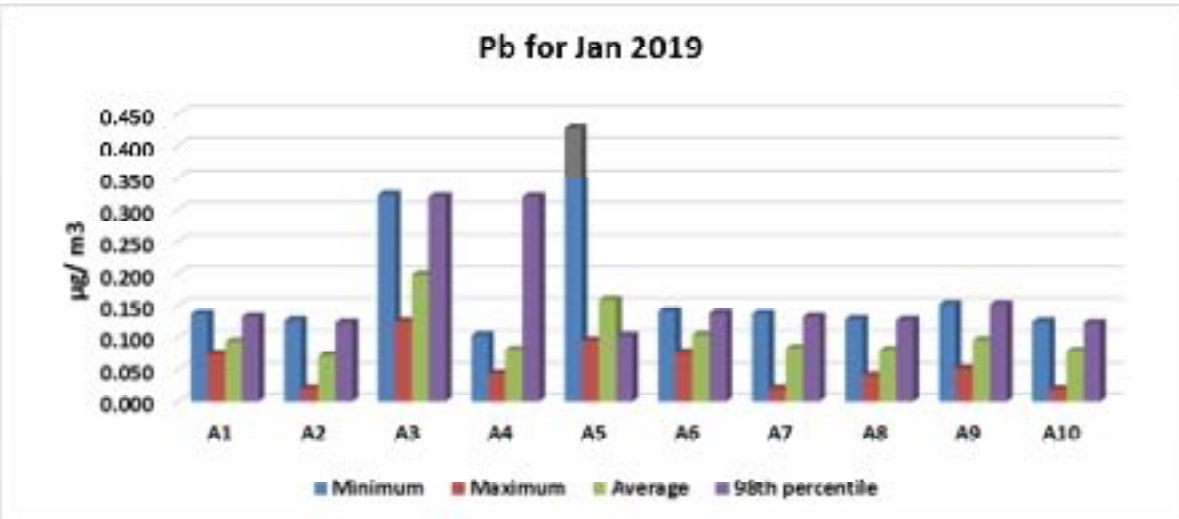
NOX for Jan 2019				
Location	Max	Min	Avg	98th Percentile
A1	32.15	27.61	29.41	32.02
A2	39.72	33.43	36.54	39.53
A3	28.65	24.78	26.53	28.46
A4	36.40	27.37	31.02	36.21
A5	29.58	23.67	27.06	29.39
A6	27.45	22.91	25.50	27.41
A7	29.49	21.48	24.85	29.21
A8	35.62	21.59	26.45	34.98
A9	37.33	20.61	30.16	37.14
A10	33.22	23.35	27.42	32.99



CO for Jan 2019				
Location	Max	Min	Avg	98th Percentile
A1	0.96	0.68	0.82	0.95
A2	0.58	0.41	0.50	0.58
A3	0.49	0.28	0.39	0.48
A4	0.63	0.43	0.55	0.63
A5	0.70	0.47	0.58	0.70
A6	0.77	0.45	0.62	0.53
A7	0.77	0.45	0.62	0.76
A8	0.48	0.29	0.37	0.47
A9	0.65	0.53	0.60	0.65
A10	0.75	0.50	0.65	0.75



Pb for Jan 2019				
Location	Max	Min	Avg	98th Percentile
A1	0.137	0.074	0.093	0.133
A2	0.127	0.020	0.072	0.124
A3	0.324	0.125	0.198	0.321
A4	0.103	0.044	0.081	0.321
A5	0.428	0.095	0.159	0.102
A6	0.141	0.076	0.104	0.138
A7	0.137	0.020	0.083	0.133
A8	0.129	0.041	0.080	0.128
A9	0.152	0.051	0.096	0.152
A10	0.125	0.019	0.078	0.123



4.5.1 Inferences on the Ambient Air Quality Analysis

Particulate Matter – PM_{10}

The average concentrations for PM10 recorded were within the prescribed CPCB limits of 100µg/m3 at all the sampling locations.

The PM10 monitored at following locations exceeded the prescribed standards.

- 100.5 µg/m3 in November 2018 at Minerva Circle (A-9);
- 101.6 µg/m3 in November 2018 & 100.6 µg/m3,103.4 µg/m3, 101.3 µg/m3,102.6 µg/m3 in December, 2018; 102.1 µg/m3 in January 2019 at Mekhri Circle (A-1);
- 102.6 µg/m3 in November 2018; & 122.7 µg/m3 in January 2019 at Lifestyle Junction, Richmond Road (A-5);
- 107.2 µg/m3 in January 2019 & 112.7 µg/m3 in January 2019 at Domlur SAARC Park (A-6);
- 115.7 µg/m3, 103.9 µg/m3, 100.4 µg/m3, 102.4 µg/m3 in January 2019 at Indian Express Circle (A-4) and
- 100.3 µg/m3 in January 2019 at Marathahalli Junction (A-7).

Particulate Matter – $PM_{2.5}$

The average concentrations for PM2.5 recorded were within the prescribed CPCB limits of 60µg/m3 at all the sampling locations. The minimum value for PM2.5 was recorded as 26.1 µg/m3 at Domlur SAARC park (A-6) in January 2019 and the maximum value was recorded as 53.9 µg/m3 at Marathahalli Junction (A-7) in November 2018.

Sulphur Dioxide (SO_2)

The average concentrations for SO2 recorded were within the prescribed CPCB limits of 80µg/m3 at all the sampling locations .The maximum values of SO2 of 9.89 µg/m3 were recorded at Marathahalli Junction (A-7) in January 2019 and minimum value of 5.62 µg/m3 is recorded at ITI Campus Junction(A-3) in November 2018.

Oxides of Nitrogen (NOx)

The average concentrations for NOX recorded were within the prescribed CPCB limits of 80µg/m3 at all the sampling locations. The maximum NOx concentration was observed to be 30.93 µg/m3 at Deepanjalinagar (A-10) in November 2018 and minimum value of 20.61 µg/m3 was recorded at Minerva Circle (A-9) in January 2019.

Carbon Monoxide

The average concentrations for CO recorded were within the prescribed CPCB limits of 4µg/m3 at all the sampling locations. The maximum CO concentration was observed to be 1.07 µg/m3 at Mekhri Circle (A-1) in Decemeber 2018 and minimum value of 0.02 µg/m3 was recorded at Wheelers Road Junction (Opp to HQ MEG Centre) (A-2) in November 2018.

Lead (Pb)

The average concentrations for Pb recorded were within the prescribed CPCB limits of 1µg/m3 at all the sampling locations. The maximum Pb concentration was observed to be 0.149 µg/m3 at Lifestyle Junction and Domlur SAARC park (A-5, A-6) in Decemeber 2018 and minimum value of 0.02 µg/m3 was recorded at Wheelers Road Junction (Opp to HQ MEG Centre) (A-2) and Indian Express (A-4) in November 2018.

Figure 4-6: Photographs of Air Quality Monitoring

	
A1 –Mekhri Circle	A2 - Wheelers Road Junction
	
A3 - ITI Campus Junction along NH4	A4 - Indian Express Circle
	
A5 - Lifestyle Junction on Richmond Road	A6 - Domlur SAARC Park

	
A7 – Marathahalli Junction	A8 - St. John's Medical College & Hospital
	
A9 - Minerva Circle	A10 - Deepanjalinagar, Mysore Road

4.5.2 Air Quality Modelling done for the project area:

Figure 4-7: Air Quality Modelling for PM 10 (Annual)

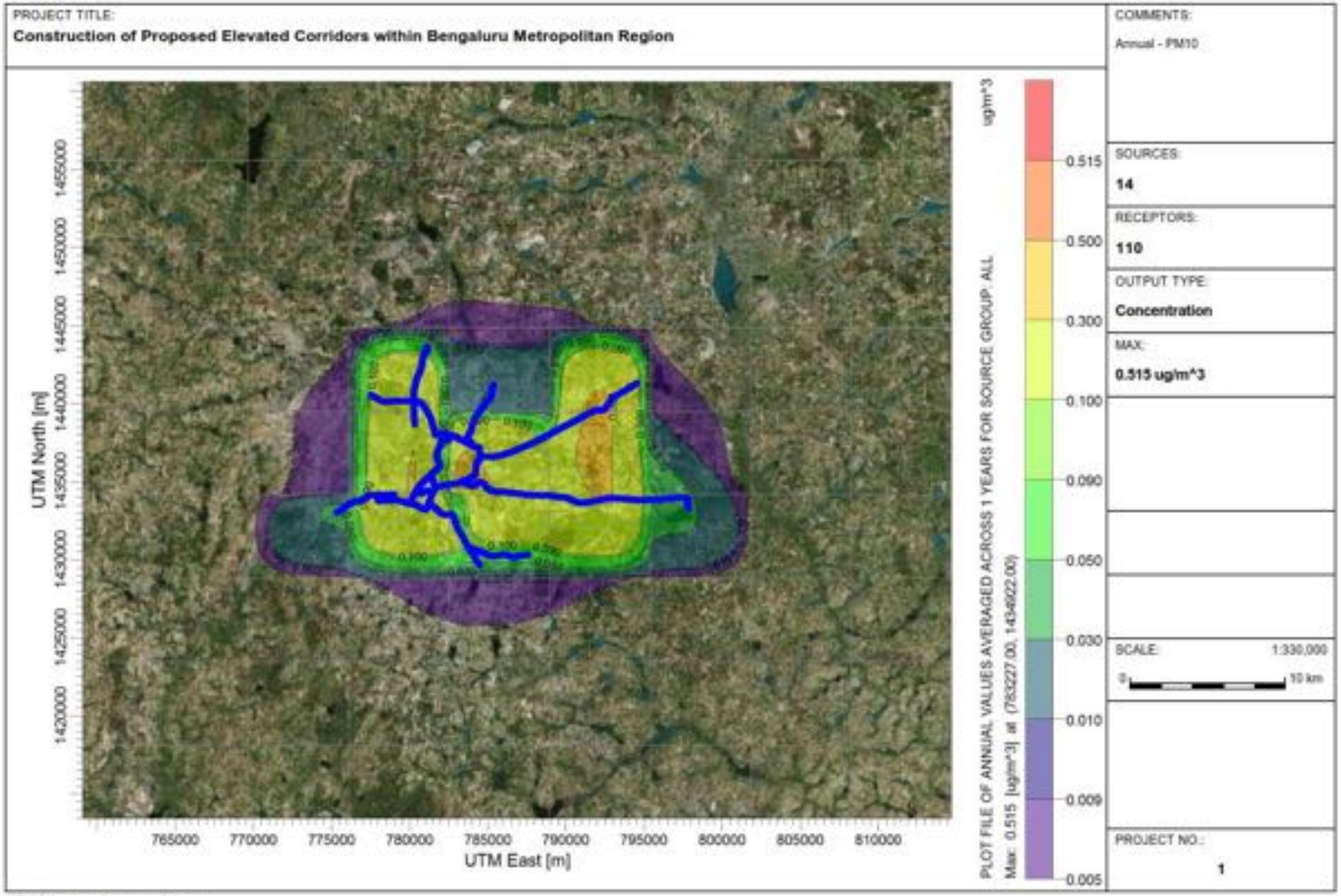


Table 4-18: Results of Air Quality Modelling for PM 10 (Annual)

Particulate Matter 10					
Sl No	Receptor	Baseline in (µg/m3)	Modeled results / Predicted Concentration (µg/m3)	Cumulative (µg/m3)	NAAQS (µg/m3)
1	A1- Mekhri Circle	99.18	1.8768	101.0568	100
2	A2 - Wheeler Road Junction(Opp to HQ MEG Centre)	88.96	2.43771	91.39771	100
3	A3 - ITI Campus Junction along NH4	88.74	2.32568	91.06568	100
4	A4 - Indian Express / Minsk Square	95.62	0.73446	96.35446	100
5	A5 - Marthalli Junction	91.71	2.24018	93.95018	100
6	A6 -Domlur SAARC Park	91.57	1.80165	93.37165	100
7	A7 - Life Style Juncton on Richmond Road	98.38	3.04753	101.42753	100
8	A8 - St.John's Medical College & Hospital (junction)	94.29	0.71492	95.00492	100
9	A9 - Minerva Circle	79.43	1.85682	81.28682	100
10	A10 - Deepanjalinagar ,Mysore Road	81.23	0.27048	81.50048	100

Figure 4-8: Air Quality Modelling for PM 2.5 (Annual)

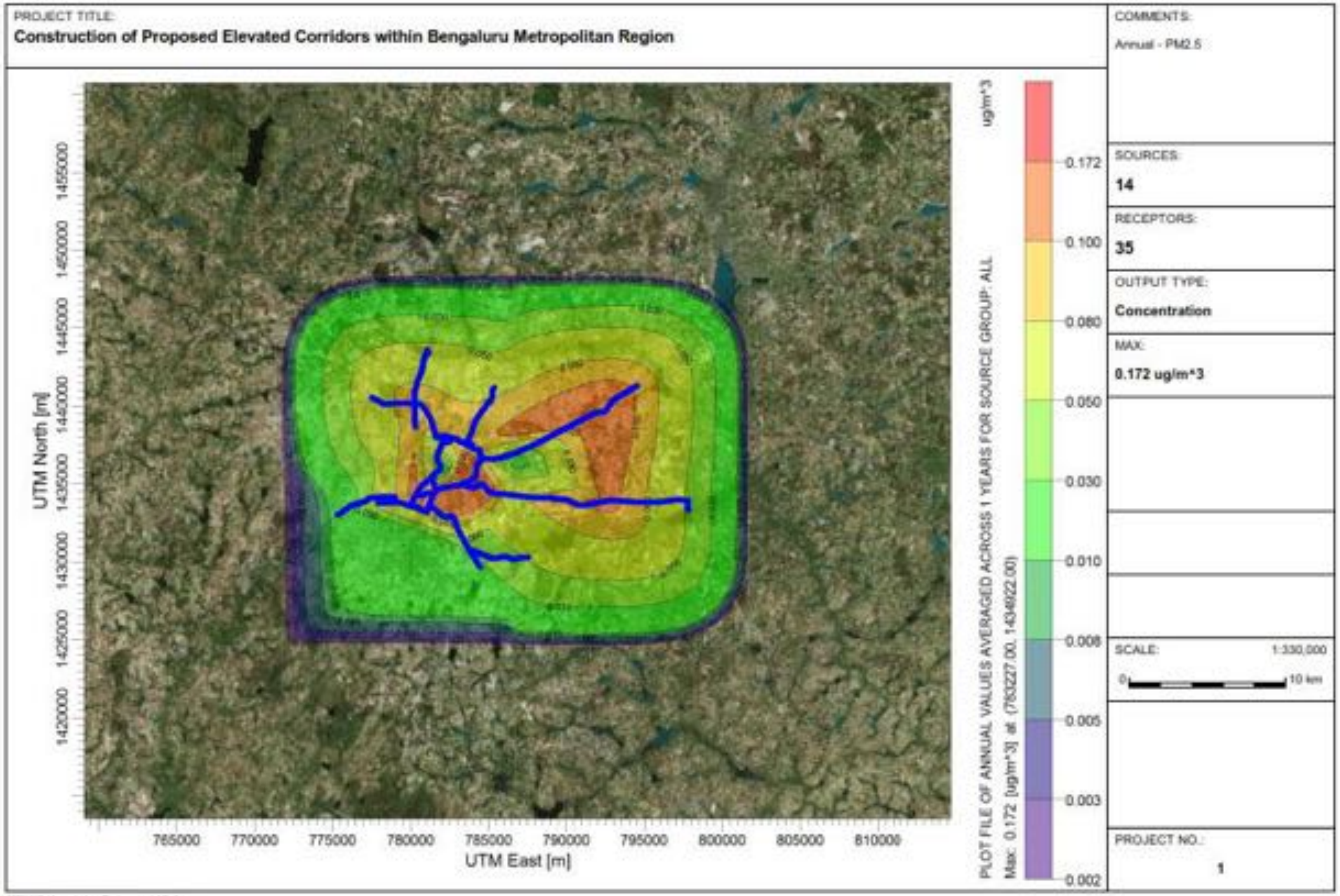


Table 4-19: Results of Air Quality Modelling for PM 2.5 (Annual)

Particulate Matter 2.5					
Sl No	Receptor	Baseline in (µg/m3)	Modeled results / Predicted Concentration (µg/m3)	Cumulative (µg/m3)	NAAQS (µg/m3)
1	A1- Mekhri Circle	45.26	0.6256	45.8856	60
2	A2 - Wheeler Road Junction(Opp to HQ MEG Centre)	40.11	0.81257	40.92257	60
3	A3 - ITI Campus Junction along NH4	35.41	0.77523	36.18523	60
4	A4 - Indian Express / Minsk Square	36.29	0.24482	36.53482	60
5	A5 - Marthalli Junction	38.42	0.74673	39.16673	60
6	A6 -Domlur SAARC Park	40.99	0.60055	41.59055	60
7	A7 - Life Style Juncton on Richmond Road	44.24	1.01584	45.25584	60
8	A8 - St.John's Medical College & Hospital (junction)	39.56	0.23831	39.79831	60
9	A9 - Minerva Circle	32.97	0.61894	33.58894	60
10	A10 - Deepanjalinagar ,Mysore Road	33.34	0.09016	33.43016	60

Figure 4-9: Air Quality Modelling for SO2 (Annual)

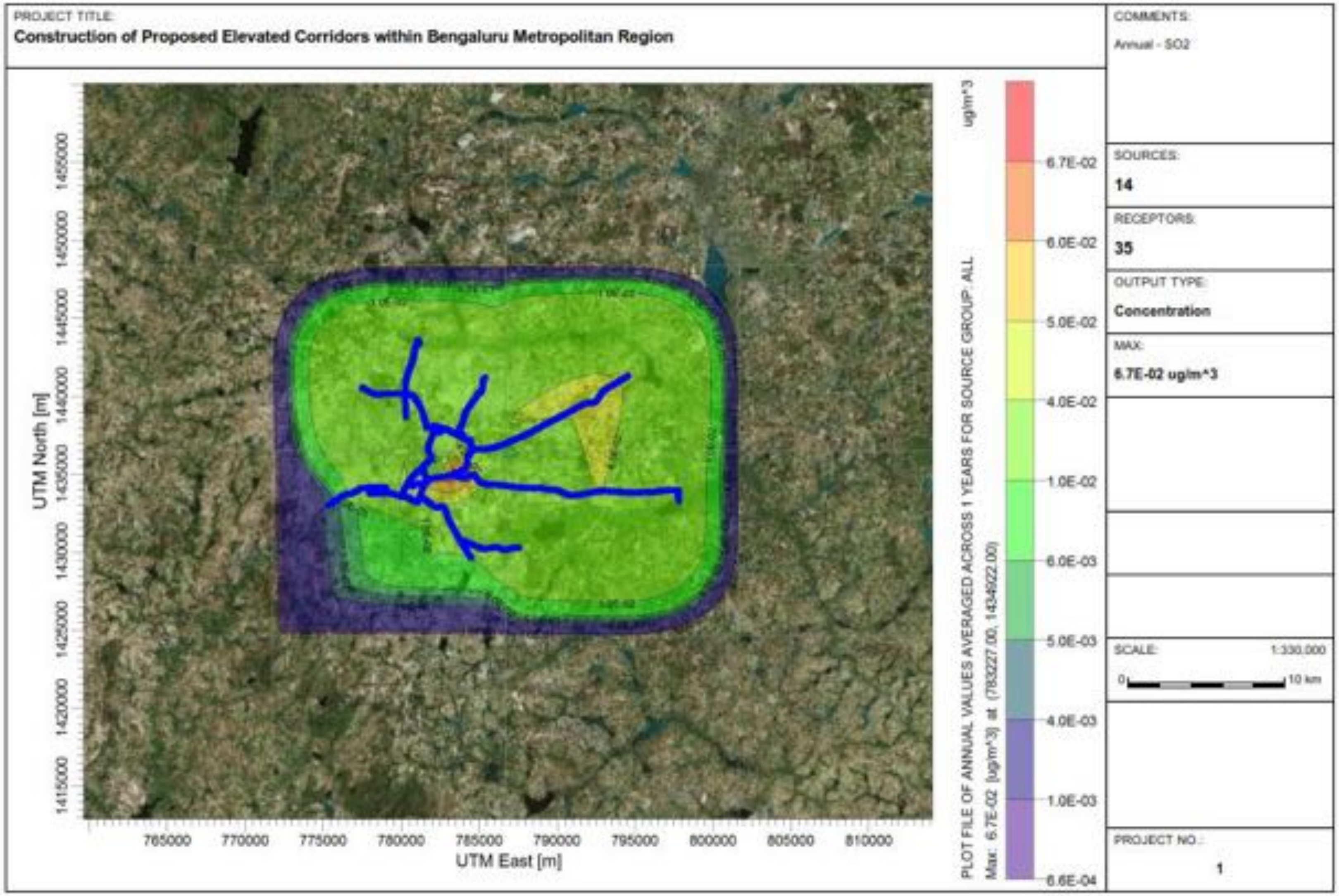


Table 4-20: Results of Air Quality Modelling for SO_2 (Annual)

SO2						
Sl. No.	Receptor	Baseline in (µg/m3)	Modeled results / Predicted Concentration (µg/m3)	Cumulative (µg/m3)	NAAQS (µg/m3)
1	A1- Mekhri Circle	7.72	0.11467	7.83467	80
2	A2 - Wheeler Road Junction(Opp to HQ MEG Centre)	7.86	0.12547	7.98547	80
3	A3 - ITI Campus Junction along NH4	7.06	0.1517	7.2117	80
4	A4 - Indian Express / Minsk Square	6.73	0.03111	6.76111	80
5	A5 - Marthalli Junction	7.42	0.13041	7.55041	80
6	A6 -Domlur SAARC Park	7.15	0.09695	7.24695	80
7	A7 - Life Style Juncton on Richmond Road	7.82	0.204	8.024	80
8	A8 - St.John's Medical College & Hospital (junction)	7.82	0.0385	7.8585	80
9	A9 - Minerva Circle	6.48	0.12663	6.60663	80
10	A10 - Deepanjalinagar ,Mysore Road	6.51	0.01578	6.52578	80

Figure 4-10: Air Quality Modelling for NO2 (Annual)

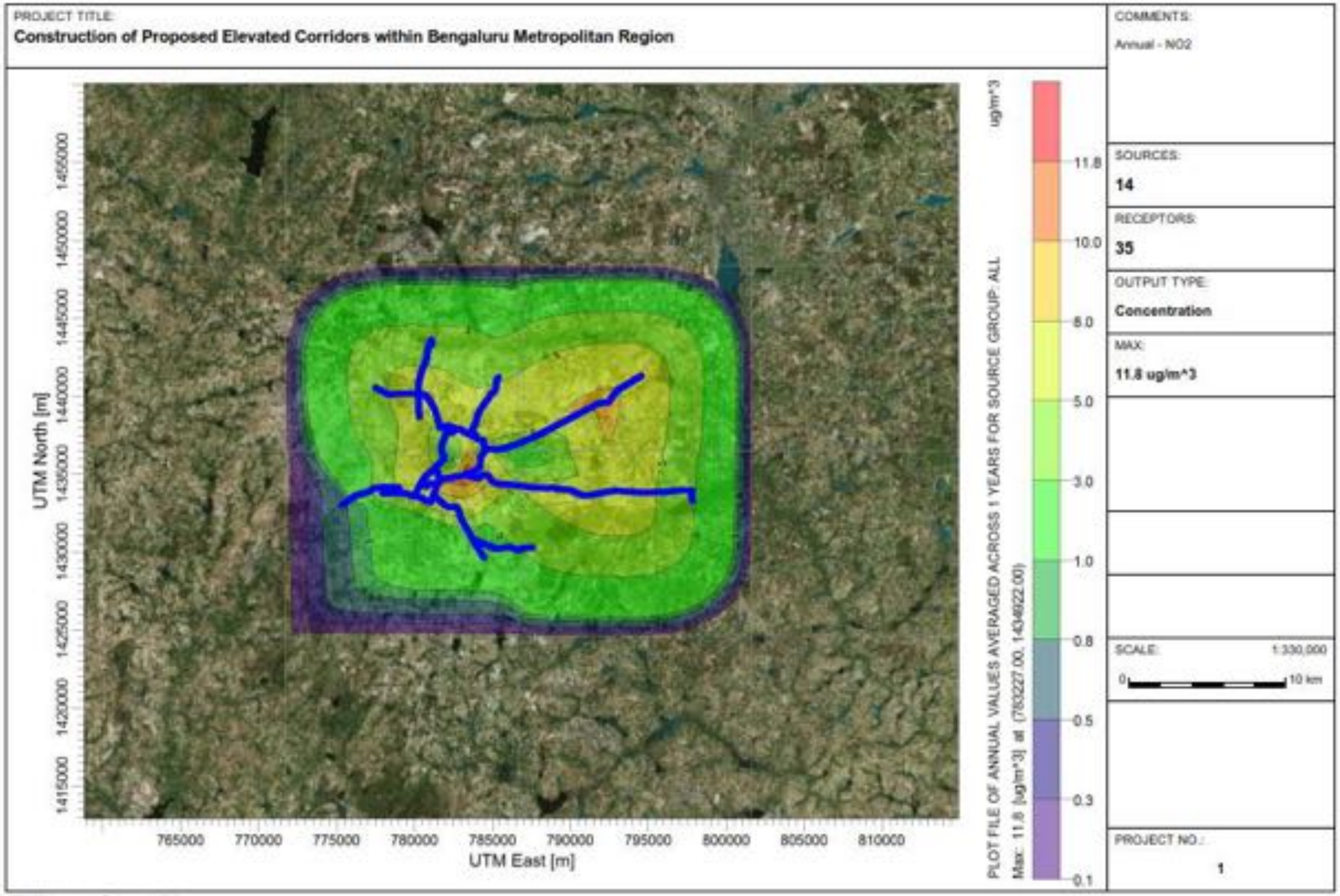


Table 4-21: Results of Air Quality Modelling for NO_2 (Annual)

NO2					
Sl. No.	Receptor	Baseline in (µg/m3)	Modeled results / Predicted Concentration (µg/m3)	Cumulative (µg/m3)	NAAQS (µg/m3)
1	A1- Mekhri Circle	28.78	20.44192	49.22192	80
2	A2 - Wheeler Road Junction(Opp to HQ MEG Centre)	30.46	22.17051	52.63051	80
3	A3 - ITI Campus Junction along NH4	26.82	26.82786	53.64786	80
4	A4 - Indian Express / Minsk Square	28.11	5.50259	33.61259	80
5	A5 - Marthalli Junction	27.12	22.98981	50.10981	80
6	A6 -Domlur SAARC Park	27.35	17.09165	44.44165	80
7	A7 - Life Style Juncton on Richmond Road	24.9	35.93694	60.83694	80
8	A8 - St.John's Medical College & Hospital (junction)	28.11	6.70718	34.81718	80
9	A9 - Minerva Circle	24.24	22.62089	46.86089	80
10	A10 - Deepanjalinagar ,Mysore Road	24.67	2.70736	27.37736	80

Figure 4-11: Air Quality Modelling for CO (Anual)

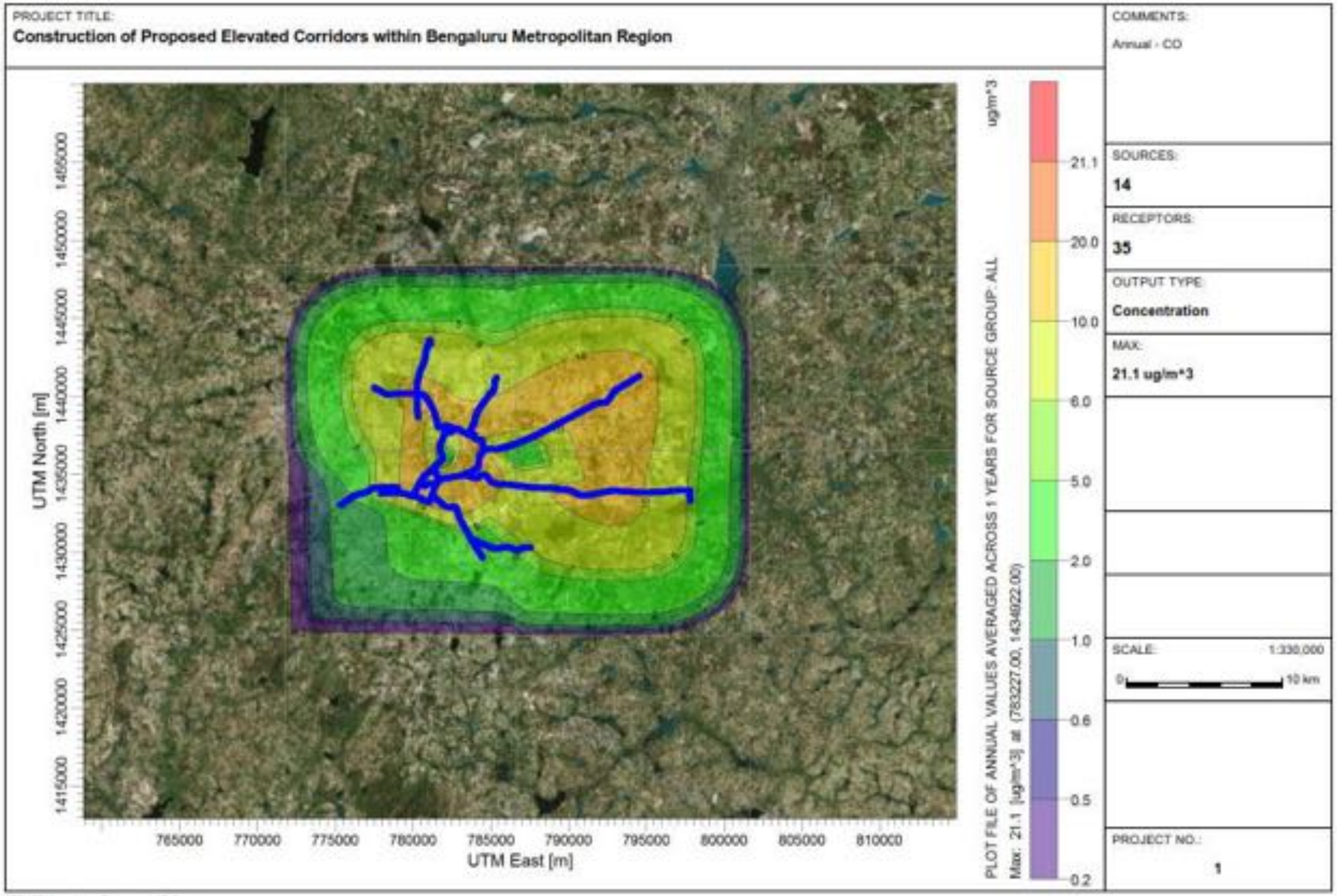


Table 4-22: Results of Air Quality Modelling for CO (Annual)

CO (Annual)					
Sl. No.	Receptor	Baseline in (mg/m3)	Modeled results / Predicted Concentration (mg/m3)	Cumulative (mg/m3)	NAAQS (mg/m3)
1	A1- Mekhri Circle	0.84	0.05011494	0.89011494	4
2	A2 - Wheeler Road Junction(Opp to HQ MEG Centre)	0.42	0.05552215	0.47552215	4
3	A3 - ITI Campus Junction along NH4	0.31	0.06797803	0.37797803	4
4	A4 - Indian Express / Minsk Square	0.48	0.01342359	0.49342359	4
5	A5 - Marthalli Junction	0.63	0.05792516	0.68792516	4
6	A6 -Domlur SAARC Park	0.41	0.04283636	0.45283636	4
7	A7 - Life Style Juncton on Richmond Road	0.54	0.0887033	0.6287033	4
8	A8 - St.John's Medical College & Hospital (junction)	0.29	0.01669832	0.30669832	4
9	A9 - Minerva Circle	0.35	0.05700822	0.40700822	4
10	A10 - Deepanjalinagar ,Mysore Road	0.36	0.00626299	0.36626299	4

4.6 Noise Environment

Noise levels were monitored continuously for 24 hours at ten (10) locations within the study zone, using a spot noise measurement device. Noise level measurement locations were identified for assessment of existing noise level status, keeping in view the noise sensitive receptors, land use pattern, residential areas, etc.

Table 4-23: Noise Monitoring Location in the study area

Station	Location	Distance from the site, m	Direction from the site
N-1	Mekhri Circle	3.0	South West
N-2	Wheeler Road Junction	10.0	North & South
N-3	ITI Campus Junction along NH4	5.0	North
N-4	Indian Express	3.0	North West
N-6	Lifestyle Junction, Richmond Road	5.0	North
N-7	Domlur SAARC Park	5.0	South
N-8	Marathhalli Junction	5.0	South
N-9	St John Medical College & Hospital	3.0	East
N-10	Minerva Circle (Bangalore Medical College)	2.0	West

The results of the ambient noise level monitoring along with CPCB noise limits for day time and night time are presented in Error! Reference source not found..

Table 4-24: Noise Levels monitored at Mekhri Circle (N1)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N1	Mekhri Circle. GPS: 13^{0}00’52.9”N, 77^{0}35’01.25”E	6:01am to 10:00pm	88.5	52.3	69.65	65 dB(A) Day
		10:01pm to 6:00am	72.2	50.1	61.14	55 dB(A) Night

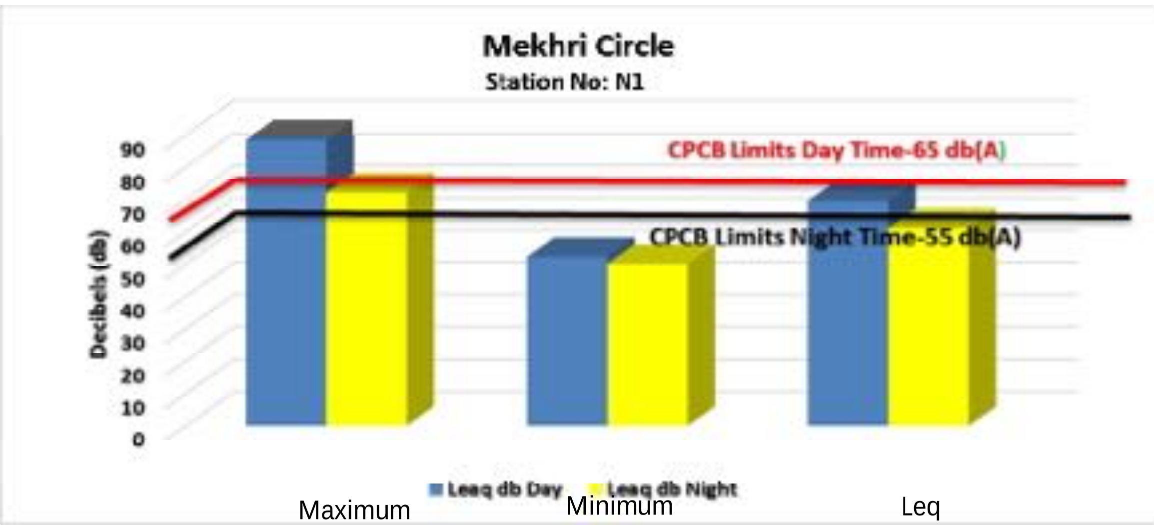


Table 4-25: Noise Levels monitored at Wheeler Road Junction (N2)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N2	Wheeler Road Junction (Opp to HQ MEG Centre) GPS: 12⁰59'28.2"N, 77⁰36'51.6"E	6:01am to 10:00pm	93.1	48.3	71.41	65 dB(A) Day
		10:01pm to 6:00am	71.0	35.1	59.38	55 dB(A) Night

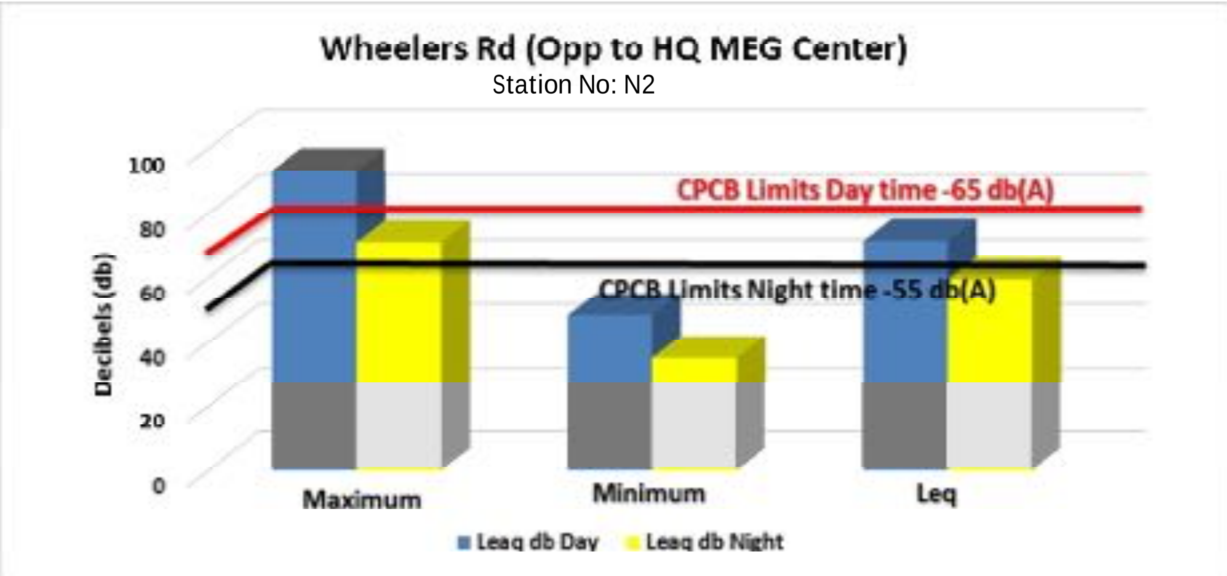


Table 4-26: Noise Levels monitored at ITI Campus Junction (N3)

Station No.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N3	ITI Campus Junction along NH-4. GPS:13⁰00'29.44"N, 77⁰41'38.12"E	6:01am to 10:00pm	81.3	55.1	64.29	65 dB(A) Day
		10:01pm to 6:00am	86.4	43.5	62.98	55 dB(A) Night

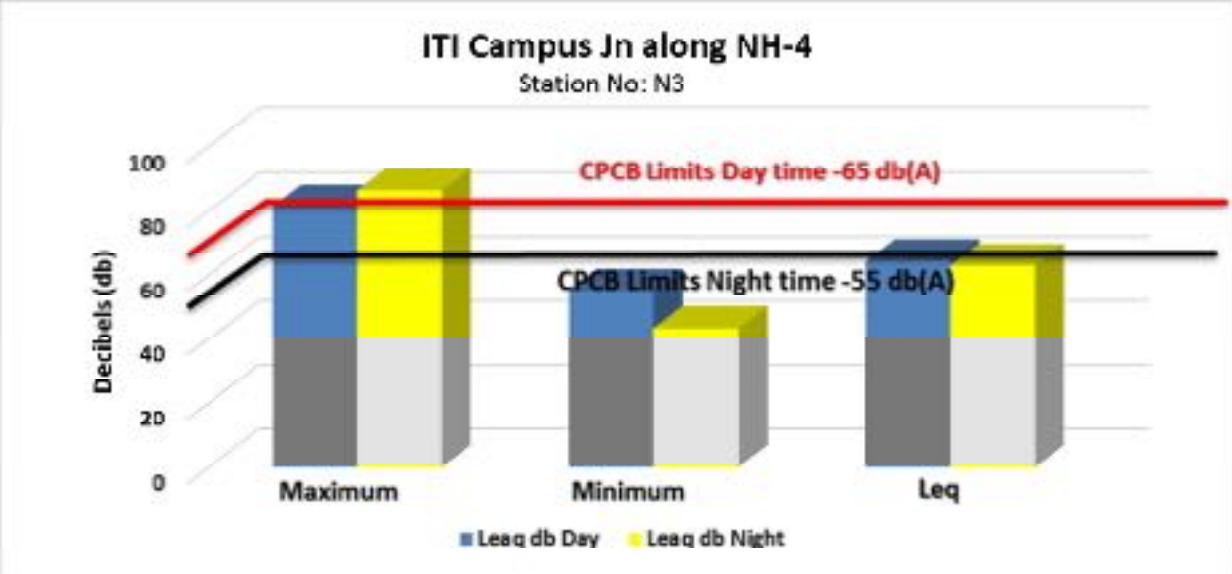


Table 4-27: Noise Levels monitored at Indian Express Circle (N4)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N4	Indian Express Circle GPS: 12°58'31.02" N, 77°36'6.12" E	6:01am to 10:00pm	84.7	50.5	69.54	65 dB(A) Day
		10:01pm to 6:00am	79.3	41.4	58.22	55 dB(A) Night

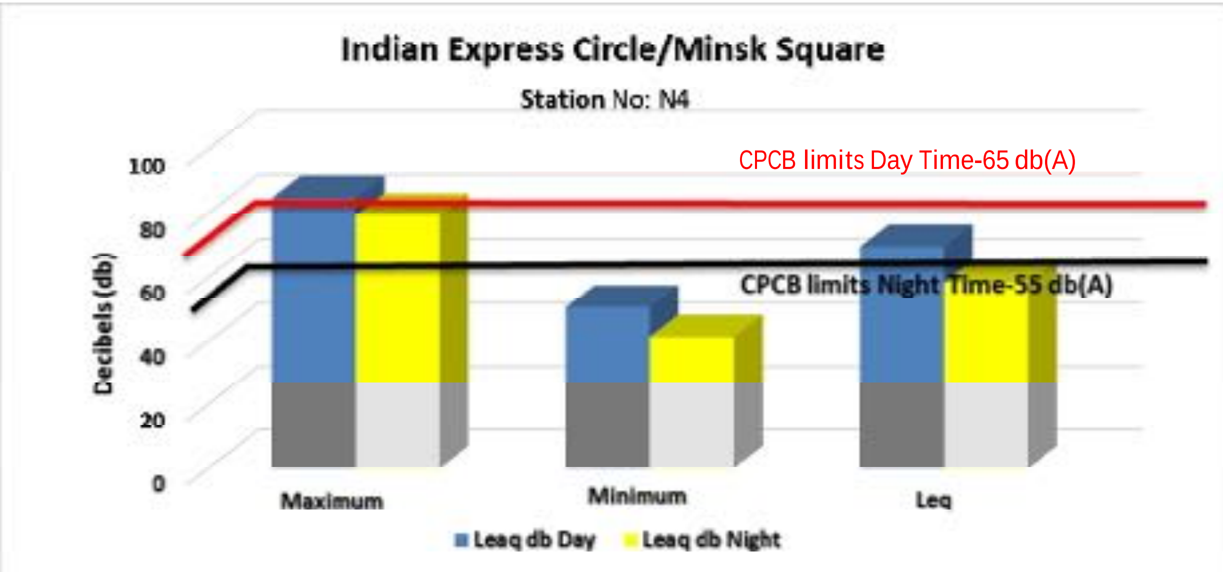


Table 4-28: Noise Levels monitored at Lifestyle Junction (N5)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N5	Lifestyle Junction on Richmond Road. GPS: 12⁰58'00.26" N, 77⁰36'38.23"E	6:01am to 10:00pm	83.1	48.6	67.85	65 dB(A) Day
		10:01pm to 6:00am	80.3	46.9	57.96	55 dB(A) Night

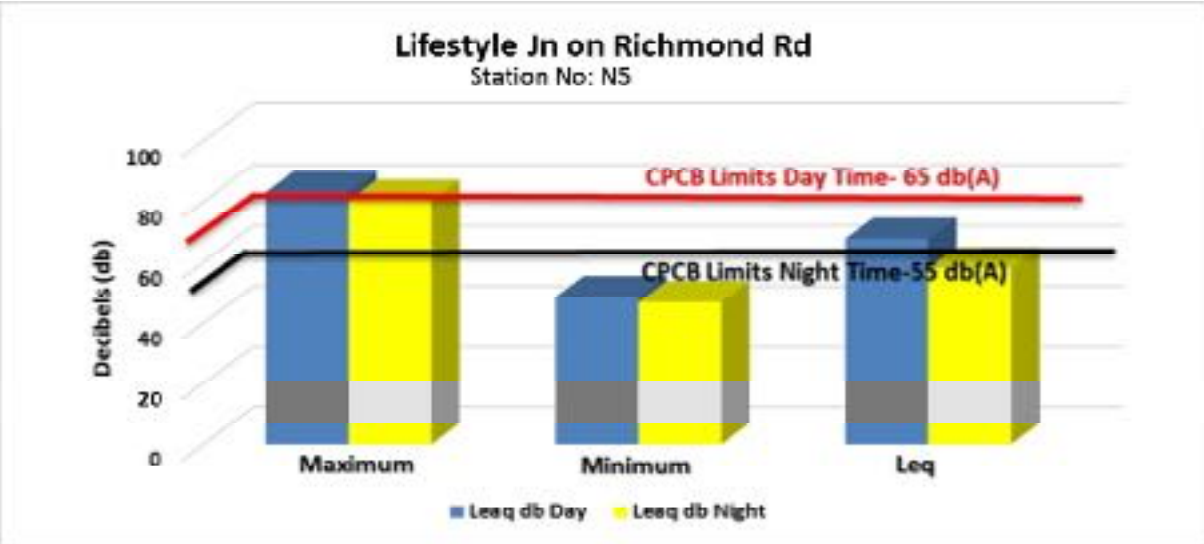


Table 4-29: Noise Levels monitored at Domlur SAARC Park (N6)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N6	Domlur SAARC Park. GPS: 12⁰57'37.89" N, 77⁰38'25.75"E	6:01am to 10:00pm	90.5	51.5	65.06	65 dB(A) Day
		10:01pm to 6:00am	70.5	54.9	61.54	55 dB(A) Night

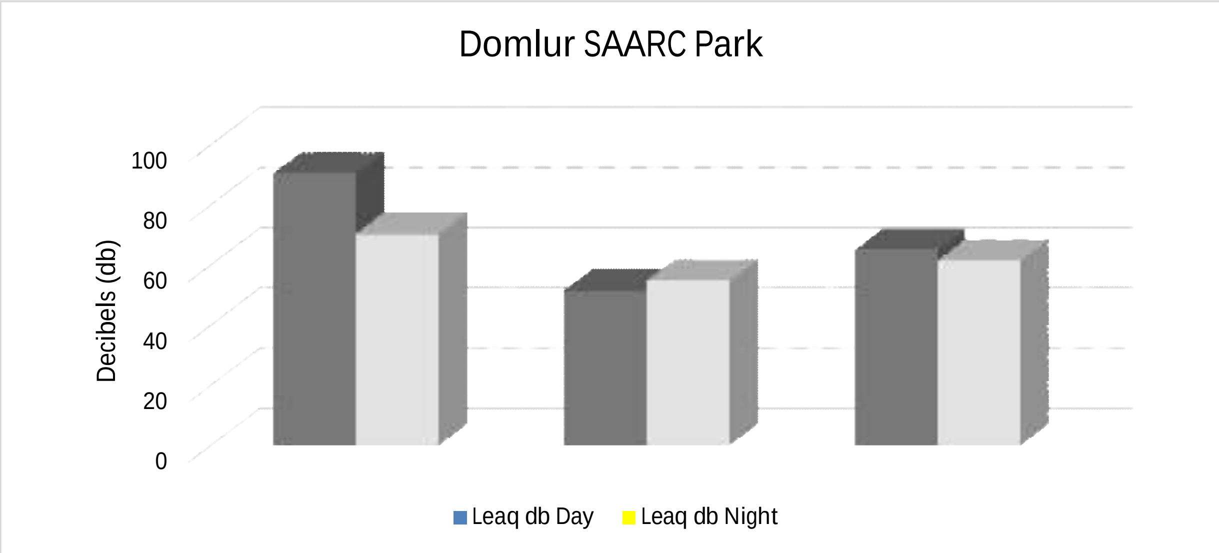


Table 4-30: Noise Levels monitored at Marathhalli Junction (N7)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N7	Marathhalli Junction. GPS: 12°57'24.05" N, 77°41'50.57"E	6:01am to 10:00pm	94.4	50.9	74.10	65 dB(A) Day
		10:01pm to 6:00am	86.7	62.6	72.24	55 dB(A) Night

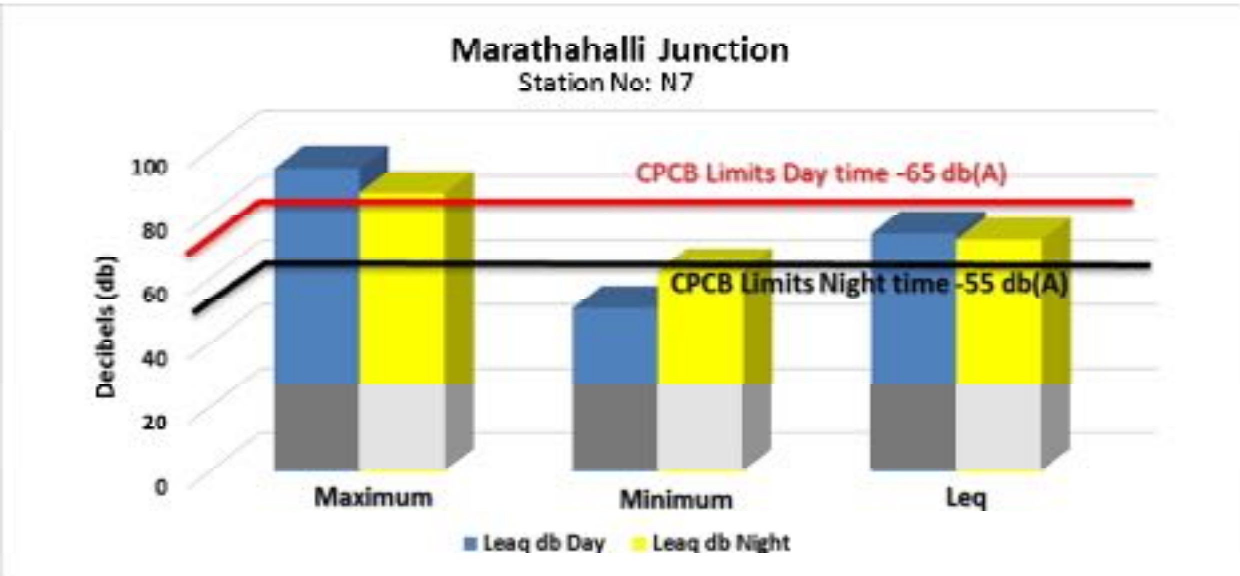


Table 4-31: Noise Levels monitored at St John's Medical College (N8)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N8	St.John's Medical College & Hospital Junction. GPS: 12°55'48.69"N, 77°36'52.40"E	6:01am to 10:00pm	98.9	57.8	75.77	65 dB(A) Day
		10:01pm to 6:00am	81.1	50.0	74.30	55 dB(A) Night

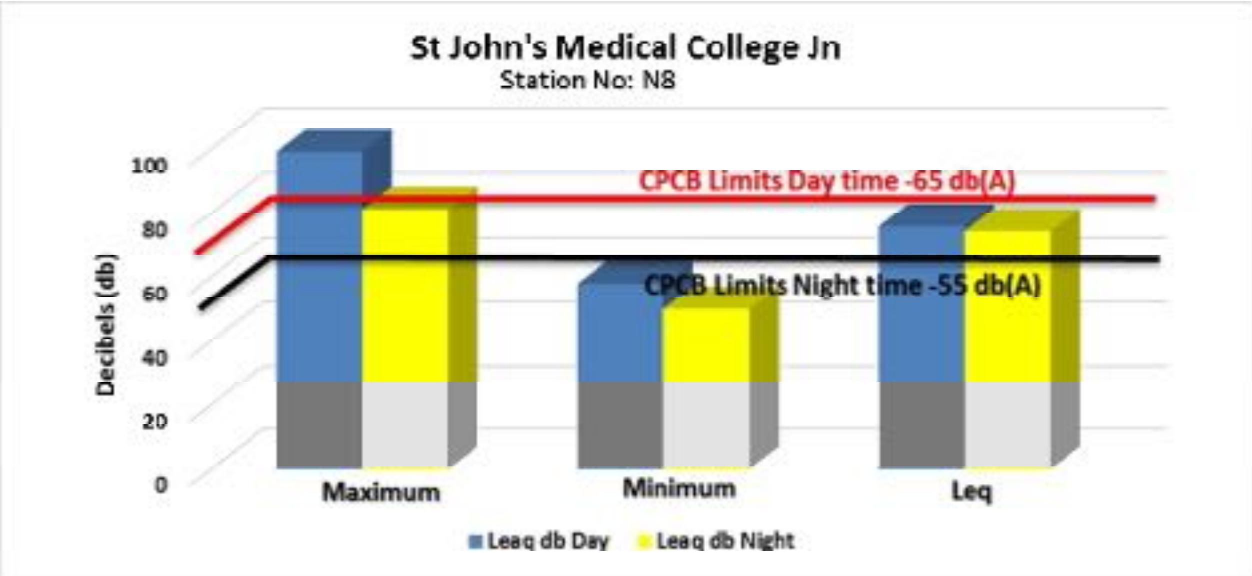


Table 4-32: Noise Levels monitored at Minerva Circle (N9)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N9	Minerva Circle. GPS: 12°57'32.02"N, 77°34'58.15"E	6:01am to 10:00pm	92.0	58.8	72.48	65 dB(A) Day
		10:01pm to 6:00am	84.2	47.5	69.06	55 dB(A) Night

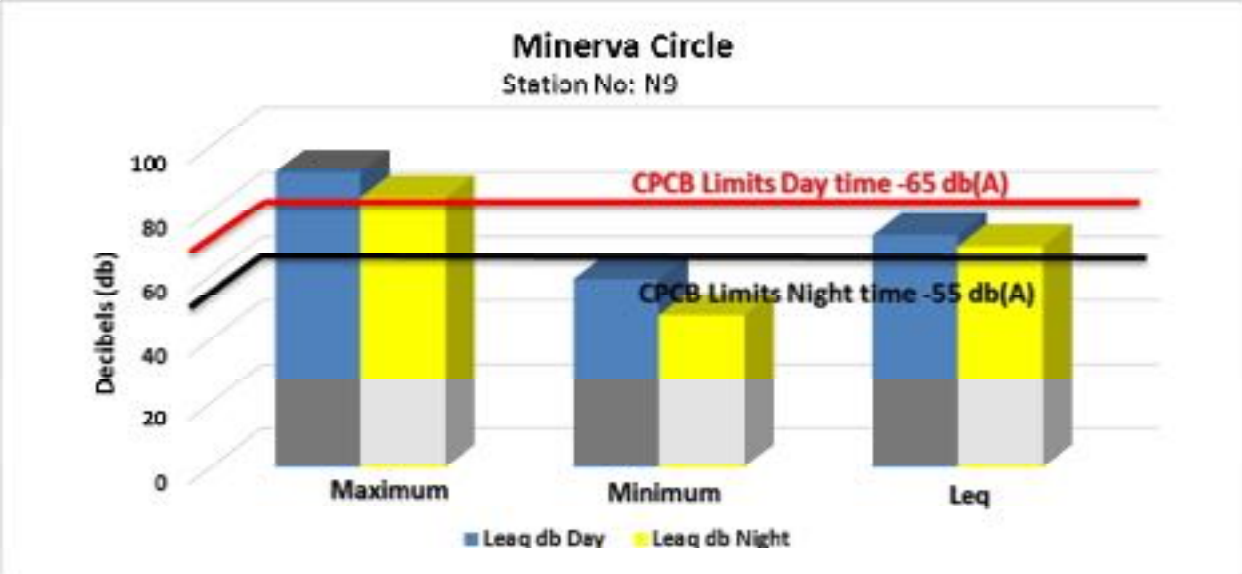


Table 4-33: Noise Levels monitored at Deepanjali Nagar (N10)

Station Id.	Sample Location	Time Frequency	Parameters in dB(A)			CPCB Standards for Commercial Zone
			Max.	Min.	Leq	
N10	Deepanjalinagar, Mysore Road. GPS: 12°57'12.26"N, 77°32'31.74"E	6:01am to 10:00pm	89.6	42.9	75.34	65 dB(A) Day
		10:01pm to 6:00am	73.6	32.1	46.23	55 dB(A) Night

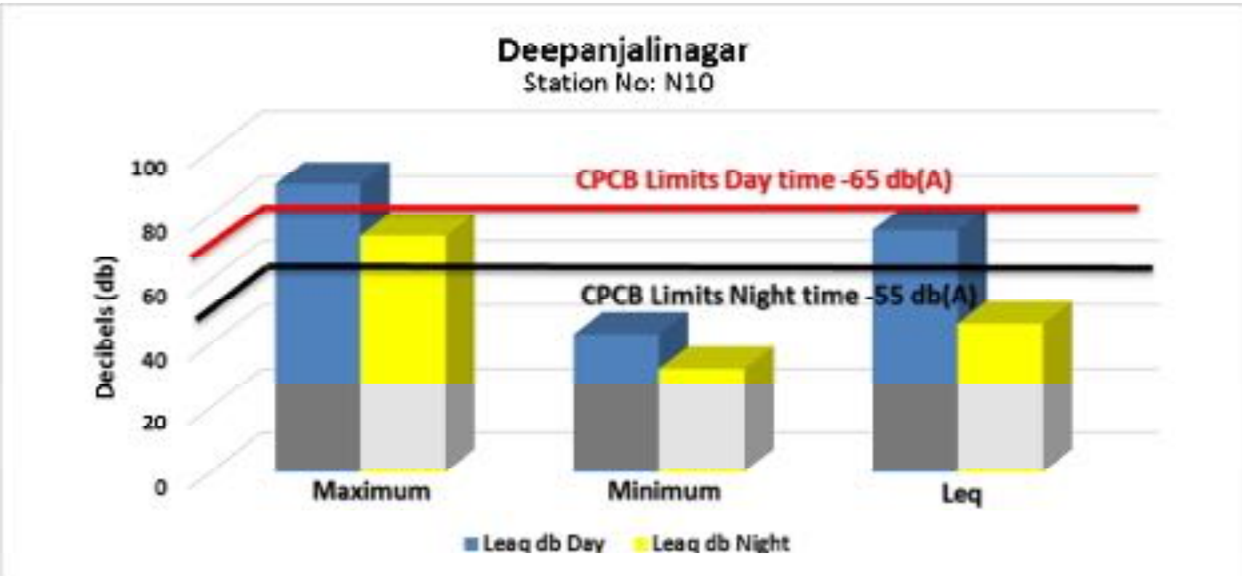


Figure 4-12: Photographs of Noise Levels Monitoring

A1 - Mekhri Circle

A2 - Wheelers Road Junction

A3 - ITI Campus Junction along NH4

A4 - Indian Express Circle / Minsk Square

A5 - Lifestyle Junction on Richmond Road

A6 - Domlur SAARC Park

A7 – Marathahalli Junction

A8 - St. John's Medical College & Hospital

A9 - Minerva Circle

A10 - Deepanjalinagar, Mysore Road

4.6.1 Inference on the monitored Noise levels

Noise levels were monitored at ten different locations along the project alignment. The noise levels at Mekhri Circle (N1) is 69.65 Leq, Wheeler Road (N2) is 71.41 Leq, Indian express (N4) is 69.54 Leq, Lifestyle Junction on Richmond road(N5) is 67.85 Leq, Marathahalli Junction (N7)is 74.1 Leq, St Johns medical college (N8) is 75.77 Leq, Minerva Circle (N9) is 72.48 Leq, Deepanjalinagar (N10) is 75.34 Leq are higher than the CPCB prescribed norms of 65 dB(A) during day. Noise levels at Mekhri Circle (N1) is 61.14 Leq, Wheeler Road (N2) is 59.38 Leq, ITI Campus (N3) is 62.98 Leq, Indian express (N4) is 58.22 Leq, Lifestyle Junction on Richmond road(N5) is 57.96 Leq, Domlur SAARC park (N6) is 61.54 Leq, Marathahalli Junction (N7)is 72.24 Leq, St Johns medical college (N8) is 74.3 Leq, Minerva Circle (N9) is 69.06 Leq have recorded noise levels higher than the CPCB prescribed limits of 55.8 dB (A) for night time. The details of maximum, minimum and Leq noise levels at all the ten noise monitoring stations are given in table along with respective graphical representations above.

4.7 Water Environment

No major rivers run through the city, though the Arkavathi and South Pennar cross paths at the Nandi Hills, 60 km to the north. River Vrishabhavathi, a minor tributary of the Arkavathi, arises within the city at Basavanagudi and flows through the city. The rivers Arkavathi and Vrishabhavathi together carry much of Bengaluru's sewage. There are two major river basins in the district namely Cauvery and South Pennar. Shimsha and Kanva River of the Cauvery basin is draining majority of the district and Anekal taluk is drained by South Pennar river of Ponnaiyar basin, which takes its birth from Nandi hills and flows towards south.

The city has a few freshwater lakes and water tanks such as Madivala tank, Hebbal tank, Ulsoor lake, Bellandur lake, Varthur lake and Sankey Tank. Groundwater occurs in silty to sandy layers of alluvial sediments and jointed quartzite.

Government after realizing the importance of waterbodies and the need for preservation and restoration of lakes transferred these lakes from Minor Irrigation Department to the Forest Department. The detail on lakes as per the Lake development working circle is given in Table 4-34 below.

Table 4-34: Abstract of tanks under Bengaluru Urban (Forest) Division

Sl. No.	Name of the Range / Unit	Number of Tanks	Extent In Ha
1	Bengaluru town unit	17	306.96
2	Banashankari unit	17	170.45
3	Rajajinagar unit	16	117.77
4	Tree unit	7	51.78
5	Kaggali pura range	7	54.97
6	K.R.Puram town unit	25	470.69
7	Ulsoor Unit	31	343.17
8	Yelahanka Range	6	60.30
	Total	126	1576.09

Table 4-35: Details of alignment passing near water bodies, lakes, rajakaluve, etc.

Sl. No.	Phase No.	Water bodies / Lakes	Name of the Corridor	LHS / RHS	Distance of pier foundation from Water body (m)	Location
1	Phase I Package - I	Hebbal Lake	NS	RHS	5	Near Hebbal Flyover
2	Phase II Package - I	KR Puram Lake,	EW-1	RHS	20	Along NH 4
3	Phase II Package - I	Benniganahalli Lake	EW-1	RHS	350	Swamy Vivekananda Road
4	Phase II Package - I	Pond near Sarvagna Nagar	EW-1	RHS	20	Swamy Vivekananda Road
5	Phase II Package - II	Ulsoor Lake	EW-1	LHS	5	Kensington Road

6	Phase V Package - I	Varthur Lake	EW-2	LHS/ RHS	5	HAL Airport road and along SH 35 respectively
7	Phase V Package - I	Thubarahalli Lake	EW-2	RHS	120	Varthur road / HAL Airport road
8	Phase IV Package - I	Vrishabhavathi Nalla	EW-2	LHS / RHS	5	Mysore road
9	Phase I Package - III	Agara Lake	CC-1	LHS	30	Sarjapur main road
10	Phase II Package - II	Challkere	CC-3	RHS	30	100 ft. Ring road
11	Phase - II	Rajakaluve	CC-3		1	At Banasawadi
12	Phae I Package - II	Rajakaluve	NS		1	At Shathinagar Bus Depot

NGT's new no-development buffer zone order was issued on May 4, 2016. The NGT judgment, delivered on May 7, 2016 increased the buffer zone or no-construction zone around lakes and wetlands from 30 metres to 75 metres in the city. Para 3 of General Directions of NGT order stated that the distances in respect of buffer zone specified in the judgment shall be made applicable to all projects, and the authorities concerned are directed to incorporate such conditions in the projects to whom Environmental Clearance and other permissions are now granted not only around Bellandur lake, rajakaluves, Agara lake, but also all other lakes/wetlands in Bengaluru.

Examining the proposed elevated corridor project in the background of NGT Order, As mentioned in Table 4-35, it was found that some stretches of the proposed alignment passes within the prescribed buffer zones of some of the lakes. It is inevitable to take the alignment of proposed elevated corridor only on the existing major roads which have comparatively wider right of way (RoW) and are apparently located adjacent to the water bodies. The possible alternatives are limited as otherwise there will be severe impact on the buildings and structures.

Figure 4-13: Drainage map of Bengaluru Urban district

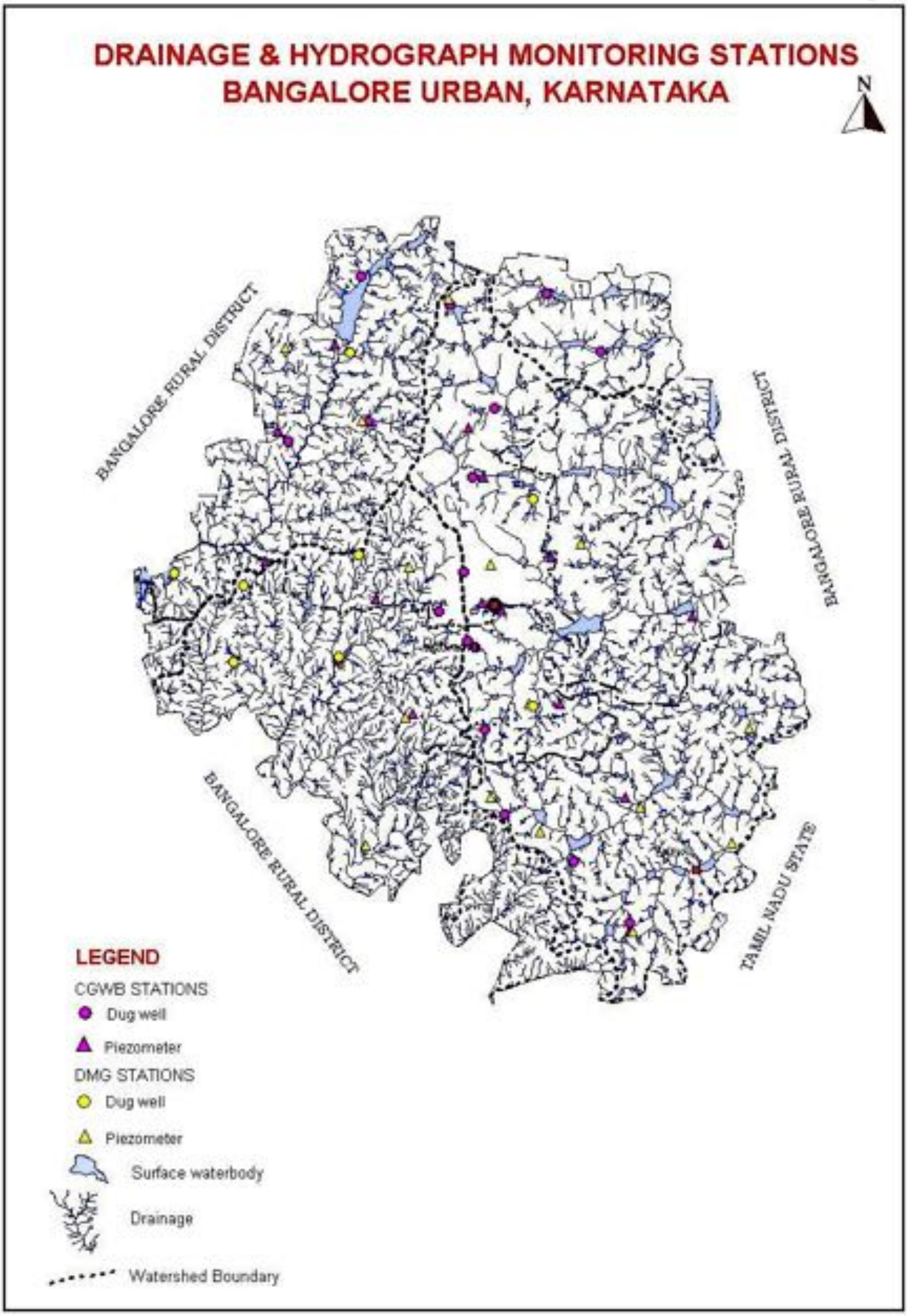
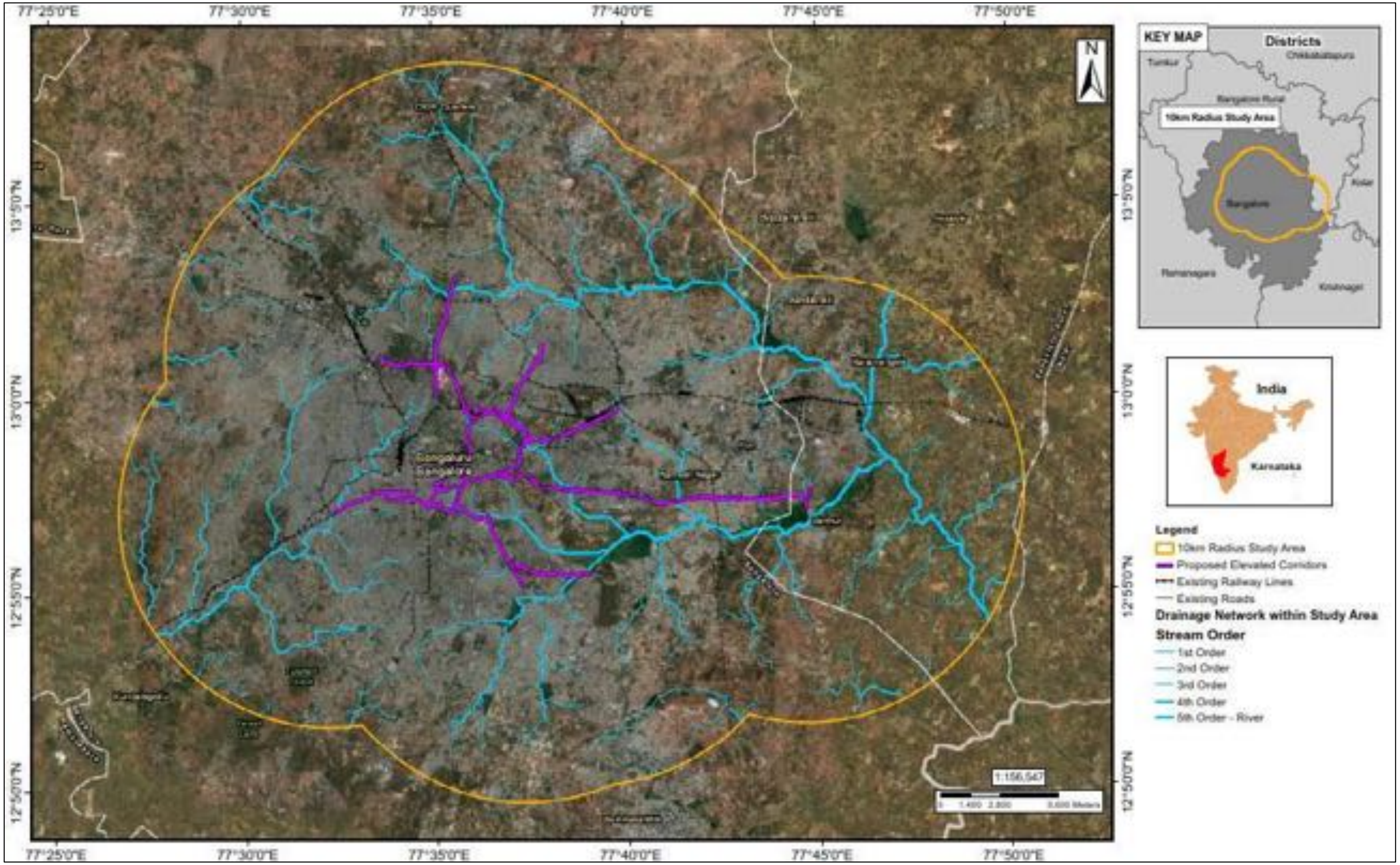


Figure 4-14: Drainage map for 10 km radius Study area



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4.7.1 Water Environment

Seven surface water samples and three ground water samples were collected from the study area for analysis of water quality in the area (Table 4-36). Samples from Ponds and lakes were collected for surface water analysis while borewell water samples were collected to analyse the groundwater quality.

Table 4-36: Locations of Ground Water and Surface Water in Study Area

Sample Code	Name of the Location
SW-1	Hebbal Lake
SW-2	Ulsoor Lake
SW-3	Benneganahalli Lake
SW-4	KR Puram Lake
SW-5	Varthur Lake
SW-6	Agara Lake
SW-7	Vrishabhavathi Stream / River
GW-1	Bore Well along HAL Airport road
GW-2	Bore Well near GG Palya along Tumkur road
GW-3	Bore Well along Dodda Banaswadi Main Road

The surface water samples were analyzed for parameters as specified in IS: 10500 (2012) standards, “Drinking Water- Specifications” and analyzed as per methods specified in IS: 3025.

Table 4-37: Results of Surface Water Analysis

Sl. No	Parameters	Std. IS 10500:2012 (Second Revision)		Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7
		AL	PL								
1.	pH	6.5-8.5		-	8.64	7.91	8.87	7.66	7.91	8.66	7.73
2.	Colour	5	15	Hazen	<1	<1	<1	<1	<1	<1	<1
3.	Odour	Agreeable		--	Agreeable	Agreeable	Agreeable	Disagreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity	1	5	NTU	8.04	25.4	3.35	35.1	19.7	3.38	2.15
5.	Total Dissolved Solids	500	2000	mg/L	1260	1140	810	904	525.0	342.0	780.0
6.	Dissolved Oxygen	Not Specified		mg/L	4.8	4.9	4.0	4.2	4.4	Nil	4.3
7.	Total Hardness as $CaCO_3$	200	600	mg/L	312	280	168.0	244	96.0	100	188
8.	Alkalinity as $CaCO_3$	200	600	mg/L	484	512	140	432	88.0	124	224
9.	Nitrate as NO_3	45		mg/L	9.86	19.05	6.48	32.74	9.03	4.48	18.28
10.	Phosphate as PO_4	Not Specified		mg/L	26.37	4.25	0.45	24.24	BDL	0.12	BDL
11.	Chloride as Cl	250	1000	mg/L	218.37	182.63	115.14	127.05	156.83	63.52	160.80
12.	Sulphate as SO_4	200	400	mg/L	59.04	26.72	78.79	46.02	51.04	7.99	47.73
13.	Sodium as Na	Not Specified		mg/L	246	156	98	144	104	39.66	107.77
14.	Potassium as K	Not Specified		mg/L	24.76	22.17	14.20	20.38	13.70	12.96	17.91
15.	Calcium as Ca	75	200	mg/L	65.6	92.8	38.4	57.6	24.0	20.8	44.8
16.	Magnesium as Mg	30	100	mg/L	35.96	11.66	17.49	24.3	8.74	11.66	18.46
17.	Fluoride as F	1	1.5	mg/L	0.28	0.22	0.70	0.34	0.94	0.17	0.93
18.	Iron as Fe	0.3		mg/L	0.10	0.36	0.26	0.65	0.48	0.21	0.28
19.	Manganese as Mn	0.1	0.3	mg/L	0.110	0.113	0.067	0.134	0.022	0.040	0.261
20.	Copper as Cu	0.05	1.5	mg/L	0.003	0.005	0.004	0.041	BDL	BDL	0.004
21.	Zinc as Zn	5	15	mg/L	0.005	0.014	0.009	0.189	0.007	0.005	0.007
22.	Mercury as Hg	0.001		mg/L	BDL	BDL	BDL	0.020	BDL	BDL	BDL
23.	Total Chromium as Cr	0.05		mg/L	BDL	BDL	BDL	0.020	BDL	BDL	BDL
24.	E-coli	Not Specified		MPN Index/10	920	2100	240	110 x 10^4	170	1700	920

Sl. No	Parameters	Std. IS 10500:2012 (Second Revision)		Unit	SW1	SW2	SW3	SW4	SW5	SW6	SW7
		AL	PL								
				0ml							

Table 4-38: Results of Ground Water Analysis

Sl. No.	Parameters	Std. IS 10500:2012 (Second Revision		Unit	GW1	GW2	GW3
1.	pH	AL	PL	-	8.04	6.68	6.70
2.	Colour	6.5-8.5		Hazen	<1	<1	<1
3.	Odour	5	15	--	Agreeable	Agreeable	Agreeable
4.	Turbidity	Agreeable		NTU	0.15	0.38	0.40
5.	Total Dissolved Solids	1	5	mg/L	790	1025	1030
6.	Dissolved Oxygen	500	2000	mg/L	5.1	4.9	5.0
7.	Total Hardness as $CaCO_3$	Not Specified		mg/L	192	468	348
8.	Alkalinity as $CaCO_3$	200	600	mg/L	352	228	296
9.	Nitrate as NO_3	200	600	mg/L	35.15	35.40	25.95
10.	Phosphate as PO_4	45		mg/L	0.70	BDL	BDL
11.	Chloride as Cl	Not Specified		mg/L	101.24	180.65	166.75
12.	Sulphate as SO_4	250	1000	mg/L	31.29	106.09	79.25
13.	Sodium as Na	200	400	mg/L	120	39.62	107.59
14.	Potassium as K	Not Specified		mg/L	0.99	8.26	4.74
15.	Calcium as Ca	Not Specified		mg/L	36.8	108.8	92.8
16.	Magnesium as Mg	75	200	mg/L	24.3	47.62	28.18
17.	Fluoride as F	30	100	mg/L	0.92	0.70	0.62
18.	Iron as Fe	1	1.5	mg/L	BDL	BDL	BDL
19.	Manganese as Mn	0.3		mg/L	0.008	BDL	0.137
20.	Copper as Cu	0.1	0.3	mg/L	0.003	0.003	BDL
21.	Zinc as Zn	0.05	1.5	mg/L	0.026	0.019	0.874
22.	Mercury as Hg	5	15	mg/L	BDL	BDL	BDL
23.	Total Chromium as Cr	0.001		mg/L	BDL	0.003	BDL
24.	E-coli	0.05		MPN Index/100ml	<1.8	<1.8	<1.8
AL – Acceptable Limit, PL – Permissible Limit, BDL: Below Detectable Limit							

Table 4-39: Water Quality Standards by CPCB for Best Designated Usage

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less
		pH between 6.5 and 8.5
		Dissolved Oxygen 6mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organized)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 3mg/l or less

Designated-Best-Use	Class of water	Criteria
disinfection		
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more
		Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5
		Electrical Conductivity at 25°C micro mhos/cm Max.2250
		Sodium absorption Ratio Max. 26
		Boron Max. 2mg/l
-	Below-E	Not Meeting A, B, C, D & E Criteria

Figure 4-15: Photographs of Water Sampling

SW1 – KR Puram Lake

SW2 – Varthur Lake

SW3 – Agara Lake

SW5 - Ulsoor Lake

SW6-Vrishabhvati River

GW1 - Borewell along HAL Airport road

GW2- Borewell near GG Palya along Tumkur road

GW3 - Bore well along Dodda Banaswadi

4.7.2 Inference on the water quality analysis

The inferences of the analysis of water samples are as follows:

SW-1 - KR Puram Lake:

The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev), except pH & Turbidity.

SW-2 - Varthur Lake:

The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev), except Turbidity & Iron.

SW-3 - Agara Lake:

The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev), except pH.

SW-4 - Vrisabhavati River:

The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev), except Odour, Turbidity & Iron.

SW-5 - Hebbal Lake:

The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev), except Turbidity & Iron.

SW-6 - Ulsoor Lake:
The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev), except pH.

SW-7 - Bennganahalli Lake:
The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev).

GW-1 - Bore hole along HAL Road:
The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev).

GW-2 - Near GG Palya Tumkur Road:
The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev).

GW-3 - Borehole along Doddabanasawadi Main Road:
The measured values for the above parameters for those standards have been specified, were observed to be within the prescribed IS 10500 Standard of 2012 (2 Rev).

4.8 Land Environment

Bengaluru (Urban) district consists of Charnokites and peninsular gneisses complex. The peninsular gneiss is the dominant group of rocks and covers two-thirds of the area and includes granites, gneisses and migmatites. Small patches of porphyritic granite are also seen in Bengaluru South and Bengaluru North taluks.

Bengaluru falls under the expanse of Peninsular Gneissic Complex. The main rock type in the district is gneissic rock and intrusions of granites and migmatites. Bangalore district lies over a hard and moderately dense gneissic basement which dates back to Archean era (2500-3500 million years). They recorded the principal rock formations namely upper Vindhyan super group, Deccan traps and Inter-trappean beds, alluvium and laterite. These rock types represent different time segments within Archean era.

The analysis of the soil type reveals that the study area is predominantly covered by red loamy and sandy soils, laterite soil. Red loamy and sandy soils generally occur on hilly to undulating land slope on granite and gneissic terrain. The soils are light textured and are highly leached in nature with good infiltration rate. 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 covered in Anekal taluk and western parts of Bangalore North and South taluks.

Table 4-40: Details of Soil Sampling Locations

Location Code	Soil Sampling Locations
S-1	Lalbagh Park
S-2	Cubban Park
S-3	ITI Campus, NH4
S-4	Kendriya Vidyalaya near Mekhri Circle
S-5	SAARC Park, Domlur
S-6	St John Medical College Grounds, Sarjapur Main Road
S-7	MV Garden, Ulsoor
S-8	Park near Banasawadi Fire Station
S-9	Coles Park
S-10	HAL Airport Road

Table 4-41: Results of Soil Quality Analysis

Sl. No	Parameters	Unit	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1.	pH	-	6.90	7.06	7.12	6.85	7.02	7.10	7.26	6.61	7.04	7.40
2.	Electrical Conductivity	µs/cm	103.1	109.9	126.9	171.5	118.3	161.7	147.8	108.7	1080	286
3.	Organic Carbon	Percent	0.35	0.29	0.23	0.29	0.35	0.17	0.23	0.29	0.17	0.11
4.	Sand	Percent	62.96	58.96	54.96	60.96	66.96	60.96	64.96	56.96	62.96	70.96
5.	Silt	Percent	27.28	29.28	31.28	31.28	21.28	25.28	23.28	29.28	27.28	21.28
6.	Clay	Percent	9.76	11.76	13.76	7.76	11.76	13.76	11.76	13.76	9.76	7.76
7.	Porosity	Percent	41.43	28.5	44.58	25.25	53.46	36.53	45.41	41.55	39.41	56.6
8.	Texture	-	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam
9.	Available Nitrogen as N	kg/ha	235.79	215.25	150.99	223.91	174.48	141.59	234.82	174.42	199.44	122.93
10	Available Potassium as K	kg/ha	441.16	220.52	100.55	585.76	202.38	201.48	205.52	326.36	306.09	192.86
11	Available Phosphorus as P_2O_5	kg/ha	184.87	100.59	135.93	386.05	116.90	367.02	342.2	133.21	187.58	122.34
12	Calcium as Ca	meq/L	7.2	5.0	6.4	5.9	6.6	2.5	7.0	5.1	4.2	5.5
13	Magnesium as Mg	meq/L	0.9	2.7	1.6	1.9	2.3	1.1	1.1	0.9	1.3	0.7
14	Sodium as Na	mg/100gm	4.50	1.96	3.07	3.91	1.40	5.73	3.70	2.34	25.21	3.78
15	Boron as B	mg/100gm	18.43	17.25	13.16	19.52	5.99	24.51	BDL	3.13	8.12	BDL
16	Iron as Fe	mg/kg	7147.1	4508.5	4629.2	6035.1	4265.8	4462.3	5053.0	5301.9	5453.1	2930.2
17	Zinc as Zn	mg/kg	16.2	9.6	16.6	10.9	30.8	4.5	20.0	13.2	13.5	6.7
18	Molybdenum as Mo	mg/kg	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
19	Copper as Cu	mg/kg	9.1	3.7	7.3	7.3	10.2	3.1	7.8	5.0	5.0	4.5
20	Aluminium as Al	mg/kg	3106.9	2449.8	2330.0	3479.6	1992.3	1431.2	2148.0	2630.3	2587.8	1735.0

BDL: Below Detectable Limit.

Figure 4-16: Photographs of Soil Sampling

	
S1 - Near Lalbagh Park	S2 - Near Cubban Park
	
S3 - Near ITI Campus, NH4	S4 - Coles Park
	
S5 - Kendriya Vidyalaya Near Mekhri Circle	SAARC Park, Domlur
	

S7 - Makkala Koota Park (Near KIMS)	S8 - St john Medical College Grounds
	
S9 - MV Garden, Ulsoor	S10 - Park Near Banasawadi Fire Station

4.9 Hydrogeology

Granites and Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Laterites of Tertiary age occur as isolated patches capping crystalline rocks in Bangalore north taluk and ground water occur in phreatic condition. Alluvium of limited thickness of 20 to 25m and aerial extent occur along the valley portions, possess substantial ground water potential. 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 (Figure 1-9).

Studies have been done on the ground water quality for Bengaluru Urban district by Central Ground Water Board based on hydro-chemical data of network hydrograph stations wells and exploration bore wells. Results show wide variations in its chemical composition. The shallow and deep groundwater is alkaline with pH value ranging from 7.8 to 8.5. Total hardness varies from 100 to 600 ppm. Fluoride content in general is less than 1 ppm. Major part of the district is having fresh water with EC ranging from 250 to 2000 micro mhos/cm at 25° C.

In urban area of Bengaluru district, main problems affecting ground water are sewage pollution and industrial pollution; high Nitrate concentration in ground water and over exploitation of ground water resources[2]. This is further attributed to factors like urbanization in the last two decades paving way for commercial buildings, layouts and industries. The green cover, tanks and lakes have also diminished leading to depletion of water levels. Rapid urbanization, IT boom, related economic activities, trade and commerce have exerted pressure and this has increased the sewage waste into the lakes. Improper

[2] Central Ground Water Board Ground Water Information Booklet, Bangalore Urban District, 2012.

environmental planning has given room for establishment of new residential layouts without proper sewerage network and even if such systems have been provided, they are mostly not functional or connected to trunk sewers of BWSSB. The municipal effluents from natural drains leading to tanks and lakes deteriorate the quality of the water. Sedimentation of pollutants has not only reduced the surface area of the water, but has also reduced ground water levels on account of poor permeability with more and more silt, clay deposits, trash and toxic waste accumulation in the lakes year after year.

Sewage pollution as observed in the western part of Bengaluru city where all the sewage is let into Vrishabhavathi River valley and most of the tanks are also polluted from sewage source due to unplanned urbanization. As per CGWB studies, most of the open wells/bore wells situated in the vicinity of Vrishabhavathi River is polluted due to sewerage discharging into the river. Study of CGWB shows that, in Industrial belt of Peenya, Rajajinagar and Hosakote area, Ground water is slightly alkaline and indicated high concentrations of chloride and magnesium in ground water and high nitrate in all the industrial belts of Peenya, Hosakote, Rajajinagar and Kanakapura road. However water is free from bicarbonates.

Rapid and unplanned urbanization has taken its toll on ground water resource of the district, with increased exploitation by bore wells dug up in all possible terrains. The only solution is building up of ground water resource through artificial recharge and rainwater harvesting.

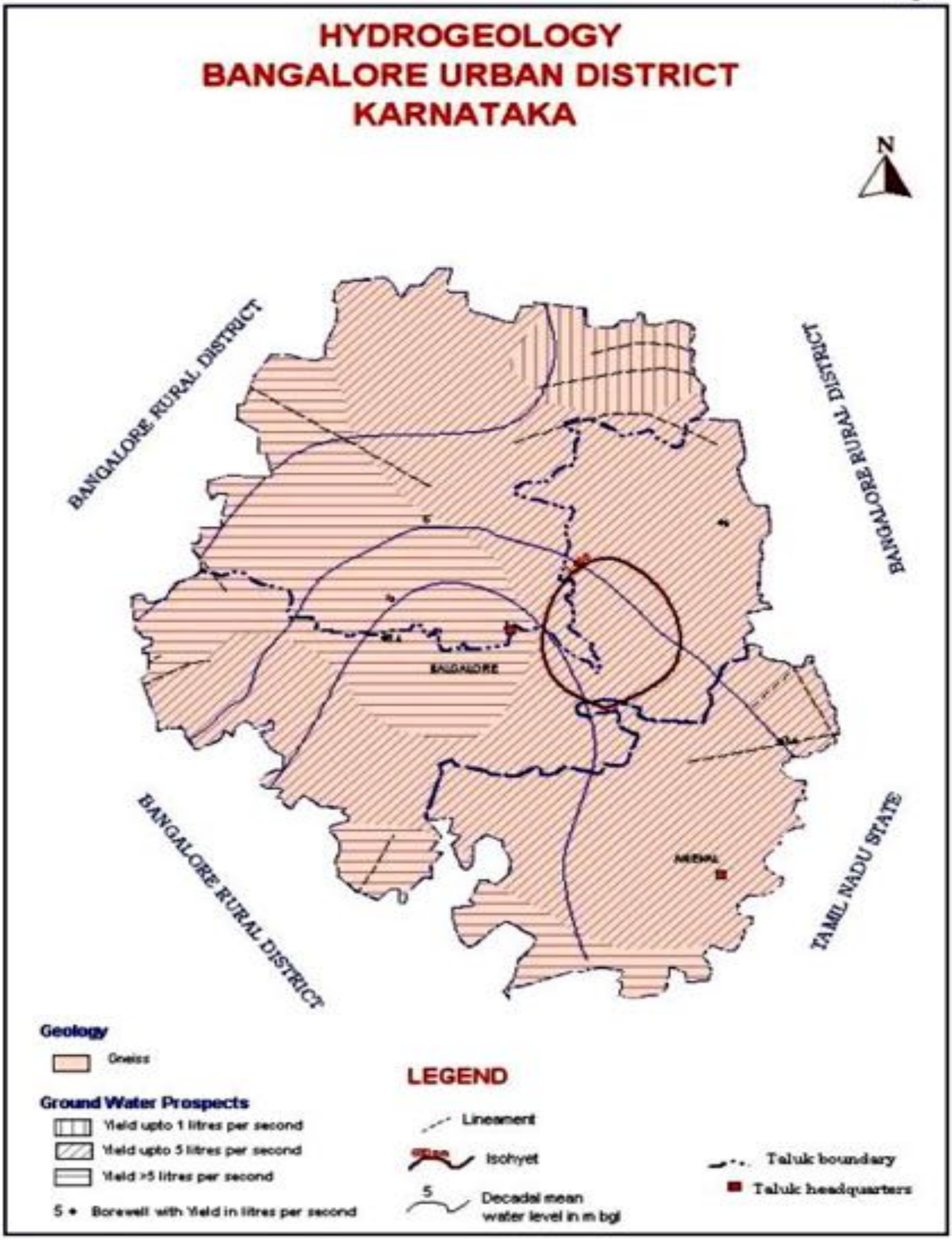


Figure 4-17: Hydrogeology of Bengaluru Urban district

4.10 Land use pattern

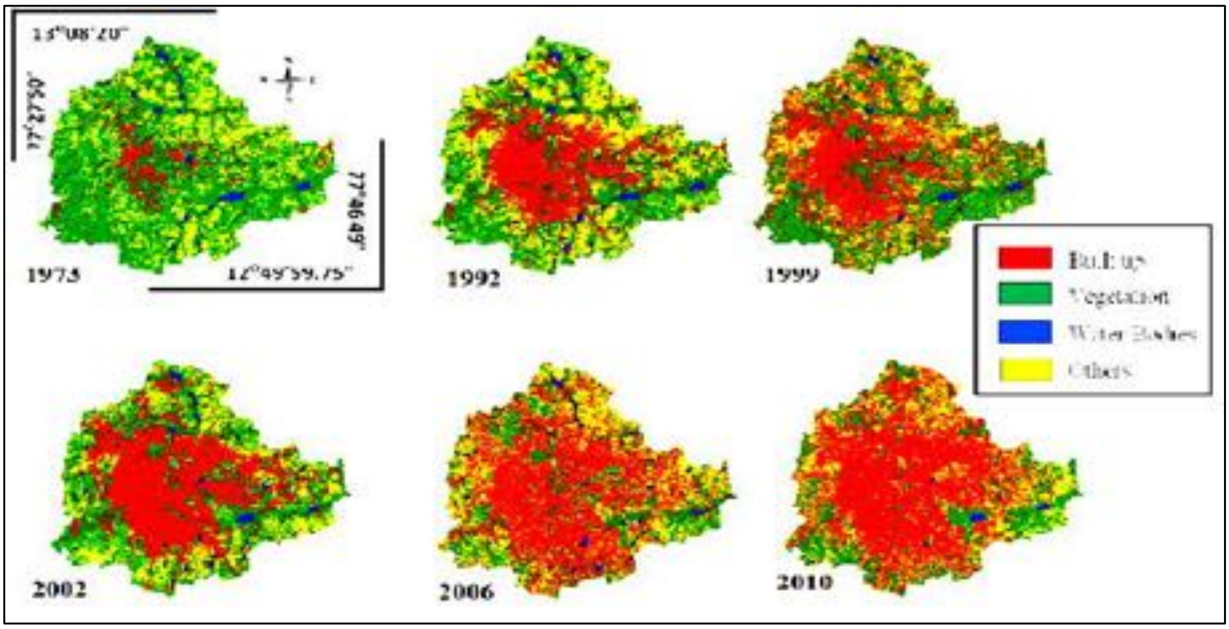
Bengaluru is one of the fastest growing cities in India. The city is a part of Bengaluru district, which is situated in the south- eastern part of Karnataka state. The city is being heavily flooded with public investment in industry and infrastructure.

Major contributors for rapid land use changes in Bengaluru are increase in population, rapid urbanization, industrialization, commercial establishments, political influences, tourism, etc. leading to an unplanned growth of the city. The change in land use is leading to expansion of urban sprawl consuming productive agricultural land, vegetation cover and water bodies. Functioning of city has hampered due to over-crowding, inadequate housing, development of slums, social polarization, traffic congestion and environmental pollution, ill-health, etc. This land-use change has complex interactions with the ecosystem, hydrological cycle and atmospheric circulation leading to modification of micro-climate ultimately affecting the quality of life. Category wise land use change in the city of Bengaluru is outlined from 1973 to 2013 is given in the following Table 4-42and Figure 4-18.

Table 4-42: Land use changes in Bengaluru during 1973 to 2013

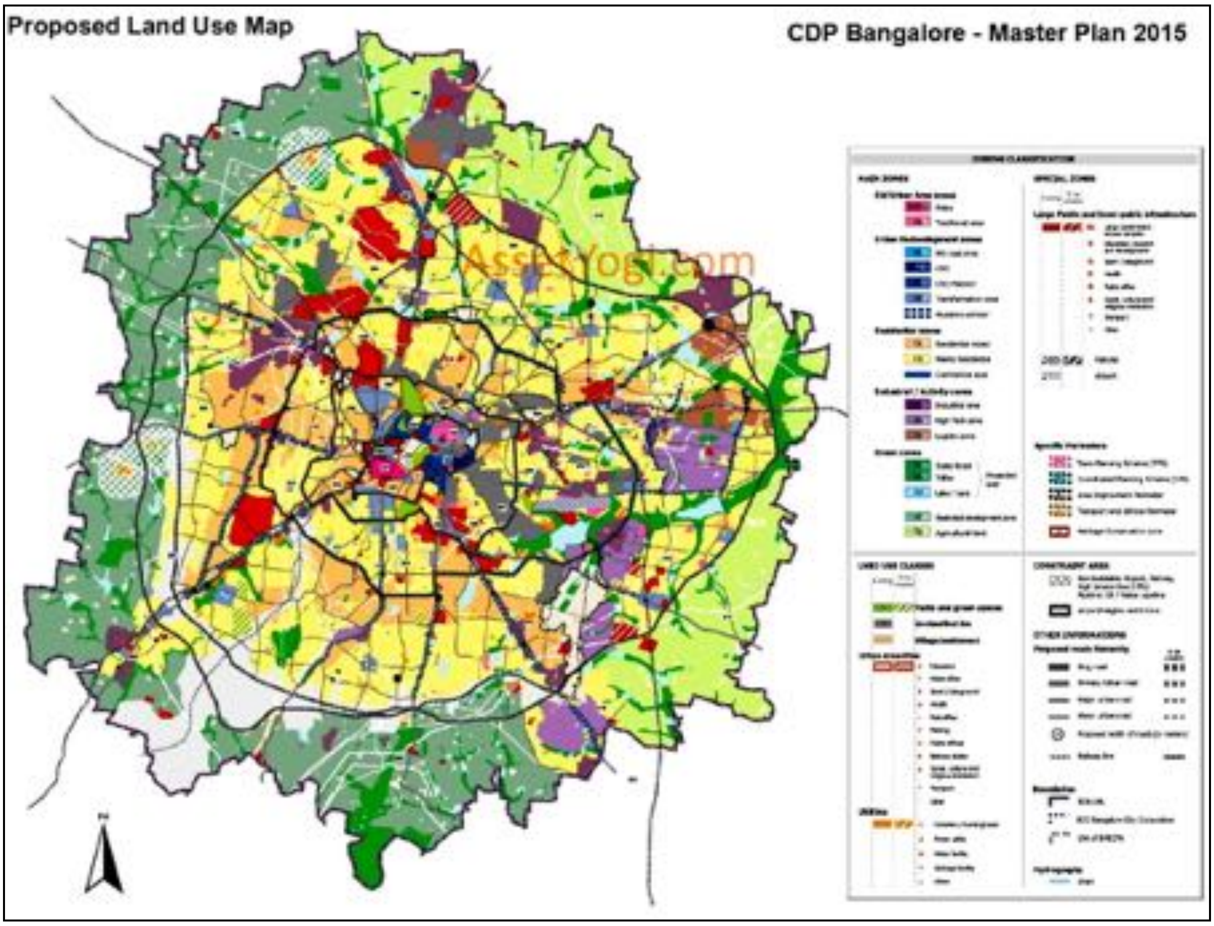
Land use Class	Urban		Vegetation		Water		Others	
Year	Ha	%	Ha	%	Ha	%	Ha	%
1973	5448	7.97	46639	68.27	2324	3.40	13903	20.35
1992	18650	27.30	31579	46.22	1790	2.60	16303	23.86
1999	24163	35.37	31272	45.77	1542	2.26	11346	16.61
2002	25782	37.75	26453	38.72	1263	1.84	14825	21.69
2006	29535	43.23	19696	28.83	1073	1.57	18017	26.37
2010	37266	54.42	16031	23.41	617	0.90	14565	21.27
2013	50440	73.72	10050	14.69	445.95	0.65	7485	10.94

Figure 4-18: Land use changes in Bengaluru city (1973 to 2010) [3]



[3] Source: Ramachandra T V, Vinay S and Bharath H.Aithal, 2015. Detrimental land use changes in Agara-Belllandur wetland, ENVIS Technical Report 95, CES, IISc, Bangalore, India.

Figure 4-19: Proposed land use map from CDP Bangalore Master Plan 2015



An attempt is made to prepare land use map covering 10 km radius around the project site. Analysis is made based on using ESRI latest satellite imagery. The Land Use Land Cover graph is shown in Figure 4-20. LULC mapping is done using guidance from BDA master plan and NRSC LULC from 2011/12 and analysis is performed on latest satellite imagery from ESRI, HERE, DeLorme, MapmyIndia, OpenStreetMap contributors and the GIS user community.

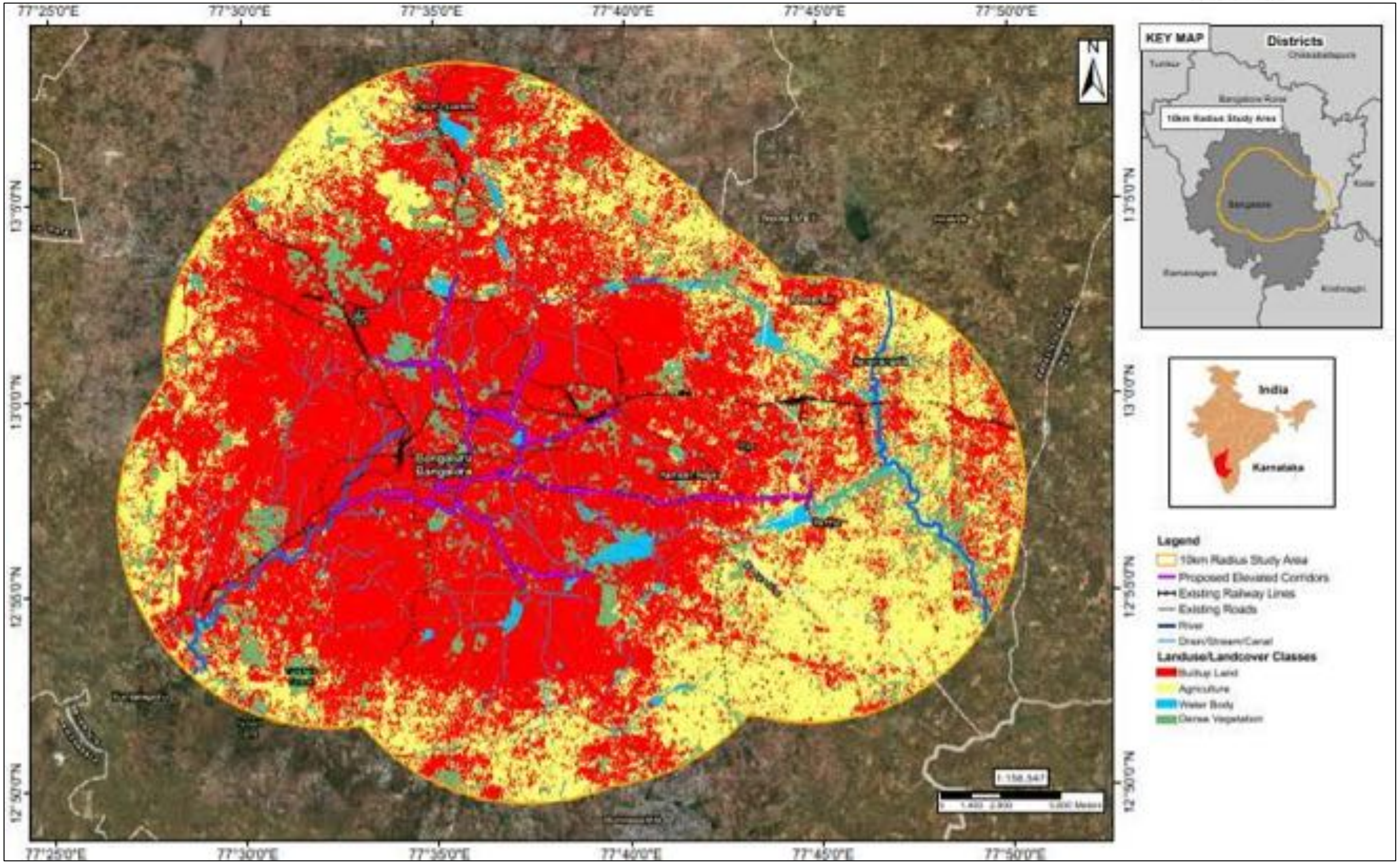


Figure 4-20: Landuse / Landcover Classes Map for 10km Radius Study Area

Class	Total Area (ha)
Agriculture	302912.57
Builtup Land	618205.69
Vegetation	115210.54
Water Body	12319.71
Grand Total	1048648.51

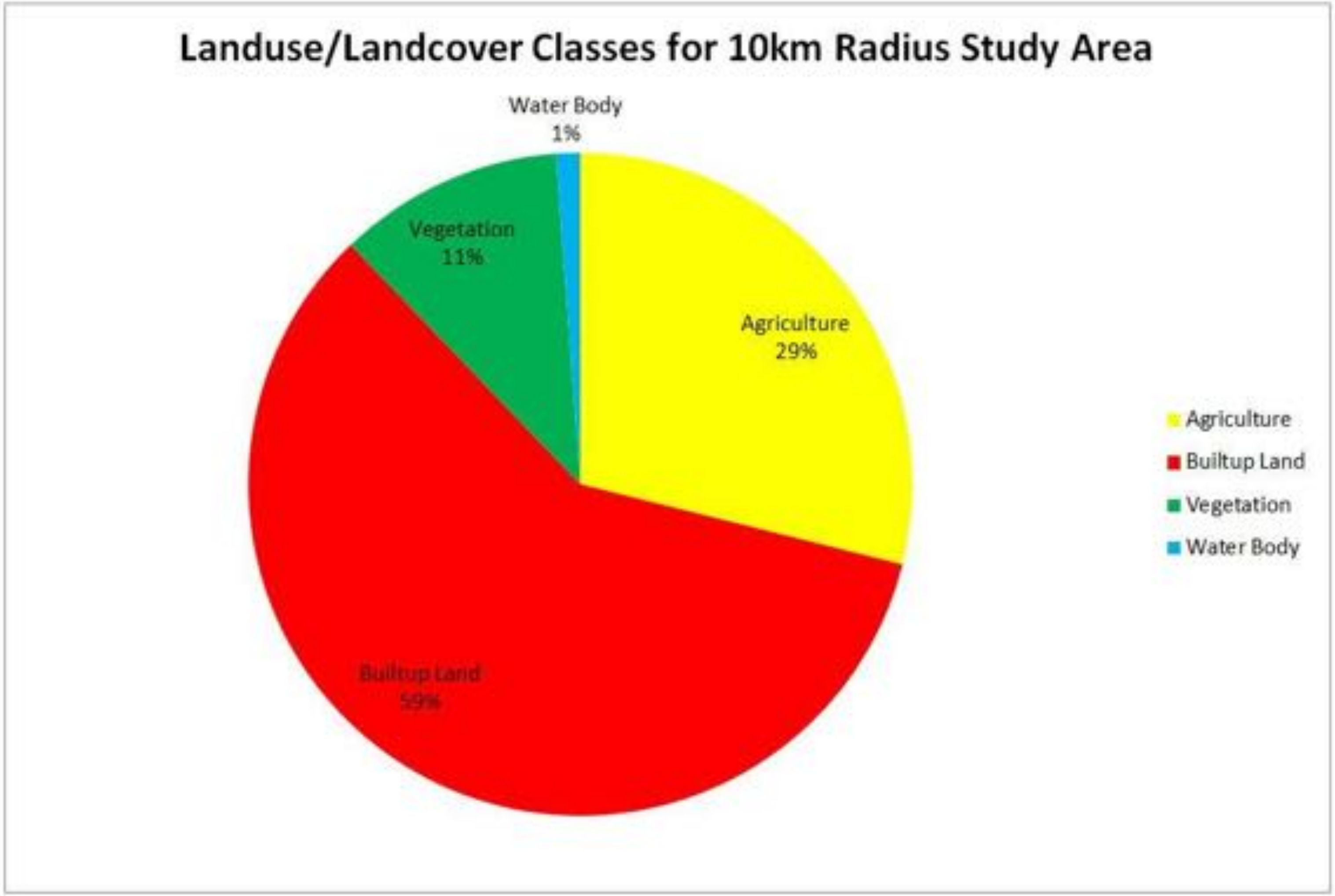


Figure 4-21: Landuse/Landcover Classes for 10km Radius Study Area

4.11 Environmental Pollution

About 4000 metric tonnes of Municipal Solid Waste (MSW) is currently being generated daily within the area under the jurisdiction of Bruhat Bengaluru Mahanagara Palike (BBMP). Handling and management of this huge quantity of municipal waste is a challenge for the Urban Local Body with regard to environmental, social and techno-financial aspects. of the total quantity of municipal solid waste being generated, about 3,000 tonnes is collected and sent to composting units such as the Karnataka Composting Development Corporation and other common municipal waste handling facilities which were established recently. The remaining solid waste collected by the municipality is dumped in open spaces or on roadsides outside the city.

The pollution level in Bengaluru city's air has deteriorated over the recent years to an alarming level. The city suffers significantly with dust pollution, hazardous waste disposal, and disorganized, unscientific waste retrievals. The IT hub, Whitefield region is the most polluted area in Bengaluru. Recently a study found that over 36% of diesel vehicles in the city exceed the national limit for emissions.

Status of baseline air quality in Bengaluru city during the year 2015-16 is presented in the Table 4-43 below.

Table 4-43: Status of baseline air quality in Bengaluru city during the year 2015-16

Sl. No.	Name of the Station	SO2 µg/m3	NO2 µg/m3	RSPM µg/m3	PM 2.5 µg/m3	NH3 µg/m3	lead (Pb) µg/m3
1	Export Promotional Park ITPL	3.8	21.1	189.0	80.0	19.0	0.046
2	K.H.B Industrial Area	3.6	15.5	109.0	*	14.0	0.080
3	Peenya Industrial Area - RO	3.9	20.2	127.0	69.0	25.0	0.091
4	Swan Silk Peenya Industrial Area	2.0	36.0	117.0	66.0	30.0	0.056
5	Yeshwanthpura Police Station	3.6	22.6	105.0	49.0	21.0	0.040
6	Amco Batteries	4.0	20.2	119.0	57.0	20.0	0.018
7	Central Silk Board	3.9	21.1	165.0	*	28.0	0.059
8	DTDC House	3.7	17.5	135.0	*	14.0	0.061
9	CAAQM City Railway Station	9.0	45.6	104.0	*	*	*
10	CAAQM S.G. Halli	3.7	25.7	72.0	*	*	*
11	Kajisonnenahalli	3.6	12.6	75.0	*	13.0	0.088
12	Victoria Hospital	4.0	23.0	102.0	60.0	24.0	0.038
13	Indira Gandhi Children Care	3.8	17.5	113.0	35.0	16.0	0.069
	CPCB Standards	50.0	40.0	60.0	40.0	100.0	0.500

Source: http://kspcb.gov.in/AQI-DATA-Bangalore-CITY-2015-16.pdf

Air quality monitoring of representative land uses and environmentally sensitive zones of the project area will be carried out as per the Terms of Reference (ToR) issued by SEAC (State Environmental Appraisal Committee) as a part of detailed feasibility study through an approved agency to know the background quality of ambient air.

4.12 Biological Environment

Bengaluru has been well known for its green spaces and lakes. In recent years, city has witnessed accelerated and unplanned growth leading to transformation of green lung spaces like forests, orchards, pastures and fertile agricultural fields into a concrete jungle flats and commercial agglomerations. The Bengaluru city, is called as the Garden City of India has an abundance of fauna and flora. The city has two nationally renowned botanical gardens Cubbon Park and Lal Bagh. The Cubbon Park has a history of over 100 years. It was established in the year 1870 by John Meade, the then acting Commissioner of Mysore. The vast landscape of the park was conceived by Major General Richard Sankey, the then Chief Engineer of the State. As a mark of honor to John Meade, the park was initially named as “Meade’s Park” and subsequently it was called the Cubbon Park. Lalbagh, is a botanical garden and has been a treasure house of plants. The rich floral wealth of Lalbagh extends over an area of 97 hectares (240 acres) accommodating 1854 species 673 genera and 890 cultivars of plants.

In 1982 a Forest Division was created under the name Bangalore Green Belt Division which was entrusted with the job of greening of Bengaluru Metropolitan Region and later on, the same has been enlarged to cover the Bengaluru Urban District. The natural vegetation consists species like Albizzia amara, Albizzia lebbek, Anogiessus latifolia, Acacia species, Shorea talura and Santalum album,

Home gardens within the city have been critical for enhancing green cover and biodiversity support in Bengaluru city. These gardens constitutes ubiquitous coconut trees, jackfruit, mango and drumstick, and plants such as papaya, banana and other ornamental flowering plants

The geographical area of Bengaluru Urban (Forest) division is 2,17,410 ha. The extent of forestlands within the division is 4,298.43 ha which includes both notified and other Government lands constituting 1.97 % of the geographical area. The forests in the division are of tropical dry deciduous type mostly containing Acacias, Albizzia, Wrightia tinctoria, Zizyphus, Pongamia, etc.

As per the Working Plan of Bengaluru Urban forest division, total area has been divided into five territorial ranges comprising of reserved forests, protected forests and other Government lands. The details of ranges, reserved and protected forests, other Government lands and lakes are given in Table 4-44.

Table 4-44: Details of various categories of forests, range wise abstract (Area in ha)

Sl. No.	Name of the range	Total area of notified forests	Other Govt. Lands (in ha.)	Total tanks Extent in ha.	Total forest Area in ha.
1	Anekal	34.07	112.00	-	146.07
2	Bengaluru	504.33	86.67	646.96	1237.96
3	Kaggalipura	1831.24	252.97	54.97	2139.18

4	K.R. Puram	395.70	701.45	813.86	1911.01
5	Yelahanka	380.00	-	60.30	440.30
	Total	3145.34	1153.09	1576.09	5874.52

Source: Working Plan for Bengaluru Urban Forest Division (period - 2002-03 to 2011-12), 2003

The government lands in the division are not notified forests but are under the control of the Forest Department. These lands include revenue kharab lands, gomal lands and other areas where the department has raised plantations over the years. Besides, the Revenue Department quite often grants these lands, hence the extent of these lands is decreasing day by day. In addition to the above areas Social Forestry wing of the Forest department also own government lands that have not been notified as forests.

Other government lands (C & D class lands, Gomals, tanks, etc. district forests) under the control of Bangalore Urban Division, Forest Department can be utilized for compensatory afforestation in lieu of trees being cut for implementation of elevated corridor project

The following table (Table 4-45) shows the details on the name of the forests and their extent in the jurisdiction of Bengaluru Urban Division.

Table 4-45: Various types of forests with extent in Bengaluru Urban Division

Sl. No.	Name of the forest	Forest area in Ha.
1	Jarakabande Reserved Forest	199.92
2	Marasandra Reserved Forest	380.00
3	Kumbaranahalli Reserved Forest	34.07
4	Govindapura Reserved Forest	19.42
5	Arkavathi Reserved Forest	42.89
6	Madappanahalli Plantation	62.29
7	Jarakabande Sandal Reserved Forest	129.81
8	Sulikere Reserved Forest	210.01
9	Turahalli Gudda Protected Forest	238.97
10	Basavanathara Reserved Forest	566.80
11	Doresanipalya Reserved Forest	54.88
12	Jyothipura Reserved Forest	228.00
13	Mandoor Reserved Forest	129.60
14	B.M.Kaval Reserved Forest	562.87
15`	Kadugodi Reserved Forest	38.10
	Total	2897.63

As per the statement of mixed plantation raised in Bengaluru Urban Forest Division Nilagiri, Bevu, Sirude, Kamara, Sissoo, Acacia auriculiformis, Kamara, Jali, Karijali, Hunise, Nerale, Honge, Hippe, Gulmohar, Spathodia, Mavu, Sampige, Malemara, Ala, Mathi, Bamboo, Salle, Saruli, Thore Mathi, Sakke, Agala tharis, Peltophorum, Basavanapada, Thangadi, Sarve, S. mahagony, Subabul, Atti, Arali, Bage, Halasu, Nelli, Muthuga, Dalchinni, Kadhembe, Badami, Uvalli, Huvarasi, Nelli, Biudire, Peltophorum, Antuvala, Cherry, Bottlebrush, Holemathi, Kanagal, Silver Oak, Swietenia mahagony, Teak, Kumkum (Mallotus philippensis), Sita, Ashoka, Shivani (Gmelina arborea), Jakaranda, etc.

The nearest wildlife sanctuary which is adjacent to Bengaluru Urban District is Banneraghatta National Park. Most of the animals found in these protected areas are also found in the forests of Bengaluru urban division. Wild animals like elephant, wild boar, bear from the sanctuary destroy agricultural crop raised by farmers in and around their habitations. There are also instances of human beings and domestic cattle being killed by wild animals. Often elephants are found migrating from adjacent forests of Banneraghatta National Park.

The list of birds found in and around Bangalore in addition to Nandi hills, Bannerghatta forest ranges and Kaveri sangam area roughly extending 40 km around the city center are included. Some of the important birds found are Common quail, Grey jungle fowl, Indian peafowl, Lesser whistling-duck, Bar-headed goose, Spot-billed duck, Northern shoveler, Common teal, Greater flamingo, Lesser flamingo, Painted stork, Asian open bill, Black-headed ibis, Red-napped ibis, Eurasian spoonbill, Little egret, Grey heron, Purple heron, Intermediate egret, Cattle egret, Indian pond heron, Spot-billed pelican, Great white pelican, Little cormorant, Indian cormorant, Great cormorant, Oriental darter, Crested honey buzzard, Brahminy kite, Grey-headed fish eagle, Egyptian vulture, Indian vulture, Crested serpent eagle, Marsh harrier, Montagu's harrier, Eurasian sparrow hawk, Indian spotted eagle, Common buzzard, Red-necked falcon, Laggar falcon, Great Indian bustard, White-breasted water hen, Water cock, Grey-headed swamp hen, Common moorhen, Eurasian coot, Barred buttonquail, Pacific golden plover, Common ringed plover, Yellow-wattled lapwing, Grey-headed lapwing, Red-wattled lapwing, Pheasant-tailed jacana, Bronze-winged jacana, Eurasian woodcock, Marsh sandpiper, Common sandpiper, River tern, Whiskered tern, Painted sandgrouse, Chestnut-bellied sandgrouse, Rock pigeon, Spotted dove, Red turtle dove, Yellow-footed green pigeon, Rose-ringed parakeet, Pied cuckoo, Indian cuckoo, Common cuckoo, Grey-bellied cuckoo, Asian koel, Barn owl, Oriental scops owl, Indian scops owl, Mottled wood owl, Jungle owlet, Common kingfisher, White-throated kingfisher, Stork-billed kingfisher, Blue-bearded bee-eater, Blue-tailed bee-eater, Chestnut-headed bee-eater, Indian grey hornbill, Brown-capped woodpecker, Yellow-crowned woodpecker, White-cheeked barbet, Coppersmith barbet, Indian golden oriole, Black drongo, White-bellied drongo, Indian paradise flycatcher, White-bellied tree pie, House crow, Red-whiskered bulbul, White-eared bulbul, Yellow-throated bulbul, Paddy field warbler, Common starling, Common myna, Jungle myna, Indian blue robin, House sparrow, Yellow-throated sparrow, Red munia, Forest wagtail, Common rose finch, etc.

Snakes such as Cobra, Russels Viper, Common Krait, Saw Scaled Viper, Checkerded Keel back, Common Verm or Blind Snake, Russell's Earth Boa, Trinket Snake, Rat Snake, Indian Python, etc. and many types of lizards and insects.

4.13 Social Economic Environment

Bengaluru had population of 9,621,551 in 2011. Of which male and female were 5,022,661 and 4,598,890 respectively. In contrast, as per 2001 census, Bengaluru had a population of 6,537,124 of which males were 3,426,599 and remaining 3,110,525 were females. The census data shows that population density of 4,381 people per sq. km in 2011 in the district as against 2,985 people per sq. km in 2001.

Average literacy rate of Bangalore in 2011 were 87.67 compared to 82.96 of 2001. If things are looked out at gender wise, male and female literacy were 91.01 and 84.01 respectively. For 2001 census, same figures stood at 87.92 and 77.48 in Bangalore District. Total literate in Bangalore District were 7,512,276 of which male and female were 4,078,041 and 3,434,235 respectively. In 2001, Bangalore District had 4,782,565 in its district.

With regards to Sex Ratio in Bangalore, it stood at 916 per 1000 male compared to 2001 census figure of 908. The average national sex ratio in India is 940 as per latest reports of Census 2011 Directorate. In 2011 census, child sex ratio is 944 girls per 1000 boys compared to figure of 943 girls per 1000 boys of 2001 census data.[4]

Infrastructure: Annual average power consumption by Bengaluru district is about 14,225 MU and 28% of it is industrial requirement and 33 % is for domestic consumption. Power transmission in the district is being done by Bengaluru Electricity Supply Company Limited (BESCOM) Bengaluru is being supplied with 1480 MLD of water which is being managed by Bengaluru Water Supply and Sewerage Board. Water is sourced from Arkavathi River and Cauvery for drinking purpose. Bengaluru Urban has 46- water tanks of various capacities serving the irrigation needs and has 52 reservoirs and 118 ground level reservoirs.

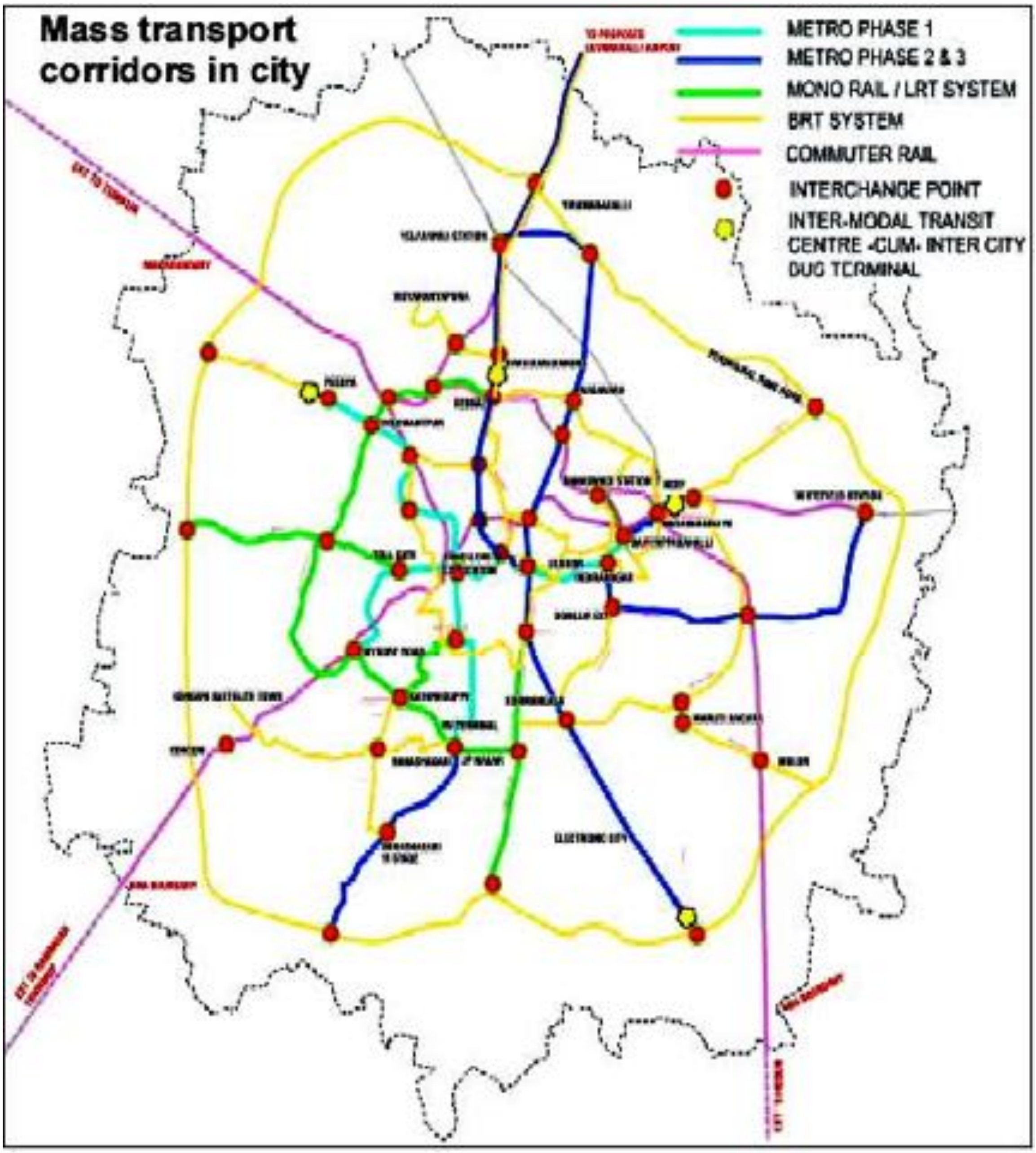
Bengaluru district has a total length of 147 km NH. NH 4, NH 7 and NH 209 passes through the district. District has a total railway route of 148.32 km. Bengaluru International Airport is fourth busiest airport in India. Bengaluru Metro (Namma Metro) – Mass Rapid Transit System extends for a total length of 137 Km under different phases of execution (Figure – 1-10).

Bengaluru is the highest contributor of the State's economy. Its total Gross Domestic Product (GDP) is INR 993.25 billion contributing 33.3% to Gross State Domestic Product (GSDP) with the per capita annual income in the district being INR. 2,02,340. However, the Gross District Domestic Product (GDDP) trend is 5.5% Compound Annual Growth Rate (CAGR) from 2007-8 to 2012-13; with the services sector reigning supreme at INR 683.30 billion with 39.5% contribution to the state.5 Bengaluru has 14.09% of its land for cultivation. Amongst this, cereals and pulses occupy 66.36% and 9.94% of the land respectively. Best known for Ragi, especially, in Anekal Taluk which is called 'Ragi Bowl' in the State. Bengaluru Urban is recognized as Class A destination for floriculture projects. Major crops grown are Paddy, Ragi, Maize, Horse gram and Oilseeds along with Horticultural crops like Banana, Grapes, Papaya, Mango Sapota, Pomegranate and Plantation crops like Coconut and Rose. The district also has 649 milk co-operatives that annually produce 119 Million liters of Milk, 34.7 million Eggs, and 5,880 tonnes of Meat.

Bengaluru Urban district is a vital business hub with 315 large scale industries with an investment of INR 147.9249 billion; 211 medium scale industries with an investment of INR 134.233 billion and 74,282 small-scale industries with a massive investment of INR 412.13 billion. The District has 16 odd industrial areas and Peenya has the largest industrial cluster in Asia; 13 industrial estates and 14 notified operational SEZ in Bengaluru forms the framework to the rich industrial landscape in the region.

[4] Source: http://www.census2011.co.in/census/district/242-bangalore.html
[5] http://www.investkarnataka.co.in/district-profiles-bangaloreurban

Figure 4-22: Mass Transport Corridors in Bengaluru city



The District is India's highest IT related exporter with 35% of the 1 million IT pool of India employed here. Bengaluru has India's largest bio-cluster with 40% of India's biotechnology companies present here. It houses 137 of 340 units in India at Electronic city. Bengaluru anchors Aerospace industries in India. Bengaluru is the headquarters of ISRO & DRDO, and many internationally renowned institutions like HAL, DRDO, ISRO, ADA, NAL, IISC, and Antrix Corporation. Also, 4 out of 9 R&D Centers of HAL and DRDO's 5 Aeronautic Centers are in Bengaluru.

Bengaluru city hosts number of autonomous institutions with high caliber medical professionals, such as National Institute of Mental Health and Neuroscience (NIMHANS) and the Jayadeva Institute of Cardiology. Further, a huge private sector caters to the health needs of the population. Bengaluru is a hub for medical tourism, with super-specialty hospitals boasting state-of-the-art treatment facilities.

4.14 Sites of Tourist and Archaeological Interest

Bengaluru Palace: Constructed by Chamaraja Wodeyar in 1887, the palace carves a niche for its architecture. Besides, the Gothic windows and fortified towers of this palace are worth viewing. Bengaluru Palace is a minor replica of the Windsor Castle in England.

HAL Aerospace Museum: Located 11 km from the city, it is the first aerospace museum in India. The museum is home to equipment for navigation and communication, and many model aircraft.

Cubban Park: has been serving as a lung space of Bengaluru city in the central administrative area. It has a rich recorded history of abundant flora and fauna plantation coupled with numerous impressive and aesthetically located buildings and statues of famous personages.

Lal Bagh: One of the popular botanical gardens of India, Lal Bagh is home to approximately 1,000 species of rare herbs and plants. Sprawled across 2,400 acres, the garden is well secured with stone walls. Visitors can visit this park anytime between 6 am in the morning to 7 pm in the evening. Lalbagh botanical garden was commissioned by the ruler of Mysore, Hyder Ali.

Bannerghatta National Park: Located 22 km from Bengaluru, this national park is famous for its picturesque natural beauty. Besides, the park is also home to Indian tigers, lions, and crocodiles. Bannerghatta National Part is a rich natural zoological reserve which also hosts first butterfly park of India.

Bull Temple: is a magnificent pilgrimage of Nandi which is 15 ft tall and over 20 ft long.

Visvesvaraya Industrial and Technological Museum: is famous for its interactive exhibits.

There are two structures of archaeological interest near the EW 2 Corridor alignment.

Tipu Sultan's Palace: Though the construction of the palace was initiated by Hyder Ali in 1781 AD, Tipu Sultan completed the construction of the same in 1791. Formerly one of the summer retirements of Tipu Sultan, today the palace has been transformed into a museum. The palace is a beautiful two storied ornate wooden structure with exquisitely carved pillars arches and balconies built in 1791 and were Tipu Sultan’s summer retreat. This is a splendid structure now present within the old fort. It has a large open courtyard in the front with a fountain and small, ornamental garden.

Old Dungeon Fort & Gates: Old Dungeon Fort & Gates or Bengaluru Fort began in 1537 as a mud fort by Sri Kempe Gowda I, a vassal of the Vijaynagar Empire and the founder of Bengaluru. Haider Ali in 1761 replaced the mud fort with a stone fort. The army of the British East India Company, led by Lord Cornwallis on 21 March 1791 captured the fort in the siege of Bengaluru during the Third Mysore War (1790–1792). Today, the fort's Delhi gate, on Krishna Rajendra Road and two bastions are the primary remains of the fort in Figure 4-23.

Figure 4-23: Tipu Sultan's Palace & Old Dungeon Fort & Gates

	
Tipu Sultan's Summer Palace	Tipu Sultan's Summer Palace
	
Old Bangalore Fort, Front View	Old Bangalore Fort, Inside view

4.15 Seismicity

Bengaluru Urban district lies in a seismically stable region, Zone III. Bengaluru has been untouched by major seismic events but only mild tremors have been recorded in the past. The Indian Peninsular region was once considered to be seismically stable is experiencing many earthquakes recently. As a part of micro-zonation programme, Department of Science and Technology, Government of India has carried out seismic hazard analysis of Bengaluru region considering the regional seismo-tectonic activity based on faults, lineaments, shear zones and historic earthquake events of more than 150 events in about 350 km radius around Bengaluru city. About 21 numbers of faults and lineaments are identified as a vulnerable sources as a first step. The vulnerable source for Bangalore city is identified as Mandya – Channapatna – Bengaluru lineament with an earthquake moment magnitude of 5.1.[6]

[6] TG Sitaram, and P Anbazhagan, 2006, Seismic Hazard Analysis for the Bangalore Region

5. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The proposed elevated corridor project aims to ease the traffic nuisance being faced by Bengaluru dwellers and contributes towards better infrastructure and improved connectivity. Improved access to job locations, education, health facilities, market centers, tourist places and other essential services for the public of the city in the region; reduced sufferings during monsoons and adverse climatic conditions; improved public safety and security; productive use of time which influences and improves the income patterns; the quality of life and human dignity; opens up opportunities for social interaction; etc. All these factors improve economic and social welfare of communities in the vicinity and the state as a whole.

For all the positive impacts, road improvement projects could also generate some adverse impacts on environment. The direct environmental impacts are usually due to activities that are directly related to construction and rehabilitation activities, while indirect environmental impacts are usually related to the operation of improved roads. Such indirect environmental impacts include cumulative impacts due to improved access to certain geographic areas.

The environmental impacts caused by the development of the project corridor / road can be categorized as primary and secondary impacts. Primary impacts are induced directly by the project, whereas secondary impacts are indirectly induced, and typically include the associated investment and changing pattern of social and economic activities in the region. The generic impacts of the project on the environment are presented below. Impacts of the elevated corridor project can be appropriately discussed under following heads.

- Impacts during Pre-construction Phase.
- Impacts during Construction Phase.
- Impacts during Operation Phase.

5.1 IMPACTS DURING PRECONSTRUCTION PHASE

5.1.1 Change of Land use:

The proposed elevated corridor project requires acquiring private residential, commercial, government and Army lands. It is difficult to avoid acquiring land as the scope for alignment alternatives are located within Bengaluru city and finalization of the alignment is much influenced by traffic induced obligatory factors. However, all attempts have been made to restrict the width of the elevated structure after taking into consideration the traffic projections for each proposed corridor to minimise the impact and land acquisition required for the project. It is estimated that about total of 56.89 Ha of land have to be acquired for the project. Acquisition of land adjacent to the proposed corridor will lead to change in the land use. Apart from main corridor which runs across Bengaluru city, large area of land is also required for construction of access ramp structures which connect elevated corridor with at-grade roads, junction improvements, grade separators and associated developments. Further, during construction phase additional land is required, for establishing construction camps, casting yards, material storage and labour camps including space for meeting the requirements of construction works.

Transfer of land and involuntary resettlement will cause adverse social, economic and cultural impacts on families and communities who are dependent on them.

Table 5-1: Land to be acquired (Source: DFR Study)

Type of Ownership	North - South Corridor	East West Corridor - 1	East West Corridor - 2	Connecting Corridor - 1	Connecting Corridor - 2	Connecting Corridor - 3	Total (Ha)
Private land	3.14	10.65	3.21	0.03	0.31	0.42	17.76
Defence Land	0.08	0.54	1.87	0.00	0.05	0.00	2.54
Central Govt.	2.00	1.00	0.06	0.00	0.00	0.00	3.07
State Govt.	10.54	21.36	0.28	0.47	0.72	0.15	33.52
Total Land (Hectares)	15.77	33.55	5.42	0.50	1.08	0.57	56.89

Mitigation measures:

- The land acquisition has been avoided or minimized to reduce the impact on owners owning the adjacent properties and lands. Alternative engineering designs has been attempted to avoid or minimize land acquisition.
- Where land acquisition is unavoidable, resettlement of Project Affected Persons (PAPs) shall be implemented as an integral part of the project.
- All temporary land acquisition will be preferably Government lands and away from Bengaluru city to reduce the impact of these construction establishments.
- The temporarily acquired lands for construction establishments shall be transferred back after suitable rehabilitation before the completion of construction works.

5.1.2 Structures Affected

Social screening survey along all the project corridors has identified social impact especially impact on buildings or structures. Survey covered major structures like residential, commercial and Altogether, Corridor wise impact are illustrated in below sections and summary is presented in table

Approximately 1130 structures are affected by the proposed elevated corridor especially at those stretches where available right of way (ROW) is narrow. The type of structures impacted includes residential, commercial, religious and other structures like compound wall, sheds, bathrooms, abandoned structures, etc. Rehabilitation and Resettlement (R&R) of displaced structures and families is important and is addressed in Social Impact Assessment report.

Table 5-2: Impact on structures

Phase Nos.	Residential	Commercial	Residential/ Commercial	Religious	Govt./ Community	Education	Others	Total
I	169	48	1	6	8	1	64	297
II	8	143	10	9	2	2	47	220
III	32	339	5	14	2	5	146	543
IV	0	47	5	3	1	1	13	70
Total	209	577	21	32	13	9	270	1130

*Includes room, shed, under construction, toilet, abandoned etc.

A total of 47 religious structures like small temples, mosque, shrines etc., were identified as affected religious structures. Category wise religious structures under all the corridors are summarized in the below table.

Table 5-3: Category wise Religious Properties

Phase Nos.	Temple	Church	Mosque	Total
I	5	3	2	10
II	20	1	0	21
III	7	2	1	10
IV	6	0	0	6
Total	38	6	3	47

Mitigation measures:

- The alignment shall be planned in such a way that impact on the adjacent structures is minimized. Alternative engineering designs shall be attempted to avoid or minimize land acquisition.
- Project-affected persons, families, households and groups shall be compensated as per the statutory provisions before the commencement of project. The impact shall be addressed as per the KIADB Act with compensation at par with Land Acquisition, Rehabilitation and Resettlement Act, 2013.

5.2 IMPACTS DURING CONSTRUCTION PHASE

5.2.1 Impact on Topography

The significance of the impact on the topography is based on the spread of the impact of cutting and the embankment construction along the corridor alignments. Hence there is no significant impact on the topography along the elevated stretch of the project except at location of ramps where (both up ramp & down ramp) earth will be filled and retained with the help of retaining structures to access the elevated structures. There are about 53 such ramp locations in the proposed elevated corridor project. In addition, there will be significant change in topography at the locations of material storage yards, gravel & sand quarries and murrum borrow areas.

5.2.2 Impact on Soil

The soil / debris will be generated during foundation excavations for pile construction which needs to be carefully and safely disposed of. Lot of waste slurry is also generated during pile foundation construction which causes serious soil pollution if it is not disposed properly. However, soil contamination is not considered to be a significant concern from this proposal looking at the nature of land uses in the project areas.

The debris generated (approximately 5,88,678 cum) at the pile foundation location will be partially utilized for construction of ramps and rehabilitation of quarries and borrow pits.

Table 5-4: Quantity of Debris generated

Phase Nos.	Length of Project Corridor (km)	Quantity of Debris generated (Cum)
Phase I	24.47	1,77,171
Phase II	41.20	2,08,881
Phase III	27.12	1,36,348
Phase IV	9.25	66,278
Total	102.04	5,88,678

The run off from unprotected excavated areas during construction results in excessive soil erosion. Periods of prolonged rainfall or heavy downpours during construction phase may increase the risk of erosion and subsequent sedimentation of local storm water drains. Similarly, periods of dry and windy weather may increase the potential for soil erosion near the project area.

Land clearing for the project will involve removal of trees which have a very important role in binding the soil intact. Stripping of topsoil at the project and construction site to level the ground will lead to the loss of developed and stable soil. However the impact on the soil is not of importance as the land use pattern in project area is urban and uncultivable. It is necessary to limit the removal of ground cover, trees or shrubs only to the area needed for permanent works to minimize the impact on soil. Alteration of storm water drainage along the corridor alignment may lead to soil erosion. The hard impervious bituminous/concrete pavement of the elevated road will have the surface runoff and if this runoff is not drained off properly by means of drains, may lead to flooding and accelerated soil erosion on the at grade roads.

Scarification of existing bituminous pavement at grade for preparatory works of pile foundation and indiscriminate disposal would cause soil pollution. These wastes could be managed well, by careful handling, storing and disposal.

Unplanned disposal of the soil generated from the pile foundation excavation and other project activities during the project implementation will cause the loss of productive top soil and at the same time will lead to erosion of soil. For such locations where soil erosion is evident, exposed surface area shall be limited to minimum and duration of construction shall be scheduled immediately after completing land clearing.

Proposed project involves construction of as many as 11,705 pile foundations which requires soil to be excavated and disposed of elsewhere safely. Phase wise details of pile foundations and ramps (both up and down ramps) are given in the following table. On an average each ramp will have length of approximately 250 m.

Table 5-5: Pile foundations and ramp locations along the proposed project corridor

Phase Nos.	Pile Foundations (Nos.)	Ramps (Nos.)
Phase I	806	23
Phase II	417	10
Phase III	699	19
Phase IV	275	-
Total	2197	52

Mitigation measures:

- Soil erosion can be effectively controlled by careful planning, timing of cut and fill operations and safe disposal of excess excavated unserviceable soil, especially during monsoon season.
- The soil erosion can best be mitigated by removing vegetative cover only from the specific site on which construction is to take place and by disturbing the vegetation in adjacent areas as little as possible.
- Bituminous wastes should not be disposed nearby water bodies, open spaces and parks and wastes should not be left unmanaged on the road sides. The scarified bitumen shall be disposed of in clay lined bitumen disposal pits.
- The excavated soil from the pile foundations shall be stockpiled and covered such that the soil are not eroded away and they should be transported securely to disposal sites.
- At borrow pits, the depth of the pit should be regulated so that the sides of slope are not steeper than 1 vertical to 4 horizontal.
- Location of borrow areas should be preferred on infertile soils. The top soil shall be stripped and stored. The stored topsoil shall be spread back to maintain the original characteristics of the soil.
- The topsoil from all areas of cutting, shall be stripped to a specified depth of 150 mm and stored in stockpiles of heights not exceeding 2 m. If borrow areas are located on agricultural lands, it shall be ensured that the topsoil be preserved & reutilized during rehabilitation of borrow areas.
- Borrow pits shall be redeveloped by dumping of unserviceable soils and debris and by leveling elevated or raised earth mounds.
- Adopting waste minimization technologies would minimize the generation of waste materials to be disposed and thereby the cost incurred for transportation and handling will be reduced.
- Demolition and Construction waste should be dumped in pre-identified and approved pits, developed on infertile land.

5.2.3 Impact on Water Quality, Drainage and Hydrology

There are a few important water bodies along the proposed elevated corridors which may be impacted during construction phase of elevated corridor. The lakes which are within 100 m from the proposed corridors are considered to be impacted directly by the project. Water bodies adjacent to the corridor are shown in the Annexure.

Table 5-6: Details of water bodies adjacent to proposed elevxated corridor

Sl. No.	Phase No.	Water bodies / Lakes	Name of the Corridor	LHS / RHS	Distance of pier foundation from Water body (m)	Location
1	Phase I Package - I	Hebbal Lake	NS	RHS	5	Near Hebbal Flyover
2	Phase II Package - I	KR Puram Lake,	EW-1	RHS	20	Along NH 4
3	Phase II Package - I	Benniganahalli Lake	EW-1	RHS	350	Swamy Vivekananda Road
4	Phase II Package - I	Pond near Sarvagna Nagar	EW-1	RHS	20	Swamy Vivekananda Road
5	Phase II Package - II	Ulsoor Lake	EW-1	LHS	5	Kensington Road
6	Phase V Package - I	Varthur Lake	EW-2	LHS/ RHS	5	HAL Airport road and along SH 35 respectively
7	Phase V Package - I	Thubarahalli Lake	EW-2	RHS	120	Varthur road / HAL Airport road
8	Phase IV Package - I	Vrishabhavathi Nalla	EW-2	LHS / RHS	5	Mysore road
9	Phase I Package - III	Agara Lake	CC-1	LHS	30	Sarjapur main road
10	Phase II Package - II	Challkere	CC-3	RHS	30	100 ft. Ring road
11	Phase - II	Rajakaluve	CC-3		1	At Banasawadi
12	Phae I Package - II	Rajakaluve	NS		1	At Shathinagar Bus Depot

There is a possible impact on the water bodies like KR Puram Lake, Ulsoor Lake and Agara Lake. As the East-West corridor alignment passes over Ulsoor Lake, and two piers may have to be established within the water body and the water body may get affected by the construction activities during construction phase if proper precautions are not taken.

This can be avoided by careful planning of the construction methodology to avoid the spill of the soil and debris into the water body. Construction works shall not be taken up during monsoon season.

The establishment of temporary construction camps and labour camps during the construction of project corridor will cause water pollution due to oil spills from construction equipment, sewage and garbage form the camps. If these wastes are let into the river without proper treatment, they will lead to water pollution which may spread communicable diseases further down the stream. Precaution shall be taken to treat and dispose the wastes in a proper manner to prevent and minimize the impact.

There are many bore wells along the sides of the road implemented through various schemes by the state Government which will be impacted by widening of at-grade roads. Alternative arrangement of water supply shall be made for the day to day house activities to those people who are living adjacent to the project road. The affected water resources shall be rehabilitated at the earliest.

The establishment of temporary construction camps will generate environmental impacts due to inappropriate sewage and disposal of garbage, spills from construction equipment operations, conflicts related to the use of existing facilities and disseminating communicable diseases.

Consrufciton of elevated corridor requires total 266 M litres of water. Water required for construction shall not be sourced from public water resources and supplies. Contractor shall source water from ground water resources like bore wells and tube wells dug after obtaining all necessary permissions from concerned authorities. Contractor shall source treated water from local Sewage Treatment Plants to use in the construction.

Mitigation measures:

- Batching plants, hot mix plants, labour camps, stone crushers, and other heavy machinery should be located away from the water bodies. Domestic and sewage wastes from labour camps shall be treated to the standards as per the CPCB standards and disposed.
- Arrangement for the supply and storage of water shall be made by the contractor, in such a way that the water availability and supply to nearby communities remains unaffected. If a new tube-well is to be bored, proper sanction and approval from local authorities and Central Ground Water Board.
- The impacted community water resource such as taps, stand posts tube-wells, along the at-grade road shall be relocated immediately.
- The excavated earth, stones or any other construction material, shall be properly disposed of so as not to choke the drainage system and block the flow of water.
- All required precautions shall be taken up to ensure no silt, soil, construction material reaches and silt up the adjacent waterbodies by constructing suitable retaining barricades.
- Construction works close to water bodies and streams shall be avoided, especially during the monsoon period.
- The required permissions from Forest Department / Lake Development Authority / National Green Tribunal (NGT) as required shall be obtained.
- To avoid contamination from fuel and lubricants, the vehicles and equipment shall be properly maintained and repaired. Oil interceptors shall be installed at the construction camps, vehicle service areas, fuel storage areas to ensure oils and oil based product do not pollute the soil or reach nearby waterbodies.

- Fuel storage and refilling sites should be kept away from cross drainage structures and water bodies.

5.2.4 Traffic Diversions

During construction of pile foundations, complete or partial traffic diversions on at grade road will be required. Traffic shall have to be diverted into alternate roads which not only creates traffic nuisance but also inconveniences with respect to emission of dust pollutant gases, increased noise levels to the adjacent inhabitants.

As most of the construction activities are on the existing roads but most of the proposed alignment passes through double lane roads. Hence, rather than completely blocking the roads it will be advisable to make these roads as one way to allow for operation of traffic together with construction activities. Moreover, on both sides of the at-grade roads, a clear passage shall be maintained for smooth operation of traffic, emergency and local movements. Dissemination of information on traffic diversions in advance will be an advantage to commuters of affected routes.

Traffic diversion arrangements are required to be done at all major junctions and existing narrow project stretches to avoid traffic chaos. Phase wise details of major junctions and the narrow project stretches where traffic control shall be a task. The details of junctions and narrow stretches in each phase of project execution are given in the table below.

Table 5-7: Major & Minor Junctions along the proposed project (At-grade)

Phase Nos.	Major Junctions	Minor Junctions
Phase I	61	66
Phase II	23	29
Phase III	27	34
Phase IV	17	25
Total	128	154

5.2.5 Impact on Air Quality

Dust generation is the main air quality issue associated with construction of the proposed elevated corridor. Primary sources of dust during construction phase include activities like site preparatory earthworks; demolition of existing structures; foundation excavation works; erection and use of heavy equipment & machinery; loading, transporting and unloading soil and construction materials and material handling; traffic diversion; etc. In addition, dust and gaseous emissions are released from the batching plants, hot mix plant and diesel generators; stone crushing unit operations in the stone quarries. Main pollutants released during construction are suspended particulate matter (SPM) and obnoxious gaseous pollutants like Carbon Monoxide, oxides of Nitrogen, Sulphur dioxide, Lead deteriorating quality of ambient air along the project corridor and at construction establishments.

As the project construction works occur close to residential dwellings and commercial possessions, dust may be a nuisance to the community. However, the degree of dust nuisance would depend on the nature of works at the particular section, duration of construction time and the local meteorology (like humidity, wind speed and direction) at the time of construction.

In addition to dust, it is also expected that project activities release air pollutants like SO_2, NO_x, CO, Lead, Benzene and Volatile Organic Compounds (VOC). Air pollutants adversely impact on human health, vegetation and materials. Human beings exposed to air pollutants will have higher incidence of cough, shortness of breath, bronchitis, chronic fibrosis, emphysema, bronchopneumonia, colds of long duration and fatigue. Most of the SO2 and NO_x in the atmosphere are converted to acid, thereby making rain water acidic. Air pollution has damaging effect on vegetation depending upon their chemical nature, level of concentration and duration of exposure. Air pollutants cause physical and chemical change in materials and results in their damage and destruction. The most destructive air pollutants to materials are smoke, grit, dust and oxides of sulphur.

Air sensitive receptors (ASRs) such as inhabited stretches, commercial zones, schools, hostels, hospitals, office occupancies, place of public worship, sports stadium are considered as ASRs. The boundary of air quality impact considered to be adjacent (50m) to the project alignment and boundaries of all associated construction establishment areas under the project. More than 60 ASRs (Schools, Colleges & Hospital), are considered to be most likely to be affected by the construction of the project. The representative stretches of inhabited stretches (ASRs) are listed in Table 5-8 and their locations are illustrated in Annexure.

DG sets will be used at construction camps and construction sites for various construction activities. Particulate and gaseous emissions are expected from DG sets. The impacts will be short term and limited in nature. Proper site selection, appropriate location of plant and regular maintenance and monitoring shall minimize such impacts. However suitable mitigation measures such as using chimneys of required height will be ensured as per the KSPCB norms. There will not be use of DG sets during operation phase of the project.

Table 5-8: Details of Air Sensitive Receptors (ASRs) along the proposed corridor

Sl. No.	Location of Air Sensitive Receptors (Inhabited stretches)	Chainage	Length impacted (M)	LHS/ RHS
Phase I				
1	Jayamahal Road	1+200 to 1+600	400	RHS
2	Jayamahal Road	1+900 to 2+400	500	RHS
3	Millers Road	3+400 to 3+800	400	RHS
4	Millers Road	3+450 to 3+690	240	LHS
5	Cock Burn Road	4+750 to 5+400	650	LHS
6	Hosur Road Elevated Express way	12+100 to 12+400	300	RHS
7	Hosur Road	12+600 to 12+700	100	LHS
8	100 Feet Ring Road	0+000 to 0+250	250	LHS
9	100 Feet Ring Road	1+300 to 1+410	110	LHS
10	Sarjapur Main Road	1+570 to 2+200	730	RHS
11	Sarjapur Main Road	2+480 to 3+310	830	RHS
12	Sarjapur Main Road	2+600 to 3+000	400	LHS
13	District Office Road	Exit Ramp	300	LHS
14	Shamanna Main Road	10+700 to 11+200	500	RHS
15	Raja Ram Mohan Roy Road	17+160 to 17+390	230	LHS
	Total		5940	

Sl. No.	Location of Air Sensitive Receptors (Inhabited stretches)	Chainage	Length impacted (M)	LHS/ RHS
Phase II				
1	NH-4 Road	1+100 to 1+300	200	RHS
2	NH-4 Road	1+300 to 1+400	100	LHS
3	NH-4 Road	2+100 to 3+000	900	RHS
4	NH-4 Road	2+500 to 3+040	540	RHS
5	D Bhaskaran Road	10+600 to 10+700	100	RHS
6	D Bhaskaran Road	10+600 to 10+700	100	LHS
7	St Johns Church Road	12+800 to 13+300	500	LHS
8	Promenade Road	12+800 to 13+000	200	RHS
9	CV Raman Road	18+100 to 18+500	400	LHS
10	CV Raman Road	18+600 to 18+900	300	LHS
11	Ramamurthinagar Main Road	3+600 to 5+600	2000	RHS
12	Ramamurthinagar Main Road	3+600 to 5+400	1800	LHS
13	General KS Thimaiah Road	0+700 to 1+000	300	RHS
14	Kensington Road	2+000 to 2+200	200	LHS
15	Wheeler Road	0+000 to 0+500	500	LHS
16	Kensington Road	0+700 to 1+000	300	LHS
17	Kensington Road	0+580 to 1+120	540	RHS
	Total		8980	
Phase III				
1	Lal Bagh Fort Road	19+500 to 19+800	300	RHS
2	Lal Bagh Fort Road	19+470 to 19+800	330	LHS
3	Armugam Mudaliar Road	19+100 to 19+600	500	RHS
4	Alur VenkataRao Road	20+700 to 21+090	390	LHS
5	Alur VenkataRao Road	21+100 to 21+700	600	RHS
6	Alur VenkataRao Road	21+300 to 22+950	1650	LHS
7	Mysore Road	23+100 to 23+400	300	LHS
8	Mysore Road	23+800 to 24+200	400	RHS
9	Mysore Road	24+690 to 25+100	410	LHS
10	5th Main Road (Rajagopalanagar)	20+850 to 22+450	1600	RHS
11	5th Main Road (Rajagopalanagar)	20+850 to 21+930	1080	LHS
12	5th Main Road Ramachandra Agrahara	22+200 to 22+450	250	LHS
13	HAL Airport Road	0+500 to 1+100	600	LHS
14	HAL Airport Road	4+600 to 4+800	200	LHS
15	HAL Airport Road	4+900 to 5+200	300	RHS
16	HAL Airport Road	5+400 to 6+300	900	LHS
17	Old Airport Road	9+450 to 9+650	200	LHS
18	Old Airport Road	9+700 to 9+900	200	LHS
19	Old Airport Road	10+050 to 10+110	60	LHS
20	Old Airport Road	12+290 to 12+600	310	RHS
21	Old Airport Road	12+400 to 12+600	200	LHS
22	Richmond Road	16+070 to 16+250	180	LHS

Sl. No.	Location of Air Sensitive Receptors (Inhabited stretches)	Chainage	Length impacted (M)	LHS/ RHS
	Total		10960	
Phase IV				
1	Dodda Banaswadi Main Road	1+300 to 1+810	510	RHS
2	Dodda Banaswadi Main Road	1+990 to 2+240	250	RHS
3	Dodda Banaswadi Main Road	2+300 to 2+810	510	RHS
4	Dodda Banaswadi Main Road	2+500 to 2+800	300	LHS
5	Dodda Banaswadi Main Road	3+000 to 3+800	800	RHS
6	Dodda Banaswadi Main Road	3+600 to 4+100	500	LHS
7	8th Main East Road	4+600 to 5+500	900	LHS
8	8th Main East Road	4+600 to 5+500	900	RHS
	Total		4670	

Mitigation measures:

During construction, the following mitigation measures should be employed in order to minimise the impact on air quality.

- All construction sites, material haulage roads and the traffic diversion routes shall be sprayed with water two to three times a day. Water spraying is needed to compact the soil properly and prevent dust.
- The materials transported to and from the construction site should be properly covered with tarpaulin;
- Temporary stockpiles of soil or other material should be covered or sprayed with water on a regular basis, particularly during dry or windy conditions;
- All stockpiles should be located far from residences and businesses where possible, prevent placing dusty material storage piles near ASRs;
- Water sprinkling should be done regularly to suppress dust on at grade roads, temporary traffic diversion roadways and other exposed areas;
- Dust-generating activities should be minimised during windy conditions, particularly when dust is visible in the air.
- Additionally, all plant, equipment should be maintained and operated to specifications to minimise emissions of other gaseous pollutants.
- Construction vehicles used for the construction shall be serviced regularly to ensure that the air pollutants emissions are not exceeding the norms prescribed by CPCB and shall obtain the Pollution Under Control Certificate.
- Siting of all construction establishments such as hot mix plants, batching plant, crusher plant, construction camps and offices shall ensure compliance to all legal requirements and strictly adhered conditions stipulated in the consent.

- Human settlements should be at least 500 m down windward of hot (asphalt) mix plants, batching plants, crushers, etc. These construction establishments should be compulsorily fitted with dust suppression units.
- Dust generation during construction would be managed well through the implementation of Environmental Management Plan.
- Ambient air quality monitoring shall be done regularly at all the representative sensitive locations to ensure that all the emissions from construction activities are within the National Ambient Air Quality Standards by CPCB and implement required mitigation measures if any of the air pollutant exceeds the limit.

5.2.6 Impact on Noise Quality

The community living adjacent to the project corridor and those involved in construction of project corridor will be adversely affected by increase in ambient noise levels due to construction activities. Various construction activities such as demolition of structures within the proposed right of way, grading of the site, excavation and drilling operations for pile foundations, construction of structures and facilities, movement of heavy construction vehicles, loading, transportation and unloading of construction materials, equipment & machineries to construction site and unserviceable materials from construction site to disposal sites. Further, activities such as blasting at stone quarry sites, crushing plants, asphalt production plants, produce significant noise during the construction stage. Traffic diversions during construction also contribute to the increase in noise.

Table 5-9 summarizes the noise emissions from different construction equipment which may be used in the elevated corridor project. Equipment and operation noise levels are expressed in terms of L_{Max} noise levels

Table 5-9: Average noise levels generated from equipment used in construction[7]

Sr. No.	Equipment	Noise Level in dB(A) (L_{max} @ 50 feet (DBA, slow))
1	Batching Plant	83
2	Concrete Pump Truck	82
3	Dumpers	84
4	Cranes	85
5	Dozer	85
6	Generators	82
7	Excavator	85
8	Trailer	84
9	Jackhammer	85
10	Hydraulic Hammer	90
11	Compactor (ground)	83
12	Compressor (air)	78
13	Impact Pile Driver	95
14	Vibratory Concrete Mixer	80
15	Auger Drill Rig	85

[7] These values represent the default values for use in the Roadway Construction Noise Model (RCNM), Federal Highway Administration's (FHWA), national model for the prediction of construction noise.

Increase of noise around 90 dB (A) creates fatigue of the hearing organs. Prolonged living in an area infested with noise pollution may gradually induce deafness. Increased noise may induce in human body various types of temporary physiological changes, such as hypertension, change of the rate of heart-beat, high respiratory rates, excessive perspiration, vomiting tendency, vertigo, exhaustion and disturbs sleep. If the noise is intolerable, it can tend people to shift to far off places.

It is expected that the increase in noise levels on the elevated roads depends on several factors like type of vehicle, age of the vehicle, type of pavement (rigid and flexible) speed of the vehicle, distance of sensitive receptor from the source of noise generation, height of the super structure (crash barrier) on the elevated roads.

All the identified inhabited stretches are prone to increased noise. Further, noise sensitive receptors like schools, hostels, hospitals, libraries, civil courts are largely impacted from project activities both during construction and operation phase. Some of the noise sensitive receptors along the proposed corridors are tabulated in the Table 5-10 below.

Table 5-10: Noise sensitive receptors along the proposed corridors

Chainage		Schools/Colleges/Hostels/Hospitals	
From	To	LHS	RHS
NS Corridor			
Starting from Airport road flyover near Columbia Asia Hospital			
0+250	0+300	Columbia Asia Hospital, Hebbal	
3+950		R S College of Management & Science	
Starting from Mekhri Circle			
1+600			Indian Institute of Ayurvedic Medical and Research
3+100		United Theological College	
4+250		HKBK Degree College, Cantonment Railway Station Road	
4+400		Church of South India Hospital, Hazarat Kambal Posh Road	
4+830			Shifaa Hospital
			Hope Medical Centre, Queen's Road, Vasanthanagar
6+670		British Library, Kasturaba Road, Richmond Town, Bengaluru,	
8+200	8+300	United Mission High School	
8+600	8+700	Government College of Pharmacy	
10+000	10+100	Outreach School	
11+900	12+000	Shanthigiri Ayurveda & Siddha Hospital	
EW1 Corridor			
	2+100		Vidyarthi Education Academy
2+400	2+500		Sri Ramakrishna Hospital
2+900	3+000		Sri Ram Hospital
3+100	3+200	ESI Hospital	Government Hospital
5+400		Apple Kids	
12+300	12+400	Lakeside Medical Centre & Hospital	
12+900	13+000		Conrad Higher Primary School

Chainage		Schools/Colleges/Hostels/Hospitals	
From	To	LHS	RHS
13+200	13+400		St. Germain PU College
14+500	14+600		United Theological College
16+100	16+200		Eches Boys Hostel
16+300	16+400		H R H A Primary High School
18+100	18+200		Air Force School Hebbal
19+300	19+400		JRD Tata Memorial Library
20+000	20+100		New Boys Hostel
20+300	20+400		Kendriya Vidyalaya,
21+300			Indian Institute of Sciences
EW2 Corridor			
1+100	1+300	Government School	
1+600	1+700	Royal English School, Siddapura	
2+390		Prishti Pre-school	
3+000	3+100	Government Primary School	
3+400	3+500		Picasso Animation College
3+900	4+000		Sankara Eye Hospital
4+100	4+200	Yashoda Medicare and Research Center	
4880		MGA Hospital	
6+400		Deepa Nursing Home	
9+450	9+600	M Visvesvaraya College	
9+700			Cloud 9 Hospital
10+500		Manipal Hospital	
10+900		Seventh-day Adventist English High School & Pre-University College	
11+370			Manipal Global Education Services (P)
13+600	13+700		Command Hospital
15+300	15+400	Vardhaman Mahaveer Jain School	Kedriya Vidyalaya
15+900		All Saints Church and Cathedral High School	
17+300		St. Joseph College	
17+700		Kalakusuma Film Institute and Studio, Lalbagh Main road	
17+900	18+000	Govt. College of Pharmacy, Subbaiah Circle	
18+500		Jain University & Sri Bhagawan Mahaveer Jain College	
18+600		St Thomas Church,	School of Graduates
19+900	20+000	Bangalore Medical College	BMCRI Ladies Hostel & ENT Government Hospital
20+200	20+300	Minto Eye Hospital	Vanivilasa Hospital
20+400	20+500	Jnana Jyothi College of Business	
20+800	20+900	Wisdom International School	
21+000	21+100	Sri Morarji Desai Model School	JJ Ramanagar Referral Hospital
CC 1 Corridor			
1+200	1+300		Asia Pacific World School
1+400	1+500	Government Middle School	
1+900	2+400	Krupanidhi PU College	

Chainage		Schools/Colleges/Hostels/Hospitals	
From	To	LHS	RHS
2+300			St Francis High School & College
2+700	2+800		Amity Global Business School
2+800	2+900	CGHS Wellness Centre Hospital	
2+900	2+950		Greenwood High Pre School
3+000	3+100		The Freethinking School
3+200	3+300		Dr. Agarwal`s Eye Hospital
3+300		Indian Institute of Astro Physics	
3+600	3+700		St. John's Hospital
CC 2 Corridor			
0+200	0+500		Kendriya Vidyalaya
1+650			Sri Guru Harkrishan High School
CC 3 Corridor			
0+100	0+200	RTC Girls High School	
1+000	1+100		Government School
1+100	1+200		Ambedkar Girls Hostel
2+600	2+700		Apple Hospital
3+450		Paul’s Primary High School	
3+700	3+800		Dewan’s Hospital
5+700		Parankushachar Institute of Vedic Studies	

Construction workers are affected by the construction noise. It is true that intermittent and impulse noises are less dangerous than continuous noise due to the short exposure duration except under the situation when the level exceeds 115 dB (A).

Mitigation measures:

- The effective control of construction noise can be achieved by using a three-part approach consisting of control of the noise at the source; control along the path of the noise and control at the receptor. During construction, the following mitigation measures should be employed in order to minimise the impact from increased noise levels during the construction of elevated corridor project.
- The type of pavement on the elevated corridor affects the noise generated from the roads. Rigid pavements are known to generate more noise than the flexible asphalt roads.
- Properly designed and maintained equipment & machinery with in-built silencers, mufflers and enclosures and shock absorbing pads shall be used in construction. This would reduce their noise by 5 to 10 dB (A)
- Locating noise emitting stationary equipment away from noise sensitive receptors would decrease the impact of noise.
- All construction establishments such as batching plants, hot mix plants, casting yards, construction camps shall be sited away from the human habitations. In addition, greenbelts around the construction establishments shall be planned to obstruct the noise transmission. Further, The plant and equipment used in construction shall strictly conform to CPCB noise standards.

- Generally, piling is driven using an impact hammer which often produces excessive noise levels. This noise can be reduced by various dampening and shielding methods. Further, an alternative to driving piles, vibration or hydraulic insertion can be used. Drilled holes for cast in place piles are another alternative that may produce noise levels significantly lower than the traditional driving method.
- A large part of the noise emitted is from the intake and exhaust parts of the engine. A remedy for controlling much of the engine noise is the specification and use of muffler systems. Muffler requirements shall be made as contract specifications.
- Poor maintenance of equipment causes high noise. Faulty or damaged mufflers, loose engine parts, rattling screws, bolts or metal plates contribute to increase in the noise level from a machine. Poor maintenance, improper handling and operation of equipment also increase noise levels. Specifications / instructions shall be included to the Contractors to ensure all equipment are regularly inspected.
- Noise levels may be regulated by stopping all the noise generating construction works at night time near the inhabited localities. Noisier construction and demolition activities to be limited between 6 AM and 10 PM would comply to reduce construction noise impacts during night hours.
- Turning off construction equipment during the prolonged periods of non-use would eliminate noise from construction equipment during those periods. Continuous loud noises around noise sensitive receptors such as schools, hospitals, etc., are disturbing at all times. Restriction of construction activity to limited time periods can be effective in reducing noise induced impacts.
- Construction equipment and vehicles carrying spoil, concrete or other materials can be routed over those streets that could cause least disturbance to residents in the vicinity of the project. The contractor shall propose and get the approval for such proposed hauling routes prior to the construction.
- Dissemination of information to the public and adjacent property owners of upcoming noise impacts related to the construction activity. The scope of the proposed work and when possible, the time span of the activity should be spelt out in order to allow residents to plan their activities accordingly.
- Efforts shall be made to reduce truck trips by increasing load size, decreasing fill requirements, or combining trips would reduce noise levels.
- Ensure proper personal protective devices to all the persons working in high noise zones.
- Regular monitoring of noise levels shall be done at noise sensitive locations along the construction sites and associated construction establishments to monitor and have a control over increase in noise.
- IS 4954 - Recommendations for Noise Abatement in Town planning, 1968 (reaffirmed 2006) shall be considered during design of corridors.

- Increased noise and its transmission to sensitive receptors from the vehicles can be controlled and regulated by providing suitable noise barriers. Noise barriers are constructed to suit the acoustic requirements and aesthetic considerations as well.
- Sign boards on restricting use of horns and speed limit shall be erected at all the noise sensitive receptors.

5.2.7 Impact on Biological Environment

Removal of these trees will impact the quality of air. Trees are major sources of air purification in urban areas making cities socio-economically and environmentally more sustainable. Trees clean air by absorbs CO2 from atmosphere and play an important role in climate change mitigation. Trees in cities will help to control temperature and keeps the air cool, thus reducing the urban heat island effect.

Loss of trees: The impact on the trees is unavoidable as the alignment of the corridor is taken almost along the existing roads which have substantial width to accommodate lanes for the projected traffic. There will be a significant impact on trees by construction of elevated corridors. Space of about one meter beyond actual corridor of impact is required on both sides to carryout construction activities and for safety reasons. This requires tree branches obstructing the construction of elevated structures to be pruned.

Not all the trees along the elevated corridor are to be cut. Trees along some of the stretches are to be pruned as the height of the elevated structure is much higher than the height of the trees. Hence, the trees impacted are grouped under two headings i.e. trees to be cut and trees to be pruned. Phase wise details of impacted trees are as shown in Table 5-11.

Table 5-11: Trees impacted along the proposed project corridors

Trees to be Cut / Trimmed	Phase I	Phase II	Phase III	Phase IV	Total
Trees to be cut (within CoI)	940	710	983	376	3009
Trees to be trimmed / pruned	212	120	241	28	601
Total	1152	830	1224	404	3610

There are a few identified environmentally sensitive thickly wooded stretches which are affected by the project. These are mainly located along North-South corridor, East –West Corridors 1 & 2 as detailed in the following table and shown in Annexure.

Table 5-12: Environmentally sensitive wooded stretches

Sl. No.	Location of Sensitive wooded Stretches	Approximate Length impacted (M)	Approximate number of trees (Nos.)	Phase No.	Corridor Name
1	Cubban Park, Kasturabha Road	876	120	Phase I	NS
2	Near Bengaluru Palace, Jayamahal	1100	356	Phase I	NS

Sl. No.	Location of Sensitive wooded Stretches	Approximate Length impacted (M)	Approximate number of trees (Nos.)	Phase No.	Corridor Name
	Road				
3	Coles Park, Promenade Road	350	47	Phase II	EW 1
4	IISc Campus to Mekhri circle, CV Raman Road	1350	195	Phase II	EW 1
5	IISc Campus to Yeshwanthpur circle, CV Raman Road.	900	32	Phase II	EW 1
6	Raja ram Mohan Roy Road	960	108	Phase I	EW 2

The proposed elevated corridors are within Bangalore Metropolitan Region and does not pass through any forests and wildlife sensitive zones.

Mitigation measures:

- Trees cutting and felling shall be done only after the confirming that the tree comes in the way of construction.
- Trees cleared shall be replaced with minimum of 10 trees per tree cut or according to Compensatory Afforestation Policy under Forest Conservation Act-1980.
- No damage shall be caused to the trees other than trees to be felled along the proposed during construction activities. No paint thinner, paint, plaster or other liquid or solid excess or waste construction materials or wastewater shall be dumped on the ground or base of the tree.
- Wherever cuts are made in the ground near the roots of trees, appropriate measures shall be taken to prevent exposed soil from drying out and causing damage to tree roots.
- Where feasible all possible efforts shall be made to transplant the trees to a safer and preapproved location. Transplanting of tree depends on general health, form and structure of the tree; size and quality of root system; size of trees, species and conservation status of a tree; availability and suitability of a receptor site, time for preparation, cost effectiveness, etc.
- Vertical garden shall be grown on the piers to enhance the aesthetic value and to address the vehicular pollution.
- Suitable ornamental plants shall be planted in medians of at grade roads all along the proposed alignment of elevated corridors.

5.2.8 Impact on Water Bodies

There are many water bodies along the proposed route of elevated corridors which are brought out in Table 5-13. Construction of the project corridor and the associated activities will impact on the water bodies and its ecology. The debris generated from the demolition of structures and excavation for pile foundation could potentially find its way to the nearby water bodies adjacent to the project corridor. This will not only silt up the lakes but also impact the aquatic life in these waterbodies.

Table 5-13: Details of waterbodies adjacent to the project corridor

Sl. No.	Phase No.	Water bodies / Lakes	Name of the Corridor	LHS / RHS	Distance of pier foundation from Water body (m)	Location
1	Phase I Package - I	Hebbal Lake	NS	RHS	5	Near Hebbal Flyover
2	Phase II Package - I	KR Puram Lake,	EW-1	RHS	20	Along NH 4
3	Phase II Package - I	Benniganahalli Lake	EW-1	RHS	350	Swamy Vivekananda Road
4	Phase II Package - I	Pond near Sarvagna Nagar	EW-1	RHS	20	Swamy Vivekananda Road
5	Phase II Package - II	Ulsoor Lake	EW-1	LHS	5	Kensington Road
6	Phase V Package - I	Varthur Lake	EW-2	LHS/ RHS	5	HAL Airport road and along SH 35 respectively
7	Phase V Package - I	Thubarahalli Lake	EW-2	RHS	120	Varthur road / HAL Airport road
8	Phase IV Package - I	Vrishabhavathi Nalla	EW-2	LHS / RHS	5	Mysore road
9	Phase I Package - III	Agara Lake	CC-1	LHS	30	Sarjapur main road
10	Phase II Package - II	Challkere	CC-3	RHS	30	100 ft. Ring road
11	Phase - II	Rajakaluve	CC-3		1	At Banasawadi
12	Phae I Package - II	Rajakaluve	NS		1	At Shathinagar Bus Depot

None of the proposed corridors are passing over the water bodies. However, as the elevated corridor alignments are proposed along the existing roads which are parenthetically adjacent to the waterbodies, except Thubarahalli Lake all other water bodies mentioned in table are within the buffer zone established by NGT Order.

It is also important to mention that looking at the feasibility and other parallel project developments from various department like BDA, BMRCL, BBMP, etc. there are some changes in the proposed lengths. Significant changes which reduce the impact on water bodies are as follows.

The start point of North-South Corridor will start from Baptist Hospital instead of Esteem Mall. Now, the start point is at a distance of almost 1 km

Vehicles operating on the elevated road release engine oil which are carried by surface runoff during monsoon, which is ultimately thrown in to the nearest waterbodies. Over the time accumulated oil forms a thin layer on the surface of the water and lead to eutrophication.

There is no significant impact on either ground water or water table by the project activities. The elevated corridor is proposed along the existing paved roads which are not making significant impact on the ground water percolation and ground water potential.

Mitigation measures:

- Rain water harvesting will be proposed to collect the surface runoff from the elevated paved surfaces and made to recharge ground water in the available median space after the required treatment to remove the oil.
- Proper and regular maintenance shall be carried out to clear the debris on the elevated road which otherwise choke the drains.
- To prevent these impacts effective mitigation measures shall be ensured to control the spillage of debris / construction materials into water bodies particularly where the project corridor is passing adjacent to waterbodies.

5.2.9 Impact on Land Environment

Construction of projects in urban areas involves both cut and fills activities and requires use of construction materials from quarries and excavations of soil from borrow pits. From a resource perspective, there are benefits from using excavated soil and rock as a construction material, particularly in the construction of ramps used to access the elevated corridors.

Construction of elevated corridors requires about 12 Lakh cum of borrow earth which have to be sourced from the nearby approved murrum borrow pits. The earth excavated from pile foundations shall be used for

Sl. No.	Project Phases	Quantity of excavated earth generated (Cum)	Reuse of construction excavated soils & debris (Cum)	Unserviceable construction waste to be disposed (Cum)
1	Phase I	154030	123224	30806
2	Phase II	58278	46622	11656
3	Phase III	83555	66844	16711
4	Phase IV	1863	1488	375
	Total	297726	238178	59548

The unserviceable debris generated from project construction activities shall be disposed of in a scientific and sustainable manner in the abandoned quarries located in and around

Bangalore city. Though the lead and lift is incidental to the civil works, contractor will be paid to handle the debris in a sustainable manner.

5.2.10 Impact on Structures (Religious, Community structures and Historical and Cultural Monuments

Construction of corridor project will directly impact on structures residential, commercial, residential cum commercial, religious, community and others which are directly under CoI of elevated structure and needs to be demolished. List of impacted structures are given in Table 5-14. Further, during construction access to these centres to the public will be impacted temporarily.

These impacted structures need suitable resettlement and rehabilitation in consultation with the local public.

Table 5-14: The structures under impact in the project area (Nos)

Sl. No.	Corridor Name	Residential	Commercial	Res/ Com	Religious	Govt./ Community	Educational	Others	Total
1	NS Corridor	169	48	1	6	8	1	62	295
2	EW 1 Corridor	0	155	15	8	3	2	42	225
3	EW 2 Corridor	32	339	5	14	2	5	146	543
4	Connecting Corridor 1	0	0	0	0	0	0	2	2
5	Connecting Corridor 2	4	1	0	2	0	0	6	13
6	Connecting Corridor 3	4	33	0	2	0	1	12	52
	Total	209	576	21	32	13	9	270	1130

There are two notified archaeological structures along the East West Corridor - 2. Tipu Sultan's Summer Palace being a protected monuments as per the Ancient Monuments and Archaeological Sites and Remains (Amendment & Validation) Act, 2010(prohibited area), is within a distance of 100 metres from the proposed East West Corridor - 2. Another notified structure Old Dungeon Fort & Gates is at a distance of 330 m from, beyond regulated area (200 meters further beyond prohibited area as per the latest circular). The vibrations induced by piling activity typically influence the zone stretching 10 – 50 m from the operation. Hence, there is no significant impact on the notified structure.

Mitigation measures:

- Compensation has to be settled before the start of project for all the structures being impacted as per the KIADB Act with compensation at par with the Land Acquisition, Rehabilitation and Resettlement Act, 2013.
- All the impacted cultural and community structures are to relocated and rehabilitated to proper location in consultation with the local community.
- All necessary and adequate care should be taken to minimize the impact on cultural properties.

- If valuable or invaluable articles such as fabrics, coins, artefacts, structures or other geographic or archaeological rarities are discovered, the excavation should be stopped and the archaeological department to be contacted.
- Permission from National Monument Authority shall be obtained before the start of construction in the area falling within protected area notified by the authority.
- The press-in method, an alternative technique of pile installation, which allows pre-formed piles to be installed with minimal noise and vibration.
- Pre-formed steel piles shall be preferred within the notified prohibited area.
- Mini or Baby rollers shall be used for compaction to reduce the vibration

5.2.11 Impact on Livelihood, Public services, Health and Safety of Community and Labourers

There will be lot of inconveniences and nuisance to the public temporarily during construction of the project. Inconveniences will be caused by utility shifting, excavations, unplanned stacking of excavated earth and traffic diversions in the vicinity of project corridors. Construction activities causes disturbance to traffic along the proposed alignments resulting congestion, traffic diversions, increased dust generation, emission of air pollutants by slow moving traffic. The commercial activities along the proposed alignment will be affected and incurs loss to the retailers and businessmen. Increase in noise along the corridors will impact inhabitants particularly old age community and school children and the patients.

The construction of proposed elevated corridors will impact on utilities both on the road and under the ground. Utilities such as electricity, telephone, optical cables, storm water drains, UGD, water supply resources, optical cables, etc. are common utilities to be affected during the construction stage. The inventory on the number of affected utilities above the ground is in progress.

In addition to the above concerns, there will be regional labour issues, safety of children and the elders, possibility of spread of communicable disease, etc. The issues related to safety shall be addressed by properly locating the labour camps and construction establishments sufficiently away from thickly populated areas to avoid the pressure on the local resources facilities. Construction zone should be separated by providing appropriate barricading, providing personal protective equipment (PPE) to labourers, educating and training the labourers and local community, and establishing labour camps quite far from the inhabited areas.

These impacts are temporary in nature, however, it needs planning, coordination and management to reduce the intensity of the impact and sustainable completion of the project.

Mitigation measures:

- All the utilities shall be shifted properly to safe and pre-planned locations before the start of construction such that the impact on livelihoods is not affected much.

- Contractor shall prepare traffic management plan addressing all the traffic issues in the project corridor alignment and get the approval of engineer concerned.
- Semi-skilled and unskilled labourers would be recruited from nearby areas to create some employment opportunities and sense of well-being among local people. This will also reduce social tension of migration and the necessity establishing labour camps within the city thus alleviating impacts associated with establishment of labour camps.
- All the labourers engaged in the construction works are provided with proper camp facilities including sanitation, drinking water supply, washing facilities, cooking facilities and primary health facilities.
- Construction workers are ensured adequate safety measures complying as per the occupational safety requirements to prevent accidents and hazards. Safety of workers during construction should be ensured by providing them with helmets, masks, safety goggles etc.
- The workplace shall have proper medical facilities approval by the local medical health or municipal authorities. At every work place, a readily available first aid unit, including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff and an attending doctor, to be provided.
- To ensure safe construction, the temporary accesses during construction, lighting devices and safety signals shall be installed and traffic rules and regulations to be strictly followed.
- The electrical equipment should be checked regularly to avoid risks to workers.

5.2.12 Impact on Economy

During construction phase, local people involving construction activities earn their livelihood in the form of wages and salaries. Local retail shops get their business by construction workers, making everyday purchases. This is likely to give a short-lived stimulus to daily commercial activities till the completion of project. Broader, flow-on economic impacts will be experienced in other sectors of economy as a result of purchase of construction materials. During operation stage, after the construction is complete, there will be a few long-term benefits in the economic structures of the Bengaluru city due to improved access to the different parts of city and suburban areas in the periphery.

5.2.13 IMPACTS DURING OPERATION STAGE

During operation phase no significant adverse impact is envisaged on the environment. However, Ambient air quality will be improved compared to present condition as the at grade traffic congestion will be reduced. However increase in number of vehicles over the period of design life may increase the air pollution along these corridors. Reduction in traffic congestion will reduce the air pollutant emissions due to reduction in acceleration and deceleration and also reduces the dust generated from the operating vehicles. Noise levels along the corridors will be reduced considerably as the use of horn will reduced. However, speeding vehicles will generate the noise by the friction of tyres with the pavement which may be annoying to the inhabitants adjacent to the corridors especially during nights.

5.2.14 POSITIVE IMPACTS OF ELEVATED CORRIDOR PROJECT

Construction of elevated corridor in a city like Bengaluru will also yield tangible benefits such as better accessibility, less atmospheric air pollution, less travel time, comfort and improved quality of life. The impact on the economic growth of the city, improved quality of life, reduced air pollution and its impact on health and wellbeing of city dwellers which are difficult to quantify. Some of the positive impacts have been listed and discussed below.

Employment Opportunities - The project during construction is expected to generate employment in the secondary and tertiary sector during construction and operation phases respectively. During the construction phase, there will be requirements for unskilled labourers.

Safety – The proposed corridor will be safer, efficient and faster compared to the present roads. Also reduction in traffic congestion will make the roads safer and will reduce the incidence of accidents.

Traffic Congestion Reduction – Proposed elevated corridors are aimed to provide quick access and reduce traffic congestion on the main roads in the city.

Less Fuel Consumption – The proposed elevated corridors are signal free and planned to give access to all important peripheral roads leading suburban areas and Bengaluru International airport. Ease of traffic movement on the elevated corridors and reduction of vehicles on at grade roads will help in reduction of fuel consumption in the city.

Reduced Air Pollution – Implementation of elevated corridor will reduce the traffic congestion on the at grade roads. Vehicle users prefer elevated corridor as it will serve as faster and convenient alternative to congested at grade roads. This eases the traffic on the roads and reduces traffic jams leading to reduction of gaseous emissions and improves the air quality in the city.

Traffic Noise Reduction - Any reduction in traffic and traffic congestion will also contribute for reduction in the noise levels.

5.2.15 Environmental Impact Matrix

The proposed elevated corridor project requires acquisition of valuable land abutting the proposed alignment. At some locations, it also requires to acquire land for construction of ramps and grade separators. The major environmental impact is due to felling of trees abutting the proposed alignment. Some stretches of the proposed corridor passes through thickly wooded areas. However, compensatory afforestation is suggested to minimize this impact. Increase in noise levels is significant during construction phase particularly at educational institutions. The proposed alignment passes near two notified archaeological monuments. The impact on the surrounding environment by project during the construction and operational stages were envisaged based on the observations during the baseline surveys.

The impacts on the surrounding environment during construction and operational stages are summarized in the Impact Identification Matrix given below in Table 5-15.

Table 5-15: Environmental Impact Matrix for the proposed elevated road project

Environmental Attributes / Different components of project implementation	Physical Environment						Biological Environment		Social Environment			Cultural Environment
	Air Quality	Surface & Ground water quality	Noise	Soil	Hydrology & Natural Drainage	Topography	Destruction of Habitat: Flora	Destruction of Habitat: Fauna	Public Health & Safety	Land use	Public well-being	Temples and Archaeological monuments
I. Pre-construction Phase												
Land acquisition	-	-	-	-	-	-	-	-	-	+ve/p	-ve/p	-ve / p
Demolition of physical properties	-ve/t	-ve / t	-ve/t	-ve / t	-ve / t	-ve / t	-	-	-ve / t	+ve/p	-ve p	-ve p
Cutting of Trees	-ve/p	-ve/p	-ve / p	-ve/p	-ve/p	-	-ve/p	-ve/p	-ve/p	-ve/p	-ve/p	-
Utility shifting	-ve / t	-	-ve / t	-ve / t	-ve / t	-ve / t	-ve / t	-	-ve / t	-ve / p	-ve / t	-
II. Construction Phase												
Clearing, Grubbing	-ve / t	-ve / t	-ve / t	-ve / p	-ve/t	-ve/t	-ve/p	-ve/t	-ve / t	-ve / t	-ve / t	-
Borrowing & Quarrying	-ve / p	-ve p	-ve p	-ve / p	-ve/p	-ve/p	-ve/p	-ve / p	-ve / t	-ve/p	-	-
Pile Foundation	-ve/t	-ve / t	-ve/t	-ve/t	-ve / p	-ve / t	-	-	-ve / t	-	-ve / t	-
Casting and casting yards	-ve/t	-ve / t	-ve/t	-ve / t	-ve / t	-ve / t	-ve / t	-	-ve / t	-ve / t	-ve / t	-
Material Transport & Storage	-ve/t	-ve/t	-ve/t	-ve/t	-ve/t	-ve/t	-	-	-ve / t	-ve / t	-	-
Traffic Diversion	-ve/t	-	-ve/t	-ve / t	-	-	-ve / t	-ve / t	-ve / t	-ve/t	-ve / t	-
Labour / Construction Camp Activities	-ve/t	-ve/t	-ve/t	-ve/t	-ve / t	-ve/t	-ve/t	-ve / t	-ve/t	-ve/t	-ve / t	-
Batching Plant & Hot Mix Plant	-ve p	-ve/t	-ve/t	-ve/t	-ve / t	-ve/t	-ve / p	-	-ve/t	-ve / p	-ve/t	-
Use of Construction Equipment	+ve/t	-	+ve/t	-ve / t	-ve / t	-	-ve / t	-	-ve / t	-	-ve / t	-
Pavement works	-ve/t	-ve / p	-ve/t	-	-ve/p	-	-ve / t	-	+ve / t	-	-	-
II. Operational Phase												
Tree Plantation	+ve/p	+ve/p	+ve/p	+ve/p	+ve/p	+ve / p	+ve/p	+ve/p	+ve/p	+ve/p	+ve/p	+ve/p
Vehicular Movement	-ve/p	-	-ve/p	-	-	-	+ve / p	+ve / p	+ve/p	-	+ve/p	+ve/p

Note: t – Temporary; p- Permanent; Impacts indicated in bold letters are significant impacts.

The impacts indicated above are indicative and represent the impact without mitigation measures.

5.2.16 Matrix Representation

The potential impacts during construction and operation phases are presented in the form of a matrix in Table 1-18. The table of matrix indicates the significance of the impact of different project activities both during construction and operation phases of the project. The quantification of these impacts is done using numerical scores from 0 to 5 as per the following criteria.

Table 5-16: Score to quantify the impacts

Sl. No.	Impact Indicators	Severity criteria	Impact Score
1	-	No impact	0
2	-ve t	Slight / Short-term Impact	1
3	-ve t	Occasional reversible Impact	2
4	-ve p	Irreversible / Long-term Impact	3
5	-ve p	Permanent damage	4

Scores for various environmental parameters and project activities (Pre-construction and Construction phase) are presented in Table 5-17.

Table 5-17: Cumulative Impact Score for the proposed elevated corridor project

Environmental Attributes / Different activities of project implementation	Physical Environment						Biological Environment		Social Environment			Cultural Environment
	Air Quality	Surface & Ground water quality	Noise	Soil	Hydrology & Natural Drainage	Topography	Destruction of Habitat		Public Health & Safety	Land use	Public well-being	Temples and Archaeological monuments
							Flora	Fauna				
I. Pre-construction Phase												
Land acquisition	0	0	0	0	0	0	0	0	0	4	4	3
Demolition of physical properties	2	1	2	1	1	1	0	0	1	4	3	4
Cutting of Trees	4	4	3	4	4	0	4	4	4	4	4	0
Utility shifting	1	0	1	1	1	1	1	0	1	3	1	0
II. Construction Phase												
Clearing, Grubbing	1	1	1	3	2	2	4	2	1	1	1	0
Borrowing & Quarrying	3	3	3	3	4	4	4	3	1	4	0	0
Pile Foundation	2	1	2	2	3	1	0	0	1	0	1	0
Casting and casting yards	2	1	2	1	1	1	1	0	1	1	1	0
Material Transport & Storage	2	2	2	2	2	2	0	0	1	1	0	0
Traffic Diversion	2	0	2	1	0	0	1	1	1	2	1	0
Labour / Construction Camp Activities	2	2	2	2	1	2	2	1	2	2	1	0
Batching Plant & Hot Mix Plant	3	2	2	2	1	2	3	0	2	3	2	0
Use of Construction Equipment	2	0	2	1	1	0	1	0	1	0	1	0
Pavement works	2	3	2	0	4	0	1	0	1	0	0	0
Total Cumulative Score	28	20	26	23	25	16	22	11	18	29	20	7

5.2.17 Determining the sensitiveness of Project Corridor

For analysis of sensitiveness of the project corridor, twelve categories of commonly and frequently occurring environmental attributes present in impact zone, such as inhabitants resided within 50 m from the corridor; trees being cut and pruned within the corridor of impact and buffer zone respectively; impact of noise on noise sensitive receptors like schools, education institutions & hospitals; sensitive religious and community establishments; commercial establishments along the corridor; water bodies adjacent to project corridor; narrow and congested locations which are prone to increased air and noise pollution; impact on the common utilities like electrical lines, water pipelines, optical fibres, manholes; impact from project associated construction establishments such as borrow areas, quarries, batching plants, hot mix plants, construction camps, crushers, etc., are considered.

The total negative impact of various project activities (15 major activities) on an environmental parameter is represented as a cumulative impact score and the cumulative scores of various environmental parameters (12 Nos.) are given as total cumulative score. Any particular parameter having an individual score greater than 10 or more implies serious effects due to the project and calls for suitable mitigation measures. Implementation of mitigation measures in the form of Environmental Management plan will bring down the impact score of the project and reduces the sensitiveness of the project.

6. ADDITIONAL STUDIES

6.1 Rain water Harvesting Potential and Proposal:

In absence of effective management of surface runoff water, elevated corridor may create havoc in the form of flash floods, if the lead drains are not maintained properly during monsoon. Hence, provisions are made to harvest the surface runoff and guide it to ground water recharge pits after suitable treatment.

Rainwater harvesting potential of pavement surface of elevated corridor is calculated and given in Table 6-1. Total of 5,63,000 m3 of harvested water is expected from the elevated structure. The rainwater from pavement surface will be collected through rain drain pipes and made to pass through stabilization tank fitted with specialised oil skimmers for removal of silt, grit and floating oil residues. The treated water will be led into series of percolation pits located in the median of at-grade roads for groundwater recharge.

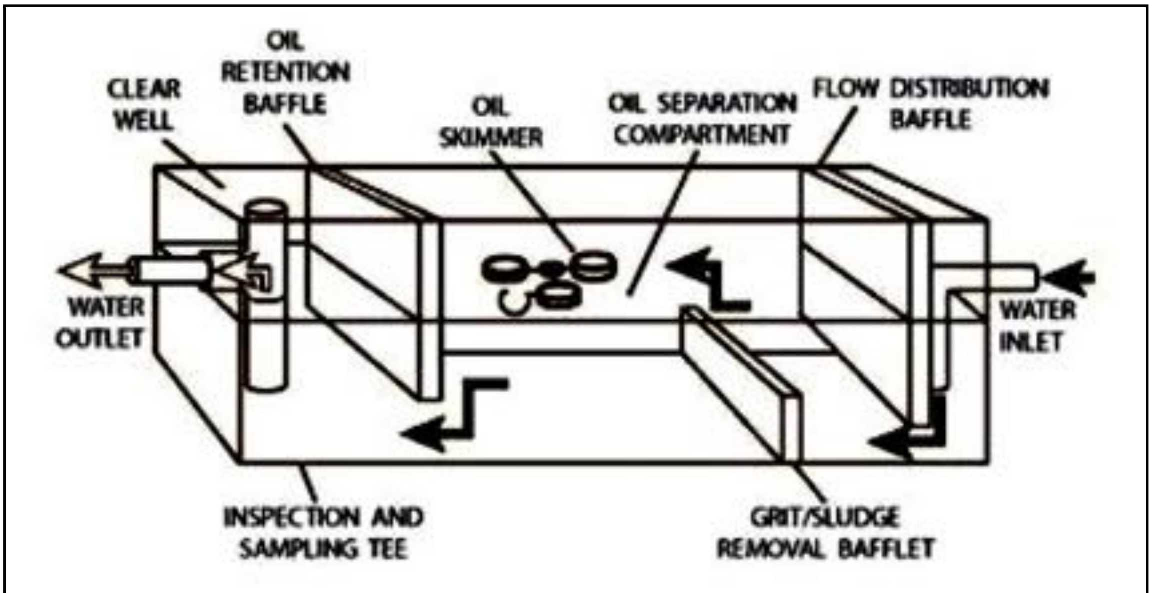
Rainwater from pavement surfaces - 2181105 x 0.86 x 0.3 = 5,62,725 m3 / Year*

Table 6-1: Rainwater harvesting potential of the proposed elevated corridors

Sl. No.	Corridor Name	Corridor Length (Km)	Carriageway area (Sq.m.)	Rainwater harvesting potential (m3/Yr)
1	Phase I	24.47	523046	134946
2	Phase II	41.20	880650	227208
3	Phase III	10.08	215460	55589
4	Phase IV	9.25	197719	51011
5	Phase V	17.04	364230	93971
		102.04	2181105	562725

(* Length of corridor x Width of corridor x Annual rainfall in m (assumed annual rainfall of 0.86 m per year) x Coefficient of runoff)

Figure 6-1: Typical Oil Separation Pits



Rain water harvesting pits will be accommodated in the middle of median structure. The plan of the oil separation pits and rain water recharge pits all along the at-grade median is shown in Figure 6.2. There will be approximately 2500 rain water harvesting pits accommodated between piers. Figure 2-17 shows the pictures of rain harvesting pits along the metro alignment implemented by BMRCL in Bangalore.

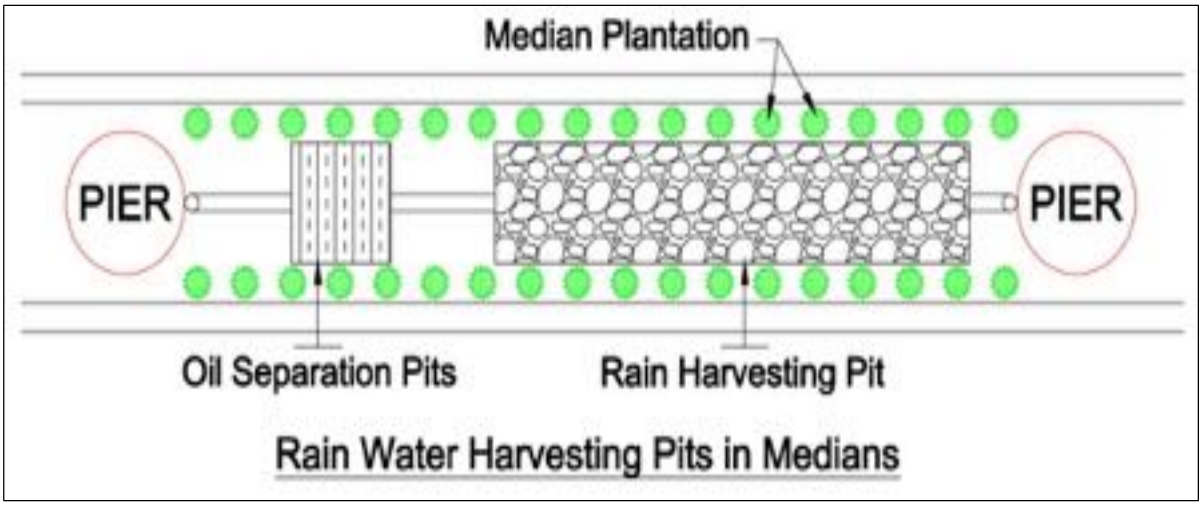


Figure 6-2: Rain Water Harvesting pits in medians

Figure 6-3: Rain Harvesting pits implemented by BMRCL along metro alignment

6.2 Tree Transplantation

No trees shall be cut unnecessarily until the construction starts. Transplanting or felling shall be considered only if it is impossible and impractical to preserve. Transplantation of trees shall be properly planned and implemented to ensure that sufficient space and trees future growth. Priority shall be given to transplant the trees to appropriate locations near to the project site so as to increase the trees' survival rate after transplanting and minimize the loss of greenery in the project area. In absence of space nearby, transplantation shall be done to a suitable location, in the proximity of project site. Tree transplantation is done in following stages.

Identification of trees for transplantation: Identification of large trees for transplantation requires great care and depends on conditions like

- General health, form and structure of the tree
- Size of root ball / quality of root system
- Size of trees
- Species and conservation status of the tree
- Availability and suitability (environmental and cultural factors) of a receptor site
- Time for preparation
- Maintenance requirements
- Access to the existing and receptor locations and transportation
- Site considerations - functional and engineering constraints
- Cost effectiveness

Most common trees suitable for transplantation are Ficus trees (Peepal, Banyan etc.) neem trees, etc.

Soil Sampling, Testing & Site Selection: The soil condition where the tree has to be transplanted is thoroughly checked & necessary treatments are done to the soil after digging a pit. The pit size has to be in accordance with the root ball of the tree. There are specific environmental requirement for each tree. The light, moisture, soil pH, wind exposure & soil drainage should be considered. Transplanted tree requires space for root and crown development therefore adequate distance between other plants is necessary.

Documenting trees being transplanted: Details of the trees being transplanted have to be noted such as girth of tree, space between the adjacent trees and any other relevant, practical information. This information will help during the transplantation and monitoring of tree for its survival and also serve as data bank for similar future works.

Tying up different Departments: Forest Department, BBMP, BESCOM, PWD, Police & Traffic Police whose help is required for successful implementation of transplantation in large scale. It is also important to involve NGOs and connect to the enthusiastic and supportive local public as this activity requires lot of on-site support.

Procurement of required permissions: It is important to check out the protocol for permissions from concerned departments to translocate from one place to other.

Involvement of tree transplantation experts: The experts who have experience in transplantation shall be consulted for identification of tress for transplantation, precaution required during transplantation, post transplantation care, etc.

Provision for Funds: It is important to estimate and strategize funds required for transplantation. The cost of transplanting depends on number of trees identified for transplantation, size of the tree, machinery cost, location of the tree, distance to transplanting location and other constraints.

Safety precautions: Tree transplantation should be conducted in a controlled and safe manner. Sites shall be checked for potential hazards prior to start of transplantation. Workers who are involved in transplanting trees should be given adequate instructions, safety gears and supervision to ensure that transplantation works are completed in a safe manner.

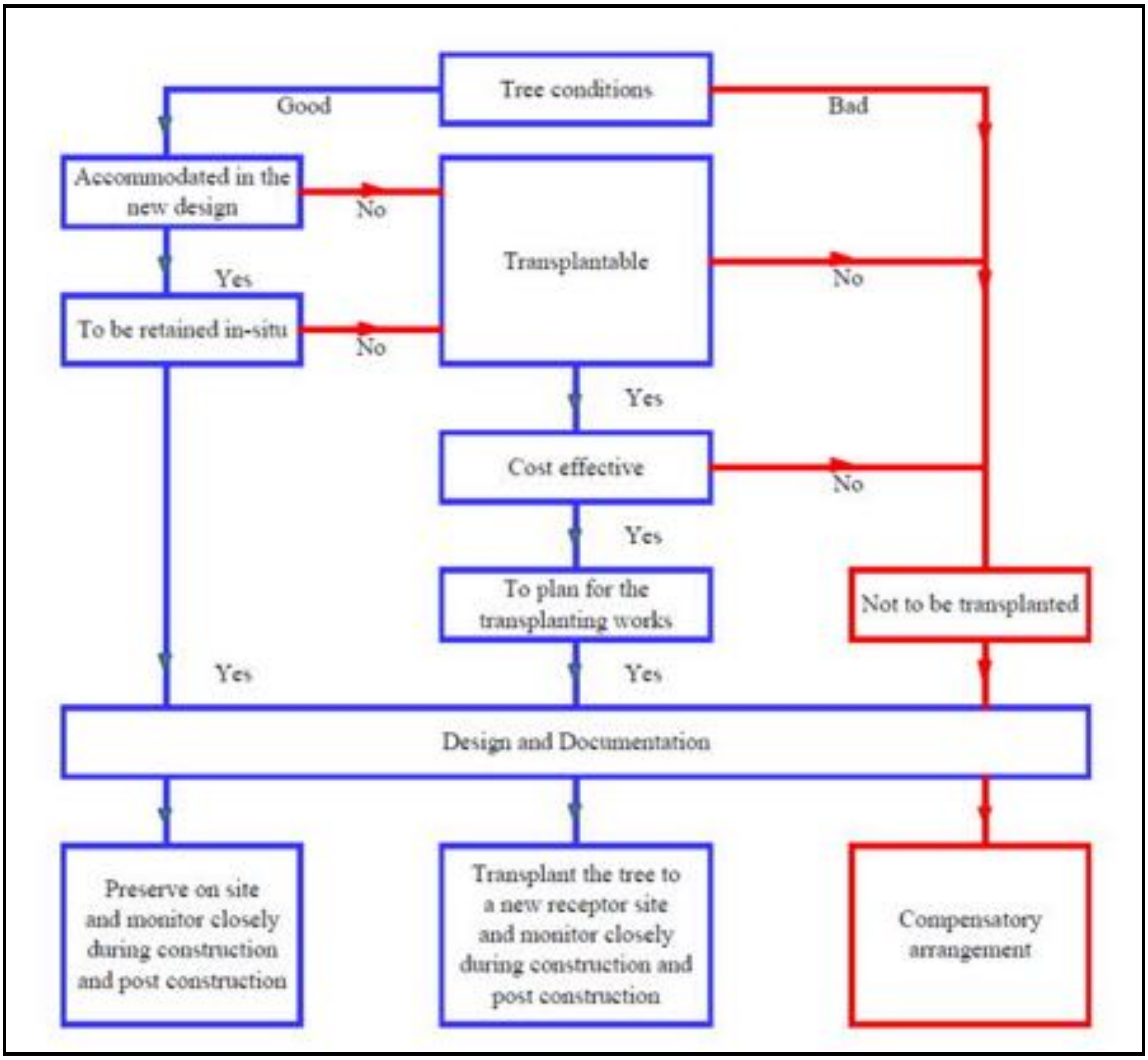


Figure 6-4: The basic work flow of tree transplantation

As per TOR, possibility of transplanting at least 20 % of the trees being affected has been considered for transplantation. The table below has the details of number of trees to be considered for transplantation.

Table 6-2: Corridor wise trees to be considered for transplantation

Trees to be Cut / Trimmed	Phase I	Phase II	Phase III	Phase IV	Total
Trees originally proposed to be cut (within CoI)	940	710	983	376	3009
Trees to be transplanted	212	120	241	28	601
Remaining trees to be cut after transplantation	728	590	742	348	2408

Following are the potential spaces for consideration of transplanting the trees in the nearest possible locations from the original tree locations.

Project Reach	Potential location for transplantation	Remarks if any
Baptist Hospital to Mekhri Circle	Institute of Animal Health & Veterinary Biologicals University of Agricultuaral Sciences (UAS)	
Mekhri Circle to Cantonment	Palace Grounds Para Regiment Training Center	
Cantonment Loop	On the periphery of Quddus Saheb Eidgah & Madina Masjid grounds	
Cantonment Station to Tiffany Circle	Cubbon Park Chinnaswamy Stadium Mahathma Gandhi Park St Joseph School Grounds	
CBD Area Wilson Garden Stretch	Lalbagh Botanical Garden Fort Highschool grounds	
Minerva circle to Nice Road Junction	Eidgah Masjid Maidan Chamrajpet Land behind Mysore Road Eidgah Masjid Jadeedh Eidgah Maidan, Mysore Road	
Bhattarhalli to Ulsoor Lake	ITI Campus, NGEF Layout Satellite Bus Station behind Baiyappanahalli Metro Station. Murphy Town Play ground Ulsoor Lake Pathway	
CC 2	Police Housing Corporation, General Thimmayya Road (behind ASC Centre and College)	
Ulsoor Lake to Cantonement Loop	K V MEG School pavilion Coles Park	
Varthur Lake to Domlur Flyover	Government School Grounds Siddapura Primary Health Centre PHC Grounds Kundalahalli Public Ground, Old Airport Road HAL grounds, Old Airport Road Vishweshwara College Grounds, Old Airport Road Domlur High School Play Ground	1+250 km on LHS 1+900 km on LHS 3+850 km on LHS 8+850 km on RHS 11+950 km on LHS
Domlur Flyover to Richmond Circle	Gun Troops Officers Colony Gowthamapura	14+200 RHS
CC1 St John Circle to Agara Junction	Agara Park Police Public School Grounds 3rd & 4th Battalion Parade Ground, KSRP, Bengaluru St.Johns Medical College Play Ground	0+300 to 0+600 km LHS 2+200 km LHS 2+500 km LHS 3+800 km LHS
NDRI to Silk Borad	NDRI premises	
Mekhri Circle to Yeshwanthpur	Kendriya Vidyalaya Play Grounds IISC Gymnasium	

6.3 Compensatory Plantation Strategy:

It will be considered for the planting of ten trees as compensation for each tree that is cut for construction of elevated corridor. The preference will be given to plant tree saplings along the proposed project alignment to compensate the trees being impacted. In addition, the plantation of trees will also be taken up in the upcoming new layouts in the suburbs of Bangalore city, parks and forests under Bangalore Urban Division shown in table 6-3 below.

Selection of trees species:

The selection of the plants for greenery development is to be made as per the following criteria;

- Plants should be fast growing & have dense canopy cover
- Indigenous species
- Preferably dry deciduous with large leaf area index
- Species resistant to air pollutants and
- Should help to maintain the ecological and hydrological balance in the region

The plant species that are selected based on the climatic condition, soil characteristics and conditions of the area. The row closest to the main carriage way will be of shade plants comprising of ornamental and flowering species. Mainly native deciduous species, which retain their foliage longest, with high crown forms, resistant to fungus and insects with rapid growth rate are selected for avenues.

Some of the preferred species for compensatory plantation are Albizzia amara, Albizzia lebbek, Anogiessus latifolia, Acacia species, Shorea talura and Santalum album

Table 6-3: Forests land available with extent (Bengaluru Urban Division)

Sl. No.	Name of the forest	Forest area in Ha.
1	Jarakabande Reserved Forest	199.92
2	Marasandra Reserved Forest	380.00
3	Kumbaranahalli Reserved Forest	34.07
4	Govindapura Reserved Forest	19.42
5	Arkavathi Reserved Forest	42.89
6	Madappanahalli Plantation	62.29
7	Jarakabande Sandal Reserved Forest	129.81
8	Sulikere Reserved Forest	210.01
9	Turahalli Gudda Protected Forest	238.97
10	Basavanathara Reserved Forest	566.80
11	Doresanipalya Reserved Forest	54.88
12	Jyothipura Reserved Forest	228.00
13	Mandoor Reserved Forest	129.60
14	B.M.Kaval Reserved Forest	562.87
15`	Kadugodi Reserved Forest	38.10
	Total	2897.63

6.4 Vertical Gardens:

Vertical gardens are being used in the cities like Bangalore for physical and psychological relaxation in addition to managing ecological system. In summers, vertical gardens increase humidity and lowers temperature. These capture dust and polluted air by the foliage of the plants. The obvious benefit is the immediate improvement in environmental quality. Vertical gardens on concrete piers supporting elevated roads will have positive impact on greening and cleaning of the cities, offering micro-climate changes (humidity, temperature, aesthetics and sequestration of C02). In addition, the dense plant foliage protects the concrete structure against the heat and pollutants.

As suggested in the TOR vertical gardens will be proposed on the pillars of elevated corridor, similar to vertical gardens by BMRCL near Rangoli Art Centre next to MG Road Metro Station using hydroponics technology (technology used in growing plants using a mineral nutrient solution). The vertical garden concept not only increases the aesthetic value of the proposed project corridor but also helps to reduce air pollution generated by at-grade operating traffic.

Figure 6-5: The vertical garden tried by BMRDCL at MG road metro Station

The details of number of pillars in each phase / package along with the details of area available for growing vertical garden in given in the following table.

Table 6-4: Detaills of area considered for vertical gardens

Project Phases	Contract Packages	No of Pillars	Area considered for vertical garden (sqm)
Phase I	Package 1	370	8,718
	Package 2	269	6,338
	Package 3	136	3,204
	Connecting Corridor 1	124	2,922

Project Phases	Contract Packages	No of Pillars	Area considered for vertical garden (sqm)
Phase II	Package 1	138	3,252
	Package 2	134	3,157
	Connecting Corridor 2	122	2,875
	Connecting Corridor 3	107	2,521
	Package 3	113	2,663
Phase III	Package 1	390	9,189
Phase IV	Package 1	264	6,220
Phase V	Package 1	220	5,184
	Package 2	364	8,577
Total		2751	64,820

The 102 km elevated corridor has total of 2751 pillars with an area of 64,820 sqm which not only increases the greenery along the corridor but also helps absorbing air pollutants and dust thus reducing the impacts of obnoxious gases significantly.

6.5 Median Plantation:

Elevated corridor is supported by pillars which are 2.0 to 2.5 m thick. These pillars are located invariably at the center of the at-grade roads thus creating median of 2.0 to 2.5 m width. Two rows of median plantation is proposed to be taken up in these medians all along the proposed elevated corridor alignment. Provision has also been made for rain water harvesting in the median which is located at the centre of median.

Figure 6-6: The Median Plantation by BMRDCL

Selection of plants species is an important task and for selection, it is necessary to consider the following factors.

i. Agro-climatic suitability, height and canopy architecture, growth rate and habit, aesthetic effect (foliage, conspicuous and attractive flower colour) and pollution tolerance.

ii. Dust absorbing capacity:

Ornamental plant species having aesthetic value and tolerance to air pollutants are recommended for planting in the medians along the at grade roads. In addition, they should also have less water requirements, slow growth rates, should be able withstand severe climatic conditions. Drought resistant shrubs are generally tolerant to pollution

Plants/shrubs suitable for planting in medians are Saraca asoca (Sita Ashoka Tree) Pavetta indica (Paapate gida), Ixora coccinea, Acalypha wilkesiana, Nyctanthes arbor tristis (Pariojatha), Gardenia gummifera, Bougainvillea spectabilis, Caesalpinia pulcherrima, Callistemon lanceolatus, Callistemon polandii, Cassia surattensis, Duranta plumeri, Euphorbia milii, Hamelia patens, Hibiscus rosa, Ixora coccinea, Jatropha panduraefolia, Lantana camara, Lantana depressa, Neruim oleander, Vinca rosea, Nerium oleander, etc.

6.6 Quantification of solar energy harvesting potential:

Most of the studies demonstrate that the available surface, railings and vertical facade area for Solar Photo Voltaic (SPV) installation is very limited on the elevated corridor road. The possible areas for solar power generation and the feasibility were explored. It is only feasible to use SPV floor tiles as a replacement to the pavements and cycling tracks. It is necessary to evaluate electrical, thermal and mechanical performance in addition to its properties like solar energy conversion efficiency, anti-slip, heat resistance, durability and compressive strength of SPV installations as a replacement to the pavements, particularly for the road pavements.

Disadvantages:

The Solar panels lying under a road has number of disadvantages.

- Solar panels on the road surface will not be at the optimum tilt angle thus produces less power.
- The road surface is more prone to shading. The shade over just 5 percent of the surface of the panel can reduce the power generation by 50 percent.
- The solar panels are also likely to be covered by dirt and dust thus requiring regular maintenance.

- The panels would need to be covered with thicker glass than the conventional panels to withstand the weight of traffic which will further limit the light they absorb.
- These solar panels will heat up more than a rooftop solar panel too. For every 1 degree Celsius increase, over optimum temperature, there will be a loss of 0.5 per cent of energy efficiency.
- Scratch resistance and toughened glass should be used for durability and required compressive strength of SPV which attracts huge costs.
- Surface of the solar panels are smooth which may not be suitable for movement of vehicles and cause slippery during monsoon.
- The road's capacity factor – which measures the efficiency of the technology by dividing its average power output by its potential maximum power output is just 4 per cent.

Case Studies:

France: One of the first solar roads to be installed is in Tourouvre-au-Perche in France. This has a maximum power output of 420 kW, from 2,800 m² and at the cost of € 5m (£4.5m) for installation. This implies the cost of €11,905 per installed kW. While the road is supposed to generate 800 kilowatt hours per day (kWh/day), some recently released data indicates a yield closer to 409 kWh/day, or 150,000 kWh/yr. In contrast, the Cestas solar plant near Bordeaux, which features rows of solar panels, carefully angled towards the sun, has the maximum power output of 300,000 kW at a capacity factor of 14 per cent and cost of € 360 m or €1,200 per installed kW, one tenth the cost of solar roadway, it generates three times more power.

In the US, a company called Solar Roadways has developed a smart highway with solar panels, including sensors and LED lights to display traffic warnings about any upcoming hazards, such as a deer. It also has heating pads to melt snow in winter. Several of its SR3 panels have been installed in a small section of pavement in Sandpoint in Idaho. This is 13.9 m^2 in area, with an installed capacity of 1.529 KW. The installation cost is given as $48,734 (about £37,482), which implies a cost per installed kW of €27,500, more than 20 times higher than the Cestas power plant.

Solar Roadway's own estimates are that the LED lights would consume 106 MWh per lane mile, with the panels generating 415 MWh – so more than 25 per cent of the useful power is consumed by the LEDs. This would reduce performance even further. The heating plates are also quoted as drawing 2.28 MW per lane mile, so running them for just six days would cancel out any net gain from the solar panels. And this is before we look at the data from the Sandpoint installation, which generated 52.397 kWh in six months, or 104.8 kWh over a year. From this we can estimate a capacity factor of just 0.782 per cent, which is 20 times less efficient than the Cestas power plant.

Perhaps, all these studies suggest that using solar panels in road pavements for harvesting solar energy potential is not a great idea. However, provision has been made to use solar panels for street lighting on the elevated corridor and traffic signal posts, toll gantry.

6.7 Carbon Foot print Study

Emission inventory for all possible sources of direct and indirect carbon emissions is developed for full life cycle of the project which includes construction of individual road corridors. Total carbon footprint of the road project will comprise of road carbon footprint from three different stages including construction, operation and maintenance phases.

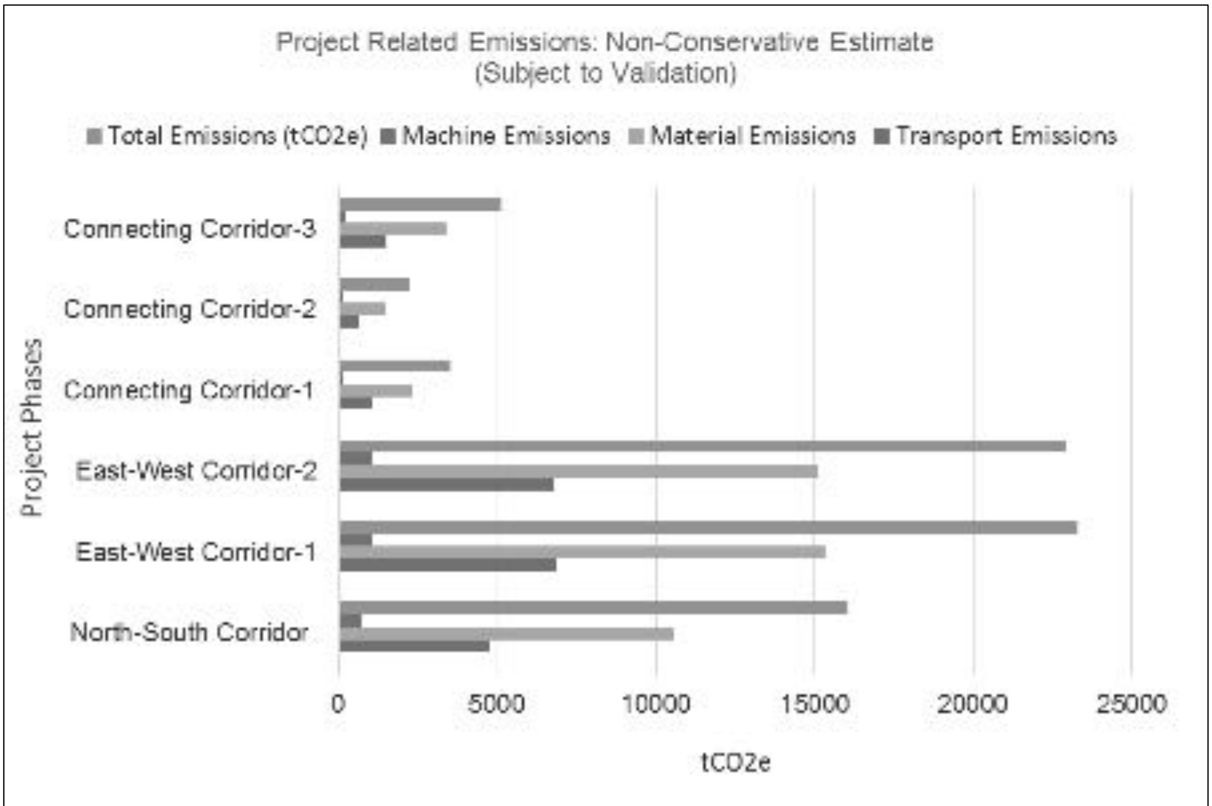
The carbon footprint of the construction phase is calculated from primary data collected from road construction contractors. The emissions from the project activities include both direct and indirect emissions. Some of the direct source of carbon dioxide emissions during the construction phase includes on-site use of diesel, furnace oil and light diesel oil in construction machinery, vehicles and power generators. The transport of construction materials to site also contributes to direct-CO2 emissions. Any vegetation removed from construction site to accommodate elevated corridor also contributes to direct CO2 emissions. The indirect emissions during construction are attributed to the embodied carbon in construction materials, fuels used on-site, amount of electricity purchased from grid. The amount of different types of construction material used per km during construction also contributes to the CO2 emissions due to the embodied carbon. Total quantity of diesel used for transporting construction materials and/or fuel to the construction site also contributes to CO2 emissions.

During the operation phase of the project, transport fuels used in vehicles during road operations contribute to direct and indirect CO2 emissions on account of fuel combustion in vehicle engines and embodied carbon in fuels respectively. In our approach, wherever possible India specific emission factors are being used to estimate the CO2 emissions from vehicle movement.

Significant maintenance work starts after few years of road operations. Maintenance work contributes to CO2 emissions (direct or indirect) on account of on-site use of fuels and construction material and transport of materials and/or fuels to the maintenance site.

Following the completion of emission Inventorization, activity factors based on based on IPCC, 2006 methodology, fuel type with its associated emission factors (EF) is used for calculating the emission intensities under various relevant categories such as transport, material and machines. The road length and different road types were multiplied by respective average value of the carbon footprint to estimate the total carbon footprint.

Figure 6-7: Project Related Carbon Emissions



Note: Emissions (tCO_2e) = Activity data × EF

Below are the emission estimates for the construction of proposed elevated corridor structure.

Table 6-5: Project Related Carbon Emission Estimates

Details of Corridor	Total Length (in Km)	Transport Emissions	Material Emissions	Machine Emissions	Emissions (tCO2e)
North-South Corridor	20.215	4750.53	10564.76	731.58	16046.87
East-West Corridor-1	29.35	6897.25	15338.90	1062.18	23298.32
East-West Corridor-2	28.9	6791.50	15103.72	1045.89	22941.11
Connecting Corridor-1	4.475	1051.63	2338.72	161.95	3552.30
Connecting Corridor-2	2.8	658.00	1463.34	101.33	2222.67
Connecting Corridor-3	6.455	1516.93	3373.51	233.61	5124.04

6.8 Carbon Emission Studies

Not many studies have been made in India unlike European countries on the emission factor development methodology. Prof. Tom V. Mathew, IIT, Bombay through his lecture notes on "Fuel Consumption and Emission Studies" (March, 2017) has attempted to study variation of emission factors for different Indian vehicle models, traffic scenario, travel related factors, quality of fuel being used, road network related factors, etc.

"Average Speed Emission Model" from the above reference is used to arrive Emission Factors (EF) for specific vehicle type for variable speeds. This model is useful in macro level analysis where detailed information is not available or required. Average Speed Emission models are widely applied in national and regional inventories. The model is suitable for the traffic net-work as a whole, on a large scale. The emission factors used in the model reflect different levels of congestion. The emission factor is measured over a range of driving cycle which includes driving, stops, starts, acceleration and deceleration and is given in g/veh-km.

CO2 emission is highest for low speeds, decreases for intermediate speeds and then again increases with the speed. The variation in exhaust emission factors with speed for different vehicle types is given in the Model. This basic schematic diagram of an emission model is considered for estimating CO2 emissions.

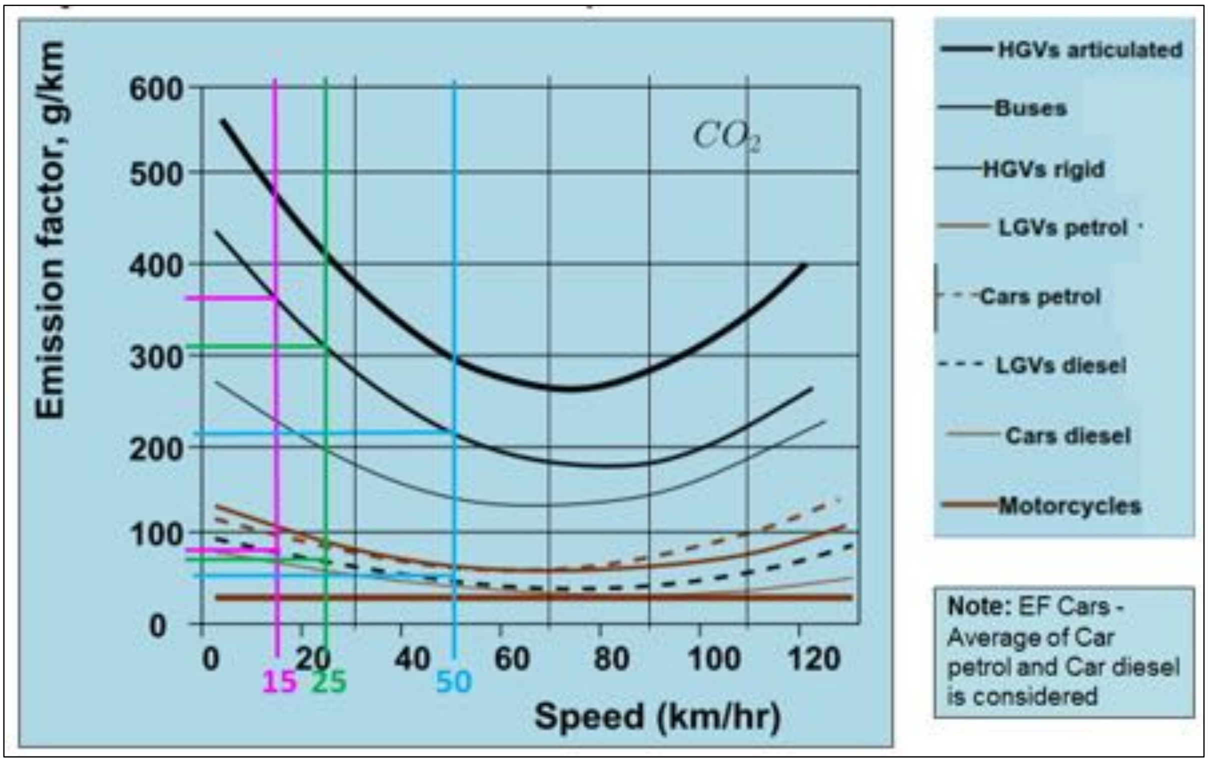


Figure 6-8: Average Speed Emission Model

Table 6-6: CO2 Emissions for various speeds changing with implementation of project

Without Implementing EC Project (2018 to 2037) at an average vehicle speed of 15 kmph			After Implementation of EC Project (2018 to 37) at an average vehicle speed of 25 kmph (For atgrade traffic)			After Implementation of EC Project (2018 to 2037) at an average vehicle speed of 50 kmph (For elevated traffic)		
Emission from Two Wheelers (EF 0.033 Kg/km) in Lakh Tonnes	Emission from Cars (EF average of petrol & Diesel 0.080 Kg/km) in Lakh Tonnes	Emission from Bus (EF 0.360 Kg/km) in Lakh Tonnes	Emission from Two Wheelers (EF 0.033 Kg/km) in Lakh Tonnes	Emission from Cars (average EF for petrol & Diesel cars 0.07 Kg/km) in Lakh Tonnes	Emission from Bus (EF 0.310 Kg/km) in Lakh Tonnes	Emission from Two Wheelers (EF 0.033 Kg/km) in Lakh Tonnes	Emission from Cars (average EF for petrol & Diesel cars 0.050 Kg/km) in Lakh Tonnes	Emission from Bus (EF 0210 Kg/km) in Lakh Tonnes
17.29	31.58	13.90	11.16	20.05	8.57	6.31	8.72	3.22

6.9 Energy Embodiment of materials and steps to reduce:

Construction Materials	Embodied energy (MJ/Kg)
Granite	3.58
Sand	1.64
Gravel	0.10
Cement	7.00
Mortar M-40/a	1.00
Mortar M-80/a	1.34
Reinforced concrete 2% steel quantity	1.64
Porous concrete 400 Kg/m3	3.71
Plaster panels	3.12
Plaster	3.30
Gypsum board	3.15
Fired clay, brick and tiles	4.50
Hollow brick masonry	2.96
Perforated brick masonry	2.85
Commercial steel (20% recycled)	35.00
Stainless steel	54.00
Primary aluminium	215.00
Commercial aluminium (30% recycled)	160.00
Plastic paint	20.00
Primary PVC	80.00
Plastic (ABS)	74.00
Epoxy resin	137.00

Reduction of energy embodiment of materials shall be done by reduce the haulage distance of construction materials from the nearest possible sources; recycling of debris generated from excavations to fill the ramp embankments; waste minimization; effective utilization of construction materials, etc.

7. PROJECT BENEFITS

Bengaluru city is experiencing the unprecedented increase in traffic day by day but the roads are falling severely short to accommodate the increasing traffic. The main objective of implementation of project corridor is to decongest the Bengaluru roads which are presently choked with traffic causing delays in reaching destination and resulting in environmental problems in the form of deterioration of air quality and increased noise levels. Some of the advantages of implementing the elevated corridor are mentioned below.

- Proposed six elevated corridors (three major corridors and three connecting corridors) shall establish connectivity to major arterial roads like Bellari road, Hosur road, Hoskote road, Tumkur road, Mysore road, Sarjapura road.
- Implementation of the proposed elevated corridor project will help segregating the fast moving long distance traffic without interrupting the slow moving neighbourhood traffic and contributes to increase in speed of at grade traffic movement.
- Elevated corridor project makes the public transport provided by BMTC on at grade road faster, thus helping public to reach their destination faster.
- Jammed roads lead to slow moving traffic to release obnoxious gaseous vehicular emissions and elevated roads make way for traffic movement without hindrance thus emitting less air pollutants.
- The proposed elevated corridors will decongest most of the major junctions along the route making some of them signal free junctions.
- Bengaluru public has been demanding for adequate number of pedestrian crossings along the major traffic hit roads. Elevated corridors will facilitate the pedestrians to use at grade roads more safely.

With the current phenomenal growth rate of vehicle population and in absence of adequate public transport system, which is ultimately leading to traffic chaos, Bengaluru city surely needs a comprehensive, integrated and sustainable transportation infrastructure which would give a boost to productivity, improved quality of life.

8. ENVIRONMENTAL MANAGEMENT PLAN

It has been observed that the elevated road development may have adverse impacts on the environment. Control measures need to be undertaken during the design of the project to prevent or reduce the impact of the project on the local environment. An EMP is developed based on the baseline environmental condition and possible environmental impacts of the project.

The EMP is designed for implementation and monitoring of environmental mitigation measures during construction and operation stages. This chapter enumerates the set of measures to be taken during implementation and operation to eliminate or avoid, offset adverse environmental impacts or to reduce them to acceptable levels, together with the action which need to be taken to implement them.

A detailed Environmental Management Plan for the proposed project is presented based on the impact studies in Table 8.1.

Table 8-1: Environmental Management Plan

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
PRE-CONSTRUCTION PHASE			
Cutting of Trees	Trees adjacent to the project alignment which are directly falling under the proposed RoW shall have to be cut and trees which are in buffer zone needs to be trimmed.	All attempts shall be made to reduce the impact on trees during design phase. Tree cutting shall be minimized as far as possible. All required clearances shall be obtained before cutting any tree in the project area and Compensatory plantation of at least ten times the number trees felled shall be taken up in line with statuary requirements.	PIU / Contractor / Third Party
Demolition of structures and physical properties	Many of the structures and physical properties such as residential, commercial, community buildings and religious structures are affected by the elevated corridor project.	Demolition of structures shall start only after the finalization of the alignment and after the proper compensation is paid to the Project Affected People (PAP) Important religious and community structures shall be relocated and rehabilitated suitably.	Consultant / PIU / Contractor
Utility shifting	Shifting of affected utilities like electric poles, electric cables, telephone cable, water supply lines, optical fibres, bore wells, water taps, etc. will impact public welfare services till they are rehabilitated.	The affected utilities are shifted suitably without hampering the continuity of necessary services. Community consensus and required clearances shall be obtained from the concerned authorities before the commencement of shifting of utilities. Contractors shall prepare traffic management plan for shifting of utilities particularly at heavy traffic stretches of the project road.	PIU / Contractor / Third Party agencies
Consents, permits, clearances, NOCs, etc.	All required statutory clearances shall be obtained and ensured their validity all through the project period to abide by all the conditions of the consents and permissions issued in the interest	PIU / Contractor shall obtain / ensure all necessary consents, permits, clearances, NOCs, etc. prior to start of actual construction of the elevated road Validity of these Consents, permits, clearances, NOCs, etc. shall be regularly checked for their validity.	PIU / Contractor

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
	of environmental protection.	The General Conditions and Specific Conditions specified while granting the environmental clearances and other permissions shall be strictly adhered.	
CONSTRUCTION PHASE			
1 Topography			
Change in topography by project activities	The project will have a little impact on topography except at ramp locations. Elevated road construction often generates significant quantity of wastes (debris) from excavation for pile foundation. The excavated debris if cleared by dumping the material at inappropriate places in an unplanned manner.	The debris generated by foundation excavation shall be utilized to fill the ramps which are part of elevated corridor projects. Debris management plan shall be prepared and adhered to handle the debris generated by the project activities during construction. Where erosion is likely to be a problem, clearing and grubbing operations shall be scheduled and performed such that grading operations and permanent erosion control measures shall follow immediately. Under no circumstances, large surface area of erodible earth material shall be exposed at any one time by clearing and grubbing.	Contractor / PIU
Change in topography by extraction of construction materials.	The major changes in topography are expected at quarry, sand mines and borrow locations. Unplanned disposal of debris generated out of demolished structures leads to change in the topography.	All the quarries areas opened for the project shall be managed as per the statutory requirements and procedures mentioned in the EMP. The cut slopes shall be suitably protected by breast walls, provision of flat stable slopes, construction of catch water and intercepting drains, treatment of slopes and unstable areas above and underneath the road, etc. Where rock blasting is involved, controlled blasting techniques shall be adopted to avoid over-shattering of hill faces. The borrow pit areas could be developed into ponds for fisheries.	Contractor / PIU
2 Soil			
Soil Erosion	Cleaning & grubbing and cutting of trees and plants will cause and accelerate soil erosion	Clearing and grubbing for the project corridor shall be limited to the required area only. At borrow pits, the depth of the pit should be regulated so that the	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
	Excavations of borrow pits will increase soil erosion	sides of the excavation will have a slope not steeper than 1 vertical to 4 horizontal from the edge of the final section of bank Cutting of trees shall be done in phases without much impact on the soil. Soil erosion mitigation measures will be ensured at construction establishments, casting yards and labour camps. Surface drains shall have gentle slopes.	
Loss of topsoil	Loss of productive topsoil during the leasing of land to contractors for storing, stock yards, casting yards, construction camps and workers camp Borrowing pits during project construction	The top soil shall be stripped and stored for productive use. The stored topsoil shall be spread back to maintain the physico-chemical properties of the soil Stock yards, casting yards, construction camps and workers camp shall not be located on productive agricultural lands. If new borrow areas are selected, there should be no loss of productive soil.	Contractor / PIU
Borrowing of earth	There is a little quantity of earth is required for construction or ramps and for making embankment.	No earth should be borrowed from unauthorized borrow pits and within the city limits The excavation and transportation of earth shall be done only during day time The borrow areas should not be dug continuously and the size and shape of borrow pits is to be approved by the engineer in charge Borrow pits should be redeveloped by dumping of spoils or by creating a pond for fisheries or by leveling the raised earth mounds	Contractor / PIU
Contamination of soil from fuel and lubricants	Oil and lubricants from construction equipment and vehicles will impact on the soil characteristics	Construction vehicles and equipment machines are maintained and refilled in such a fashion that old diesel spillage does not contaminate the soil Fuel storage and refilling sites should be provided with oil interceptors and kept away from cross drainage and water bodies All oil and lubricant spoils shall be handled, stored and disposed of	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
		as per the Hazardous Waste (Management, Handling and Trans-boundary Movement) Rules, 2008 and subsequent amendments.	
Contamination of soil from construction and demolition waste	The unplanned disposal of construction and demolition waste will impact the soil structure and quality	Construction and demolition waste should be dumped in preapproved locations or abandoned quarries. Follow the criteria specified in the Construction and Demolition Waste Management Rules, 2016 for storage, collection, processing or recycling, transportation of construction and demolition waste. Borrow pits opened for the project shall be filled by such waste and reclaimed with the consent of owner.	Contractor / PIU
Contamination of soil by drilling mud from pile foundation	Contamination of soil from drilling mud from pile foundation construction	Small quantity of drilling mud generated during drilling for pile foundations shall be reused for construction of ramps of elevated structures. Excess of this drilling mud if any, shall be disposed of in abandoned quarries.	
2 Water resources and quality			
Water bodies	Water quality may deteriorate due to surface runoff from the construction site, dumping of construction debris, etc. Community water sources like bore wells may be affected	Major construction works shall be avoided during monsoon season Construction establishments like labour camps, stone crushers, batching plants and hot mix plants shall not be located near water bodies. Dumping of excavated and construction debris near the water bodies shall be strictly avoided	Contractor / PIU
Community water resources	Water resources like water pipe lines and community taps shall be impacted during construction and community water supply may be hampered. affected	Any source of water supply for the community affected shall be replaced immediately. All desired measures shall be taken to prevent temporary or permanent flooding	Contractor / PIU
Drainage and run-off water	The flow of runoff water will be affected largely, and this be add to the	At cross drainages, the earth, stone or any other construction material, should be properly disposed of so as not to block the flow	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
	problem of flooding if the runoff flow is not managed especially at certain locations where the drainage problem already exists	of water All necessary precautions shall be taken to construct temporary or permanent devices to prevent water pollution (due to increased siltation and turbidity) Drainage of the water from road surface shall be linked to the existing drainage system.	
Contamination of water from construction waste	Construction waste if enters into water bodies, may increase the suspended matter and clay in the water bodies The community dependent on such water, using it for purposes other than drinking, may be affected	Construction work close to water bodies shall be avoided, especially during the monsoon period and waste materials must be collected, stored and taken to approved disposal sites All waste arising from the project is to be disposed of away from water bodies., as per Solid Waste Management Rules 2016 of CPCB	Contractor / PIU
Contamination of water from fuel and lubricants	The fuel and lubricants used in construction vehicles and equipment may enter into the water bodies affecting the quality of water in the water bodies adding more trouble to already polluted city lakes.	Servicing of vehicles and equipment with lubricants and shall be done in the specified location. The accidental spills shall not be allowed enter the water bodies and should be modified and re-channeled so that contaminants do not enter the water body To avoid contamination from fuel and lubricants, the vehicles and equipment shall be properly maintained and repaired.	Contractor / PIU
Sanitation and waste disposal in construction camps	Absence of proper sanitation may lead to outbreak and spread of communicable diseases, which are mostly water-borne	Preferably local labourers shall be engaged for construction works and avoid establishment of construction camps. If necessary, construction labour camps shall be located away from habitation and major water bodies. Mobile toilets shall be used at construction and labour camps. The sewerage handling system shall be properly designed and built at labour camps, to avoid water pollution.	Contractor / PIU
Use of water for	Construction of elevated corridor requires huge water. Utilization of	Contractor shall make arrangement for the supply and storage of water for all the construction activities in such a way that the water	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
construction	water for construction from sources already in use by local community, may lead to scarcity of water for the dependent community	availability and supply to nearby communities remains unaffected. If, new tube-wells for water to be used in construction. They are to be bored, after obtaining required sanctions and approval by Bengaluru Water Supply and Sewerage Board (BWSSB) The wastage of water during the construction should be minimized	
3 Air quality			
Emission from construction vehicles and machinery	Air pollutants cause several allergies respiratory and cardiovascular system diseases in human beings. Air pollutants and solid particulate matter (SPM) reduce growth rate and productivity of the green plants and trees Crowded commercial places and construction sites will have higher degree of emission	Vehicles, equipment and machinery used for construction shall be regularly maintained to ensure that the emission levels of pollutants are under control and pollution levels do not exceed the norms prescribed by CPCB Air pollutants along the proposed project corridor shall be monitored for their levels against prescribed standards and compared with baseline values. The air monitoring shall be done at regular intervals as proposed in the monitoring plan / Terms of Reference / as decided by the engineer concerned. Ambient air quality monitoring at construction camps, batching plants, crushers, hot mix plants, shall be done regularly monitored to ensure all the pollutants are within the prescribed norms.	Contractor / PIU
Dust and its control	The impact of dust at construction sites is rather adverse, but localised in nature The solid particulate matter containing lead, nickel, arsenic and those present in diesel exhaust are of major concern. These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems.	During construction, water shall be sprinkled along the proposed corridor alignment two to three times in a day to mitigate the generation of dust Dust mitigation measures such as cover by hood, water sprinkling arrangement, cyclone precipitator or filter bags or wet scrubber unit fitted for stone crusher unit and hot mix plant to reduce the dust emissions shall be ensured Stone crushers and hot-mix plants are sited at least 500 m from the nearest habitation and major water bodies. Materials transportation vehicles should be properly covered with	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
		tarpaulins. Green belt development around the construction establishments. Worker working close to such units shall be provided with nose masks	
4 Noise Levels			
Noise from project activities like foundation excavation, casting, drilling, etc. and construction vehicles, hot mix plants, crushers, casting yards, and construction equipment	Project activities use of heavy machinery and equipment will significantly add to the baseline ambient noise and this increase in noise levels is localized and intermittent in nature Increase in noise will cause fatigue, hearing problems, deafness, exhaustion, physiological changes and sleep disorders.	Noise generating project activities shall be provided with enclosures to reduce the transmission of noise to the noise receptors. The plant and equipment used in construction shall strictly conform to consent to operate (CFO) issued by KSPCB and CPCB prescribed noise standards Vehicles and equipment used shall be fitted with silencers Noise standards shall be strictly enforced Construction works in project sites adjacent to human settlements shall be stopped during night hours between 10:00 pm and 6:00 am. Noise generating construction establishments shall be located away from human settlements and all possible mitigation measures shall be implemented to reduce and mitigate noise from source, transmission and at noise receptors. Workers working in the vicinity shall be provided with ear plugs/ear mufflers	Contractor/ PIU
5 Flora			
Loss / damage to vegetation	Loss of trees leads to deterioration of air quality due to increase in concentration of air pollutants, Tree removal accelerates soil erosion. For city like Bengaluru which is called as Garden city loss of trees will change	Trees shall be cut only after obtaining all the required clearances Cutting of trees shall be avoided as far as possible by pruning the branches wherever possible. All possibilities of tree transplantation shall be adopted for transplanting the small sized trees which are getting affected by the project.	Contractor/ PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
	the microclimate of Bengaluru due to loss of shade and decrease in humidity and affects rainfall. Tree cutting will lead to loss of habitat for avifauna	Every tree cut shall be compensated with 10 numbers of tree plantations. Tree clearing in buffer zone (space for construction between line of CoI and 2 m off the COI line) shall be strictly avoided and managed with pruning of branches as required. Local species shall be preferred while planning for compensatory plantation. Median along the pier line of elevated corridor shall be utilized for planting of shrubs and small trees	
6 Safety and Accidental Risk			
Accident risk from construction activities	The project construction activities may create various unsafe situations. Most of the safety issues are of occupational in nature in addition to community safety in the vicinity of construction zone. Accidental risks due to ill-maintained machines and vehicles, due to poor light conditions in the work place, or due to carelessness and poor management of the work involved	All safety requirements shall be met as per the Building and other Construction Workers (Regulation and the Employment and Conditions of Service) Act, 1996; the Factories Act, 1948 as amended in 1987; the Child labour (Prohibition and Regulation) Act 1986, etc. Contractor shall prepare Safety Management Plan and get it approved by Engineer concerned before implementation. Contractor shall conduct regular tool box meetings involving construction labourers and also ensure proper training on construction safety. Safety of workers undertaking various operations during construction should be ensured by providing them with safety gears such as safety harness, helmets, masks, safety goggles, etc. Safety at all the construction establishment shall be ensured Traffic Management Plans shall be prepared and implemented during construction to ensure safety of road users. Temporary barricades shall be erected around the construction site to avoid any incidence of entry of public (local community) to construction zone and ensure their safety.	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
		Sufficient illumination and safety sign boards shall be arranged in the construction zone. Traffic rules and regulations are to be strictly followed by vehicles used in construction. The electrical equipment should be checked regularly to avoid risks to workers At every work place, a readily available first aid unit, including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff and an attending doctor, to be provided Safety audit must be conducted regularly	
Health issues	The prevalence of unhygienic conditions in the work place of construction workers The non-availability of good drinking water Outbreak of communicable diseases from the labourers camp if they are established near settlements	At every workplace, clean and sufficient water supply shall be maintained to avoid waterborne diseases and to maintain the health of workers. Adequate drainage, sanitation and waste disposal facilities shall be provided in workplaces Sufficient medical care to be provided to construction workers as necessary	Contractor / PIU
7 Cultural Properties			
Damage or loss of cultural properties and notified archaeological monuments	Impact on notified archaeological monuments along the corridor due to construction activities Demolition of religious and community structures, cemeteries etc. along the proposed elevated corridor	All necessary permits and clearances shall be obtained for the corridors passing near (protected and regulated areas) notified archaeological structures. All necessary and adequate care should be taken to minimize the impact on cultural and heritage structures If valuable or invaluable articles such as fabrics, coins, artifacts, structures or other geographic or archaeological rarities are discovered, the excavation should be stopped and the archaeological department contacted In such cases, archaeologists will supervise the excavation to avoid	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
		any damage to the relics	
Roadside landscape development	There will be positive impact on bio-aesthetics and beauty Landscaping and beautification of ponds, and access roads will improve aesthetics	Wherever possible, avenue plantation with foliage and shady trees mixed with flowering trees, shrubs and plants as per detailed designs The enhancement of water bodies, parks / sites to be developed	Contractor / PIU
Roadside amenities	People will be largely benefit by the comfort and use provided by these amenities	Restoration and improvement of at-grade bus shelters, bus bays shall be taken up for the commuters. Road furniture including footpaths, railings, traffic signs, speed zone signs etc. shall be erected as per design	Contractor / PIU
OPERATION PHASE			
Contamination from spills due to traffic and accidents	The chances of accidents are likely to be reduced on elevated road improved width and quality of the road. The contamination of soil and water due to spills will be minor	Cleaning of the spills at accident sites by a workforce provided by state government.	Contractor / PIU
Air pollution	The degree of air pollution is likely to be on a lower scale with improvement in road surface and with better maintenance	Vehicular emissions of PM_{10}, $PM_{2.5}$, CO, SO2, NOx to be monitored regularly.	Contractor / PIU
Water pollution	Due to the improved longitudinal and cross drains, water logging during rains will not take place Improved drainage along the roadside will also improve the water flow	The drainage system should be periodically checked and maintained	Contractor / PIU
Accidents involving hazardous	The chances of such emergencies /accidents will be minimum, yet not unavoidable	The rules as defined in Environmental (Protection) Act, 1986 should be complied with In case of spillages, a report to the relevant department must be	Contractor / PIU

Environmental Issue	Impact Description	Remedial Measures	Planning, Execution & Monitoring
materials		made and instructions followed	
Safety measures	The chance of accidents to be reduced	Traffic control measures, including speed limits, to be enforced strictly by erecting warning signals and signboards	Contractor / PIU

8.1 Other Mitigation Plans

8.1.1 Resettlement Plan

The project proponent shall prepare a Resettlement Action Plan to address the impacts arising out of the project. The Resettlement & Rehabilitation Policy for the project will be in the lines of BMRCL policy, which follows the KIADB Act with compensation at par with RFCTLARRA 2013.

8.1.2 Construction Water Management Plan

It is the responsibility of the contractor to make arrangements for supply and storage of water required for the whole construction period. The plan should have list of sources from where water shall be used for the project. Contractor shall source the required water preferentially by conjunctive use of surface water and groundwater but with prior permission from the Local City Municipal (BWSSB) and Groundwater Authority. All precaution shall be taken to minimize the wastage of water during construction phase.

8.1.3 Emergency Response Plan

Site specific Emergency Response Plans shall be prepared to face and address any emergency situation with respect to vehicular accidents, spillage of oil or other hazardous materials and water impounding and floods during monsoon. It requires establishing and developing an emergency resources, communication system and emergency response procedure to face the emergencies with preparedness and minimize the impacts of emergency situations and also minimize the response time required to safeguard people, property and environmental resources. Contractor shall also submit Accident Safety and Hazardous Chemical Spill Management Plan and get the approval from the concerned. The plan should essentially have details of detours in case of emergency.

8.1.4 Oil spill contingency plans (SCP) and clean up procedures

Impacts from spills could occur on elevated corridor, access roads, at-grade roads and construction camps. Spills into water body can disperse and affect a larger area, water quality and ecology.

Construction vehicle and equipment servicing is expected to be done at construction camps during construction phase. While servicing, some of the following potential contaminant materials are used, which includes.

- Fuels – petrol and diesel
- Lubricating oils and grease
- Hydraulic and motor oil

Spills may result from any of the following reasons.

- Leaks of fuel storage drums or tanks
- Valve or line failure in systems, vehicles or heavy equipment
- Vehicular accidents
- Spill during fuel transfer

- Vandalism
- Mishandling due to lack proper training

This Spill Contingency Plan (SCP) has to be developed for use by the Contractor or Concessionaire for the Project and regulatory approvals. The successful Concessionaire shall provide a list and quantity of potential hazardous materials on-site with a map indicating their locations in their SCP. Contractor is responsible for preparing and implementing the SCP during the entire construction phase.

The purpose of SCP is to provide a guide to all site personnel in the event of an accidental release of fuel or other waste during the project implementation. The SCP provides the protocols for personnel to follow in response to a spill. All persons involved with the project should read and be familiar with the SCP as it is important that all personnel are familiar with their responsibilities and steps to be taken in the event of a spill.

The Material Safety Data Sheets (MSDS) for each hazardous material shall be submitted along with the SCP.

SCP should have the flowchart to identify the response organization and the chain of communication responding to a spill. The flowchart should also help to identify the responsible personnel, their duties, on or off-site work locations and contact information, including 24x7 telephone numbers of those responsible for taking action.

Contractor shall also be responsible for preparation of Spill Contingency Action Plans (SCAPs): This shall outline the procedures that must be taken in response to a spill. It should indicate the size of a spill that could occur for each material stored on-site, the potential source of the spill and the potential impacts related to the spill. Description of the worst possible scenario should also be included.

In the SCAP, the Contractor shall provide the details of procedures for initial action; spill reporting procedures; procedures for containing and cleaning up the spill; procedures for transferring, storing and managing spill-related wastes and procedures for restoring the affected areas, providing representatives with status updates and clean-up completion should be described. SCAP should address reporting procedures, report templates, investigation procedures, etc.

8.2 Grievance Redressal Mechanism

A combined social and environmental grievance redress mechanism shall be implemented under the project. Grievances and suggestions from stakeholders and affected people on the issues related to problems being faced during the construction of project, R& R issues and implementation of EMP. Grievance re-dress mechanism shall be posted at the respective Ward offices by Contractor on behalf of project proponent prior to commencement of construction works. The issues shall be addressed through acknowledgement, evaluation, action and response approach. Grievances from public or stakeholders related to project and EMP implementation shall be directed to the concerned Executive Engineer of project proponent. The Executive Engineer shall refer the grievance to Construction Supervision Consultants (CSC) or Authority Engineer (AE) who then assess whether the grievances/suggestions are genuine and acceptable and resolved within stipulated time from the date of receipt. This mechanism is non-judicial in nature. The action taken and the outcome shall form a part of quarterly report.

8.3 Environmental Monitoring programme

Monitoring is an essential component for sustainability of any development project. Development projects introduce complex inter-relationships in the project influence area between people, natural resources and developing forces thus, creating a new environment. It is difficult to predict with a certainty the exact post-project environmental scenario. Hence, monitoring of critical parameters is essential in the post project phase.

The monitoring programme consists of performance indicators, reporting formats and necessary budgetary provision. The budgetary statements are provided in Table 8-6 for the purpose of evaluation of the EMP.

The monitoring plan should be in accordance with the baseline environmental monitoring locations.

The monitoring plan has the following objective.

- Ensure effective implementation of EMP
- Comply with all applicable environmental, safety, labour and local legislation
- Ensure that public opinions and obligations are taken in to account and respected to the required satisfaction level
- Modify the mitigation measures or implementing additional measures, if required

For each of the environmental condition indicators, the monitoring plan specifies the parameters to be monitored, location of the monitoring sites, frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan and details of monitoring locations for environmental condition indicators of the project during the construction and operation stage are presented in Table 8-2. The monitoring will be carried out by PIU through the approved agency and will be supervised by the Environmental Experts of the Construction Supervision Consultants and PIU.

Table 8-2: Environmental monitoring for Air, Water, Noise and Soil

Attribute	Parameter	Special guidance	Standards	Frequency	Duration	Location	No of samples	Implementation
Air	$SO2$, NO_2, PM_{10}, $PM_{2.5}$, O_3, Pb, CO and Benzene.	High volume sampler to be located 50m from the plant in the down wind direction. Use method specified by CPCB for 24 hr sampling	Air (Prevention and Control of Pollution) Act. 1981 & Notification No. S.O 935(E) dated 14th Oct 1998.	Once in every four months during construction and operation phase.	Two years	Representative construction sites & major construction establishments including base line monitored stations	354 or as directed	KRDCL
Water	Water quality parameters to be monitored or as directed by Environmental Specialist, CSC.	Grab sample collected from source and analyze as per standard methods for examination	IS for Inland surface waters (IS:2296,1982) and for drinking water (IS: 10500-1991)	Once in every four months during construction and operation phase.	Two years	Drinking water samples from the labour camps and from hand pumps, Surface water from the water courses along the project corridor.	204 or as directed	KRDCL
Noise	Noise quality as per National Ambient Noise Standards on db (A) scale	Equivalent noise levels using and integrated noise level meter kept at a distance of 15m from edge of pavement Leq in db (A) of day time and night	The Noise Pollution (Regulation and Control) Rules, 2000	Once in every four months during construction and operation stage.	Two years	Near the construction camps, working zones, sensitive receptors at major human settlements along the project corridor.	354 or as directed	KRDCL

Attribute	Parameter	Special guidance	Standards	Frequency	Duration	Location	No of samples	Implementation
		time						
*Soil	Monitoring of pH, Nitrogen, Phosphorus,, Potassium, Sodium, Chloride, Organic Carbon and Lead	Sample of soil collected and analyzed using absorption spectrometer		One sample each during the pre and post monsoon for construction and operation stage.	Two years	Construction camp / plant sites, Labour camps, Batching plants and parks abutting traffic detours and traffic diversions and major intersections.	160 or as directed	KRDCL

*

*Accidental spillage of hazardous and non-hazardous substances need to be dealt with as special cases largely depends on the circumstances including state of the substance (liquid or solid)

*Monitoring shall be carried out at all locations used for collection of primary data in the study.

8.4 Performance indicators

Environmental components identified of a particular significance in affecting the environment at critical locations have been suggested as performance indicators (PIs).

Table 8-3: Performance Indicators and monitoring plan

S. No	Monitoring plan/ Performance indicators	Description of Item	Indicator	Stage	Responsibility
1	Monitoring plan	No. of trees planted (Total) No of trees transplanted No. of trees under Compensatory Afforestation No. of Trees planted along Road sides No. of Trees planted at other locations (such as camps, borrow areas, debris disposal sites and plant areas) No. of trees planted at enhancement sites	Road side and other plantation areas	Post construction stage	Forest Department and KRDCL
3	Performance indicators	No. of Borrow Areas identified and verified No. of sites for which restoration plans have been prepared No. of Sites restored and rehabilitated No. of sites handed over	Borrow Area	Pre - Construction and Post-Construction	Contractor
4	Performance indicators	No. of Quarry Areas identified and verified No. of sites for which restoration plans have been prepared No. of sites restored and rehabilitated No. of sites handed over	Quarry	Pre – Construction and Post Construction	Contractor
5	Performance indicators	Quantity of debris and spoils to be disposed off No. of locations finalized for Debris disposal Quantity of debris and spoils disposed off No. of locations for which rehabilitation works have been completed	Disposal sites	Construction and Post Construction	Contractor
6	Performance indicators	No. of locations identified for the construction camp and construction plant sites No. of locations approved Lay-outs approved No. of sites for which site restoration and rehabilitation has been completed	Construction camps and plant sites	Pre-construction and Post Construction	Contractor

S. No	Monitoring plan/ Performance indicators	Description of Item	Indicator	Stage	Responsibility
7	Performance indicators	No. of Trees to be cut No. of Trees cut % Progress on the tree removal	Tree cutting	Pre-construction	KRDCL
8	Performance indicators	No. of locations identified for temporary storage of the excavated materials to be used in embankment and sub grade	Storage of excavated materials	Pre-construction and construction	Contractor
9	Monitoring plan	Statutory environmental monitoring as per the conditions stipulated in the consents / permission issued by PCB	Environmental status at construction Sites	Construction	Contractor
10	Monitoring plan	Environmental parameter monitoring in accordance with the frequency and duration of monitoring as well as the locations as per the Monitoring Plan given in above table	Air, Noise, Soil and Water quality	Construction and Operation	KRDCL through external agency
11	Monitoring plan	Before the onset of monsoon all the debris / excavated materials shall be cleaned from the work sites and disposed of at the pre–identified approved locations	Silting of water bodies	Construction	Contractor supervised by the Environmental specialist of CSC / AE
12	Performance indicators	Implementation of enhancement measures for Parks Cultural properties Religious properties	Enhancements	Construction	Contractor
13	Performance indicators	No. of Training sessions organized for - Department staff - Contractors - Combined No. of people trained - Department staff - Contractors	Training imparted	Construction and Operation Phase	KRDCL
14	Performance indicators	Slope protection measures Length (by type) No. of Locations	Work sites	Construction	Contractor
15	Performance indicators	Drainage Length No. of Locations	Work sites	Construction	Contractor
16	Performance indicators	Safety provisions Signage (by type and No.) Guard Rails Guide Rails	Work sites	Construction	Contractor
17	Performance indicators	No. of chute drains provided	Work sites	Construction	Contractor

S. No	Monitoring plan/ Performance indicators	Description of Item	Indicator	Stage	Responsibility
18	Performance indicators	Soil erosion prevention measures Silt fencing (No. of locations and quantity) Stone pitching (No. of locations and quantity) Any other (Grass seeding etc.,)	Work sites	Construction	Contractor
19	Performance indicators	Utility ducts Length provided No. of Locations	Utility ducts	Construction	Contractor
20	Performance indicators	Water sources No. of sources protected No. of sources relocated	Work sites	Construction	Contractor
21	Performance indicators	No. of HIV awareness sessions conducted	Labours	Construction Stage	KRDCL
22	Performance indicators	No. Safety awareness sessions conducted	Labours	Construction Stage	KRDCL
23	Monitoring plan	No. of awareness sessions for educating the public about road safety and other environmental aspects (such as waste dumping, preservation of enhanced sites, pollution and health impacts etc.)	Public in the vicinity of project road.	Construction Stage	KRDCL

8.5 Reporting system

Environmental monitoring involves regular checking of the environmental management issues detailed in the EMP and to ascertain whether the mitigation measures are achieving their objectives, according to the EMP, with the progress of the works. It provides the necessary feedback for project management to keep the programme on schedule will still achieving the expected outcomes.

The Contractor, CSC and PIU operate the reporting system for environmental conditions and environmental management indicators. Reporting formats for contractors and CSC have to be prepared, which will form the basis of the implementation by the Contractor and monitoring by the CSC and PIU. The list of reporting formats prepared for the project is presented in Table 8.5 and formats are presented in Appendix – 5.

The reporting system will start with the construction contractor who executes the works. The contractor will report to the CSC who in turn shall report to the KRDCL. The Contractor shall submit monthly and quarterly environmental compliance reports along with formal monthly and quarterly reporting to the CSC.

The CSC shall submit separate quarterly environmental monitoring reports to PIU in addition to submission of the summary of the activities of the month in the formal monthly report including any deviations and corrective actions.

KRDCL shall be responsible for the preparation of the targets for identified non-compliances for the EMP compliance.

A full record of construction activities shall be kept as a part of normal contract monitoring system. Reporting and Monitoring Systems for various stages of construction and related activities have to be proposed to ensure timely and effective implementation of the EMP. The operation stage monitoring reports may be annual or biannual, provided the Project Environmental Completion Report shows that the implementation is satisfactory.

The reporting system shall be as follows:

- Reporting by the Contractor to CSC / AE
- Reporting by CSC / AE to KRDCL
- Reporting by KRDCL for the information of all interested parties.

Table 8-4: Reporting System

Item	Contractor	Construction Supervision consultant (CSC)		PIU to oversee compliance monitoring
		Supervision	Reporting to PIU	
Construction Stage				
Monitoring of construction site and construction camp	Before start of work	Regular	Quarterly	Regular
Pollution monitoring	As required	As required	Quarterly	Quarterly
Debris disposal area	Weekly	As required	Quarterly	Quarterly
Monitoring Enhancements	Implementation	Regular	Quarterly	Quarterly
Top soil preservations	Weekly	Weekly	Monthly	Quarterly
Borrow area / quarry area / Debris disposal area	Regular	Weekly	Monthly	Quarterly
Tree cutting	Weekly	Weekly	Monthly	Quarterly
Tree plantation	Monthly	Monthly	Monthly	Quarterly
Operation stage				
Pollution Monitoring	Quarterly	Quarterly	Quarterly	As per monitoring plan

Table 8-5: Summary Details of Reporting Formats

Format No.	Item	Stage	Contractor	Forest Department	Construction Supervision Consultant (CSC)	
			Implementation and Reporting to Engineer	Implementation and Reporting to PIU	Supervision	Reporting to PIU
EMS1	Approval of construction camp / plant site and its management	Pre-construction	One time	-	One time	One time

Format No.	Item	Stage	Contractor	Forest Department	Construction Supervision Consultant (CSC)	
			Implementation and Reporting to Engineer	Implementation and Reporting to PIU	Supervision	Reporting to PIU
	plan					
EMS2	Approval of Borrow Management Plan (General and Specific)	Pre-construction	General- One time Specific redevelopment plan – One for each borrow area	-	Regular	Quarterly
	Identification of temporary storage yards and Management plan	Pre-construction	One time	-	One time	One time
	Solid waste Management Plan (General and Specific)	Pre-construction	General- One time Specific redevelopment plan – One for each camp or plant site	-	Regular	Quarterly
EMS3	Construction camp and plant site management	Construction	Monthly	-	Regular	Quarterly
EMS 4	Top Soil management	Construction	Monthly	-	Regular	Quarterly
EMS 5	Construction plants and pollution control Monitoring	Construction	Monthly	-	Regular	Quarterly
EMS 6	Vehicles and Pollution Control	Construction	Monthly	-	Regular	Quarterly
EMS 7	Details of the DG sets and pollution control	Construction	Monthly	-	Regular	Quarterly
EMS 8	Details of oil Storage	Construction	Monthly	-	Regular	Quarterly
EMS 9	Working at water courses and pollution control	Construction	Monthly	-	Regular	Quarterly
EMS10	Details of Water	Construction	Monthly	-	Regular	Quarterly

Format No.	Item	Stage	Contractor	Forest Department	Construction Supervision Consultant (CSC)	
			Implementation and Reporting to Engineer	Implementation and Reporting to PIU	Supervision	Reporting to PIU
	Extraction					
EMS11	Details of personal protective Equipment	Construction	Monthly	-	Regular	Quarterly
EMS12	Status of consent for water extraction	Construction	Half yearly	-	Half yearly	Half yearly
EMS13	Deviations and corrective Actions	Construction		-	Monthly	Quarterly
EMS14	Tree plantation	Construction and Operation		Quarterly		Quarterly
EMS15	Plantation of shrubs and grass	Construction and Operation	As applicable	Quarterly	As applicable	As applicable
EMS16	Implementation of Enhancement measures for cultural properties, parking areas and incidental spaces	Construction	Monthly	-	Regular	Quarterly
	Status Regarding Rehabilitation of Borrow Areas	Operation		-		Half yearly
	Noise barrier construction	Operation	As applicable	-	Quarterly	Quarterly
	Survival rate of plants	Operation		Quarterly		Quarterly
EMS17	Debris generated due to road widening	During construction	Throughout the construction period during widening	-	Regular	Quarterly

The Environmental Specialist of CSC/AE shall ensure to cover monitoring of all environmental parameters for effective reporting of environmental issues. Some of the environmental monitoring parameter should be included in the request for inspection (RFI) such as debris disposal area approval request. CSC should discuss the reporting formats with the Contractor and PIU to make the required changes in the frequency of reporting as per the site requirements for effective implementation and monitoring, This will not only ensure that the environmental provisions are addressed but also link the satisfactory compliance to environmental procedures prior to approval of the Interim Payment Certificate (IPC) by the Engineer. In the regular monthly meeting the environmental aspects should also be discussed and the staff responsible for the implementation of the environmental management from the contractor, PIU and CSC should also be present

8.6 Institutional Arrangements for implementation

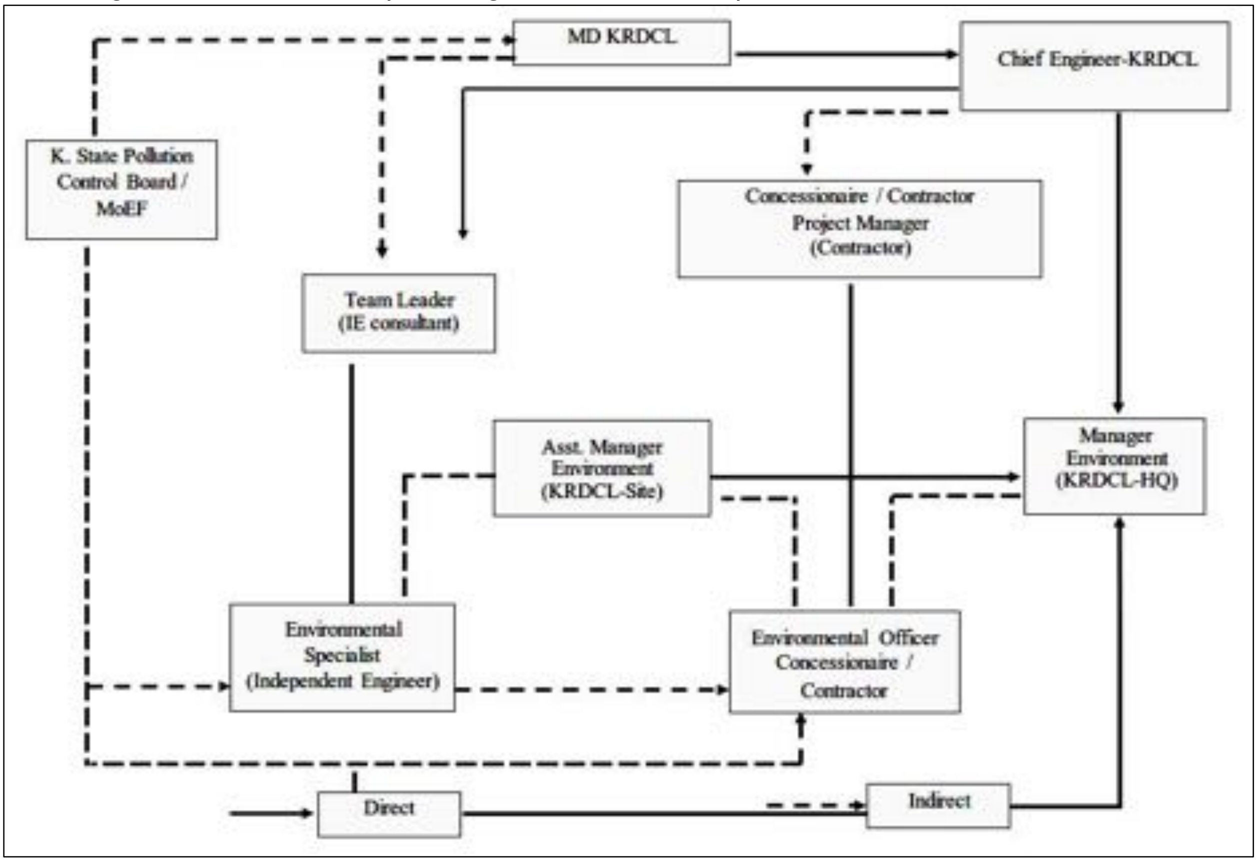
Project Implementation Unit (PIU) is responsible for implementing the project to ensure and achieve certain level of quality in the project, and make sure that the statutory requirements are not violated. The Managing Director heads KRDCL will be responsible for the successful implementation of the Project. The Chief Engineer is the head of Project Implementation Unit (PIU) of KRDCL set up for the implementation of the project. CE is assisted by Executive Engineers to look after all the technical issues of the project implementation and Manager (Environment) to look after Environmental issues of the project. It is proposed to constitute sub unit, Environmental Management Plan Implementation Unit (EMPIU), which functions under PIU.

The Manager (Environment) and Social expert of KRDCL will look after the environmental and social issues during the project preparation, implementation and operation with the assistance of the Environmental Specialist of Project Design and Environmental Officer (EO) of the CSC in the respective phases of implementation.

During the operation phase monitoring will be carried out by PIU or the concessionaire depending on the contract modalities with the help of environmental monitoring agencies approved by the State or Central Pollution Control Board.

Relationship among Environmental Specialist of Construction Supervision Consultancy (CSC), Karnataka Road Development Corporation Limited (KRDCL) and Contractor / Concessionaire with respect to supervision and monitoring of EMP is depicted in the following Figure 8-1.

Figure 8-1: Relationship among Environmental Specialist of CSC and KRDCL



Environmental Cell, KRDCL

KRDCL has organizational and institutional capacity at the headquarters created to meet the requirements for implementation of the environmental mitigation measures in the EMP. Manager (Environment) reports to Chief Engineer who is responsible for management of environmental issues of the project. KRDCL will establish Environmental cell headed by Manager (Environment) with 2 to 3 Assistant Environmental Officers who shall be responsible to look after all the Environment issues related to the project during the project preparation, implementation and operation period and Environmental cell will be supported by the technical and field staff for the project implementation with the assistance of the Environmental Specialist of the CSC / IE.

It is envisaged that the Environmental Cell will be responsible for

- Monitor implementation of the EMP measures in consonance with the timeline for the project as per the approved budget;
- Maintain interaction with the various other statutory bodies like State Pollution Control Board and MoEF Regional Office;
- Interact with the Environmental Expert of the CSC / IE on the status of the environmental mitigation and enhancement measures;
- Regularly inspect the project site to monitor the mitigation measures being implemented by the Concessionaire / Contractor;

- Document and disseminate good practices, minimise and resolve bottlenecks during the implementation of EMP.

Role of Construction Supervision Consultant (CSC) / Independent Engineer (IE)

The CSC / IE will be procured to assist KRDCL for implementation of project, before the project is awarded. The Environmental Specialist of the CSC / IE shall be the key personnel to ensure the successful implementation of EMP provisions. The Environmental Specialist will ensure that the Concessionaire complies with the various EMP requirements. In addition, he will update KRDCL on the progress of environmental protection and enhancement works as envisaged in the EMP. It is envisaged that the responsibilities of the Environmental Specialist of will include:

- Supervise and monitor the implementation of EMP by the Concessionaire / Contractor
- Review and approve site-specific environmental mitigation / enhancement designs submitted by the Concessionaire based on the EMP prepared.
- Review and recommend the Concessionaire / Contractor on implementation plans for approval and suggest any changes that may be necessary to ensure compliance with the environmental provisions of the Contract.
- Monitor tree plantation programs and the periodic environmental monitoring of air, noise, water, soil, etc. during pre-construction, construction and operation phase to ensure compliance with the statutory requirements and the EMP.
- Hold regular meetings with Contractor / Concessionaire and keep it updated to Manager (Environment), KRDCL regarding the progress of environmental works.
- Prepare and submit monthly and quarterly environmental progress reports to KRDCL.
- Develop and organize environmental training programs to upgrade the skills to the staff of Environmental Cell, Contractors and the Concessionaire.
- Document and develop good practices during project implementation for wider dissemination.

Role of Concessionaire

For effective implementation and management of the EMP, the Concessionaire shall arrange to establish a Safety, Health and Environment (SHE) Cell headed by an Environment Officer to deal with the SHE issues of the project. This officer shall interact with the EPC Contractor, KRDCL, CSC/IE and other line departments to ensure that the mitigation and enhancement measures mentioned in EMP are adhered. The Environmental officer of the Concessionaire shall be the interface between the Environmental Specialist of and the Environmental Officer of the contractor. His prime responsibility shall be to apprise the Environmental Specialist about the ground conditions. He shall also procure the requisite clearances and the NOCs for the project and shall also strictly supervise that the Contractor adheres to the EMP. The environmental officer can also look after the additional charges of safety and health.

Role of Contractor

Execution of works will be the responsibility of the EPC Contractor. The Concessionaire may himself be the executioner of the project or might decide to outsource or hire contractor. In case the Concessionaire decides to execute the work by himself then the responsibilities of the EO shall also be performed by the EO of the Concessionaire. If, Concessionaire decides to outsource the work then the contractors shall employ an Environmental Officer. In both the cases the Concessionaire will implement the environmental measures (either through the contractors or themselves).

8.7 Institutional Capacity Building

The Manager (Environment) at PIU, Environmental Specialist of the CSC/IE and the Concessionaire, are responsible for the implementation of the EMP, need to be trained on environmental issues of proposed elevated corridor project and ensure the successful implementation of the proposed project in a sustainable manner.

8.8 Training Components:

The training should encompass the following:

- Understanding of the relevant environmental regulations and their application to the project.
- Significant impacts of the project on the environment.
- Mitigation measures as proposed in the EMP and their implementation.
- Duties and responsibilities of the Contractors, Supervision Consultants and PIU staff involved in the project.
- Public/Stakeholder's consultation and its role during the implementation of the project.
- Supervision and implementation of the EMP and handling environmental issues during construction.
- Monitoring performance indicators during different stages of project implementation and operation.
- Weekly, monthly and quarterly reporting requirements, preparations and submission.

8.9 Training Programme:

A training programme shall be worked out incorporating the project needs as well as the capacity building requirements. The training would cover the basic principles of environmental assessment, statutory requirements with respect to environment conservation, nature of impacts by the proposed project, mitigation plans and programmes implementation techniques, monitoring and management methods and tools, etc. The programme should consist of a number of training modules specific to target groups suggested below.

Module I: Environmental Overview

- General environmental issues
- Environmental issues associated with highways development.

- Principles and policies for (natural) environmental mitigation in development projects.
- Role of Environmental Management in project development

Module II: Environmental Regulations and Acts

- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and Control of Pollution) Act, 1974
- Hazardous Materials (Transportation and Handling) Rules
- Forest (Conservation) Act, 1980
- EIA Notification, 2006 and amendments
- Other environmental acts, rules and regulations relevant in highways development.
- Role of environmental planning, conservation and enforcement authorities

Module III: Pollution

- Pollution and Wastes
- Highways and pollution
- Generation of wastes in highway construction
- Possibilities of abating pollution and waste-generation

Module IV: Environmental management Plan

- Basic features of an EMP
- Planning and designing the environmental mitigation measures
- Incorporation of environmental components in design, construction and operations stages.
- Environmental monitoring, evaluation and review techniques

Module V: Environmental Issues

- Natural resource management and bio-diversity
- Green tunnels and roadside vegetation
- Natural vegetation- selection of species
- Wildlife protection
- Protection of water bodies and water resources
- Protection and transplantation of trees
- Wastewater disposal
- Soil conservation

Module VI: Environmental Issues in the Project

- Legal and institutional aspects

- Introduction to the designs and implementation schedule
- Probable natural environmental impacts

Module VII: Environmental Management Plan

- Construction stage environmental concerns and mitigation.
- Environmental design and implementation plans

Module VIII: Environmentally Sound Construction Management

- Laws and other statutes associated with the project
- New and alternative technology and materials
- New equipment, machines and their environmental / pollution performance
- Effluent control systems for construction processes and equipment
- Waste minimization and management in construction
- Efficient construction activity monitoring; compliance monitoring
- Environmental clauses in contract documents and their implications
- Good practices for project construction

Module IX: Planning for Environmentally Sustainable Operations

- Controlling pollution in during operation phase
- Cross-agency responsibilities and co-ordination
- Monitoring requirements; monitoring techniques
- Environmental evaluation techniques
- Performance indicators
- Reporting requirements and mechanisms for the Project

Module X: Long Term Environmental Issues

- Environmental surveys including ambient air, noise, biological and water quality surveys
- Data storage, analysis and retrieval
- Contract documents and incorporation of environmental clauses
- Community consultation
- Risk assessment and management
- Contingency planning and management

8.10 Environmental Budgetary Provisions

The budgetary provision for the implementation of the Environmental Management Plan of the project corridor is presented in Table 8-6.

Table 8-6: Cost for implementation of Environmental Management Action Plan to be executed under civil works contract

Sl. No.	Description	Unit	Estimated Quantity	Rate (Rs.) In Figures	Amount (Rs.)
1	A. Carting away the unserviceable materials from work site to the nearest disposal site (up to a lead of 5km) and disposing the same in disposal pits or borrow areas including depositing unserviceable materials in layers and manual compaction.	Cum	53,633	88.00	4,719,704.00
	B. The 30 cm top layer of disposal pit shall be provided with good earth, suitable for development of vegetation/plantation. All work shall be carried out as per specifications and approval of the Engineer in Charge	Sqm.	35,755	30.00	1,072,660.00
2	Turfing at ground level at disposal pits for un-serviceable material as per specifications and approval of the Engineer in Charge.	Sqm.	35,755	24.00	858,128.00
3	Regular water sprinkling (at least 4 times) per day at all construction sites for suppression of visible dust levels. Note: This item is to be operated after the completion of earthwork to suppress the visible dust levels. Cost of watering during compaction of earthwork is deemed to be already covered under civil works.	Km	87.86	12,000.00	1,054,320.00
4	Construction of recharge pits along the median (pier line) at each pier location and within the selected water bodies along the project road to facilitate percolation of runoff water in to the ground as per approved design and drawing as developed by Central Ground Water Board.	Nos.	2200	80,000.00	17,60,00,000.00
5	Construction of noise barrier(s) at specified locations along Project corridor. Glass fibre reinforced plastic sheet of 6 mm thickness for a total height of 2.67 m (inclusive of crash barrier height) erected with the help of revetment to steel angle (ISA 80x80x10 mm) with a spacing of 1 m from angle to angle embedded up to a depth of 0.8 m into crash barrier.	M	5,527	5,000.00	27,634,250.00
6	Sign boards for restriction on use of horns and speed limit near noise sensitive receptors (LHS & RHS)	Nos.	258	7,000.00	15,00,000.00

7	Periodic air quality monitoring during construction stage along the proposed corridor construction camp sites, batching plants, bitumen hot mix plants, crusher plants (if specifically established for Project), at major Air sensitive receptors along project road. The parameters to be monitored are SO2, NO_2 PM_{10}, $PM_{2.5}$, and CO, Lead. Each monitoring schedule shall be over duration of 24 hours (in 8 hour shifts), once in four months for 2 Years). (The tests are to be conducted in accordance CPCB norms)	Nos.	354	7,500.00	26,55,000.00
8	Water quality monitoring during construction phase at locations. The sampling shall be carried out once in four months for 2 years and cover all parameters as per IS10500 including heavy metals.	Nos.	204	5,000.00	10,20,000.00
9	Noise quality monitoring at specified silent receptors along Project Road, at construction camp sites, bitumen hot mix plants, crusher plants(if specifically established for Project), and at major settlement areas along project road. – Each monitoring schedule shall be over duration of 12hours (6Am to 6PM), once in four months for 2 Years. The monitoring shall be carried out in accordance with CPCB norms.	Nos.	354	2000.00	7,08,000.00
10	Soil quality monitoring at construction camp sites, work shop areas, oil/lubricant handling areas, bitumen hot mix plants, at all parking lay byes, vehicle servicing stations along Project Road. Parameters shall include pH, Nitrogen, Phosphorus,, Potassium, Sodium, Chloride, Organic Carbon and Lead and carried out twice in a year (Pre monsoon and Post monsoon for 2 years.	Nos.	160	3,500.00	5,60,000.00
11	Providing Oil Interceptors at the fuel/oil storage camps or construction camps.	Nos.	2200	5,000.00	60,000.00
12	Providing Personal Protective Equipment to labours during construction Phase of the project.	Cost/ person/ annum	6,400	1,500.00	96,00,000.00
13	Provision for two health check-ups for the carcinogens from bituminous fumes, which may inhaled during road paving works. The first health check-up prior to induction of the personnel into the construction works and the last health check-up prior to the discharge of the personnel from the construction works	Cost/ person	1,280	2,000.00	25,60,000.00

14	Raising compensatory plantation along the project corridor and or nearest available government lands. Planting of trees in 0.6 m dia holes, 1 m depth dug in the ground, mixing the soil with decayed farmyard manure, planting the saplings, backfilling the trench, watering, fixing the tree guard and maintaining the plants for 5 yrs.	Tree Nos.	37,160	2,714.00	10,08,52,240.00
15	Tree transplantation at suitable site within a distance of 5 km from the existing tree including uprooting, cutting roots, pruning branches and planting in a trench of 50 * 50 m wide trench having a depth of 1 to 2 m. including excavation at transplantation location and backfilling and levelling of uprooted site.	Tree Nos.	3,716	1,00,000.00	37,16,00,000.00
16	Leasing of land required for transplanting/planting trees @ 1200 / hectare to compensate the trees cut along the proposed corridors.	Hectares	35.12	3,70,500.00	1,30,11,960.00
17	Environmental Enhancement measures: 1. Improvement/restoration of water bodies adjacent to the corridor with desilting, soil erosion control measures and catchment area development, etc. 2. Improvement of Parks adjacent to the corridor; 3. Median Plantation and plantation at left over lands at government offices, hospitals, schools and military lands.	Cost/km	87.86	50,00,000.00	43,93,00,000.00
18	Providing short term environmental training for staff of PIU, Contractors personnel by supervision consultant. The responsibility of developing and conducting training program shall be with supervision consultant but the cost will be borne by contractor. Training shall cover for pre-construction, construction and post-construction of project implementation.	Nos.	30	2,00,000.00	6,000,000.00
19	The scheme for vertical garden on the pillars in order to reduce the heat effect & vehicular emissions.	Sqm	64,819	600.00	3,88,91,400.00
	Total Carried to Summary				1,199,657,662

Note: Tree transplantation considered @ 10 % of the total number of trees being cut.
Each tree being cut is compensated by planting 10 new trees.

9. CONCLUSION

The Environmental Impact Study exercise provides a full description of the project corridor environment, and significant positive and negative impacts on natural environment owing to the proposed project. An attempt has also been made to counteract the potential impacts identified in terms of mitigation measures for the proposed corridor project.

The proposed elevated corridor project will cause following significant impacts during pre-construction and construction phases and their mitigative measures.

- It is estimated that approximately 98 acres of land to be acquired along the alignment of the proposed six corridors. Most of the land acquired is for ramps, junction improvements, grade separators which are integral parts of the proposed project.
- Approximately 4,34,500 cum of debris would be generated from the excavations for piles and pile cap out of which 75% of the debris suiting to the requirements of soil fillings shall be utilized for ramp construction and 25 % of unserviceable materials shall have to be disposed in borrow pits or abandoned quarries in an environmentally sustainable manner.
- There are altogether 10 water bodies in the vicinity of project however, project alignment passes close to only three lakes that is Ulsoor lake, Varthur Lake and Agara Lake. Stringent mitigation measures will be taken up to avoid and reduce the impact of construction activities.
- Waste water generated at construction camps and labour camps will be treated to the standards prescribed by CPCB to water pollution in the vicinity of the project associated construction camps and labour camps.
- City traffic will get disrupted during the construction phase of the project due to traffic diversions which will be handled by effective traffic management and diversion plans.
- Generation of dust by the project activities like site preparatory earthworks; demolition of existing structures; foundation excavation works; erection and use of heavy equipment & machinery; loading, transporting and unloading soil and construction materials and material handling; traffic diversion; etc. is the main air quality issue associated with construction of the proposed elevated corridor. In addition to dust, it is also expected that project activities could release air pollutants like SO_2, NO_x, CO, Lead, Benzene and Volatile Organic Compounds (VOC). Proper dust and emission mitigation measures are proposed in the EMP to handle the dust during various phases of project implementation to prevent adverse impact on air sensitive receptors.
- The air pollutants emission is likely to come down to a greater extent by the operating vehicles on elevated corridor with extensive savings on consumption of fuel because of the signal free uninterrupted traffic movements.

- Project corridor alignment has more than 60 air and noise sensitive receptors such as schools, colleges, hostels, hospitals, libraries including 30 km stretch of communities (built-up sections). Dust mitigation by regular sprinkling of water and noise mitigation measures such as provision of barricades during construction and noise barriers will be made at all the identified air and noise sensitive receptors to reduce the impact during construction and operation stages.
- 3716 trees may get impacted by the project which seems to be the most significant to Bangalore city. The sincere efforts shall be made to save trees and avoid tree cutting at all the stages of the project implementation by just pruning the branches wherever possible. Attempt shall also be made to translocate at least 20 % of the trees being impacted to nearby identified locations. In addition at-grade median plantation will be taken up all along the proposed alignment and vertical gardens will be proposed on the piers of elevated corridor. In addition to above for every tree impacted it shall be compensated at the rate of ten trees as per the direction of Forest Department.
- There are two notified archaeological structures along the North - South corridor. Tipu Sultan's Summer Palace being a protected monument as per the Ancient Monuments and Archaeological Sites and Remains (Amendment & Validation) Act, 2010(prohibited area), is within a distance of 100 metres from the proposed East West Corridor - 2. Another notified structure Old Dungeon Fort & Gates is at a distance of 330 m from the proposed North - South corridor, beyond regulated area (200 meters further beyond prohibited area as per the latest circular). Required permission / NOC will be obtained from Archaeological Survey of India before construction of elevated corridor.
- The project would impact on the livelihood, public services, health and safety of community and labourers temporarily during construction of the project. Inconveniences caused by utility shifting, excavations, unplanned stacking of excavated earth and traffic diversions in the vicinity of project corridors will be handled suitably as per the Statutory provisions.

10. DISCLOSUREOF CONSULTANTS ENGAGED

AECOM has been accredited as EIA consultant for various sectors including Townships and Area Development projects which falls under Category 8(b) of Notification dated 14th September, 2006. The accreditation has been granted by National Accreditation Board for Education and Training (NABET) of Quality Council of India (QCI) under the Accreditation Scheme for EIA Consultant Organisations as per MoEF requirements.

The following approved consultants and experts were engaged for preparation of the EIA report for the proposed study.

Sl. No.	EIA Coordinators /Functional Areas	Required Functional Areas	Signature
1	EIA Coordinator – Townships and Area Development projects	Balakrishna Y V	
2	Associate EIA Coordinator – Townships and Area Development projects	Avijit Sarkar	ASarkar
3	Air Quality & Air Pollution	Shivnath Chalka	Shivnath Chalka
4	Noise & Vibration	Atul Kumar	Atul Kumar
5	Water Pollution Monitoring, Prevention & Control (WP)	Balakrishna Y V	
6	Ecology and biodiversity	Deepti Bapat	Bapat

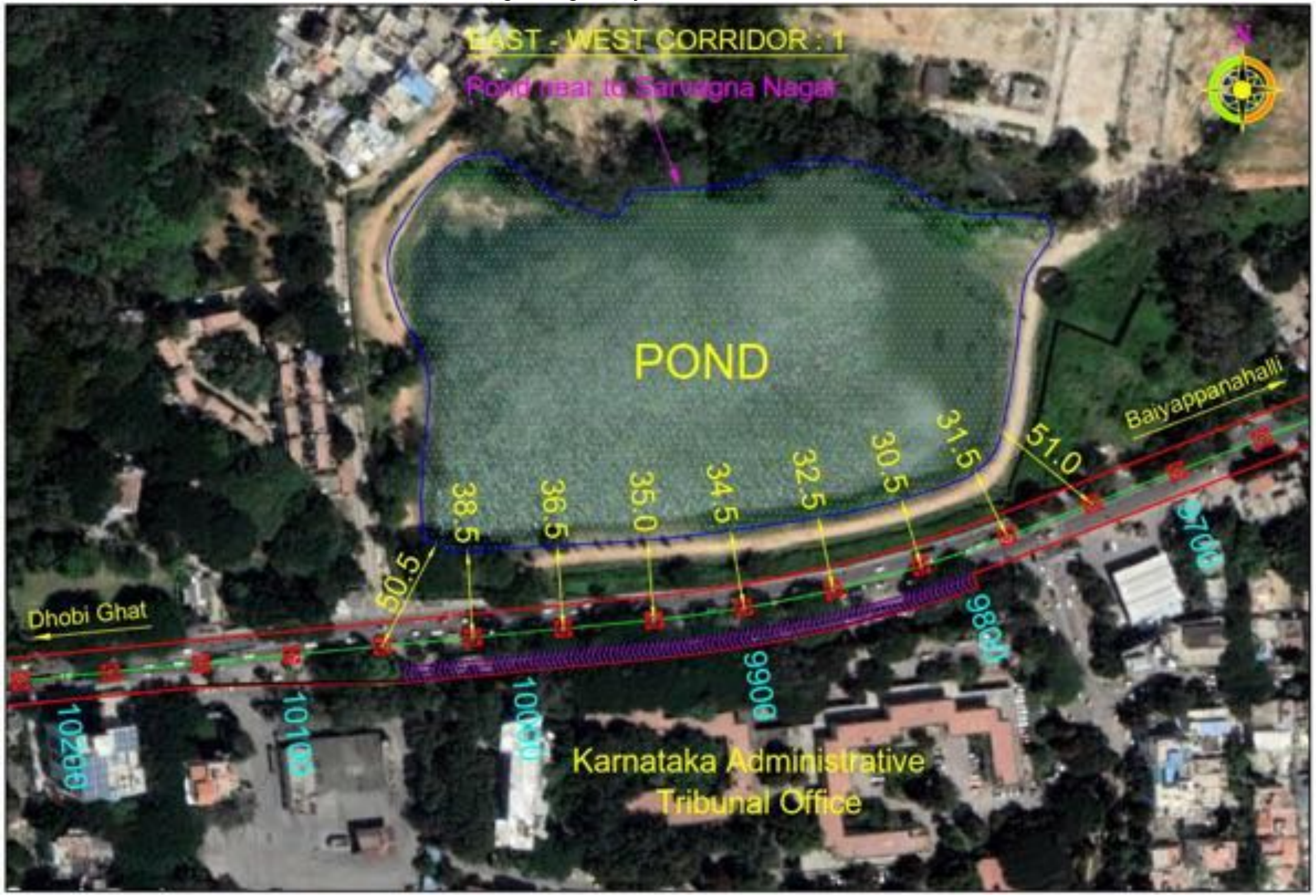
7	Land Use (LU)	Aditi	
Team Members:			
8		Vandana Singh	
9		Prajakta Pathare	

ANNEXURE - 1 : WATER BODIES

Hebbal Lake adjacent to the North-South Corridor

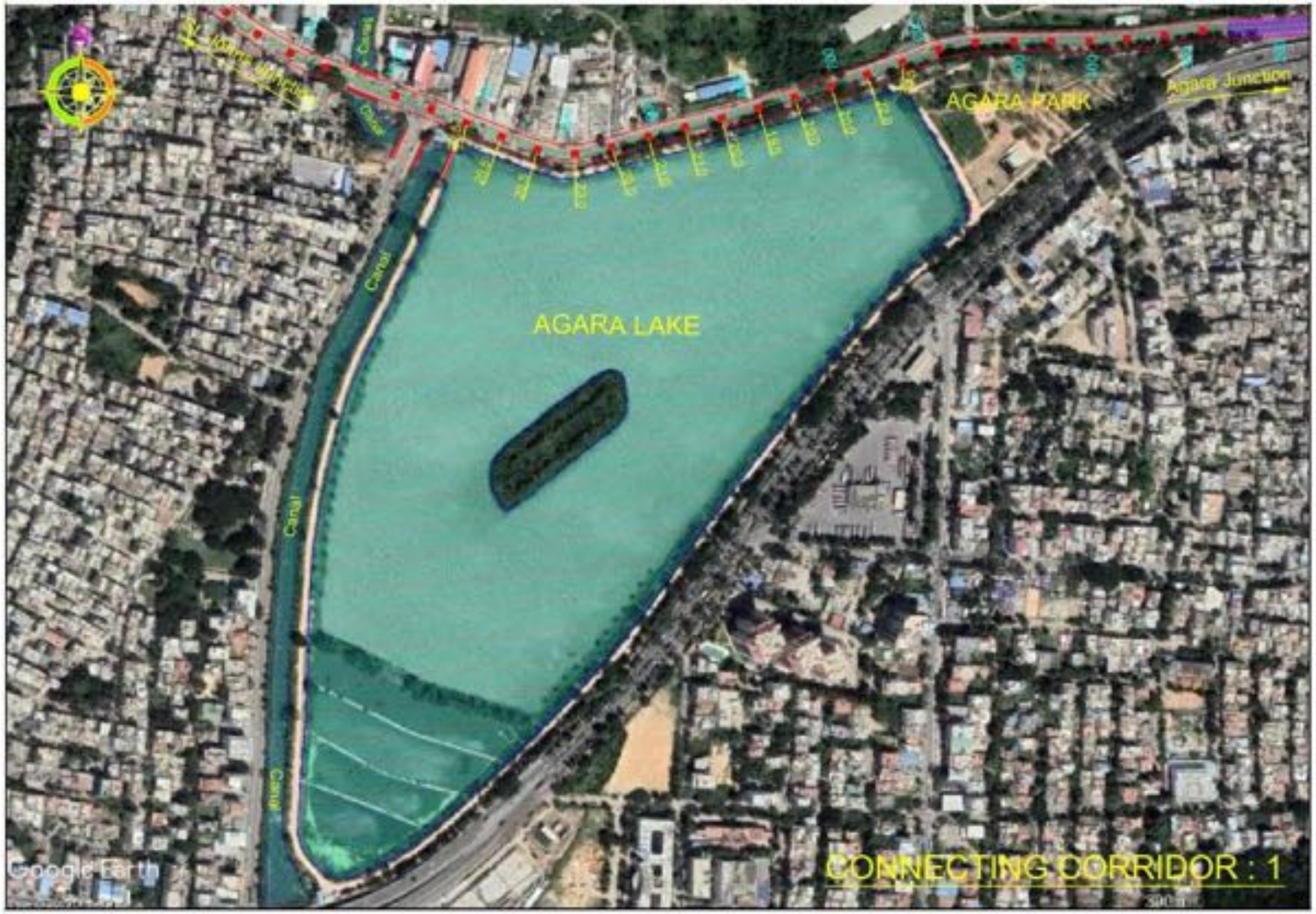
Ulsoor Lake adjacent to the East West 1 Corridor

Pond near Sarvagnanagar adjacent to the East West 1 Corridor



KR Puram Lake adjacent to the East West 1 Corridor

Agara Lake adjacent to Connecting Corridor - 1



Varthur Lake adjacent to East-West Corridor - 2

Vrishabhavathi Stream across East-West Corridor - 2

Chalkere Lake across Connecting Corridor - 3

Water Bodies adjacent to the Connecting Corridor 3

ANNEXURE - 2: AIR SENSITIVE RECEPTORS

Air Sensitive Receptors along the proposed North-South corridor

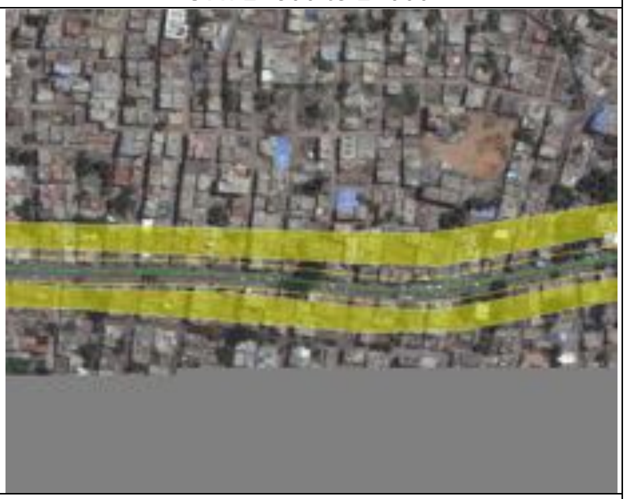
	
CH: 1+200 to 1+600 _ Jayamahal 2nd Main Rd	CH: 1+900 to 2+400 _ Jayamahal 2nd Main Rd
	
CH: 3+400 to 3+800 _ Millers Road	CH: 4+750 to 5+100 _ Cock Burn Road
	

CH: 5+100 to 5+400 _ Cock Burn Road	Ramp at CH: 8+100_District Office Road
	
CH: 19+800 to 19+550 _ LBF Road	CH: 10+700 to 11+200 _ Shamanna Main Road
	
CH: 12+100 to 12+400 _ Hosur Road	CH: 12+600 _ Hosur Road

Air Sensitive Receptors along the proposed East West Corridor 1

	
CH: 1+100 to 1+400 _ NH-4 Road	CH: 2+100 to 2+500 _ NH-4 Road
	
CH: 2+500 to 3+040 _ Swamy Vivekananda Road	CH: 2+500 to 3+040 _ NH-4 Road
	
CH: 10+600 to 10+700 _ D Bhaskaran Road	CH: 2+500 to 3+040 _ NH-4 Road

Air Sensitive Receptors along the proposed East West Corridor 1

	
CH: 12+800 - 13+300 St Johns Church Road	CH: 12+800 - 13+300 St Johns Church Road
	
CH: 12+800 to 13+000 _ Promenade Road	CH: 1+500 to 1+900
	
CH: 3+700 to 4+100 _ Ramamurthinagar Main RD	CH: 4+100 to 4+500 _ Ramamurthinagar Main RD

Air Sensitive Receptors along the proposed East West Corridor 1

CH: 4+500 to 4+900 _ Ramamurthinagar Main RD

CH: 4+900 to 5+300 _ Ramamurthinagar Main RD

CH: 5+300 to 5+600 _ Ramamurthinagar Main RD

Air Sensitive Receptors along the proposed East West Corridor 2

CH: 0+500 to 0+900 _ HAL Airport Road

CH: 0+900 to 1+100 _ HAL Airport Road

CH: 4+600 to 4+800 _ HAL Airport Road

CH: 4+900 to 5+200 _ HAL Airport Road

CH: 5+400 to 5+800 _ HAL Airport Road

CH: 5+800 to 6+300 _ HAL Airport Road

Air Sensitive Receptors along the proposed East West Corridor 2

	
CH: 9+450 to 9+650 _ HAL Airport Road	CH: 9+750 to 9+910 _ HAL Airport Road
	
CH: 16+070 to 16+250 _ Richmond Road	CH: 17+160 to 17+390 _ Mission Rd to Residency Road Flyover
	
CH: 16+070 to 16+250 _ Richmond Road	CH: 17+160 to 17+390 Mission Rd to Residency Road Flyover

Air Sensitive Receptors along the proposed East West Corridor 2

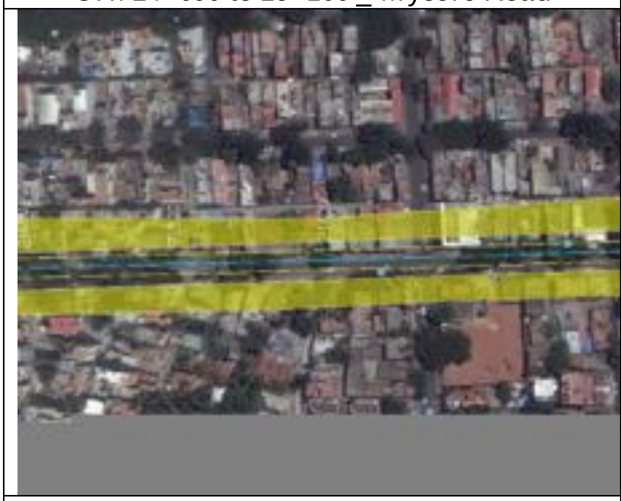
	
CH: 17+160 to 17+390 _ Raja Ram Mohan Roy Road	CH: 19+100 to 19+400 _ Arumugam Mudaliar Road
	
CH: 19+400 to 19+600 _ Arumugam Mudaliar Road	CH: 20+700 to 21+090 _ Alur VenkataRao Road
	
CH: 21+500 to 22+700 _ Alur VenkataRao Road	CH: 22+700 to 22+950 _ Alur VenkataRao Road

CH: 23+100 to 23+400 _ Mysore Road

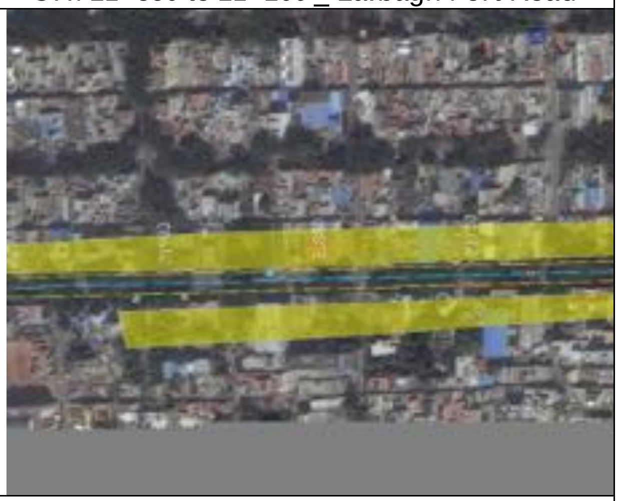
CH: 23+800 to 24+200 _ Mysore Road

CH: 24+690 to 25+100 _ Mysore Road

CH: 21+850 to 21+200 _ Lalbagh Fort Road



CH: 21+200 to 21+600 _ Lalbagh Fort Road

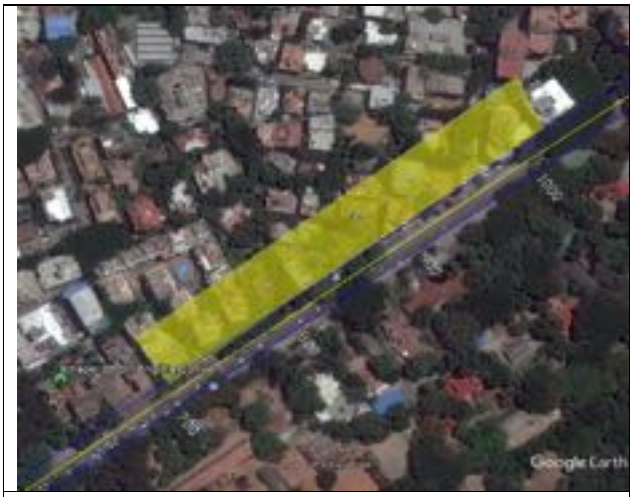


CH: 21+600 to 22+000 _ Lalbagh Fort Road

Air Sensitive Receptors along the proposed Connecting Corridor 1

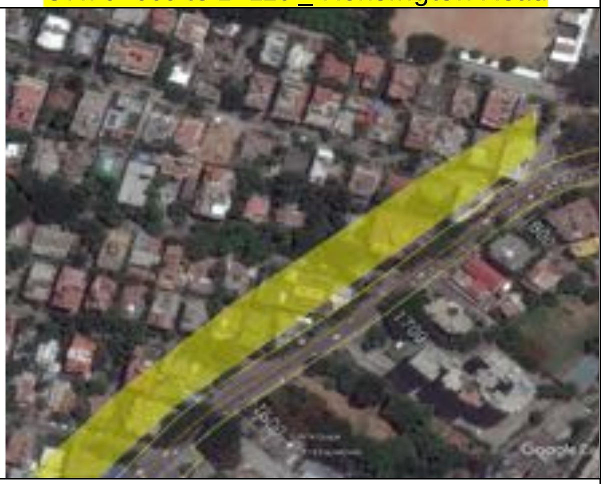
	
CH: 0+000 to 0+250 _ 100 Feet Ring Road	CH: 1+570 to 2+200 _ Sarjapur Main Road
	
CH: 2+470 to 2+800 _ Sarjapur Main Road	CH: 2+800 to 3+200 _ Sarjapur Main Road
	
CH: 3+200 to 3+310 _ Sarjapur Main Road	

Air Sensitive Receptors along the proposed Connecting Corridor 2

	
CH: 0+700 to 1+000 _ General KS Thimayya Road	CH: 2+000 to 2+200 _ Kensington Road

Air Sensitive Receptors along the proposed Connecting Corridor 3

	
CH: 0+000 to 0+300 _ Wheeler Road	CH: 0+300 to 0+500 _ Wheeler Road

	
CH: 0+580 to 0+900 _ Kensington Road	CH: 0+900 to 1+120 _ Kensington Road
	
CH: 1+300 to 1+600 _Dodda Banswadi Main Road	CH: 1+600 to 1+810 _Dodda Banswadi Main Road
	
CH: 1+990 to 2+240 _Dodda Banswadi Main Road	CH: 2+300 to 2+600 _Dodda Banswadi Main Road

CH: 2+600 to 2+810 _Dodda Banswadi Main Road

CH: 3+000 to 3+400 _Dodda Banswadi Main Road

CH: 3+600 to 3+800 Dodda Banswadi Main Road

CH: 3+800 to 4+120 _Dodda Banswadi Main Road

CH: 3+610 to 5+000 _8th Main East Road

CH: 5+000 to 5+400 _ 8th Main East Road

CH: 5+400 to 5+500 _8th Main East Road

ANNEXURE - 3: SENSITIVE WOODED STRUCTURES

Sensitive wooded stretches along the NS & EW2 project corridors

Sensitive wooded stretches from 18+250 to 20+500 – Mekhri Circle to Yeshwanthpur flyover

along the East West - 1 Corridor

Sensitive wooded stretch from 1+600 to 2+700 – Cantonment Railway Station to Mekhri Circle along the North - South Corridor

Sensitive wooded stretch from 13+300 to 13+700 at Coles Park along the Easr-West 1 Corridor

ANNEXURE - 4: NATIONAL STANDARDS FOR AMBIENT AIR, AMBIENT NOISE, WATER, AND SOIL ALONG WITH SAMPLING LOCATIONS TO BE MONITORED

1 Ambient Air Quality Standards (National)

Pollutants	Time-Weighted Average	Concentration in ambient air	
		Industrial, Residential, Rural & other Areas	Ecologically Sensitive Area (Notified by Central Government)
Sulphur Dioxide (SO_2) µg/m3	Annual Avg.	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO_2) µg/m3	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (Size less than 10 µm) or PM_{10} µg/m3	Annual	60	60
	24 Hours**	100	100
Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$ µg/m3	Annual	40	40
	24 Hours**	60	60
Ozone (O3) µg/m3	8 Hours**	100	100
	1 Hours**	180	180
Lead (Pb) µg/m3	Annual	0.5	0.5
	24 Hours**	1.0	1.0
Carbon Monoxide (CO) mg/m3	8 Hours**	2.0	2.0
	1 Hour	4.0	4.0
* Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval ** 24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.			

Water quality Standards (IS 10500: 1991)

Sl. No.	SUBSTANCE/ CHARACTERISTIC	DESIRABLE LIMIT	PERMISSIBLE LIMIT	REMARKS
1	COLOUR, HAZEN UNITS, MAX	5	25	Extended to 25 if toxic substance are not suspected in absence of alternate sources
2	ODOUR	Unobjectionable		a) Test cold and when heated
				b) Test at several dilution
3	TASTE	Agreeable		Test to be conducted only after safety has been established
4	TURBIDITY N T U, Max	5	10	
5	pH value	6.5 to 8.5	No relaxation	
6	TOTAL HARDNESS (as Ca CO3 mg/lit)	600	600	
7	IRON (as Fe mg/lit,	0.3	1.0	

Sl. No.	SUBSTANCE/ CHARACTERISTIC	DESIRABLE LIMIT	PERMISSIBLE LIMIT	REMARKS
	Max			
8	CHLORIDES (as Cl mg/lit Max	250	1000	
9	RESIDUAL FREE CHLORINE, mg/lit Max	0.2		To be applicable only when water is chlorinated. Treated at consumer end. When protection against viral infection is required, it should be Min 0.5 mg/lit
10	DISSOLVED SOLIDS mg/l, Max	500	2000	
11	CALCIUM (as Ca) mg/l, Max	75	200	
12	COPPER (as Cu) mg/l, Max	0.05	1.5	
13	MANGANESE (Mn) mg/l Max	0.1	0.3	
14	SULPHATE (As SO4), Max	200	400	May be extended up to 400 provided (as Mg) does not exceed 30
15	NITRATE (as No3) mg/l, Max	45	100	
16	FLUORIDE (as F) mg/l, Max	1.0	1.5	
17	PHENOLIC COMPOUNDS (as C6H6OH) mg/l Max	0.001	0.002	
18	ARSENIC (as As mg/l	0.05	No relaxation	To be tested when pollution is suspected
19	LEAD (as Pb) mg/l	0.05	No relaxation	
20	ANIONIC DETERGENTS (as MBAS) mg/l	0.2	1.0	
21	CHROMIUM (as Cr) mg/l	0.05	1.0	To be tested when pollution is suspected
22	MINERAL OIL mg/l	0.01	0.03	
23	ALKALINITY mg/l	200	600	
24	TOTAL COLIFORM	95% of the sample should not contain coliform in 100 ml. 10 coliform /100 ml		

National Ambient Noise Standards

Area Code	Category of Area	Limits in dB (A) Leq

		Day Time	Night Time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence area	50	40

Day time shall mean from 6.00 AM to 10.00 PM and Night shall mean from 10.00PM to 6.00 AM silence zone defined as area up to 100m around premises of hospitals, educational institutions and courts. Use of vehicles horns, loud speakers and bursting of crackers are banned in these zones.

The location for air, water, noise and soil quality monitoring stations have been selected depending on the impact of pollutants on sensitive noise sensitive receptors like human habitations adjacent to the corridor alignment, representativeness of the sample; baseline data monitored location, ecologically sensitive locations, etc., Number and frequency of samples to be monitored along the proposed project road are given in the following tables. Cost for monitoring has been estimated and included in the EMP BoQ.

ANNEXURE - 5: DETAILS OF TREES TO BE FELLED

NS CORRIDOR

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
1	R0/1	Peepal Tree	Ficus religiosa	120	LHS	Phase 1: Package 1 - Hebbal to Cantonment
2	R0/2	Peepal Tree	Ficus religiosa	60	LHS	
3	R0/3	Jamun Tree	Syzygium cumini	140	RHS	
4	R0/4	Jamun Tree	Syzygium cumini	150	RHS	
5	R0/5	Jamun Tree	Syzygium cumini	180	RHS	
6	R1/1	Rain Tree	Samanea saman	90	RHS	
7	R1/2	West Indian Mahogany	Swietenia mahagoni	190	RHS	
8	R1/3	Copper Pod	Peltophorum pterocarpum	140	RHS	
9	R2/1	Rain Tree	Samanea saman	170	RHS	
10	R2/2	Copper Pod	Peltophorum pterocarpum	150	RHS	
11	R2/3	West Indian Mahogany	Swietenia mahagoni	250	RHS	
12	R2/4	West Indian Mahogany	Swietenia mahagoni	200	RHS	
13	R2/5	Copper Pod	Peltophorum pterocarpum	130	RHS	
14	R2/6	West Indian Mahogany	Swietenia mahagoni	170	RHS	
15	R2/7	Copper Pod	Peltophorum pterocarpum	90	RHS	
16	R2/8	Copper Pod	Peltophorum pterocarpum	140	RHS	
17	R2/9	Copper Pod	Peltophorum pterocarpum	130	RHS	
18	R2/10	West Indian Mahogany	Swietenia mahagoni	180	RHS	
19	R2/11	West Indian Mahogany	Swietenia mahagoni	270	RHS	
20	R2/12	Rain Tree	Samanea saman	340	RHS	
21	R2/13	Rain Tree	Samanea saman	310	RHS	
22	R2/14	Jack Fruit	Artocarpus heterophyllus	170	RHS	
23	R2/15	West Indian Mahogany	Swietenia mahagoni	160	RHS	
24	R2/16	Copper Pod	Peltophorum pterocarpum	140	RHS	
25	R2/17	West Indian Mahogany	Swietenia mahagoni	200	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
26	R2/18	West Indian Mahogany	Swietenia mahagoni	180	RHS	
27	R2/19	Copper Pod	Peltophorum pterocarpum	260	RHS	
28	R2/20	West Indian Mahogany	Swietenia mahagoni	100	RHS	
29	R2/21	Copper Pod	Peltophorum pterocarpum	170	RHS	
30	R2/22	West Indian Mahogany	Swietenia mahagoni	390	RHS	
31	R2/23	West Indian Mahogany	Swietenia mahagoni	300	RHS	
32	R2/24	West Indian Mahogany	Swietenia mahagoni	200	RHS	
33	R2/25	West Indian Mahogany	Swietenia mahagoni	160	RHS	
34	R2/26	West Indian Mahogany	Swietenia mahagoni	280	RHS	
35	R2/27	West Indian Mahogany	Swietenia mahagoni	140	RHS	
36	R2/28	West Indian Mahogany	Swietenia mahagoni	200	RHS	
37	R2/29	West Indian Mahogany	Swietenia mahagoni	180	RHS	
38	R2/30	West Indian Mahogany	Swietenia mahagoni	120	RHS	
39	R2/31	West Indian Mahogany	Swietenia mahagoni	80	RHS	
40	R2/32	West Indian Mahogany	Swietenia mahagoni	290	RHS	
41	R2/33	West Indian Mahogany	Swietenia mahagoni	80	RHS	
42	R2/34	West Indian Mahogany	Swietenia mahagoni	360	RHS	
43	R2/35	Copper Pod	Peltophorum pterocarpum	150	RHS	
44	R2/36	West Indian Mahogany	Swietenia mahagoni	180	RHS	
45	R2/37	West Indian Mahogany	Swietenia mahagoni	360	RHS	
46	R2/38	West Indian Mahogany	Swietenia mahagoni	210	RHS	
47	R2/39	West Indian Mahogany	Swietenia mahagoni	210	RHS	
48	R2/40	Gulmohar Tree	Delonix regia	300	RHS	
49	R2/41	Copper Pod	Peltophorum pterocarpum	160	RHS	
50	R2/42	Copper Pod	Peltophorum pterocarpum	180	RHS	
51	R2/43	Copper Pod	Peltophorum pterocarpum	140	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
52	R2/44	Copper Pod	Peltophorum pterocarpum	140	RHS	
53	R2/45	Copper Pod	Peltophorum pterocarpum	190	RHS	
54	R2/46	Ashoka Tree	Saraca indica	70	RHS	
55	R2/47	Ashoka Tree	Saraca indica	80	RHS	
56	R2/48	Ashoka Tree	Saraca indica	80	RHS	
57	R2/49	Ashoka Tree	Saraca indica	80	RHS	
58	R2/50	Honge	Pongamia pinnata	85	RHS	
59	R2/51	Ashoka Tree	Saraca indica	80	RHS	
60	R2/52	Golden Shower Tree	Cassia fistula	60	RHS	
61	R2/53	Attimara	Ficus racemosa	120	RHS	
62	R2/54	Golden Shower Tree	Cassia fistula	60	RHS	
63	R2/55	Golden Shower Tree	Cassia fistula	60	RHS	
64	R3/1	Golden Shower Tree	Cassia fistula	80	RHS	
65	R3/2	Copper Pod	Peltophorum pterocarpum	230	RHS	
66	R3/3	Gulmohar Tree	Delonix regia	270	RHS	
67	R3/4	Copper Pod	Peltophorum pterocarpum	80	RHS	
68	R3/5	Copper Pod	Peltophorum pterocarpum	200	RHS	
69	R3/6	West Indian Mahogany	Swietenia mahagoni	150	RHS	
70	R3/7	Attimara	Ficus racemosa	130	RHS	
71	R3/8	Mountain Ebony	Bauhnia variegata	90	RHS	
72	R3/9	Golden Shower Tree	Cassia fistula	160	RHS	
73	R3/10	West Indian Mahogany	Swietenia mahagoni	160	RHS	
74	R3/11	Copper Pod	Peltophorum pterocarpum	190	RHS	
75	R3/12	West Indian Mahogany	Swietenia mahagoni	100	RHS	
76	R3/13	Copper Pod	Peltophorum pterocarpum	280	RHS	
77	R3/14	West Indian Mahogany	Swietenia mahagoni	240	RHS	
78	R3/15	Rain Tree	Samanea saman	340	RHS	
79	R3/16	Copper Pod	Peltophorum pterocarpum	140	RHS	
80	R3/17	Copper Pod	Peltophorum pterocarpum	210	RHS	
81	R3/18	Copper Pod	Peltophorum pterocarpum	120	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
82	R3/19	African tuliptree	Spathodea campanulata	300	RHS	
83	R3/20	West Indian Mahogany	Swietenia mahagoni	140	RHS	
84	R3/21	Copper Pod	Peltophorum pterocarpum	150	RHS	
85	R3/22	Portia tree	Thespesia populnea	80	RHS	
86	R3/23	Gulmohar Tree	Delonix regia	150	RHS	
87	R3/24	Copper Pod	Peltophorum pterocarpum	150	RHS	
88	R3/25	Golden Shower Tree	Cassia fistula	280	RHS	
89	R3/26	Copper Pod	Peltophorum pterocarpum	160	RHS	
90	R3/27	Golden Shower Tree	Cassia fistula	260	RHS	
91	R3/28	Caribbean trumpet tree	Tabebuia aurea	150	RHS	
92	R3/29	Rain Tree	Samanea saman	350	RHS	
93	R3/30	Gulmohar Tree	Delonix regia	70	RHS	
94	R4/1	Peepal Tree	Ficus religiosa	370	RHS	
95	R4/2	Rain Tree	Samanea saman	340	RHS	
96	R4/3	Golden Shower Tree	Cassia fistula	260	RHS	
97	R4/4	Copper Pod	Peltophorum pterocarpum	200	RHS	
98	R4/5	Copper Pod	Peltophorum pterocarpum	160	RHS	
99	R4/6	Rain Tree	Samanea saman	320	RHS	
100	R4/7	Gulmohar Tree	Delonix regia	80	RHS	
101	R4/8	Gulmohar Tree	Delonix regia	80	RHS	
102	R4/9	Tamarind	Tamarindus indica	180	RHS	
103	R4/10	Silver Oak	Grevillea robusta	120	RHS	
104	R4/11	Rubber fig	Ficus elastica	110	RHS	
105	R4/12	West Indian Mahogany	Swietenia mahagoni	120	RHS	
106	R4/13	Silver Oak	Grevillea robusta	100	RHS	
107	R4/14	Tamarind	Tamarindus indica	140	RHS	
108	L3/1	Golden Shower Tree	Cassia fistula	80	LHS	
109	L3/2	West Indian Mahogany	Swietenia mahagoni	130	LHS	
110	L3/3	Copper Pod	Peltophorum pterocarpum	150	LHS	
111	L3/4	Peepal Tree	Ficus religiosa	380	LHS	
112	L3/29	Champak	Magnolia	70	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
			champaca			
113	L3/5	Copper Pod	Peltophorum pterocarpum	120	LHS	
114	L3/6	Golden Shower Tree	Cassia fistula	180	LHS	
115	L3/7	Golden Shower Tree	Cassia fistula	120	LHS	
116	L3/8	Golden Shower Tree	Cassia fistula	130	LHS	
117	L3/9	Golden Shower Tree	Cassia fistula	150	LHS	
118	L3/30	Golden Shower Tree	Cassia fistula	70	LHS	
119	L3/10	Golden Shower Tree	Cassia fistula	160	LHS	
120	L3/11	Golden Shower Tree	Cassia fistula	100	LHS	
121	L3/12	Golden Shower Tree	Cassia fistula	130	LHS	
122	L3/13	Golden Shower Tree	Cassia fistula	160	LHS	
123	L3/14	Golden Shower Tree	Cassia fistula	160	LHS	
124	L3/15	Golden Shower Tree	Cassia fistula	70	LHS	
125	L3/16	Golden Shower Tree	Cassia fistula	160	LHS	
126	L3/17	Copper Pod	Peltophorum pterocarpum	130	LHS	
127	L3/31	Teak	Tectona grandis	70	LHS	
128	L3/32	Silver Oak	Grevillea robusta	120	LHS	
129	L3/18	Golden Shower Tree	Cassia fistula	100	LHS	
130	L3/19	Golden Shower Tree	Cassia fistula	110	LHS	
131	L3/20	Golden Shower Tree	Cassia fistula	90	LHS	
132	L3/21	Golden Shower Tree	Cassia fistula	130	LHS	
133	L3/33	Teak	Tectona grandis	80	LHS	
134	L3/22	Copper Pod	Peltophorum pterocarpum	140	LHS	
135	L3/23	Golden Shower Tree	Cassia fistula	130	LHS	
136	L3/24	Golden Shower Tree	Cassia fistula	100	LHS	
137	L3/34	Golden Shower Tree	Cassia fistula	70	LHS	
138	L3/25	Teak	Tectona grandis	200	LHS	
139	L3/26	Teak	Tectona grandis	90	LHS	
140	L3/27	Teak	Tectona grandis	140	LHS	
141	L3/28	Honge	Pongamia pinnata	120	LHS	
142	L3/35	Teak	Tectona grandis	60	LHS	
143	L3/37	Copper Pod	Peltophorum pterocarpum	60	LHS	
144	L3/38	Rain Tree	Samanea saman	130	LHS	
145	L3/36	Teak	Tectona grandis	50	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
146	L3/39	Golden Shower Tree	Cassia fistula	120	LHS	
147	L3/40	Copper Pod	Peltophorum pterocarpum	70	LHS	
148	L3/41	Copper Pod	Peltophorum pterocarpum	100	LHS	
149	L3/42	Copper Pod	Peltophorum pterocarpum	140	LHS	
150	L3/43	Rubber fig	Ficus elastica	70	LHS	
151	L3/44	Rubber fig	Ficus elastica	110	LHS	
152	L3/45	East Indian walnut	Albizia lebbeck	190	LHS	
153	L3/46	West Indian Mahogany	Swietenia mahagoni	120	LHS	
154	L3/47	Copper Pod	Peltophorum pterocarpum	140	LHS	
155	L3/48	Golden Shower Tree	Cassia fistula	140	LHS	
156	L3/49	West Indian Mahogany	Swietenia mahagoni	60	LHS	
157	L3/50	Copper Pod	Peltophorum pterocarpum	130	LHS	
158	L3/51	Golden Shower Tree	Cassia fistula	180	LHS	
159	L3/52	Rubber fig	Ficus elastica	110	LHS	
160	L3/53	Copper Pod	Peltophorum pterocarpum	130	LHS	
161	L3/54	Jamun Tree	Syzygium cumini	120	LHS	
162	L3/55	Jamun Tree	Syzygium cumini	180	LHS	
163	L3/56	Jamun Tree	Syzygium cumini	140	LHS	
164	L3/57	Copper Pod	Peltophorum pterocarpum	160	LHS	
165	L3/58	Rain Tree	Samanea saman	120	LHS	
166	L3/59	Rubber fig	Ficus elastica	70	LHS	
167	L3/60	Rubber fig	Ficus elastica	110	LHS	
168	L3/61	Rain Tree	Samanea saman	120	LHS	
169	L3/62	Rain Tree	Samanea saman	100	LHS	
170	L3/63	West Indian Mahogany	Swietenia mahagoni	60	LHS	
171	L3/64	Rubber fig	Ficus elastica	170	LHS	
172	L3/65	West Indian Mahogany	Swietenia mahagoni	130	LHS	
173	L3/66	Golden Shower Tree	Cassia fistula	70	LHS	
174	L3/67	Golden Shower Tree	Cassia fistula	120	LHS	
175	L3/68	Copper Pod	Peltophorum pterocarpum	150	LHS	
176	L3/69	Rubber fig	Ficus elastica	70	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
177	L3/70	Rain Tree	Samanea saman	200	LHS	
178	L3/71	Golden Shower Tree	Cassia fistula	190	LHS	
179	L3/72	Golden Shower Tree	Cassia fistula	60	LHS	
180	L3/73	West Indian Mahogany	Swietenia mahagoni	80	LHS	
181	L3/74	Golden Shower Tree	Cassia fistula	80	LHS	
182	L3/75	Golden Shower Tree	Cassia fistula	160	LHS	
183	L3/76	Golden Shower Tree	Cassia fistula	70	LHS	
184	L3/77	Golden Shower Tree	Cassia fistula	170	LHS	
185	L3/78	Subabul	Leucaena leucocephala	150	LHS	
186	L3/79	Rubber fig	Ficus elastica	120	LHS	
187	L3/80	Copper Pod	Peltophorum pterocarpum	170	LHS	
188	L3/81	Copper Pod	Peltophorum pterocarpum	170	LHS	
189	L3/82	Golden Shower Tree	Cassia fistula	170	LHS	
190	L3/83	Copper Pod	Peltophorum pterocarpum	80	LHS	
191	L3/84	Rain Tree	Samanea saman	220	LHS	
192	L3/85	Copper Pod	Peltophorum pterocarpum	110	LHS	
193	L3/86	Rain Tree	Samanea saman	210	LHS	
194	L3/87	Copper Pod	Peltophorum pterocarpum	110	LHS	
195	L3/88	Golden Shower Tree	Cassia fistula	180	LHS	
196	L3/89	Rain Tree	Samanea saman	200	LHS	
197	L3/90	Rain Tree	Samanea saman	140	LHS	
198	L3/91	Tamarind	Tamarindus indica	120	LHS	
199	L3/92	Rain Tree	Samanea saman	100	LHS	
200	L3/93	Tamarind	Tamarindus indica	100	LHS	
201	L3/94	Rain Tree	Samanea saman	130	LHS	
202	L3/95	Copper Pod	Peltophorum pterocarpum	120	LHS	
203	L3/96	Copper Pod	Peltophorum pterocarpum	150	LHS	
204	L3/97	Copper Pod	Peltophorum pterocarpum	110	LHS	
205	L3/98	Golden Shower Tree	Cassia fistula	60	LHS	
206	L3/99	Golden Shower Tree	Cassia fistula	200	LHS	
207	L3/100	Golden Shower Tree	Cassia fistula	90	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
208	L3/101	Jamun Tree	Syzygium cumini	170	LHS	
209	L3/102	Jamun Tree	Syzygium cumini	70	LHS	
210	L3/103	Copper Pod	Peltophorum pterocarpum	160	LHS	
211	L3/104	Rain Tree	Samanea saman	80	LHS	
212	L3/105	Copper Pod	Peltophorum pterocarpum	130	LHS	
213	L3/106	Jamun Tree	Syzygium cumini	110	LHS	
214	L3/107	Jamun Tree	Syzygium cumini	150	LHS	
215	L3/108	Copper Pod	Peltophorum pterocarpum	160	LHS	
216	L3/109	Golden Shower Tree	Cassia fistula	170	LHS	
217	L3/110	Rubber fig	Ficus elastica	100	LHS	
218	L3/111	Rubber fig	Ficus elastica	150	LHS	
219	L3/112	Golden Shower Tree	Cassia fistula	190	LHS	
220	L3/113	Rain Tree	Samanea saman	260	LHS	
221	L3/114	Rubber fig	Ficus elastica	140	LHS	
222	L3/115	Tamarind	Tamarindus indica	140	LHS	
223	L3/116	Gulmohar Tree	Delonix regia	70	LHS	
224	L3/117	Rubber fig	Ficus elastica	170	LHS	
225	L3/118	Copper Pod	Peltophorum pterocarpum	130	LHS	
226	L3/119	Jamun Tree	Syzygium cumini	390	LHS	
227	L3/120	Subabul	Leucaena leucocephala	100	LHS	
228	L3/121	Peepal Tree	Ficus religiosa	350	LHS	
229	L3/122	Rubber fig	Ficus elastica	110	LHS	
230	L3/123	Copper Pod	Peltophorum pterocarpum	110	LHS	
231	L3/124	Copper Pod	Peltophorum pterocarpum	180	LHS	
232	L3/125	Copper Pod	Peltophorum pterocarpum	80	LHS	
233	L3/126	Golden Shower Tree	Cassia fistula	100	LHS	
234	L3/127	West Indian Mahogany	Swietenia mahagoni	80	LHS	
235	L3/128	Golden Shower Tree	Cassia fistula	180	LHS	
236	L3/129	Copper Pod	Peltophorum pterocarpum	150	LHS	
237	L3/130	Attimara	Ficus racemosa	130	LHS	
238	L3/131	Jamun Tree	Syzygium cumini	170	LHS	
239	L3/132	Jamun Tree	Syzygium cumini	130	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
240	L3/133	Golden Shower Tree	Cassia fistula	180	LHS	
241	L3/134	Golden Shower Tree	Cassia fistula	120	LHS	
242	L4/1	Golden Shower Tree	Cassia fistula	210	LHS	
243	L4/2	Copper Pod	Peltophorum pterocarpum	170	LHS	
244	L4/3	Gulmohar Tree	Delonix regia	150	LHS	
245	L4/4	Copper Pod	Peltophorum pterocarpum	150	LHS	
246	L4/5	Rubber fig	Ficus elastica	70	LHS	
247	L4/6	West Indian Mahogany	Swietenia mahagoni	150	LHS	
248	L4/7	Jamun Tree	Syzygium cumini	150	LHS	
249	L4/8	Honge	Pongamia pinnata	140	LHS	
250	L4/9	Copper Pod	Peltophorum pterocarpum	150	LHS	
251	L4/10	Tamarind	Tamarindus indica	140	LHS	
252	L4/11	Honge	Pongamia pinnata	220	LHS	
253	L4/12	Copper Pod	Peltophorum pterocarpum	300	LHS	
254	L4/13	Copper Pod	Peltophorum pterocarpum	150	LHS	
255	L4/14	Honge	Pongamia pinnata	80	LHS	
256	L4/15	Golden Shower Tree	Cassia fistula	200	LHS	
257	L4/16	Golden Shower Tree	Cassia fistula	130	LHS	
258	L4/17	Attimara	Ficus racemosa	160	LHS	
259	L4/18	Copper Pod	Peltophorum pterocarpum	190	LHS	
260	L4/19	Rubber fig	Ficus elastica	200	LHS	
261	R0/1	West Indian Mahogany	Swietenia mahagoni	240	RHS	Hebbal to Cantonment (Jayamahal Road)
262	R0/2	Silver Oak	Grevillea robusta	220	RHS	
263	R0/3	Caribbean trumpet tree	Tabebuia aurea	320	RHS	
264	R0/4	Honge	Pongamia pinnata	100	RHS	
265	R0/5	West Indian Mahogany	Swietenia mahagoni	110	RHS	
266	R0/6	West Indian Mahogany	Swietenia mahagoni	130	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
267	R0/7	Honge	Pongamia pinnata	100	RHS	
268	R0/8	Rain Tree	Samanea saman	160	RHS	
269	R0/9	West Indian Mahogany	Swietenia mahagoni	180	RHS	
270	R0/10	Rain Tree	Samanea saman	140	RHS	
271	R0/11	West Indian Mahogany	Swietenia mahagoni	100	RHS	
272	R0/12	West Indian Mahogany	Swietenia mahagoni	110	RHS	
273	R0/13	West Indian Mahogany	Swietenia mahagoni	130	RHS	
274	R0/14	Mango	Mangifera indica	260	RHS	
275	R0/15	Honge	Pongamia pinnata	180	RHS	
276	R0/16	Jamun Tree	Syzygium cumini	300	RHS	
277	R0/17	West Indian Mahogany	Swietenia mahagoni	210	RHS	
278	R0/18	West Indian Mahogany	Swietenia mahagoni	140	RHS	
279	R0/19	West Indian Mahogany	Swietenia mahagoni	140	RHS	
280	R0/20	Jamun Tree	Syzygium cumini	300	RHS	
281	R0/21	West Indian Mahogany	Swietenia mahagoni	280	RHS	
282	R0/22	West Indian Mahogany	Swietenia mahagoni	90	RHS	
283	R0/23	West Indian Mahogany	Swietenia mahagoni	280	RHS	
284	R0/24	West Indian Mahogany	Swietenia mahagoni	70	RHS	
285	R0/25	West Indian Mahogany	Swietenia mahagoni	100	RHS	
286	R0/26	West Indian Mahogany	Swietenia mahagoni	110	RHS	
287	R0/27	Honge	Pongamia pinnata	120	RHS	
288	R0/28	West Indian Mahogany	Swietenia mahagoni	20	RHS	
289	R0/29	Mountain Ebony	Bauhnia variegata	120	RHS	
290	R0/30	Jamun Tree	Syzygium cumini	280	RHS	
291	R0/31	Mango	Mangifera indica	290	RHS	
292	R0/32	Copper Pod	Peltophorum pterocarpum	180	RHS	
293	R0/33	West Indian Mahogany	Swietenia mahagoni	70	RHS	
294	R0/34	Honge	Pongamia pinnata	120	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
295	R0/35	Jamun Tree	Syzygium cumini	310	RHS	
296	R0/36	West Indian Mahogany	Swietenia mahagoni	110	RHS	
297	R0/37	Copper Pod	Peltophorum pterocarpum	110	RHS	
298	R0/38	West Indian Mahogany	Swietenia mahagoni	140	RHS	
299	R0/39	Honge	Pongamia pinnata	140	RHS	
300	R0/40	Honge	Pongamia pinnata	140	RHS	
301	R0/41	Honge	Pongamia pinnata	160	RHS	
302	R0/42	Rubber fig	Ficus elastica	100	RHS	
303	R0/43	Rubber fig	Ficus elastica	140	RHS	
304	R0/44	Rubber fig	Ficus elastica	140	RHS	
305	R0/45	Copper Pod	Peltophorum pterocarpum	180	RHS	
306	R0/46	Copper Pod	Peltophorum pterocarpum	180	RHS	
307	R0/47	Rubber fig	Ficus elastica	200	RHS	
308	R0/48	West Indian Mahogany	Swietenia mahagoni	160	RHS	
309	R0/49	West Indian Mahogany	Swietenia mahagoni	120	RHS	
310	R0/50	Mango	Mangifera indica	280	RHS	
311	R0/51	Mango	Mangifera indica	360	RHS	
312	R0/52	Rain Tree	Samanea saman	140	RHS	
313	R0/53	Honge	Pongamia pinnata	70	RHS	
314	R0/54	Mango	Mangifera indica	260	RHS	
315	R0/55	West Indian Mahogany	Swietenia mahagoni	70	RHS	
316	R0/56	West Indian Mahogany	Swietenia mahagoni	110	RHS	
317	R0/57	Gulmohar Tree	Delonix regia	210	RHS	
318	R0/58	Rubber fig	Ficus elastica	140	RHS	
319	R0/59	Honge	Pongamia pinnata	120	RHS	
320	R0/60	Mango	Mangifera indica	360	RHS	
321	R0/61	Rubber fig	Ficus elastica	110	RHS	
322	R0/62	Rubber fig	Ficus elastica	70	RHS	
323	R0/63	Rubber fig	Ficus elastica	180	RHS	
324	R0/64	Rubber fig	Ficus elastica	120	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
325	R0/65	Caribbean trumpet tree	Tabebuia aurea	130	RHS	
326	R0/66	Caribbean trumpet tree	Tabebuia aurea	110	RHS	
327	R0/67	Caribbean trumpet tree	Tabebuia aurea	70	RHS	
328	R0/68	West Indian Mahogany	Swietenia mahagoni	70	RHS	
329	R0/69	West Indian Mahogany	Swietenia mahagoni	70	RHS	
330	R0/70	Rubber fig	Ficus elastica	110	RHS	
331	R0/71	Copper Pod	Peltophorum pterocarpum	180	RHS	
332	R0/72	Subabul	Leucaena leucocephala	170	RHS	
333	R0/73	Honge	Pongamia pinnata	90	RHS	
334	R0/74	West Indian Mahogany	Swietenia mahagoni	150	RHS	
335	R0/75	Honge	Pongamia pinnata	110	RHS	
336	R0/76	Subabul	Leucaena leucocephala	200	RHS	
337	R0/77	Honge	Pongamia pinnata	210	RHS	
338	R0/78	West Indian Mahogany	Swietenia mahagoni	200	RHS	
339	R0/79	Mango	Mangifera indica	400	RHS	
340	R0/80	Mullu Byala		210	RHS	
341	R0/81	West Indian Mahogany	Swietenia mahagoni	200	RHS	
342	R0/82	Mango	Mangifera indica	180	RHS	
343	R0/83	West Indian Mahogany	Swietenia mahagoni	240	RHS	
344	R0/84	Rubber fig	Ficus elastica	160	RHS	
345	R0/85	West Indian Mahogany	Swietenia mahagoni	170	RHS	
346	R0/86	Copper Pod	Peltophorum pterocarpum	210	RHS	
347	R0/87	Mango	Mangifera indica	260	RHS	
348	R0/88	Mango	Mangifera indica	400	RHS	
349	R0/89	Ippe	Madhuca indica	210	RHS	
350	R0/90	West Indian Mahogany	Swietenia mahagoni	190	RHS	
351	R0/91	West Indian Mahogany	Swietenia mahagoni	180	RHS	
352	R0/92	Jamun Tree	Syzygium cumini	270	RHS	
353	R0/93	Jamun Tree	Syzygium cumini	180	RHS	
354	R0/94	Tamarind	Tamarindus	200	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
			indica			
355	R0/95	Silver Oak	Grevillea robusta	100	RHS	
356	R0/96	Silver Oak	Grevillea robusta	110	RHS	
357	R0/97	Silver Oak	Grevillea robusta	90	RHS	
358	R0/98	Honge	Pongamia pinnata	70	RHS	
359	R0/99	Silver Oak	Grevillea robusta	50	RHS	
360	R0/100	Silver Oak	Grevillea robusta	80	RHS	
361	R0/101	Silver Oak	Grevillea robusta	90	RHS	
362	R0/102	Silver Oak	Grevillea robusta	100	RHS	
363	R0/103	Silver Oak	Grevillea robusta	90	RHS	
364	R0/104	Silver Oak	Grevillea robusta	70	RHS	
365	R0/105	Mango	Mangifera indica	210	RHS	
366	R0/106	Mango	Mangifera indica	70	RHS	
367	R0/107	Mango	Mangifera indica	70	RHS	
368	R0/108	Mango	Mangifera indica	90	RHS	
369	R0/109	Mango	Mangifera indica	60	RHS	
370	R0/110	Silver Oak	Grevillea robusta	100	RHS	
371	R0/111	Silver Oak	Grevillea robusta	90	RHS	
372	R0/112	Silver Oak	Grevillea robusta	80	RHS	
373	R0/113	Mango	Mangifera indica	200	RHS	
374	R0/114	Silver Oak	Grevillea robusta	100	RHS	
375	R0/115	Silver Oak	Grevillea robusta	100	RHS	
376	R0/116	Rain Tree	Samanea saman	180	RHS	
377	R0/117	Rain Tree	Samanea saman	220	RHS	
378	R0/118	Rubber fig	Ficus elastica	200	RHS	
379	R0/119	Tamarind	Tamarindus indica	260	RHS	
380	R0/120	Silver Oak	Grevillea robusta	200	RHS	
381	R0/121	Rubber fig	Ficus elastica	220	RHS	
382	R0/122	Silver Oak	Grevillea robusta	100	RHS	
383	R0/123	Mango	Mangifera indica	190	RHS	
384	R0/124	Rubber fig	Ficus elastica	180	RHS	
385	R0/125	West Indian Mahogany	Swietenia mahagoni	160	RHS	
386	R0/126	West Indian Mahogany	Swietenia mahagoni	150	RHS	
387	R0/127	Teak	Tectona grandis	100	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
388	R0/128	Rain Tree	Samanea saman	160	RHS	
389	R0/129	Teak	Tectona grandis	100	RHS	
390	R0/130	Mango	Mangifera indica	210	RHS	
391	R0/131	Gulmohar Tree	Delonix regia	200	RHS	
392	R0/132	Copper Pod	Peltophorum pterocarpum	270	RHS	
393	R0/133	Mango	Mangifera indica	210	RHS	
394	R0/134	Gulmohar Tree	Delonix regia	190	RHS	
395	R0/135	Honge	Pongamia pinnata	210	RHS	
396	R0/136	Copper Pod	Peltophorum pterocarpum	200	RHS	
397	R0/137	Mango	Mangifera indica	340	RHS	
398	R0/138	Mango	Mangifera indica	380	RHS	
399	R0/139	Copper Pod	Peltophorum pterocarpum	280	RHS	
400	R0/140	Gulmohar Tree	Delonix regia	200	RHS	
401	R0/141	West Indian Mahogany	Swietenia mahagoni	170	RHS	
402	R0/142	Rain Tree	Samanea saman	180	RHS	
403	R0/143	Rain Tree	Samanea saman	220	RHS	
404	R1/1	Copper Pod	Peltophorum pterocarpum	110	RHS	
405	R1/2	Copper Pod	Peltophorum pterocarpum	180	RHS	
406	R1/3	Gulmohar Tree	Delonix regia	380	RHS	
407	R1/4	Gulmohar Tree	Delonix regia	310	RHS	
408	R1/5	Copper Pod	Peltophorum pterocarpum	240	RHS	
409	R1/6	Peepal Tree	Ficus religiosa	200	RHS	
410	R1/7	Copper Pod	Peltophorum pterocarpum	160	RHS	
411	R1/8	Copper Pod	Peltophorum pterocarpum	170	RHS	
412	R1/9	Gasagase	Muntingia	100	RHS	
413	R1/10	Copper Pod	Peltophorum pterocarpum	160	RHS	
414	R1/11	Gasagase	Muntingia calabura	90	RHS	
415	R1/12	Copper Pod	Peltophorum pterocarpum	160	RHS	
416	R1/13	Rain Tree	Samanea saman	160	RHS	
417	R1/14	Copper Pod	Peltophorum pterocarpum	160	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
418	R1/15	Copper Pod	Peltophorum pterocarpum	130	RHS	
419	R1/16	Copper Pod	Peltophorum pterocarpum	160	RHS	
420	R1/17	Copper Pod	Peltophorum pterocarpum	140	RHS	
421	R2/1	Copper Pod	Peltophorum pterocarpum	180	RHS	
422	R2/2	Ashoka Tree	Saraca indica		RHS	
423	R2/3	Ashoka Tree	Saraca indica		RHS	
424	R2/4	Ashoka Tree	Saraca indica		RHS	
425	R2/5	Ashoka Tree	Saraca indica		RHS	
426	R2/6	Ashoka Tree	Saraca indica		RHS	
427	R2/7	Ashoka Tree	Saraca indica		RHS	
428	R2/8	Ashoka Tree	Saraca indica		RHS	
429	R2/9	Ashoka Tree	Saraca indica		RHS	
430	R2/10	Ashoka Tree	Saraca indica		RHS	
431	R2/11	Ashoka Tree	Saraca indica		RHS	
432	R2/12	Ashoka Tree	Saraca indica		RHS	
433	R2/13	Ashoka Tree	Saraca indica		RHS	
434	R2/14	Ashoka Tree	Saraca indica		RHS	
435	R2/15	Ashoka Tree	Saraca indica		RHS	
436	R2/16	Ashoka Tree	Saraca indica		RHS	
437	R2/17	Ashoka Tree	Saraca indica		RHS	
438	R2/18	Ashoka Tree	Saraca indica		RHS	
439	R2/19	Ashoka Tree	Saraca indica		RHS	
440	R2/20	Ashoka Tree	Saraca indica		RHS	
441	R2/21	Ashoka Tree	Saraca indica		RHS	
442	R2/22	Ashoka Tree	Saraca indica		RHS	
443	R2/23	Ashoka Tree	Saraca indica		RHS	
444	R2/24	Ashoka Tree	Saraca indica		RHS	
445	R2/25	Ashoka Tree	Saraca indica		RHS	
446	R2/26	Ashoka Tree	Saraca indica		RHS	
447	R2/27	Ashoka Tree	Saraca indica		RHS	
448	R2/28	Ashoka Tree	Saraca indica		RHS	
449	R2/29	Ashoka Tree	Saraca indica		RHS	
450	R2/30	Ashoka Tree	Saraca indica		RHS	
451	R2/31	Ashoka Tree	Saraca indica		RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
452	R2/32	Ashoka Tree	Saraca indica		RHS	
453	R2/33	Ashoka Tree	Saraca indica		RHS	
454	R2/34	Ashoka Tree	Saraca indica		RHS	
455	R2/35	Ashoka Tree	Saraca indica		RHS	
456	R2/36	Ashoka Tree	Saraca indica		RHS	
457	R2/37	Ashoka Tree	Saraca indica		RHS	
458	R2/38	Ashoka Tree	Saraca indica		RHS	
459	R2/39	Ashoka Tree	Saraca indica		RHS	
460	R2/40	Ashoka Tree	Saraca indica		RHS	
461	L2/1	Mango	Mangifera indica	450	LHS	Behind TV TOWER trees within Private property
462	L2/2	Attimara	Ficus racemosa		LHS	"
463	L2/3	Silver Oak	Grevillea robusta		LHS	"
464	L2/4	Silver Oak	Grevillea robusta		LHS	"
465	L2/5	African tuliptree	Spathodea companulata		LHS	"
466	L2/6	African tuliptree	Spathodea companulata		LHS	"
467	L2/7	African tuliptree	Spathodea companulata		LHS	"
468	L2/8	Mango	Mangifera indica		LHS	"
469	L2/9	Tamarind	Tamarindus indica		LHS	"
470	L2/10	Tamarind	Tamarindus indica		LHS	"
471	L2/11	Mullu Byala			LHS	"
472	L2/12	Rain Tree	Samanea saman		LHS	"
473	L2/13	Rain Tree	Samanea saman		LHS	"
474	L3/1	Christmas Tree			LHS	"
475	L4/1	Mango	Mangifera indica		LHS	"
476	L4/2	Mango	Mangifera indica		LHS	"
477	L4/3	Mango	Mangifera indica		LHS	"
478	L4/4	Silver Oak	Grevillea robusta		LHS	"
479	L4/5	Silver Oak	Grevillea robusta		LHS	"
480	L4/6	Silver Oak	Grevillea robusta		LHS	"
481	L4/7	Silver Oak	Grevillea robusta		LHS	"
482	L4/8	Silver Oak	Grevillea robusta		LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
483	L4/9	Silver Oak	Grevillea robusta		LHS	"
484	L4/10	Silver Oak	Grevillea robusta		LHS	"
485	L4/11	Rain Tree	Samanea saman		LHS	"
486	L4/12	Rain Tree	Samanea saman		LHS	"
487	L4/13	Rain Tree	Samanea saman		LHS	"
488	L4/14	Jamun Tree	Syzygium cumini		LHS	"
489	L4/15	Surgi			LHS	"
490	L4/16	Coconut	Cocus nucifera		LHS	"
491	L4/17	Mango	Mangifera indica		LHS	"
492	L4/18	Surgi			LHS	"
493	L4/19	West Indian Mahogany	Swietenia mahagoni		LHS	"
494	L4/20	Jamun Tree	Syzygium cumini		LHS	"
495	L4/21	Surgi			LHS	"
496	L4/22	West Indian Mahogany	Swietenia mahagoni		LHS	"
497	L4/23	Surgi			LHS	"
498	L4/24	Surgi			LHS	"
499	L5/1	Copper Pod	Peltophorum pterocarpum		LHS	"
500	L5/2	Copper Pod	Peltophorum pterocarpum		LHS	"
501	L5/3	Copper Pod	Peltophorum pterocarpum		LHS	"
502	L5/4	Copper Pod	Peltophorum pterocarpum		LHS	"
503	R2/42	African tuliptree	Spathodea companulata	480	RHS	
504	R2/43	African tuliptree	Spathodea companulata	270	RHS	
505	R2/44	African tuliptree	Spathodea companulata	480	RHS	
506	R2/45	African tuliptree	Spathodea companulata	250	RHS	
507	R2/46	West Indian Mahogany	Swietenia mahagoni	130	RHS	
508	R2/47	West Indian Mahogany	Swietenia mahagoni	220	RHS	
509	R2/48	West Indian Mahogany	Swietenia mahagoni	190	RHS	
510	R2/49	West Indian Mahogany	Swietenia mahagoni	160	RHS	
511	R3/1	Copper Pod	Peltophorum pterocarpum	210	RHS	
512	R3/2	West Indian Mahogany	Swietenia mahagoni	220	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
513	R3/3	Rain Tree	Samanea saman	240	RHS	
514	R3/4	Rain Tree	Samanea saman	130	RHS	
515	R3/5	Rubber fig	Ficus elastica	140	RHS	
516	R3/6	Rubber fig	Ficus elastica	120	RHS	
517	R3/7	Rubber fig	Ficus elastica	200	RHS	
518	R3/8	Coconut	Cocus nucifera	120	RHS	
519	R4/1	Rain Tree	Samanea saman	510	RHS	
520	R4/2	Rain Tree	Samanea saman	510	RHS	
521	R4/3	Rain Tree	Samanea saman	480	RHS	
522	R4/4	Rain Tree	Samanea saman	480	RHS	
523	R4/5	Rain Tree	Samanea saman	400	RHS	
524	R4/6	Rain Tree	Samanea saman	270	RHS	
525	R4/7	Rain Tree	Samanea saman	340	RHS	
526	R4/8	Rain Tree	Samanea saman	340	RHS	
527	R4/9	Rain Tree	Samanea saman	400	RHS	
528	R4/10	Rain Tree	Samanea saman	480	RHS	
529	R4/11	Rain Tree	Samanea saman	270	RHS	
530	R4/12	Rain Tree	Samanea saman	480	RHS	
531	R4/13	Rain Tree	Samanea saman	450	RHS	
532	R4/14	Rain Tree	Samanea saman	430	RHS	
533	R4/15	Rain Tree	Samanea saman	420	RHS	
534	R4/16	Rain Tree	Samanea saman	530	RHS	
535	R4/17	African tuliptree	Spathodea companulata	140	RHS	
536	R4/18	Copper Pod	Peltophorum pterocarpum	240	RHS	
537	R4/19	Ashoka Tree	Saraca indica	100	RHS	
538	R4/20	Copper Pod	Peltophorum pterocarpum	70	RHS	
539	R4/21	Rain Tree	Samanea saman	240	RHS	
540	R4/22	Rain Tree	Samanea saman	320	RHS	
541	R4/23	Copper Pod	Peltophorum pterocarpum	110	RHS	
542	R4/24	Copper Pod	Peltophorum pterocarpum	220	RHS	
543	R4/25	Copper Pod	Peltophorum pterocarpum	150	RHS	
544	R5/1	Rain Tree	Samanea saman	320	RHS	
545	R5/2	Rain Tree	Samanea saman	280	RHS	
546	R5/3	Rain Tree	Samanea saman	250	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
547	R5/4	Rain Tree	Samanea saman	220	RHS	
548	R5/5	Rain Tree	Samanea saman	380	RHS	
549	R5/6	Rain Tree	Samanea saman	310	RHS	
550	R5/7	Rain Tree	Samanea saman	290	RHS	
551	R5/8	Rain Tree	Samanea saman	270	RHS	
552	R5/9	Rain Tree	Samanea saman	300	RHS	
553	R5/10	Rain Tree	Samanea saman	340	RHS	
554	R5/11	Rain Tree	Samanea saman	260	RHS	
555	R5/12	Rain Tree	Samanea saman	350	RHS	
556	R5/13	Rain Tree	Samanea saman	180	RHS	
557	R5/14	Rain Tree	Samanea saman	280	RHS	
558	R5/15	Alemara	Tabebuia aurea	100	RHS	
559	R5/16	Tamarind	Tamarindus indica	400	RHS	
560	R5/17	Peepal Tree	Ficus religiosa	160	RHS	
561	R5/18	Peepal Tree	Ficus religiosa	170	RHS	
562	R5/19	Alemara	Tabebuia aurea	90	RHS	
563	R5/20	Jamun Tree	Syzygium cumini	460	RHS	
564	R5/21	Alemara	Tabebuia aurea	140	RHS	
565	R6/1	Alemara	Tabebuia aurea	100	RHS	
566	R6/2	Copper Pod	Peltophorum pterocarpum	160	RHS	
567	R6/3	Tamarind	Tamarindus indica	360	RHS	
568	R6/4	Peepal Tree	Ficus religiosa	200	RHS	
569	R6/5	Tamarind	Tamarindus indica	280	RHS	
570	R6/6	Kagase		140	RHS	
571	R6/7	Copper Pod	Peltophorum pterocarpum	130	RHS	
572	R6/8	Kagase		80	RHS	
573	R6/9	Tamarind	Tamarindus indica	300	RHS	
574	R6/10	Banyan Tree	Ficus benghalensis	170	RHS	
575	R6/11	Rain Tree	Samanea saman	230	RHS	
576	R6/12	Jamun Tree	Syzygium cumini	100	RHS	
577	R6/13	Alemara	Tabebuia aurea	70	RHS	
578	R6/14	Alemara	Tabebuia aurea	80	RHS	
579	R6/15	Rain Tree	Samanea saman	230	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
580	R6/16	Tamarind	Tamarindus indica	250	RHS	
581	R6/17	Tamarind	Tamarindus indica	310	RHS	
582	R6/18	Tamarind	Tamarindus indica	250	RHS	
583	R6/19	Alemara	Tabebuia aurea	90	RHS	
584	R6/20	Alemara	Tabebuia aurea	80	RHS	
585	R6/21	Alemara	Tabebuia aurea	90	RHS	
586	R6/22	Alemara	Tabebuia aurea	180	RHS	
587	R6/23	Alemara	Tabebuia aurea	90	RHS	
588	R6/24	Alemara	Tabebuia aurea	140	RHS	
589	R7/1	African tuliptree	Spathodea companulata	280	RHS	Package 1 - Phase 4: Vittal Mallya Jn to Minerva Circle
590	R7/2	African tuliptree	Spathodea companulata	110	RHS	
591	R8/1	Ashoka Tree	Saraca indica	90	RHS	
592	R8/2	Ashoka Tree	Saraca indica	90	RHS	
593	R8/3	Ashoka Tree	Saraca indica	90	RHS	
594	R8/4	Ashoka Tree	Saraca indica	90	RHS	
595	R8/5	Ashoka Tree	Saraca indica	90	RHS	
596	R8/6	Ashoka Tree	Saraca indica	90	RHS	
597	R8/7	Ashoka Tree	Saraca indica	90	RHS	
598	R8/8	Ashoka Tree	Saraca indica	90	RHS	
599	R8/9	Ashoka Tree	Saraca indica	90	RHS	
600	R8/10	Ashoka Tree	Saraca indica	90	RHS	
601	R8/11	Ashoka Tree	Saraca indica	90	RHS	
602	R8/12	Ashoka Tree	Saraca indica	90	RHS	
603	R8/13	Ashoka Tree	Saraca indica	90	RHS	
604	R8/14	Ashoka Tree	Saraca indica	90	RHS	
605	R8/15	Ashoka Tree	Saraca indica	90	RHS	
606	R9/1	Rain Tree	Samanea saman	220	RHS	
607	R9/2	Rain Tree	Samanea saman	250	RHS	
608	L9/1	Copper Pod	Peltophorum pterocarpum	210	LHS	
609	L9/2	Copper Pod	Peltophorum pterocarpum	150	LHS	
610	L9/3	Copper Pod	Peltophorum	170	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
			pterocarpum			
611	L9/4	Copper Pod	Peltophorum pterocarpum	130	LHS	
612	L9/5	Copper Pod	Peltophorum pterocarpum	230	LHS	
613	M9/1	Ashoka Tree	Saraca indica	160	Median	
614	M9/2	Ashoka Tree	Saraca indica	160	Median	
615	M9/3	Ashoka Tree	Saraca indica	160	Median	
616	M9/4	Ashoka Tree	Saraca indica	160	Median	
617	M9/5	Ashoka Tree	Saraca indica	160	Median	
618	M9/6	Ashoka Tree	Saraca indica	160	Median	
619	M9/7	Ashoka Tree	Saraca indica	160	Median	
620	M9/8	Ashoka Tree	Saraca indica	130	Median	
621	M9/9	Ashoka Tree	Saraca indica	120	Median	
622	M9/10	Ashoka Tree	Saraca indica	130	Median	
623	M9/11	Ashoka Tree	Saraca indica	120	Median	
624	L9/6	Copper Pod	Peltophorum pterocarpum	260	LHS	
625	L9/7	Copper Pod	Peltophorum pterocarpum	160	LHS	
626	L9/8	Copper Pod	Peltophorum pterocarpum	230	LHS	
627	L9/9	Copper Pod	Peltophorum pterocarpum	190	LHS	
628	M9/12	Ashoka Tree	Saraca indica	100	Median	
629	M9/13	Ashoka Tree	Saraca indica	110	Median	
630	M9/14	Ashoka Tree	Saraca indica	110	Median	
631	M9/15	Ashoka Tree	Saraca indica	110	Median	
632	M9/16	Ashoka Tree	Saraca indica	100	Median	
633	M9/17	Ashoka Tree	Saraca indica	120	Median	
634	M9/18	Ashoka Tree	Saraca indica	130	Median	
635	M9/19	Ashoka Tree	Saraca indica	140	Median	
636	M9/20	Ashoka Tree	Saraca indica	140	Median	
637	M9/21	Ashoka Tree	Saraca indica	190	Median	
638	M9/22	Ashoka Tree	Saraca indica	190	Median	
639	M18/1	Ashoka Tree	Saraca indica	140	Median	
640	M18/2	Copper Pod	Peltophorum pterocarpum	80	Median	
641	M18/3	Ashoka Tree	Saraca indica	50	Median	
642	M18/4	Ashoka Tree	Saraca indica	60	Median	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
643	M18/5	Ashoka Tree	Saraca indica	80	Median	
644	M18/6	Ashoka Tree	Saraca indica	80	Median	
645	M18/7	Ashoka Tree	Saraca indica	90	Median	
646	M18/8	Rubber fig	Ficus elastica	50	Median	
647	M18/9	Ashoka Tree	Saraca indica	90	Median	
648	M18/10	Ashoka Tree	Saraca indica	90	Median	
649	M18/11	Ashoka Tree	Saraca indica	90	Median	
650	M18/12	Ashoka Tree	Saraca indica	90	Median	
651	M18/13	Copper Pod	Peltophorum pterocarpum	70	Median	
652	M18/14	Ashoka Tree	Saraca indica	90	Median	
653	M18/15	Copper Pod	Peltophorum pterocarpum	110	Median	
654	M18/16	Ashoka Tree	Saraca indica	90	Median	
655	M18/17	Ashoka Tree	Saraca indica	90	Median	
656	M18/18	Copper Pod	Peltophorum pterocarpum	190	Median	
657	M18/19	Ashoka Tree	Saraca indica	80	Median	
658	M18/20	Rubber fig	Ficus elastica	140	Median	
659	M18/21	Ashoka Tree	Saraca indica	100	Median	
660	M18/22	Ashoka Tree	Saraca indica	110	Median	
661	M18/23	Ashoka Tree	Saraca indica	140	Median	
662	M18/24	Ashoka Tree	Saraca indica	140	Median	
663	M18/25	Ashoka Tree	Saraca indica	90	Median	
664	M18/26	Ashoka Tree	Saraca indica	130	Median	
665	M18/27	Ashoka Tree	Saraca indica	130	Median	
666	M18/28	Ashoka Tree	Saraca indica	110	Median	
667	M18/29	Ashoka Tree	Saraca indica	150	Median	
668	M18/30	Ashoka Tree	Saraca indica	160	Median	
669	M18/31	Ashoka Tree	Saraca indica	160	Median	
670	M18/32	Ashoka Tree	Saraca indica	140	Median	
671	M18/33	Ashoka Tree	Saraca indica	130	Median	
672	M18/34	Ashoka Tree	Saraca indica	170	Median	
673	M18/35	Ashoka Tree	Saraca indica	130	Median	
674	M18/36	Ashoka Tree	Saraca indica	150	Median	
675	M18/37	Rubber fig	Ficus elastica	50	Median	
676	M18/38	Ashoka Tree	Saraca indica	170	Median	
677	M18/39	Ashoka Tree	Saraca indica	140	Median	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
678	M18/40	Rubber fig	Ficus elastica	80	Median	
679	M18/41	Rubber fig	Ficus elastica	60	Median	
680	M18/42	Ashoka Tree	Saraca indica	150	Median	
681	M18/43	Ashoka Tree	Saraca indica	150	Median	
682	M18/44	Rubber fig	Ficus elastica	80	Median	
683	M18/45	Ashoka Tree	Saraca indica	130	Median	
684	M18/46	Rubber fig	Ficus elastica	50	Median	
685	M18/47	Ashoka Tree	Saraca indica	50	Median	
686	M18/48	Ashoka Tree	Saraca indica	120	Median	
687	M18/49	Rubber fig	Ficus elastica	90	Median	
688	L18/1	Coconut	Cocus nucifera	130	LHS	within Lalbagh Compound
689	L18/2	Coconut	Cocus nucifera	130	LHS	"
690	L18/3	West Indian Mahogany	Swietenia mahagoni	240	LHS	"
691	L18/4	Silver Oak	Grevillea robusta	80	LHS	"
692	L18/5	Silver Oak	Grevillea robusta	110	LHS	"
693	L18/6	Silver Oak	Grevillea robusta	90	LHS	"
694	L18/7	Honge	Pongamia pinnata	90	LHS	"
695	L18/8	West Indian Mahogany	Swietenia mahagoni	240	LHS	"
696	L18/9	Silver Oak	Grevillea robusta	80	LHS	"
697	L18/10	Silver Oak	Grevillea robusta	60	LHS	"
698	L18/11	Silver Oak	Grevillea robusta	100	LHS	"
699	L18/12	Silver Oak	Grevillea robusta	140	LHS	"
700	L18/13	Silver Oak	Grevillea robusta	120	LHS	"
701	L18/14	Silver Oak	Grevillea robusta	60	LHS	"
702	L18/15	Silver Oak	Grevillea robusta	80	LHS	"
703	L18/16	Silver Oak	Grevillea robusta	100	LHS	"
704	L18/17	Subabul	Leucaena leucocephala	340	LHS	"
705	L18/18	Rubber fig	Ficus elastica	100	LHS	"
706	L18/19	Rubber fig	Ficus elastica	120	LHS	"
707	L18/20	Rubber fig	Ficus elastica	120	LHS	"
708	L18/21	Rubber fig	Ficus elastica	140	LHS	"
709	L18/22	Rubber fig	Ficus elastica	120	LHS	"
710	L18/23	Rubber fig	Ficus elastica	130	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
711	L18/24	Rubber fig	Ficus elastica	140	LHS	"
712	L18/25	Rubber fig	Ficus elastica	140	LHS	"
713	L18/26	Rubber fig	Ficus elastica	160	LHS	"
714	L18/27	Rubber fig	Ficus elastica	150	LHS	"
715	L18/28	Rubber fig	Ficus elastica	150	LHS	"
716	L18/29	Rubber fig	Ficus elastica	160	LHS	"
717	L19/1	Peepal Tree	Ficus religiosa	260	LHS	
718	L19/2	Rain Tree	Samanea saman	300	LHS	
719	R0/1	Rain Tree	Samanea saman	130	RHS	Minerva Circle
720	R0/2	Rain Tree	Samanea saman	220	RHS	
721	R0/3	Rain Tree	Samanea saman	90	RHS	
722	R0/4	Rain Tree	Samanea saman	130	RHS	
723	L0/5	Rain Tree	Samanea saman	220	LHS	
724	L0/6	Rain Tree	Samanea saman	290	LHS	
725	L0/7	Copper Pod	Peltophorum pterocarpum	280	LHS	
726	L0/8	Rain Tree	Samanea saman	160	LHS	
727	L0/9	Rain Tree	Samanea saman	390	LHS	
728	L0/10	West Indian Mahogany	Swietenia mahagoni	290	LHS	
729	R0/1	Rain Tree	Samanea saman	90	RHS	
730	R0/2	Rain Tree	Samanea saman	100	RHS	
731	R0/3	West Indian Mahogany	Swietenia mahagoni	80	RHS	
732	R0/4	Honge	Pongamia pinnata	140	RHS	
733	R0/5	Rain Tree	Samanea saman	140	RHS	
734	R0/6	Rain Tree	Samanea saman	90	RHS	
735	L0/11	Rain Tree	Samanea saman	100	LHS	
736	L0/12	Peepal Tree	Ficus religiosa	400	LHS	
737	L1/1	West Indian Mahogany	Swietenia mahagoni	100	LHS	
738	R1/1	West Indian Mahogany	Swietenia mahagoni	80	RHS	Rajarammohan Roy Road
739	L1/1	Rain Tree	Samanea saman	320	LHS	
740	L1/2	Rain Tree	Samanea saman	260	LHS	
741	L1/3	West Indian Mahogany	Swietenia mahagoni	150	LHS	
742	L1/4	Rain Tree	Samanea saman	320	LHS	
743	L1/5	Gulmohar Tree	Delonix regia	280	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
744	L2/1	Peepal Tree	Ficus religiosa	110	LHS	
745	R11/1	Honge	Pongamia pinnata	190	RHS	Audugodi
746	R11/2	Rain Tree	Samanea saman	120	RHS	
747	R11/3	Rain Tree	Samanea saman	230	RHS	
748	R11/4	Rain Tree	Samanea saman	250	RHS	
749	R11/5	Rain Tree	Samanea saman	320	RHS	
750	R11/6	Rain Tree	Samanea saman	80	RHS	
751	R11/7	Rain Tree	Samanea saman	120	RHS	
752	R11/8	Rain Tree	Samanea saman	220	RHS	
753	L11/1	Gulmohar Tree	Delonix regia	150	LHS	
754	L12/1	West Indian Mahogany	Swietenia mahagoni	260	LHS	
755	L12/2	Rain Tree	Samanea saman	360	LHS	
756	L12/3	Rain Tree	Samanea saman	350	LHS	
757	L12/4	Rain Tree	Samanea saman	260	LHS	
758	L12/5	Rain Tree	Samanea saman	300	LHS	
759	R12/1	Tamarind	Tamarindus indica	320	RHS	
760	R13/1	Rain Tree	Samanea saman	120	RHS	Within Indian Institute of Psychology
761	R13/2	Gulmohar Tree	Delonix regia	190	RHS	"
762	R13/3	Copper Pod	Peltophorum pterocarpum	140	RHS	"
763	R13/4	Caribbean trumpet tree	Tabebuia aurea	120	RHS	"
764	R13/5	Rain Tree	Samanea saman	170	RHS	"
765	R13/6	Silver Oak	Grevillea robusta	120	RHS	"
766	R13/7	Silver Oak	Grevillea robusta	120	RHS	Within St. Antony Frirary Church
767	R13/8	Silver Oak	Grevillea robusta	120	RHS	"
768	R13/9	Silver Oak	Grevillea robusta	110	RHS	"
769	R13/10	Silver Oak	Grevillea robusta	120	RHS	"
770	R13/11	Honge	Pongamia pinnata	90	RHS	"
771	R13/12	Silver Oak	Grevillea robusta	100	RHS	"
772	R13/13	Surgi		110	RHS	"
773	R13/14	Silver Oak	Grevillea robusta	100	RHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
774	R13/15	Surgi		100	RHS	"
775	R13/16	Mullu Seege		140	RHS	"
776	R13/17	Ashoka Tree	Saraca indica	50	RHS	"
777	R13/18	Silver Oak	Grevillea robusta	110	RHS	"
778	R13/19	Silver Oak	Grevillea robusta	110	RHS	"
779	R13/20	African tuliptree	Spathodea companulata	120	RHS	"
780	R13/21	Surgi		150	RHS	"
781	R13/22	Surgi		130	RHS	"
782	R13/23	Sandalwood	Santalum album	80	RHS	"
783	R13/24	Surgi		100	RHS	"
784	R13/25	Surgi		170	RHS	"
785	R13/26	Surgi		140	RHS	"
786	R13/27	Tamarind	Tamarindus indica	120	RHS	"
787	R13/28	Surgi		220	RHS	"
788	R13/29	Surgi		290	RHS	"
789	R13/30	Surgi		220	RHS	"
790	L13/1	Kagase		100	LHS	with in St. John's Medical College Ground
791	L13/2	Kagase		140	LHS	"
792	L13/3	African tuliptree	Spathodea companulata	200	LHS	"
793	L13/4	Kagase		140	LHS	"
794	L13/5	Gulmohar Tree	Delonix regia	130	LHS	"
795	L13/6	African tuliptree	Spathodea companulata	240	LHS	"
796	L13/7	Subabul	Leucaena leucocephala	110	LHS	"
797	L13/8	Gulmohar Tree	Delonix regia	110	LHS	"
798	L13/9	American mahogany	Swietenia mahagoni	100	LHS	"
799	L13/10	Jamun Tree	Syzygium cumini	180	LHS	"
800	L13/11	African tuliptree	Spathodea companulata	190	LHS	"
801	L13/12	African tuliptree	Spathodea companulata	280	LHS	"
802	L13/13	Honge	Pongamia pinnata	50	LHS	"
803	L13/14	Gulmohar Tree	Delonix regia	130	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
804	L13/15	Gulmohar Tree	Delonix regia	100	LHS	"
805	L13/16	Copper Pod	Peltophorum pterocarpum	280	LHS	"
806	L13/17	Copper Pod	Peltophorum pterocarpum	180	LHS	"
807	L13/18	Rain Tree	Samanea saman	220	LHS	"
808	L13/19	Honge	Pongamia pinnata	80	LHS	"
809	L13/20	Copper Pod	Peltophorum pterocarpum	220	LHS	"
810	L13/21	African tuliptree	Spathodea companulata	210	LHS	"
811	L13/22	Kagase		110	LHS	"
812	L13/23	Copper Pod	Peltophorum pterocarpum	140	LHS	"
813	L13/24	Bamboo Culm			LHS	"
814	L13/25	Honge	Pongamia pinnata	140	LHS	"
815	L13/26	Bamboo Culm			LHS	"
816	L13/27	Bamboo Culm			LHS	"
817	L13/28	Nilgiri		160	LHS	"
818	L13/29	Bamboo Culm			LHS	"
819	L13/30	Bamboo Culm			LHS	"
820	L13/31	Mullu Byala		180	LHS	"
821	L13/32	African tuliptree	Spathodea companulata	300	LHS	"
822	L13/33	Mullu Byala		200	LHS	"
823	L0/1	Kapok Silk Cotton	Ceiba pentandra	260	LHS	CC1 : with in Agara Lake Park
824	L0/2	Rain Tree	Samanea saman	80	LHS	"
825	L0/3	Mullu Byala		130	LHS	"
826	L0/4	Kaadujathi Mara		130	LHS	"
827	L0/5	Kapok Silk Cotton	Ceiba pentandra	250	LHS	"
828	L0/6	Kapok Silk Cotton	Ceiba pentandra	120	LHS	"
829	L0/7	Kapok Silk Cotton	Ceiba pentandra	120	LHS	"
830	L0/8	Kapok Silk Cotton	Ceiba pentandra	220	LHS	"
831	L0/9	Kapok Silk Cotton	Ceiba pentandra	150	LHS	"
832	L0/10	Kapok Silk Cotton	Ceiba pentandra	250	LHS	"
833	L0/11	Kapok Silk Cotton	Ceiba pentandra	200	LHS	"
834	L0/12	Kapok Silk Cotton	Ceiba pentandra	100	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
835	L0/13	Kapok Silk Cotton	Ceiba pentandra	110	LHS	"
836	L0/14	Kapok Silk Cotton	Ceiba pentandra	200	LHS	"
837	L0/15	Kapok Silk Cotton	Ceiba pentandra	200	LHS	"
838	L0/16	Kapok Silk Cotton	Ceiba pentandra	220	LHS	"
839	L0/17	Kapok Silk Cotton	Ceiba pentandra	150	LHS	"
840	L0/18	Kapok Silk Cotton	Ceiba pentandra	80	LHS	"
841	L0/19	Kapok Silk Cotton	Ceiba pentandra	180	LHS	"
842	L0/20	Kapok Silk Cotton	Ceiba pentandra	200	LHS	"
843	L0/21	Kapok Silk Cotton	Ceiba pentandra	90	LHS	"
844	L0/22	Kapok Silk Cotton	Ceiba pentandra	240	LHS	"
845	L0/23	Kapok Silk Cotton	Ceiba pentandra	200	LHS	"
846	L0/24	Kapok Silk Cotton	Ceiba pentandra	230	LHS	"
847	L0/25	Kaadujathi Mara		150	LHS	"
848	L0/26	Kaadujathi Mara		150	LHS	"
849	L0/27	Banyan Tree	Ficus benghalensis	260	LHS	"
850	L0/28	Banyan Tree	Ficus benghalensis	220	LHS	"
851	L0/29	Banyan Tree	Ficus benghalensis	220	LHS	"
852	R0/1	Banyan Tree	Ficus benghalensis	500	LHS	
853	L0/30	Banyan Tree	Ficus benghalensis	180	LHS	Within Agara Lake Park
854	L0/31	Honge	Pongamia pinnata	60	LHS	"
855	L0/32	Honge	Pongamia pinnata	190	LHS	"
856	L0/33	Honge	Pongamia pinnata	190	LHS	"
857	L0/34	Honge	Pongamia pinnata	230	LHS	"
858	L0/35	Honge	Pongamia pinnata	210	LHS	"
859	L0/36	Honge	Pongamia pinnata	190	LHS	"
860	L0/37	Honge	Pongamia pinnata	160	LHS	"
861	L0/38	Honge	Pongamia pinnata	110	LHS	"
862	L0/39	Honge	Pongamia pinnata	170	LHS	"
863	L0/40	Copper Pod	Peltophorum pterocarpum	190	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
864	L0/41	Honge	Pongamia pinnata	180	LHS	"
865	L0/42	Honge	Pongamia pinnata	210	LHS	"
866	L0/43	Copper Pod	Peltophorum pterocarpum	160	LHS	"
867	L0/44	Copper Pod	Peltophorum pterocarpum	180	LHS	"
868	L1/1	Copper Pod	Peltophorum pterocarpum	190	LHS	
869	L1/2	Copper Pod	Peltophorum pterocarpum	280	LHS	
870	L1/3	Copper Pod	Peltophorum pterocarpum	130	LHS	
871	L1/4	Copper Pod	Peltophorum pterocarpum	150	LHS	
872	L1/5	Kaadujathi Mara		170	LHS	
873	L1/6	African tuliptree	Spathodea companulata	200	LHS	
874	R1/1	African tuliptree	Spathodea companulata	150	LHS	
875	L1/7	Indian Almond	Terminalia catappa	160	LHS	
876	R2/1	Copper Pod	Peltophorum pterocarpum	220	RHS	
877	R2/2	Copper Pod	Peltophorum pterocarpum	220	RHS	
878	R2/3	Honge	Pongamia pinnata	130	RHS	
879	R2/4	American mahogany	Swietenia mahagoni	110	RHS	
880	R2/5	American mahogany	Swietenia mahagoni	210	RHS	
881	R2/6	American mahogany	Swietenia mahagoni	180	RHS	
882	R2/7	American mahogany	Swietenia mahagoni	150	RHS	
883	R2/8	Honge	Pongamia pinnata	280	RHS	
884	L2/1	Champak	Magnolia champaca	100	LHS	
885	L2/2	Champak	Magnolia champaca	100	LHS	
886	L2/3	African tuliptree	Spathodea companulata	380	LHS	
887	L2/4	African tuliptree	Spathodea companulata	360	LHS	
888	L2/5	Rain Tree	Samanea saman	380	LHS	
889	L2/6	Mutthugada mara		110	LHS	
890	L2/7	Hulbe		200	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
891	L2/8	Hulbe		280	LHS	
892	L2/9	Mountain Ebony	Bauhnia variegata	160	LHS	
893	L2/10	Mountain Ebony	Bauhnia variegata	160	LHS	
894	L2/11	Banyan Tree	Ficus benghalensis	130	LHS	
895	L2/12	Banyan Tree	Ficus benghalensis	160	LHS	
896	L2/13	American mahogany	Swietenia mahagoni	80	LHS	
897	L3/1	Portia tree	Thespesia populnea	100	LHS	
898	L3/2	Portia tree	Thespesia populnea	80	LHS	
899	L3/3	Mullu Byala		90	LHS	
900	L3/4	Portia tree	Thespesia populnea	100	LHS	
901	L3/5	Mountain Ebony	Bauhnia variegata	110	LHS	
902	L3/6	Mountain Ebony	Bauhnia variegata	100	LHS	
903	L3/7	Portia tree	Thespesia populnea	70	LHS	
904	L3/8	Mountain Ebony	Bauhnia variegata	110	LHS	
905	L3/9	Portia tree	Thespesia populnea	100	LHS	
906	L3/10	Portia tree	Thespesia populnea	50	LHS	
907	L3/11	Portia tree	Thespesia populnea	50	LHS	
908	L3/12	American mahogany	Swietenia mahagoni	80	LHS	
909	L3/13	Banyan Tree	Ficus benghalensis	140	LHS	
910	L3/14	Banyan Tree	Ficus benghalensis	120	LHS	
911	L3/15	Banyan Tree	Ficus benghalensis	140	LHS	
912	L3/16	Banyan Tree	Ficus benghalensis	140	LHS	
913	L3/17	Banyan Tree	Ficus benghalensis	120	LHS	
914	R0/1	Mango	Mangifera indica	140	RHS	Cantonment Railway Road
915	R0/2	Mango	Mangifera indica	130	RHS	
916	R0/3	American mahogany	Swietenia mahagoni	110	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of Tree (in Cm)	LHS /RHS	Remarks
917	R0/4	American mahogany	Swietenia mahagoni	110	RHS	
918	R0/5	Mango	Mangifera indica	250	RHS	
919	L0/1	Mango	Mangifera indica	80	LHS	
920	L0/2	Rubber fig	Ficus elastica	100	LHS	
921	L0/3	Rubber fig	Ficus elastica	80	LHS	
922	L0/4	Rubber fig	Ficus elastica	70	LHS	
923	L0/5	Rubber fig	Ficus elastica	80	LHS	
924	L0/6	Rubber fig	Ficus elastica	90	LHS	
925	L0/7	Rubber fig	Ficus elastica	80	LHS	
926	L0/8	Rubber fig	Ficus elastica	80	LHS	
927	L0/9	Rubber fig	Ficus elastica	90	LHS	
928	L0/10	Belada mara	Aegle marmelos	140	LHS	
929	L0/11	Subabul	Leucaena leucocephala	110	LHS	
930	L0/12	Tamarind	Tamarindus indica	120	LHS	
931	L0/13	Belada mara	Aegle marmelos	130	LHS	
932	L0/14	Coconut	Cocus nucifera	90	LHS	
933	L0/15	Silver Oak	Grevillea robusta	150	LHS	
934	L0/16	Coconut	Cocus nucifera	80	LHS	
935	L0/17	Coconut	Cocus nucifera	90	LHS	
936	L0/18	Subabul	Leucaena leucocephala	110	LHS	
937	L0/19	Mango	Mangifera indica	120	LHS	
938	L0/20	Silver Oak	Grevillea robusta	150	LHS	
939	L0/21	Silver Oak	Grevillea robusta	160	LHS	
940	L0/22	Jamun Tree	Syzygium cumini	220	LHS	

East West CORRIDOR 1

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
1	M7/1	Nilgiri	Eucalyptus	60	Median	EW1 : Package 1 : Phase 2 - Gopalan Mall to Ulsoor Lake
2	M7/2	Rain Tree	Samanea saman	90	Median	
3	M8/1	Jamun	Syzygium cumini	90	Median	
4	L8/1	Copper Pod	Peltophorum pterocarpum	120	LHS	
5	L8/2	Copper Pod	Peltophorum pterocarpum	200	LHS	
6	L8/3	Moutain ebony	Bauhinia variegata	90	LHS	
7	L8/4	Copper Pod	Peltophorum pterocarpum	160	LHS	
8	L8/5	Copper Pod	Peltophorum pterocarpum	170	LHS	
9	L8/6	Copper Pod	Peltophorum pterocarpum	190	LHS	
10	L8/7	Copper Pod	Peltophorum pterocarpum	150	LHS	
11	L8/8	Copper Pod	Peltophorum pterocarpum	210	LHS	
12	L8/9	Copper Pod	Peltophorum pterocarpum	170	LHS	
13	L8/10	Copper Pod	Peltophorum pterocarpum	200	LHS	
14	L9/1	Portia tree	Thespesia populnea	90	LHS	
15	L9/2	Copper Pod	Peltophorum pterocarpum	260	LHS	
16	L9/3	Copper Pod	Peltophorum pterocarpum	300	LHS	
17	L9/4	Copper Pod	Peltophorum pterocarpum	210	LHS	
18	L9/5	Copper Pod	Peltophorum pterocarpum	230	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
19	L9/6	American mahogany	Swietenia mahagoni	140	LHS	
20	L9/7	Rain Tree	Samanea saman	220	LHS	
21	L9/8	Moutain ebony	Bauhinia variegata	90	LHS	
22	L9/9	American mahogany	Swietenia mahagoni	90	LHS	
23	L9/10	American mahogany	Swietenia mahagoni	90	LHS	
24	L9/11	American mahogany	Swietenia mahagoni	90	LHS	
25	L9/12	Caribbean trumpet tree	Tabebuia aurea	60	LHS	
26	L9/13	American mahogany	Swietenia mahagoni	120	LHS	
27	L9/14	American mahogany	Swietenia mahagoni	120	LHS	
28	R9/1	Banyan Tree	Ficus benghalensis	390	RHS	
29	R9/2	American mahogany	Swietenia mahagoni	120	RHS	
30	R9/3	Badminton Ball Tree	Parkia biglandulosa	180	RHS	
31	R9/4	Copper Pod	Peltophorum pterocarpum	160	RHS	
32	R9/5	Copper Pod	Peltophorum pterocarpum	470	RHS	
33	R9/6	Copper Pod	Peltophorum pterocarpum	380	RHS	
34	R9/7	Copper Pod	Peltophorum pterocarpum	80	RHS	
35	R9/8	American mahogany	Swietenia mahagoni	220	RHS	
36	R9/9	Bannimara	Prosopis cineraria	280	RHS	
37	R9/10	Moutain ebony	Bauhinia variegata	110	RHS	
38	R9/11	American mahogany	Swietenia mahagoni	140	RHS	
39	R9/12	Moutain ebony	Bauhinia variegata	130	RHS	
40	R9/13	American mahogany	Swietenia mahagoni	150	RHS	
41	R9/14	American mahogany	Swietenia mahagoni	110	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
42	R9/15	Copper Pod	Peltophorum pterocarpum	210	RHS	
43	R9/16	American mahogany	Swietenia mahagoni	140	RHS	
44	R9/17	American mahogany	Swietenia mahagoni	120	RHS	
45	R9/18	American mahogany	Swietenia mahagoni	180	RHS	
46	L9/15	Rain Tree	Samanea saman	220	LHS	
47	L9/16	Rain Tree	Samanea saman	260	LHS	
48	L9/17	Badminton Ball Tree	Parkia biglandulosa	170	LHS	
49	L9/18	Portia tree	Thespesia populnea	100	LHS	
50	L9/19	Rain Tree	Samanea saman	290	LHS	
51	L9/20	Portia tree	Thespesia populnea	50	LHS	
52	L9/21	Rain Tree	Samanea saman	300	LHS	
53	L9/22	Rain Tree	Samanea saman	240	LHS	
54	L9/23	Rain Tree	Samanea saman	240	LHS	
55	L9/24	Rain Tree	Samanea saman	250	LHS	
56	L9/25	Rain Tree	Samanea saman	180	LHS	
57	L9/26	Rain Tree	Samanea saman	250	LHS	
58	L10/1	Beete	Rosewood	150	LHS	
59	L10/2	American mahogany	Swietenia mahagoni	200	LHS	
60	L10/3	Moutain ebony	Bauhinia variegata	100	LHS	
61	L10/4	Copper Pod	Peltophorum pterocarpum	240	LHS	
62	L10/5	Copper Pod	Peltophorum pterocarpum	210	LHS	
63	L10/6	American mahogany	Swietenia mahagoni	180	LHS	
64	L10/7	Copper Pod	Peltophorum pterocarpum	160	LHS	
65	L10/8	Moutain ebony	Bauhinia variegata	70	LHS	
66	L10/9	American mahogany	Swietenia mahagoni	90	LHS	
67	L10/10	Moutain ebony	Bauhinia variegata	110	LHS	
68	L10/11	Badminton Ball Tree	Parkia biglandulosa	140	LHS	
69	L10/12	Tamarind	Tamarindus indica	300	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
70	L10/13	Rain Tree	Samanea saman	320	LHS	Within Graveyard
71	L10/14	Rain Tree	Samanea saman	220	LHS	
72	L10/15	Rain Tree	Samanea saman	320	LHS	
73	L10/16	Rain Tree	Samanea saman	210	LHS	
74	L10/17	Rain Tree	Samanea saman	400	LHS	
75	L10/18	Badminton Ball Tree	Parkia biglandulosa	170	LHS	
76	R10/1	Rain Tree	Samanea saman	240	RHS	Within Defence land
77	R10/2	Rain Tree	Samanea saman	260	RHS	
78	M10/1	Rain Tree	Samanea saman	70	Median	
79	L10/19	Moutain ebony	Bauhinia variegata	130	LHS	
80	M11/1	Royal Palm	Roystonea regia	170	Median	Phase 2: PKG 2 Ulsoor Lake to Millers Road
81	M11/2	Royal Palm	Roystonea regia	130	Median	
82	M11/3	Royal Palm	Roystonea regia	270	Median	
83	M11/4	Royal Palm	Roystonea regia	270	Median	
84	M11/5	Royal Palm	Roystonea regia	270	Median	
85	M11/6	Royal Palm	Roystonea regia	270	Median	
86	M11/7	Royal Palm	Roystonea regia	270	Median	
87	M11/8	Royal Palm	Roystonea regia	270	Median	
88	M11/9	Royal Palm	Roystonea regia	270	Median	
89	M11/10	Royal Palm	Roystonea regia	270	Median	
90	M11/11	Royal Palm	Roystonea regia	270	Median	
91	R11/1	Moutain ebony	Bauhinia variegata	120	RHS	
92	R11/2	Champak	Magnolia champaca	100	RHS	
93	R11/3	African tuliptree	Spathodea campanulata	120	RHS	
94	R11/4	Peepal Tree	Ficus Religiosa	220	RHS	
95	R11/5	Ashoka Tree	Saraca indica	120	RHS	
96	R11/6	Ashoka Tree	Saraca indica	100	RHS	
97	R11/7	Ashoka Tree	Saraca indica	100	RHS	
98	R11/8	Ashoka Tree	Saraca indica	80	RHS	
99	R11/9	Ashoka Tree	Saraca indica	80	RHS	
100	R11/10	Ashoka Tree	Saraca indica	60	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
101	R11/11	Ashoka Tree	Saraca indica	80	RHS	
102	L11/1	Peepal Tree	Ficus Religiosa	250	LHS	Within Ulsoor Lake Park
103	L11/2	Rain Tree	Samanea saman	400	LHS	"
104	L11/3	Jamun Tree	Syzygium cumini	230	LHS	"
105	L11/4	Jamun Tree	Syzygium cumini	290	LHS	"
106	L11/5	Jamun Tree	Syzygium cumini	250	LHS	"
107	L11/6	Gulmohar Tree	Delonix Regia	190	LHS	
108	L11/7	Ashoka Tree	Saraca indica	120	LHS	
109	R11/12	Silver Oak	Grevillea robusta Cunn	200	RHS	
110	R11/13	Tamarind	Tamarindus indica	160	RHS	
111	R11/14	Honge	Pongamia Pinnata	60	RHS	
112	R11/15	Peepal Tree	Ficus Religiosa	120	RHS	
113	R11/16	Attimara	Ficus Racemosa	140	RHS	
114	R11/17	Silver Oak	Grevillea robusta Cunn	160	RHS	
115	R11/18	Royal Palm	Roystonea regia	120	RHS	
116	R11/19	Silver Oak	Grevillea robusta Cunn	180	RHS	within Indian Red Cross Society
117	R11/20	Silver Oak	Grevillea robusta Cunn	180	RHS	"
118	R11/21	Mango	Mangifera Indica	70	RHS	"
119	R11/22	Silver Oak	Grevillea robusta Cunn	180	RHS	"
120	R11/23	Honge	Pongamia Pinnata	140	RHS	"
121	R11/24	Silver Oak	Grevillea robusta Cunn	160	RHS	"
122	R11/25	Silver Oak	Grevillea robusta Cunn	160	RHS	"
123	R11/26	Silver Oak	Grevillea robusta Cunn	180	RHS	"
124	R11/27	Silver Oak	Grevillea robusta Cunn	190	RHS	"
125	R11/28	Mango	Mangifera Indica	120	RHS	"
126	L11/8	Ashoka Tree	Saraca indica	160	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
127	R11/29	Silver Oak	Grevillea robusta Cunn	160	RHS	within Indian Red Cross Society
128	R11/30	Silver Oak	Grevillea robusta Cunn	180	RHS	"
129	R11/31	Silver Oak	Grevillea robusta Cunn	220	RHS	"
130	R11/32	Silver Oak	Grevillea robusta Cunn	200	RHS	"
131	L11/9	Mullu Byala		280	LHS	
132	R11/33	Honge	Pongamia Pinnata	130	RHS	
133	R11/34	Silver Oak	Grevillea robusta Cunn	190	RHS	
134	R11/35	Silver Oak	Grevillea robusta Cunn	200	RHS	
135	R11/36	Silver Oak	Grevillea robusta Cunn	160	RHS	
136	R11/37	Silver Oak	Grevillea robusta Cunn	170	RHS	
137	R11/38	Silver Oak	Grevillea robusta Cunn	190	RHS	
138	R11/39	Silver Oak	Grevillea robusta Cunn	200	RHS	
139	L11/10	Moutain ebony	Bauhinia variegata	180	LHS	
140	R11/40	Tamarind	Tamarindus indica	240	RHS	within Indian Red Cross Society
141	R11/41	Silver Oak	Grevillea robusta Cunn	200	RHS	"
142	L11/11	American mahogany	Swietenia mahagoni	130	LHS	Bosch Apartments
143	R11/42	Mango	Mangifera Indica	100	RHS	"
144	L11/12	Honge	Pongamia Pinnata	240	LHS	With in Ulsoor Lake Park
145	L11/13	Honge	Pongamia Pinnata	500	LHS	"
146	L11/14	Honge	Pongamia Pinnata	600	LHS	"
147	L11/15	Honge	Pongamia Pinnata	600	LHS	"
148	L11/16	Honge	Pongamia Pinnata	400	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
149	L11/17	Honge	Pongamia Pinnata	500	LHS	"
150	L11/18	Jamun Tree	Syzygium cumini	300	LHS	"
151	L11/19	Royal Palm	Roystonea regia	160	LHS	"
152	L11/20	Royal Palm	Roystonea regia	160	LHS	"
153	L11/21	Royal Palm	Roystonea regia	160	LHS	"
154	L11/22	Royal Palm	Roystonea regia	160	LHS	"
155	L11/23	Royal Palm	Roystonea regia	160	LHS	"
156	L11/24	Royal Palm	Roystonea regia	160	LHS	"
157	L11/25	Royal Palm	Roystonea regia	160	LHS	"
158	L11/26	Royal Palm	Roystonea regia	160	LHS	"
159	L11/27	Royal Palm	Roystonea regia	160	LHS	"
160	L11/28	Royal Palm	Roystonea regia	160	LHS	"
161	L11/29	Royal Palm	Roystonea regia	160	LHS	"
162	L11/30	Royal Palm	Roystonea regia	160	LHS	"
163	L11/31	Royal Palm	Roystonea regia	160	LHS	"
164	L11/32	Ashoka Tree	Saraca indica	80	LHS	"
165	L11/33	Ashoka Tree	Saraca indica	80	LHS	"
166	L11/34	Ashoka Tree	Saraca indica	80	LHS	"
167	L11/35	Ashoka Tree	Saraca indica	80	LHS	"
168	L11/36	Ashoka Tree	Saraca indica	80	LHS	"
169	L11/37	Ashoka Tree	Saraca indica	80	LHS	"
170	L11/38	Ashoka Tree	Saraca indica	80	LHS	"
171	L11/39	Ashoka Tree	Saraca indica	80	LHS	"
172	L11/40	Ashoka Tree	Saraca indica	80	LHS	"
173	L11/41	Ashoka Tree	Saraca indica	80	LHS	"
174	L11/42	Ashoka Tree	Saraca indica	80	LHS	"
175	L11/43	Ashoka Tree	Saraca indica	80	LHS	"
176	L11/44	Ashoka Tree	Saraca indica	80	LHS	"
177	L11/45	Ashoka Tree	Saraca indica	80	LHS	"
178	L11/46	Ashoka Tree	Saraca indica	80	LHS	"
179	L11/47	Ashoka Tree	Saraca indica	80	LHS	"
180	L11/48	Ashoka Tree	Saraca indica	80	LHS	"
181	L11/49	Ashoka Tree	Saraca indica	80	LHS	"
182	L11/50	Ashoka Tree	Saraca indica	80	LHS	"
183	L11/51	Ashoka Tree	Saraca indica	80	LHS	"
184	L11/52	Ashoka Tree	Saraca indica	80	LHS	"
185	L11/53	Ashoka Tree	Saraca indica	80	LHS	"
186	L11/54	Ashoka Tree	Saraca indica	80	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
187	L11/55	Ashoka Tree	Saraca indica	80	LHS	"
188	L11/56	Ashoka Tree	Saraca indica	80	LHS	"
189	L11/57	Ashoka Tree	Saraca indica	80	LHS	"
190	L11/58	Ashoka Tree	Saraca indica	80	LHS	"
191	L11/59	Ashoka Tree	Saraca indica	80	LHS	"
192	L11/60	Ashoka Tree	Saraca indica	80	LHS	"
193	L11/61	Ashoka Tree	Saraca indica	80	LHS	"
194	L11/62	Ashoka Tree	Saraca indica	80	LHS	"
195	L11/63	Ashoka Tree	Saraca indica	80	LHS	"
196	L11/64	Ashoka Tree	Saraca indica	80	LHS	"
197	L11/65	Ashoka Tree	Saraca indica	80	LHS	"
198	L11/66	Ashoka Tree	Saraca indica	80	LHS	"
199	L11/67	Ashoka Tree	Saraca indica	70	LHS	"
200	L11/68	Cassia		100	LHS	"
201	L11/69	Cassia		100	LHS	"
202	L11/70	Cassia		80	LHS	"
203	L11/71	Cassia		80	LHS	"
204	L11/72	Cassia		80	LHS	"
205	L11/73	Cassia		80	LHS	"
206	L11/74	Copper Pod	Peltophorum pterocarpum	120	LHS	"
207	L11/75	Cassia		100	LHS	"
208	L11/76	Cassia		140	LHS	"
209	L11/77	Subabul	Leucaena leucocephala	100	LHS	"
210	L11/78	Cassia		180	LHS	"
211	L11/79	Cassia		180	LHS	"
212	L11/80	Cassia		110	LHS	"
213	L11/81	African tuliptree	Spathodea campanulata	80	LHS	"
214	L12/1	American mahogany	Swietenia mahagoni	90	LHS	
215	L12/2	Rain Tree	Samanea saman	220	LHS	
216	L12/3	American mahogany	Swietenia mahagoni	180	LHS	
217	L12/4	Moutain ebony	Bauhinia variegata	160	LHS	
218	L12/5	Coconut	Cocus Nucifera	110	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
219	L12/6	American mahogany	Swietenia mahagoni	170	LHS	
220	L12/7	Coconut	Cocus Nucifera	110	LHS	
221	L12/8	Coconut	Cocus Nucifera	100	LHS	
222	L12/9	Gulmohar Tree	Delonix Regia	280	LHS	
223	L12/10	American mahogany	Swietenia mahagoni	170	LHS	
224	L12/11	American mahogany	Swietenia mahagoni	140	LHS	
225	L12/12	American mahogany	Swietenia mahagoni	100	LHS	
226	L12/13	Coconut	Cocus Nucifera	100	LHS	
227	L12/14	Cassia		230	LHS	
228	L12/15	American mahogany	Swietenia mahagoni	170	LHS	
229	L12/16	American mahogany	Swietenia mahagoni	140	LHS	
230	L12/17	Coconut	Cocus Nucifera	100	LHS	
231	L12/18	American mahogany	Swietenia mahagoni	130	LHS	
232	R12/1	Rain Tree	Samanea saman	500	RHS	
233	R12/2	Rain Tree	Samanea saman	470	RHS	
234	R12/3	Rain Tree	Samanea saman	410	RHS	
235	R12/4	Rain Tree	Samanea saman	590	RHS	
236	R12/5	Rain Tree	Samanea saman	580	RHS	
237	R12/6	Rain Tree	Samanea saman	590	RHS	
238	R12/7	Rain Tree	Samanea saman	360	RHS	
239	R12/8	Rain Tree	Samanea saman	530	RHS	
240	R12/9	Gulmohar Tree	Delonix Regia	200	RHS	
241	L12/19	Rain Tree	Samanea saman	80	LHS	
242	L12/20	Rain Tree	Samanea saman	100	LHS	
243	L12/21	Rain Tree	Samanea saman	90	LHS	
244	L12/22	Beete	Rosewood	140	LHS	
245	L12/23	Ashoka Tree	Saraca indica	100	LHS	
246	L12/24	Beete	Rosewood	190	LHS	
247	L12/25	Rain Tree	Samanea saman	280	LHS	
248	L12/26	Copper Pod	Peltophorum pterocarpum	190	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
249	L12/27	Jamun Tree	Syzygium cumini	160	LHS	
250	L12/28	Portia tree	Thespesia populnea	120	LHS	
251	L12/29	Portia tree	Thespesia populnea	80	LHS	
252	L12/30	Badminton Ball Tree	Parkia biglandulosa	200	LHS	
253	L12/31	Gulmohar Tree	Delonix Regia	280	LHS	
254	L12/32	Copper Pod	Peltophorum pterocarpum	220	LHS	Promenade Road
255	L12/33	Copper Pod	Peltophorum pterocarpum	200	LHS	
256	L12/34	Copper Pod	Peltophorum pterocarpum	240	LHS	
257	L12/35	Copper Pod	Peltophorum pterocarpum	200	LHS	
258	L12/36	Gulmohar Tree	Delonix Regia	190	LHS	
259	R12/10	Moutain ebony	Bauhinia variegata	120	RHS	
260	R12/11	Moutain ebony	Bauhinia variegata	100	RHS	
265	R13/1	Gulmohar Tree	Delonix Regia	200	RHS	
266	L13/1	Gulmohar Tree	Delonix Regia	190	LHS	
267	R13/2	Copper Pod	Peltophorum pterocarpum	210	RHS	
268	R13/3	Gulmohar Tree	Delonix Regia	210	RHS	
269	R13/4	Copper Pod	Peltophorum pterocarpum	200	RHS	
270	R13/5	Gulmohar Tree	Delonix Regia	210	RHS	
271	R13/6	Gulmohar Tree	Delonix Regia	200	RHS	
272	R13/7	Copper Pod	Peltophorum pterocarpum	190	RHS	
273	R13/8	Portia tree	Thespesia populnea	100	RHS	
274	R13/9	Copper Pod	Peltophorum pterocarpum	160	RHS	
275	R13/10	American mahogany	Swietenia mahagoni	90	RHS	
276	R13/11	Gulmohar Tree	Delonix Regia	200	RHS	
277	R13/12	American mahogany	Swietenia mahagoni	160	RHS	
278	R13/13	Gulmohar Tree	Delonix Regia	200	RHS	
279	R13/14	American mahogany	Swietenia mahagoni	170	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
280	R13/15	Badminton Ball Tree	Parkia biglandulosa	220	RHS	
281	R13/16	Copper Pod	Peltophorum pterocarpum	190	RHS	
282	L13/2	Copper Pod	Peltophorum pterocarpum	100	LHS	
283	R13/7	Hercules		200	RHS	
284	R13/8	Copper Pod	Peltophorum pterocarpum	130	RHS	with in Coles Park
285	L12/32	Ashoka Tree	Saraca indica	140	LHS	St. John's Road
286	L12/33	Portia tree	Thespesia populnea	180	LHS	
287	L12/34	Honge	Pongamia Pinnata	160	LHS	within Field Marshal Manekshaw Enclave
288	L12/35	Silver Oak	Grevillea robusta Cunn	180	LHS	"
289	L12/36	Jamun Tree	Syzygium cumini	160	LHS	"
290	L12/37	Rain Tree	Samanea saman	200	LHS	"
291	L12/38	Rain Tree	Samanea saman	220	LHS	
292	L13/1	Portia tree	Thespesia populnea	100	LHS	
293	L13/2	Moutain ebony	Bauhinia variegata	120	LHS	
294	L13/3	American mahogany	Swietenia mahagoni	120	LHS	
295	L13/4	American mahogany	Swietenia mahagoni	90	LHS	
296	L13/5	Copper Pod	Peltophorum pterocarpum	140	LHS	
297	R13/1	Gulmohar Tree	Delonix Regia	150	RHS	
298	R13/2	Mullu Byala		180	RHS	
299	R13/3	African tuliptree	Spathodea campanulata	240	RHS	
300	R13/4	Copper Pod	Peltophorum pterocarpum	140	RHS	
301	R13/5	Copper Pod	Peltophorum pterocarpum	130	RHS	
302	R13/6	Copper Pod	Peltophorum pterocarpum	100	RHS	
303	R18/1	Rain Tree	Samanea saman	300	RHS	Mekhri

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
						Circle
304	R18/2	Rain Tree	Samanea saman	340	RHS	
305	R18/3	Rain Tree	Samanea saman	260	RHS	
306	R18/4	Rain Tree	Samanea saman	280	RHS	
307	R18/5	Rain Tree	Samanea saman	280	RHS	
308	R18/6	Rain Tree	Samanea saman	210	RHS	
309	R18/7	Rain Tree	Samanea saman	260	RHS	
310	R18/8	Rain Tree	Samanea saman	300	RHS	
311	R18/9	Rain Tree	Samanea saman	250	RHS	
312	R18/10	Rain Tree	Samanea saman	150	RHS	
313	R18/11	Peepal Tree	Ficus Religiosa	170	RHS	
314	R18/12	Rain Tree	Samanea saman	160	RHS	
315	R18/13	Rain Tree	Samanea saman	300	RHS	
316	R18/14	Rain Tree	Samanea saman	240	RHS	
317	R18/15	Rain Tree	Samanea saman	240	RHS	
318	R18/16	Rain Tree	Samanea saman	150	RHS	
319	L18/1	African tuliptree	Spathodea campanulata	120	LHS	
320	L18/2	African tuliptree	Spathodea campanulata	180	LHS	
321	L18/3	African tuliptree	Spathodea campanulata	90	LHS	
322	L18/4	African tuliptree	Spathodea campanulata	170	LHS	
323	L18/5	Caribbean trumpet tree	Tabebuia aurea	120	LHS	
324	L18/6	Copper Pod	Peltophorum pterocarpum	120	LHS	
325	L18/7	Caribbean trumpet tree	Tabebuia aurea	210	LHS	
326	L18/8	Teak	Tectona grandis	220	LHS	
327	L18/9	American mahogany	Swietenia mahagoni	60	LHS	
328	L18/10	Teak	Tectona grandis	100	LHS	
329	L18/11	Teak	Tectona grandis	130	LHS	
330	L18/12	Rain Tree	Samanea saman	270	LHS	
331	L19/1	Gulmohar Tree	Delonix Regia	260	LHS	
332	L19/2	Rain Tree	Samanea saman	280	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
333	L19/3	Rain Tree	Samanea saman	260	LHS	
334	L19/4	Gulmohar Tree	Delonix Regia	120	LHS	
335	L19/5	American mahogany	Swietenia mahagoni	200	LHS	
336	R19/1	Ashoka Tree	Saraca indica	100	RHS	within BEML Compound Wall
337	R19/2	Ashoka Tree	Saraca indica	120	RHS	"
338	R19/3	Badami		120	RHS	
339	L19/6	Cassia		300	LHS	
340	R19/4	Ashoka Tree	Saraca indica	120	RHS	
341	R19/5	Badami		110	RHS	
342	R19/6	Ashoka Tree	Saraca indica	100	RHS	
343	L19/7	Mullu Byala		120	LHS	
344	L19/8	Rubber fig	Ficus elastica	180	LHS	
345	L19/9	Rubber fig	Ficus elastica		LHS	within Forest Campus
346	L19/10	Rubber fig	Ficus elastica		LHS	"
347	L19/11	Rubber fig	Ficus elastica		LHS	"
348	L19/12	Rubber fig	Ficus elastica		LHS	"
349	L19/13	American mahogany	Swietenia mahagoni	110	LHS	"
350	L19/14	Champak	Magnolia champaca	90	LHS	"
351	L19/15	Rubber fig	Ficus elastica		LHS	"
352	L19/16	Copper Pod	Peltophorum pterocarpum		LHS	"
353	L19/17	Honge	Pongamia Pinnata		LHS	"
354	L19/18	Honge	Pongamia Pinnata		LHS	"
355	L19/19	Rubber fig	Ficus elastica		LHS	"
356	L19/20	Copper Pod	Peltophorum pterocarpum		LHS	"
357	L19/21	Teak	Tectona grandis		LHS	"
358	L19/22	Champak	Magnolia champaca	90	LHS	"
359	L19/23	Teak	Tectona grandis		LHS	"
360	L19/24	Jackfruit	Artocarpus heterophyllus		LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
361	L19/25	Copper Pod	Peltophorum pterocarpum		LHS	
362	L19/26	Champak	Magnolia champaca	100	LHS	
363	L19/27	Copper Pod	Peltophorum pterocarpum		LHS	
364	L19/28	Sandalwood	Santalum		LHS	
365	L19/29	Copper Pod	Peltophorum pterocarpum		LHS	
366	L19/30	Copper Pod	Peltophorum pterocarpum		LHS	
367	L19/31	African tuliptree	Spathodea campanulata		LHS	
368	L19/32	Mango	Mangifera Indica	250	LHS	
369	L19/33	Copper Pod	Peltophorum pterocarpum		LHS	
370	L19/34	Peepal Tree	Ficus Religiosa		LHS	
371	L19/35	Copper Pod	Peltophorum pterocarpum		LHS	
372	L19/36	Honge	Pongamia Pinnata		LHS	
373	L19/37	Copper Pod	Peltophorum pterocarpum		LHS	
374	L19/38	Ichala	Phoenix sylvestris		LHS	
375	L19/39	Honge	Pongamia Pinnata		LHS	
376	L19/40	Honge	Pongamia Pinnata	180	LHS	
377	L19/41	Honge	Pongamia Pinnata	160	LHS	
378	L19/42	Nilgiri	Eucalyptus	240	LHS	
379	L19/43	American mahogany	Swietenia mahagoni		LHS	
380	L19/44	Nilgiri	Eucalyptus		LHS	
381	L19/45	Honge	Pongamia Pinnata		LHS	
382	L19/46	Copper Pod	Peltophorum pterocarpum		LHS	
383	L19/47	Honge	Pongamia Pinnata		LHS	
384	L19/48	Hercules			LHS	
385	L19/49	Tamarind	Tamarindus indica		LHS	
386	L19/50	Rubber fig	Ficus elastica		LHS	
387	L19/51	Rubber fig	Ficus elastica		LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
388	L19/52	Honge	Pongamia Pinnata		LHS	
389	L19/53	Honge	Pongamia Pinnata		LHS	
390	L19/54	Rubber fig	Ficus elastica		LHS	
391	L19/55	Rain Tree	Samanea saman		LHS	
392	L19/56	Honge	Pongamia Pinnata		LHS	
393	L19/57	Copper Pod	Peltophorum pterocarpum		LHS	
394	L19/58	Copper Pod	Peltophorum pterocarpum		LHS	
395	L19/59	Copper Pod	Peltophorum pterocarpum		LHS	
396	L19/60	Copper Pod	Peltophorum pterocarpum		LHS	
397	L19/61	Copper Pod	Peltophorum pterocarpum	350	LHS	
398	L19/62	Jamun Tree	Syzygium cumini	240	LHS	
399	L19/63	Mango	Mangifera Indica	130	LHS	
400	L19/64	Mango	Mangifera Indica	120	LHS	
401	L20/1	Gulmohar Tree	Delonix Regia	200	LHS	within Indian Institute of Science Campus
402	L20/2	Gulmohar Tree	Delonix Regia	140	LHS	"
403	L20/3	Champak	Magnolia champaca	90	LHS	"
404	L20/4	American mahogany	Swietenia mahagoni	130	LHS	"
405	L20/5	Mango	Mangifera Indica	240	LHS	"
406	L20/6	Mango	Mangifera Indica	310	LHS	"
407	L20/7	Gulmohar Tree	Delonix Regia	300	LHS	"
408	L20/8	Gulmohar Tree	Delonix Regia	200	LHS	"
409	L20/9	Gulmohar Tree	Delonix Regia	200	LHS	"
410	L20/10	Gulmohar Tree	Delonix Regia	220	LHS	"
411	L20/11	Gulmohar Tree	Delonix Regia	310	LHS	"
412	L20/12	Gulmohar Tree	Delonix Regia	190	LHS	"
413	L20/13	Gulmohar Tree	Delonix Regia	200	LHS	"
414	L20/14	Gulmohar Tree	Delonix Regia	320	LHS	"
415	L20/15	Gulmohar Tree	Delonix Regia	280	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
416	L20/16	Gulmohar Tree	Delonix Regia	260	LHS	"
417	L20/17	Gulmohar Tree	Delonix Regia	210	LHS	"
418	L20/18	Gulmohar Tree	Delonix Regia	300	LHS	"
419	L20/19	Gulmohar Tree	Delonix Regia	200	LHS	"
420	L20/20	Gulmohar Tree	Delonix Regia	290	LHS	"
421	L20/21	Gulmohar Tree	Delonix Regia	110	LHS	"
422	L20/22	Gulmohar Tree	Delonix Regia	220	LHS	"
423	L20/23	Gulmohar Tree	Delonix Regia	210	LHS	"
424	L20/24	Gulmohar Tree	Delonix Regia	200	LHS	"
425	L20/25	Gulmohar Tree	Delonix Regia	150	LHS	"
426	L20/26	Gulmohar Tree	Delonix Regia	140	LHS	"
427	L20/27	Gulmohar Tree	Delonix Regia	200	LHS	"
428	L20/28	Gulmohar Tree	Delonix Regia	200	LHS	"
429	L20/29	Gulmohar Tree	Delonix Regia	180	LHS	"
430	L20/30	Gulmohar Tree	Delonix Regia	190	LHS	"
431	L20/31	Copper Pod	Peltophorum pterocarpum	170	LHS	"
432	R19/1	Coconut	Cocus Nucifera	110	RHS	
433	R19/2	Ashoka Tree	Saraca indica	90	RHS	
434	R19/3	Coconut	Cocus Nucifera	110	RHS	
435	R19/4	Tamarind	Tamarindus indica	200	RHS	
436	R19/5	Caribbean trumpet tree	Tabebuia aurea	70	RHS	
437	R19/6	Mango	Mangifera Indica	320	RHS	
438	R19/7	Mango	Mangifera Indica	310	RHS	
439	R19/8	Champak	Magnolia champaca	80	RHS	
440	R19/9	Caribbean trumpet tree	Tabebuia aurea	80	RHS	
441	R19/10	Banyan Tree	Ficus benghalensis	340	RHS	
442	R19/11	Tamarind	Tamarindus indica	190	RHS	
443	R19/12	American mahogany	Swietenia mahagoni	210	RHS	
444	R19/13	Copper Pod	Peltophorum pterocarpum	100	RHS	
445	R19/14	Tamarind	Tamarindus indica	140	RHS	
446	R19/15	Hercules		200	RHS	
447	R19/16	Jamun Tree	Syzygium cumini	200	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
448	R19/17	Rubber fig	Ficus elastica	150	RHS	
449	R19/18	Jamun Tree	Syzygium cumini	140	RHS	
450	R19/19	Mullu Byala		70	RHS	
451	R19/20	Hercules		310	RHS	
452	R19/21	Copper Pod	Peltophorum pterocarpum	140	RHS	
453	R19/22	Rain Tree	Samanea saman	320	RHS	
454	R19/23	Gulmohar Tree	Delonix Regia	120	RHS	
455	R19/24	Gulmohar Tree	Delonix Regia	350	RHS	
456	R19/25	Gulmohar Tree	Delonix Regia	140	RHS	
457	R19/26	Gulmohar Tree	Delonix Regia	110	RHS	
458	R19/27	Gulmohar Tree	Delonix Regia	60	RHS	
459	R19/28	Badami		240	RHS	
460	R19/29	Gulmohar Tree	Delonix Regia	130	RHS	
461	R19/30	Honge	Pongamia Pinnata	110	RHS	
462	R19/31	Caribbean trumpet tree	Tabebuia aurea	60	RHS	
463	R19/32	Gulmohar Tree	Delonix Regia	120	RHS	
464	R19/33	Gulmohar Tree	Delonix Regia	130	RHS	
465	R19/34	Gulmohar Tree	Delonix Regia	110	RHS	
466	R19/35	Gulmohar Tree	Delonix Regia	140	RHS	
467	R19/36	Honge	Pongamia Pinnata	90	RHS	
468	R19/37	Honge	Pongamia Pinnata	60	RHS	
469	R19/38	Gulmohar Tree	Delonix Regia	120	RHS	
470	R19/39	Gulmohar Tree	Delonix Regia	180	RHS	
471	R19/40	Gulmohar Tree	Delonix Regia	150	RHS	
472	R19/41	Gulmohar Tree	Delonix Regia	130	RHS	
473	R19/42	Gulmohar Tree	Delonix Regia	240	RHS	
474	R19/43	Gulmohar Tree	Delonix Regia	150	RHS	
475	R19/44	Honge	Pongamia Pinnata	110	RHS	
476	R19/45	Gulmohar Tree	Delonix Regia	120	RHS	
477	R19/46	Gulmohar Tree	Delonix Regia	140	RHS	
478	R20/1	Mango	Mangifera Indica	320	RHS	
479	R20/2	Mango	Mangifera Indica	290	RHS	
480	R20/3	Jamun Tree	Syzygium cumini	350	RHS	
481	R20/4	Mango	Mangifera Indica	300	RHS	
482	R20/5	Banyan Tree	Ficus benghalensis	400	RHS	
483	R20/6	Mango	Mangifera Indica	120	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
484	R20/7	Mango	Mangifera Indica	280	RHS	
485	R20/8	Mango	Mangifera Indica	320	RHS	
486	R20/9	Mango	Mangifera Indica	300	RHS	
487	R20/10	Banyan Tree	Ficus benghalensis	350	RHS	
488	R0/1	Rain Tree	Samanea saman	180		CC-2 : Phase 2 Package 2 - D'Souza Circle to Ulsoor Lake
489	R0/2	Nilgiri	Eucalyptus	200	RHS	within compound wall
490	L0/1	Rain Tree	Samanea saman	400	RHS	"
491	L0/2	Rain Tree	Samanea saman	280	LHS	
492	L0/3	Rain Tree	Samanea saman	340	LHS	
493	L0/4	Rain Tree	Samanea saman	430	LHS	
494	L0/5	Copper Pod	Peltophorum pterocarpum	110	LHS	within Dobhighat
495	L0/6	Copper Pod	Peltophorum pterocarpum	110	LHS	"
496	L0/7	Rain Tree	Samanea saman	440	LHS	
497	L0/8	Rain Tree	Samanea saman	310	LHS	
498	L0/9	Rain Tree	Samanea saman	360	LHS	
499	L0/10	Rain Tree	Samanea saman	510	LHS	
500	R0/3	Copper Pod	Peltophorum pterocarpum	260	RHS	
501	R0/4	Copper Pod	Peltophorum pterocarpum	180	RHS	
502	R0/5	Copper Pod	Peltophorum pterocarpum	160	RHS	
503	R0/6	Copper Pod	Peltophorum pterocarpum	220	RHS	
504	L0/11	African tuliptree	Spathodea campanulata	180	LHS	
505	R0/7	Honge	Pongamia Pinnata	130	RHS	
506	R0/8	Copper Pod	Peltophorum pterocarpum	280	RHS	
507	L0/12	Tamarind	Tamarindus indica	320	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
508	R0/9	Moutain ebony	Bauhinia variegata	130	RHS	
509	R0/10	Copper Pod	Peltophorum pterocarpum	170	RHS	
510	R0/11	Copper Pod	Peltophorum pterocarpum	250	RHS	
511	R1/1	Rain Tree	Samanea saman	440	RHS	
512	R1/2	Rain Tree	Samanea saman	310	RHS	
513	R1/3	Mango	Mangifera Indica	50	RHS	within compound wall of Trinity church
514	R1/4	Nilgiri	Eucalyptus	160	RHS	"
515	R1/5	Rain Tree	Samanea saman	230	RHS	"
516	L1/1	Honge	Pongamia Pinnata	130	LHS	"
517	L1/2	Rain Tree	Samanea saman	140	LHS	"
518	L1/3	Rain Tree	Samanea saman	130	LHS	"
519	L1/4	Honge	Pongamia Pinnata	110	LHS	"
520	L1/5	Moutain ebony	Bauhinia variegata	140	LHS	"
521	L1/6	American mahogany	Swietenia mahagoni	110	LHS	
522	L1/7	Mango	Mangifera Indica	60	LHS	within defense land ulsoor lake
523	L1/8	Nilgiri	Eucalyptus	200	LHS	"
524	L1/9	Jamun Tree	Syzygium cumini	280	LHS	"
525	L1/10	Copper Pod	Peltophorum pterocarpum	170	LHS	"
526	L1/11	Rain Tree	Samanea saman	180	LHS	"
527	L1/12	Rubber fig	Ficus elastica	120	LHS	"
528	L1/13	Honge	Pongamia Pinnata	140	LHS	"
529	L1/14	Mango	Mangifera Indica	130	LHS	"
530	L1/15	Gulmohar Tree	Delonix Regia	160	LHS	"
531	L1/16	Mango	Mangifera Indica	120	LHS	"
532	L1/17	Jamun Tree	Syzygium cumini	210	LHS	"
533	L1/18	American mahogany	Swietenia mahagoni	180	LHS	"
534	L1/19	Banyan Tree	Ficus benghalensis	240	LHS	"
535	L1/20	Rain Tree	Samanea saman	220	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
536	L2/1	Rain Tree	Samanea saman	180	LHS	
537	L2/2	Copper Pod	Peltophorum pterocarpum	260	LHS	
538	L2/3	Copper Pod	Peltophorum pterocarpum	160	LHS	
539	M2/1	Royal Palm	Roystonea regia	120	Median	
540	M2/2	Royal Palm	Roystonea regia	120	Median	

East West CORRIDOR - 2

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
1	R0/1	Rain Tree	Samanea saman	180		CC-2 : Phase 2 Package 2 - D'Souza Circle to Ulsoor Lake
2	R0/2	Nilgiri	Eucalyptus	200	RHS	within compound wall
3	L0/1	Rain Tree	Samanea saman	400	RHS	"
4	L0/2	Rain Tree	Samanea saman	280	LHS	
5	L0/3	Rain Tree	Samanea saman	340	LHS	
6	L0/4	Rain Tree	Samanea saman	430	LHS	
7	L0/5	Copper Pod	Peltophorum pterocarpum	110	LHS	within Dobhighat
8	L0/6	Copper Pod	Peltophorum pterocarpum	110	LHS	"
9	L0/7	Rain Tree	Samanea saman	440	LHS	
10	L0/8	Rain Tree	Samanea saman	310	LHS	
11	L0/9	Rain Tree	Samanea saman	360	LHS	
12	L0/10	Rain Tree	Samanea saman	510	LHS	
13	R0/3	Copper Pod	Peltophorum pterocarpum	260	RHS	
14	R0/4	Copper Pod	Peltophorum pterocarpum	180	RHS	
15	R0/5	Copper Pod	Peltophorum pterocarpum	160	RHS	
16	R0/6	Copper Pod	Peltophorum pterocarpum	220	RHS	
17	L0/11	African	Spathodea campanulata	180	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
		tuliptree				
18	R0/7	Honge	Pongamia pinnata	130	RHS	
19	R0/8	Copper Pod	Peltophorum pterocarpum	280	RHS	
20	L0/12	Tamarind	Tamarindus indica	320	LHS	
21	R0/9	Moutain ebony	Bauhinia variegata	130	RHS	
22	R0/10	Copper Pod	Peltophorum pterocarpum	170	RHS	
23	R0/11	Copper Pod	Peltophorum pterocarpum	250	RHS	
24	R1/1	Rain Tree	Samanea saman	440	RHS	
25	R1/2	Rain Tree	Samanea saman	310	RHS	
26	R1/3	Mango	Mangifera Indica	50	RHS	within compound wall of Trinity church
27	R1/4	Nilgiri	Eucalyptus	160	RHS	"
28	R1/5	Rain Tree	Samanea saman	230	RHS	"
29	L1/1	Honge	Pongamia pinnata	130	LHS	"
30	L1/2	Rain Tree	Samanea saman	140	LHS	"
31	L1/3	Rain Tree	Samanea saman	130	LHS	"
32	L1/4	Honge	Pongamia pinnata	110	LHS	"
33	L1/5	Moutain ebony	Bauhinia variegata	140	LHS	"
34	L1/6	American mahogany	Swietenia mahagoni	110	LHS	
35	L1/7	Mango	Mangifera Indica	60	LHS	within defense land ulsoor lake
36	L1/8	Nilgiri	Eucalyptus	200	LHS	"
37	L1/9	Jamun Tree	Syzygium cumini	280	LHS	"
38	L1/10	Copper Pod	Peltophorum pterocarpum	170	LHS	"
39	L1/11	Rain Tree	Samanea saman	180	LHS	"
40	L1/12	Rubber fig	Ficus elastica	120	LHS	"
41	L1/13	Honge	Pongamia pinnata	140	LHS	"
42	L1/14	Mango	Mangifera Indica	130	LHS	"
43	L1/15	Gulmohar Tree	Delonix regia	160	LHS	"
44	L1/16	Mango	Mangifera Indica	120	LHS	"
45	L1/17	Jamun Tree	Syzygium cumini	210	LHS	"
46	L1/18	American	Swietenia mahagoni	180	LHS	"

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
		mahogany				
47	L1/19	Banyan Tree	Ficus benghalensis	240	LHS	"
48	L1/20	Rain Tree	Samanea saman	220	LHS	
49	L2/1	Rain Tree	Samanea saman	180	LHS	
50	L2/2	Copper Pod	Peltophorum pterocarpum	260	LHS	
51	L2/3	Copper Pod	Peltophorum pterocarpum	160	LHS	
52	M2/1	Royal Palm	Roystonea regia	120	Median	
53	M2/2	Royal Palm	Roystonea regia	120	Median	
54	R0/1	Banyan Tree	Ficus benghalensis	310	RHS	Victoria Rd Juntion to Hosmat Hospital Circle
55	R0/2	Copper Pod	Peltophorum pterocarpum	80	RHS	
56	R0/3	Copper Pod	Peltophorum pterocarpum	70	RHS	
57	R0/4	Copper Pod	Peltophorum pterocarpum	70	RHS	
58	R0/5	Copper Pod	Peltophorum pterocarpum	70	RHS	
59	R0/6	Honge	Pongamia pinnata	270	RHS	
63	L0/1	Rubber fig	Ficus elastica	240	LHS	
64	L0/2	Banyan Tree	Ficus benghalensis	170	LHS	
65	L0/3	Peepal Tree	Ficus religiosa	170	LHS	
66	L0/4	Banyan Tree	Ficus benghalensis	150	LHS	
67	L0/5	American mahogany	Swietenia mahagoni	130	LHS	
68	L0/6	American mahogany	Swietenia mahagoni	220	LHS	
69	L0/7	Moutain ebony	Bauhinia variegata	130	LHS	
70	L0/8	Subabul	Leucaena leucocephala	140	LHS	
71	L0/9	Coconut	Cocus nucifera	100	LHS	
72	L0/10	Mango	Mangifera Indica	200	LHS	
73	L0/11	Coconut	Cocus nucifera	130	LHS	
74	L0/12	Coconut	Cocus nucifera	130	LHS	
75	L0/13	Mango	Mangifera Indica	120	LHS	
76	R0/7	Peepal Tree	Ficus religiosa	600	RHS	
77	R0/8	Nilgiri	Eucalyptus	300	RHS	
78	R0/9	Tamarind	Tamarindus indica	160	RHS	
79	L0/1	Jamun Tree	Syzygium cumini	90	LHS	EW2 :

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
						Package 1: Phase 5 Varthur kodi to After Marathalli Junction
80	L0/2	Tamarind	Tamarindus indica	220	LHS	
81	L0/3	American mahogany	Swietenia mahagoni	70	LHS	
82	L0/4	American mahogany	Swietenia mahagoni	80	LHS	
83	L0/5	American mahogany	Swietenia mahagoni	80	LHS	
84	L0/6	Ashoka Tree	Saraca indica	100	LHS	
85	L0/7	Coconut	Cocus nucifera	100	LHS	
86	R0/1	Honge	Pongamia pinnata	60	RHS	
87	R0/2	Honge	Pongamia pinnata	80	RHS	
88	R0/3	Honge	Pongamia pinnata	70	RHS	
89	R0/4	Honge	Pongamia pinnata	80	RHS	
90	R0/5	African tuliptree	Spathodea campanulata	70	RHS	
91	R0/6	Jackfruit	Artocarpus heterophyllus	80	RHS	
92	R0/7	Coconut	Cocus nucifera	110	RHS	
93	R0/8	Peepal Tree	Ficus religiosa	110	RHS	
94	R0/9	Coconut	Cocus nucifera	110	RHS	
95	R0/10	Coconut	Cocus nucifera	110	RHS	
96	R0/11	American mahogany	Swietenia mahagoni	50	RHS	
97	R0/12	Coconut	Cocus nucifera	100	RHS	
98	R0/13	Golden Shower Tree	Cassia fistula	70	RHS	
99	R0/14	Coconut	Cocus nucifera	110	RHS	
100	R0/15	Coconut	Cocus nucifera	110	RHS	
101	R0/16	American mahogany	Swietenia mahagoni	50	RHS	
102	R0/17	Surgi		90	RHS	
103	L0/8	Indian Almond	Terminalia catappa	90	LHS	
104	L0/9	Champak	Magnolia champaca	50	LHS	
105	L0/10	Champak	Magnolia champaca	50	LHS	
106	R0/18	Neem	Azadirachta indica	100	RHS	
107	R0/19	Coconut	Cocus nucifera	120	RHS	
108	R0/20	Nilgiri	Eucalyptus	160	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
109	R0/21	Indian Almond	Terminalia catappa	60	RHS	
110	R0/22	Indian Almond	Terminalia catappa	60	RHS	
111	L0/11	Indian Almond	Terminalia catappa	60	LHS	
112	R0/23	Indian Almond	Terminalia catappa	70	RHS	
113	R0/24	American mahogany	Swietenia mahagoni	50	RHS	
114	R0/25	American mahogany	Swietenia mahagoni	60	RHS	
115	R0/26	Indian Almond	Terminalia catappa	70	RHS	
116	R1/1	Copper Pod	Peltophorum pterocarpum	70	RHS	
117	R1/2	Copper Pod	Peltophorum pterocarpum	70	RHS	
118	R1/3	Indian Almond	Terminalia catappa	60	RHS	
119	L1/1	Jamun Tree	Syzygium cumini	140	LHS	
120	R1/4	American mahogany	Swietenia mahagoni	60	RHS	
121	R1/5	Indian Almond	Terminalia catappa	60	RHS	
122	R1/6	Honge	Pongamia pinnata	60	RHS	
123	R1/7	Honge	Pongamia pinnata	80	RHS	
124	R1/8	Honge	Pongamia pinnata	80	RHS	
125	R1/9	Honge	Pongamia pinnata	70	RHS	
126	R1/10	Honge	Pongamia pinnata	60	RHS	
127	R1/11	American mahogany	Swietenia mahagoni	70	RHS	
128	R1/12	Honge	Pongamia pinnata	70	RHS	
129	R1/13	Honge	Pongamia pinnata	60	RHS	
130	R1/14	Honge	Pongamia pinnata	90	RHS	
131	R1/15	Honge	Pongamia pinnata	60	RHS	
132	R1/16	Honge	Pongamia pinnata	50	RHS	
133	R1/17	Golden Shower Tree	Cassia fistula	90	RHS	
134	R1/18	Honge	Pongamia pinnata	80	RHS	
135	R1/19	Honge	Pongamia pinnata	70	RHS	
136	R1/20	Honge	Pongamia pinnata	50	RHS	
137	R1/21	Honge	Pongamia pinnata	60	RHS	
138	R1/22	Honge	Pongamia pinnata	60	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
139	L1/2	Golden Shower Tree	Cassia fistula	140	LHS	
140	L1/3	Golden Shower Tree	Cassia fistula	150	LHS	
141	L1/4	Golden Shower Tree	Cassia fistula	160	LHS	
142	L1/5	Golden Shower Tree	Cassia fistula	120	LHS	
143	L1/6	Golden Shower Tree	Cassia fistula	120	LHS	
144	L1/7	Golden Shower Tree	Cassia fistula	130	LHS	
145	L1/8	Golden Shower Tree	Cassia fistula	110	LHS	
146	L1/9	Golden Shower Tree	Cassia fistula	150	LHS	
147	L1/10	Golden Shower Tree	Cassia fistula	140	LHS	
148	L1/11	Golden Shower Tree	Cassia fistula	110	LHS	
149	L1/12	Golden Shower Tree	Cassia fistula	120	LHS	
150	L1/13	Golden Shower Tree	Cassia fistula	110	LHS	
151	L1/14	Golden Shower Tree	Cassia fistula	110	LHS	
152	R1/23	Honge	Pongamia pinnata	80	RHS	
153	R1/24	Honge	Pongamia pinnata	90	RHS	
154	R1/25	American mahogany	Swietenia mahagoni	60	RHS	
155	R1/26	Golden Shower Tree	Cassia fistula	70	RHS	
156	R1/27	Badminton Ball Tree	Parkia biglandulosa	70	RHS	
157	R1/28	Champak	Magnolia champaca	50	RHS	
158	R1/29	Portia tree	Thespesia populnea	50	RHS	
159	L1/15	Golden Shower Tree	Cassia fistula	130	LHS	
160	L1/16	Golden Shower Tree	Cassia fistula	80	LHS	
161	L1/17	Golden Shower Tree	Cassia fistula	110	LHS	
162	L1/18	Golden Shower Tree	Cassia fistula	120	LHS	
163	L1/19	Golden	Cassia fistula	100	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
		Shower Tree				
164	L1/20	Golden Shower Tree	Cassia fistula	130	LHS	
165	L1/21	Golden Shower Tree	Cassia fistula	100	LHS	
166	L1/22	Golden Shower Tree	Cassia fistula	110	LHS	
167	L1/23	Golden Shower Tree	Cassia fistula	110	LHS	
168	L1/24	Golden Shower Tree	Cassia fistula	100	LHS	
169	L1/25	Rain Tree	Samanea saman	240	LHS	
170	L1/26	Banyan Tree	Ficus benghalensis	550	LHS	
171	L1/27	Peepal Tree	Ficus religiosa	480	LHS	
172	L1/28	Banyan Tree	Ficus benghalensis	800	LHS	
173	L1/29	Beete	Rosewood	80	LHS	
174	L1/30	African tuliptree	Spathodea campanulata	190	LHS	
175	L1/31	Banyan Tree	Ficus benghalensis	300	LHS	
176	L1/32	Indian Almond	Terminalia catappa	60	LHS	
177	L1/33	American mahogany	Swietenia mahagoni	90	LHS	
178	L1/34	Peepal Tree	Ficus religiosa	260	LHS	
179	L1/35	Badminton Ball Tree	Parkia biglandulosa	80	LHS	
180	L1/36	African tuliptree	Spathodea campanulata	90	LHS	
181	L1/37	Champak	Magnolia champaca	110	LHS	
182	L1/38	Champak	Magnolia champaca	110	LHS	
183	L1/39	Champak	Magnolia champaca	110	LHS	
184	L1/40	Badminton Ball Tree	Parkia biglandulosa	120	LHS	
185	L2/1	Indian Almond	Terminalia catappa	70	LHS	
186	L2/2	Beete	Rosewood	200	LHS	
187	R2/1	Indian Almond	Terminalia catappa	110	RHS	
188	R2/2	Portia tree	Thespesia populnea	60	RHS	
189	L2/3	Indian Almond	Terminalia catappa	70	LHS	
190	L2/4	American mahogany	Swietenia mahagoni	60	LHS	
191	L2/5	American	Swietenia mahagoni	60	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
		mahogany				
192	L2/6	Portia tree	Thespesia populnea	70	LHS	
193	L2/7	Portia tree	Thespesia populnea	60	LHS	
194	L2/8	American mahogany	Swietenia mahagoni	50	LHS	
195	L2/9	Honge	Pongamia pinnata	90	LHS	
196	L2/10	Portia tree	Thespesia populnea	60	LHS	
197	L2/11	Portia tree	Thespesia populnea	60	LHS	
198	R2/3	Jamun Tree	Syzygium cumini	70	RHS	
199	L2/12	Portia tree	Thespesia populnea	80	LHS	
200	L2/13	American mahogany	Swietenia mahagoni	70	LHS	
201	L2/14	Coconut	Cocus nucifera	110	LHS	
202	L2/15	American mahogany	Swietenia mahagoni	50	LHS	
203	L2/16	Golden Shower Tree	Cassia fistula	70	LHS	
204	R2/4	Jamun Tree	Syzygium cumini	80	RHS	
205	R2/5	Portia tree	Thespesia populnea	80	RHS	
206	R2/6	Portia tree	Thespesia populnea	90	RHS	
207	R2/7	Portia tree	Thespesia populnea	80	RHS	
208	R2/8	Portia tree	Thespesia populnea	70	RHS	
209	R2/9	Portia tree	Thespesia populnea	90	RHS	
210	R2/10	Portia tree	Thespesia populnea	70	RHS	
211	R2/11	Portia tree	Thespesia populnea	80	RHS	
212	R2/12	Rain Tree	Samanea saman	130	RHS	
213	R2/13	Golden Shower Tree	Cassia fistula	100	RHS	
214	R2/14	Portia tree	Thespesia populnea	70	RHS	
215	R2/15	Portia tree	Thespesia populnea	80	RHS	
216	R2/16	Honge	Pongamia pinnata	80	RHS	
217	R2/17	Portia tree	Thespesia populnea	70	RHS	
218	L2/17	American mahogany	Swietenia mahagoni	120	LHS	
219	L2/18	Peepal Tree	Ficus religiosa	140	LHS	
220	L2/19	American mahogany	Swietenia mahagoni	70	LHS	
221	L2/20	Portia tree	Thespesia populnea	50	LHS	
222	L2/21	Portia tree	Thespesia populnea	70	LHS	
223	L2/22	Portia tree	Thespesia populnea	80	LHS	
224	L2/23	Copper Pod	Peltophorum pterocarpum	90	LHS	
225	L2/24	Jamun Tree	Syzygium cumini	50	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
226	R2/18	Portia tree	Thespesia populnea	70	RHS	
227	R2/19	Portia tree	Thespesia populnea	80	RHS	
228	R2/20	Portia tree	Thespesia populnea	80	RHS	
229	R2/21	Portia tree	Thespesia populnea	80	RHS	
230	R2/22	Portia tree	Thespesia populnea	70	RHS	
231	R2/23	Indian Almond	Terminalia catappa	110	RHS	
232	R2/24	Jamun Tree	Syzygium cumini	90	RHS	
233	L2/25	Portia tree	Thespesia populnea	90	LHS	
234	L2/26	Portia tree	Thespesia populnea	80	LHS	
235	L2/27	Portia tree	Thespesia populnea	80	LHS	
236	L2/28	Banyan Tree	Ficus benghalensis	370	LHS	
237	L2/29	Rain Tree	Samanea saman	260	LHS	
238	R2/25	Banyan Tree	Ficus benghalensis	320	RHS	
239	R2/26	Honge	Pongamia pinnata	70	RHS	
240	R2/27	Jamun Tree	Syzygium cumini	50	RHS	
241	R2/28	American mahogany	Swietenia mahagoni	50	RHS	
242	L2/30	Portia tree	Thespesia populnea	60	LHS	
243	L2/31	Indian Almond	Terminalia catappa	160	LHS	
244	L2/32	American mahogany	Swietenia mahagoni	70	LHS	
245	L2/33	Portia tree	Thespesia populnea	80	LHS	
246	L2/34	Portia tree	Thespesia populnea	90	LHS	
247	L2/35	Portia tree	Thespesia populnea	70	LHS	
248	R2/29	Moutain ebony	Bauhinia variegata	70	RHS	
249	R2/30	American mahogany	Swietenia mahagoni	60	RHS	
250	R2/31	American mahogany	Swietenia mahagoni	60	RHS	
251	R2/32	Honge	Pongamia pinnata	70	RHS	
252	R2/33	Banyan Tree	Ficus benghalensis	400	RHS	
253	L2/36	American mahogany	Swietenia mahagoni	80	LHS	
254	L2/37	Indian Almond	Terminalia catappa	120	LHS	
255	R2/34	American mahogany	Swietenia mahagoni	80	RHS	
256	R2/35	Portia tree	Thespesia populnea	60	RHS	
257	L2/38	Portia tree	Thespesia populnea	70	LHS	
258	L2/39	Portia tree	Thespesia populnea	80	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
259	R2/36	Rain Tree	Samanea saman	320	RHS	
260	R2/37	Rain Tree	Samanea saman	380	RHS	
261	L2/40	Portia tree	Thespesia populnea	80	LHS	
262	L3/1	Portia tree	Thespesia populnea	90	LHS	
263	L3/2	Portia tree	Thespesia populnea	90	LHS	
264	L3/3	Portia tree	Thespesia populnea	90	LHS	
265	L3/4	Neem	Azadirachta indica	80	LHS	
266	L3/5	American mahogany	Swietenia mahagoni	90	LHS	
267	L3/6	American mahogany	Swietenia mahagoni	90	LHS	
268	R3/1	African tuliptree	Spathodea campanulata	100	RHS	
269	R3/2	Honge	Pongamia pinnata	110	RHS	
270	R3/3	Jamun Tree	Syzygium cumini	60	RHS	
271	L3/7	Copper Pod	Peltophorum pterocarpum	100	LHS	
272	L3/8	Banyan Tree	Ficus benghalensis	70	LHS	
273	L3/9	Jamun Tree	Syzygium cumini	80	LHS	
274	L3/10	Attimara	Ficus racemosa	100	LHS	
275	L3/11	Jamun Tree	Syzygium cumini	60	LHS	
276	L3/12	Jamun Tree	Syzygium cumini	70	LHS	
277	L3/13	Banyan Tree	Ficus benghalensis	120	LHS	
278	L3/14	Portia tree	Thespesia populnea	70	LHS	
279	L3/15	American mahogany	Swietenia mahagoni	50	LHS	
280	L3/16	Honge	Pongamia pinnata	60	LHS	
281	L3/17	Banyan Tree	Ficus benghalensis	220	LHS	
282	L3/18	Honge	Pongamia pinnata	70	LHS	
283	M3/1	Portia tree	Thespesia populnea	90	Median	
284	M3/2	Portia tree	Thespesia populnea	180	Median	
285	M3/3	Mullu Byala		80	Median	
286	L3/19	Portia tree	Thespesia populnea	70	LHS	
287	L3/20	Portia tree	Thespesia populnea	70	LHS	
288	R6/1	Attimara	Ficus racemosa	160	RHS	
289	R6/2	Mattimara	Terminalia elliptica	120	RHS	
290	R6/3	Mattimara	Terminalia elliptica	130	RHS	
291	R6/4	Mattimara	Terminalia elliptica	140	RHS	
292	R6/5	Mattimara	Terminalia elliptica	110	RHS	
293	R6/6	Mattimara	Terminalia elliptica	160	RHS	
294	R6/7	Honge	Pongamia pinnata	120	RHS	
295	M6/1	Rain Tree	Samanea saman	90	Median	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
296	M6/2	Rain Tree	Samanea saman	60	Median	
297	M6/3	Rain Tree	Samanea saman	50	Median	
298	M6/4	Rain Tree	Samanea saman	70	Median	
299	M6/5	Rain Tree	Samanea saman	100	Median	
300	M6/6	Rain Tree	Samanea saman	90	Median	
301	L6/1	Mattimara	Terminalia elliptica	140	LHS	
302	L6/2	Mattimara	Terminalia elliptica	160	LHS	
303	L6/3	Mattimara	Terminalia elliptica	140	LHS	
304	L6/4	Mattimara	Terminalia elliptica	150	LHS	
305	L6/5	Mattimara	Terminalia elliptica	140	LHS	
306	L6/6	Mattimara	Terminalia elliptica	140	LHS	
307	L6/7	Peepal Tree	Ficus religiosa	240	LHS	
308	L6/8	Attimara	Ficus racemosa	160	LHS	
309	L6/9	Portia tree	Thespesia populnea	90	LHS	
310	L6/10	Portia tree	Thespesia populnea	100	LHS	
311	L6/11	Rain Tree	Samanea saman	260	LHS	
312	L6/12	Rain Tree	Samanea saman	110	LHS	
313	L6/13	Rain Tree	Samanea saman	190	LHS	
314	L6/14	Rain Tree	Samanea saman	180	LHS	
315	L6/15	Rain Tree	Samanea saman	120	LHS	
316	L6/16	Honge	Pongamia pinnata	140	LHS	
317	L6/17	Rain Tree	Samanea saman	120	LHS	
318	L6/18	East Indian walnut	Albizia lebbeck	140	LHS	
319	L6/19	Rain Tree	Samanea saman	200	LHS	
320	L6/20	Rain Tree	Samanea saman	190	LHS	
321	L6/21	Rain Tree	Samanea saman	1800	LHS	
322	L6/22	Rain Tree	Samanea saman	200	LHS	
323	L6/23	Rain Tree	Samanea saman	140	LHS	
324	L6/24	Rain Tree	Samanea saman	70	LHS	
325	L6/25	Rain Tree	Samanea saman	200	LHS	
326	L6/26	Rain Tree	Samanea saman	220	LHS	
327	L6/27	Rain Tree	Samanea saman	130	LHS	
328	L6/28	Rain Tree	Samanea saman	200	LHS	
329	L6/29	Rain Tree	Samanea saman	160	LHS	
330	L6/30	Rain Tree	Samanea saman	110	LHS	
331	L6/31	Rain Tree	Samanea saman	150	LHS	
332	L6/32	Rain Tree	Samanea saman	160	LHS	
333	L6/33	Rain Tree	Samanea saman	160	LHS	
334	L6/34	Rain Tree	Samanea saman	190	LHS	
335	L6/35	Rain Tree	Samanea saman	120	LHS	
336	L6/36	Rain Tree	Samanea saman	160	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
337	L6/37	Rain Tree	Samanea saman	190	LHS	
338	L6/38	Rain Tree	Samanea saman	120	LHS	
339	L6/39	African tuliptree	Spathodea campanulata	100	LHS	
340	L6/40	Rain Tree	Samanea saman	220	LHS	
341	L6/41	African tuliptree	Spathodea campanulata	200	LHS	
342	L6/42	Rain Tree	Samanea saman	140	LHS	
343	L6/43	African tuliptree	Spathodea campanulata	110	LHS	
344	L6/44	Rain Tree	Samanea saman	200	LHS	
345	L6/45	African tuliptree	Spathodea campanulata	140	LHS	
346	L6/46	Rain Tree	Samanea saman	200	LHS	
347	L6/47	Rain Tree	Samanea saman	180	LHS	
348	L6/48	Rain Tree	Samanea saman	60	LHS	
349	L6/49	African tuliptree	Spathodea campanulata	240	LHS	
350	L6/50	Rain Tree	Samanea saman	100	LHS	
351	L6/51	Rain Tree	Samanea saman	160	LHS	
352	L6/52	African tuliptree	Spathodea campanulata	190	LHS	
353	L6/53	Rain Tree	Samanea saman	240	LHS	
354	L6/54	Honge	Pongamia pinnata	110	LHS	
355	L7/1	African tuliptree	Spathodea campanulata	180	LHS	
356	L7/2	Rain Tree	Samanea saman	160	LHS	
357	L7/3	African tuliptree	Spathodea campanulata	200	LHS	
358	L7/4	Rain Tree	Samanea saman	180	LHS	
359	L7/5	African tuliptree	Spathodea campanulata	130	LHS	
360	L7/6	Rain Tree	Samanea saman	200	LHS	
361	L7/7	African tuliptree	Spathodea campanulata	150	LHS	
362	L7/8	Rain Tree	Samanea saman	110	LHS	
363	L7/9	Rain Tree	Samanea saman	190	LHS	
364	L7/10	Rain Tree	Samanea saman	70	LHS	
365	L7/11	Rain Tree	Samanea saman	230	LHS	
366	L7/12	Rain Tree	Samanea saman	60	LHS	
367	L7/13	African tuliptree	Spathodea campanulata	180	LHS	
368	L7/14	Rain Tree	Samanea saman	160	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
369	L7/15	African tuliptree	Spathodea campanulata	160	LHS	
370	L7/16	Rain Tree	Samanea saman	210	LHS	
371	L7/17	Rain Tree	Samanea saman	190	LHS	
372	L7/18	African tuliptree	Spathodea campanulata	220	LHS	
373	L7/19	African tuliptree	Spathodea campanulata	140	LHS	
374	L7/20	Rain Tree	Samanea saman	170	LHS	
375	L7/21	African tuliptree	Spathodea campanulata	190	LHS	
376	L7/22	African tuliptree	Spathodea campanulata	200	LHS	
377	L7/23	African tuliptree	Spathodea campanulata	230	LHS	
378	L7/24	Honge	Pongamia pinnata	140	LHS	
379	L7/25	Rain Tree	Samanea saman	60	LHS	
380	L7/26	Rain Tree	Samanea saman	190	LHS	
381	L7/27	African tuliptree	Spathodea campanulata	100	LHS	
382	L7/28	Rain Tree	Samanea saman	140	LHS	
383	L7/29	Rain Tree	Samanea saman	80	LHS	
384	L7/30	Rain Tree	Samanea saman	140	LHS	
385	L7/31	Rain Tree	Samanea saman	110	LHS	
386	L7/32	African tuliptree	Spathodea campanulata	220	LHS	
387	L7/33	Rain Tree	Samanea saman	80	LHS	
388	L7/34	Rain Tree	Samanea saman	120	LHS	
389	L7/35	African tuliptree	Spathodea campanulata	220	LHS	
390	L7/36	Rain Tree	Samanea saman	140	LHS	
391	L7/37	Rain Tree	Samanea saman	100	LHS	
392	L7/38	African tuliptree	Spathodea campanulata	240	LHS	
393	L7/39	Rain Tree	Samanea saman	170	LHS	
394	L7/40	Caribbean trumpet tree	Tabebuia aurea	430	LHS	
395	L7/41	Caribbean trumpet tree	Tabebuia aurea	380	LHS	
396	L7/42	Caribbean trumpet tree	Tabebuia aurea	280	LHS	
397	L7/43	Rain Tree	Samanea saman	200	LHS	
398	L7/44	Tamarind	Tamarindus indica	140	LHS	
399	L7/45	Rain Tree	Samanea saman	190	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
400	L7/46	Neem	Azadirachta indica	80	LHS	
401	L7/47	Rain Tree	Samanea saman	210	LHS	
402	L7/48	Neem	Azadirachta indica	70	LHS	
403	L7/49	Rain Tree	Samanea saman	190	LHS	
404	L7/50	Neem	Azadirachta indica	80	LHS	
405	L7/51	Rain Tree	Samanea saman	110	LHS	
406	L7/52	Rain Tree	Samanea saman	130	LHS	
407	L7/53	Rain Tree	Samanea saman	150	LHS	
408	L7/54	Rain Tree	Samanea saman	150	LHS	
409	L7/55	Rain Tree	Samanea saman	120	LHS	
410	L7/56	Honge	Pongamia pinnata	100	LHS	
411	L7/57	Rain Tree	Samanea saman	200	LHS	
412	L7/58	Rain Tree	Samanea saman	150	LHS	
413	L7/59	Rain Tree	Samanea saman	110	LHS	
414	L7/60	Rain Tree	Samanea saman	110	LHS	
415	L7/61	Rain Tree	Samanea saman	200	LHS	
416	L7/62	Rain Tree	Samanea saman	180	LHS	
417	L7/63	Honge	Pongamia pinnata	70	LHS	
418	L7/64	Rain Tree	Samanea saman	270	LHS	
419	L7/65	Rain Tree	Samanea saman	110	LHS	
420	L7/66	Rain Tree	Samanea saman	110	LHS	
421	L7/67	Rain Tree	Samanea saman	200	LHS	
422	L7/68	Honge	Pongamia pinnata	100	LHS	
423	L7/69	Rain Tree	Samanea saman	180	LHS	
424	L7/70	Rain Tree	Samanea saman	180	LHS	
425	L7/71	Rain Tree	Samanea saman	60	LHS	
426	L7/72	Rain Tree	Samanea saman	160	LHS	
427	L7/73	Honge	Pongamia pinnata	80	LHS	
428	L7/74	Rain Tree	Samanea saman	120	LHS	
429	L7/75	Rain Tree	Samanea saman	140	LHS	
430	L7/76	Honge	Pongamia pinnata	90	LHS	
431	L7/77	Rain Tree	Samanea saman	140	LHS	
432	L7/78	Jamun Tree	Syzygium cumini	230	LHS	
433	L7/79	Honge	Pongamia pinnata	90	LHS	
434	L7/80	Honge	Pongamia pinnata	150	LHS	
435	L7/81	Honge	Pongamia pinnata	150	LHS	
436	L7/82	Rain Tree	Samanea saman	280	LHS	
437	L7/83	Rain Tree	Samanea saman	200	LHS	
438	L7/84	Rain Tree	Samanea saman	180	LHS	
439	L7/85	Rain Tree	Samanea saman	190	LHS	
440	L7/86	Rain Tree	Samanea saman	170	LHS	
441	L7/87	Rain Tree	Samanea saman	110	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
442	L7/88	Rain Tree	Samanea saman	180	LHS	
443	L7/89	Rain Tree	Samanea saman	120	LHS	
444	L7/90	Rain Tree	Samanea saman	160	LHS	
445	L7/91	Rain Tree	Samanea saman	70	LHS	
446	L7/92	Rain Tree	Samanea saman	180	LHS	
447	L7/93	Rain Tree	Samanea saman	130	LHS	
448	L7/94	Rain Tree	Samanea saman	140	LHS	
449	L7/95	Rain Tree	Samanea saman	120	LHS	
450	L7/96	Rain Tree	Samanea saman	70	LHS	
451	L7/97	Rain Tree	Samanea saman	80	LHS	
452	L7/98	Rain Tree	Samanea saman	150	LHS	
453	L7/99	Rain Tree	Samanea saman	150	LHS	
454	L7/100	Rain Tree	Samanea saman	150	LHS	
455	L7/101	Rain Tree	Samanea saman	160	LHS	
456	L7/102	Rain Tree	Samanea saman	170	LHS	
457	L7/103	Rain Tree	Samanea saman	170	LHS	
458	L7/104	African tuliptree	Spathodea campanulata	240	LHS	
459	L7/105	African tuliptree	Spathodea campanulata	110	LHS	
460	L7/106	Honge	Pongamia pinnata	110	LHS	
461	L7/107	Honge	Pongamia pinnata	110	LHS	
462	L7/108	Jamun Tree	Syzygium cumini	130	LHS	
463	L7/109	Rain Tree	Samanea saman	200	LHS	
464	L7/110	Kapok Silk Cotton	Ceiba pentandra	200	LHS	
465	L7/111	Kapok Silk Cotton	Ceiba pentandra	160	LHS	
466	L7/112	Rain Tree	Samanea saman	220	LHS	
467	L7/113	Rain Tree	Samanea saman	180	LHS	
468	L7/114	Rain Tree	Samanea saman	180	LHS	
469	L7/115	Honge	Pongamia pinnata	120	LHS	
470	L7/116	Honge	Pongamia pinnata	130	LHS	
471	L7/117	Honge	Pongamia pinnata	60	LHS	
472	L7/118	Honge	Pongamia pinnata	80	LHS	
473	L7/119	Honge	Pongamia pinnata	80	LHS	
474	L7/120	Honge	Pongamia pinnata	110	LHS	
475	L7/121	Rain Tree	Samanea saman	240	LHS	
476	L7/122	Rain Tree	Samanea saman	170	LHS	
477	L7/123	Jamun Tree	Syzygium cumini	160	LHS	
478	L7/124	Rain Tree	Samanea saman	190	LHS	
479	L7/125	Rain Tree	Samanea saman	100	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
480	L7/126	Rain Tree	Samanea saman	180	LHS	
481	L7/127	Honge	Pongamia pinnata	130	LHS	
482	L7/128	Rain Tree	Samanea saman	150	LHS	
483	L7/129	Honge	Pongamia pinnata	110	LHS	
484	L7/130	Honge	Pongamia pinnata	110	LHS	
485	L7/131	Honge	Pongamia pinnata	130	LHS	
486	L7/132	Honge	Pongamia pinnata	130	LHS	
487	R6/8	Rain Tree	Samanea saman	200	RHS	
488	R6/9	Rain Tree	Samanea saman	150	RHS	
489	R6/10	Rain Tree	Samanea saman	190	RHS	
490	R6/11	Rain Tree	Samanea saman	130	RHS	
491	R6/12	Rain Tree	Samanea saman	180	RHS	
492	R6/13	Rain Tree	Samanea saman	180	RHS	
493	R6/14	Rain Tree	Samanea saman	210	RHS	
494	R6/15	Rain Tree	Samanea saman	140	RHS	
495	R6/16	Rain Tree	Samanea saman	180	RHS	
496	R6/17	Rain Tree	Samanea saman	180	RHS	
497	R6/18	Rain Tree	Samanea saman	190	RHS	
498	R6/19	Rain Tree	Samanea saman	150	RHS	
499	R6/20	Rain Tree	Samanea saman	160	RHS	
500	R6/21	Rain Tree	Samanea saman	180	RHS	
501	R6/22	Rain Tree	Samanea saman	130	RHS	
502	R6/23	Rain Tree	Samanea saman	150	RHS	
503	R6/24	Rain Tree	Samanea saman	120	RHS	
504	R6/25	Rain Tree	Samanea saman	170	RHS	
505	R6/26	Rain Tree	Samanea saman	120	RHS	
506	R6/27	Rain Tree	Samanea saman	170	RHS	
507	R6/28	Rain Tree	Samanea saman	140	RHS	
508	R6/29	Rain Tree	Samanea saman	160	RHS	
509	R6/30	Rain Tree	Samanea saman	170	RHS	
510	R6/31	Rain Tree	Samanea saman	140	RHS	
511	R6/32	Rain Tree	Samanea saman	160	RHS	
512	R6/33	Rain Tree	Samanea saman	150	RHS	
513	R6/34	Rain Tree	Samanea saman	170	RHS	
514	R6/35	Rain Tree	Samanea saman	150	RHS	
515	R6/36	Rain Tree	Samanea saman	190	RHS	
516	R6/37	Rain Tree	Samanea saman	160	RHS	
517	R6/38	Rain Tree	Samanea saman	140	RHS	
518	R6/39	Rain Tree	Samanea saman	140	RHS	
519	R6/40	Rain Tree	Samanea saman	140	RHS	
520	R6/41	Rain Tree	Samanea saman	140	RHS	
521	R6/42	Rain Tree	Samanea saman	140	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
522	R6/43	Rain Tree	Samanea saman	130	RHS	
523	R6/44	Rain Tree	Samanea saman	170	RHS	
524	R6/45	Rain Tree	Samanea saman	130	RHS	
525	R6/46	Rain Tree	Samanea saman	160	RHS	
526	R6/47	Rain Tree	Samanea saman	200	RHS	
527	R6/48	Rain Tree	Samanea saman	70	RHS	
528	R6/49	Rain Tree	Samanea saman	180	RHS	
529	R6/50	Rain Tree	Samanea saman	200	RHS	
530	R6/51	Rain Tree	Samanea saman	190	RHS	
531	R6/52	Rain Tree	Samanea saman	130	RHS	
532	R6/53	Rain Tree	Samanea saman	170	RHS	
533	R6/54	Rain Tree	Samanea saman	160	RHS	
534	R6/55	Rain Tree	Samanea saman	160	RHS	
535	R6/56	Rain Tree	Samanea saman	140	RHS	
536	R6/57	Rain Tree	Samanea saman	150	RHS	
537	R6/58	Rain Tree	Samanea saman	140	RHS	
538	R6/59	Rain Tree	Samanea saman	150	RHS	
539	R6/60	Rain Tree	Samanea saman	150	RHS	
540	R6/61	Rain Tree	Samanea saman	140	RHS	
541	R6/62	Rain Tree	Samanea saman	160	RHS	
542	R6/63	Rain Tree	Samanea saman	70	RHS	
543	M7/1	Beete	Rosewood	60	Median	
544	M7/2	Beete	Rosewood	70	Median	
545	M7/3	Beete	Rosewood	50	Median	
546	M7/4	Beete	Rosewood	60	Median	
547	M7/5	Beete	Rosewood	60	Median	
548	M7/8	Honge	Pongamia pinnata	60	Median	
549	M7/9	Beete	Rosewood	80	Median	
550	M7/10	Beete	Rosewood	100	Median	
551	M7/11	Peepal Tree	Ficus religiosa	130	Median	
552	M7/12	Beete	Rosewood	60	Median	
553	M7/13	Beete	Rosewood	80	Median	
554	M7/14	Beete	Rosewood	80	Median	
555	M7/15	Beete	Rosewood	60	Median	
556	M7/16	Beete	Rosewood	60	Median	
557	M7/17	Beete	Rosewood	50	Median	
558	M7/18	Beete	Rosewood	50	Median	
559	M7/19	Beete	Rosewood	60	Median	
560	M7/20	Nilgiri	Eucalyptus	120	Median	
561	M7/21	Rain Tree	Samanea saman	70	Median	
562	M7/22	Rain Tree	Samanea saman	100	Median	
563	M7/23	Rain Tree	Samanea saman	70	Median	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
564	M7/24	Rain Tree	Samanea saman	70	Median	
565	M7/25	Honge	Pongamia pinnata	100	Median	
566	M7/26	Attimara	Ficus racemosa	90	Median	
567	M7/27	Rain Tree	Samanea saman	90	Median	
568	M7/28	Rain Tree	Samanea saman	100	Median	
569	M7/29	Rain Tree	Samanea saman	90	Median	
570	M7/30	Rain Tree	Samanea saman	80	Median	
571	M7/31	Rain Tree	Samanea saman	100	Median	
572	M7/32	Copper Pod	Peltophorum pterocarpum	180	Median	
573	M7/33	Attimara	Ficus racemosa	90	Median	
574	R7/4	Rain Tree	Samanea saman	200	RHS	
575	R7/5	Honge	Pongamia pinnata	100	RHS	
576	R7/6	Rain Tree	Samanea saman	180	RHS	
577	R7/7	Rain Tree	Samanea saman	220	RHS	
578	R7/8	Honge	Pongamia pinnata	120	RHS	
579	L7/133	Rain Tree	Samanea saman	80	LHS	
580	L7/134	Mullu Byala		170	LHS	
581	L7/135	Mullu Byala		80	LHS	
582	L7/136	Rain Tree	Samanea saman	110	LHS	
583	L7/137	Honge	Pongamia pinnata	140	LHS	
584	L7/138	Honge	Pongamia pinnata	70	LHS	
585	L7/139	Honge	Pongamia pinnata	70	LHS	
586	L7/140	Rain Tree	Samanea saman	220	LHS	
587	L8/1	Rain Tree	Samanea saman	280	LHS	
588	L8/2	Rain Tree	Samanea saman	100	LHS	
589	L8/3	Honge	Pongamia pinnata	120	LHS	
590	L8/4	Honge	Pongamia pinnata	70	LHS	
591	L8/5	Gulmohar Tree	Delonix regia	120	LHS	
592	L8/6	Gulmohar Tree	Delonix regia	140	LHS	
593	L8/7	Mango	Mangifera indica	90	LHS	
594	L8/8	Rain Tree	Samanea saman	160	LHS	
595	R8/1	Honge	Pongamia pinnata	70	RHS	
596	R8/2	Rain Tree	Samanea saman	110	RHS	
597	R8/3	Rain Tree	Samanea saman	140	RHS	
598	R8/4	Rain Tree	Samanea saman	150	RHS	
599	R8/5	Honge	Pongamia pinnata	100	RHS	
600	R8/6	Honge	Pongamia pinnata	90	RHS	
601	R8/7	Rain Tree	Samanea saman	140	RHS	
602	R8/8	Rain Tree	Samanea saman	110	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
603	R8/9	Rain Tree	Samanea saman	150	RHS	
604	R8/10	Rain Tree	Samanea saman	160	RHS	
605	L8/9	Rain Tree	Samanea saman	140	LHS	
606	L8/10	Rain Tree	Samanea saman	110	LHS	
607	L8/11	Rain Tree	Samanea saman	200	LHS	
608	R8/11	Jamun Tree	Syzygium cumini	140	RHS	
609	R8/12	Kapok Silk Cotton	Ceiba pentandra	200	RHS	
610	R8/13	Rain Tree	Samanea saman	60	RHS	
611	R8/14	Kapok Silk Cotton	Ceiba pentandra	190	RHS	
612	L8/12	Moutain ebony	Bauhinia variegata	120	LHS	
613	L8/13	Kapok Silk Cotton	Ceiba pentandra	130	LHS	
614	L8/14	Rain Tree	Samanea saman	250	LHS	
615	L8/15	Banyan Tree	Ficus benghalensis	600	LHS	
616	L8/16	Peepal Tree	Ficus religiosa	110	LHS	
617	L8/17	Rain Tree	Samanea saman	330	LHS	
618	L8/18	Rain Tree	Samanea saman	200	LHS	
619	L8/19	Rain Tree	Samanea saman	240	LHS	
620	L8/20	Rain Tree	Samanea saman	150	LHS	
621	L8/21	Rain Tree	Samanea saman	270	LHS	
622	L8/22	Rain Tree	Samanea saman	170	LHS	
623	L8/23	Rain Tree	Samanea saman	270	LHS	
624	L8/24	Rain Tree	Samanea saman	230	LHS	
625	L8/25	Rain Tree	Samanea saman	180	LHS	
626	L8/26	Rain Tree	Samanea saman	220	LHS	
627	L8/27	Rain Tree	Samanea saman	220	LHS	
628	L8/28	Rain Tree	Samanea saman	230	LHS	
629	L8/29	Rain Tree	Samanea saman	200	LHS	
630	L8/30	Rain Tree	Samanea saman	230	LHS	
631	L8/31	Rain Tree	Samanea saman	210	LHS	
632	L8/32	Rain Tree	Samanea saman	330	LHS	
633	L8/33	Copper Pod	Peltophorum pterocarpum	210	LHS	
634	L8/34	Gulmohar Tree	Delonix regia	150	LHS	
635	R8/15	Rain Tree	Samanea saman	340	RHS	
636	R8/16	Rain Tree	Samanea saman	410	RHS	
637	R8/17	Rain Tree	Samanea saman	300	RHS	
638	R8/18	Rain Tree	Samanea saman	270	RHS	
639	R8/19	Rain Tree	Samanea saman	180	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
640	R8/20	Rain Tree	Samanea saman	250	RHS	
641	R8/21	Rain Tree	Samanea saman	120	RHS	
642	R8/22	Rain Tree	Samanea saman	150	RHS	
643	R8/23	Rain Tree	Samanea saman	210	RHS	
644	R8/24	Rain Tree	Samanea saman	220	RHS	
645	R8/25	African tuliptree	Spathodea campanulata	110	RHS	
646	R8/26	Rain Tree	Samanea saman	220	RHS	
647	R8/27	Rain Tree	Samanea saman	250	RHS	
648	R8/28	Rain Tree	Samanea saman	270	RHS	
649	R8/29	Rain Tree	Samanea saman	200	RHS	
650	R8/30	Rain Tree	Samanea saman	280	RHS	
651	R8/31	Rain Tree	Samanea saman	270	RHS	
652	R8/32	Rain Tree	Samanea saman	270	RHS	
653	R8/33	Rain Tree	Samanea saman	310	RHS	
654	R8/34	Rain Tree	Samanea saman	300	RHS	
655	R8/35	Rain Tree	Samanea saman	160	RHS	
656	R8/36	Rain Tree	Samanea saman	260	RHS	
657	R8/37	Rain Tree	Samanea saman	210	RHS	
658	R8/38	Jamun Tree	Syzygium cumini	150	RHS	
659	R8/39	Rain Tree	Samanea saman	280	RHS	
660	R8/40	Rain Tree	Samanea saman	190	RHS	
661	R8/41	Rain Tree	Samanea saman	210	RHS	
662	R8/42	Rain Tree	Samanea saman	320	RHS	
663	R8/43	Rain Tree	Samanea saman	120	RHS	
664	M9/1	Ashoka Tree	Saraca indica	100	Median	
665	M9/2	Ashoka Tree	Saraca indica	70	Median	
666	M9/3	Jamun Tree	Syzygium cumini	60	Median	
667	M9/4	Jamun Tree	Syzygium cumini	60	Median	
668	M9/5	Jamun Tree	Syzygium cumini	50	Median	
669	M9/6	Ashoka Tree	Saraca indica	60	Median	
670	M9/7	Ashoka Tree	Saraca indica	60	Median	
671	M9/8	Ashoka Tree	Saraca indica	70	Median	
672	M9/9	Ashoka Tree	Saraca indica	60	Median	
673	M9/10	Ashoka Tree	Saraca indica	60	Median	
674	M9/11	Ashoka Tree	Saraca indica	60	Median	
675	M9/12	Ashoka Tree	Saraca indica	70	Median	
676	M9/13	Ashoka Tree	Saraca indica	70	Median	
677	M9/14	Ashoka Tree	Saraca indica	60	Median	
678	M9/15	Ashoka Tree	Saraca indica	70	Median	
679	M9/16	Ashoka Tree	Saraca indica	70	Median	
680	M9/17	Ashoka Tree	Saraca indica	60	Median	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
681	M9/18	Ashoka Tree	Saraca indica	70	Median	
682	M9/19	Jamun Tree	Syzygium cumini	50	Median	
683	M9/20	Jamun Tree	Syzygium cumini	70	Median	
684	M9/21	Rain Tree	Samanea saman	110	Median	
685	M9/22	Ashoka Tree	Saraca indica	80	Median	
686	M9/23	Jamun Tree	Syzygium cumini	90	Median	
687	M9/24	Jamun Tree	Syzygium cumini	100	Median	
688	M10/1	Ashoka Tree	Saraca indica	80	Median	
689	M10/2	Jamun Tree	Syzygium cumini	60	Median	
690	M10/3	Ashoka Tree	Saraca indica	80	Median	
691	M10/4	Ashoka Tree	Saraca indica	70	Median	
692	M10/5	Ashoka Tree	Saraca indica	60	Median	
693	M10/6	Ashoka Tree	Saraca indica	70	Median	
694	M10/7	Ashoka Tree	Saraca indica	80	Median	
695	M10/8	Ashoka Tree	Saraca indica	70	Median	
696	M10/9	Ashoka Tree	Saraca indica	80	Median	
697	M10/10	Ashoka Tree	Saraca indica	80	Median	
698	M10/11	Ashoka Tree	Saraca indica	70	Median	
699	M10/12	Ashoka Tree	Saraca indica	80	Median	
700	M10/13	Ashoka Tree	Saraca indica	70	Median	
701	M10/14	Ashoka Tree	Saraca indica	80	Median	
702	M10/15	Ashoka Tree	Saraca indica	80	Median	
703	M10/16	Ashoka Tree	Saraca indica	80	Median	
704	M10/17	Ashoka Tree	Saraca indica	90	Median	
705	R10/1	Badminton Ball Tree	Parkia biglandulosa	260	RHS	
706	R10/2	Badminton Ball Tree	Parkia biglandulosa	220	RHS	
707	M10/18	Ashoka Tree	Saraca indica	80	Median	
708	M10/19	Ashoka Tree	Saraca indica	80	Median	
709	M10/20	Ashoka Tree	Saraca indica	70	Median	
710	M10/21	Ashoka Tree	Saraca indica	70	Median	
711	M10/22	Ashoka Tree	Saraca indica	80	Median	
712	M10/23	Ashoka Tree	Saraca indica	70	Median	
713	M10/24	Ashoka Tree	Saraca indica	70	Median	
714	R10/3	American mahogany	Swietenia mahagoni	60	RHS	
715	M10/25	Ashoka Tree	Saraca indica	60	Median	
716	M10/26	Ashoka Tree	Saraca indica	70	Median	
717	M10/27	Ashoka Tree	Saraca indica	80	Median	
718	M10/28	Ashoka Tree	Saraca indica	70	Median	
719	M10/29	Ashoka Tree	Saraca indica	70	Median	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
720	M10/30	Ashoka Tree	Saraca indica	80	Median	
721	M11/1	Ashoka Tree	Saraca indica	80	Median	
722	M11/2	Ashoka Tree	Saraca indica	100	Median	
723	M11/3	Ashoka Tree	Saraca indica	90	Median	
724	M11/4	Ashoka Tree	Saraca indica	100	Median	
725	M11/5	Ashoka Tree	Saraca indica	110	Median	
726	M11/6	Ashoka Tree	Saraca indica	90	Median	
727	M11/7	Ashoka Tree	Saraca indica	80	Median	
728	M11/8	Ashoka Tree	Saraca indica	80	Median	
729	M11/9	Ashoka Tree	Saraca indica	80	Median	
730	M11/10	Ashoka Tree	Saraca indica	90	Median	
731	M11/11	Ashoka Tree	Saraca indica	80	Median	
732	M11/12	Ashoka Tree	Saraca indica	80	Median	
733	M11/13	Ashoka Tree	Saraca indica	80	Median	
734	M11/14	Ashoka Tree	Saraca indica	90	Median	
735	R11/1	Copper Pod	Peltophorum pterocarpum	110	RHS	
736	R11/2	Attimara	Ficus racemosa	110	RHS	
737	R11/3	Portia tree	Thespesia populnea	90	RHS	
738	M11/15	Ashoka Tree	Saraca indica	80	Median	
739	M11/16	Ashoka Tree	Saraca indica	80	Median	
740	M11/17	Ashoka Tree	Saraca indica	80	Median	
741	L11/1	Gulmohar Tree	Delonix regia	150	LHS	
742	M11/18	Ashoka Tree	Saraca indica	90	Median	
743	M11/19	Ashoka Tree	Saraca indica	80	Median	
744	R11/4	Portia tree	Thespesia populnea	100	RHS	
745	R11/5	Portia tree	Thespesia populnea	90	RHS	
746	R11/6	Kapok Silk Cotton	Ceiba pentandra	200	RHS	
747	R11/7	Jamun Tree	Syzygium cumini	90	RHS	
748	M11/20	Ashoka Tree	Saraca indica	80	Median	
749	M11/21	Ashoka Tree	Saraca indica	90	Median	
750	R11/8	Rain Tree	Samanea saman	400	RHS	
751	R11/9	Rain Tree	Samanea saman	330	RHS	
752	R11/10	American mahogany	Swietenia mahagoni	60	RHS	
753	M11/22	Rain Tree	Samanea saman	110	Median	
754	R11/11	Peepal Tree	Ficus religiosa	230	RHS	
755	R11/12	Gulmohar Tree	Delonix regia	190	RHS	
756	R11/13	Copper Pod	Peltophorum pterocarpum	160	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
757	M11/23	Rain Tree	Samanea saman	60	Median	
758	M11/24	Rain Tree	Samanea saman	70	Median	
759	M11/25	Rain Tree	Samanea saman	120	Median	
760	M11/26	Peepal Tree	Ficus religiosa	110	Median	
761	R11/14	Honge	Pongamia pinnata	140	RHS	
762	R11/15	Jamun Tree	Syzygium cumini	110	RHS	
763	M11/27	Ashoka Tree	Saraca indica	60	Median	
764	M11/28	Ashoka Tree	Saraca indica	70	Median	
765	M11/29	Ashoka Tree	Saraca indica	60	Median	
766	M11/30	Ashoka Tree	Saraca indica	60	Median	
767	M11/31	Ashoka Tree	Saraca indica	70	Median	
768	M11/32	Honge	Pongamia pinnata	70	Median	
769	M11/33	Honge	Pongamia pinnata	70	Median	
770	M11/34	Nilgiri	Eucalyptus	110	Median	
771	M11/35	Honge	Pongamia pinnata	60	Median	
772	M11/36	Ashoka Tree	Saraca indica	90	Median	
773	M11/37	Ashoka Tree	Saraca indica	80	Median	
774	M11/38	Ashoka Tree	Saraca indica	70	Median	
775	M12/1	Ashoka Tree	Saraca indica	100	Median	
776	M12/2	Ashoka Tree	Saraca indica	50	Median	
777	M12/3	Ashoka Tree	Saraca indica	100	Median	
778	M12/4	Ashoka Tree	Saraca indica	80	Median	
779	M12/5	Ashoka Tree	Saraca indica	80	Median	
780	L12/1	Caribbean trumpet tree	Tabebuia aurea	90	LHS	
781	L12/2	Gulmohar Tree	Delonix regia	200	LHS	
782	L12/3	Copper Pod	Peltophorum pterocarpum	90	LHS	
783	L12/4	Copper Pod	Peltophorum pterocarpum	80	LHS	
784	L12/5	Gulmohar Tree	Delonix regia	90	LHS	
785	L12/6	Kapok Silk Cotton	Ceiba pentandra	220	LHS	
786	L12/7	Kapok Silk Cotton	Ceiba pentandra	160	LHS	
787	L12/8	Kapok Silk Cotton	Ceiba pentandra	80	LHS	
788	L12/9	Gulmohar Tree	Delonix regia	180	LHS	
789	L12/10	Rain Tree	Samanea saman	280	LHS	
790	L12/11	Rain Tree	Samanea saman	340	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
791	L12/12	Rain Tree	Samanea saman	310	LHS	
792	L12/13	Gulmohar Tree	Delonix regia	110	LHS	
793	L12/14	Gulmohar Tree	Delonix regia	170	LHS	
794	L12/15	Rain Tree	Samanea saman	320	LHS	
795	L12/16	Rain Tree	Samanea saman	320	LHS	
796	L12/17	Portia tree	Thespesia populnea	60	LHS	
797	L12/18	Kapok Silk Cotton	Ceiba pentandra	110	LHS	
798	L12/19	Kapok Silk Cotton	Ceiba pentandra	170	LHS	
799	L12/20	Kapok Silk Cotton	Ceiba pentandra	60	LHS	
800	L12/21	Kapok Silk Cotton	Ceiba pentandra	180	LHS	
801	M12/6	Honge	Pongamia pinnata	60	Median	
802	R12/1	Portia tree	Thespesia populnea	70	RHS	
803	R12/2	Portia tree	Thespesia populnea	120	LHS	
804	R12/3	Copper Pod	Peltophorum pterocarpum	200	LHS	
805	L12/22	Peepal Tree	Ficus religiosa	560	LHS	
806	L12/23	Peepal Tree	Ficus religiosa	210	LHS	
807	L12/24	Copper Pod	Peltophorum pterocarpum	150	LHS	
808	L12/25	Copper Pod	Peltophorum pterocarpum	150	LHS	
809	L12/26	Banyan Tree	Ficus benghalensis	420	LHS	
810	L12/27	Portia tree	Thespesia populnea	60	LHS	
811	L12/28	Portia tree	Thespesia populnea	50	LHS	
812	L12/29	Rain Tree	Samanea saman	170	LHS	
813	L12/30	Portia tree	Thespesia populnea	60	LHS	
814	L12/31	Portia tree	Thespesia populnea	70	LHS	
815	L12/32	Portia tree	Thespesia populnea	70	LHS	
816	L12/33	Portia tree	Thespesia populnea	70	LHS	
817	R12/4	Copper Pod	Peltophorum pterocarpum	240	RHS	
818	R12/5	Copper Pod	Peltophorum pterocarpum	190	RHS	
819	R12/6	Rain Tree	Samanea saman	220	RHS	
820	R12/7	Rain Tree	Samanea saman	270	RHS	
821	L13/1	Gulmohar Tree	Delonix regia	160	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
822	L13/2	Gulmohar Tree	Delonix regia	140	LHS	
823	L13/3	Gulmohar Tree	Delonix regia	160	LHS	
824	L13/4	Peepal Tree	Ficus religiosa	190	LHS	
825	L13/5	Peepal Tree	Ficus religiosa	190	LHS	
826	L13/6	Copper Pod	Peltophorum pterocarpum	150	LHS	
827	L13/7	Copper Pod	Peltophorum pterocarpum	150	LHS	
828	L13/8	Rain Tree	Samanea saman	210	LHS	
829	L13/9	Rain Tree	Samanea saman	220	LHS	
830	L13/10	Gulmohar Tree	Delonix regia	120	LHS	
831	L13/11	Gulmohar Tree	Delonix regia	140	LHS	
832	L13/12	Rain Tree	Samanea saman	340	LHS	
833	R13/1	African tuliptree	Spathodea campanulata	250	RHS	
834	R13/2	African tuliptree	Spathodea campanulata	130	RHS	
835	R13/3	African tuliptree	Spathodea campanulata	170	RHS	
836	L13/14	Honge	Pongamia pinnata	50	LHS	
837	L13/15	American mahogany	Swietenia mahagoni	60	LHS	
838	R13/4	Portia tree	Thespesia populnea	50	RHS	
839	R13/5	Portia tree	Thespesia populnea	60	RHS	
840	R13/6	Portia tree	Thespesia populnea	70	RHS	
841	R13/7	Portia tree	Thespesia populnea	60	RHS	
842	R13/8	Portia tree	Thespesia populnea	90	RHS	
843	R13/9	Portia tree	Thespesia populnea	90	RHS	
844	R13/10	Portia tree	Thespesia populnea	100	RHS	
845	L13/16	Rain Tree	Samanea saman	110	LHS	
846	L13/17	Rain Tree	Samanea saman	100	LHS	
847	L13/18	Moutain ebony	Bauhinia variegata	110	LHS	
848	L13/19	Moutain ebony	Bauhinia variegata	120	LHS	
849	R13/11	Ashoka Tree	Saraca indica	60	RHS	
850	R13/12	Ashoka Tree	Saraca indica	80	RHS	
851	R13/13	Ashoka Tree	Saraca indica	70	RHS	
852	R13/14	Ashoka Tree	Saraca indica	60	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
853	R13/15	Ashoka Tree	Saraca indica	90	RHS	
854	R13/16	Ashoka Tree	Saraca indica	60	RHS	
855	R13/17	Ashoka Tree	Saraca indica	70	RHS	
856	R13/18	Ashoka Tree	Saraca indica	80	RHS	
857	R13/19	Ashoka Tree	Saraca indica	60	RHS	
858	R13/20	Ashoka Tree	Saraca indica	60	RHS	
859	R13/21	Ashoka Tree	Saraca indica	60	RHS	
860	R13/22	Ashoka Tree	Saraca indica	60	RHS	
861	R13/23	Ashoka Tree	Saraca indica	80	RHS	
862	R13/24	Ashoka Tree	Saraca indica	80	RHS	
863	R13/25	Ashoka Tree	Saraca indica	80	RHS	
864	R13/26	Ashoka Tree	Saraca indica	70	RHS	
865	R13/27	Ashoka Tree	Saraca indica	70	RHS	
866	R13/28	Ashoka Tree	Saraca indica	60	RHS	
867	R13/29	Ashoka Tree	Saraca indica	70	RHS	
868	R13/30	Ashoka Tree	Saraca indica	70	RHS	
869	R13/31	Ashoka Tree	Saraca indica	60	RHS	
870	R13/32	Ashoka Tree	Saraca indica	80	RHS	
871	R13/33	Ashoka Tree	Saraca indica	80	RHS	
872	R13/34	Ashoka Tree	Saraca indica	80	RHS	
873	R13/35	Ashoka Tree	Saraca indica	80	RHS	
874	R13/36	Ashoka Tree	Saraca indica	80	RHS	
875	R13/37	Ashoka Tree	Saraca indica	80	RHS	
876	R13/38	Ashoka Tree	Saraca indica	80	RHS	
877	R13/39	Ashoka Tree	Saraca indica	80	RHS	
878	R13/40	Ashoka Tree	Saraca indica	80	RHS	
879	R13/41	Ashoka Tree	Saraca indica	80	RHS	
880	R13/42	Ashoka Tree	Saraca indica	80	RHS	
881	R13/43	Ashoka Tree	Saraca indica	80	RHS	
882	R13/44	Ashoka Tree	Saraca indica	80	RHS	
883	R13/45	Ashoka Tree	Saraca indica	80	RHS	
884	R13/46	Ashoka Tree	Saraca indica	80	RHS	
885	R13/47	Ashoka Tree	Saraca indica	80	RHS	
886	R13/48	Ashoka Tree	Saraca indica	80	RHS	
887	R13/49	Ashoka Tree	Saraca indica	80	RHS	
888	R13/50	Ashoka Tree	Saraca indica	80	RHS	
889	R13/51	Ashoka Tree	Saraca indica	80	RHS	
890	R13/52	Ashoka Tree	Saraca indica	7	RHS	
891	R13/53	Ashoka Tree	Saraca indica	80	RHS	
892	R13/54	Ashoka Tree	Saraca indica	90	RHS	
893	R13/55	Ashoka Tree	Saraca indica	80	RHS	
894	R13/56	Ashoka Tree	Saraca indica	80	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
895	R13/57	Ashoka Tree	Saraca indica	80	RHS	
896	L13/20	American mahogany	Swietenia mahagoni	100	LHS	
897	L13/21	American mahogany	Swietenia mahagoni	100	LHS	
898	L13/22	American mahogany	Swietenia mahagoni	50	LHS	
899	R13/58	Copper Pod	Peltophorum pterocarpum	50	RHS	
900	R13/59	Copper Pod	Peltophorum pterocarpum	60	RHS	
901	R13/60	Rain Tree	Samanea saman	150	RHS	
902	R13/61	Peepal Tree	Ficus religiosa	200	RHS	
903	R13/62	Peepal Tree	Ficus religiosa	180	RHS	
904	R13/63	Ashoka Tree	Saraca indica	70	RHS	
905	R13/64	Ashoka Tree	Saraca indica	80	RHS	
906	R13/65	Ashoka Tree	Saraca indica	60	RHS	
907	R13/66	Ashoka Tree	Saraca indica	80	RHS	
908	R13/67	Ashoka Tree	Saraca indica	70	RHS	
909	R14/1	Ashoka Tree	Saraca indica	60	RHS	
910	R14/2	Ashoka Tree	Saraca indica	80	RHS	
911	R14/3	Ashoka Tree	Saraca indica	70	RHS	
912	R14/4	Ashoka Tree	Saraca indica	60	RHS	
913	R14/5	American mahogany	Swietenia mahagoni	80	RHS	
914	R14/6	Gulmohar Tree	Delonix regia	140	RHS	
915	R14/7	Ashoka Tree	Saraca indica	60	RHS	
916	R14/8	Ashoka Tree	Saraca indica	70	RHS	
917	R14/9	Ashoka Tree	Saraca indica	60	RHS	
918	R14/10	Ashoka Tree	Saraca indica	80	RHS	
919	R14/11	Ashoka Tree	Saraca indica	60	RHS	
920	R14/12	Ashoka Tree	Saraca indica	70	RHS	
921	R14/13	Ashoka Tree	Saraca indica	70	RHS	
922	R14/14	Ashoka Tree	Saraca indica	60	RHS	
923	R14/15	Ashoka Tree	Saraca indica	80	RHS	
924	R14/16	Ashoka Tree	Saraca indica	70	RHS	
925	R14/17	Ashoka Tree	Saraca indica	70	RHS	
926	R14/18	Ashoka Tree	Saraca indica	60	RHS	
927	R14/19	Ashoka Tree	Saraca indica	80	RHS	
928	R14/20	Ashoka Tree	Saraca indica	90	RHS	
929	R14/21	Ashoka Tree	Saraca indica	80	RHS	
930	R14/22	Ashoka Tree	Saraca indica	70	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
931	R14/23	Ashoka Tree	Saraca indica	60	RHS	
932	R14/24	Ashoka Tree	Saraca indica	70	RHS	
933	R14/25	Ashoka Tree	Saraca indica	60	RHS	
934	R14/26	Ashoka Tree	Saraca indica	60	RHS	
935	L14/1	Rain Tree	Samanea saman	420	LHS	
936	L14/2	Moutain ebony	Bauhinia variegata	110	LHS	
937	L14/3	Rain Tree	Samanea saman	420	LHS	
938	L14/4	Jamun Tree	Syzygium cumini	60	LHS	
939	L14/5	African tuliptree	Spathodea campanulata	320	LHS	
940	L14/6	American mahogany	Swietenia mahagoni	130	LHS	
941	L14/7	American mahogany	Swietenia mahagoni	140	LHS	
942	L14/8	African tuliptree	Spathodea campanulata	110	LHS	
943	L14/9	American mahogany	Swietenia mahagoni	160	LHS	
944	L14/10	American mahogany	Swietenia mahagoni	50	LHS	
945	L14/11	American mahogany	Swietenia mahagoni	50	LHS	
946	R14/27	Mango	Mangifera indica	150	RHS	
947	R14/28	Copper Pod	Peltophorum pterocarpum	60	RHS	
948	L14/12	Copper Pod	Peltophorum pterocarpum	60	LHS	
949	L14/13	Jackfruit	Artocarpus heterophyllus	120	LHS	
950	L14/14	Mango	Mangifera indica	70	LHS	
951	L14/15	Rain Tree	Samanea saman	320	LHS	
952	L14/16	Peepal Tree	Ficus religiosa	340	LHS	
953	L14/17	Honge	Pongamia pinnata	130	LHS	
954	L14/18	Honge	Pongamia pinnata	100	LHS	
955	L14/19	Honge	Pongamia pinnata	110	LHS	
956	L14/20	Honge	Pongamia pinnata	50	LHS	
957	L14/21	Honge	Pongamia pinnata	130	LHS	
958	L14/22	Honge	Pongamia pinnata	100	LHS	
959	R14/29	Attimara	Ficus Racemosa	110	RHS	
960	R14/30	Banyan Tree	Ficus benghalensis	120	RHS	
961	R14/31	Banyan Tree	Ficus benghalensis	220	RHS	
962	R14/32	Peepal Tree	Ficus religiosa	320	RHS	
963	L14/23	Honge	Pongamia pinnata	110	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
964	L14/24	Honge	Pongamia pinnata	130	LHS	
965	R14/33	Banyan Tree	Ficus benghalensis	500	RHS	
966	R14/34	Caribbean trumpet tree	Tabebuia aurea	80	RHS	
967	R14/35	Ashoka Tree	Saraca indica	110	RHS	
968	R14/36	Ashoka Tree	Saraca indica	120	RHS	
969	R14/37	Caribbean trumpet tree	Tabebuia aurea	120	RHS	
970	R14/38	Ashoka Tree	Saraca indica	110	RHS	
971	R14/39	Ashoka Tree	Saraca indica	120	RHS	
972	R14/40	Ashoka Tree	Saraca indica	130	RHS	
973	R14/41	Subabul	Leucaena leucocephala	50	RHS	
974	R14/42	Subabul	Leucaena leucocephala	60	RHS	
975	R14/43	Mango	Mangifera indica	60	RHS	
976	R14/44	Ashoka Tree	Saraca indica	50	RHS	
977	R14/45	Attimara	Ficus racemosa	140	RHS	
978	R14/46	Ashoka Tree	Saraca indica	60	RHS	
979	R14/47	Ashoka Tree	Saraca indica	50	RHS	
980	R14/48	Ashoka Tree	Saraca indica	60	RHS	
981	R14/49	Ashoka Tree	Saraca indica	70	RHS	
982	R14/50	Coconut	Cocus nucifera	80	RHS	
983	R14/51	Ashoka Tree	Saraca indica	60	RHS	
984	R14/52	Ashoka Tree	Saraca indica	60	RHS	
985	R14/53	Copper Pod	Peltophorum pterocarpum	250	RHS	
986	R14/54	Coconut	Cocus nucifera	110	RHS	
987	R14/55	Banyan Tree	Ficus benghalensis	120	RHS	
988	R14/56	Subabul	Leucaena leucocephala	100	RHS	
989	R14/57	Mullu Byala		210	RHS	
990	R14/58	Jamun Tree	Syzygium cumini	120	RHS	
991	R14/59	Ashoka Tree	Saraca indica	100	RHS	
992	R14/60	Ashoka Tree	Saraca indica	60	RHS	
993	R14/61	Ashoka Tree	Saraca indica	80	RHS	
994	R14/62	Ashoka Tree	Saraca indica	80	RHS	
995	R14/63	Ashoka Tree	Saraca indica	70	RHS	
996	R14/64	Ashoka Tree	Saraca indica	70	RHS	
997	R14/65	Ashoka Tree	Saraca indica	60	RHS	
998	R14/66	Ashoka Tree	Saraca indica	80	RHS	
999	R14/67	Ashoka Tree	Saraca indica	70	RHS	
1000	R14/68	Ashoka Tree	Saraca indica	70	RHS	
1001	R14/69	Ashoka Tree	Saraca indica	60	RHS	
1002	R14/70	Ashoka Tree	Saraca indica	80	RHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
1003	R14/71	Ashoka Tree	Saraca indica	80	RHS	
1004	R14/72	Ashoka Tree	Saraca indica	70	RHS	
1005	R14/73	Ashoka Tree	Saraca indica	60	RHS	
1006	R14/74	Ashoka Tree	Saraca indica	60	RHS	
1007	R14/75	Ashoka Tree	Saraca indica	80	RHS	
1008	R14/76	Ashoka Tree	Saraca indica	90	RHS	
1009	R14/77	Ashoka Tree	Saraca indica	70	RHS	
1010	R14/78	Ashoka Tree	Saraca indica	70	RHS	
1011	R14/79	Ashoka Tree	Saraca indica	60	RHS	
1012	R14/80	Ashoka Tree	Saraca indica	80	RHS	
1013	L15/1	American mahogany	Swietenia mahagoni	60	RHS	
1014	L15/2	American mahogany	Swietenia mahagoni	60	LHS	
1015	L15/3	American mahogany	Swietenia mahagoni	60	LHS	
1016	L15/4	American mahogany	Swietenia mahagoni	60	LHS	
1017	L15/5	American mahogany	Swietenia mahagoni	50	LHS	
1018	L15/6	Portia tree	Thespesia populnea	80	LHS	
1019	L15/7	Ashoka Tree	Saraca indica	220	LHS	
1020	L15/8	Rain Tree	Samanea saman	350	LHS	
1021	L15/9	Kapok Silk Cotton	Ceiba pentandra	140	LHS	
1022	L15/10	Rain Tree	Samanea saman	120	LHS	
1023	L16/1	Golden Shower Tree	Cassia fistula	120	LHS	
1024	L16/2	American mahogany	Swietenia mahagoni	320	LHS	
1025	L16/3	Portia tree	Thespesia populnea	190	LHS	
1026	R16/1	American mahogany	Swietenia mahagoni	320	RHS	
1027	R20/1	Peepal Tree	Ficus religiosa	300	RHS	Mysore Road
1028	L20/1	American mahogany	Swietenia mahagoni	120	LHS	
1029	L20/2	Mango	Mangifera indica	130	LHS	
1030	R20/2	Peepal Tree	Ficus religiosa	120	RHS	
1031	R20/3	Peepal Tree	Ficus religiosa	140	RHS	
1032	L20/3	Copper Pod	Peltophorum pterocarpum	200	LHS	
1033	L20/4	Ashoka Tree	Saraca indica	100	LHS	
1034	L20/5	Ashoka Tree	Saraca indica	100	LHS	

Sl. No.	Tree No.	Common Name of Tree	Scientific Name of Tree	Girth of tree (in Cm)	LHS /RHS	Remarks
1035	L20/6	Ashoka Tree	Saraca indica	90	LHS	
1036	L20/7	Ashoka Tree	Saraca indica	80	LHS	
1037	L20/8	Ashoka Tree	Saraca indica	100	LHS	
1038	L20/9	Ashoka Tree	Saraca indica	100	LHS	
1039	L20/10	Ashoka Tree	Saraca indica	100	LHS	
1040	L20/11	Ashoka Tree	Saraca indica	80	LHS	
1041	L20/12	Rain Tree	Samanea saman	100	LHS	
1042	L20/13	Moutain ebony	Bauhinia variegata	110	LHS	
1043	R20/4	Ashoka Tree	Saraca indica	90	RHS	
1044	R20/5	Ashoka Tree	Saraca indica	80	RHS	
1045	R20/6	Ashoka Tree	Saraca indica	70	RHS	
1046	R20/7	Ashoka Tree	Saraca indica	60	RHS	
1047	R20/8	Ashoka Tree	Saraca indica	60	RHS	
1048	R20/9	Ashoka Tree	Saraca indica	70	RHS	
1049	R20/10	Ashoka Tree	Saraca indica	60	RHS	
1050	R20/11	Ashoka Tree	Saraca indica	70	RHS	
1051	R20/12	Ashoka Tree	Saraca indica	80	RHS	
1052	R20/13	Ashoka Tree	Saraca indica	70	RHS	
1053	R20/14	Ashoka Tree	Saraca indica	80	RHS	
1054	R20/15	Ashoka Tree	Saraca indica	80	RHS	
1055	R20/16	Ashoka Tree	Saraca indica	80	RHS	
1056	R20/17	Ashoka Tree	Saraca indica	70	RHS	
1057	R20/18	Ashoka Tree	Saraca indica	60	RHS	
1058	R20/19	Ashoka Tree	Saraca indica	70	RHS	
1059	R20/20	Ashoka Tree	Saraca indica	50	RHS	
1060	R20/21	Ashoka Tree	Saraca indica	60	RHS	
1061	R20/22	Ashoka Tree	Saraca indica	60	RHS	

APPENDIX 1: DISPOSAL SITE MANAGEMENT

SELECTION OF DISPOSAL SITES:

The locations of Disposal sites have to be selected such that:

No residential areas are located downwind side.

Disposal sites are located at least 1000 m away from sensitive locations like Settlements, Water bodies, notified forest areas, sanctuaries or any other sensitive locations.

Disposal sites do not contaminate any water sources, rivers, etc. for this site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.

Permission from the concerned Village/local community is to be obtained for the Disposal site selected.

Environment Engineer of CSC and Executive Engineer of Project Implementation Unit must approve the location and plan.

PRECAUTIONS TO BE FOLLOWED DURING DISPOSAL OF DEBRIS / WASTE MATERIAL

The Contractor shall take the following precautions while disposing the waste material

During the site clearance and disposal of debris, the Contractor will take full care to ensure that public or private properties are not affected, there is no dwellings below the dumpsite and that the traffic is not interrupted.

Contractor shall dispose of debris only at the identified places or at other places only with prior permission of Engineer-in-Charge of works.

In the event of any spoil or debris from the sites being deposited on any adjacent land, the Contractor shall immediately remove all such spoil debris and restore the affected area to its original state and to the satisfaction of the Engineer-in-Charge of works.

Contractor shall utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.

Materials having the potential to produce dust shall not be loaded to a level higher than the side and tail boards and shall be covered with a tarpaulin in good condition.

Any diversion required for traffic, during disposal of debris shall be provided with traffic control signals and barriers after discussing with local people and with the permission of Engineer-in-Charge of works.

While disposing debris / waste material, Contractor shall take into account the wind direction and location of settlements to ensure that there is no problem to locals by the dust.

GUIDELINES FOR REHABILITATION OF DISPOSAL SITES

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the Engineer and the supervision consultant

The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants such that the landscape is coherent and is in harmony with its various components.

In case where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.

Some of the dumpsites could be used either for plantation or for agriculture.

Care should always be taken to maintain the hydrological flow in the area.

Possible impacts due to the excavated debris materials:

The expected scenario, If not disposed of properly, is described in the following sections.

Obstruction to natural watercourses

The materials if not disposed of properly would be taken by the running water to the lowest portion of the valleys/streams creating huge obstruction to free flow of natural stream water thus causing flooding.

Siltation in surface water reservoir

Most of the materials would be ultimately taken down stream through rivers and ultimately depositing in to reservoirs leading to heavy siltation. This in turn would reduce the reservoir capacity substantially within a very short span.

Soil Erosion

Massive soil erosion is the most direct impact of the debris excavation. The precipitation and the consequent run off would erode the loose materials by way of suspension and solution. Once reached up to the mainstream courses even the big boulders would be transported down due to the steep gradients available along the stream courses.

Spoiling of Agricultural land

If due to poor planning and limited resources the Contractor disposes the haphazardly, the debris could encroach upon the private agricultural fields and thereby causing destruction of the crops.

Identification of Disposal Areas:

Contractor should make use of all disposal areas identified during the project preparation stage.

Following are some of the borrow pits nearby Bangalore city, which can be used as disposal sites for unserviceable materials derived from the project.

Disposal methods and its limitations:

There are several constraints in the disposal of materials in the identified locations. They are

- Disposal areas are uneven and irregular in shape
- Most of the disposal areas requires construction of retaining walls
- Disposal areas requires compaction
- Disposal areas requires plantation
- No overloading of debris in trucks and should be in small trucks or dumpers

- Need to be transported safely with covered trucks using tarpaulin
- Consultation with all concerned villages / local community & written permission form all concerned
- Transportation through difficult haul roads may require maintenance
- Ultimately the disposed area should be compacted using road rollers.
- The capacity of the disposal locations, name of the location etc. shall be written in an information board at each identified disposal locations.

Proposed design:

Contractor needs to plan the disposal in the following way

- Identify the disposal area
- Photograph the present land use and condition of the area
- Consult with all stakeholders
- Get written agreement from all concerned
- Prepare a suitable design for the safe disposal
- Construct all required structures (e.g. retaining wall)
- Planting of fast growing popular trees on the outer potion of the retaining wall in the form of a linear wall parallel to the retaining wall
- Compact of the materials after disposal
- Prepare a Contractors debris disposal plan with design drawings for each identified area
- With regards to plan, there would be only one disposal plan with small changes for each location. Contractors need to get approvals for specific design for each identified disposal area.

APPENDIX 2: BORROW AREAS MANAGEMENT

Borrow areas will be identified and finalized by Contractor/Concessionaire and approved by CSC and PIU.

Contractor shall consider following criteria before finalizing the locations.

The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available. In such cases, the loss of productive and agricultural land should be minimum.

If the borrow land belongs to private owners, an agreement shall be reached between contractor and landowners before the approval of identified borrow sites

The borrow pits should not be located along the roads.

Borrow pits shall not be located near the water bodies.

The loss of vegetation is almost nil or minimum.

Sufficient quantity of suitable earth / soil is available.

Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the laboratory. Contractor shall submit the following information to the concerned Engineer for approval at least 7 working days before commencement of compaction. After identification of borrow areas as per guidelines. Contractor shall fill the reporting format and submit the same for approval of the Engineer.

Values of maximum dry density (MDD) and optimum moisture content (OMC) tested in accordance with IS: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fill materials he intends to use. A graph of density plotted against content from which, each of the values above of maximum dry density and optimum moisture content are determined.

The Dry density-moisture content – CBR relationships for light, intermediate and heavy compaction efforts (light corresponding to IS: 2720 (Part-7), heavy corresponding to IS: 2420 (Part-8) and intermediate in between the two) for each of the fill material be intends to use in ramps.

Arrangement for locating the source of supply of material for ramps as well as compliance to environment requirements in respect of excavation and borrow areas as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the Contractor.

After receipt of approval Contractor will begin operations keeping in mind following;

No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Contractor shall be permitted to remove acceptable material form the site to suit his operational requirements.

Where the excavation reveals a combination of acceptable and un-acceptable materials, contractor shall, unless otherwise agreed by the Engineer, carryout the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un-acceptable materials. The acceptable material shall be stockpiled separately.

Contractor shall ensure that he does not adversely affect the stability of excavation or fills by stockpiling materials, use of plants or siting of temporary buildings or structures.

It shall be ensured that the fill material is compacted to the required density

Borrow Areas located in Agricultural Lands

Preservation of topsoil shall be carried out in stockpile.

Topsoil up to a depth of 15 cm shall be stripped off from the borrow pit and stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

Borrowing of earth shall be carried out up to a depth of 1.5m from the existing ground level.

Borrowing of earth shall not be done continuously throughout the stretch.

The slope of the edges shall be maintained not steeper than 1:4 (Vertical: Horizontal).

Borrow Areas located in Agriculture Land in un-avoidable Circumstances:

Preservation of topsoil shall be carried out in stockpile.

A 15 cm topsoil shall be stripped off and stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

The depth of borrow pits shall not be more than 30 cm after stripping the 15 cm topsoil aside.

Borrow Areas located on Elevated Lands

Preservation of topsoil shall be carried out in stockpile

A 15 cm topsoil shall be stripped off from borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

At location where private owners desire their fields to be leveled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields.

Borrow Areas near Settlements

The preservation of topsoil will be carried out in stockpile

A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

Borrow pit location will be located at least 0.75 km from villages and settlements. If un-avoidable, the pit will not be dug for more than 30 cm and drains will be cut to facilitate drainage.

Borrow pits located in such location will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with a layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF/CPCB guidelines.

Borrow Pits along the Road

Borrow pits along the road shall be discouraged. All the prescribed guidelines shall be followed while locating borrow pits near to national highways and state highways.

Preservation of topsoil will be carried out in stockpile

A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

Ridges of not less than 8m widths should be left at intervals not exceeding 300m.

Small drains shall be cut through the ridges to facilitate drainage.

Depth of the pits shall be so regulated that their bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of bank. Maximum depth in any case shall be limited to 1.5m.

Re-development of Borrow Areas

The objective of the rehabilitation programme is to make the borrow pit sites as a safe and secure area. Securing borrow pits to a stable condition is fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit to the normal ground level.

Borrow Re-development Plan shall be prepared by the Contractor before the start of construction works as per the agreement between the contractor and the land owner and to the satisfaction of owner.

Borrow Areas shall be rehabilitated as follows:

Borrow pits shall be backfilled with rejected construction wastes (unserviceable materials) compacted and shall be given turfing or vegetative cover on the surface. If this is not possible, then excavation slope should be smoothened and depression is filled in such a way that it looks more or less like the original ground surface.

Contractor shall keep record of photographs of various stages i.e. before borrowing materials form the location (Pre-construction Phase), for the period borrowing activities (Construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.

APPENDIX 3 : Formats for Environmental monitoring

EMS 1: Construction camp/ plant site management plan

Sl. No.	Description	Compliance
1	Name of the location	
2	Nearest road chainage	
3	Name of the owner	
4	Area involved	
5	Arrangements with the owner (agreement with land owner, including the restoration aspects, should be attached as an Annexure)	
6	Existing land use	
7	Photographs depicting the present condition of the construction camp and access road	
8	Land use of the area surrounding the borrow area including a map	
9	Site layout plan of the construction camp	
10	Establishment and maintenance of demarcated and labeled different areas within the camp	
11	Number of trees to be removed, if any, along with compensation measures	
12	Proposed top soil management	
13	Activities planned in the construction camp	
14	Machinery & equipment to be used on site	
15	Labour camp facilities onsite	
16	Health facilities	
17	Site drainage provisions	
18	Copy of the consents to establish and operate should be attached as an Annexure	
19	Conditions laid down in the clearance/ licenses and plans	
20	Staff strength and details such as contractor staff v/s sub contractors, women labour, migrant v/s local labour and skilled& unskilled labour	
21	Access road condition and proposed maintenance	
22	Safety provision such as fire protection equipment and personal protective measure.	
23	Closure/ completion plan	

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..

Designation …….. Designation …….. Designation ……..

Contractor Environmental Engineer (CSC) Executive Engineer (PWD)

EMS 1A: Closure plan construction camp and/plant site

Sl. no.	Description	Compliance
1	Name / Identity of location	
2	Distance from the project road and site	
3	Name of the owner	
4	Details of the land i) Survey number ii) Boundaries iii) Other Revenue details	
5	Details of settlements, sensitive areas, water bodies, wells and bore wells with in 500m i) Population in numbers ii) Name of the village iii) Distance from the construction camp iv) Details of water bodies / sensitive areas / wells / bore wells	
6	Physical details i) Number of labour stationed ii) Number of dwellings constructed iii) Number of toilets provided iv) Were dwellings demolished and cleared v) Was the waste water treatment facilities demolished and cleaned vi) Was the solid waste generated cleared and disposed of properly; if yes specify the location and quantity. vii) Whether any soil was contaminated with oils and waste oils was cleared and disposed safely, if yes specify the location and quantity. viii) Was scrap generated while the construction removed, if yes specify the details such as where, when, to whom and quantity	
7	Land use before establishment proposed user after completion of works	

Submitted Checked Approved

Signature ………… Signature ………… Signature …………

Name ………….. Name ………….. Name …………..

Designation …….. Designation …….. Designation ……..

Contractor Environmental Engineer (CSC) Executive Engineer (PWD)

EMS 2: Borrow Area Management plan

Sl. No.	Description	Compliance
1	Name / Identity of location	
2	Nearest project road chainage	
3	Name of the owner	
4	Area involved /capacity/ quantity	
5	Type of material proposed to be taken	
6	Arrangement with the owner including restoration aspect	
7	Existing land use	
8	Land use of the area surrounding the proposed area	
9	A map of the area	
10	Number of trees to be removed, if any along with the compensation measure	
11	Top soil management if required	
12	Access road condition and proposed maintenance	
13	Photograph depicting the present condition of the proposed area and access	
14	Closure/Completion plan	EMS 2A

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 2A: Closure plan for borrow area

Sl. No.	Description	Compliance
1	Name / Identity of location	
2	Nearest project chainage, distance from the project road and side	
3	Name of the owner	
4	Details of the land i) Survey number ii) Boundaries iii) Other Revenue details	
5	Details of settlements, sensitive areas, water bodies within 500m i) Population in numbers ii) Name of the village iii) Distance from the borrow area iv) Details of water bodies / sensitive areas / wells / bore wells	
6	Physical details Length and width in meters Depth excavated in meters, Quantity excavated in Cum. Type of materials excavated	
7	Land use before opening, proposed use, before opening details of surroundings	
8	Drawing showing the dimension of the borrow areas, access roads and features of surrounding	Appendix -1
9	Number of trees removed (girth>300mm) if any along with the compensation measure	
10	Details of top soil Quantity excavated in Cum Where was it used	
11	Initial access road condition and final access road condition	
12	Photographs depicting the original condition, during the operation, top soil management, and after closure	Appendix -2
13	Copy of the agreement with the Owner, Details of the agreed redevelopment if any	Appendix -3
14	Land use after rehabilitation, Details should be submitted if the final land use changed from the original land use	
15	Satisfaction certificate from the owner	Appendix -4
16	Details of the practical problems faced and solutions adopted, if any during the operation phase	

Submitted Checked Approved

Signature ………… Signature ………… Signature …………

Name ………….. Name ………….. Name …………..

Designation …….. Designation …….. Designation ……..

Contractor Environmental Engineer (CSC) Executive Engineer (PWD)

EMS 3: Construction camp / Plant and Environmental Management

Sl. No.	Issue	Status	
		Camp -1	Camp - 2
1	Drainage system 1.Closed Drainage		
2	Disposal of waste water i. Kitchen waste water ii. Waste water from water closets iii. Wastewater from bathrooms iv. Wastewater from the vehicular washings.		
3	Collection and Disposal of solid waste i. Waste from the office ii. waste from the Kitchen iii. waste from sweeping		
4	Drinking water facility Source with quantity No of bore wells with capacity Location of the well and bore well Any treatment facility, No of overhead tanks, Test results of the Drinking water Any license obtained		
5	First Aid Facility		
6	Roads in camp Site Type of Road Dust suppression practicing or not, if roads are not tarred, condition of the road.		
7	Fuel storage i. Impervious Base ii. spills and wastewater will be collected in a sump iii. Number of drums where wastes are collected. iv. Number of drums disposed		
8	Garbage & night soil i. Provision of garbage ii. Separation of polythene materials		

	iii. Records of solid waste removal from septic tanks		

Submitted Checked Approved

Signature ………… Signature ………… Signature …………

Name ………….. Name ………….. Name …………..

Designation …….. Designation …….. Designation ……..

Contractor Environmental Engineer (CSC) Executive Engineer (PWD)

EMS 4: Soil Management

Sl. No.	Chainage in km	Quantity in Cum	Whether preserved in accordance with specifications	Remarks

Submitted Checked Approved

Signature ………… Signature ………… Signature …………

Name ………….. Name ………….. Name …………..

Designation …….. Designation …….. Designation ……..

Contractor Environmental Engineer (CSC) Executive Engineer (PWD)

EMS 5: Construction plants and pollution control

Sl. No.	Construction plant	Locations	Capacity	Description of pollution control system / Equipment	Remarks
1					
2					
3					
4					
5					

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 6: Machinery / Vehicles and pollution Control

Sl. No.	Machinery/ Vehicles with capacity	Diesel consumed per month	Engine oil consumed per month	PUC certificate, Number and Validity	Machinery new/old	Remarks
1						
2						
3						
4						
5						
6						

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 7: Details of the DG sets with the pollution control equipment

Sl. no.	Capacity in KVA	Vertical stack if provided height (in m)	Noise control system	Remarks
Camp -I				
Camp - II				
Crusher -I				

Plant Site - I				
Construction works				

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 8: Details of oil storage

Sl. No.	Type of Product	Location	Number of Barrels	Capacity of barrels in Liters	Increase / Decease in Storage	Stored on impervious base (Yes/No)	Remarks
1							
2							
3							
4							
5							

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 9: Working at water course and pollution control measures

Sl.No.	Location	Type	Stream/canal Diversion	Silt Fencing	Remarks

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 10: Details of the ground water Extraction

Sl. no.	Location	Capacity of Motor Installed in HP	Quantity of water drawn in Kilo Liters			Ground Water Dept. permission	Type of source
			During the month	Up to end of last month	Total		
1							
2							
3							
4							
5							
6							

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 11: Personal protective Equipments

Sl. No.	Details of Equipment	Total Numbers procured	Distributed in No.	Available in store in No.	Remarks
1	Helmets				
2	Safety shoe				
3	Ear plugs				
4	Nose masks				
5	Hand Gloves				
6	Goggles				
7	Safety Belts				
8	Reflective jackets				
9	Gum boots				

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 12: Status of consents and permissions

Plant	Consent	Number / Status	Validity Date	Remarks
Hot Mix Plants				
Crusher				
Batching plant				
WMM Plant				
Crusher at Dalla				
Diesel pump – I				
Labour license				

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 13: Deviations with corrective actions

Sl.No.	Deviation	Corrective Actions	Schedule

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 14: Details of tree and shrubs plantation

Sl. No.	Location/ Chainage in km	Planted Trees/ Shrubs (in No.)		Survival rate in %	Remarks
		Trees	Shrubs		

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 15: Plantation of Grass

Sl. No.	Location / Chainage	Area of grass planted	Survival at 6 months interval	Remarks

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 16: Implementation of Enhancement Measures

Sl. no.	Type of Enhancement	Side of the Road (RHS/LHS)	Progress of completion		
			Target date	Actual completion date	Reasons of delay if any

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)

EMS 17: Identification of disposal site locations (To be filled by the contractor)
Name of Contractor:
Link No:
(Give chainages and nearest settlements from both ends)

Sl. No.	Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
1	Existing Land use				
2	Area covered (Sq. m)				
3	Total Material that can be dumped within the site (Cum)				
4	Depth to which dumping is feasible (m)				

Sl. No.	Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
5	Distance of nearest water course (m)				
6	Nearest settlement (m)				
7	Date/s of community consultation/s				
8	Whether the community is agreeable to siting of dumping site (Y/N)				
9	Date of Permission from Village / Local community				
10	Proposed future use of the site				
11	Selected Site (tick any one column only)				

Enclosures (Tick as appropriate)

1. Map of each location
2. Photographs
   a. Each disposal location
   b. Each community consultation
3. Photo copy of Agreement

Submitted	Checked	Approved
Signature …………	Signature …………	Signature …………
Name …………..	Name …………..	Name …………..
Designation ……..	Designation ……..	Designation ……..
Contractor	Environmental Engineer (CSC)	Executive Engineer (PWD)