BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

SOUTHERN ZONE, CHENNAI

O.A. NO. 236 of 2024 (SZ)

BETWEEN:

Suo moto proceedings initiated
Based on news item titled "Over
2000 citizens oppose felling of
33000 trees for Bengaluru Suburban
Railway Project Report" appearing
in the Hindustan Times
dated 11.06.2024 **PETITIONER**

AND:

Bruhat Bengaluru Mahanagara Palike
And others **RESPONDENTS**

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CHENNAI
DATE: 25/10/24

ADVOCATE FOR RESPONDENT NO.2

Apart from the above projects, there are few augmentations such as development of underpasses, roads and construction of apartments, residential and commercial building projects, which will also happen during construction stage of the BSRP.

These subsequent sections describe the likely cumulative impacts of the above upcoming projects intervening resulting from the interaction with the current project.

8.8.1.2. Cumulative Impacts of Vehicular Traffic

There will be temporary direct adverse effects on traffic during construction phase at junctions. Simultaneous construction of the above identified projects, residential and commercial properties will result in the movement of vehicles used in construction activities and thus can increase traffic flow in the short term.

The program schedule for all the above projects is not currently known, so it is not possible to predict the level of disruption that may occur. However, if all these projects occur simultaneously, there could be significant cumulative impacts. Though it is very unlikely that all the projects will take off at a time, never the less the contractor should be aware of other project activities in the region and plan his activities in a way to reduce impact. Traffic management measures proposed in Chapter 8 of this document will ensure effects are insignificant. The junction improvements that will be taken up will also aid in reducing the cumulative impact of vehicular traffic at junctions.

8.8.1.3. Cumulative Impacts on Valued Environmental Components (VECs)

A valued Environmental Components (VECs) is an element of the environment that has scientific, economic, social or cultural significance.

As far as the wildlife, forests and geology are concerned the project has no direct impact thus the cumulative impact is also nil. Environmental impact on other valued environmental components like air, water, noise, vegetation and social aspects is significant; the cumulative impact could increase if any other projects are implemented simultaneously.

Impacts on air quality during the construction phase of the project will be considerable as the amount of work involved in improvement of the railway, construction and integration of stations and construction of depots is significant. However, any possible impacts will be transitory. Due to the proposed project, there will be some direct and indirect long-term impacts on the water resources (storm water drains) as well as sensitive noise receptors. The major impact in the project on flora involves the removal of trees to permit construction and to provide clear zone for safety of the road users. All these impacts can aggravate if other similar projects are implemented together.

The Project will reduce the use of personal vehicles, increase the transit mode share and will contribute to community re-development through the stimulation of future concentrated and mixed land use, as well as a positive business environment. It will contribute to environmental sustainability initiatives by reducing regional car trips, enhance community livability and reducing greenhouse gas (GHG) emissions. Project operation is expected to have a positive effect on air quality since the Project will use an EMU train which is exhaust-free and quieter compared to diesel and locomotive-drawn multiple units. As such, the Project's contribution to the cumulative impacts particularly during the operation would be positive.

During project operations, due to existing high background noise levels along portions of the alignment caused by the existing volume of road traffic in the area and vicinities, receptors may experience a low to moderate noise impact close to the proposed stations and maintenance depots. This will be mitigated by an operating schedule of day time and erection of site specific noise attenuation panels at the stations such that the Project's contribution to cumulative impact on noise is considered not significant. Vibration levels associated with project operations (i.e., train passing by) will be largely imperceptible.

On the socio economic front the project has both positive and negative impact. As there is very minimum impacts of land acquisition, since BSRP alignments and stations are proposed within Indian Railway Land. There is insignificant impact on livelihood and economic activities of the project area. On the other hand accessibility and connectivity increases. Thus, the time of travel between project localities shall reduce significantly. With the advent of the Suburban railway the vehicle operating and congestion of roads is expected to go down substantially.

Based on the foregoing, the Project along with related infrastructure development projects within the area will result in positive long-term benefits in air quality, public health, safety, and travel time savings and connectivity. No adverse residual effects to human health will occur as a result of project construction or operation. While exposure to elevated noise levels, fugitive dust and gaseous emissions will occur in proximity to project work sites during construction, due to their short-term, localized nature, these effects are expected to be minor. Project operations will benefit the general public by contributing to the long-term improvement of air quality in the area. By providing a viable alternative to the use of private vehicles, it will also reduce traffic volumes, relieve traffic congestion, and improve community livability.

8.9. Environmental Enhancement Measures

The proposed project is environmental friendly with fuel efficiency and reduced environmental pollution. In the long term, compensatory afforestation and Green belt development will enhance environment of the project area.

8.10. Inference

The environmental impact assessment of the project with potential negative impacts discussed in above sections from Section 8.2 to Section 8.9 reveal that though impacts appear to be significant they can be mitigated by following a proper Environmental Management Plan (EMP) with stringent strategic actions during project implementation.

The project emit major negative impacts on environment such as Air Pollution, Water Pollution and noise pollution mainly during construction of Suburban Railway project in already highly populated and polluted city like Bengaluru. In turn, the negative environmental impacts affect human health. There is dire requirement of adequate care and attention to be given for every environmental concern in all directions during planning and construction of suburban railway project. In addition, special emphasis on required measures needs to be given for predicted distinct circumstances or emergency situations. By proper planning and execution, the adverse environmental impacts, health and safety hazards can be minimized or reduced at construction sites. An Environmental Management of potential negative impacts with mitigation measures is discussed in the **Chapter 10** – Environmental Impact Mitigation & Management Plan (EMP) and an Action Plan is provided for its implementation by the Contractor and K RIDE during project Construction and Operation phases.

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Chapter 9. Project Benefits

9.1. Positive Environmental Impacts

Beneficial or positive impacts of the BSRP on the environment are discussed in this Section. The proposed project also yields beneficial or positive impacts on natural and social environment along with the negative impacts on Environment. The Suburban rail system after construction and commissioning will certainly reduce the pollution level and add convenience to the public, but such project may grossly aggravate the pollution problem during construction stage, especially in respect of noise and air pollution which are generally at their peak. To compound the issues further, suburban rail alignment generally passes through densely populated areas and high vehicular traffic zones, at certain areas where there is already high pollution level. Higher the compression of implementation period higher is the pollution level due to intense construction activity increasing pollution levels. Numerous positive impacts identified for this project are listed below and discussed in under the following headings:

- Employment Opportunities
- Benefits to Economy
- Direct benefits to passengers
- Reduction in Traffic Accidents and Safety
- Reduction in Traffic Noise
- Reduction of plying vehicles and Traffic congestion on Road
- Saving in Road Infrastructure
- Low energy Consumption
- Reduced Air pollution
- Reduction in GHG Emission including Carbon-Di-Oxide
- Clean Development Mechanism (CDM) and Carbon Credits
- Other Benefits

9.1.1. Employment Opportunities

Employment opportunities are highly open during construction stage of the project. Aftermath of COVID situation has affected the workers to the maximum. About 6000 workers, especially skilled and unskilled labours will be benefitted (directly or indirectly) with the employment opportunity from this project. The tentative based on the nature of work is assessed to be 60% unskilled labour and 40% skilled labours. However, details will be provided regularly through quarterly progress reports, once the contractor is on board.

During operation stage, about 18 - 20 persons per km length of the corridor will be benefited with employment opportunity. During project operation, overall 3000 persons will be benefited directly and indirectly with operation & maintenance, Ticketing, security jobs, etc. and other related activities and trades.

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9.1.2. Benefits to Economy

The project will facilitate movement of people from different parts of city. These corridors will yield benefits in terms of growth in economic activity due to better accessibility; reduction in vehicle operating costs, cost of road construction and maintenance, loss of productivity due to health disorders resulting from pollution and accidents, savings in travel time and improvement in quality of life due to reduction in road travel and certain socio-economic benefits. In this study only savings in fuel consumption and reduction in air pollution have been quantified.

9.1.3. Direct Benefits to Passengers

Direct benefits to commuters of suburban trains include reduction in Vehicle Operating Costs (VOCs) including fuel consumption and maintenance cost of vehicles, 50 - 75% reduction in travel time, improvement in quality of life, improvement in productivity due to reduced travel and improvement in health disorders causing due to their exposure to pollution if they travel in other modes and reduction in road accidents.

9.1.4. Reduction in Traffic Accidents and Safety

There is a great reduction in number of accidents and fatality is noticed after the execution of Bengaluru Metro Phase I & II by BMRCL in Bengaluru. As the population of the Silicon city is getting increased day by day, the implementation of BSRP Railway project also provides improved safety and substantial reduction in the number of accidental deaths. This may happen due to shifting of commuters from road to suburban rails.

The Suburban railway project leads to accident reduction which in turn results in the following:

- Savings in terms of capital loss related to fatality and cost incurred towards major or minor injury of victims in accidents due traffic congestion and accidents.
- Savings in damage cost to vehicles involved in accidents.

9.1.5. Reduction in Traffic Noise

During operation, there will be 6-12 % reduction in Vehicular trips and 3 dB reduction in noise levels in ambience as predicted, irrespective of the absolute number of vehicles operated. Further, there may be reduction of 10% to 50% in traffic volume and about 10% reduction in ambient noise at the tune of 0.5 dB & 3.0 dB in due course of time.

9.1.6. Reduction of Plying Vehicles and Traffic Congestion on Road

As there will be shift of trips from road vehicles to suburban trains, naturally there will be comparative reduction in number of plying vehicles along the project corridors. The reduction in number of vehicles on road due to modal shift of passengers to this Suburban Railway System in turn enhances the benefits to economy as discussed above under Section 9.1.2. The project ensures greater traffic carrying –capacity as much traffic as 7 lanes of bus traffic or 24 lanes of car traffic (either way). As per BSRP Feasibility Report 2019, the details of modal shift from road to suburban with reduction in number of trips on road are presented in the **Table 9.1**.

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Table 9.1. Estimated Demand and Modal Share-in 'With' and 'Without' Suburban Rail System Scenario

Mode	Trips (With Suburban Rail System)				Trips (Without Suburban Rail System)				Vehicular Reduction due to Suburban Railway System BSRP			
	2025	2031	2041	2051	2025	2031	2041	2051	2025	2031	2041	2051
Metro	2300000	3000000	3400000	3853333	2300000	3000000	3400000	3853333	0	0	0	0
Bus	4903884	5645251	6756421	8077355	5254835	6126120	7381477	8889486	350951	480869	625056	812131
Car	853522	945308	1129932	1345178	997312	1139580	1388665	1689850	143790	194272	258733	344672
Two Wheelers	3954510	4524018	5413394	6467447	4300427	4995900	6031492	7277004	345917	471882	618098	809557
Auto	839763	929058	1110468	1321846	983480	1123200	1369100	1666481	143717	194142	258632	344635
Suburban Railway	984374	1341165	1760518	2310994	0	0	0	0	0	0	0	0
Total	**13836053**	**16384800**	**19570733**	**23376154**	**13836053**	**16384800**	**19570733**	**23376154**	**984375**	**1341165**	**1760519**	**2310995**

Source : BSRP – Feasibility Report, 2019

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Reduced number of vehicles on road leads to reduction in traffic congestion. As a result, there will be smoother operations of passenger trips of other mode vehicles owing to reduced congestion on roads. The proposed project will reduce journey time and hence congestion and delay in reaching destination.

9.1.7. Saving in Road Infrastructure

In case of non-introduction of Suburban Railway System, there will not be saving due to road infrastructure and development costs that would be required to cater to increase in traffic. With less number of vehicles on roads, expenditure on road maintenance is expected to reduce. Approximately, a lump-sum expenditure of 145 Crores / year is assumed. About 10% of road infrastructure will be saved.

9.1.8. Low Energy Consumption

During operation, there is reduced fossil fuel consumption. The reduction in energy consumption is about 20% per passenger km in comparison to road-based systems. The energy consumption to meet the traction and non-traction power requirement is based on traffic demand for different horizon years. The consumption of electricity is a significant part of O&M activities for Bengaluru Suburban Rail corridors.

There will be a reduction in number of vehicle trips on implementation of this project. Therefore, it is estimated that both petrol and diesel consumption will also get reduced. There is an inter-fuel substitution of petrol and diesel to electricity that could result in savings of foreign exchange and a reduction of air pollution.

9.1.9. Clean Development Mechanism (CDM) and Carbon Credits

9.1.9.1. Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM) was recognized in the Kyoto Protocol to operationalize the United Nations Framework Convention on Climate Change (UNFCCC) by committing reduction in CO_2 emissions. CDM projects such as Suburban railway project are an alternative to existing modes of transport viz buses, taxis, passenger cars; automatize three & two wheelers which has serious effects on urban eco system due to congestion and emission of greenhouse gases / other air pollutants. The suburban railway project result in passenger ridership shift from road-based transport to suburban railway system and provides alternate mode of public transportation. Suburban Railway network System is a more efficient, faster, safer and more reliable mode of green transport and complements as well as substantially replaces other modes of transport. It improves the resource efficiency of transport passengers as emissions per passenger kilometer are reduced compared to a transport situation without the suburban rail system.

The ex-ante estimate of reductions of Carbon dioxide in crediting period i.e. 2025 will be 19,66,166 tonness of CO_2e per year; six years later i.e. in 2031 will be 23,01,512 tonnes of CO_2e per year and ten years later i.e. in 2041 it will be 27,24,768 tonnes of CO_2e per year. The annual average emission reduction estimated over the crediting period is 23,30,816 tonnes CO_2e. The BSRP will contribute in a global initiative of reducing the global warming effect by ensuring reduction in emissions of CO_2 and other greenhouse gases.

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9.1.9.2. Carbon Credits

A carbon credit is a financial instrument and permit that allows the project proponent or Industrial owner of a State or Country to emit a certain amount of carbon dioxide or other greenhouse gases. The emission reductions generated by different mechanisms are collectively referred to as 'Carbon Credits'. One Carbon Credit is the emission reduction or avoidance of one ton of carbon dioxide or the equivalent (tCO_2e) in other greenhouse gases from the atmosphere. A carbon credit is a financial instrument that represents a reduction or the avoidance of one ton of carbon dioxide equivalent from the atmosphere.

Carbon credits were devised as a mechanism to reduce greenhouse gas emissions. Carbon dioxide is one of the major greenhouse gases, which directly deplete the ozone layer. To reduce the overall greenhouse gas emissions International Emission Trading (IET) Mechanism has been followed under Kyoto Protocol. Under IET mechanism, countries can trade in the international carbon credit market. Countries with surplus credits can sell the same to countries with quantified emission limitation and reduction commitments under the Kyoto Protocol.

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. This sets legally binding targets for 37 industrialized countries to limit or reduce overall GHG emissions by at least 5% below 1990 levels during the period 2008-2012. In the Doha Amendment to the Kyoto Protocol December 2012 new commitments to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020 were committed from 1 January 2013 to 31 December 2020.

The climate change study has shown clearly that in order to avert the worst impacts of climate change and preserve a livable planet, global temperature increase needs to be limited to 1.5°C above pre-industrial levels. Currently, the Earth is already about 1.1°C warmer than it was in the late 1800s, and emissions continue to rise. To keep global warming to no more than 1.5°C – as called for in the Paris Agreement – emissions need to be reduced by 45% by 2030 and reach net zero by 2050.

Carbon credits have different prices, depending on the location and market where they are traded. In 2019, the average price for carbon credits was $4.33 per ton. This figure spiked to as much as $5.60 per ton in 2020 before settling to an average of $4.73 the following year.

Carbon credits are measured in units of certified emission reductions (CERs). Each CER is equivalent to one ton of carbon dioxide reduction. Therefore, 1966166, 2301512 and 2724768 annual Carbon credits will be achieved through this project in the 2025, 2031 and 2041 respectively. In economic terms, it is evaluated as ₹ 1,27,792 lakhs (19,66,166 Carbon Credits X 80.72 Euros X 80.52 ₹), ₹ 149588 lakhs (23,01,512 Carbon Credits X 80.72 Euros X 80.52 ₹) and ₹ 1,77,098 lakhs (27,24,768 Carbon Credits X 80.72 Euros X 80.52 ₹) for the years 2025, 2031 and 2041 respectively.

According to Clean Development Mechanism (CDM), one ton of CO_2 increase will yield one Carbon credit and 80.72 Euros (1EUR = ₹ 81.52 as on 02nd August 2022) as on Date per Carbon credit as per 2022 statistics. In current carbon markets, the price of one carbon credit can vary from a few cents per metric ton of CO_2 emissions to $15/mt$CO_2e$ or even $20/mt$CO_2e$ for afforestation or reforestation projects.

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Compensatory afforestation in the ratio 1:10 is about 325720 trees. The reduction of CO_2 from the atmosphere by the mature plants after 5 years (if 5 year old plants from Forest Nursery are planted during project Construction and nurtured well) would be 71,00,696 Kg and Carbon Credits calculated may be 7100 and costs 5,73,168 Euros or ₹ 461.51 lakhs. The O_2 production after 5 Years would be 72,54,940 Kg/Year and the cost would be ₹ 435,296,400/- or ₹ 4,352.96 lakhs. Thereby, the impact on Biological/Ecological aspects and Climate Change will be compensated and help to balance Carbon Credits.

CDM objectives: The clean development mechanism was designed to meet dual objectives:

- to help developed countries fulfil their commitments to reduce emissions, and
- to assist developing countries in achieving sustainable development.

CDM Benefits: Benefits of CDM projects include investment in climate change mitigation projects in developing countries, transfer or diffusion of technology in the host countries, as well as improvement in the livelihood of communities through the creation of employment or increased economic activity.

Transport projects such as MRTS including the proposed Suburban Railway Project – BSRP contribute to reductions in GHG emissions and have potential for Carbon finance – Carbon Credits.

9.1.9.3. Carbon Credits for Bengaluru Suburban Railway Project

The Carbon Credits for Bengaluru Suburban Railway Project are calculated with the measures falling under the following:

- Reduction in emissions per km by use of regenerating breaking system & electric vehicles
- Reduction in emission per unit transported modal shift from two, three and four wheelers

9.1.9.4. Reduction in Emissions per Km by use of Regenerating Breaking System & Electric Vehicles

The operation of BSRP is dependent on low GHG emitting rolling stocks with regenerative braking system. The project adopts regenerative braking technology fitted rolling stocks in place of conventional electro-dynamic rheo-static braking technology. This replacement of conventional braking technology with regenerative braking technology enhances the reduction in consumption of equivalent grid electrical energy being utilized by the powering trains. This helps in conservation of electrical energy and further result in reduction in GHG emissions. This GHG emission reduction is a greater beneficial impact of the proposed project.

The net annual Energy requirement for Traction and auxiliary power for all the corridors of BSRP is given in **Table 9.6**. Rolling stock proposed for the suburban has regeneration features and it is expected that 30% of total traction energy. Hence, the total regeneration energy for all the corridors in Year 2025 is 25,50,00,000 kWh.

Energy consumption (Traction and Auxiliary - Traction & power supply incl. OHE, ASS, etc.) and reduction due to regeneration energy for year 2025 are estimated based on the grid electrical energy (Electricity from grid) and results are given in **Table 9.2** and **Table 9.3**.

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Table 9.2. Traction and Power Supply including OHE and ASS for BSRP Corridors in 2025

Sl. No.	Activity	kVAh	kWh
1	Traction and Power Supply including OHE, ASS, etc.,	30,00,00,000	25,50,00,000

Source: BSRP Feasibility Report, 2019

Table 9.3. Energy Consumption during Suburban Railway Operations in 2025

Activity	Units
Traction and Power Supply including OHE, ASS, etc., (kWh)	25,50,00,000
Regeneration Energy (30% of total Energy) (kWh)	7,65,00,000

9.1.9.5. Reduction in Emissions due to Trans-modal Shift

The reduction in vehicles during project operation due to shift from other modes to Suburban rail system, results in reduced emission of pollutants including GHG and CO_2. Estimation of vehicular emissions for with and without suburban railway project is presented in **Table 9.4**. Total reduction in GHGs due to introduction of BSRP is presented in **Table 9.5**. The details of the trans-modal shift with CO_2 emission and CO_2 reduction with and without BSRP are as given in the **Table 9.6**.

Table 9.4. Estimation of Vehicular Emissions (GHGs) for with and without BSRP

Particulars	Total Vehicular Emission with BSRP (in Tonnes/year)			Total Vehicular Emission without BSRP (in Tonnes/year)		
	2025	2031	2041	2025	2031	2041
Total Vehicles	984375	1341165	1760519	13836053	16384800	19570733
CO	1305.36	1778.49	2334.59	18347.71	21727.56	25952.36
HC	256.41	349.35	458.58	3604.02	4267.91	5097.78
NO_X	1030.01	1403.34	1842.14	14477.49	17144.40	20478.03
PM	56.82	77.41	101.62	798.62	945.73	1129.62
CO_2	150598.63	205183.60	269340.18	2116765.02	2506695.48	2994108.44

Table 9.5. Reduction in CO2 and GHGs in the Region due to Introduction of BSRP

Reduction in GHG (in Tonnes/year)				
Year	2025	2031	2041	2051
Total Vehicles	12851678	15043635	17810214	21065159
CO	17042	19949	23618	27934
HC	3348	3919	4639	5487
NOX	13447	15741	18636	22042
PM	742	868	1028	1216
CO2	1966166	2301512	2724768	3222739

Table 9.6. Estimation of CO_2 Emissions and Reduction in CO_2 with and without BSRP

Activity	2025	2031	2041
Total CO_2 Emission of Vehicles without BSRP (Tonnes/year)	2116764.97	2506695.54	2994108.38
Reduction in CO_2 emission with BSRP (Tonnes/year)	150598.58	205183.65	2,69340.17
% of CO_2 Reduction	92.9%	91.8%	91.00%

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9.1.9.6. Reduction in Air pollution

Compared to other modes of transport, the suburban is least polluting and can be classified as an environment friendly technology since no air emissions are involved in running and operating the suburban trains. The production of air pollutants from other modes of transportation are highlighted in **Table 9.7** and reduction of air pollutants corresponding to the reduction of daily vehicle kilo meters are presented in **Table 9.8**.

Table 9.7. Mode Wise Emission Factors as per EURO II Norms (Gram/Km)

Vehicle Type/ Pollutant	CO	HC	NOX	PM	CO_2
2-wheeler	1.4	0.7	0.3	0.05	28.58
Auto	2.45	0.75	0.12	0.08	77.89
Cars (incl. cabs)	1.39	0.15	0.12	0.02	139.52
Bus (incl. BRT)	3.72	0.16	6.53	0.24	787.72

Source: Appraisal guidelines for Metro Rail Project Proposals MoHUA, GOI 2017

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Table 9.8. Reduction in Air Pollutants due to Vehicular Reduction (Tons/Day)

Mode	2025					2031					2041				
	CO	HC	NOX	PM	CO_2	CO	HC	NOX	PM	CO_2	CO	HC	NOX	PM	CO_2
Metro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bus	0.131	0.006	0.229	0.008	27.645	0.179	0.008	0.314	0.012	37.879	0.233	0.010	0.408	0.015	49.237
Car	0.020	0.002	0.002	0.000	2.006	0.027	0.003	0.002	0.000	2.710	0.036	0.004	0.003	0.001	3.610
Two Wheelers	0.048	0.024	0.010	0.002	0.989	0.066	0.033	0.014	0.002	1.349	0.087	0.043	0.019	0.003	1.767
Auto	0.035	0.011	0.002	0.001	1.119	0.048	0.015	0.002	0.002	1.512	0.063	0.019	0.003	0.002	2.014
Suburban Railway	0	0	0	0	710.37	0.000	0	0	0	710.45	0.000	0	0	0	710.48
Total	**0.234**	**0.043**	**0.243**	**0.012**	**742.129**	**0.320**	**0.058**	**0.333**	**0.016**	**753.900**	**0.418**	**0.077**	**0.433**	**0.021**	**767.108**

Source : BSRP – Feasibility Report, 2019

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9.1.9.7. Reduction in GHG Emission and Carbon-Di-Oxide

Rail is considered as a low-carbon transportation mode. Besides the high level of electrification, energy efficiency in rail transport is one of the main reasons for the low carbon footprint of rail.

The reduction in plying vehicles due to project implementation will be helpful in reducing CO_2 emission. Low consumption of energy during project operation also reduces CO_2 emission. Reduction in emission of CO_2 which is a GHG component, contributes to the global environmental protection in terms of reducing ozone depletion and global warming in addition to the compensatory afforestation which will be undertaken during project implementation. The reduction in CO_2 emission from 2025 to 2041 is provided in the **Table 9.9**.

Table 9.9. Reduction in CO_2 Emission due to the Suburban Railway Project

Mode	CO2 Emission (Tons/Day) due to Vehicular Reduction		
	2025	2031	2041
Metro	0	0	0
Bus	27.645	37.879	49.237
Car	2.006	2.71	3.61
Two Wheelers	0.989	1.349	1.767
Auto	1.119	1.512	2.014
Suburban Rail	710.37	710.45	710.48
Total	**742.129**	**753.90**	**767.108**

Source : BSRP – Feasibility Report, 2019

The Sources of GHG Emissions during the Life Cycle of a Rail Project is given below in **Table 9.10**.

Table 9.10. Sources of GHG Emissions during the Life Cycle of a Rail Project (applied from ADB, 2010)

Suburban Rail Project's Stages			
Sources of Carbon Dioxide	**Construction**	**Maintenance**	**Operation**
Materials	Embodied Carbon		N.A.
Machinery Use	Direct GHG Emissions		N.A.
Transportation	Direct GHG Emissions		N.A.
Vegetation Removal	Sequestration/Restoration Potential Lost		
Road Use	Direct GHG Emissions		N.A.

GHG emissions calculation from ADB Guidelines – Construction and Operation Phases -Rail emits about one-fifth of trucks' GHG emissions, and with IR planning to become a net-zero carbon emitter by 2030, it has the potential to eliminate 7.5 million tons of carbon dioxide and other greenhouse gases each year.

9.1.9.8. Economic Benefits of Adopting Climate Risk Measures

The main benefit of adaptation measures to BSRP is climate change resilient railway infrastructure and operation, ensuring connectivity of transport network with implications to economic prosperity and welfare. Besides, the auxiliary benefits of adaptation measures are contribution to sustainable development and climate change mitigation (transport mode shift towards rail leading to reduction in greenhouse gas emissions (GHGs)). Also other synergies and co-benefits of adaptation measures

beyond the environmental field are desirable. For instance, structural protection measures may, apart from protecting railway track, also protect settlements or other infrastructure such as roads or energy supply. Adaptation shall be therefore considered as a permanent transition policy on the very long-term.

9.1.10. Other Benefits

The Quantification of some of the social benefits has not been attempted because universally acceptable norms do not exist to facilitate such an exercise. However, it has been considered appropriate to highlight the same, as given below:

- Reduced road stress
- Better accessibility to facilities in the influence area
- Economic stimulation in the micro region of the infrastructure
- Increased business opportunities
- Overall increased mobility
- Facilitating better planning and up-gradation of influence area
- Improving the image of the city

9.1.11. Inference

Project specific positive impacts discussed above equally weigh and manage to neutralize the negative impacts to at its maximum.

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Chapter 10. Environmental Management Plan

10.1. Overview

Based on the base line studies of the project as discussed in **Chapter 5** and potential negative environmental impacts and their assessment as discussed in **Chapter 8**, strategic Environmental Management Plan (EMP) has been framed for the ease of the project execution. In context of Environmental Safeguards the prime factors of consideration for EMP include protection, conservation and preservation of Environment. Management of Environment is possible with the stipulation of necessary safeguards during project execution i.e. during Pre-Construction, Construction and Operation stages.

Environmental Management Plan (EMP) guides to measure and achieve compliance with the environmental protection and mitigation requirements of a project. Environmental Management Plan provides more specific Environmental Mitigation measures to be followed by contractors during construction phase of a project.

This Chapter provides Management Plan for Environmental Protection including required preventive safeguard/mitigation measures for the negative impacts of the project on Environment during project construction and operation, which reduce or mitigate adverse environmental impacts to acceptable or tolerance limits. Along with Environmental Mitigation Measures the EMP also provides investment components for proper functioning of EMP. This Chapter has been sub-divided into the following:

1. Disaster management
2. Emergency Preparedness and Response Measures /Management
3. Institutional Strengthening/Capacity Building for Management and Training
4. Grievance Mechanism
5. Environmental Management Action Plan (EMAP) and Environmental Monitoring Plan (EMoP) for Implementation

Prior to this, it is very essential to understand the roles and responsibilities for project related Environmental Approvals/Clearances/Permits and the same is briefed below.

10.2. Approvals/Clearances

The roles and responsibilities to obtain project specific Environmental Approvals/Clearances/Permits during pre-Construction and Construction Period are summarised in **Table 10.1**. The Project Implementation Authority (PIA) will hold the total responsibility to ensure that all required Clearances/Approvals/Permits are in place during project pre-construction stage and Construction Stage.

Table 10.1. Roles and Responsibilities to Obtain Project Specific Environmental Approvals/ Clearances/ Permits

Sl. No.	Required Clearances/ Approvals/ Permits	Applicable Rules / Regulations	Applicability	Responsible Agency/ Authority	Time Required	Approval Authority
Pre-Construction Phase						
1.	Forest Clearance under Forest (Conservation) Act	Forest (Conservation) Act, 1980 and amendments	Diversion of forest land for Akkupete Depot	PIA/EMU	8-12 months	Forest Department & MoEFCC
2.	Permission for felling of trees and compensatory Afforestation	The Karnataka Preservation of Trees Act, 1976 and amendments	Felling of trees along proposed BSRP alignment & Stations	PIA/EMU	6-8 months	BBMP Forest wing/Forest Department
3.	Prior permission to be obtained under The Ancient Monuments and Archaeological Sites and Remains Act	The Ancient Monuments and Archaeological Sites and Remains Act, 1958 and it's Amendment, 2010	Construction of Station and Rail alignment at Devanahalli	PIA/EMU	4-6 months	National Monument Authority
4.	Construction Railway within buffer zone of Lakes	Karnataka Tank Conservation and Development Authority Act, 2018	Crossing/ abutting in buffer zone of Lakes	PIA/EMU	2-3 months	Karnataka Tank Conservation and Development Authority
5.	Consent to Establish & Operate under Air and Water Acts	Water(Prevention and Control of Pollution)Act, 1974 & Air(Prevention and Control of Pollution) Act,1981	Railway Locomotive Workshop	PIA/EMU	2-3 months	Karnataka Pollution Control Board
6.	Building Permissions for Depot, stations and property development	Respective Building bylaws	Before Construction	PIA/EMU	2-3 months	BBMP / Municipal Corporation
7.	Utility/traffic diversion	Respective Acts and Rules	Before Construction	PIA/EMU	2-3 months	Local Offices of respective Authorities such

Sl. No.	Required Clearances/ Approvals/ Permits	Applicable Rules / Regulations	Applicability	Responsible Agency/ Authority	Time Required	Approval Authority
						as RTO, BESCOM, BWSSB, Telecom Dept., etc.
8.	Consent to Establish construction yards, labour camps, stations and Depot (since non-residential)	Water(Prevention and Control of Pollution)Act, 1974 & Air(Prevention and Control of Pollution) Act,1981	Before Construction	Contractors/PIA /EMU	2-3 months	Karnataka State Pollution Control Board (KSPCB) and Development Authority for land use clearance
9.	Sites to establish labour camps, pre-casting and material yards	Air(Prevention and Control of Pollution) Act,1981	Before Construction	Contractors/PIA /EMU	2-3 months	BBMP / Municipal Corporation
		Land use Master Plan and DC&PR	Before Construction	Contractors/PIA /EMU	2-3 months	
Construction Phase						
10.	Consent for Establishment and Operation of Hot Mix Plants (HMP), Crushers, Batching Plants, etc.	Water(Prevention and Control of Pollution)Act, 1974 & Air(Prevention and Control of Pollution) Act,1981	Construction	Contractors	2-3 months	Karnataka State Pollution Control Board (KSPCB)
11.	Consent for Establishment of labour camps		Construction	Contractors	2-3 months	BBMP / Municipal Corporation
12.	Permission for drawl of ground water for construction (not recommended)	Environment (Protection) Act, 1986	Construction	Contractors	2-3 months	Regional Director, Central Ground Water Board and Municipal Corporation
13.	Permission to store and Authorization for Disposal of Hazardous Waste	Hazardous Waste(Management and Handling and trans boundary movement) Rules, 2016	Construction	Contractors	2-3 months	Karnataka State Pollution Control Board (KSPCB)

Sl. No.	Required Clearances/ Approvals/ Permits	Applicable Rules / Regulations	Applicability	Responsible Agency/ Authority	Time Required	Approval Authority
14.	Consent for disposal of waste water from construction sites and sewage from labour camps	Water (Prevention and Control of Pollution) Act, 1974	Construction	Contractors	2-3 months	Karnataka State Pollution Control Board (KSPCB)
15.	PUC certificate for vehicles for construction	Environment (Protection) Act, 1986	Construction	Contractors	1-2 months	Transport Department of Karnataka
16.	Labour employment, safety, health/welfare measures and labour license	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Construction	Contractors	2-3 months	District Labour Commissioner
17.	Permission for management of C&D waste and muck	Construction and Demolition Waste Management Rules, 2016	Construction	Contractors	2-3 months	BBMP/Municipal Corporation and Karnataka State Pollution Control Board (KSPCB)
Operation Phase						
18.	Consent for Operation to Operate Depot	Environment Protection Act, 1986	After construction	PIA /EMU	2-3 months	Karnataka State Pollution Control Board (KSPCB)
19.	Installation and operation of DG sets at stations	Air (Prevention and Control of Pollution) Act, 1981	After construction	PIA /EMU	2-3 months	Karnataka State Pollution Control Board (KSPCB)

10.3. Environmental Management Plan (EMP)

Environmental Management Plan (EMP) for implementation includes the Environmental Management Action Plan (EMAP) and Environmental Monitoring Plan (EMoP). Environmental Management Action Plan (EMAP) is prepared considering project specific location, environmental factors, risks & impacts and mitigation measures; applicable Disaster Management plan and Emergency Preparedness Action Plan in line with Indian and World Bank laws/regulations, EIB's Environmental and social guidelines and responsible agencies/organization for implementation, monitoring and approval authorities for Construction Stage and operation stage of the project; and same is presented below in **Table 10.2**. Disaster Management plan and Emergency Response/Preparedness and Management are briefed in the following paragraphs.

EMAP is for overall management of minor and major, temporary and long term, moderate impacts on environment and people. Disaster Risk Management (DRM) is part of EMAP. However, for the better understanding and implementation, the Plan is separately provided. Emergency Response Plan (ERP) is part under DRM. However, for the better understanding and implementation, all these Plans are separately provided. Disaster Management plan and Emergency Response Plan are briefed in the following paragraphs followed by Institutional Strengthening for EMP Implementation, Training, Grievance Redress Mechanism Environmental Management Action Plan (EMAP) and Environmental Monitoring Plan.

10.4. Disaster/Risk – Incident Management

Disaster is a major hazard and unexpected event due to sudden failure of the system, external threats, internal disturbances, earthquakes, fire and accidents leading to loss of life, injury, total or partial destruction and damage to buildings, environment and public. The first step is to identify the causes which develop/ pose unexpected danger to the structural integrity due to construction. The potential causes are excessive load, cracks, failure and malfunctioning of sensing instruments, accident, etc. These need to be looked into with care.

Disaster risk is the combination of the severity and frequency of a hazard, the number of people and assets exposed to the hazard, and their vulnerability to damage. Focal point of the United Nations system for disaster risk reduction (UNISDR) is to reduce disaster risk rather than managing disasters. The overarching objective of UNISDR is prevention and reduction of existing disaster risk and strengthening resilience through successful multi-hazard disaster risk management. The main action in reducing risk lies in reducing exposure and vulnerability. Disaster/Risk/Incident Management Plan shall be in accordance with EHS guidelines and National and International Guidelines. During Construction stage, Environmental Specialist. of General Consultant will update DRMAP, in case of anticipated emergency. The Contractor will implement and Environmental Spcialist of General Consultant will assist in monitoring DRMAP and EMP Implementation Unit of K RIDE is the Approval authority. During operation stage EMU, KRIDE will be solely responsible for execution of DRMAP or EMU, KRIDE may hire agency to execute DRMAP and themselves monitor the Actions required and taken by the agency.

Disaster Risk Management includes the following four important actions:

Reduction and Prevention: Measures to reduce existing and avoid new disaster risks, for instance relocating exposed people and assets away from a hazard area. In case of mass transit like Suburban trains such measures are not required.

Mitigation : The lessening of the adverse impacts of hazards and related disasters. For instance implementing strict land use and building construction codes. This aspect is accounted for in design and construction of the project.

Transfer : The process of formally or informally shifting the financial consequences of particular risks from one party to another, for instance by insurance. This is not yet available.

Preparedness : The knowledge and capacities of governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to, and recover from the impacts of hazard events or conditions, for instance installing early warning systems, identifying evacuation routes and preparing emergency supplies.

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Risk Assessment and Disaster Management process comprises the following stages:

- Description of the system that is at risk
- Identify the potential hazards or sources of risk (the list of initiating events or scenarios of events leading to the undesired outcome–technological and human)
- Risk analysis to estimate the likely hood of the scenarios or events occurring and each scenario's consequence
- Compare and rank the various risk drivers
- Action plan in response to the identified major risks
- Regular monitoring, review and updating of the process. For example, the system at risk needs to be defined as to include inter-modal integration.
- Examples of potential hazards are fire risk or security alarms or failure of train controlormotivepowerorpassengerdoors/escalators/platformscreendoorsontrainsorin stations; staff training and work environment; inadequate maintenance.

Disaster Risk Management Action Plan includes the following measures :

Procedures and Records: Evaluation of progress and effectiveness of EMP and EMoP, response to inquiries, complaints and requests for information surveillance, incident reporting, corrective and preventive actions, emergencies, training and emergency exercises, response to emergencies shall be carried out.

Identification of resources: Sources of repair equipment, personnel, transport and medical aid for use during emergency shall be identified.

Emergency systems: Back-up systems for ventilation, communication and train control, lighting, etc. shall be established.

Evacuation procedures: Evacuation procedures will be prepared in consultation with local administration and notified. To ensure coordinated action, an Emergency Action Committee shall be constituted.

Communication System : Primary and back-up system shall be put in place at emergency situations. The damage areas shall be clearly identified and provided with temporary and full proof communication system.

Review and Updating : Drawing inputs from the incident reporting system the Action Plan shall be reviewed at pre-decided intervals and upon occurrence of defined ``trigger events`` and suitably updated.

Maintenance of Incident/ Risk/Disaster Record : Proper maintenance of Incident Records shall be taken care. Required preventive measures shall be under taken to avoid repetition of risks/hazards.

Disaster Risk Management Manual may be prepared and made readily available at all stations of Suburban rail corridors for ready reference and timely action by the staff / personnel of Suburban services / SPV personnel. As suggested in the Feasibility Report, Self-propelled road-cum-railcar – (or accident relief train equipped to handle any track failure or derailment of train) should be stabled in the depot sheds, manned round the clock to be moved in any emergency to the affected spot. The

rail-cum road- car should be a multi-utility vehicle. Hence, the following equipment is suggested to be readily available in the road-cum-rail car in good fettle:

- Track grinding equipment
- Re-railing equipment
- Auxiliary hand pump
- High pressure hoses
- Telescopic jacks
- Floodlights
- Traversing jack
- Re-railing bridge Pulling device
- Towing equipment
- Air compressor
- Vetter airbag

Institutional framework for Disaster Risk Management is depicted in **Figure 10.1**.

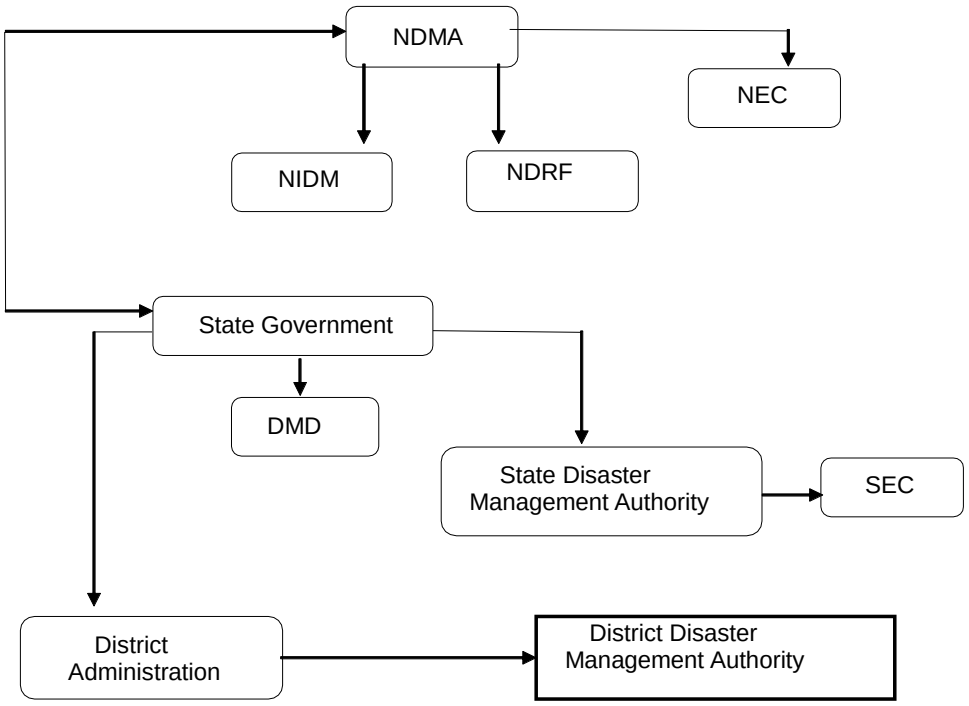

Figure 10.1. Institutional Framework for Disaster Management

No Railway official is nominated either in the National Executive Committee (NEC) or State Executive Committee (SEC), though they can be co-opted as per need.

During Construction stage, Senior Environmental Specialist or Environmental Specialist of General Consultant will update DRMAP, if required in case of anticipated emergency. Contractor will implement and Senior Environmental Specialist or Environmental Specialist of General Consultant will assist KRIDE in monitoring DRMAP implemented by the Contractor and EMPIU of KRIDE will approve the records and reports as and when required.

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During operation stage EMPIU, KRIDE will be solely responsible for execution of DRMAP or EMPIU, KRIDE may hire agency to execute DRMAP and Themselves monitor the Actions required and taken by the agency.

10.5. Emergency Response /Preparedness and Management

Emergency Management involves steps such as Prevention, mitigation, preparedness, response and recovery. The emergency measures are adopted to avoid any failure in the system such as lights, fire, means of escape, ventilation shafts, etc. The aim of Emergency Response Plan is to identify areas, population and structures likely to be affected due to a catastrophic event of accident. The action plan should also include preventive action, notification, warning procedures and co-ordination among various relief authorities. During operation stage, EMP Implementation Unit, K RIDE will be solely responsible for execution of DRMAP or EMP Implementation Unit, K RIDE may hire agency to execute DRMAP and Themselves monitor the Actions required and taken by the agency. These are discussed in the following sections.

10.5.1. Emergency Response Actions for Disaster Risks

Following emergency response actions shall be taken at suburban railway stations and Depot for disaster risks :

Preventive Action

Once the likelihood of a disaster is suspected, action has to be initiated to prevent a failure. Engineers responsible for preventive action should be aware of availability of repair equipment, materials, labour and expertise for use during emergency.

Reporting Procedures

The level at which a situation will be termed a disaster shall be specified. This shall include the stage at which the surveillance requirements should be increased both in frequency and details. The Engineer-in-Chief should notify the officer for Exit points for the public and nearest medical facilities.

Communication System

An efficient communication system is absolutely essential for the success of any disaster management plan. This has to be worked out in consultation with local authorities. More often, the entire communication system gets disrupted when a disaster occurs. The damage areas need to be clearly identified and provided with temporary and full proof communication system.

Emergency Action Committee

To ensure coordinated action, an Emergency Action Committee should be constituted. Chairman cum Director, K RIDE will be the Chairman of this Committee. The committee may comprise of:

- Head of operations,
- Head of technical services,
- Head of security,
- Fire brigade,
- Police representatives, and

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- NGO

Environmental & Social NGOs, who are active in this field are entrusted in these meetings. Representatives of NGOS will be engaged once the project is commenced at full-fledge. Emergency Action Committee will prepare the evacuation plan and procedures for implementation based on local needs and facilities available. The plan should include:

- Demarcation of the areas to be evacuated with priorities,
- Safe route to be used, adequacy of transport for evacuation, and traffic control,
- Safe area and shelters,
- Security of property left behind in the evacuated areas,
- Functions and responsibilities of various members of evacuation teams,
- Setting up of Joint Control Room.

All personnel involved in the Emergency Response Plan should be thoroughly familiar with all the elements of the plan and their responsibilities. They should be trained through mock drills for the Emergency Response Plan. The staff at the site should be trained for problem detection, evaluation and emergency remedial measures. Individual responsibility to handle the segments in emergency plan must be allotted.

Success of an emergency plan depends on public participation, their response to warning notifications and timely action. Public has to be educated on the hazards and key role in disaster mitigation by helping in the planned evacuation and rescue operations.

It is essential to communicate by whom and how a declared emergency will be terminated. There should be proper notification to the public on de-alert signals regarding termination of the emergency. The notification should be clear so that the evacuees know precisely what to do when re-entering or approaching the affected areas.

10.5.2. Emergency Provisions for Disaster Risks

To manage the disaster risk the following measures shall be undertaken at Suburban stations and Depot :

10.5.2.1. Emergency Lighting

The emergency lights operated on battery power should be provided at each station. The battery system should supply power to at least 25% of the lights at the station, platforms and viaducts for a period of 2 hours.

10.5.2.2. Fire Protection

The building materials should be of appropriate fire resistance standard. For surface or overhead structures the fire resistance period should be at least 2 hours. Wood shall not be used for any purpose, excluding artificial wood products, which are flame resistant. The materials which have zero surface burning characteristics need to be used. The electrical systems shall be provided with automatic circuit breakers activated by the rise of current as well as activated by over current. The design of a station will include provision for the following:

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- Fire prevention measures,
- Fire control measures,
- Fire detection systems,
- Means of escape /evacuation,
- Access for fire man, and
- Means of firefighting.

Accumulations of refuse of inflammable material like paper, plastic cartons constitute a major fire hazards and should not be permitted. Smoking should be strictly prohibited at all locations of BSRP.

All aspects of fire prevention and control will be dealt in close collaboration with the city fire fighting authority. Smoke control will be achieved by the following means:

- A minimum of 30 minutes supply of water is to be assured in the case of fire. The pumps/overhead tanks shall have the capacity to discharge the water at the rate of 1100 litres per minute at a head of 21 m at nozzle mouth.
- The storage capacity in an underground or overhead tank may be divided into two parts i.e. dead storage and running storage. Firefighting pumps shall be provided with a diesel pump as a standby arrangement, in case of power failure.
- Fire of electrical origin, water cannot be used until the electric system has been made dead and earthen. For electrical fires, non-aqueous extinguishers like chemical dry powder or CO_2 gas are utilized for firefighting. Fire extinguishers with these agents shall be liberally provided at static installations and on the rolling stock.
- Generally there are often more casualties from smoke inhalation than from burning. Smoke needs to be transported away from the site of the fire. In order to achieve this, fresh air has to be introduced and exhaust gases should be sucked out.
- Openings, including ducts and passages, between MRTS – Suburban Railway property and any adjoining structures which allow free access into the MRTS – Suburban Railway property will be protected by fire doors, fire shutters, fire dampers, etc. as appropriate. Fire detection and alarm systems will be provided as per the prevailing state of art technology.

Fire Prevention and Safety Measures

Fire prevention measures will be designed and implemented to minimize the risk of outbreak of fire by appropriate choice, location and installation of various materials and equipment. In stations planning, potential sources of fire can be reduced by:

Fire Prevention

Fire prevention can be carried out by following measures :

- Use of non-combustible or smoke retardant materials wherever possible,
- Rolling stock is provided with fire retarding materials, low smoke zero halogen type electric cable is also provide,

- Provision of layout which permits ease of maintenance for equipment and cleaning of the station premises,
- Provision of special storage spaces for combustible materials such as paint and oil,
- Prohibition of smoking in fire prone areas,
- Good housekeeping.

Safety Measures

Following provisions are required from fire safety point of view:

- Automatic sprinkler/detection system to be provided if floor area exceeds 750 sq. m
- One wet riser-cum-down comer per 1000 sq. m floor area with static underground storage tank, overhead tanks and pumps of suitable capacity with hydrants, first-aid reel, etc.
- Portable fire non-aqueous extinguishers of Carbon-di-oxide, chemical dry powder, etc. at suitable places.
- Automatic smokes venting facilities.
- Two separate means of exit shall be provided, if more than 10 persons are working and the area exceeds 1400 sq. m.
- Fire resisting doors shall be provided at appropriate places along the escape routes to prevent spread of fire and smoke.
- The travel distance for fire escape shall not exceed 20 m where escape is available in more than one direction; the distance could be up to 40 m.

Fire Alarm and Detection System

A complete fire detection system with equipment complying with the requirements of Bengaluru Regional Fire Services shall be provided through out each station and ancillary buildings including entrance passage ways, subways, etc. to give visual and audible indication of alarm conditions actuated by the operation of break glass contact or fire sensors e.g. detector heads, linear heat detecting cables etc. The system shall be operated from 24 V DC Power sources.

Manually operated call points shall be provided at every hydrant and nose reel points, station head wall, tail wall and other locations. Alarm bells shall be installed in each plant room complex at both platform and concourse level and shall be clearly audible at all points in the room/area. Heat detector shall be installed at roof level, ceiling and floor cavity.

Smoke probe units shall be installed in rooms/compartments. When an alarm point is operated, the fire pump shall start to operate automatically. A station fire control and indicating panel shall be provided/ installed in the station controllers room, for the control, indication and monitoring of the whole detection and firefighting systems. While designing the firefighting system, the zone of Bengaluru regional Fire Services shall be taken into account for linking with the same.

Fire Control Measures

Control of the spread of fire and smoke will be achieved by partition of fire risk areas, planning for smoke extraction, and arrangement for smoke containment. Partition is aimed at limiting the extent

of a fire. The openings must be capable of being sealed in the event of fire. With the exception of station public areas, a fire compartment will not exceed 1500m^2.

Partition of the public areas in stations is not practicable for operational reasons. The fire resistance period of this separated area should be about 3 hours.

Access for Fireman

A secondary access to the station, not used by passengers for evacuation, shall be available to fireman when the need arises. The entry point shall be easily accessible from the road. Access shall be available to all levels of the station. The minimum width of the stairs is 1.0 m and maximum height should not exceed 60 cm.

Provision for Emergency Doors

The rolling stock is provided with emergency doors at both ends of the cab to ensure directed evacuation of passengers in case of any emergency including fire in the train.

10.5.3. Emergency Response Action for Structural Failures during construction and Community Safety

The individual stages of risk management can be used to analyze the risk of the structural failures. These stages are as follows:

Step 1 : Risk identification—the threats need to be identified and analysed based on the analysis of reports of similar projects implemented before. The data need to be presented on radar charts and analyzed in detail.

Step 2 : Hazard classification—classification should be made on the basis of the causes of the structural failures. Two main groups should be distinguished—(i) disasters caused by random causes (mainly due to the force of nature) and (ii) those caused by man (human errors). The failures from the second group (human errors) were classified into three subgroups closely related to the life cycle of a building, namely—design, construction and exploitation.

Step 3 : Risk assessment and measurement—based on the Failure Mode and Effects Analysis (FMEA) method, and more precisely on the determination of the probability of a given threat (P), severity of its result(S), difficulties in its detection (D). These data made it possible to determine the Risk Priority Number (RPN). This number indicates which of the threats (causes) identified in steps 1 and 2 are the most critical from the point of view of the structural failures.

Step 4 : Risk monitoring and response methods—in the fourth stage, so-called counter- measures (preventive actions), i.e. actions which is aimed at reducing the risk of the structural failures in the analyzed groups of causes, should be considered. As mentioned before, the Failure Mode and Effects Analysis (FMEA) method should be used to analyze the process of managing the risk of the structural failures.

Following are the action plans to for the preparedness :

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Mechanical resistance and stability

The design and construction of the facility must take into account the loads that, both during construction and exploitation will not lead to collapse of the whole or part of the facility; major deformations to an inadmissible degree; damage to other parts of the facility or its equipment; damage by an event to an extent disproportionate to the original cause.

Safety in case of fire

The design and construction of the facility must assume the risk of a fire breakout. Buildings/Structure must be designed in such a way that the load-bearing capacity of the structure is maintained for some time during a fire. The designer and contractors are obliged to meet the technical and construction requirements relating to fire protection. The design, taking into account the possibility of a fire, must ensure restrictions on the spread of fire and smoke in the building and to other objects, the possibility of evacuating people at risk, the safety of rescuers.

Hygiene, health and the environment

The facilities must not pose a threat to employees, users or neighbors throughout their entire life cycle. They must not emit harmful volatile, aqueous or solid substances in any way.

Safety and accessibility in use

The facilities must be safe for its users. There must be no risk of falls, burns or electric shock. Moreover, Contractor must ensure safe use of access for people particularly those with disabilities at buildings or any structure.

Protection against noise

Protection against noise is one of the seven basic requirements. People want to live quietly, have a quiet neighborhood and work quietly. Unnecessary noise is distracting, stressful and a source of discomfort. The acoustic measures should be implemented.

Energy economy and heat retention

It is very important to equip buildings ensuring energy economy and heat retention. Optimum energy consumption also applies to the construction and demolition phase.

Sustainable use of natural resources

Throughout the life cycle of the facilities (design, construction, demolition), it is important to ensure sustainable use of resources (sustainable design), sustainable construction and sustainable demolition. Sustainable design includes the reduction of energy, water, raw materials, greenhouse gas emissions and waste production (Czajkowska and Ingaldi 2019). There are many ways to reduce the negative impact on the environment in the construction industry. One of the solutions is use of passive houses, energy-efficient houses, the use of safe building materials, modernization of heating systems, recycled materials, etc.

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10.6. EMP Implementation Monitoring and Institutional Strengthening Mechanism

During project implementation construction activities of the Contractors need to be regularly/ periodically monitored till the project is set forth for operation and further, operational monitoring is required during operation phase of the project. The regular or periodical monitoring is required to ascertain whether activities are going according to the approved plans.

Project monitoring and evaluation is used to measure a project's progress. It's important because it helps the Project Implementation Authority (PIA) keep tabs on a project and identify potential problems and to resolve so that project progress is not impacted. It provides necessary feedback for project management team to keep the program on schedule. The supervision and reporting process with respect to implementation status of environmental mitigation measures during construction will initiate from the Contractor at the lowest rung who will report to the Project Implementation Authority (PIA) through the General Consultant (GC).

10.6.1. Establishment of Environmental Management Unit for Efficient EMP Implementation

Environment Management Unit shall be established by the Project Authority at the initial stage of the project implementation. This unit shall have an Senior Environmental Officer and two Environmental Specialists as PIU members from PIA, K RIDE. The task of the division will be to monitor implementation of environmental mitigation measures and environmental monitoring and it should report directly to Chief Engineer of the Project Authority. Progress of the division shall be reviewed by an Independent Environmental Advisor/Auditor once in a year. The Environmental Auditor should be an experienced expert familiar with environmental management in similar projects. Cost for the first five years (including 10% annual increase) is given in **Table 11.7.**

Roles of Environmental Auditor:

The objective of an Environmental Auditor is to detect any existing or potential environmental compliance problems or management system deficiencies and to make recommendations for implementation. Progress of the EMP implementation will be reviewed by an Environmental Auditor, as an External expert. Environmental auditor assesses the management / performance of implementation of EMAP and EMoP to ensure stipulated EIB, KfW and World bank standards of environmental control are being complied with.

Environmental Auditor will prepare the periodical Environmental Audit Report in compliance with stipulated standards of National and funding agency Environmental and Social Safegaurds, as applicable.

He will also provide inputs during EMP Training sessions to ensure the the implementing organization is complying with stipulated standards of National and funding agency Environmental and Social Safegaurds in due diligence. Budget for appointing environmental auditor to perform the above activities on intermitent basis is estimated to 20 lakhs (4 quarter x 100000 x 5 years).

During project execution – construction and operation phases, the EMP implementation comprises of the following key activities to be monitored by EMU of PIA:

- Implementing various mitigation and enhancement measures within the time frame recommended

- Overseeing the implementing various mitigation and enhancement measures and fine tuning/advocating more measures, if needed, depending on site conditions;
- Project level monitoring of key performance indicators to evaluate the implementation of EMP measures at the recommended intervals.
- Periodical reporting of status of EMP implementation and monitoring results and key performance indicators and
- Constant evaluation of EMP measures implemented based on the data available from project level monitoring and status reports submitted by Environmental Specialist of General Consultant and providing directions accordingly.

10.6.2. Reporting of EMP Implementation

The implementation of EMP during construction phase by the Contractors will be followed by their reporting to Environmental Specialist of the GC who will monitor the implementation of EMP at project site during construction and report to PIA. During operation, the employed monitoring agency will supervise or take care of implementation of mitigation measures and report to the EMU of PIA.

During both construction and operation phases, the employed independent environmental monitoring agency (third party) will carry out EMoP implementation activities and report to the EMU of PIA with suggestions, as required.

Environmental Audit Reports shall be prepared by Independent Environmental Advisor/Auditor and submitted to PIA.

Periodical Environmental Monitoring Reports shall be preparted by PIA with the support of Sr. Environmental Specialsit of General Consultant and will be submitted to funding agency.

10.6.3. Capacity Building

The above mentioned activities have to be carried out in coordination by various agencies that will be involved in the implementation of suburban rail project. It is also to be noted that all these activities will be carried out concurrently or at regular intervals and at different duration and location. This makes it pertinent that all agencies involved work within a predefined setup. The coordination model proposed during construction and operation phases is presented in **Figure 10.2** and **Figure 10.3** respectively. The identified agencies and their sphere of work are presented in following section.

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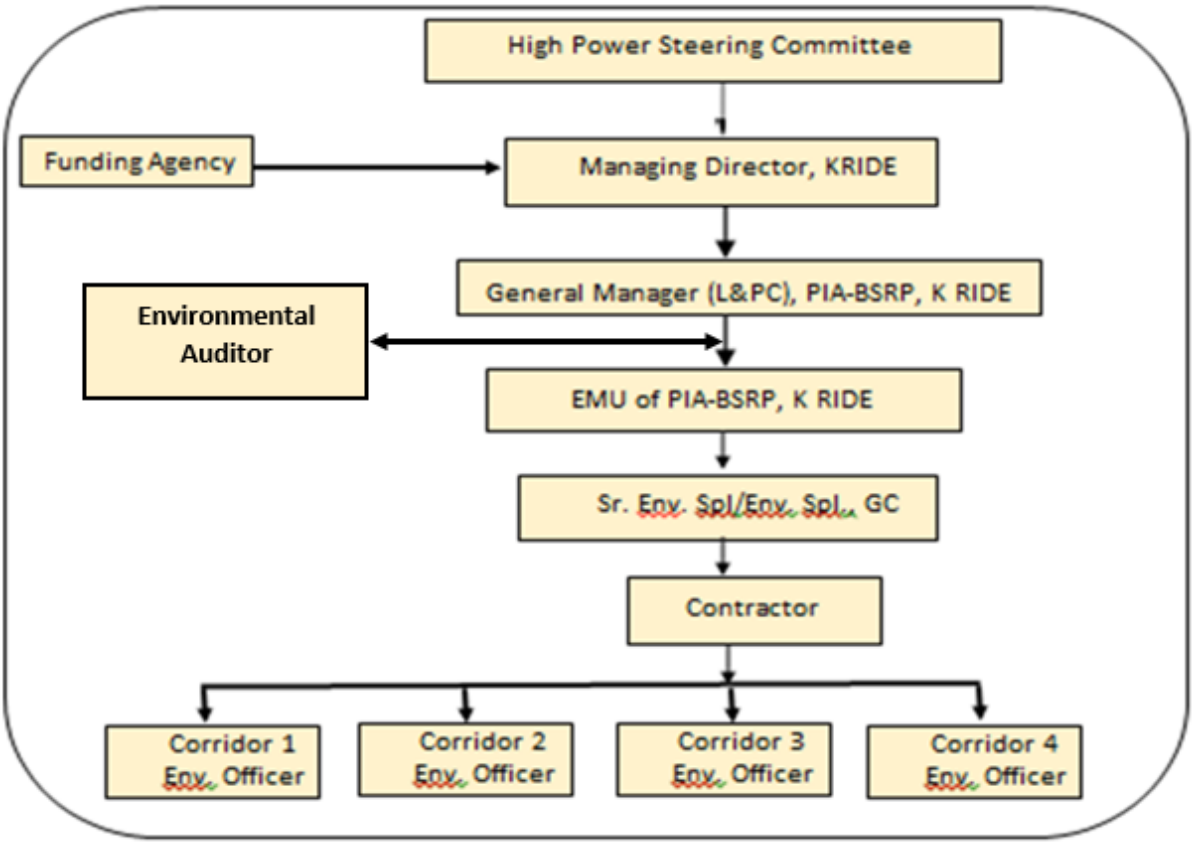

Figure 10.2. EMU's Institutional Mechanism for EMP Implementation during Construction Phase

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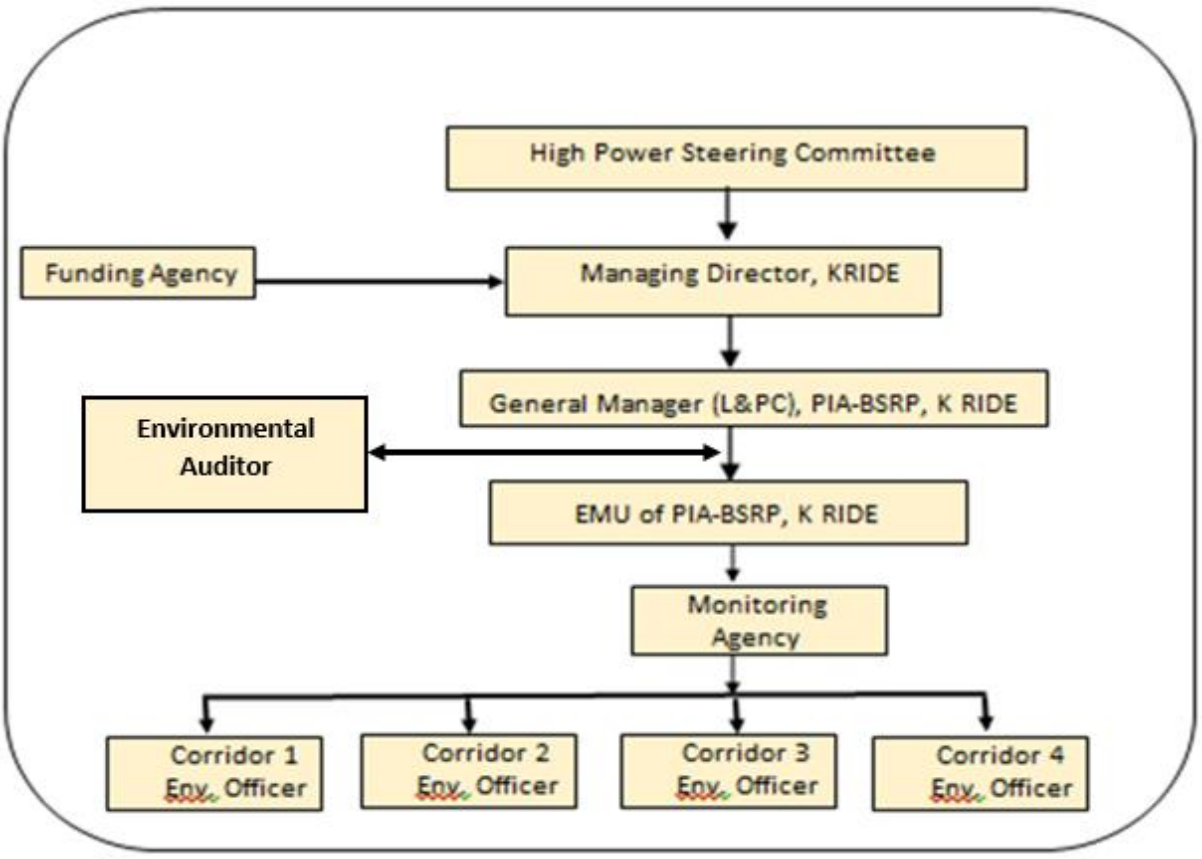

Figure 10.3. EMU's Institutional Mechanism for EMP Implementation during Operation Stage

Project Implementation Authority (PIA): The responsibility of implementing environmental mitigation measures lies with the PIA. PIA in this project will be Rail Infrastructure Development Company Karnataka Limited (K RIDE). The responsibility also includes various tasks such as notifying various affected parties such as the resident and commercial establishment, facilitate there location of people, notify other utility departments such as telephone, water supply, sewerage, etc. which used the road for providing public utility services.

Environmental Management Unit: K RIDE will set up an Environmental Management Unit (EMU) which shall look after the monitoring and implementation of the environmental mitigation measures in the EMP and address the grievances of environmental and social issues of the project and ensure compliances with World Bank Frameworks, EIB's Environmental and Social Standards, guidance note, General EHS guidelines and Railway specific EHS Guidelines and GIIPs and applicable State and National laws.

The PIA's Environmental Management Unit comprises staff and structure is shown in **Figure 10.4**.

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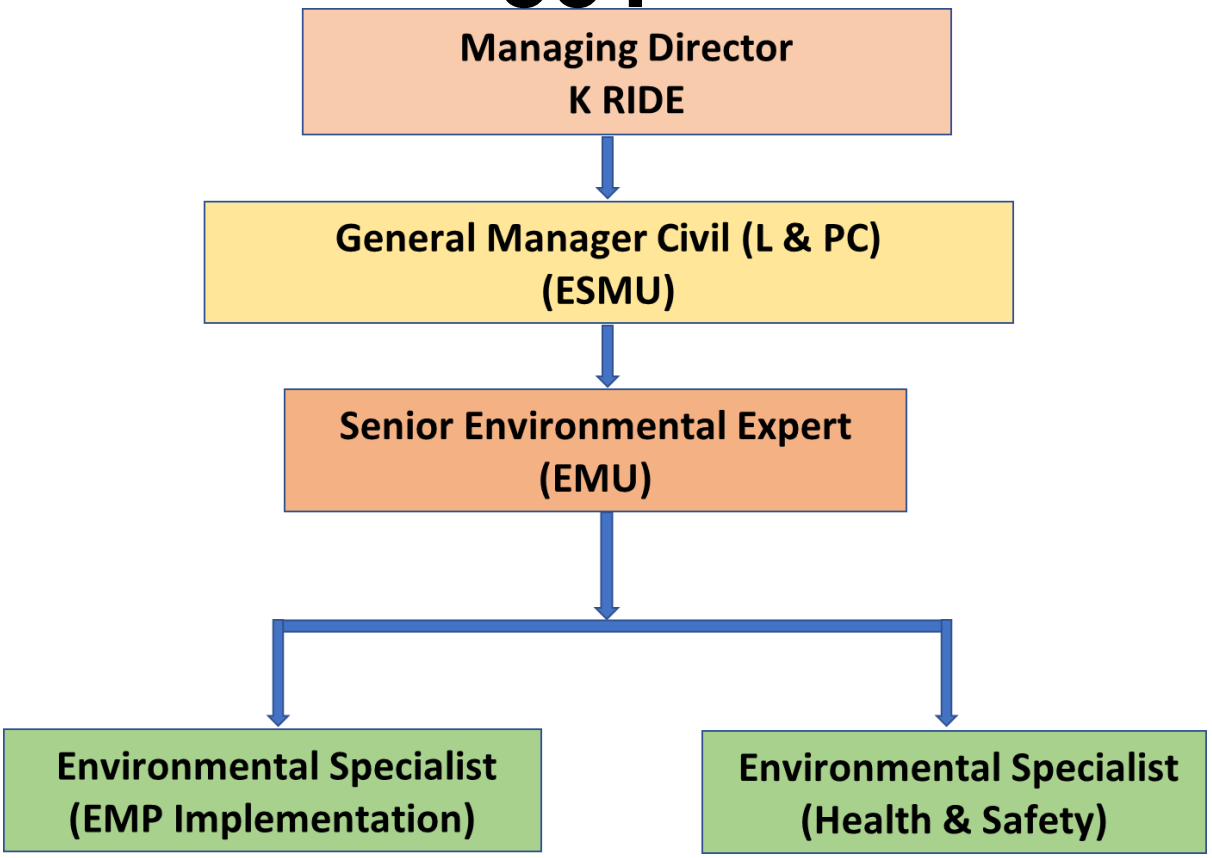

Figure 10.4. PIA's Environmental Management Unit's Organization Structure

Senior Environmental Expert (Sr.EE) of EMU reports to General Manager Civil (L&PC) (ESMU) who is responsible for management of environmental and social issues of the project. Sr. Environmental Expert of EMU will be assisted by Environmental Specialist (2 nos), who shall be responsible to look after all the environment issues related to the project during the project preparation, implementation and operation periods. Environmental and Social Management Unit will be supported by the technical and field staffs for the project implementation with the assistance of the Environmental Specialist of Design Consultant & Contractor.

It is envisaged that the Environmental Management Unit will be responsible for:

- Ensuring approvals/permission/NOC obtained from regulatory bodies/authorities for various components at different project stages
- Monitoring implementation of the EMP measures in consonance with the timeline for the project as per the approved budget;
- Maintaining interaction with the stakeholders, public and various statutory authorities pertaining to environment, land acquisition, rehabilitation and resettlement of K RIDE project;
- Interacting regularly with the Environmental Expert of Design Consultant & Contractor on the status of the environmental mitigation and enhancement measures;
- Inspecting project site on regular basis to monitor the mitigation measures being implemented by the Contractor;
- Document and disseminate good practices, minimize and resolve bottlenecks during the implementation of EMP.

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Responsibility of Senior Environmental Expert:

He is familiar with the Indian environmental legislation, environmental monitoring, EMP implementation aspects etc. The Environmental Expert shall oversee day to day implementation of the environmental management plans pertaining to the construction contract for various BSRP Corridors and is also responsible for monitoring reports to funding agencies. Additional recruitment if needed will be undertaken as necessary on contract basis. He will be responsible for obtaining regulatory clearances. He will coordinate with PIA to conduct necessary training program for the workers, engineers and office staffs. Briefing the Contractor about the requirements of the Environmental Specification and/ or EMP, as applicable, advising the Engineer about the interpretation, implementation and enforcement of the Environmental Specification and other related environmental matters, monitoring and reporting on the performance of the contractor/project in terms of environmental compliance with the EMP to the GM (L&PC) and MD K RIDE and KfW & EIB and providing technical advice relating to environmental issues are also the responsibility of the Senior Environmental Expert. As required by the Funding Agecny, the periodical Monitoring and Compliance Report will be prepared by Sr. Environmental Expert of PIA with the Assistance of Sr. Environmental Speciasit of GC. The EMU of PIA will review and then submit the Environmental Compliance Report (ECR) to Project Director (PD), finally the will be submitted to the Funding Agency for approval.

Sr. Env. Expert of EMU, PIA, BSRP will be responsible to report to the Funding Agency, regarding EMP compliances during operation stage.

Responsibility of Environmental Specialist (EMP Implementation) of EMU;

The main duties of the Environmental Specialists will include:

- Collection and dissemination of relevant environmental documents including amendments to environmental protection acts issued by the Government and various agencies such as the World Bank and other organisations.
- Co-ordination with non-government organisations (NGOs), community groups, government departments, etc. on environmental issues and obtaining the necessary clearances from the regulatory authorities.
- Monitoring the environmental aspects of the project during construction to ensure that the environmental requirements of the contract and the mitigation measures proposed in the EMP are implemented.
- Development of guidelines or a code of good practice on low-cost environmental measures that can be implemented in the railway construction and maintenance programs for the PIA.
- Development of environmental training activities for contractors and supervisory consultants staff.
- Assistance to local governments in the restoration of the environmentally degraded portions of any existing Right-of-Way, which may revert to their control due to the construction of realignments.
- Promotion of the policies adopted for the development of aesthetics of stations, Depot & along rail alignments.

- Coordinating with the EO of PIA and report to GM (L&PC) on all matters related to implementation of the Environmental Management Plan.
- Laison with institutional stakeholders such as Forest Dept., Pollution Control board, Ground Water Dept., Urban Local Body, Lake Authority etc., for approvals and smooth implementation of Environmental Management Plan.
- Issuing completion certificate for constructed railway works (Stations, Deports & suburban Railway alignments) for payment.

Responsibility of Environmental Specialist (Health & Safety) of EMU;

The main duties of the Environmental Specialists will include:

- Collection and dissemination of relevant health and safety documents issued by the Ministry of Railways and other funding agencies such as the World Bank, KfW and other organisations.
- Co-ordination with non-government organisations (NGOs), community groups, government departments, etc. on environmental health and safety issues and addressing suitable manner.
- Advising the Engineer and preparing the environmental health and safety inputs for the monthly progress report.
- Development of guidelines or a code of good practice on low-cost environmental health and safety measures that can be implemented in the railway construction and maintenance programs for the PIA.
- Development of environmental training activities for contractors and General Consultants staff.
- Assistance to local governments in the restoration of the environmentally degraded portions of any existing Right-of-Way, which may revert to their control due to the construction of realignments.
- Assistance with the rail safety components (Stations, Deports & suburban Railway alignments).
- Ensuring and reporting of construction health and safety, labour health and safety and community health and safety as per WB's Environmental Health and Safety guidelines at railway construction site, stations, Depot, sub-stations and project associated facilities such as batching mix plant, disposal sites, etc.,

General Consultant (GC): The PIA will get the EMP implemented through the General Consultant (GC) appointed for managing engineering and construction related activity. The PIA will deliver the responsibility of the implementation as per the contract agreement. In order to effectively discharge the duties GC will have an Sr. Environmental Specialist /Officer in the project management unit. The Sr. Environmental Specialist /Officer will work for a full time basis at the site office. The environmental Specialist /Officer must possess minimum 3 years experience in the environmental management of suburban or metro or likely projects. The GC will monitor periodically the EMP implementation activities and its compliance and review monthly reports of Contractor;

The GC will review and approve the Environmental Compliance Report (ECR) submitted monthly by the contractor and forward the ECR to PIA after approval.

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Project Contractor: Project contractor will implement the EMP measures, enhancement measures and measures as directed by PIA and GC. The responsibility to implement the EMP measures will be built in to the contractual agreement. The contractor shall submit a monthly progress report to the GC in compliance to the environmental mitigation measures mentioned in EMAP.

Ministry of Environment, Forests & Climate Change: The Ministry of Environment, Forests & Climate Change (MoEFCC) is the nodal agency in India to plan, promote, co-ordinate and oversee the implementation of environmental and forestry programmes. Principal activities undertaken by the Ministry of Environment, Forests & Climate Change consist of conservation & survey of flora, fauna, forests and wildlife, prevention & control of pollution, afforestation & regeneration of degraded areas and protection of environment, in the frame work of legislations.

Authorities will be consulted and reported as per the Acts and Rules. All the activities of the proposed Project including its execution and operation will have to comply with the present environmental regulations by MoEFCC and their amendments from time to time and to submit the compiance repots, as required by Ministry. There will be no specific and direct involvement of the Ministry in EMU.

Central and State Pollution Control Boards: Central Pollution Control Board (CPCB) is a statutory authority attached to the MoEFCC and located in New Delhi. The main responsibilities of CPCB include inter alia the following.

- Plan and implement water and air pollution control programs;
- Advise the Central Government on water and air pollution control programs;
- Set air and water standards; and
- Co-ordinate with the State Pollution Control Boards.

Karnataka State Pollution Control Board (KSPCB) is the regulatory body in the state of Karnataka to enforce various environmental legislations of the Government of India. While regulatory powers are delegated to KSPCB from CPCB, the administrative control of the board rests with the State Environment and Forest Department. More specifically, the functions of the board are listed below.

- Implementing the provisions of EP, Water and Air Acts
- Advise State Government in respect to suitability of particular area for industrial development
- Assess the quality of environment in terms of ambient air and water quality through monitoring
- Issue and enforce consent orders for industrial pollution control
- Oversee, supervise and regulate water, air, solid, bio-medical and hazardous waste management in urban areas

In performing the above duties the board is headed by a Chairman who is supported by a Member Secretary and a Chief Environmental Engineer. The Chief Environmental Engineer is supported by District Environmental Engineers in each District of the state.

KSPCB will be the key agency for monitoring and ensuring the implementation of the various environmental regulations applicable to the project. In addition to issuing consent to establish to the project, the agency will also be responsible for the monitoring of implementation of EMP and its

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implications and to submit the compiance repots, as required by SPCB. However, there will be no specific and direct involvement of the PCB in EMU.

Karnataka State Forest Department: Karnataka State Forest Department is a nodal agency which is authorized to conserve and protect forest and wildlife of the State. As pet the Forest Act and Karnataka tree preservation act, the department has delegated powers to process Forest clearance and accord tree felling permission. The department has a responsibility to monitoring and ensuring the implementation of the regulations with respect to forest and preservation of trees applicable to the project.

10.7. Training

To ensure effective implementation of the EMP, environmental, health and Safety training will be provided by engaging third party independent consultant to staff involved in the project management, engineering supervision, K RIDE and project workers during construction phase. The training during construction phase will be conducted before commencement of the construction and focus on:

1) National, local and International (including compliance with lenders' E&S standards) regulations on environmental protection;
2) Good management practice related to minimize environmental impact;
3) Related requirements of environmental, health and, safety (EHS); and
4) Environmental mitigation measures included in the EMP.

During operation stage, K RIDE will incorporate environmental protection into its management system and provide staff training on Environmental Management System (ISO 14001) and Occupational Safety and Health Management System (OSHMS), in compliance with the lenders' standards.

The training for engineers, managers and workers will be imparted by K RIDE on regular basis to

- Monitor implementation of approved EMS by Contractor
- Monitor environmental status during operation and
- Monitor disaster management during operation.

The cost is estimated to be ₹ 12.20 Lakhs for each corridor as given in **Table 11.6.** The curriculum for all the corridors will be same. One Assistant Environmental Engineer for each corridor (is considered and cost is distributed equally among the each corridor).

10.8. Grievance Redressal Mechanism in BSRP

Grievance Redressal Cell shall be set up to mitigate, manage, and resolve potential or realized negative impacts, and to ensure that the project proponent (K RIDE) meet their obligations in terms of international human rights law. GRM enables project proponent to learn about and resolve concerns related environmental and social aspects including implementation of mitigation measures, ensuring workers and community health and safety, payment of compensation, resettlement and rehabilitation, restoration of loss of livelihood activities, assistance to the vulnerable people, replacement of common property resources, etc., as stated in the Environmental Management Plan (EMP) & Resettlement Action Plan (RAP) before they escalate. GRMs should permit a peaceful and timely resolution of problems, assuring stakeholders that their concerns have been heard and that the institutionalized mechanism will yield a fair and impartial outcome.

All grievances related environmental and social issues (implementation of EMP measures & compensation for land and resettlement assistance) will be addressed by the General Manager (Land & Project Co-ordination), K RIDE. Grievances received at the corporate office of K RIDE, will be sorted according to subject matter and will be informed the respective offices/agencies to resolve it.

Labour grievance mechanism shall be developed during construction phase to resolve the labour issues, health and safety issues as per applicable regulations. The representatives from the Contactor, labour, General Consultant and K RIDE form the parts of Labour Grievance Unit.

Grievance redress will be carried out at two levels: namely first level and the appellate level. Grievances of affected persons will be first brought to the attention of K RIDE (through contractor, Environmental and social field officers of K RIDE, Environmental monitoring consultant, Resettlement Plan implementation Consultant, etc.) and land acquisition office, KIADB. At this level, the time taken to address a matter may vary from 15 days to one month, depending on the matter. Land related cases take longer than one week as it may require providing legal documents, change of alignment or dropping the properties from acquisition etc. All these matters require consultation with planning and design section, before a decision can be reached, thus the process can extend up to a month.

In cases where the affected person is not satisfied with the decision of the land acquisition office or the field level office / corporate office of the K RIDE, the person can approach the Grievance Redress Committee (GRC). The GRC will convene within 15 days of receiving the matter. The grievance redress process is given in **Figure 10.5**. The composition of the GRC is:

Director (Projects and Planning),	Chairman
General Manager (L & PC)	Convener
General Manager (F & A)	Member
Chief Public Relations Officer	Member
Tahsildar	Member
Community Representative (PAP - Male)	Member
Community Representative (PAP – Female)	Member
Team Leader of Resettlement Plan Implementation Consultant	Member
*Team Leader of Environmental Monitoring Consultant	*Member

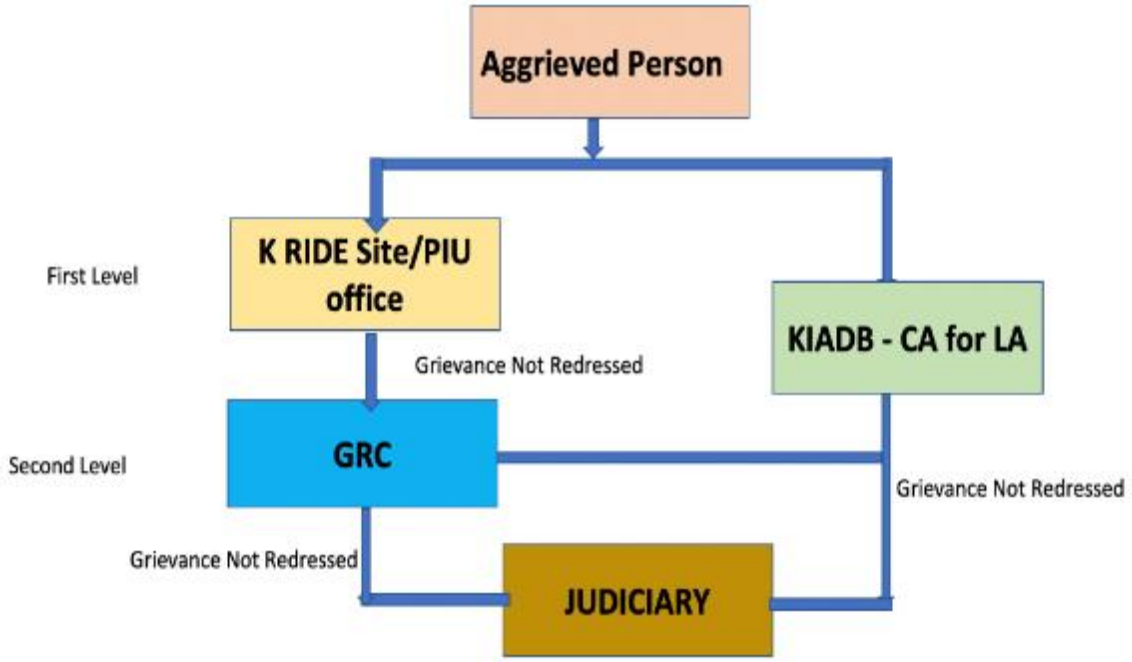

Figure 10.5. Grievance Redress Process

The main responsibilities of the GRC are:

- to provide support to affected persons on problems arising out of eligibility provided entitlements compensation and assistance provided;
- to record the grievance of the disadvantage community & PAPs and resolve them within the stipulated time frame;
- to report to the aggrieved parties about the development regarding their grievances and decision of K RIDE and
- address problems and complaints arising out of land acquisition and relocation of utilities.
- Address environmental, health and safety issues and complaints raised during construction phase
- K RIDE shall monitor overall activities of GRC.

10.8.1. Registration of Grievances

Grievances can be submitted as the written application in English or Kannada at the K RIDE field office, corporate office, or land acquisition officer. Careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. The Project Implementation Authority (PIA), K RIDE will have the overall responsibility for timely grievance redress on environmental & social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party. The aggrieved person also has the option of opting for judicial review/intervention by the courts at any point in time.

The project may be established a grievance redressal cell at PMU headed by a Public Relation Officer solely responsible for handling the grievance of the people. The team will be responsible for directing the aggrieved person to the concerned official through appropriate mode of communication. On receiving any complaints, a unique number may be generated (MIS based) which will be the reference number for the caller, and s/he can trace the progress of his/her grievance / query through that number. Any complaint lodged will be addressed within 15 days of receiving the complaint in general and non-risky situations. Immediate corrective action shall be taken under emergency situations.The system may have escalation matrix, i.e. if the grievance / query remains unattended or there is no response from the concern officer for a specified period of time than the system will escalate the grievance / query to the next level and the notification will be sent to the Public Relation officer and the petitioner.

The project will also commit itself to proactive disclosure and sharing of information with the key stakeholders, including the communities/beneficiaries. The Disclosure/ sharing of information is concerned with information on grievances/ complaints received, progress & results. The environmental monitoring and resettlement plan implementation consultants (would be appointed by K RIDE) staff will be responsible for assisting illiterate community members and other stakeholders in registering their grievances.

10.8.2. Process Flow of Grievance Redressal Mechanism

The grievance redress mechanism will be planned around the following process flow.

- **Step 1:** Public Grievance is received by the redressal officer at field level or PMU and the officer will enter the details of the complainant.
- **Step 2:** A confirmation will be sent through auto generated SMS, with a reference number to the person on receipt of the complaint.
- **Step 3:** Once the complaint is registered, the concerned officer/consultants will receive an SMS notification, with a deadline of 15 days to resolve the grievance. The public relation officer will monitor the complaint status by option of choosing the following actions:

  1) View (Complaint will be viewed)
  2) Action (what are the actions that have been taken to resolve the complaint)
  3) Assign / forward (the action will be forwarded)
  4) Resolve (The Problem is solved in the stipulated timeperiod)
  5) Escalate (The complaint will be escalated to the appropriate authority)

- **Step 4 - Taking Action:** A window of 15 days will be provided to the field level officers of K RIDE/consultant/Contractors site representative concerned to resolve the issue and submit their responses. In case of non-response, SMS alert will be issued to remind the officers about the action pending.
- **Step 5 - Resolving the grievance:** Once the grievance is addressed and updated information is placed in the software, the grievance is labelled as resolved. An SMS will be accordingly issued to the complainant. If any grievance is not resolved within 15 days an SMS alert will be issued to the Public Relation Officer, PMU and the concerned officer will take appropriate action (elevate the same for the consideration of GRC) to solve the grievance.

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- **Step 6 - Meetings and decision-making process of the committee:** It is suggested that grievance committee shall meet regularly (at least twice in a month) on a pre-fixed date. The committee will fix responsibilities to implement the decisions of the committee. This will not only help proper assessment of the situation but also in suggesting corrective measures at the field level itself. The committee shall deliver its decision within seven days of the sitting.

10.8.3. Functions of GRC

It includes complaint handling system at Field level and GRC at PIA . Functions of the GRC include Field level complaint handling system; and Meetings and decision-making process of the committee with in time required action. The complaints received from community members and other stakeholders of any concerns or complaints, or grievances should be taken up in the grievance redressal process. The concerned officer should maintain a register of all petitions received with details of date of receipt of the petition, the date of hearing, if any, date when it was considered by the committee, along with nature of complaint/concern, action taken, and date of communication sent to petitioner. Communication in writing should be sent to the aggrieved person about the date, time and venue of the GRC sitting and make it known that s/he is entitled for personal hearing and that representation through the proxy will not be entertained. Communication will also be sent through Environmental & Resettlement Plan Implementation Consultants so as to ensure that the petitioner is informed about the date of GRC sitting.

Copies of petitions received 1-week prior to the committee's sitting should be sent to the Chairman and the member along with an explanatory note from appropriate authority and/or environmental and resettlement plan implementation consultants, as the case may be, to enable the Chairman and member to scrutinize the petitions in detail. Petitions received during the week of the committee's sitting, shall be taken up during the sitting and resolved.

10.8.4. GRC Response

The GRC will hear grievances once in 15 days. The GRC will inform the complainant of their decision within three days of the hearing of the grievance.

There is no cost involved in approaching the project authorities or the GRC in registering grievances. The grievance redress mechanism is accessible to not only the affected persons, but the community as a whole.

Detail address of Grievance Redressal Officer is given below.

Rail Infrastructure Development Company (Karnataka) Ltd.,

"Samparka Soudha", 1st Floor, (Opp. Orion Mall),

Dr. Rajkumar Road, Rajajinagar 1st Block,

Bengaluru – 560 010,

Karnataka.

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Since the project is in design phase, only K RIDE office address has been given for submitting the Grievances. As and when the project progress, more channels of communications will be provided such as Email Id, Toll free number, Whatsapp /Telegarm number, Facebook, Instragram, twitter, etc.,

10.8.5. Internal Grievance Redressal Mechanism

Internal Grievance Redressal Cell shall be implemented by Contractor to handle grievances of Construction Workers at site and Employees at Office level. Similarly, Employees' grievance shall also be managed by GC and PIA, K RIDE via Internal Grievance Redressal Mechanism. Following strategies are implicated in the Grievance Redress Mechanism. Grievance Redressal Cell shall remain same as mentioned earlier.

10.8.5.1. Grievance Management of workers and Employees

Employee Grievance is a formal complaint raised by an employee against a fellow employee or manager, or even against the employer. Employees usually file grievances for workplace harassment, discrimination, nepotism, concerns regarding team management or regarding terms of the employment.

Employee grievance refers to the discontentment of an employee with the corporate and its management. A company or employer is expected to provide an employee with a safe working environment, clear knowledge of job responsibilities, adequate compensation, respect etc. However, employee grievance is caused when there is a gap between what the employee expects and what he receives from the employer.

Employee grievances may or may not be justified. However, they need to be tackled adequately by the leadership team because they not only lower the motivation and performance of the employee but also affects the work environment. Employee grievances if left unchecked can lead to large disputes within the company. It can also drop the motivation levels of other employees. Any company must have a proper channel for employee grievance redressal.

Employee Grievance should be handled in a proper and well defined manner. If an employee voice is raised or someone reports a matter associated with a policy or one thing he or she isn't pleased with or needs to criticism against, a framework outlined in policy ought to be used.

Complaints or Grievances can be submitted as the written application in English or Kannada at the Employer's Office by the Complainant. The Complaint or the Grievance Application should include Complainant's Name, Address, position/Designation, Date, time and details of grievance event, source of grievance, grievance causative person with his Designation and other details, if any. The complaint should be submitted to the concerned and designated person in the Employer's Office along with needed documents such as photographs, letter, or videos, etc.

The Complaint Register should be maintained in the Employer's office with designated person to register complaints/grievances. The complaint registering person should document the complaint with all details including Complainant's Name, Address, position/Designation, Date & time of receiving complaint, location of the problem area/section/Department, Date, time and details of grievance event, source of grievance, grievance causative person with his Designation and other details, if any and mention the action to be taken by the concerned person, and Date and time required to address the complaint. The acknowledgement should be given to the Complainant.

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At the next level, the complaint details should be immediately passed on to the concerned person for necessary action along with required Date and time to close the complaint. Any complaint lodged will be addressed within 15 days of receiving the complaint in general and non-risky situations. Immediate corrective action shall be taken under emergency situations. Complaint or Grievance may be resolved through verbal or written actions or through communication or other actions, as required. When once the issue is resolved, the details of action taken, date and time, the satisfaction of the Complainant, etc. should be recorded in the Complaint Register. The system may have escalation matrix, i.e. if the grievance / query remains unattended or there is no response from the concern officer for a specified period of time than the system will escalate the grievance / query to the next level and the notification will be sent to the Public Relation officer and the petitioner.

The Employer direcly or indirectly related to the Project will have the overall responsibility for timely grievance redress on environmental & social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party. The aggrieved person also has the option of opting for judicial review/intervention by the courts at any point in time, if the issue is not resolved properly. Whenever required, the Complaint Register along with other documents may need to be submitted to the internal or external Auditors during Inspections.

Flow Chart may be followed as given under Section 8.5.2, with slignt modifications, if required.

These are the most common grievances in the workplace include:

- **Workplace Harassment**: This includes bullying, discrimination and micro-management. Not everyone in your team will get along all the time. Friction is likely to occur. But that doesn't mean you shouldn't ignore it or dismiss it as a common occurrence. Let your employees know that such behavior is not tolerated.
- **Compensation**: Employees might sometimes feel that their work deserves a higher pay. There can be issues wherein they think they should receive the same compensation as someone else. Or could be about reimbursements.
- **Workload and employee burnout**: When employees end up doing more work than they were initially expected to, most likely because of taking up the work of a resigning/terminated employee., or staff redundancy. They are often frustrated wondering how this would benefit them.
- **Work conditions**: Cleanliness and safety are the two most important things your employees will be concerned about.

Effectively handling Employee Grievances:

- **Have an informal chat with disgruntled employee**: Have a small discussion with the employee to understand where exactly the issue is stemming from. It is essential to make them feel heard. If the employee still insists on pursuing a formal grievance procedure, written statement can be requested and action can be taken.
- **Set up a Grievance Redressal system**: Employees should know that they can voice their concerns. Grievance policy should be in place accessible by all the employees. Employees should know point of contact or communication and confidentiality should be assured. Most importantly, a timeline shall be provided to act on the grievances.

- **Acknowledge the issue**: When someone has an issue, the most important thing is to make them feel heard. The solution may not be handy, but it is necessary to let them know that the issue will be taken care of, in a fair, transparent and timely manner.
- **Grievance investigation**: An investigation committee should be set up to address the concerns of the employee. Incident should be enquired and employees should be communicated properly, if necessary and employees should be allowed to provide evidence for their claims.
- **Take an informed decision**: After inquiry and evidence submission, a thoughtful and informed decision should be undertaken. Decision can be taken to accept (full or partial) or reject the claims entirely. No verbal decision should be made. The decision should be in writing and steps should be given on how the employee should handle such a situation henceforth.
- **Provide scope for appeal**: If the employee is unhappy with the decision of the committee, they should be given a chance to appeal. The appeal should be acknowledged and parties who were not a part of the initial decision should also be included. The evidence should be shared with them, helping them to take an unbiased decision.
- **Take care of the root cause**: It is important for employers to ensure that the issues do not repeat themselves. As a result, the root cause should be identified and uprooted entirely.

10.8.6. Handling/Management of Supply Chain Workers

Social risks in supply chains are anything that could impede human rights, welfare and safety, or community development. Contractors should also engage in public-private partnerships or multi-stakeholder initiatives that harness collective attention and resources to grapple with these broader challenges to industry.

Strategies for construction workforce management -

1) Collaborating and communicating properly with workers.
2) Applying Technological Means for Management, Data collection and Analysis
3) Recruiting qualified workers
4) Motivating of construction workforce.
5) Handling logistics properly.
6) Improving workplace safety.
7) Addressing Underperformance Issues
8) Caring about the health of the workers.
9) Managing manpower properly.
10) Managing on-site disputes wisely.
11) Optimize workday.

Applicable laws and Acts for Supply Chain Workers :

International Labour Organization (ILO), the Factories Act, 1948, The Occupational Safety, Health and Working Conditions Code, 2019, Social Security Code, 2020 and the Industrial Relations Code, 2019 and the Wage Code, 2019 and wage related laws such as the Minimum Wages Act, 1948; the Payment of Wages Act, 1936; the Equal Remuneration Act, 1976; the Payment of Bonus Act, 1965 along with the Indian Labour Conference ("ILC") in 1957 and reiterated in the 44th and 46th ILCs in 2012 and 2015.

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Child Labour: (Similar as presented under Section 8.5.1.4 – Same repeated here) Child labour Age is up to 18 for developing countries,– Labour Rights and up to 18 as per ILO standards for hazardous work (C 138 - Minimum Age Convention, 1973 (No. 138)]. The Child Labour is totally prohibited in the project. No child under the age of 14 shall be employed or permitted to work in any sort of works related to project, as per the Child Labour (Prohibition and Regulation) Act, 1986. Whoever employs any child or permits any child to work in contravention of the provisions of Section 3 shall be punishable with imprisonment for a term which shall not be less than three months but which may extend to one year or with fine which shall not be less than ten thousand rupees but which may extend to twenty thousand rupees or with both, as per Section 14 of the Child Labour (Prohibition and Regulation) Act, 1986. If the Contractor is found guilty of breaching the Act, he shall be treated as per the Child Labour (Prohibition and Regulation) Act, 1986 and the relevant procedure shall be followed by the K RIDE.

Forced Labour: Vulnerable Forced labour and specifically debt bondage may be the case while supply chains employ migrant workers. As conflict, climate change and soaring food and energy prices drive higher numbers of people into poverty, the risk of forced labour is also increasing in low or middle income group of community. Contractor should be able to identify forced labour risks in their supply chains or take adequate steps to address such risks.

Forced Labour Risk Assessment: This step involves doing a due diligence on different aspects of labor rights compliance. These aspects may include:

- Presence of management systems for internal and supply chain labor rights compliance
- Labor relations and legal history
- Fair Wages
- Working hours
- Equal Employment Opportunities
- Social Security and Welfare
- Health & Safety
- Child & Forced Labor
- Employee Unions

Human rights abuses — such as forced labor, a form of human trafficking or modern slavery, shall be totally banned in the BSR project. Human rights of forced labour are respected and required actions shall be taken in favour of forced labour, in case any malpractice is noticed.

Fixed Weekly working Hours : As per ILO conventions, fixed working hours shall be 10 hours in any 24 hour period and 77 hours in any 7 day period or weekly working hours of 48 hours or less. Hours of rest may be divided into no more than 2 periods one of which shall be at least 6 hours in length. These limits serve to promote higher productivity while safeguarding workers' physical and mental health.

Occupational Health and Safety of Supply Chain Workers:

- **Awareness**: Workers will need to strengthen their awareness of risks, preventing accidents, and making their tasks safer. Managers and Supervisors will also need a strong understanding of current operations and the associated risks. Adopting required measures in place to create a safer environment is only the first step in a long process. Consistent mindfulness is necessary to continue that safety day-to-day.

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- **Right reporting system**: The right reporting system allows workers to point out a problem, share it with the community, and take action. Other workers can avoid a hazardous area, for example. The proper protective gear can be issued or assigned. Maintenance and clean-up crews can take action faster and know where they're needed. All of these teams work together to improve general safety. Communication and Adopting Safety Culture need to be practiced.
- **Leveraging Technology**: By leveraging technology a physical commitment is made to safety while helping to empower workforce at the same time. The system will notify a person when there's a potential danger, giving him ample time to take action or be more mindful of the situation. In a way, it automates and democratizes safety culture, but there's definitely something to be said about the reliability of the related systems. Contractors must continue to maintain these technologies so that the workforce knows they're indeed trustworthy and working as intended.
- **Securing the Resources**: Depending on the environment, safety culture may also require physical resources like personal protective equipment, cleaning supplies, new components or parts, and so on. It's imperative for Contractors to secure the budget for such a thing, but also to secure the resources too. For supply chain safety, in particular, there should be a dedicated team for this. They should regularly assess risks and threats and then work collaboratively with live teams to take action.
- Out-dated or damaged gear should be replaced. Malfunctioning equipment should be serviced promptly, or replaced. Dangerous conditions should be dealt with, as soon as possible, and making sure the related supplies are available should be up to the safety task force. Most importantly, these teams should work in tandem to secure proper safety for all, not independently.
- **Creating Fail Safes**: Contractor should consider how safety is handled with automated machinery or equipment. A machine itself is generally inspected and serviced, but also there's usually a failsafe in place. That could be a rail or guide that engages seconds before a disaster. Or, it could be a program built into the software to power down the machine at a moment's notice.
- Fail safes are designed to be the last line of defence in the safety culture. Analysis shall be made on do the Contractors have people in place to monitor a dangerous situation and alert everyone involved? What kind of fail safes do you have in place for your operation? Are there devices, technologies, or roles you can implement to reduce accidents or risk? All those fail safes should be identified, analysed, rectified wherever needed and implemented in adherence with related policies and procedures.
- **Safety Culture Practice**: Safety culture needs to be practiced by everyone in the working team - from the executive team to the supply chain floor. Everyone should understand what's required, how to secure their safety, and how to protect each other. From there, it's about putting the policies, hardware, and resources in place to preserve that safety, all while maintaining it and keeping everything in good working order. It just highlights how important safety really is in the grand scheme of things and goes to show just how much of an impact it can have on standard operations.

10.8.6.1. Risks and Impacts of Supply Chain Workers

Along with other fatal impacts, the aftereffects of the pandemic COVID-19, there was scarcity of labours in supply chain system from the year 2020. It has resulted in Labour uncertainty, self-restriction of dis-satisfied labour to work, delay and disrupted vital processes of serving and delivering, manufacturing, marketing and operations, distribution and delivery. It is getting improved these days. Flexible manufacturing systems or optimized production technology have been adopted for a stable supply-chain.

It has already exposed the vulnerabilities of many global organizations, especially those such as Contractors in Indian Infrastructure Projects like BSRP, who have a high dependence on supply-chains to fulfil their need for raw materials or finished products.

Post COVID-19 impacts on Supply Chain : These include the following:

- Direct impact on manufacturing and retail;
- Procurement and supply chain disruptions;
- Disruption leading to increase in inflation;
- Impact on delivery timelines and consequent delay re-negotiations;
- Stability of business;
- Labour and human resources management, to name a few.

Impacts on Construction Contracting Companies due to supply-chain disruptions :

Impacts are categorised as Short term and long term impacts. Following are the impacts addressed :

Short term impacts

- Unstable supply sources with global disruptions, considering for alternate supply sources;
- Increase in the lead time for customer deliveries;
- Cancelation or limiting new customer orders/ adapting to changed consumer behaviour;
- Re-negotiating customer contracts;
- Re-integrating of geographically diverse manufacturing and logistics sources;
- Implementing disaster recovery plans.

Long term impacts

- Alteration of entire design of the supply chain, anticipating deep risks.
- Adapting greater geographical diversification, critical onshore functions for imports relying on warehousing and logistics.
- Implanting automated technologies such as robotics to reduce the risk of production and transportation epidemics.
- Implementation of more pragmatic approaches to lean supply chains and just-in-time inventory management.
- Cultivating technology based approach as opposed to process based.

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Mitigation Measures:

Gaps in the Supply Chain shall be compensated with an efficient and tightly controlled inventory management system.

The ISO 28000 standard provides a best practice framework to reduce risks for people and cargo within the supply chain. It helps manage and mitigate potential security within the logistics area, targeting threats such as terrorism, fraud and piracy.

Technological advancement and adaptation to the newest equipment and techniques available had making way. The planning included:

- Material Requirement Planning,
- Flexible Manufacturing Systems,
- Inventory management

The following vital tools and the principles of best practice shall be followed by the Supply Chain system to support profitable growth and build or maintain a competitive advantage.

- Integrating supply management systems
- Creating tools for clarity and collaboration
- Supporting improvements in supplier performance
- Suppressing cycles and maximising inventory yield
- Collating and analysing meaningful data
- Scalable solutions

Other than the above practices, the following supply-chain solutions are weaved in future delivery systems for the BSRP :

10.8.6.2. Alternate Sources of Supply

Primary suppliers are undergoing logistical issues. Organizations are hedging risks by seeking alternate sources of supply of products. Some of these alternate sources, could be smaller set ups requiring support themselves.

Technology has introduced flexibility and operational logistical issues are being outsourced to third party suppliers. Adapting to digital supply chain management practices involving predictive analytics, real-time productive planning, clean-sheet models for warehousing/transportation/inventory used for managing targets will replace the traditional ways. Global Logistic companies are increasing their use of digital technologies, to boost to track movement closely with real time data.

Costs can be contained by keeping the alternate sources of labour or suppliers close to the place of business.

10.8.6.3. Third Party Supply Chain

A third party supply chain involves a separate entity / service provider to assist with one of the crucial steps in the supply chain. Now-a-days third party organisations are solely responsible for organizing supply of raw materials or finished products and are providing warehouse storage facilities.

Warehousing business has several compliance and legal adherence protocols which can be to a degree met with ease by entities in the business of logistics and warehousing. With labour stability being challenged in India, data management and securitisation becomes imperative for logistic companies.

10.8.6.4. Delivery Business Models

An important aspect of labour in the post COVID -19 pandemic era will be dependence on policies of contact-less delivery and contact tracing for staff. This helps in avoiding any disrupts in the supply chain.

10.8.6.5. Product scheduling and staggering shifts

The concept of product scheduling helps determine which products need to be prioritized in the event there is acute raw material and labour shortage. This eases the strain on the current limited workforce to deliver only the prioritised products instead of all.

Technology based payment systems will have to be integrated into the system. A staggered shift pattern arranges shifts of employees to arrive at different times. Both of these methods, if applied together with a large work-force employed to constantly rotate shifts – stabilizing the function would be possible.

Pandemic management through workforce requirements, having preventive health protocols of tying up with a health centre for easy access Medical Doctor, quick health check-up kiosks on site, sanitization exercise undertaken at regular frequencies, educating workforce on guidelines to be followed in event of ill health.

10.8.6.6. Transportation

Since trucking is the most common form of transportation in India, alternatives like rail can also be relied upon for cargo.

10.8.7. GRM during Covid-19 & Omicron Pandemic Situation

Covid-19 and Omicron pandemic has severely affected the global economy from the year 2020 onwards. Many countries imposed lockdown to regulate the spreading of the virus to its people. Still the situation is grim where many countries are fighting against it. Recently World Health Organisation has cautioned the world on increasing cases in European and Central Asia countries. Again, spreading of Covid-19 or Omicron viruses cannot be ruled out in India. In such cases, if lockdown imposed by State Govt., project authority should come up with mechanism to receive the grievances in online and address the same through either telephone discussions or virtual meetings.

10.8.8. Community Participation during Project Implementation

The Community Participation during Project Implementation is considered part of GRM to understand the local problems and to get local opinion and suggestion regarding the implementation of the project. The effectiveness of the Environmental Management Plan & Resettlement Action Plan (RAP) is directly related to the degree of continuing involvement of those affected by the project. Several additional rounds of consultations with PAPs will form part of the project implementation. EMP measures will be implemented in close coordination with public, local public and NGOs. Consultations during resettlement plan implementation will involve providing support for PAPs to receive compensation and resettlement and rehabilitation assistances. Another round of consultation will

occur when compensation and assistance are provided. During public consultations, issues related to environmental health and safety issues, land acquisition, compensation, income restoration, employment generation, information flow, grievance redress, safety, role of administration etc will be discussed. The EMP & RAP addresses all issues raised during public consultation and recommends institutional strengthening measures as well.

The following set of activities will be undertaken for effective implementation of the plan:

- Project Implementation Authority (PIA) will conduct information dissemination sessions in the project area and solicit the help of the local community/ leaders and encourage the participation of the project implementation.
- Consultation and focus group discussions will be conducted with the vulnerable groups like women, families of BPL, Scheduled Castes to ensure that the vulnerable groups understand the process and their needs are specifically taken into consideration.
- The Project Authority will organize public meetings and will appraise the communities about the progress in the implementation of project works and payment and assistance paid to the community. Regular update of the program of environment and social components of the project will be placed for public display at the project offices.
- Taking into consideration the risks of HIV/AIDs during the project construction period and road safety issues.

Stakeholder Engagement Plan (SEP) for the project has been prepared considering environmental and social stakeholders; and has been incorporated as part of Social Impact Assessment.

10.9. Environmental Management Action Plan (EMAP)

Environment Management Unit (EMU) is intended to facilitate implementation, tracking and reporting on Environment Management Action Plan and Environment Monitoring Plan proposed for the project. The Environmental Management Action Plan (EMAP) is the synthesis of all proposed mitigation and monitoring actions, set to a time-frame with specific responsibility assigned and follow-up actions defined. It contains all the information for the proponent, the contractor and the regulatory agencies to implement the project within a specified timeframe.

The main objectives of this EMAP are:

- To ensure compliance with Funding Agency's applicable safeguard policies, and regulatory requirements of Karnataka and India;
- To formulate avoidance, mitigation measures for anticipated adverse environmental impacts during construction and operation, and ensure that socially acceptable, environmentally sound, sustainable and good practices are adopted; and
- To stipulate monitoring and institutional requirements for ensuring safeguard compliance.

This EMAP consists of a set of mitigation, monitoring and institutional measures to be taken for the project to avoid, minimize and mitigate adverse environmental and social impacts and enhance positive impacts. The plan also includes the actions needed for the implementation of these measures. The major components of the Environmental Management Action Plan are:

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- Identification of potential impacts for each environmental components;
- Proposing appropriate mitigation measures which is proven as per local and international standards
- Environmental monitoring and monitoring of EMP implementation during project implementation and operation to mitigate potentially adverse impacts;
- Identification of executing and supervising organization/authority for the proper implementation of proposed mitigation measures.

Identification of potential Impacts with appropriate mitigation measures and roles and responsibilities of the organisations/ authority for Implementation of Environmental Management Action Plan (EMAP) are summarized in **Table 10.2.** Environmental Monitoring Plan (EMoP) for construction and operation phase with other particulars is given in **Table 10.3** and **Table 10.4**. The budget/cost estimate are provided separately in **Table 11.9** under Chapter 11. A typical EMU organization chart is depicted in **Figure 10.4**.

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Table 10.2. Environmental Management Action Plan (EMAP)

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
Design Phase								
D.1	Land acquisition, Displacement of people and private property acquisition and related impact on environmentally sensitive areas	Project Corridors - Wherever existing RoW is less than proposed RoW	Alignments are designed to utilise Government and Indian Railway lands to the maximum and to avoid or minimize impacts on private land or properties, in accordance with Land Acquisition Act, 1894 and Rehabilitation and Resettlement Act, 2013 and WB ESS 5 and EIB Standard 6. Accordingly, RAP is prepared including (i) the analysis of number, status, eligibility of PAPs and related mitigation measures following lenders standards, (ii) consultation activities with community members, including discussion of corrective and remedial actions with the PAPs (iii) GRM's availability. EMAP are prepared to minimize, mitigate and control the potential environmental impacts during various project phases.				Design consultant & Special Deputy Commissioner, KRIDE.	PIA, K RIDE
D.2	Change in Land Use and Impact on land	Project Corridors	The compensation for land is detailed in Social Impact Assessment Study Report. Impact on Private land comprises of residential land, commercial land and vacant land. As per RAP notice shall be given in advance to the encroachers (and squatters, if any) present in the Corridor of Impact, who need to be relocated. All R and R activities shall be undertaken as per the relevant acts and also comply with WB's ESS 5 and EIB's ESS 6. Entitlements as per K RIDE entitlement framework shall be completed before the commencement of construction.				Special Deputy Commissioner, KRIDE & PIA, K RIDE.	PIA, K RIDE
D.3	Impact on Forest Land	Akkupete Depot site near Devanahalli	Identification of forest land for Akkupete Depot. Clearing of vegetation at proposed Akkupete depot site shall be undertaken	There are no diversion of forest land in Corridor 2, 3, and 4.			Design consultant & Bengaluru Rural Forest Division	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
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			manually through Bengaluru Rural Forest division as per statutory guidelines laid out under Karnataka Preservation of Tree Act, 1976 and amendments and Forest Conservation Act, 1980. Compensatory afforestation and its maintenance for loss of trees will be undertaken by Bengaluru Rural Forest division as per these above Acts/guidelines. Tree Management Plan is prepared in accordance with the Forest					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			(Conservation) Act, 1980 and in compliance with WB ESS 6 and EIB Standard 4.					
D.4	Impact on Biological/Ecological Environment	Project Corridors and Depots	Transplantation of trees shall be carried out by the BBMP Forest Wing and Forest Authority in consultation with K RIDE. Tree removal shall be carried out in accordance with the Karnataka Forest Act, 1963 (Karnataka Act 5 of 1964) amended with Karnataka Forest Rules, 1969, The Karnataka Preservation of Trees Act, 1976 and The Karnataka Preservation of Trees (amendment) Act, 2014, Forest Conservation Act 1980 and ESS 6 of World Bank and ESS 4 of EIB. Compensatory afforestation and its maintenance for loss of trees will be undertaken by Bengaluru Rural Forest division as per these above Acts/guidelines. The Forest Department will be responsible for the Afforestation Programme and Tree Maintenance during project implementation.				Bengaluru Rural & Forest division & BBMP	PIA, K RIDE
D.5	Impact on Flora and Aquatic Bodies causing loss of trees and water bodies	Throughout the corridor	Alignments are designed to avoid or minimize impacts and are in line with ESS1 and ESS 6 of World Bank and ESS 1 & 4 of EIB and The Karnataka Preservation of Trees Act, 1976 and amendments and Karnataka Tank Conservation and Development Authority Act, 2014 and amendment Act, 2018.				Design consultant	PIA, K RIDE
D.6	Visual intrusion	Throughout the corridor	Aesthetic structures of viaduct and stations are designed on elevated sections.				Design consultant	PIA, K RIDE
D.7	Impact on Archaeological Monuments	Corridor 1	Corridor 1: Impact on legally protected Archaeological	No Central or State protected Archaeological Monuments or Cultural Heritage sites are present in Corridors 2, 3 and 4.			Design consultant	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			Monuments - Devanahalli Fort and Tippu Sultan's Birth Place at Devanahalli, due to proposed alignments. Measures shall be implemented in accordance with ESS 8 of World Bank, EIB ESS 10 and The Ancient Monuments and Archaeological sites and Remains Act, 1958 amended in 2010 (as per the stipulated conditions of ASI).					
D.8	Social Impacts	Project Corridors	The acquisition of land and private properties shall be carried out in accordance with the R & R Plan /RAP and entitlement framework of the Project in accordance with EIB's ESS 6 & WB's ESS 5, Karnataka Industrial Areas Development Act, 1966 (KIADA) and Government of Karnataka Revenue Department resolutions.				Special Deputy Commissioner, K RIDE	PIA, K RIDE
D.9	Project Design	Impact on Natural resource, conservation of water & energy.	Project design should incorporate green building measures such as energy efficient design and optimisation of resources, conservation of water, greening of building, etc., to make the project environmentally sustainable with minimum carbon footprint during its operation. Measures such as using of fly ash bricks and manufactured sand & wood, using locally availably natural materials, solar lighting system, lightings with sensors,				Design consultant	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			design with proper ventilation and natural lighting system, reuse of treated water, rainwater harvesting, appropriate waste management components, increasing greening options inside and outside the Station buildings etc.					
Pre-construction Phase (Activities to be carried out by Executing Authority in collaboration with other concerned Govt. Organizations)								
P.1	Information Disclosure	K RIDE's Website, Project site and at certain selected public locations.	EMP/EMoP measures proposed for implementation shall be disclosed to stakeholders; upon feedback, measures shall be revised, if necessary. Information disclosure and consultation/ engagement activities will be done according to the SEP and in compliance with WB ESS 10 and EIB ESS 2. K RIDE has to ascertain that acquisition of land in the post design phase are addressed and integrated into the EMP and relevant contract documents.				PIA, K RIDE	PIA, K RIDE
P.2	Land Acquisition & Displacement and Change in Land Use	Project site	The acquisition of land and private properties shall be carried out in accordance with the R & R Plan /RAP and entitlement framework of the Project in accordance with WB's ESS 5 and EIB's ESS 6, Karnataka Industrial Areas Development Act, 1966 (KIADA) and Government of Karnataka Revenue Department resolutions. As per RAP notice shall be given in advance to the PAP (including encroachers and squatters, etc.,) present in the Corridor of Impact, who need to be relocated. All R and R activities shall be undertaken as per the relevant acts and also comply with WB's ESS 5 and EIB ESS 6. Entitlements as per K RIDE entitlement framework shall be completed before construction starts. It is ensured that no private property will be acquired and no PAPs will be displaced prior to RAP approval.				PIA, K RIDE and Revenue Dept. and collaborating agencies	PIA, K RIDE
P.3	Forest Land Diversion	Project Corridor 1	Diversion of 18.6Ha of forest land for proposed depot at Akkupete, which shall be diverted in compliance with the Forest	There is no diversion of forest land in Corridor 2, 3, and 4.			Bengaluru Rural Forest division	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			(Conservation) Act, 1980 and in compliance with WB ESS 6 and EIB Standard 4.					
P.4	Impact on Flora - Tree Removal - Loss of trees	Trees along the Project Corridors falling within proposed RoW	Trees shall be removed from the Corridor of Impact before the actual commencement of the work with the permission from the BBMP Forest Wing/state Forest Department. Cutting shall be undertaken only when the implementation of the project in that particular location of cutting is confirmed. This will be in line with Karnataka Preservation of Trees Act, 1976, Forest Conservation Act 1980, Tree Management Plan and ESS 6 of World Bank and EIB's ESS 4.				State Forest Dept./BBMP in consultation with K RIDE	PIA, K RIDE & State Forest Dept.
			Stacking, transport and storage of the wood shall be done as per the relevant norms.					
	Preservation/ Conservation of Flora/ Trees	Project Corridors with green cover and trees present at the toe line of the carriage way and trees of valuable species having ecological value.	All efforts shall be made to preserve/save trees. Specific attention shall be given for protecting large trees, green tunnels and locally important trees (religiously important etc.). Details of the trees affected due to the proposed project corridors are given in (Section 5.9.2 of EIA Report) Tree cutting shall be preceded only after all the legal requirements including attaining of In-principle and Formal Clearances from the Forest Dept. are completed and subsequently a written order is issued to the Implementing Agency. Tree preservation will be line with Karnataka Preservation of Trees Act, 1976, Forest Conservation Act 1980, Tree Management Plan, EIB's ESS 4 and ESS 6 of World Bank.					
			Compensatory afforestation for the tree cut and translocated trees shall be carried out by BBMP forest Wing/ Forest Dept. as per the statutory guidelines of Forest Conservation Act, 1980 and Karnataka Preservation of Trees Act, 1976, Tree Management Plan, EIB's ESS 4 and ESS 6 of World Bank.					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
P.5	Relocation of Community Utilities and Common Property Resources	Throughout the Project corridors	All community utilities and properties i.e. hand pumps, open wells, water supply lines, sewer lines and telephone cables shall be relocated before only when construction of corridor activities commence. Prior approval will be obtained from the concerned authority, before shifting of these community utilities. This will be in line with ESS 10 of World Bank and EIB's ESS 2.				Contractor	PIA, K RIDE (GC during Construction Phase)
P.6	Relocation of affected Cultural and Religious Properties	Throughout the Project corridors at stretches especially nearby settlements	All religious property resources such as shrines, temples and mosques within the project corridor shall be relocated. Total number of cultural properties affected in BSRP corridors is given in the Section 8.3.8. of EIA Report. A list of Common property resources affected due to project corridors are presented as **Table 8.11**. If there is any relocation of the religious structures may happen then it shall be identified in accordance with the choice of the community. K RIDE in consultation with local people shall finalize those. The relocation shall be completed before the construction starts in these sites. This will be in line with ESS 1 & 5 of World Bank and EIB's ESS 1 & 6.				Contractor	PIA, K RIDE (GC during Construction Phase)
P.7	Preliminary Site measures	Throughout the Project corridors	Environment, Health and Safety (EHS) Manual shall be prepared in line with national Regulations, World Bank ESS guidelines 1, 3, & 4 and EIB's ESS 1, 3, & 9.				Contractor	PIA, K RIDE
P.8	Man Power for Environmental Management and Monitoring	Throughout the Project corridors	Institutional requirements I.e., employing Environmental, Health and Safety Experts for implementation of EMP and EMoP shall be executed. This will be in line with ESS 1 of World Bank and EIB's ESS 1.				Contractor	PIA, K RIDE
Pre-Construction Activities (to be carried out by Contractor under supervision of GC)								
P.9	Preventive measures to avoid impacts on Environment	Throughout the Project corridors wherever changes are required	Field Verification and Modification of the Contract Documents - Joint Field verification shall be carried out by the Environmental Specialist of GC and the Contractor to ascertain any possibilities of saving trees, environmental and community resources; which shall be taken up by the construction contractor.				Contractor	Environmental Specialist of GC & PIA, K RIDE
			Assessment of Impacts due to Changes/Revisions/additions in the Project Work -The Environmental Specialist of GC shall assess impacts and revise/modify the EMP and other					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
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			required sections of the project document/s in the event of changes/revisions (including addition or deletion) in the project's scope of work. This will be in line with WB ESS 1 to 10 and EIB ESS 1 to 2.					
P.10	Plant establishment	Plant Site/Location - Crushers and Batching Plant's Location	Preventive measures shall be taken up in line with Air (prevention of control of pollution) Act, 1981 and The Noise Pollution (Regulation and Control) Rules, 2000 and WB ESS 1 & 3 and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC & PIA, K RIDE
			All construction plants shall be sited sufficiently away (500m) from settlements and agricultural operations or any commercial establishments. Such plants shall be located at least 500m away from the nearest dwelling preferably in the downwind direction, if the settlement is too near.					
			The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Specialist of GC, prior to the establishment and obtain approval. Guidelines and reporting format for siting of Construction Camp is presented as **Annexure 10.2** and **Annexure 10.17** respectively.					
			Arrangements to control dust pollution through provision of windscreens, water sprinklers, and dust extraction systems shall have to be provided at all Plant work sites.					
			Specifications for crushers, hot mix plants and batching plants shall comply with the requirements of the relevant emission control legislations. Consent for the Establishment and Operation from KSPCB shall be obtained before establishment and operation respectively and a copy should be submitted to the GC and K RIDE.					
			In case of water scarcity the Water sprinkling shall be limited to one time in the morning. To balance this deficient information boards shall be erected at appropriate locations with a message "Dust prone area" and required precautions shall be taken care.					
P.11	Usage of Construction Vehicles, Equipment and Machinery	Applicable to all vehicles used in	All vehicles, equipment and machinery to be procured for construction shall confirm to the relevant Bureau of India Standard (BIS) norms. Maintenance of all construction vehicles shall be taken care.				Contractor	Environmental Specialist

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
		the construction	Required Mitigation measures shall be undertaken in accordance with Air pollution Control Act, 1981, Noise Rules and Motor Vehicle Act, 1988. The discharge standards promulgated under the Environment Protection Act, 1986 and Motor Vehicles Act, 1988 and WB ESS 3 shall be strictly adhered to.					of GC & PIA, K RIDE
			The silent/quiet equipment available in the market shall be used in the Project.					
			The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period which shall be produced to EO, K RIDE's verification whenever required.					
P. 12	Construction Materials							
P.12.1	Construction Materials - Crusher materials	Stone Crusher locations or procurement directly from the supplier	Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient quantity of materials, quality and other logistic arrangements or he can directly procure crusher materials from the supplier. Contractor shall be solely responsible to obtain and maintain all the legal records of approvals, as per the Indian regulations and WB ESS 1 & 6 and EIB Standard 1 & 4. Contractor shall also work out haul road network and report to Environmental Specialist of GC and GC shall inspect and in turn report to K RIDE before approval.				Contractor	Environmental Specialist of GC & PIA, K RIDE
P.12.2	Construction Materials - Borrow Earth	Borrow Areas	Finalising soil borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, shall be the sole responsibility of the Contractor and shall be in line with EPA 1986 and ESS 1 & 6 of World Bank and EIB ESS 1 & 4.				Contractor / Environmental Specialist of GC	PIA, K RIDE
			The Contractor shall not start borrowing earth from selected borrow area until the formal agreement is signed between landowner and Contractor and a copy is submitted to the GC.					
			Locations finalized by the Contractor shall be reported to the Environmental Specialist of GC for approval and he/she shall report to K RIDE.					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
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			Planning of haul roads for accessing borrows areas shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible and shall use the existing village roads wherever available.					
			The environmental personnel of the GC shall be required to inspect every borrow area location prior to approval. The GC should include the Request for Inspection form for borrow area approval from the environmental point of view. Guidelines and reporting format for siting, operation and re-development of borrow area is presented as **Annexure 10.4.** Reporting format for borrow area management plan is presented as **Annexure 10.19**.					
P.12.3	Construction Materials - Borrow earth	Borrow Sites	Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient quantity of materials, quality and other logistic arrangements. Contractor shall be solely responsible to obtain and maintain all the legal records of approvals, as per the regulations and WB ESS 1 & 6 & EIB ESS 1 & 4.				Contractor	Environmental Specialist of GC & PIA, K RIDE
			Contractor shall also work out haul road network and report to Environmental Specialist of GC and GC shall inspect and in turn report to K RIDE before approval.					
P.12.4	Construction Materials - Sand / M-Sand	Approved Sand Mines or Crusher sites	The Sand shall be procured from approved sand mines. The Contractor shall obtain copy of the Lease Agreement of the supplier and submit to GC before procuring the sand. Procurement shall be in compliance with WB ESS 1, 3 & 6 and EIB ESS 1, 3 & 4.				Contractor	Environmental Specialist of GC & PIA, K RIDE
			As a substitute, M-Sand may be used, wherever feasible. The Contractor shall obtain copy of the Lease Agreement of the supplier and submit to GC before procuring the sand.					
P.13	Construction Water Procurement	Project Work Sites	The contractor shall use ground/surface water as a source of water for the construction and may set up own bore well facility for construction work and shall follow stipulations as per the contract document and EPA, 1986. This will be in line with ESS 1, 3 & 6 of World Bank & EIB's ESS 1, 3 & 4.				Contractor	Environmental Specialist

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			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			To avoid disruption/disturbance to other water users, the Contractor shall extract water from fixed locations and consult Environmental Specialist of GC before finalizing the locations.					of GC & PIA, K RIDE
			The Contractor shall provide a list of locations and type of sources from where water for construction shall be extracted.					
			The Contractor shall need to comply with the requirements of the State Ground Water Department for the extraction and seek their approval for doing so and submit copies of the permission to GC and K RIDE.					
P.14	Pre-casting yards and Material stockpiling	Casting Yards & Storage Areas	Mitigation measures include careful planning, timing of casting operations and storage in casting yards and camps. Pre-casts will be properly stock piled in Cast yards. The Construction materials such as steel, bricks, concrete materials, etc. will be stock piled and stored properly in a fenced or closed Store yard. Precautionary measures shall be taken to reduce and mitigate dust generation at Store and Cast yards. The unwanted or unused balance materials will be removed for use, if required; if not will be disposed properly after the completion of works. The unwanted or unused balance materials, if suitable will be utilized for borrow areas or open pit or trench filling. The activities shall be in line with ESS 1 & 3 of World Bank and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC & PIA, K RIDE
P.15	Construction Camp Locations – Selection, Design and Layout	Construction Camp	Siting of the construction camps shall be as per the guidelines and details of layout to be approved by GC Resident Engineer and Environment Specialist, shall comply with Occupational Safety and Health Standards, Part 1910.142 and in line with ESS 1, 3 & 6 of World Bank and EIB ESS 1, 3 & 4.				Contractor	Environmental Specialist of GC & PIA, K RIDE
			Construction camps shall not be proposed within 500m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community.					
			Contractor's camps shall be identified at least 2km away from the Forest Reserves.					

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			Location for stockyards for construction materials shall be identified at least 300m away from watercourses.					
			The Sewage Treatment Plant and solid waste treatment for the camp shall be designed, built and operated. Guidelines and layout for setting-up of Construction Camp is presented as **Annexure 10.2.** And Reporting format for identification and establishment of Construction camp are presented in **Annexure 10.16** and **Annexure 10.17** respectively.					
P.16	Labour Procurement	Throughout Project Corridors and Plant Sites	Labour procurement shall be in accordance with labour laws and Contract Document as per the Child Labour (Prohibition and Regulation) Act, 1986, ILO (C 138 - Minimum Age Convention, 1973 (No. 138), The Factories Act, 1948, The Building and Other Constructions Workers (Regulation of Employment and Conditions of Service) Act, 1996 (BOCW Act, 1996), The Industrial Relations Code 2020, The Code on Social Security 2020, The Occupational Safety, Health and Working Conditions Code, 2020 and The Code on Wages 2019 and in line with ESS 2 of World Bank and EIB ESS 8. The Child Labour is totally prohibited in the project. No child under the age of 18 years (as per ILO standards for hazardous work) shall be employed or permitted to work in any sort of works related to project. Contractor shall not employ, use or benefit from child labour or forced labour. The Contractor shall comply with the minimum age requirements defined under the aforementioned laws and guidelines. Labours employed or engaged in the project works shall be regular monitoring of health, working conditions and working hours. Children shall not be employed informally, even when this is socially or culturally acceptable practice in the sect.				Contractor	Environmental Specialist of GC & PIA, K RIDE

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			For unskilled labour the Contractor shall preferably employ local communities to give maximum benefits to the local community.					
P.17	Provision for Temporary Land	Construction camps and borrow areas	The Contractor as per prevalent rules shall carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction camp/construction/borrow areas etc. in line with Occupational Safety and Health Standards, Part 1910.142 and WB ESS 6.				Contractor	Environmental Specialist of GC & PIA, K RIDE
P.18	Orientation Training for Implementing Agencies and Contractors	Throughout the project implementation period.	The K RIDE shall organize Orientation Sessions and regular training sessions by engaging third party independent consultant at all stages of the project. This shall include on-site training (general as well as in the specific context of a sub-project). These sessions shall involve all staff of K RIDE involved in the implementation of EMP, Environmental Specialists of GC and Contractors. The training shall be conducted as per EMP and other training plan/s developed by Environmental Specialists of GC/K RIDE.				Contractor	Environmental Specialist of GC & PIA, K RIDE
Construction Phase								
C.1	Site Clearance							
C.1.1	Clearing and Grubbing (C & G)	Throughout the corridor	Vegetation shall be removed from the construction zone before commencement of construction. All works shall be carried out such that the damage or disruption of flora other than those identified for cutting is minimal.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from the Sr. Environmental Specialist of GC.					
C.1.2	Tree Felling/Removal	Throughout the corridor	The Contractor, under any circumstances shall not cut or damage trees and forest reserves. Trees identified under the project shall be cut only after receiving clearance from the BBMP Forest Wing/Forest Dept./DoEF/MoEFCC (as applicable) and after the receipt of K RIDE's written permission in this regard. This will be in line with ESS 1 & 6 of World Bank and EIB ESS 1 & 4.				Contractor	Environmental Specialist of GC and PIA, K RIDE

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			Vegetation only with girth size of over 30 cm shall be considered as trees and shall be compensated, in the event of K RIDE's instruction to undertake tree cutting.					
			Translocation of trees less than 30cm and trees as suggested by BBMP Forest Wing/Forest Dept. shall be carried out adequately.	Translocation of trees less than 30cm and trees as suggested by BBMP Forest Wing shall be carried out adequately.				
			Compensatory afforestation for the tree cut and translocated trees shall be carried out by BBMP forest Wing/ Forest Dept. as per the statutory guidelines of Forest Conservation Act, 1980 and Karnataka Preservation of Trees Act, 1976. A Tree Management Plan is prepared in line with the State's Tree Act and World banks guidelines and is attached as **Annexure 10.44**.					
C.1.3	Disposal of Construction Wastes and Debris from dismantling structures and work zones	Work zones and Disposal sites	Construction Waste and Debris shall be disposed as per Guidelines provided in EMP and complying with the Solid Waste Management Rules, 2016, amended in 2018 and Regulations of PCB and ESS 1 & 3 of World Bank and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			The pre-identified disposal site shall be a part of Comprehensive Waste Disposal Plan. Solid Waste Management Plan shall be prepared by the Contractor for disposal of debris in consultation and with approval of Environmental Specialist of CSC. In the case of non-availability of disposal site, Solid Wastes shall be handed over to BBMP authority regularly, as per the Solid Waste Management Rules, 2016, amended in 2018 and Regulations of PCB.					
			Surplus materials and other debris generated due to dismantling of the existing structures along the corridors shall be suitably reused in the proposed construction zone, subjected to the structure suitability of the materials and approval of the Resident Engineer and Sr. Environmental Specialist of GC as follows:					

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			○ For filling and leveling of School grounds and proposed parking areas.					
			○ Earth from cutting shall be used as embankment fill material.					
			Existing base and sub-base material shall be recycled as sub-base of the haul road or access roads.					
			The existing bitumen road shall be utilized as haulage routes for transportation of materials.					
			The Contractor shall suitably dispose-off unutilized debris materials either through filling up of borrows areas located in wasteland or at pre-designated disposal locations, subject to the approval of the Environmental Specialist of GC.					
			All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, shall be considered incidental to the work and shall be planned and implemented by the Contractor as approved and directed by the Environmental Specialist of GC.					
			<u>Reuse and Recycling of materials shall be carried out as follows :</u>					
			○ Segregation and temporary storage of reusable and recyclable materials at identified locations. Transportation of recyclable materials to construction sites.					
			○ Sale of metal scrap and other saleable waste.					
			○ Identification of intended transport means and route.					
			○ Obtaining permission wherever required, for treatment of the hazardous component and its disposal.					
			○ Concrete material shall be broken in to coarse size and reutilized in filling.					
			The pre-designed disposal locations shall be a part of Waste Disposal Plan in consultation and with approval of Environmental Specialist of GC. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the nearby surface water bodies or for mud puddles in the area.					

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			The Contractor shall identify dumping sites as per the Debris Disposal Plan prepared using the Guidelines provided in the **Annexure 10.8**; The identified locations shall be reported to the Environmental Specialist of GC. These locations shall be checked on site and accordingly approved by Environmental Specialist of GC prior to any disposal of waste materials. Reporting format for identification and site selection and management of Debris disposal site is presented in **Annexure 10.21** and **Annexure 10.22** respectively.					
C.1.4	Soil erosion and fugitive dust generation	Work zones and Disposal sites	Suitable measures and construction methods shall be implemented as per EHS Plan and in line with WB ESS 3 and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			The Contractor shall be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures.					
			The surface area of erodible earth material exposed by clearing and grubbing, excavation shall be limited to the extent practicable. Works such as construction of temporary berms, temporary mulches, seeding or other methods as necessary to control erosion shall be implemented.					
			Mitigation measures include careful planning, timing of cut and fill operations and re-vegetation in accordance with Water (Prevention and Control of Pollution) Act, 1974 & its amendments and ESS 1, 3 and 6 of World Bank. In general, construction works shall be stopped during monsoon season.					
			The pre-identified disposal location shall be part of Comprehensive Waste Disposal Plan Solid Waste Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Specialist of GC.					
			Careful planning, timing of cut and fill operations and re-vegetation shall reduce the Soil Erosion and dust generation. Guidelines for preparation of Comprehensive Waste Management Plan are provided in **Annexure 10.9**. Guidelines on topsoil conservation					

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			and reuse and slope stabilization measures are provided in **Annexure 10.1** and **Annexure 10.3**.					
			Contractor shall dispose the muck/dry soil generated at construction sites at a mutually agreed location by K RIDE and Contractor.					
C.1.5	Muck and other Construction Wastes Disposal	Work zones and Disposal sites	The pre-identified disposal site shall be a part of Comprehensive Waste Disposal Plan. Solid Waste Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Specialist of GC. In the case of non-availability of disposal site, Solid Wastes shall be handed over to BBMP authority regularly, as per the Solid Waste Management Rules, 2016, amended in 2018 and Regulations of PCB, also in line with WB ESS 3 and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Location of disposal sites shall be finalized prior to initiation of the works on any particular section of the corridor.					
			The Environmental Specialist of GC shall approve these disposal sites after conducting a joint inspection on the site with the Contractor.					
			Contractor shall ensure that any spoils or material unsuitable for embankment fill shall not be disposed-off near any water course or agricultural land, orchards and Natural Habitats like Grasslands. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridor (if it so desired by the owner/community and approved by the Environmental Specialist, GC).					
			Non-bituminous wastes shall be dumped in borrow pits covered with a layer of 30cm soil to ensure that borrow pit is restored to original use. No new disposal site shall be created as part of the project, except with prior approval of the Environmental Specialist of GC.					
			All waste materials shall be completely disposed and the site shall be completely cleaned and certified by Environmental Specialist of GC before handing over.					
			Contractor shall carry out the reconciliation for the disposed soil and quantities shall submit to K RIDE on quarterly basis.					

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			Dry wheel wash facilities shall be provided at exit gate, from where soil disposal shall be carried.					
			Sufficient staff shall be made available at site to control the disposal of muck/soil from site such as a supervisor, labors for wheel cleaning; brooms for wheel cleaning and concrete pad where wheels will be cleaned.					
			The dumpers carrying the muck/dry soil has to be covered while plying on the roads on the way to disposal location.					
			Contractor shall take due care that muck generated during piling works does not get contaminated with any contaminant.					
			The onsite muck shall be monitored quarterly at random location during piling works in progress. In case any polluted muck is produced; the muck shall be handled and disposed as per provisions of Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 and its amendments.					
			Construction and Demolition Waste shall be disposed in accordance with the provisions of C & D waste Handling Rules 2016 and its amendments.					
			The Contractor at his own cost shall resolve any claim, arising out of waste disposal management.					
			Muck Disposal Site Management:					
			• Disposal sites shall be cleaned and then treated so that leached water does not contaminate the Ground Water.					
			• Material will be stock-piled with suitable slopes					
			• Material will be stabilised each day by watering or other accepted dust suppression techniques. The muck shall be filled in the dumping site in layers and compacted mechanically.					
			• Once the filling is complete, the entire muck disposal area shall be provided with a layer of good earth on the top and covered with vegetation.					

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			Guidelines on muck and debris disposal and site management are provided in **Annexure 10.7** and **Annexure 10.8** respectively. Reporting format on muck and debris disposal and site selection and management are provided in **Annexure 10.22** and **Annexure 10.23**. Guidelines for storage, handling, use and emergency response for Hazardous substance are provided in **Annexure 10.12**.					
C.1.6	Stripping, stocking and preservation of top soil	At all construction material storage areas	The preservation of Top soil shall be in accordance with EPA 1986 and ESS 1 & 6 of World Bank and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The topsoil from all areas of cutting and all areas to be permanently covered shall be stripped off to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way shall be earmarked for storing topsoil. The locations for stock piling shall be pre-identified in consultation and with approval of Environmental Specialist of GC. The following precautionary measures shall be taken to preserve them till they are used:					
			Stockpile shall be designed such that the slope does not exceed 1:2 (Vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing shall protect the edges of the pile.					
			Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum to ensure that no compaction shall occur. The stockpiles shall be covered with gunny bags or vegetation.					
			It shall be ensured by the Contractor that the topsoil shall not be unnecessarily trafficked either before stripping or when in stockpiles.					
			Such stockpiled topsoil shall be utilized for –					
			(a) Covering all disturbed areas including borrow areas, only in case where they are to be rehabilitated.					
			(b) Dressing of slopes of embankment/agricultural fields of farmers acquired temporarily land.					

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			Guidelines on topsoil conservation and reuse and slope stabilization measures are presented in **Annexure 10.1** and **Annexure 10.3** respectively.					
C.1.7	Accessibility	Throughout the project corridor especially at intersections and settlements and schools	The Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property access, providing temporary connecting roads in compliance with WB ESS 1 & 4 and EIB ESS 1 & 9.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The Contractor shall also ensure that the existing accesses shall not be undertaken without providing adequate provisions.					
C.1.8	Traffic Management Planning for traffic diversions and detours	Throughout the project corridor especially at intersections and settlements and schools	Detailed Traffic Management Plans shall be prepared by the Contractor incorporating details of temporary diversions, traffic safety arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, safety measures for night time traffic and precaution for transportation of hazardous materials and arrangement of flagmen. The TMP shall be submitted to the Environmental Specialist of GC for approval before 10 days of commencement of works at concerned sites. After review, this TMP shall be approved by Environmental Specialist and Resident Engineer of GC from seven days prior to commencement of works on minor sections of road. If required, the TMP shall be passed on to the PIA to obtain approval and support from the concerned official of the Competent authority such as Regional Transport Office, in Traffic Management at major work sites.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.					
			The Contractor shall also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from GC and K RIDE. The temporary traffic detours shall be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic). This will comply with WB ESS 4 & EIB ESS 9.					

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			Guidelines for Preparation of Traffic Management Plan are provided as **Annexure 10.10**.					
C.2	Procurement of Construction Materials							
C.2.1	Earth from Borrow Areas for Construction	All borrow areas	Procurement of Borrow Earth for construction shall be in compliance with EPA, 1986, IRC 10: 1961, MoEFCC Notifications and WB ESS 1, 3 & 6 and EIB's 1, 3, & 4. No borrow area shall be opened without permission of the Environmental Specialist of GC. The location, shape and size of the designated borrow areas shall be as approved by the Environmental Specialist of GC and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC: 10: 1961). The borrowing operations shall be carried out as specified in the guidelines for siting and operation of borrow areas.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; shall be maintained dust free by the Contractor. Sprinkling of water shall be carried out twice a day to control dust along such roads during their period of use. During dry seasons (winter and summer) frequency of water sprinkling shall be increased in the settlement areas and Environmental Specialist of GC shall decide the sprinkling time depending on the local requirements.					
			Contractor shall rehabilitate the borrow areas as soon as borrowing of soil is over from a particular borrow area in accordance with the approved Borrow Area Redevelopment Plan. Guidelines on siting, operation, and redevelopment of borrow area is presented in **Annexure 10.4**. Reporting format for borrow area management plan is provided in **10.19**.					
C.2.2	Transporting Construction Materials and Haul Road Management	All roads used for haulage of construction materials	Transportation of Construction Materials and Haul Road Management shall be in line with WB ESS 1, 3 & 6 and EIB's 1, 3, & 4.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Contractor shall maintain all existing roads, which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site shall be covered to avoid spillage of materials.					

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			All existing roads used by vehicles of the Contractor or any of his subcontractor or suppliers of materials and similarly roads, which are part of the works, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles.					
			Contractor shall arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces.					
C.2.3	Construction Material Management and House Keeping	Construction Camp, Plant Sites and Work Sites	Implementation of the proposed mitigation measures in compliance with Indian Standards and WB ESF guidelines ESS 1, 3 & 6 and EIB's 1, 3, & 4.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Full height fence, barriers, barricades etc. shall be erected around the site					
			All stairways, passageways and gangways shall be maintained without any blockages or obstructions					
			All surplus earth and debris shall be removed/disposed-off from the working areas to officially designated dumpsites. Trucks carrying sand, earth and any pulverized materials, etc. shall be covered while moving.					
			Unused/surplus cables, steel items and steel scrap within the working areas shall be removed to pre-identified locations.					
			All wooden scrap, empty wooden cable drums and other combustible packing materials shall be removed from workplace to identified locations.					
			Empty cement bags and other packaging materials shall be properly stacked and removed.					
			Proper and safe stacking of material is of paramount importance at yards, stores and such locations for future use. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner.					
C.2.4	Construction Water	Throughout the project corridor	Procurement of Construction Water shall be carried out by the Contractor in compliance with Environmental Protection Act, 1986, The Water (Prevention and Control of Pollution) Act, 1974 and WB ESS 1, 3 & 4 and EIB's ESS 1, 3, & 9. The quantity required for construction with other details shall be planned properly, linked to the contractor's work plan and the same shall be submitted to the CSC.				Contractor	Environmental Specialist of GC, & PIA, K RIDE

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			Contractor need to implement the finally approved contractors Construction Water Management Plan in accordance with Environmental Protection Act 1986. This is linked to the contractor's work plan.					
			Contractor shall arrange adequate supply and storage of water for the whole construction period at his own cost. The contractor shall submit a list of source/s from where water shall be used for the project to GC and K RIDE.					
			The Contractor shall source the requirement of water preferentially by conjunctive use of Surface water and groundwater but with prior permission from the Groundwater Authority. A copy of the permission shall be submitted to GC and K RIDE prior to initiation of construction. The Contractor shall take all precaution to minimize the wastage of water in the construction process/operation.					
C.3	Measures during Construction Activities							
C.3.1	Drainage and flood control	Construction sites of cross drainage structures	Contractor shall ensure that no construction materials like earth, stone, or appendage disposed-off in a manner that block the flow of water of any water course and cross drainage channels in compliance with WB ESS 1 & 3 and EIB ESS 1 &3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Contractor shall take all necessary measures to prevent any blockage to the water flow. In addition to the design requirements, the Contractor shall take all required measures as directed by the Environmental Specialist of GC to prevent temporary or permanent flooding of the site or any adjacent area.					
C.3.2	Control of Siltation of water bodies and degradation of water quality	Construction sites of cross drainage structures	The Contractor shall not excavate beds of any stream/canals/any other water body for borrowing earth for embankment construction in compliance with WB ESS 1& 3 and EIB's ESS 1 &3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Contractor shall construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including springs and wells) adjacent to the project corridor and around the stockpiles at the construction sites including ancillary sites close to water bodies. The fencing shall be provided prior to commencement of					

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			earthwork and continue till the stabilization of the embankment slopes, on the particular section of the project corridor. Typical cross section of Silt trap is presented in **Annexure 10.31**.					
			Contractor shall ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse. Guidelines on sediment control measures are provided in **Annexure 10.6.**					
C.3.3	Slope protection and control of soil erosion	At bridge approaches; high embankment sections (Low lying areas) and borrow pits	All temporary sedimentation control works and maintenance thereof shall be deemed as incidental to the earth work or other items of work and as such no separate payment shall be made for them in compliance with WB ESS 1 & 3 and EIB's 1 &3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Contractor shall ensure the following aspects:					
			i) After construction of railway embankment, the side slopes shall be covered with grass and shrubs (refer **Annexure 10.3** and **Annexure 10.25**) as per design specifications.					
			ii) Turfing works shall be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization shall include mulching netting and seeding of batters and drains immediately on completion of earthworks.					
			iii) In borrow pits, the depth shall be so regulated that the sides of the excavation shall have a slope no steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank.					
			iv) Along sections abutting water bodies, pitching as per design specification shall protect slopes.					
			Guidelines on slope stabilization, sediment control and Embankment/slope protection measures are presented in **Annexure 10.3, Annexure 10.6** and **Annexure 10.25** respectively**.** Typical cross section of Silt trap is presented in **Annexure 10.31**.					
C.4	Environmental Pollution	Monitoring Locations as given in Table	The periodic monitoring of the ambient air quality, noise level, vibration level, water (both ground and surface water) quality, soil quality shall be carried out at the selected locations as suggested in pollution monitoring plan of EMP and shall be in compliance				Contractor	Environmental Specialist

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
		10.3 of EIA Report.	with Environmental Protection Act, 1986, The Air (Prevention and Control) Act, 1981, The Water (Prevention and Control) Act, 1976 and The noise pollution (regulation and control) rules, 2000; and with all with Amendments and in compliance with WB ESS 1& 3 and EIB's 1 & 3. Reporting format for pollution monitoring is presented in **Annexure 10.34**.					of GC, & PIA, K RIDE
			Construction Phase Environmental Monitoring cost = ₹ 93.36 Lakhs	Construction Phase Environmental Monitoring cost = ₹ 88.86 Lakhs	Construction Phase Environmental Monitoring cost = ₹ 82.5 Lakhs	Construction Phase Environmental Monitoring cost = ₹ 95.04 Lakh	Contractor	Environmental Specialist of GC, & PIA, K RIDE
C.4.1	Water Pollution Control							
C.4.1.1	Water Pollution from Construction Wastes	At all surface water bodies intercepting with the project corridor (as given in Table 5.10 under Section 5.6.3.1 – Surface Water Quality in EIA Report).	The proposed measures shall be implemented in compliance with Water (Prevention and Control of Pollution) Act, 1974 & its amendments and ESS 1& 3 of World Bank and EIB's ESS 1& 3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The Contractor shall take all precautionary measures to prevent entering of wastewater into streams, water bodies or the irrigation system during construction.					
			Contractor shall avoid construction works close to the streams or water bodies during monsoon.					
			Contractor shall not wash his vehicles in water body and shall not enter the water body for that purpose.					
			Measures such as sedimentation tanks on site for batching plants shall be implemented.					
			Contractor shall try and reduce the water consumption through use of energy efficient water fixtures at sites and project offices.					
			Leakage of water should not be allowed through pipes and valves.					
			Reuse of water used for curing and for other uses shall be planned.					
			Proper sanitation facilities will be provided at the construction site to prevent health related problems due water contamination					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			An effective traffic management plan is to be implemented to avoid any accidental spillage of hazardous materials.					
			All the construction and preparatory activities including construction of CD structures will be carried out during dry seasons only.					
			The CD structures should not be drained to the agricultural and horticultural farms or to the immediate vicinity of houses of the locales.					
			The unlined roadside drains in rural stretches carrying storm water will be connected to the nearest natural drainage channel, water bodies with silt traps.					
			The Contractor shall take all precautionary measures to prevent entering of wastewater into streams, water bodies or the irrigation system during construction.					
			Contractor shall avoid construction works close to the streams or water bodies during monsoon. All measures related to water pollution control as mentioned under C. 4.1.2. Water Pollution from Fuel and Lubricants of EMAP table, shall be strictly followed.					
			Rainwater Harvesting Measures : Measures including treatment and reuse of waste water and rain water harvesting to augment ground water shall be implemented. Rainwater harvesting structure shall be constructed at 500m interval along the alignment and at stations and Depot. Typical cross section for rain water harvesting/ground water recharge pit is given as **Annexure 10.32.**					
C.4.1.2	Water Pollution from Fuel and Lubricants	At all surface water bodies intercepting with the project corridor; refueling	The Contractor shall ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites shall be located at least 500 m away from rivers and irrigation canal/ponds. All required measures as presented below shall be undertaken in accordance with 1 & 3 and EIB ESS 1 &3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The Contractor shall submit all locations and layout plans of such sites prior to their establishment and shall be approved by the Environmental Specialist of GC.					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
		stations and construction camps (as given in Table 5.10 under Section 5.6.3.1 – Surface Water Quality).	Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refuelling shall be carried out in such a manner that spillage of fuels and lubricants does not contaminate the ground.					
			Provision for oil interceptors shall be made at all the construction camps / workshop areas to separate the oil and grease waste generated from servicing of equipment and vehicles used in the construction. Wastewater from vehicle parking, fuel storage areas, workshops, wash down and refuelling areas shall be treated in an oil interceptor before discharging it on land or into surface water bodies or into other treatment system.					
			Overall fuel storage and refuelling areas, if located on agricultural land or areas supporting vegetation, the topsoil shall be stripped, stockpiled and returned after cessation of such storage.					
			Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to GC and K RIDE) and approved by the Environmental Specialist of GC. All spills and collected petroleum wastes shall be disposed-off in accordance with Petroleum Rules and PCB guidelines.					
			Streams at RHS Km 2/610 and 11/850; Gantigunahalli Lake at LHS Km 4/200 and Nellukunte Lake at Km 6/300 and at RHS Km 1/350 Yelahanka Lake and Open Well at Km LHS 12/000. Proper care and measures shall be undertaken as mentioned above	No Lakes or Streams. Open Wells at 4 locations - RHS at km 216/830, Km 217/450, Km 217/600 & Km 218/100 and at LHS Km 217/550 and Borewell with Pump at RHS Km 216/625. Proper care and measures shall be undertaken as	No Lakes or Streams. Bore well at RHS Km 6/820 and Open Well at RHS Km 349/860. Proper care and measures shall be undertaken as mentioned above and in line with Water (Prevention and Control of Pollution) Act,	Lakes along the existing corridor - Huskur Lake at LHS Km 188/600, Panathur Lake at LHS Km 185/800 and Doddanekundi Lake at LHS Km 202/050; Jakkur Lake at RHS Km 12/880 and Yalahanka Lake at RHS Km 17/600.	Contractor	Environmental Specialist of GC, & PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			and in line with Water (Prevention and Control of Pollution) Act, 1974 & its amendments and ESS 3 of World Bank.	mentioned above and in line with Water (Prevention and Control of Pollution) Act, 1974 & its amendments and ESS 3 of World Bank.	1974 & its amendments and ESS 3 of World Bank.	Proper care and measures shall be undertaken as mentioned above and in line with Water (Prevention and Control of Pollution) Act, 1974 & its amendments and ESS 3 of World Bank.		
			Reporting format for pollution monitoring is presented in **Annexure 10.34**. Typical cross section of silt traps and oil interceptors to control water pollution are presented in **Annexure 10.31** and **Annexure 10.33**.					
			Water Pollution Monitoring :				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Monitoring locations : Baseline Water Quality monitoring locations, labour camp & other sensitive water bodies as suggested by Envi. Specialist of GC and cost = ₹ 6.72 Lakhs	Monitoring locations : Baseline Water Quality monitoring locations, labour camp & other sensitive water bodies as suggested by Envi. Specialist of GC and cost = ₹ 7.56 Lakhs	Monitoring locations : Baseline Water Quality monitoring locations, labour camp & other sensitive water bodies as suggested by Envi. Specialist of GC	Monitoring locations : Baseline Water Quality monitoring locations, labour camp & other sensitive water bodies as suggested by Envi. Specialist of GC and cost = ₹ 8.4 Lakhs		

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
					and cost = ₹ 6.72 Lakhs			
			Rainwater Harvesting Measures :					
			Measures including treatment and reuse of waste water and rain water harvesting to augment ground water shall be implemented. Rainwater harvesting structure shall be constructed at 500m interval along the alignment and at stations and Depot. Typical cross section for rain water harvesting/ground water recharge pit is given as **Annexure 10.32.**					
			No. of RWH Locations = 100	No. of RWH Locations = 65	No. of RWH Locations = 51	No. of RWH Locations = 114		
			Cost = ₹ 94.7 Lakhs (@ ₹ 0.947 lakh/Unit)	Cost = ₹ 61.56 Lakhs (@ ₹ ₹ 0.947 lakh/Unit)	Cost = ₹ 48.30 Lakhs (@ ₹ 0.947 lakh/Unit)	Cost = ₹ 108.4 Lakhs (@ ₹ 0.947 lakh/Unit)		
			Oil Interceptor with Silt trap at Workshop - washing area - Capacity 50L (24” X 16” X 12”), 18 Gauge					
			One unit at each construction camp Cost = ₹ 0.15 Lakhs	One unit at each construction camp Cost = ₹ 0.15 Lakhs	One unit at each construction camp Cost = ₹ 0.15 Lakhs	One unit at each construction camp Cost = ₹ 0.15 Lakhs		
C.4.2	Air Pollution Control							
C.4.2.1	Dust Pollution	Construction sites and construction establishment such as batching plants, Stone crushers as given in Table	The proposed measures shall be implemented in compliance with The Air (Prevention and Control of Pollution) Act, 1981 & its amendments and ESS 1 & 3 of World Bank and EIB’s ESS 1 & 3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE through Engineer
			The Contractor shall take every precaution to reduce the level of dust from construction plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source.					
			The Contractor shall take all mandatory precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
		10.3 of EIA Report.	and from processes such as pneumatic filling of silos, transportation by road, drilling and blasting, crushing, screening, bulk/bag unloading, etc.					
			The Contractor shall not allow emissions of fugitive dust from any transport during handling of materials, construction or storage activity. The emission should not remain visible in atmosphere beyond the property line of emission source for any prolonged period of time.					
			The Contractor shall use cover for materials of dust generating like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free-board to reduce spills and avoid fugitive dust.					
			Contractor shall install barriers around the open construction sites before commencing the work.					
			The temporary dumping areas shall be maintained by the Contractor at all times until excavated materials are reutilized for backfilling wherever necessary or as directed by Employer. Dust control activities shall continue even during any work stoppage.					
			The Contractor shall place material in a manner that will minimize dust production. Material shall be wetted each day, to minimize dust production. During dry weather, dust control measures must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.					
			The Contractor shall sprinkle water at construction sites to suppress dust, during handling of excavation soil or debris or during demolition.					
			The Contractor will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use.					
			Dust screens will be used, as feasible when additional dust control measures are needed especially where the work is near sensitive receptors.					
			In case of water scarcity in certain areas or periods, Contractor may limit water sprinkling once in the early morning hours and should erect warning boards on dust nuisance to the road users and limit the dust emanating activities.					

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Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			The concentration of suspended particulate matter at a distance of 40m from a construction plant located in a cluster of industries should be less than 500 µg. The environmental monitoring is to be conducted as per the monitoring plan.					
			Alternatively, only crushers licensed by the KSPCB shall be used. The Environmental Specialist, EO and K RIDE through the Engineer shall submit required certificates and consents.					
C.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	Construction sites and construction establishment such as batching plants, Stone crushers as given in Table 10.3 of EIA Report.	Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission standards and comply with the relevant statutory requirements of CPCB such as The Air (prevention and control of pollution) Act, 1981 and EPA, 1986 and/Motor Vehicles Rules 2000 with amendments and WB ESS 1 & 3 and EIB's ESS 1 & 3.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			The Contractor shall procure the Standard construction plants, equipment and machinery, which shall conform to the pollution control norms specified by MoEFCC/CPCB/KSPCB.					
			He shall maintain evidence of design and equipment to make these available for inspection by Employer.					
			Contractor shall ensure that all vehicles, equipment and machinery procured for construction are regularly maintained and confirm that pollution emission standards and comply with the relevant statutory requirements of CPCB such as The Air (prevention and control of pollution) Act, 1981 and EPA, 1986 and/Motor Vehicles Rules 2000 with amendments and WB ESS 1 & 3 and EIB's ESS 1 & 3.					
			The Contractor shall properly maintain and periodically check all construction / haulage vehicles, machinery and Equipment so as to comply emission in accordance with National Ambient Air Quality Standards stipulated by Statutory Agencies of Government of India or the State Government from time to time.					
			Stack height of equipment/ Plants and D. G. sets at plant site should conform to KSPCB Standards.					

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Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.					
			The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction Depot and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.					
			The Contractor shall submit PUC certificates for all vehicles/equipment/machinery used for the Project.					
			Air Pollution Monitoring:					
			Monitoring locations at baseline Air Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 28.8 Lakhs	Monitoring locations at baseline Air Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 25.2 Lakhs	Monitoring locations at baseline Air Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 21.6 Lakhs	Monitoring locations at baseline Air Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 28.8 Lakhs	Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Reporting format for pollution monitoring is presented in **Annexure 10.34**. Reporting format for details of Batching plant is given in **Annexure 10.15**.					
C.4.3	Noise Pollution Control							

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
C.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipment	Throughout the project corridor and other construction establishments as given in Table 10.3 of EIA Report.	All construction activities will have to comply with Noise Pollution (Regulation and Control) Rules, 2000 & amendments and ESS 1& 3 of World Bank and EIB's ESS 1 & 3. Night time work could require a variance for local noise regulations.				Contractor	Environmental Specialist of GC, & PIA, K RIDE
			Source Control : Each internal combustion engine used for any purpose on the project or related to the project will be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine will be operated without a muffler.					
			All Construction plants and equipment used in construction shall strictly conform to the MoEFCC/CPCB noise standards.					
			All Vehicles and equipment used in construction shall be fitted with exhaust silencers.					
			Construction of permanent and temporary noise barriers; and natural and artificial barriers could be considered for use as shielding against construction noise. Strategic placement of stationary equipment, such as compressors and generators, could reduce effects at sensitive receivers.					
			A main source of noise shall be controlled by Re-routing and regulating the traffic,					
			Electric equipment shall be used instead of diesel powered equipment,					
			Hydraulic tools shall be used instead of pneumatic tools,					
			Provision of acoustic enclosures : Acoustic enclosures shall be provided for individual noise generating construction equipment. Special acoustic enclosures should be provided for individual noise generating equipment, wherever possible. Workers in those sections where periodic adjustment of equipment/machinery is necessary, shall be provided with sound proof control rooms so that exposure to higher noise level is reduced.					
			Scheduling of truck loading, unloading and hauling operation,					
			In Loading and un-loading areas with machinery noise muffles, etc. and personal protective gear shall be provided to workers.					

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Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Environmental Specialist of GC to keep noise levels at the minimum. Proper operation and maintenance of the construction vehicles and equipment would keep them within noise limit,					
			Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall be replaced,					
			Job rotation - Shifting of workers to the extent possible from high noise level area to low noise level areas and vice-versa from time to time avoid the workers to get impacted due to continuous exposure to high level noise,					
			Scheduling work to avoid simultaneous activities,					
			Automation of equipment and machineries - Wherever possible the Automation of equipment and machineries shall be applied to avoid continuous exposure of workers to noise. If automation of machineries is not possible or feasible, then the workers exposed to noise shall be provided with protective devices.					
			Related Noise Control Measures – The following noise control measures shall be undertaken:					
			• Use of Anti-drumming floor and noise absorption material,					
			• Use of Low speed compressor, blower and air conditioner,					
			• Mounting of under frame equipment on anti-vibration pad,					
			• Provision of Smooth and gradual control of door,					
			• Provision of GRP baffle on the via-duct for elimination of noise transmission,					
			• Provision of sound absorbing material in the supply duct and return grill of air conditioner,					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			• Sealing design to reduce the aspiration of noise through the gap in the sliding doors and piping holes,					
			Noise reduction from various sources - The noise reduction from various sources is possible with the following effective measures during the construction period:					
			The noise from air compressor can be reduced by fitting exhaust and intake mufflers.					
			Noise proof barriers will be provided on the construction boundary near the residential area.					
			Noise level from loading and unloading of construction materials can be reduced by usage of various types of cranes and placing materials on sand or sandy bag beds.					
			Alternate Construction Methods – During pile driving activity increase in noise levels is anticipated even when noise mitigation measures are implemented, however, noise levels will be within acceptable limits. During these activities, alternate methods of construction may be applied to reduce noise Risks and Impacts. Vibratory or hydraulic insertion may be used for pile driving, depending on a variety of factors. Drilling holes for cast-in-place piles is an alternative construction method that may produce significantly lower level noise.					
			Management of Time Schedule and Activity Constraints - Noisier activities involving large machinery will be limited to daytime hours as practical, when most people normally get affected are either not present or engaged in less noise-sensitive activities. Night time construction will require a variance. Compliance with local noise ordinances would mitigate effects associated with construction noise. To comply with these ordinances, all construction activities adjacent to residential uses will be limited to day time hours (7:00 A.M. to 6:00 P.M.) from Monday to Saturday.					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			The contractor shall comply with standard specifications and all local sound control and noise level rules, regulations, and ordinances that apply to any work performed pursuant to the contract.					
			At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, operation of DG sets, use of high noise generation equipment shall be stopped during the night time between 10.00 pm to 6.00 am. Working hours of the construction activities shall be restricted around educational institutions/Health Centers (silent zones) up to a distance of 100 m from the sensitive receptors i.e., School, Health Centers and Hospitals etc.					
			Contractor shall provide noise barriers to the suggested locations of educational Institutions & health centers. List of locations for noise barriers is given in Table 8.43 of Section 8.6.1.1 of EIA Report. Guidelines for provision of Noise Barrier are provided as **Annexure 10. 14.**					
			Noise Barrier proposed for a length of - 545-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 109 Lakhs.	Noise Barrier proposed for a length of --1161-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 232.2 Lakhs.	Noise Barrier proposed for a length of --937-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 187.4 Lakhs.	Noise Barrier proposed for a length of --415-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 83.00 Lakhs.		
			Noise monitoring shall be carried out at the locations specified in monitoring plan by the K RIDE and the Engineer through the approved monitoring agency. Reporting format for pollution monitoring is presented in **Annexure 10.34**.					
			Monitoring locations at baseline Noise level monitoring locations, labour	Monitoring locations at baseline Noise level monitoring locations, labour	Monitoring locations at baseline Noise level monitoring	Monitoring locations at baseline Noise level monitoring	Contractor	Environmental Specialist

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 9 Lakhs	camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 6.3 Lakhs	locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 6.3 Lakhs	locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 9 Lakhs		of GC and PIA, K RIDE
C.4.4	Vibration Control	Work sites near Sensitive Receptors (Table 8.43 under Section 8.6.1.2 Noise Impact on Sensitive Receptors).	Vibration monitoring and building condition surveys at sensitive structures shall be carried out as per regulations and Guidelines; and in line with WB ESS 1& 3 and EIB's ESS 1& 3.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Preparation and implementation of a Vibration mitigation plan will be prepared by the contractor incorporating all required mitigation measures mentioned under Vibration Mitigation Measures and Scheme for Vibration Mitigation Plan in the section 8.5.12.2 of Chapter 8 of EIA Report and as per codes of practice during construction phase of the project. Following measures shall be incorporated in the mitigation Plan and implemented during construction :					
			Routing heavily-loaded trucks away from residential and sensitive areas,					
			Operation of earth-moving equipment on the construction site as far away from vibration - sensitive sites as possible,					
			Phase demolition, earth-moving and ground-impacting operations so as not to occur in the same time period. The total vibration level produced could be significantly less when each vibration source operates separately,					
			Avoidance of night time construction activities near residential and sensitive areas,					
			Avoidance of impact pile-driving where possible in vibration-sensitive areas,					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			Avoidance of vibratory rollers near sensitive areas.					
			Vibration Monitoring shall be carried out at the locations specified in monitoring plan by the K RIDE and the Engineer through the approved monitoring agency. Reporting format for vibration monitoring presented as **Annexure 10.35.**					
			Monitoring locations: Baseline Vibration monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 43.2 Lakhs	Monitoring locations: Baseline Vibration monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 43.2 Lakhs	Monitoring locations: Baseline Vibration monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 43.2 Lakhs	Monitoring locations: Baseline Vibration monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 43.2 Lakhs		
C.4.5	Soil pollution Control	Work sites, Plant sites and Construction Camps	The measures proposed to prevent ingress of toxic / heavy metals shall be implemented. Measures to mitigate the Soil Erosion and dust generation include careful planning, timing of cut and fill operations and re-vegetation in accordance with Water (Prevention and Control of Pollution) Act, 1974 & its amendments and ESS 1, 3 and 6 of World Bank and EIB Standards 1 & 3. In general, construction works shall be stopped during monsoon season.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Top soil preservation : As far as practicable, top soil removed from the construction sites will be used for construction of embankment to enhance growth of vegetation on the embankment surface and its consolidation. Besides, adequate temporary or					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			permanent drainages are planned to be provided before slope construction begins with lagoons to allow silt to settle out. As for the borrow areas, appropriate measures for the management of borrow areas will be taken. Top soils of the borrow pit sites will be conserved and restored after excavation is over.					
			Suitable storage area for such materials shall be prepared and equipment shall be made available for handling of these materials.					
			Contractor shall take all necessary precautions such that construction material, diesel, grease, waste oil, chemicals etc. does not spill on ground.					
			The Contractor shall be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures. It is suggested to utilize Ready Mix Concrete (RMC) at site directly from batching plant to avoid spillage. The Construction materials such as steel, bricks, etc. will be stored in a fenced stored yard. The unwanted or unused balance materials will be removed for use, if required; if not will be disposed after the completion of works. The surface area of erodible earth material exposed by clearing and grubbing, excavation shall be limited to the extent practicable. Works such as construction of temporary berms, temporary mulches, seeding or other methods as necessary to control erosion shall be implemented. The pre-identified disposal location shall be part of Comprehensive Solid Waste Disposal Plan which may be revised by the Contractor in consultation and with approval of Environmental Specialist of GC, if any variation is observed at identified disposal sites. Guidelines shall be followed as per Comprehensive Solid Waste Management Plan are provided in **Annexure 10.9**. Guidelines on topsoil conservation and reuse and slope stabilization measures are provided in **Annexure 10.1** and **Annexure 10.3**.					

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			Regular monitoring of groundwater and soil leachate shall be conducted at muck disposal areas where possibility of ground water contamination is anticipated. Reporting format for pollution monitoring is presented in **Annexure 10.34**.					
			Monitoring locations at baseline Soil Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 3.84 Lakhs	Monitoring locations at baseline Soil Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 4.8 Lakhs	Monitoring locations at baseline Soil Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 2.88 Lakhs	Monitoring locations at baseline Soil Quality monitoring locations, labour camp, construction site & other sensitive locations as suggested by Envi. Specialist of GC and cost = ₹ 3.84 Lakhs	Contractor	Environmental Specialist of GC, & PIA, K RIDE
C.5	Solid waste disposal from construction activities	Work sites, Plant sites and Construction Camps	The contractor shall prepare the comprehensive waste management plan in line with the provisions of Hazardous and other wastes (management and trans boundary movement) rules 2016 and its amendments and ESS 1&3 of World Bank, EIB's ESS 1&3 and submit to the Project Authority for concurrence.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Contractor shall ensure that hazardous wastes are labeled, recorded, stored in impermeable containment and for periods not exceeding mandated periods and in a manner suitable for handling storage and transport.					
			The contractor shall maintain a record of sale, transfer, storage of such waste and make these records available for inspection.					

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			Contractor shall dispose-off nonhazardous solid wastes, non-hazardous liquid wastes, and biomedical wastes as per the provisions of Hazardous and other wastes (management and trans boundary movement) rules 2016 and its amendments, EHS guidelines and WB ESS 1& 3 and EIB's ESS 1 & 3.					
			The contractor shall approach only Authorized Recyclers for treatment and disposal of Hazardous Waste, under intimation to the Project Authority.					
			If required, the treatment and disposal sites will be identified by the K RIDE in consultation with KSPCB such that pollution of water bodies and green areas are not impacted and displacement of persons is not involved. Applicable EHS guidelines shall be followed during Hazardous Material Management.					
			Guidelines for preparation muck disposal & site management, debris disposal & site management and comprehensive waste management plan are presented in **Annexure 10.7, Annexure 10.8** and **Annexure 10.9.** Reporting format for identification, site selection and management of Muck and Debris disposal sites are presented in **Annexure 10.21, Annexure 10.22** and **Annexure 10.23.**					
C.6	Occupational Safety							
C.6.1	Personal Safety Measures for Workers	Throughout the project corridor and construction phase of the project	Contractor shall provide safety to working personnel complying with EIA report, WB ESS 1& 4 and EIB's ESS 1 & 9. The Contractor Shall confirm the following personnel safety during construction:				Contractor	Environmental Specialist of GC and PIA, K RIDE
			i) Protective footwear, protective goggles and nose masks to the workers employed in asphalt works, concrete works, crusher etc.					
			ii) Welder's protective eye-shields to workers who are engaged in welding works					
			iii) Earplugs to workers exposed to loud noise, and workers working in crushing or compaction					
			iv) The Contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.					

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			v) Contractor shall provide the adequate personal protection equipment for the workers working with height, heavy electric equipment and working along existing Indian Railway alignment.					
			The Contractor shall comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract.					
			The Contractor shall make sure that during the construction work all relevant provisions of Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to.					
			The Contractor shall not employ any person below the age of 18 years (as per ILO's stipulations for hazardous work) for any work and no woman shall be employed on the work of painting with products containing lead in any form.					
			The Contractor shall also ensure that paint containing lead or lead products is used except in the form of paste or readymade paint.					
			Periodical (Monthly/Quarterly) Safety Audits shall be carried out by the Contractor and the Audit report shall be submitted to GC.					
			The Contractor shall follow the Guidelines to ensure worker safety during construction as presented in **Annexure 10.11.** Periodically contractor should report the workers safety to GC Environmental Specialist using Reporting format for Safety checklist and project safety measure are presented in **Annexure 10.26** and **Annexure 10.27.**					
C.7	Community Health and Workers Safety	Throughout the project corridor especially at work sites, intersections and settlements	Contractor shall provide community safety which shall be included in Traffic and Safety Management Plan prepared in compliance with EHS guidelines and WB ESS 1 & 4 and EIB ESS 1 & 9. Periodical (Monthly/Quarterly) Safety Audits shall be carried out by the Contractor and the Audit report shall be submitted to GC.				Contractor	Environmental Specialist of GC and PIA, K RIDE

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C.7.1	Traffic Management and Pedestrian / Road Users' Safety	Construction sites, intersections and settlements	Traffic Management and Engineering measures like traffic segregation, one-way movements, traffic diversions, acquisition of service lanes, etc. shall be implemented in compliance with the Traffic Management Plan and Indian Standards and WB ESS 4 and EIB's ESS 9 guidelines for the safety of pedestrians and other road users.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			The Contractor shall take all necessary measures for the safety of traffic during construction and provide erect and maintain such barricades, including safety signage - warning/Caution signage, information signage in advance of the work sites; markings, flags, lights and flagmen as proposed in the Traffic Management Plan with Drawings and as required by the Environmental Specialist of GC for the information and protection on traffic approaching or passing through the section of any existing cross roads.					
			The Contractor shall ensure that all signs, retro-reflectors, barricades, pavement markings are provided as per the guidelines. Before taking up of construction on any section of the existing lanes of the intersection roads, a Traffic Management Plan shall be devised and implemented to the satisfaction of the Environmental Specialist of GC. Guidelines for preparation of Traffic Management Plan are provided as **Annexure 10.10.**					
C.7.2	Access to adjacent public properties	Construction sites	Temporary ramps, makeshift pathways, temporary mobile foot over bridges, etc., should be provided to facilitate easy access to adjacent buildings and shops. Special consideration shall be given in the local traffic management to the safety of pedestrians. The temporary traffic arrangement should be kept free of encroachments / commercial activities. This should be undertaken in compliance with WB's ESS 4.				Contractor	Environmental Specialist of GC and K RIDE
			Contractor shall at all times during construction, make available, at least pedestrian access to adjacent properties so as not to obstruct the ingress and egress from the neighbouring houses and commercial and other buildings.					
			This will be a part of Traffic Management Plan. This should be undertaken in compliance with WB's ESS 4 and EIB ESS 9.					
C.7.3	Electrical Safety	Construction sites, Plant	The Contractor shall take all required precautions to prevent danger from electrical equipment in line with WB's ESS 4 and EIB's ESS 9, and ensure that –				Contractor	Environmental

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		sites, Labour camp and storage areas	a) No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public.					Specialist of GC and PIA, K RIDE
			b) All necessary fencing and lights shall be provided to protect the public in construction zones.					
			c) All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environmental Specialist of GC.					
			d) Contractor shall provide the adequate personal protection equipment for the workers working with height and heavy electric equipment					
C.7.4	Fire Safety	Construction sites, Plant sites and Labour camp	The Contractor shall implement required preventive measures for Fire safety as per The Karnataka Fire Force Act, 1964 and Indian Fire Safety Requirements, complying with WB ESS 4 and EIB's ESS 9.				Contractor	Environmental Specialist of GC and K RIDE
			The Contractor shall provide Fire Extinguishers at Plant sites and Construction Camps. The Contractor shall organize Training and Mock Drill for Workers, Technical and Non-technical persons involved in the project. Guidelines to ensure workers safety is presented in **Annexure 10.11.**					
C.7.5	Risk force measure	Throughout the construction phase	Contractor shall take all reasonable precautions to prevent danger to the workers and public from fire, flood, etc. resulting due to construction activities in line with WB's ESS 2 & 4 and EIB's ESS 8 & 9.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Contractor shall make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor shall identify necessary actions in the event of an emergency. Guidelines to ensure worker's safety during construction are provided as **Annexure 10.11.** Contractor shall prepare reports on workers safety, project safety measures, accident report, workers health check-up and workshop/awareness programme on Workers					

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			health/AIDS/COVID using reporting formats presented as **Annexure 10.26, Annexure 10.27, Annexure 10.28, Annexure 10.29** and **Annexure 10.30** respectively**.**					
C.7.6	Informatory Signs and Hoardings	Construction sites and construction establishments	The Contractor shall provide, erect and maintain informatory/safety signs, hoardings written in English and local language (Kannada), wherever required or as suggested by the Environmental Specialist of GC and in compliance with WB ESS 2 & 4 and EIB ESS 8 & 9.				Contractor	Environmental Specialist of GC and PIA, K RIDE
C.7.7	Incident/Accident/Risk/ Disaster Management	Risk/Accident areas	Disaster Management Plan and Emergency Response Plan shall be revised as per requirement and reported as per reporting formats. Preventive measures shall be adopted to avoid reoccurrence of the incident. In addition the Contractor shall report the Accident occurred referring to Reporting format presented in **Annexure 10.28**. This is in line with WB ESS 2 & 4 and EIB ESS 8 & 9.				Contractor	Environmental Specialist of GC and PIA, K RIDE
	Emergency Response - First Aid Facilities and Transport to Hospital	Construction sites; labour camps and construction establishments	Emergency Response Plan shall be revised as required and implemented. The Contractor shall arrange immediately for –					
			• Readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules.					
			• Suitable transport at all times to take injured to the nearest hospital.					
			• Equipment and trained nursing staff to attend the injured person.					
			The Contractor shall prepare the Accident report referring to Reporting format presented in **Annexure 10.28.** Periodical (Monthly/Quarterly) Safety Audits shall be carried out by the Contractor and the Audit report shall be submitted to GC.					
C.8	Construction/Labour Camp Management							
C.8.1	Accommodation	Labour camps	Contractor shall follow all relevant provisions of the Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996 and Factories Act, 1948 and amended in 1987, International Labour Standards (ILO), as per IFC's				Contractor	Environmental Specialist

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			Workers accommodation procedures (**as given Annexure 10.20.)** and WB ESS 2 & 4 and EIB's ESS 8 & 9 for construction and maintenance of labour camp.					of GC and PIA, K RIDE
			The location, layout and basic facility provision of each labour camp shall be submitted to GC and K RIDE prior to their construction.					
			The Construction shall commence only upon the written approval of the Environmental Specialist of GC.					
			Shelter at Workplace: At every workplace, shelter shall be provided free of cost, separately for use of men and women labourers. The height of shelter shall not be less than 3m from floor level to lowest part of the roof. Shelters shall be with adequate illumination and ventilation and the space provided shall be on the basis of at least 0.5m2 per head. Sufficient number of mosquito nets shall be provided. Housekeeping and hygiene are monitored by the Contractor.					
			Canteen Facilities : A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered necessary. Usage of Fire Wood for cooking or any other purpose shall be totally avoided to prevent CO_2 emission.					
			Conveyance : Free and adequate transport facilities shall be provided for all workers employed by the Contractor and residing at base camp to construction sites and Back.					
			The Contractor shall maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Sr. Environmental Specialist, GC.					
C.8.2	Provision for Potable Water	Construction site and Labour camp	The Contractor shall construct and maintain all labour accommodation in such a fashion that potable water is available for drinking, cooking and washing.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			The Contractor shall also provide potable water facilities within the premises of every camp at an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and as per IFC's workers accommodation procedures (**as given Annexure 10.20.)** also in line with WB ESS 3 and EIB ESS 3.					

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			The Contractor shall also guarantee the following:					
			a) Supply of sufficient quantity of Potable Water (as per IS) in every workplace/labour camp (Site at suitable and easily accessible places and regular maintenance of such facilities.					
			b) If any water storage tank is provided that shall be kept such that the bottom of the tank at least 1 m above the surrounding ground level.					
			c) If water is drawn from any existing well, which is within 30 m proximity of any toilet, drain or other source of pollution, the well shall be disinfected before water is used for drinking.					
			d) All such wells shall be entirely covered and provided with a trap door, which shall be dust proof and water proof.					
			e) A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once in a month.					
			f) Analysis of water shall be done every month as per parameters prescribed in IS 10500-1991. Water quality testing shall be carried out as per the guidelines provided in Environmental Monitoring plan is presented in section 10.10 of EIA Report and reporting format for recording results is given in **Annexure 10.39.**					
			Environmental Specialist of GC shall be required to inspect the labour camp once in a week to ensure the compliance of the EMP.					
C.8.3	Sanitation and Sewage System	Labour camps	The Contractor shall implement proper sanitation and sewage system in accordance with the Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996 and Factories Act, 1948 and amended in 1987, also in line with WB ESS 1 & 3 and EIB ESS 1 & 3.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			a) The Sewage system for the camp shall be designed, built and operated in such a manner that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place.					

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			b) Separate and adequate toilets/urinals and wash room Facilities shall be provided at Base Camp for Workers, separate for men and women (marked in vernacular). Cleaning/washing and bathing places shall be provided. Separate and adequate toilets and bathrooms, wherever required, shall be provided for men and women.					
			c) Adequate water supply shall be provided in all toilets and urinals; and wash rooms/bath rooms.					
			d) Drains for waste water shall be provided for the flow of used water outside the camp. Drains and ditches shall be treated on a regular basis.					
			e) Wastewater shall be discharged to the existing sewage network or will be disposed-off in septic tank and soak pit.					
			f) Night soil can be disposed of with the help of local municipal extractor or disposed of by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm layer of waste or refuse and then covered with a layer of earth for fortnight.					
			g) Hygienic condition shall be maintained till the closure of labour camp. All septic tank/soak pits shall be regularly serviced and emptied to reduce the risk of surface or groundwater pollution.					
			h) The contractor shall conform generally to sanitary requirements of local medical, health and municipal authorities and at all times adopt such precautions as may be necessary to prevent soil pollution of the site.					
C.8.4	Solid Waste Disposal	Labour camps and Construction Sites	The pre-identified disposal site shall be a part of Comprehensive Waste Disposal Plan. Solid Waste Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Specialist of CSC. In case of non-availability of disposal site, Solid Wastes shall be handed over to BBMP authority regularly, as per the Solid Waste Management Rules, 2016, amended in 2018 and Regulations of PCB; and in line with WB ESS 3 and EIB's ESS 3.				Contractor	Environmental Specialist of GC and K RIDE

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			The Contractor shall provide colour coded garbage bins for wet and dry wastes in the camps and ensure that these are regularly emptied and disposed-off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Specialist of GC.					
			Solid waste generated from labour camps shall be segregated and collected in separate Garbage bins for non-biodegradable and biodegradable waste and regularly emptied and the garbage shall be disposed-off in a hygienic manner. Biodegradable Municipal solid waste shall be collected by local BBMP and transported to local municipal bins for onward disposal to disposal site. Non-biodegradable waste shall be disposed by selling to scrap dealers (recyclable) and to existing authorized agency (inert and non-recyclables). Guidelines for preparation of Comprehensive Waste Management Plan are provided as **Annexure 10.9.**					
C.8.5	Occupational Health Measures and Medical Facilities for Workers	Construction Sites and Labour camps	Measures shall be as follows in compliance with WHO, the Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996 and Factories Act, 1948 and amended in 1987 and WB ESS 4 and EIB's ESS 9.				Contractor	Environmental Specialist of GC and K RIDE
C.8.5.1	Occupational Health Measures - Health Check-up & First Aid Facilities	Construction Sites and Labour camps	Medical Facilities on site: Occupational Health Centre, Ambulance van and clinical room to test HIV/ AIDS/COVID prevention and control with all requirements. The Contractor shall arrange for the following –				Contractor	Environmental Specialist of GC and PIA, K RIDE
			i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone and Labour Camp.					
			ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital.					
			iii) Equipment and trained nursing staff at construction camp.					
			iv) Periodical health check-up for construction workers and their family and for the sick persons.					

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			Control of Occupational Health Hazards : Housekeeping and hygienic (cleanliness) conditions shall be well maintained at labour camps and construction sites to avoid any epidemics such as COVID, etc. among workers. Mosquito breeding shall be prevented by avoiding any stagnant water at base camps or at work sites. Mosquito control fogging shall be carried out in all sites as well as in labor camps for Malaria and Dengue control. Rest sheds shall be provided to workers working on sites to avoid humidity effects and rest during lunch hours. Provision of conditions in contract and good construction practices will take care of any occupational health hazard issues and provide environmentally safe work areas.					
			Prevention of Infectious diseases:					
			• One-one interactions – helps to build confidence,					
			• Counselling- addressing the myths and misconceptions,					
			• Community events-street theatre, puppetry, cultural programs are proven communication tools to the illiterate community to message dissemination,					
			• STD clinic - early identification through testing,					
			• Condom promotion- encouraging condom usage, an accessible place, made available at all times and free distribution.					
			• Advertisement board at appropriate location will be put to make aware about the infectious diseases.					
			Reporting format for workers health check-up is presented as **Annexure 10.29.**					
C.8.5.2	Awareness Programme on HIV/AIDS/COVID, etc.	Labour camps	Periodical Awareness or Orientation Training Programme on HIV/AIDS/COVID, etc. shall be organized for the welfare of Labourers and their family in line with WB ESS 2 & 4 and EIB ESS 8 & 9. The Contractor should undertake workshop/awareness program on health/AIDS/COVID using reporting format presented in **Annexure 10.30**.				Contractor	Environmental Specialist

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			First Aid Training shall be organized by the Contractor for the welfare of Labourers and all the personnel involved in the project.					of GC and K RIDE
C.9	Community Health	In the vicinity of Construction Sites	Community health measures shall be implemented by the Contractor in line with ESS 4 of World Bank Guidelines and EIB's ESS 9. The measures include the following :				Contractor	Environmental Specialist of GC and PIA, K RIDE
			○ establishing workers camps separated from local communities (500ms away from the settlements) with strict protocols for interaction with local communities in order to avoid project impacts from labor influx;					
			○ implementing sensitization and specific mitigation measures for social impacts from labor influx during construction or service provision of the project;					
			○ adopting all required mitigation measures to avoid air, water, soil and noise pollution & vibration as mentioned under Mitigation Measures for air, water, soil and noise pollution & vibration Sections in this Chapter;					
			○ providing first aid facilities and establishing health clinics;					
			○ incorporating safe road crossings into project design;					
			○ implementing safety signage and traffic management during construction at work sites;					
			○ adopting all required safety protocols at work sites					
			○ strict following of protocols for temporary blasting during demolition at the reinstatement or restoration phase;					
			Periodical Community Health Awareness programmes shall be conducted by the Contractor involving Community participation.					
C.10	Energy Management /Conservation	Construction sites, Plant sites and Labour camp	The contractor shall use and maintain lighting, tools and equipment of appropriate specifications so as to conserve energy as per EHS guidelines, complying with WB ESS 3& 6 and EIB's ESS 3 & 4.				Contractor	Environmental Specialist of GC and PIA, K RIDE

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C.11	Ban on Plastics	Construction sites, Plant sites and Labour camp	There shall be total ban on usage of plastics and one time use plastic in accordance with the Plastic Waste Management Amendment Rules, 2021. The usage of Paper or cotton bags shall be encouraged and shall be in practice, complying with WB ESS 1, 3 & 4 and EIB's ESS 1, 3, & 9.				Contractor	Environmental Specialist of GC and PIA, K RIDE
C.12	Provision for Liquid Waste Management (Sewage and Effluent) during Operation	Stations & Depot	Contractor shall make provisions for proper collection of liquid waste – Sewage and Effluent which will be generated from Stations and Depot during operation. Sewage water generated from station will be treated using Bio-digesters with in the vicinity and reused for flushing and gardening purposes. Typical cross section for Bio-digesters is given in Figure 8.6. Sewage and Effluents from depot sites shall be collected and treated using Effluent Treatment Plant in the premises.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Provision of Bio-digesters for Stations:					
			No. of Bio-digester Locations = 16	No. of Bio-digester Locations = 14	No. of Bio-digester Locations = 14	No. of Bio-digester Locations = 20		
			Cost = ₹ 26.1 Lakhs	Cost = ₹ 16.8 Lakhs	Cost = ₹ 13.33 Lakhs	Cost = ₹ 23.56 Lakhs		
			Effluent Treatment Plant (ETP) for Depot:					
			No. of ETP = 1	No. of ETP = 1	No. of ETP = 1	No. of ETP = 1		
			Cost = ₹ 1.75 Lakhs	Cost = ₹ 1.75 Lakhs	Cost = ₹ 1.5 Lakhs	Cost = ₹ 1.5 Lakhs		
C.13	Institutional capacity & Strengthening	Project Site	Environmental Engineer for implementation of EMP and Health & Safety Officer shall be employed by the Contractor for every project corridor. Project Manager of the Contractor shall monitor Environment Engineer and Health & Safety officer. EMP trainings/Workshops on implementation of EMP, Health, Safety and Closure Activities as per EMP of EIA Report and EHS guidelines shall be undertaken periodically by the Contractor and will be conducted by the Environmental Specialist of GC.				Contractor & Environmental Specialist of GC	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			Environment Monitoring Unit (EMU) established at PIA (K RIDE) shall be the approval authority.					
C.14	Continuous Community Participation	Along the project corridor	The Environmental Specialist of GC in Coordination with EMU shall have continuous interactions with local people around the project area to ensure that the construction activities are not causing undue inconvenience to the locals residing in the vicinity of project site under construction due to noise, dust or disposal of debris, etc. in compliance with WB ESS 10 & EIB ESS 2. The contractor shall use the reporting format given in **Annexure 10.37** to carry out the public consultation at work sites.				Environmental Specialist of GC & EMU, K RIDE	PIA, K RIDE
C.15	Flora and Fauna: Plantation/Preservation/ Conservation Measures							
C.15.1	Tree protection, Cutting/Removal and Disposal	Throughout project corridor	The tree protection/preservation, cutting and disposal shall be planned in line with The Karnataka Tree Preservation Act, 1976 & amendment Rule 2008, Forest Conservation Act 1980 and ESS 6 of World Bank and EIB's ESS 4.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Other than Contractor, no one is allowed to cut the identified trees which are falling in the ROW.					
			Fugitive dust deposition on pubescent leaves of nearby vegetation shall be controlled to avoid impact on reduction of their photosynthesis.					
			Biomass shall not be stored at site for more than 15 days.					
			The Contractor shall do turfing on embankment slopes, plantation of shrubs as specified in the Contract.					
C.15.2	Impact on Flora and chance finds - wild Fauna	Throughout project corridor especially near forest stretches including	Vegetation shall be removed from the construction zone before commencement of construction. All works shall be carried out such that the damage or disruption of flora other than those identified for cutting is minimal. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from the Sr. Environmental Specialist of GC.				Contractor	Environmental Specialist of GC and PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
		surface water bodies	The Contractor, under any circumstances shall not cut or damage trees and forest reserves, if any. Trees identified under the project shall be cut only after receiving clearance from the BBMP Forest Wing/Forest Dept./DoEF/MoEFCC (as applicable) and after the receipt of K RIDE's written permission in this regard. This will be in line with ESS 1, 3 & 6 of World Bank and EIB Standards 1, 3 & 4. Vegetation only with girth size of over 30 cm shall be considered as trees and shall be compensated, in the event of K RIDE's instruction to undertake tree cutting. Translocation of trees less than 30cm and trees as suggested by BBMP Forest Wing/Forest Dept. shall be carried out adequately. Compensatory afforestation for the tree cut and translocated trees shall be carried out by BBMP forest Wing/ Forest Dept. as per the statutory guidelines of Forest Conservation Act, 1980 and Karnataka Preservation of Trees Act, 1976.					
			The Contractor shall take reasonable precaution in line with WB ESS 6 and EIB ESS 4 to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found in the vicinity of construction sites by chance, at any point of time, the contractor shall immediately upon discovery thereof acquaint in the Environmental Specialist of GC and carry out his instructions for dealing with the same.					
			Environmental Specialist of GC shall report to the nearby forest office (range office or divisional office) and shall take appropriate steps/measures, if required in consultation with the forest officials.					
C.15.3	Plantation in Surplus land available along Railway alignment and Compensatory Afforestation Strategy	Surplus land available along Railway alignment	The trees for compensatory plantation shall be as per the Tree Plantation Strategy.	Contractor shall prepare an action plan as per compensatory afforestation norms	Contractor shall prepare an action plan as per compensatory afforestation	Contractor shall prepare an action plan as per compensatory afforestation	Contractor	Environmental Specialist of GC & PIA K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			The proposed Afforestation measures shall comply with World Bank ESF guidelines. The Contractor shall prepare an action plan as per compensatory afforestation norms provided by BBMP Forest Wing/Forest Dept., for successful implementation of compensatory afforestation in line with WB ESS 6 and EIB ESS 4.	provided by BBMP Forest Wing/Forest Dept., for successful implementation of compensatory afforestation in line with WB ESS 6 and EIB ESS 4.	norms provided by BBMP Forest Wing/Forest Dept., for successful implementation of compensatory afforestation in line with WB ESS 6 and EIB ESS 4.	norms provided by BBMP Forest Wing/Forest Dept., for successful implementation of compensatory afforestation in line with WB ESS 6 and EIB ESS 4.		
			The compensatory plantation shall be carried out by the State Forest Department/BBMP forest wing.				Contractor	Environmental Specialist of GC and PIA, K RIDE
			Minimum 80 percent survival rate of the saplings shall be acceptable otherwise the Contractor/Forest Department shall replace dead plants at his own cost.					
			The Environmental Specialist of GC shall inspect regularly the survival rate of the trees planted by the Contractor to carryout by BBMP Forest Wing/Forest Dept.					
			About 24703 trees to be affected and trees proposed to be	About 3491 trees to be affected and trees proposed to be	About 2072 trees to be affected and trees proposed to	About 2306 trees to be affected and trees proposed to	Contractor	Environmental Specialist

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			planted are about 247030 saplings.	planted are about 34910 saplings.	be planted are about 20720 saplings.	be planted are about 23060 saplings.		of GC and PIA, K RIDE
			Number of Trees along the alignment is 24703. About 17323 trees comes under forest Dept. in proposed Akkupete depot	Number of Trees along the alignment is 3491.	Number of Trees along the alignment is 2072.	Number of Trees along the alignment is 2306.		
			Compensatory Afforestation cost is ₹ 4026.6 Lakhs.	Compensatory Afforestation cost is ₹ 565.4 Lakhs.	Compensatory Afforestation cost is ₹ 337.7 Lakhs.	Compensatory Afforestation cost is ₹ 375.9 Lakhs.		
			Ecological monitoring during tree felling & translocation and compensatory afforestation is ₹ 1.8 Lakhs.	Ecological monitoring during tree felling & translocation and compensatory afforestation is ₹ 1.8 Lakhs.	Ecological monitoring during tree felling & translocation and compensatory afforestation is ₹ 1.8 Lakhs.	Ecological monitoring during tree felling & translocation and compensatory afforestation is ₹ 1.8 Lakhs.		
C.16	Preservation of fossils, archaeological remains, etc.							
C.16.1	Impact on Archaeological sites, monuments, fossils,	Throughout project corridor	• Interpretation panels/signage must be provided for the monument. • In case of cultural/religious structures, water sprinkling, barricading, flagman and signboard should be provided.				Contractor	Environmental Specialist

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
	historical and cultural heritage, etc. and Chance findings,		• Drainage system should be checked so that the corridor level should not be higher than the monument and water should not enter inside the monument complex. • Prior intimation should be given to ASI authority to monitor the site and also to check the impact on monument during /post digging (excavation) process. • Prior permission must be obtained from the Competent Authority for any construction or increase in height. • A certificate should be furnished to the Competent Authority on completion of proposed construction to effect that it has complied with all conditions of the permission. • The compliance must be with the heritage bye-laws of the protected monument concerned as and when the bye-laws are approved.					of GC and PIA, K RIDE
			All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest and historical/cultural heritages discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation and WB ESS 8 and EIB's ESS 10. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He shall, immediately upon discovery thereof and before removal acquaint the Environmental Specialist of GC of such discovery and carry out the GC's instructions for dealing with the same, waiting which all work shall be stopped. The GC shall seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site. The Archaeological structures identified along the project corridors, if any, shall be protected/ preserved or enhanced as per the law. The details regarding Chance Find procedure is given in **Annexure 10.5.**					
C.17	Contractor's Closure Activities before Demobilization							

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
C.17.1	Clean-up Operations, Restoration and Rehabilitation	Throughout the project corridor	Clean-up Operations, Restoration and Rehabilitation activities shall be implemented during project closure by the Contractor in line with WB ESS 3, 4 & 6 and EIB ESS 3, 9 & 4				Contractor	Environmental Specialist of GC and K RIDE
			Contractor shall prepare site restoration plans, which shall be approved by the Environmental Specialist of GC. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor shall clear all temporary structures; dispose all garbage, night soils and POL (Petroleum, Oil and Lubricants) wastes as per Comprehensive Waste Management Plan and as approved by GC. Guidelines for preparation of Comprehensive Waste Management Plan are provided presented in **Annexure 10.9.**					
			All disposal pits or trenches shall be filled in and effectively sealed off. Residual topsoil, if any shall be distributed on adjoining/proximate barren land or areas identified by the Contractor and approved by the Environmental Specialist of GC in a layer of thickness of 75 mm – 150 mm. All construction zones and facilities including culverts, project corridor side areas, camps, Crushers, batching plant sites and any other area used/affected due to the project operations shall be left clean and tidy, at the Contractor's expense, to the entire satisfaction to the Environmental Specialist of GC. The contractor shall carryout the restoration of construction sites using reporting format given in **Annexure 10.36.**					
C.18	Construction Activities by K RIDE							
C.18.1	Environmental Quality Measures (Third Party Testing)	Representative locations as directed by Sr. Environmental Specialist, GC.	Contractors will carry out environmental monitoring during construction, whereas Third Party will be hired by K RIDE. Third Party will carry out monitoring on behalf of K RIDE. The K RIDE through third party shall undertake seasonal monitoring of air, water and noise and soil quality through an approved monitoring agency in compliance with Environmental Protection Act, 1986, complying with WB ESS 3 & 6 and EIB's ESS 3 & 4. The parameters to be monitored, frequency and duration of monitoring as well as the				PIA, K RIDE	Environmental Specialist of GC and K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			locations to be monitored shall be as per the Monitoring Plan **Table 10.3** of EIA Report. There may minor variations while selecting monitoring locations during construction based on the activities going on during the period of pollution monitoring. National Standard of Air, Noise and Water given in **Annexure 10.34**. In addition Reporting format for recording environmental monitoring and mitigation measures shall be reported in the reporting format given in **Annexure 10.3** and **Annexure 10.40** respectively. Rectification Action shall be taken up by the Contractor for the improvement of Environmental Quality during Construction.					
C.18.2	Environmental Enhancement Measures - Tree Plantation	Throughout the project corridor	Environmental Enhancement activity will be undertaken by the K RIDE in the form of additional plantation under Compensatory Afforestation as Social forestry based on availability of land. The plantation at the following locations shall be implemented by BBMP forest wing/Forest dept. as per statutory guidelines of Karnataka Tree Preservation Act, 1976 and in line with Traffic Management Plan, WB ESS 6 and EIB's ESS 4.				State Forest Department/BBMP	PIA, K RIDE
		Nearby locations with available land	Compensatory Afforestation - Community Plantation shall be carried out by Forest Authority/BBMP in consultation with K RIDE. Local Trees shall be selected for plantation. This will comply with WB ESS 6 and EIB's ESS 4. In the long term, compensatory afforestation and Green belt development will enhance environment of the project area.					
Operation Phase								
O.1	Monitoring of Operation Performance Indicators	Throughout the project corridor	The K RIDE shall monitor the operational performance of the various mitigation/enhancement measures carried out as a part of the project in line with WB ESS 3, 4 & 6 and EIB ESS 3, 4 & 9.				PIA, K RIDE	PIA, K RIDE
			The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision made under the project; status of rehabilitation of borrow areas; and effectiveness of noise barriers. This will comply with WB ESS 3, 4 & 6 and EIB ESS 3, 4 & 9.					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
O.2	Maintenance of Drainage	Throughout the project corridor	K RIDE shall ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding in low lying areas, as per the Contract Document and WB ESS 1 and EIB's ESS 1.				PIA, K RIDE	PIA, K RIDE
O.3	Water supply	All Stations and Depot	The source of water supply at Depot is municipal water supply. This will be supplemented by re-use of treated water of effluent treatment plant. The fresh water demand at stations & depot for the project year 2025, would be about 2,88,249 KLD required to be used for different purposes such as for train washing – 720 KLD, floor washing/cleaning – 2,80,000 KLD, for drinking purpose – 6494 KLD for passengers and official staffs at Stations and Depot and for sanitation purpose – 1012 KLD. Guidelines under WB ESS 3 and EIB ESS 3 shall be followed.				PIA, K RIDE	PIA, K RIDE
O.4	Pollution Monitoring	At representative Baseline monitoring locations + Additional, as required.	Baseline monitoring location is treated as the reference and comparison point. In addition wherever required, additional monitoring may be carried out as and when required and decision taken by the EMU, PIA, K RIDE. The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil quality in the selected locations as suggested in pollution monitoring plan through the KSPCB or its approved monitoring agency and shall be in compliance with Environmental Protection Act, 1986, The Air (Prevention and Control) Act, 1981, The Water (Prevention and Control) Act, 1976 and The noise pollution (regulation and control) rules, 2000; and with all with Amendments and WB ESS 3 and EIB's ESS 3.				Pollution Monitoring Agency	PIA, K RIDE
			Environmental management cost during operation	Environmental management cost during operation	Environmental management cost during operation	Environmental management cost during operation		

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			phase will be ₹ 67.04 Lakhs	phase will be ₹ 63.62 Lakhs	phase will be ₹ 68.96 Lakhs	phase will be ₹ 79.8 Lakhs		
O.4.1	Air Pollution due to inter modal operational vehicles	At representative baseline monitoring locations and Depots	There are operational inter modal vehicles such as autorickshaws, taxis, two-wheelers or four wheelers to transport BSR commuters to reach nearby Suburban Railway Stations from source and Suburban Railway Stations to their destinations such as work place, residence, etc. Air Pollution monitoring shall be carried out in accordance with Air (Prevention and Control) Act, 1981 and CPCB regulations and WB ESS 3 and EIB's ESS 3.				PIA, K RIDE	PIA, K RIDE
			Air Quality Monitoring cost during Operation Phase (Stations and Depot) will be ₹ 8.64 Lakhs.	Air Quality Monitoring cost during Operation Phase (Stations only) will be ₹ 6.48 Lakhs.	Air Quality Monitoring cost during Operation Phase (Stations and Depot) will be ₹ 8.64 Lakhs.	Air Quality Monitoring cost during Operation Phase (Stations only) will be ₹ 10.8 Lakhs.		
O.4.2	Noise Pollution	All Stations and Depot	Mitigations measures for Noise Management shall be carried out in accordance with Noise Pollution (Regulation and Control) Rules, 2000 and its amendment and ESS 3 of World Bank and EIB's ESS 3.				PIA, K RIDE	PIA, K RIDE
			• Wherever required Noise barriers shall be erected and noise barriers on viaduct shall be maintained. • The use of green belt with vegetation of thick foliage at Depots and stations act as noise screeners and helps to reduce noise; • Wherever site layout permits, barrier blocks of less-vulnerable buildings may be used. • Screening of noise shall be ensured by providing parabolic noise barriers on each side of the track along the curved portion of the viaduct and at sensitive receptors during operation. Polycarbonate noise barriers 15mm to 25 mm thick are known to reduce noise level by 30dB.					

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			• Alternatively solid noise barrier walls shall be built (Manual on norms and standards for environment clearance of large construction projects, MoEFCC, 2007). Required solid Noise barriers shall be erected and shall be maintained at locations such as sharp curved portions, structures falling within 20m distance from the alignment and at sensitive receptors like educational institutions and hospitals where noise impact criteria is severe. • If compound walls are already present, the height of the wall shall be raised so that the height of the solid noise barrier shall be 3m. If not, based on the availability of land solid noise barriers shall be provided at sensitive receptors such as educational institutions and health centres. • Noise measures shall be undertaken in due consultation with Indian railway officials and land owners during pre-construction stage. Details of solid concrete noise barriers proposed for each corridor is given in Table 8.43. EMU of K RIDE shall arrange to monitor the noise environment at these locations before erecting the solid noise barriers during operation.					
			Noise Level Monitoring cost will be ₹ 3.6 Lakhs.	Noise Level Monitoring cost will be ₹ 2.34 Lakhs.	Noise Level Monitoring cost will be ₹ 4.32 Lakhs.	Noise Level Monitoring cost will be ₹ 4.32 Lakhs.		
			Noise Barrier proposed for a length of - 545-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 109 Lakhs.	Noise Barrier proposed for a length of --1161-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 232.2 Lakhs.	Noise Barrier proposed for a length of --937-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 187.4 Lakhs.	Noise Barrier proposed for a length of --415-- m (₹ 0.2 Lakh/meter) and the cost will be ₹ 83.00 Lakhs.		
O.4.3	Vibration		• Vibration monitoring and building condition surveys at sensitive structures shall be implemented, as per requirement in line with WB's ESS 3 and EIB ESS 3.				PIA, K RIDE	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
		Stations and running corridors	• The proper maintenance of track and rolling stock during operation helps in controlling vibration. The vibration level can be significantly reduced by incorporating the following standard measures/factors: • Vehicles with no stiff primary suspension • No Worn or Wheel with flats • No Worn/Corrugated Track • With Floor-to-Floor Attenuation in receptor buildings • In case of ballast less track, the following are some measures for vibration damping : • Use of Resilient soft base plates between rail and track slab; • Use of Resilient rubber between the base plate and track slab; • Application of Soft elastic fastening system and • Deep and narrow trenches in the ground shall be tested at vibration-sensitive structures.					
			Vibration Monitoring cost will be ₹ 32.4 Lakhs.	Vibration Monitoring cost will be ₹ 32.4 Lakhs.	Vibration Monitoring cost will be ₹ 32.4 Lakhs.	Vibration Monitoring cost will be ₹ 32.4 Lakhs.		
O.4.4	Soil Monitoring	All Stations and Depot	Visual Monitoring and inspection of borrow areas in case operated (if closed and rehabilitated), embankments and other places expected to be affected, shall be carried out once in every three months as per monitoring plan, to check soil erosion if any. Measures shall be necessitated to avoid residual impacts such as soil erosion and mosquito breeding at stagnated water.				PIA, K RIDE	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			Soil Quality Monitoring shall be carried out in accordance with EPA, 1986 and ESS 3 of World Bank and WB ESS 3 & EIB's ESS 3.					
			Soil Quality Monitoring cost will be ₹ 2.88 Lakhs.	Soil Quality Monitoring cost will be ₹ 2.88 Lakhs.	Soil Quality Monitoring cost will be ₹ 2.88 Lakhs.	Soil Quality Monitoring cost will be ₹ 3.6 Lakhs.		
O.4.5	Water Pollution due to Liquid waste - sewage & Effluent	All Stations and Depot; and nearby water bodies, if any.	Water Quality Management at Stations and Depot will be in accordance with Water and Waste Water Management Plan in compliance with Indian Standards, in accordance with Water Pollution (Prevention and Control) Act, 1976 and its amendment, and ESS 3 of World Bank and EIB ESS 3. If required, additional locations may be provided by EMU, PIA, K RIDE.				PIA, K RIDE	PIA, K RIDE
			Required number of Latrines or urinals shall be provided as per specifications and guidelines mentioned in the Railways Works Manual, 2000 and CPCB/KSPCB regulations. Other Measures include treatment and reuse of waste water by installing Bio-digesters at Stations and Effluent treatment plant for Depots. Measures including treatment and reuse of waste water by installing Bio-digesters at Stations and Effluent treatment plant for Depot. Treated water shall be reused for flushing and washing purpose.					
			No. of Bio-digester at Stations = 16	No. of Bio-digester at Stations = 14	No. of Bio-digester at Stations = 14	No. of Bio-digester at Stations = 20		
			Water Quality Monitoring cost will be ₹ 7.68 Lakhs (for	Water Quality Monitoring cost will be ₹ 7.68 Lakhs (for	Water Quality Monitoring cost will be ₹ 10.24 Lakhs (for monitoring of	Water Quality Monitoring cost will be ₹ 13.44 Lakhs (for monitoring of		

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			monitoring of water and waste water).	monitoring of water and waste water).	water and waste water).	water and waste water).		
			No. of ETP at Depot = 1	No. of ETP at Depot = 1	No. of ETP = 1	No. of ETP = 1		
O.5	Water supply	All Stations and Depot	The source of water supply at Depot is municipal water supply. This will be supplemented by re-use of treated water of effluent treatment plant. The fresh water demand at stations & depot for the project year 2025, would be about 2,88,249 KLD required to be used for different purposes such as for train washing – 720 KLD, floor washing/cleaning – 2,80,000 KLD, for drinking purpose – 6494 KLD for passengers and official staffs at Stations and Depot and for sanitation purpose – 1012 KLD.				PIA, K RIDE	PIA, K RIDE
O.6	Solid waste disposal at stations and Depot	All Stations and Depot	Solid Waste Management at Stations and Depot will be in accordance with Solid Waste Management Plan and in compliance with Indian Standards and ESS 3 of World Bank and EIB ESS 3. EMU, PIA, K RIDE may redevelop or modify the Solid Waste Management Plan.				PIA, K RIDE	PIA, K RIDE
			Organic waste shall be segregated and treated by in-site bio composter technique.					
			Based on the situations, the municipal solid waste shall be handed over to the BBMP Authority for proper treatment and disposal.					
O.7	Soil Erosion and Monitoring of Borrow Areas	Borrow areas and embankment slopes	Visual Monitoring and inspection of operated and closed borrow areas, embankments and other places shall be carried out once in every three months as per monitoring plan, to check soil erosion if any. Measures shall be necessitated to avoid residual impacts such as soil erosion and mosquito breeding at stagnated water. This will comply with WB ESS 3 and EIB Standards 3.				PIA, K RIDE	PIA, K RIDE

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Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
O.8	Ecological Monitoring – Flora & Fauna and Water Bodies	Plantation and Water Body sites	Assessment for Change in Bio-diversity and Water body quality - Once in a season, four seasons in a year in line with WB ESS 6 and EIB ESS 4.				BBMP Forest wing/ Forest Dept. in consultation with K RIDE	PIA, K RIDE
O.9	Operational Safety	Stations. Corridors and Depots	• Implementation of rail operational safety procedures aimed at reducing the likelihood of train collisions such as a positive train control (PTC) system. If a full PTC system is not practical, automatic rail switches should be installed or, where manual switches remain, documenting when a manually operated switch in non-signalled territory is changed from the main track to a siding, and returned back to the normal position for main track movements. This information should be communicated to all crew members and the train dispatcher. • Regular inspection and maintenance of the rail lines and facilities to ensure track stability and integrity in accordance with national and international track safety standards; Implementation of an overall safety management program that is equivalent to internationally recognized railway safety programs. PPE shall be provided to workers involved in maintenance of cars. Security personnel shall also be employed.				PIA, K RIDE	PIA, K RIDE

Sl. No	Implementation Activity and Environmental Impact Issue	Location	Mitigation Measures with Applicable Laws/Acts/Guidelines				Planning and Executing Organization	Supervising Authority /Project Proponent
			Corridor 1: KSR Bengaluru City – Devanahalli	Corridor 2 : (Baiyappanahalli - Chikkabanawar)	Corridor 3: Kengeri - White Field	Corridor 4: Heelalige - Rajankunte		
			Periodical Safety Audit procedures shall be followed. Above measures will be in line with Guidelines under WB ESS 4 and EIB ESS 9.					
O.10	Incident/Disaster/Accident Management	All Stations and Depot	Guidelines under WB ESS 4 and EIB ESS 9 shall be followed. Incident Management Plan shall be in accordance with EHS guidelines, Risk/ Disaster Management plan and Emergency Response Plan.				PIA, K RIDE	PIA, K RIDE
			Proper maintenance of Incident Records shall be taken care.					
			Required preventive measures shall be under taken to avoid repetition of risks/hazards.					
O.11	Community Health and Safety	Throughout the project corridor	Emergency-response planning and monitoring for prevention and control of pollution or other risk incidents during operation shall be established in compliance with Guidelines under WB ESS 4 and EIB ESS 9.				PIA, K RIDE	PIA, K RIDE
			Sufficient number of Security personnel shall be employed to secure commuters' safety at stations.					
			Corporate Social Responsibility: Public shall be advised to construct the noise barriers such as walls, double glazed windows and tree plantation between the roads and their property.					
			The Public awareness on Safety, Noise levels and Health Impacts is necessary through the newspapers and public consultations and distribution of pamphlets during the operation stage - Once in 3 months and 4 times in a year as per EHS/EMS.				PIA, K RIDE	PIA, K RIDE
O.12	Monitoring and Grievances	Throughout the project corridor, wherever required	Grievance mechanism shall be in line to monitor progress of implementation of the EMP/EMoP measures and results achieved. Guidelines under WB ESS 10 & 4 and EIB ESS 2 & 9 shall be followed by GRC during operation.				PIA, K RIDE	PIA, K RIDE
			Project-level grievance redressal Mechanism shall be implemented.					

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10.9.1. Reporting System

The monitoring report of environmental parameters (Air, Noise, Vibration, Water and soil) will be prepared by the environmental engineer of the Contractor and submitted to the Project Management Consultant.

- The contractor will report to General Consultant (GC) and GC will report to K RIDE on compliance. K RIDE may disseminate the information to all allied / interested parties.
- Non-compliance of the monitoring will be seen by the K RIDE.
- Photographic monitoring record will be maintained by the contractor. All material source points, disposal locations, plant locations, camp locations, etc. should be photographed.
- A full record of construction activities will be kept as a part of normal contract monitoring system under the various stages of construction.

The Reporting Formats and Checklists for various activities during construction are enclosed as **Annexure 10.15** to **Annexure 10.31**.

10.9.2. Record Keeping

Project specific Monitoring forms will need to be devised for use, focusing attention on environmental issues and providing feedback for future improvement. Mitigation and enhancement measures adopted in the final design will be explicitly under the bill of quantities (BOQ), so that performance and completion is readily documented. Project diaries would record environmental problems (soil erosion, air quality, water quality, noise level etc.), as well as safety incidents and will be retained as part of the accepted environmental management.

10.10. Environmental Monitoring Plan (EMoP)

The Environmental Monitoring Programme/Plan (EMoP) plays a significant role during project implementation. The project specific Environmental Monitoring Programme aides in identification and rectification of potential environmental problems arise due to activities during project implementation. Project specific Environmental Monitoring Plan is prepared to monitor environmental pollution parameters or factors during Pre-construction, Construction and Operation phases of the project and to control risks, if any, with appropriate mitigation measures. Also it includes worker's health and safety aspects during project implementation. The same is discussed below.

10.10.1. Pre-Construction Phase

Pre-construction phase monitoring has been done for the proposed project for air, noise, vibration, and water and soil quality as part of this report. The results of base line environmental monitoring are reported in **Chapter 5.**

10.10.2. Construction Phase

Construction Phase Monitoring Plan for the entire period of construction (3 Years) is summarized in **Table 10.3.** The number of locations could be modified based on need when the construction commences. Monitoring should be carried out by NABL Accredited/MoEFCC recognized private or Government agency. The contractor will be responsible for carrying out monitoring during construction under the supervision of GC/PIA. The results of air quality, water quality, waste water,

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vibration monitoring will be submitted by the Contractors to management /executing agency quarterly during construction phase. The environmental auditing shall be carried out bi-annually for 3 years.

Table 10.3. Environmental Monitoring Plan (EMoP) for Construction Stage

Key Performance Indicators	Parameters	Locations and Frequency	Reference/ Standards	Implementing Agency	Approval Authority
Ambient Air Quality	PM_{10},$PM_{2.5}$,SO_2,NO_x,CO and HC	One day monitoring once a month at construction sites or Ambient air quality monitoring locations (as suggested by Envi. Specialist of GC) and 1 location each at Base camp and Plant site for each corridor for entire construction period.	Guidelines for Ambient Air Quality Monitoring , CPCB, 2003 National Ambient Air Quality Standards 2009	Contractor	GC/K RIDE
Noise	Leq, L90, L50, L10, Lday, Lnight, Lday-night	One day monitoring once in a month at construction sites or Ambient noise level monitoring locations (as suggested by Envi. Specialist of GC) and 1 location each at Base camp and Plant site for each corridor for entire construction period.	Protocol for Ambient Level Noise Monitoring, CPCB, May 2015 ISO/ TC 108 (vibration)	Contractor	GC/K RIDE
Vibration	Peak Particle velocity in mm/sec	Once in a season, for four seasons at construction site or Ambient vibration quality monitoring locations (as suggested by Envi. Specialist of GC).			
Water (surface and ground water)	pH, Biochemical Oxygen Demand (BOD 3 days 27°c), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS),Total Dissolved Solids (TDS), Chlorides,	Once in a season, four seasons in a year at baseline monitoring locations.	Guide Manual – Water and waste water analysis, CPCB Drinking water – Specifications	Contractor	GC/K RIDE

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Key Performance Indicators	Parameters	Locations and Frequency	Reference/ Standards	Implementing Agency	Approval Authority
	Nitrates, Sulphates, Iron, Calcium, Total Nitrogen, Lead, Total Phosphates, oils and grease and Heavy metals (optional)		IS 10500: 2012 and CPHEEO Manual		
Waste Water	pH, Biochemical Oxygen Demand (BOD 3 days 27°c), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS),Total Dissolved Solids (TDS), Chlorides, Nitrates, Sulphates, Iron, Calcium, Total Nitrogen, Lead, Total Phosphates, oils and grease; and Heavy metals	Inlet & Outlet of Sedimentation tank at stations and Depot.	Guide Manual– Water and Waste water analysis, CPCB	Contractor	GC/K RIDE
Soil	pH, Sodium, Potassium, Chloride, Nitrogen, Phosphorous, Organic Matter, Heavy Metal, oil and Grease	Once in a season, four seasons in a year at baseline monitoring locations	USEPA test protocols	Contractor	GC/K RIDE
Ecology	• Seasonal Assessment of Water body • Biodiversity - Flora	Afforestation sites	As per BBMP Forest wing /Forest authorities	BBMP/ Forest Department	BBMP/ Forest Department
Workers' Health and Safety	• Provision of PPE • Safety Audit • Periodical Health Check up • Awareness & Training	Throughput the Construction Period at Construction sites and Worker's camp sites.	As per EHS/EMS	Contractor	GC/K RIDE
Community ' Health and Safety	• Provision of Safety caution boards and proper traffic diversions with boards • Traffic Safety management • Periodical Health Check up • Safety Audit	Throughput the Construction Period at Construction sites.	As per EHS/EMS	Contractor	GC/K RIDE

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Key Performance Indicators	Parameters	Locations and Frequency	Reference/ Standards	Implementing Agency	Approval Authority
	• Awareness & Training				

Ecological Monitoring: The ecological monitoring includes visual monitoring of water body and biodiversity – flora /afforestation of trees will be solely carried out by the BBMP Forest wing/Forest Authority but in consultation with K RIDE, as per requirement.

Community and Workers Health and Safety:

Contractor will be responsible to take care of health and safety of workers and Community during construction and K RIDE is responsible to review/audit the health and safety measures/plans with the assistance of Sr. Environmental Specialist of GC. Following are the main measures to be taken up during construction by the Contractor :

- Provision of required PPE to workers at operational plant sites, borrow area operation sites, work sites and base camp.
- Regular inspection shall be carried out to workers health and safety monitoring.
- Conducting Periodical Safety Audit
- Epidemiological studies at construction sites will be performed to monitor the potential spread of diseases.
- Any recurrence of health incidents shall be recorded and appropriate mitigation measures shall be taken.
- Conducting Periodical Medical/Health Check up for workers (and local community people if required)
- Awareness & Training for workers and community regarding Health and Safety

10.10.3. Operation Phase

The environmental monitoring schedule during operation phase for 2 years is presented in **Table 10.4**. The results of air quality, water quality, waste water, noise and vibration, soil, solid and liquid waste will be submitted to management bi-annually during operation phase. The environmental auditing shall be carried out bi-annually for 2 years.

Table 10.4. Environmental Monitoring Plan (EMoP) for Operation Stage

Key Performance Indicators	Parameter	Frequency	Reference/Standard	Implementation /Approval by
Air Quality	PM10, PM2.5, SO2, NOx,CO and HC	24 hours in a week for each season, three seasons in a year at baseline monitoring locations	Guidelines for Ambient Air Quality Monitoring , CPCB, 2003 National Ambient Air Quality Standards 2009	K RIDE

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Key Performance Indicators	Parameter	Frequency	Reference/Standard	Implementation /Approval by
Noise Quality	Leq, Lday, Lnight, Lday-night	24 hours in a week for each season, three seasons in a year at baseline monitoring locations	Metro Rail Transit System, Guidelines for Noise and Vibrations, RDSO, Ministry of Railways, September 2015	K RIDE
Vibration	Peak Particle velocity in mm/sec	24 hours, once a month at baseline monitoring locations of all corridors.		
Water Quality (Surface and Ground water)	pH, Biochemical Oxygen Demand (BOD 3 days 27°c), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS),Total Dissolved Solids (TDS), Chlorides, Nitrates, Sulphates, Iron, Calcium, Total Nitrogen, Lead, Total Phosphates, oils and grease and Heavy metals (optional)	Once in a season, four seasons in a year at baseline monitoring locations	Drinking water – Specifications IS 10500:2012 and CPHEEO Manual 2012 Guide Manual –Water and waste water analysis, CPCB	K RIDE
Waste Water Quality	pH, Biochemical Oxygen Demand (BOD 3 days 27°c), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS),Total Dissolved Solids (TDS), Chlorides, Nitrates, Sulphates, Iron, Calcium, Total Nitrogen, Lead, Total Phosphates, oils and grease; and Heavy metals	Once in a season, four seasons in a year at baseline monitoring locations		
Assessment of Solid Waste Management	Monitorng for proper collection, segregation, reeuse and disposal of solid wastes	Once in a season, Four seasons in a year at Depot	Solid Waste Management Rules, 2016	K RIDE

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Key Performance Indicators	Parameter	Frequency	Reference/Standard	Implementation /Approval by
Soil	pH, Sodium, Potassium, Chloride, Nitrogen, Phosphorous, Organic Matter, Heavy Metal, oil and Grease	Once in a season, four seasons in a year at baseline monitoring locations	USEPA test protocols	K RIDE
Ecology – Flora	• Seasonal Assessment of Water body and • Biodiversity - Flora	Once in a season, four seasons in a year at Afforestation Sites	As per BBMP Forest wing /Forest authorities	BBMP Forest wing/Forest Dept. in consultation with K RIDE
Community Health and Safety	• Periodical Health Check up • Safety Audit • Awareness & Training	Once in 3 months and 4 times in a year	As per EHS/EMS	K RIDE

10.11. Management/Monitoring of Contractors' Environmental and Social Performance

The PIA supported by the Sr. Environmental Specialist and Sr. Social Specialist of General Consultant will monitor the performance of contractors concerning implementation of Environmental and Social impact Management including contracted workers also and focusing on compliance by contractors and their contractual agreements and this LMP. This will include the following:

- • Review of Contractor's monthly reports
- • Review of Contractor's incident/accident reports
- • Periodic monitoring visits to sub-project sites involving spot checks and interaction with workers and community people
- • Inspection of on-site records maintained by Contractor

The performance requirements by the Contractor will be overseen and managed by the Sr. Environmental Specialist and Sr. Social Specialist of General Consultant under the overall guidance and direction of the Chief Project Director, K RIDE.

In the context of COVID, additionally, the Contractor with respect to health of workers, will be required to include:

- Provision of medical insurance covering treatment for COVID-19, sick pay for workers who either contract the virus or are required to self-isolate due to close contact with infected workers, and compensation payment in the event of death

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- Designating/appointing a COVID-19 focal point officer responsible for monitoring and reporting COVID-19 issues and liaising with competent authorities designated by district administration or the State Government.

Non-compliance by the Contractor will result in remedial actions as per the provisions of the contractual agreement.

Managing Environmental and Social Performance, a reference document is enclosed as **Annexure 10.42** to assess the Contractor.

10.11.1. EHS Non-conformity Management Process

Non-conformity management process is to fix the error carried out by the Contractor during his performance towards Environmental and Social issues. The Corrective and Preventive Actions (CAPA) will be taken up by the Contractor in time and he should submit the evidences for his action taken for non-conformity through audio-visuals such as videos, photographs, documents, recordings, etc. and to follow in compliance with the applicable laws to the needy non-conformities during construction as well as project completion/closure stage to meet the quality standards. Non-conformity Procedure and management shall be in line with the procedure and actions given in **Annexure 10.13**. Once the report is conformity Report is submitted in compliance with applicable laws/Rules and WB's ESS Guidelines, then reviewed and assessed by the monitoring authority GC/K RIDE and the non-conformity will be closed by the authority – K RIDE.

10.11.2. Management of Change (MOC)

Management of Change (MOC) is a systematic approach to dealing with change in project improvements with respect to location, construction methodology, materials used, etc. during different phase of the project, which will have significate impacts of environmental and social aspects of the project. These changes may also have long term impacts too. The goal of this approach is to safeguard the environment and social concerns from potential harm during the change in the project or specific activity.

In order to capture the severity of the impacts on environmental and social aspects due to proposed changes, a supplementary study shall be conducted inline with National standards & Environmental and Social Framework of KfW, EIB and WB. Decision on requirement of the supplementary study shall be taken by Senior Environmental & Social Experts of ESMU. Based on the severity, it shall decide whether the study can be conducted though engaging external consultant firm or a team comprising of environmental & social experts of ESMU, GC and Contractor. In case of major change in the location, construction methodology, etc., consultation with concerned stakeholders including affected parties shall be conducted to achieve the information dissemination and collection of their grievances. The supplementary report, shall be submitted to PIA for further submission to funding agencies for approval. The approved report should be disclosed in K RIDE's website.

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Chapter 11. Environmental Budget for Implementation of EMP

11.1. Environmental Monitoring Cost during Construction

The environmental monitoring cost includes the total cost of environmental pollution monitoring and ecological monitoring cost during construction and operation phases of the project.

The environmental pollution monitoring cost during construction phase is estimated as ₹ 93.36 Lakhs for Corridor 1, ₹ 88.86 Lakhs for Corridor 2, ₹ 84.3 Lakhs for Corridor 3 and ₹ 95.04 Lakhs for Corridor 4. The estimated cost ₹ 361.56 Lakhs towards environmental monitoring during construction will be part of civil contract and details are given in **Table 11.1**.

Table 11.1 Environmental Monitoring Cost during Construction Phase

Sl. No.	Item	Quantity	Total Cost (₹ in Lakhs)
Corridor – 1: KSR Bengaluru City to Devanahalli			
i.	Air Quality Monitoring at ₹10000/sample	8 Samples X 12 times in a year X 3 Years	28.8
ii.	Noise Quality Monitoring at ₹2500/sample	10 Samples X 12 times in a year X 3 Years	9
iii.	Soil Quality Monitoring at ₹8000/sample	4 Samples X 4 times in a year X 3 Years	3.84
iv.	Water Quality Monitoring at ₹7000/sample	8 Samples X 4 times in a year X 3 Years	6.72
v.	Vibration Monitoring at ₹120000/sample	3 Samples X 4 times in a year X 3 Year	43.2
vi.	Ecological Monitoring at ₹20000/assessment	3 times in a year X 3 Years	1.8
vii.	Worker's Health and Safety monitoring	4 times in a year X 3 Years	-
vii.	Workers and Community Health and Safety Orientation Program	4 times in a year X 3 Years	-
Envi. Monitoring Cost for Corridor 1:			**93.36**
Corridor – 2: Baiyyappanahalli Terminal to Chikkabanavara			
i.	Air Quality Monitoring at ₹10000/sample	7 Samples X 12 times in a year X 3 Years	25.2
ii.	Noise Quality Monitoring at ₹2500/sample	7 Samples X 12 times in a year X 3 Years	6.3
iii.	Soil Quality Monitoring at ₹8000/sample	5 Samples X 4 times in a year X 3 Years	4.8
iv.	Water Quality Monitoring at ₹7000/sample	9 Samples X 4 times in a year X 3 Years	7.56
v.	Vibration Monitoring at ₹120000/sample	3 Samples X 4 times in a year X 3 Year	43.2

Sl. No.	Item	Quantity	Total Cost (₹ in Lakhs)
vi.	Ecological Monitoring at ₹20000/assessment	3 times in a year X 3 Years	1.8
vii.	*Worker's Health and Safety monitoring	4 times in a year X 3 Years	-
viii.	*Workers and Community Health and Safety Orientation Program	4 times in a year X 3 Years	-
Envi. Monitoring Cost for Corridor 2:			**88.86**
Corridor – 3: Kengeri to Whitefield (via KSR and Cantonment)			
i.	Air Quality Monitoring at ₹10000/sample	6 Samples X 12 times in a year X 3 Years	21.6
ii.	Noise Quality Monitoring at ₹2500/sample	7 Samples X 12 times in a year X 3 Years	6.3
iii.	Soil Quality Monitoring at ₹8000/sample	3 Samples X 4 times in a year X 3 Years	2.88
iv.	Water Quality Monitoring at ₹7000/sample	8 Samples X 4 times in a year X 3 Years	6.72
v.	Vibration Monitoring at ₹120000/sample	3 Samples X 4 times in a year X 3 Year	43.2
vi.	Ecological Monitoring at ₹20000/assessment	3 times in a year X 3 Years	1.8
vii.	*Worker's Health and Safety monitoring	4 times in a year X 3 Years	-
viii.	*Workers and Community Health and Safety Orientation Program	4 times in a year X 3 Years	-
Envi. Monitoring Cost for Corridor 3:			**82.5**
Corridor – 4: Heelalige to Rajanukunte			
i.	Air Quality Monitoring at ₹10000/sample	8 Samples X 12 times in a year X 3 Years	28.8
ii.	Noise Quality Monitoring at ₹2500/sample	10 Samples X 12 times in a year X 3 Years	9
iii.	Soil Quality Monitoring at ₹8000/sample	4 Samples X 4 times in a year X 3 Years	3.84
iv.	Water Quality Monitoring at ₹7000/sample	10 Samples X 4 times in a year X 3 Years	8.4
v.	Vibration Monitoring at ₹120000/sample	3 Samples X 4 times in a year X 3 Year	43.2
vi.	Ecological Monitoring at ₹20000/assessment	3 times in a year X 3 Years	1.8
vii.	*Worker's Health and Safety monitoring	4 times in a year X 3 Years	
viii.	*Workers and Community Health and Safety Orientation Program	4 times in a year X 3 Years	
Envi. Monitoring Cost for Corridor 4:			**95.04**

**Included in the Contracts under EHS clause. Hence, no separate cost is estimated for the same.*

11.1.1. Bio-digester Implementation Cost at Stations and Depot

The total quantity of Waste water generation and requirement of DRDO approved Bio-digesters with capacity and cost estimate for all stations at each corridor of the Suburban Rail Project are given below in **Table 11.2.**

Table 11.2. Provision of Bio-digesters at Suburban Railway Stations

Sl. No.	Station Name	Waste Water in KLD	Capacity of Bio Digester System in KLD	Cost of Bio Digester in ₹ Lakh	Cost of Bio Digester in ₹
Corridor 1 (KSR Bengaluru City - Devanahalli)					
1	KSR Bengaluru City	27.537	5	2.50	2,50,336
2	Srirampura	10.672	2	0.97	97,018
3	Malleswaram	21.889	4	1.99	1,98,991
4	Yeshwantpur	22.654	4	2.06	2,05,945
5	Muthyalanagar	18.649	3	1.70	1,69,536
6	Lottegolahalli	35.008	6	3.18	3,18,255
7	Kodigehalli	23.088	4	2.10	2,09,891
8	Judicial Layout	32.58	6	2.96	2,96,182
9	Yelahanka	29.099	5	2.65	2,64,536
10	Nitte Meenakshi	9.199	2	0.84	83,627
11	Betahalasuru	1.571	0	0.14	14,282
12	Doddajala	13.889	3	1.26	1,26,264
13	Airport Trumpet	4.788	1	0.44	43,527
14	Airport KIADB	12.984	2	1.18	1,18,036
15	Future Station @ Km 38/800	12.181	2	1.11	1,11,000
	Devanahalli	11.378	2	1.03	1,03,436
Total		**287.166**	**52**	**26.110**	**26,10,862**
Corridor 2 (Baiyappanahalli - Chikkabanawar)					
1	Baiyyappanahalli Terminal	8.626	2	0.78	78,418
2	Kasturi Nagar	9.218	2	0.84	83,800
3	Sevanagar	10.99	2	1.00	99,909
4	Banaswadi	7.753	1	0.70	70,482
5	Kaveri Nagar	15.199	3	1.38	1,38,173
6	Nagawara	22.266	4	2.02	2,02,418
7	Kanakanagara	10.075	2	0.92	91,591
8	Hebbal	7.719	1	0.70	70,173
9	Lottegolahalli	12.176	2	1.11	1,10,691
10	Yeshwantpur	22.886	4	2.08	2,08,055
11	Jalahalli	15.57	3	1.42	1,41,545
12	Shettihalli	20.532	4	1.87	1,86,655
13	Mydarahalli	11.146	2	1.01	1,01,327
14	Chikkabanavar	9.56	2	0.87	86,909
Total		**183.717**	**33**	**17**	**16,70,145**

Sl. No.	Station Name	Waste Water in KLD	Capacity of Bio Digester System in KLD	Cost of Bio Digester in ₹ Lakh	Cost of Bio Digester in ₹
Corridor 3 (Kengeri - White Field)					
1	Kengeri	25.321275	5	2.30	2,30,193
2	RV College	11.88	2	1.08	1,08,000
3	Jnanabharati	15.645825	3	1.42	1,42,235
4	Nayandahalli	6.124275	1	0.56	55,675
5	Krishnadevaraya	6.1749	1	0.56	56,135
6	Jagajeevanram Nagar	7.32375	1	0.67	66,580
7	KSR Bengaluru City	18.965475	3	1.72	1,72,413
8	Kumarapark (BDA)	10.32885	2	0.94	93,899
9	Bengaluru Cantt.	13.1004	2	1.19	1,19,095
10	Bengaluru East	10.01025	2	0.91	91,002
11	Baiyyappanahalli	6.506325	1	0.59	59,148
12	Krishanrajapuram	8.5455	2	0.78	77,686
13	Hoodi	5.977125	1	0.54	54,338
14	White Field	0.7047	0	0.06	6,406
Total		**146.608**	**27**	**13**	**13,32,806**
Corridor 4 (Heelalige - Rajankunte)					
1	Heelalige	3.116	1	0.28	28,327
2	Bommasandra	2.941	1	0.27	26,736
3	Singena Agrahara	2.415	0	0.22	21,955
4	Huskur	9.047	2	0.82	82,245
5	Ambedkar Nagar	6.219	1	0.57	56,536
6	Karmelram	24.324	4	2.21	2,21,127
7	Belandur Road	10.14	2	0.92	92,182
8	Marathahalli	12.72	2	1.16	1,15,636
9	Future Station @ Km 199/700	14.05	3	1.28	1,28,000
10	Kagadaspura	15.38	3	1.40	1,39,818
11	Benniganahalli	8.191	1	0.74	74,464
12	Channasandra	14.343	3	1.30	1,30,391
13	Horamavu	19.314	4	1.76	1,75,582
14	Hennur	30.011	5	2.73	2,72,827
15	Tannisandra	36.636	7	3.33	3,33,055
16	RK Hegde Nagar	20.971	4	1.91	1,90,645
17	Jakkur	8.596	2	0.78	78,145
18	Yelahanka	10.356	2	0.94	94,145
19	Muddenahalli	5.656	1	0.51	51,418
20	Rajanukunte	4.725	1	0.43	42,955
Total		**259.151**	**49**	**23.56**	**23,56,189**

11.1.1.1. Cost Estimate of Bio-digesters at BSRP Stations

The cost estimate of Bio-digesters at all stations in all the 4 corridors is given in **Table 11.3.**

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Table 11.3. Provision of Bio-digesters at Suburban Rail Stations

Sl. No.	Corridor Name	Waste Water in KLD	Capacity of Bio Digester System in KLD	Cost of Bio Digester in ₹ Lakh
1	Corridor 1 (KSR Bengaluru City - Devanahalli)	287.166	52	26.106
2	Corridor 2 (Baiyappanahalli - Chikkabanawar)	183.717	33	16.701
3	Corridor 3 (Kengeri - White Field)	146.608	27	13.328
4	Corridor 4 (Heelalige - Rajankunte)	259.151	49	23.559
Total		**876.642**	**159**	**79.69**

11.1.1.2. Bio-Digester & Effluent Treatment Plant at Depot

Implementation Bio-digester with Reed bed system approved by DRDO will help to handle human waste as well as waste water at each Depot. In addition to this a ETP is proposed in Depot for treatment of effluent generated. The details of waste water generated and estimated cost of depot is given in **Table 11.4.** The treated waste water may be reused for rail car washing, floor cleaning and flushing purpose in the depot area. Total estimated cost for waste water treatment is ₹ 7.18 Lakhs for depot.

Table 11.4. Capacity and Estimated Cost of Bio-Digester & ETP at Depot

Sl. No.	Corridor No.	Depot Name	Domestic Waste Water in KLD	Waste Water from Car/Train Washing in KLD	Capacity of Bio Digester System in KLD	Estimated cost of Bio-Digester in ₹ Lakh	Estimated cost of ETP ₹ Lakh
Major Depots							
1	Corridor 1	Akkupete Depot	2.04	3.5	0.371	0.19	1.75
2	Corridor 2	Soladevanahalli Depot	2.04	3.5	0.371	0.19	1.75
Micro Depots							
1	Corridor 3	Kengeri Station	1.7	3	0.309	0.15	1.5
2	Corridor 4	Heelalige Station	1.7	3	0.309	0.15	1.5
Total = 4			**7.48**	**13**	**1.36**	**0.68**	**6.5**

11.1.2. Rain Water Harvesting Cost

In view of augmentation of storage of ground water, it is proposed to construct roof top rain water harvesting structure of suitable capacity in the Depot. Ground water shall be recharged through Rainwater harvesting at each depot. One Rainwater harvesting unit for each depot is proposed. The cost estimated is ₹ 91700.00 + ₹ 3000 surcharge for installation of rainwater harvest units during construction phase. Total cost is estimated to be ₹ -312.9 Lakhs.

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Table 11.5. Cost Estimate for Provision of Rain Water Harvesting

Sl. No.	Particulars	Amount in ₹. Lakhs					
		Quantity	Corridor 1	Corridor 2	Corridor 3	Corridor 4	Total
1	Rainwater Harvesting @ ₹ 0.917 lakh/Unit + ₹ 3000 Surcharges (LS)*	Quantity	100 x ₹ 94700	65 x ₹94700	51 x ₹ 94700	114x ₹ 94700	330
		Cost ₹ in Lakhs	₹ 94.7	₹ 61.56	₹ 48.30	₹ 108.4	₹ 312.9

11.1.3. Environmental Monitoring/Management Unit Cost

The estimated cost for each corridor for 3 years of Construction is ₹ 29.55 Lakhs and total estimated cost for all corridors is ₹ 118.20 Lakhs. The division will be setup at one location for all the four corridors and capital & recurring costs are distributed equally amongst four corridors. The estimated cost for Environmental Monitoring / Management Unit is as given below (**Table 11.6**) :

Table 11.6. Environmental Monitoring/Management Unit Cost

Sl. No.	Item	Annual Cost (₹)				
		Corridor 1	Corridor 2	Corridor 3	Corridor 4	Total Cost for all Corridors
A. Capital Cost	**Office Establishment - ₹ 50,000/month LS	6,00,000	6,00,000	6,00,000	6,00,000	24,00,000
B Recurring Cost	Man Power Cost					
a.	Environmental Engineer/Officer @ ₹ 60,000/month	7,20,000	7,20,000	7,20,000	7,20,000	28,80,000
b.	Assistant Environmental Engineer @40000/month	4,80,000	4,80,000	4,80,000	4,80,000	19,20,000
c.	Office Assistant @ ₹ 15,000/month	1,80,000	1,80,000	1,80,000	1,80,000	7,20,000
d.	Office Maintenance and consumables @ ₹ 20,000/month	2,40,000	2,40,000	2,40,000	2,40,000	9,60,000
	B. Sub Total=	**16,20,000**	**16,20,000**	**16,20,000**	**16,20,000**	**64,80,000**
C	**Sub Total (A+B)**	**22,20,000**	**22,20,000**	**22,20,000**	**22,20,000**	**88,80,000**
D. Miscellaneous	Miscellaneous - Consumables and unforeseen expenses, LS (10 % of C)	2,22,000	2,22,000	2,22,000	2,22,000	8,88,000

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Sl. No.	Item	Annual Cost (₹)				
		Corridor 1	Corridor 2	Corridor 3	Corridor 4	Total Cost for all Corridors
Total cost for establishment of cell for 1 Year		24,42,000	24,42,000	24,42,000	24,42,000	97,68,000
Total cost for EMU for 3 Years of Construction Period with 10% annual increase		29.55	29.55	29.55	29.55	118.20
Total cost for EMU for additional 2 Years of Operation Period with 10% annual increase		35.75	35.75	35.75	35.75	143.00
Total cost for 5 years (Const. 3 Years + Operation 2 Years) with 10% annual increase		35.75	35.75	35.75	35.75	143.00

***Office Establishment includes Rent, water & electricity consumption, Computer, furniture, communication & Internet facilities, security, etc.*

11.2. Environmental monitoring cost during Operation

The environmental monitoring cost includes the total cost of environmental pollution monitoring and ecological monitoring cost during construction and operation phases of the project.

The details of estimated cost towards environmental Pollution monitoring during operation stage are given in **Table 11.7**.

Table 11.7. Environmental Monitoring Cost during Operation

Sl. No.	Item	Quantity	Total Cost (₹ in Lakhs)
Corridor 1 - KSR Bengaluru City – Devanahalli			
i.	Air Quality Monitoring at ₹12000/sample	12 Samples X 3 times in a year X 2 Years	8.64
ii.	Noise Quality Monitoring at ₹3000/sample	20 Samples X 3 times in a year X 2 Years	3.6
iii.	Soil Quality Monitoring at ₹ 9000/sample	4 Samples X 4 times in a year X 2 Years	2.88
iv.	Water Quality Monitoring at ₹8000/sample	12 Samples X 4 times in a year X 2 Years	7.68
v.	Vibration Monitoring at ₹135000/sample	3 Samples X 4 times in a year X 2 Years	32.4
vi.	Quality of Waste Water at Stations & Depot at ₹ 8500/sample	16 Samples X 4 times in a year X 2 Years	10.88
vii.	Solid Waste Characteristics at Depot at ₹ 12000/sample	1 Sample X 4 times in a year X 2 Years	0.96
Envi. Monitoring Cost for Corridor 1:			**67.04**
Corridor 2 - Baiyappanahalli - Chikkabanawar			
i.	Air Quality Monitoring at ₹ 12000/sample	9 Samples X 3 times in a year X 2 Years	5.76

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Sl. No.	Item	Quantity	Total Cost (₹ in Lakhs)
ii.	Noise Quality Monitoring at ₹ 3000/sample	13 Samples X 3 times in a year X 2 Years	2.16
iii.	Soil Quality Monitoring at ₹ 9000/sample	4 Samples X 4 times in a year X 2 Years	2.16
iv.	Water Quality Monitoring at ₹ 8000/sample	12 Samples X 4 times in a year X 2 Years	7.04
v.	Vibration Monitoring at ₹ 135000/sample	3 Samples X 4 times in a year X 2 Years	32.4
vi.	Quality of Waste Water at Stations & Depot at ₹ 8500/sample	16 Samples X 4 times in a year X 2 Years	10.2
vii.	Solid Waste Characteristics at Depot at ₹ 12000/sample	1 Sample X 4 times in a year X 2 Years	0.96
Envi. Monitoring Cost for Corridor 2:			**63.62**
Corridor 3 - Kengeri - White Field			
i.	Air Quality Monitoring at ₹12000/sample	12 Samples X 3 times in a year X 2 Years	8.64
ii.	Noise Quality Monitoring at ₹3000/sample	24 Samples X 3 times in a year X 2 Years	4.32
iii.	Soil Quality Monitoring at ₹ 9000/sample	4 Samples X 4 times in a year X 2 Years	2.88
iv.	Water Quality Monitoring at ₹8000/sample	16 Samples X 4 times in a year X 2 Years	10.24
v.	Vibration Monitoring at ₹135000/sample	3 Samples X 4 times in a year X 2 Years	32.4
vi.	Quality of Waste Water at Stations & Depot at ₹ 8500/sample	14 Samples X 4 times in a year X 2 Years	9.52
vii.	Solid Waste Characteristics at Depot at ₹ 12000/sample	1 Sample X 4 times in a year X 2 Years	0.96
Envi. Monitoring Cost for Corridor 3:			**68.96**
Corridor 4 - Heelalige - Rajankunte			
i.	Air Quality Monitoring at ₹12000/sample	15 Samples X 3 times in a year X 2 Years	10.8
ii.	Noise Quality Monitoring at ₹3000/sample	24 Samples X 3 times in a year X 2 Years	4.32
iii.	Soil Quality Monitoring at ₹ 9000/sample	5 Samples X 4 times in a year X 2 Years	3.6
iv.	Water Quality Monitoring at ₹8000/sample	21 Samples X 4 times in a year X 2 Years	13.44
v.	Vibration Monitoring at ₹135000/sample	3 Samples X 4 times in a year X 2 Years	32.4
vi.	Quality of Waste Water at Stations & Depot at ₹ 8500/sample	21 Samples X 4 times in a year X 2 Years	14.28
vii.	Solid Waste Characteristics at Depot at ₹ 12000/sample	1 Sample X 4 times in a year X 2 Years	0.96

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Sl. No.	Item	Quantity	Total Cost (₹ in Lakhs)
Envi. Monitoring Cost for Corridor 4:			**79.8**

The environmental monitoring cost during operation phase is ₹ 67.04 Lakhs for Corridor 1 (KSR Bengaluru City – Devanahalli), ₹ 63.62 Lakhs for Corridor 2 (Baiyappanahalli - Chikkabanawar), ₹ 68.96 Lakhs for Corridor 3 (Kengeri - White Field) and ₹ 79.8 Lakhs for Corridor 4 (Heelalige - Rajankunte). The total estimated cost towards environmental monitoring during operation will be ₹ 279.42 Lakhs and the responsibility of monitoring lies with EMU.

11.2.1. Capacity Building Training Cost

During operation stage of the project, the periodical EMP training (for 6 sessions of 3 days each) will be imparted by Environmental Engineer/Officer from EMU, PIA, K RIDE (one for each corridor – totally 4 Officers are required for EMU, PIA, K RIDE for one year duration) for K RIDE engineers, Managers and all the workers. The training modules will cover implementation of EMP, occupational safety and Health, Community safety and Health, Risk Assessment, Disaster Management and Emergency Response Actions. The task modules for all the corridors will remain same. In addition to the Training he will also assist the EMU, PIA in site inspections as and when required; and he will be responsible to (a) monitor implementation of approved EMP (b) monitor environmental status (c) monitor risks and disaster probabilities and (d) preparation of Training and Site Inspection Reports. The Assistant Environmental Engineer will support the Environmental Engineer/Officer in EMP training and overall implementation activities (one for each corridor – totally 4 Assistants are required for EMU, PIA, K RIDE for one year duration).

The cost is estimated to be ₹ 12.20 Lakhs for each corridor as given in **Table 11.8.** The curriculum for all the corridors will be same. One Assistant Environmental Engineer for each corridor (is considered and cost is distributed equally among the each corridor.

Table 11.8. Cost Estimate for Training Program

Sl. No.	Particulars	Cost (₹)
1	Module Development and Material preparation - 1 month ₹ 50,000 LS	50,000
2	Environmental Engineer/Officer for 1 year (₹ 60,000/month)	7,20,000
3	Assistant Environmental Engineer (₹25,000/month)	3,00,000
4	Presentation Aids (LS)	1,00,000
5	Miscellaneous (LS)	50,000
Total		**12,20,000**

11.3. Summary of EMP Implementation Cost

The total estimated environmental management and monitoring cost for the proposed project is ₹ **7227.54 Lakhs** including Compensatory Afforestation and Transplantation charges and the same is detailed corridor wise in **Table 11.9** & **11.10**. The cost towards environmental monitoring and rain water harvesting during construction phase will be the part of Civil Contract and remaining cost will be the part of Project Implementation Authority (PIA). The Compensatory afforestation cost including Transplantation cost, if any, will be decided by the Forest Authority in consultation with K RIDE after the finalization of Tree enumeration by the Forest Department. Source for unit cost consider for preparation EMP implementation is presented as **Annexure 11.1.**

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Table 11.9. Summary of Total Cost Estimation for Implementation of Environmental Management Plan for Corridor 1 & 2

Sl. No.	Particulars	Amount in ₹.			
		Quantity	Corridor 1	Quantity	Corridor 2
1	Compensatory Afforestation & Transplantation @ ₹ 1630 per Tree (Forest SR)	247030 x ₹ 1630	₹ 40,26,58,900.00	34690 x ₹1630	₹ 5,65,44,700.00
2	Solid Concrete Noise Barriers at sensitive receptors @ 0.20 Lakh/meter (KPWD SR)	545 x ₹ 20000	₹ 1,09,00,000.00	1161 x ₹ 20000	₹ 2,32,20,000.00
3	Rainwater Harvesting @ ₹ 0.917 lakh/Unit + ₹ 3000 Surcharges (KPWD SR)	100 x ₹ 94700	₹ 94,70,000.00	65 x ₹94700	₹ 61,55,500.00
4	Oil Interceptor with Silt Trap @ 0.15 lakh/Unit (as per agency price in India Mart)	1 x ₹ 15000 (Base Camp) + 1 x ₹ 15000 (Depot)	₹ 15,000.00	1 x ₹ 15000	₹ 15,000.00
5	A. Environmental Monitoring during Construction (Quotation Received)				
	Air Quality Monitoring @ ₹ 10000/sample	8 Samples X 12 times in a year X 3 Years x ₹ 10000/sample	₹ 28,80,000.00	7 Samples X 12 times in a year X 3 Years x ₹ 10000/sample	₹ 25,20,000.00
	Noise Quality Monitoring ₹ 2500/sample	10 Samples X 12 times in a year X 3 Years x ₹ 2500/sample	₹ 9,00,000.00	7 Samples X 12 times in a year X 3 Years x ₹ 2500/sample	₹ 6,30,000.00
	Soil Quality Monitoring ₹ 8000/sample	4 Samples X 4 times in a year X 3 Years x ₹ 8000/sample	₹ 3,84,000.00	5 Samples X 4 times in a year X 3 Years x ₹ 8000/sample	₹ 4,80,000.00
	Water Quality Monitoring ₹ 7000/sample	8 Samples X 4 times in a year X 3 Years x ₹7000/sample	₹ 6,72,000.00	9 Samples X 4 times in a year X 3 Years x ₹7000/sample	₹ 7,56,000.00
	Vibration Monitoring ₹ 120000/sample	3 Samples X 4 times in a year X 3 Year x ₹ 120000/sample	₹ 43,20,000.00	3 Samples X 4 times in a year X 3 Year x ₹ 120000/sample	₹ 43,20,000.00
	Ecological Monitoring (Seasonal Assessment of Water body and Biodiversity - Flora) ₹ 20000/- LS per assessment	3 times in a year X 3 Years x ₹ 20000/assessment	₹ 1,80,000.00	3 times in a year X 3 Years x ₹ 20000/assessment	₹ 1,80,000.00
	*Workers Health and Safety monitoring at ₹ 10000/Session	4 times in a year X 3 Years		4 times in a year X 3 Years	
	*Workers and Community Health and Safety Orientation Program at ₹ 5000/Session	4 times in a year X 3 Years		4 times in a year X 3 Years	
	A. Sub-Total		₹ 93,36,000.00		₹ 88,86,000.00

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Sl. No.	Particulars	Amount in ₹.			
		Quantity	Corridor 1	Quantity	Corridor 2
	B. Environmental Monitoring during Operation (Quotation Received)				
	Air Quality Monitoring ₹ 10000/sample	12 Samples X 12 times in a year X 2 Years x ₹ 12000/sample	₹ 8,64,000.00	9 Samples X 12 times in a year X 2 Years x ₹ 12000/sample	₹ 6,48,000.00
	Noise Quality Monitoring ₹ 2500/sample	20 Samples X 12 times in a year X 2 Years x ₹ 3000/sample	₹ 3,60,000.00	13 Samples X 12 times in a year X 2 Years x ₹ 3000/sample	₹ 2,34,000.00
	Soil Quality Monitoring ₹ 8000/sample	4 Samples X 4 times in a year X 2 Years x ₹ 9000/sample	₹ 2,88,000.00	4 Samples X 4 times in a year X 2 Years x ₹ 9000/sample	₹ 2,88,000.00
	Water Quality Monitoring ₹ 7000/sample	12 Samples X 4 times in a year X 2 Years x ₹8000/sample	₹ 7,68,000.00	12 Samples X 4 times in a year X 2 Years x ₹8000/sample	₹ 7,68,000.00
	Vibration Monitoring ₹ 120000/sample	3 Samples X 4 times in a year X 2 Year x ₹ 135000/sample	₹ 32,40,000.00	3 Samples X 4 times in a year X 2 Year x ₹ 135000/sample	₹ 32,40,000.00
	Quality of Waste Water (LS)**	16 Samples X 4 times in a year X 2 Years x ₹8500/sample	₹ 10,88,000.00	16 Samples X 4 times in a year X 2 Years x ₹8500/sample	₹ 10,88,000.00
	Solid Waste Management at Depot (LS)**	1 Sample X 4 times in a year X 2 Years x ₹12000/sample	₹ 96,000.00	1 Sample X 4 times in a year X 2 Years x ₹12000/sample	₹ 96,000.00
	B. Sub-Total		₹ 67,04,000.00		₹ 67,04,000.00
6	EHS Training and Extension (as per the current expenses on Training aids, fees for preparation of Training modules and arrangement)	₹ 1220000/Training	₹ 12,20,000.00	₹ 1220000/Training	₹ 12,20,000.00
7	Environment Management Unit/Cell (LS) (3 construction & 2 years of operation)	₹ 35,75,000/5 years	₹ 35,75,000.00	₹ 35,75,000/5 years	₹ 35,75,000.00
8	Environmental Auditor (LS) (to monitoring and auditing the implementation of EMP measures during construction and operation phase)	₹ 20,00,000/5 years	₹ 20,00,000.00	₹ 20,00,000/5 years	₹ 20,00,000.00
9	Waste Water Treatment through Bio Digesters for Stations & Depot (DRDO) (as per agency price in India Mart)	₹ 26,10,000.00	₹ 27,80,000.00	₹ 13,00,000.00	₹ 16,70,000.00

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Sl. No.	Particulars	Amount in ₹.			
		Quantity	Corridor 1	Quantity	Corridor 2
10	Effluent Treatment Plant for Depot for 100 KLD (as per agency price in India Mart)	₹ 1,75,000.00	₹ 1,75,000.00	₹ 1,75,000.00	₹ 1,75,000.00
Total Cost in ₹.			**₹ 44,86,63,900**		**₹ 10,98,23,200**
Total in ₹. Lakh			**₹ 4486.6390**		**₹ 1098.232**

Table 11.10. Summary of Total Cost Estimation for Implementation of Environmental Management Plan for Corridor 3 & 4

Sl. No.	Particulars	Amount in ₹.			
		Quantity	Corridor 3	Quantity	Corridor 4
1	Compensatory Afforestation & Transplantation : Compensatory Afforestation @ ₹ 1630 per Tree (Forest SR)	20720 x ₹ 1630	₹ 3,37,73,600.00	23060 x ₹ 1630	₹ 3,75,87,800.00
2	Soild Concrete Noise Barriers at sensitive receptors @ 0.20 Lakh/meter (KPWD SR)	937 x ₹ 20000	₹ 1,87,40,000.00	415 x ₹ 20000	₹ 83,00,000.00
3	Rainwater Harvesting @ ₹ 0.917 lakh/Unit + ₹ 3000 Surcharges (KPWD SR)	51 x ₹ 94700	₹ 48,29,700.00	113 x ₹ 94700	₹ 1,07,95,800.00
4	Oil Interceptor with Silt Trap @ 0.15 lakh/Unit (LS) (as per agency price in India Mart)	1 x ₹ 15000	₹ 15,000.00	1 x ₹ 15000	₹ 15,000.00
5	A. Environmental Monitoring during Construction (Quotation Received)				
	Air Quality Monitoring @ ₹ 10000/sample	6 Samples X 12 times in a year X 3 Years x ₹ 10000/sample	₹ 21,60,000.00	8 Samples X 12 times in a year X 3 Years x ₹ 10000/sample	₹ 28,80,000.00
	Noise Quality Monitoring ₹ 2500/sample	7 Samples X 12 times in a year X 3 Years x ₹ 2500/sample	₹ 6,30,000.00	10 Samples X 12 times in a year X 3 Years x ₹ 2500/sample	₹ 9,00,000.00
	Soil Quality Monitoring ₹ 8000/sample	3 Samples X 4 times in a year X 3 Years x ₹ 8000/sample	₹ 2,88,000.00	4 Samples X 4 times in a year X 3 Years x ₹ 8000/sample	₹ 3,84,000.00
	Water Quality Monitoring ₹ 7000/sample	8 Samples X 4 times in a year X 3 Years x ₹7000/sample	₹ 6,72,000.00	10 Samples X 4 times in a year X 3 Years x ₹7000/sample	₹ 8,40,000.00

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Sl. No.	Particulars	Amount in ₹.			
		Quantity	Corridor 3	Quantity	Corridor 4
	Vibration Monitoring ₹ 120000/sample	3 Samples X 4 times in a year X 3 Year x ₹ 120000/sample	₹ 43,20,000.00	3 Samples X 4 times in a year X 3 Year x ₹ 120000/sample	₹ 43,20,000.00
	Ecological Monitoring (Seasonal Assessment of Water body and Biodiversity - Flora) ₹ 20000/- LS per assessment	3 times in a year X 3 Years x ₹ 20000/assessment	₹ 1,80,000.00	3 times in a year X 3 Years x ₹ 20000/assessment	₹ 1,80,000.00
	*Worker's Health and Safety monitoring at ₹ 10000/Session	4 times in a year X 3 Years		4 times in a year X 3 Years	
	*Workers and Community Health and Safety Orientation Program at ₹ 5000/Session	4 times in a year X 3 Years		4 times in a year X 3 Years	
	A. Sub-Total		₹ 82,50,000.00		₹ 95,04,000.00
	B. Environmental Monitoring during Operation (Quotation Received)				
	Air Quality Monitoring ₹ 10000/sample	12 Samples X 12 times in a year X 2 Years x ₹ 12000/sample	₹ 8,64,000.00	15 Samples X 12 times in a year X 2 Years x ₹ 12000/sample	₹ 10,80,000.00
	Noise Quality Monitoring ₹ 2500/sample	24 Samples X 12 times in a year X 2 Years x ₹ 3000/sample	₹ 4,32,000.00	24 Samples X 12 times in a year X 2 Years x ₹ 3000/sample	₹ 4,32,000.00
	Soil Quality Monitoring ₹ 8000/sample	4 Samples X 4 times in a year X 2 Years x ₹ 9000/sample	₹ 2,88,000.00	5 Samples X 4 times in a year X 2 Years x ₹ 9000/sample	₹ 3,60,000.00
	Water Quality Monitoring ₹ 7000/sample	16 Samples X 4 times in a year X 2 Years x ₹8000/sample	₹ 10,24,000.00	21 Samples X 4 times in a year X 2 Years x ₹8000/sample	₹ 13,44,000.00
	Vibration Monitoring ₹ 120000/sample	3 Samples X 4 times in a year X 2 Year x ₹ 135000/sample	₹ 32,40,000.00	3 Samples X 4 times in a year X 2 Year x ₹ 135000/sample	₹ 32,40,000.00
	Quality of Waste Water (LS)**	14 Samples X 4 times in a year X 2 Years x ₹8500/sample	₹ 9,52,000.00	21 Samples X 4 times in a year X 2 Years x ₹8500/sample	₹ 14,28,000.00
	Solid Waste Management at Depot (LS)**	1 Sample X 4 times in a year X 2 Years x ₹12000/sample	₹ 96,000.00	1 Sample X 4 times in a year X 2 Years x ₹12000/sample	₹ 96,000.00
	B. Sub-Total		₹ 68,96,000.00		₹ 78,84,000.00

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Sl. No.	Particulars	Amount in ₹.			
		Quantity	Corridor 3	Quantity	Corridor 4
6	EHS Training and Extension (as per the current expenses on Training aids, fees for preparation of Training modules and arrangement)	₹ 1220000/Training	₹ 12,20,000.00	₹ 1220000/Training	₹ 12,20,000.00
7	Environment Management Unit/Cell (3 construction & 2 years of operation)	₹ 35,75,000/5 years	₹ 35,75,000.00	₹ 3575000/5 years	₹ 35,75,000.00
8	Environmental Auditor (LS) (to monitoring and auditing the implementation of EMP measures during construction and operation phase)	₹ 20,00,000/5 years	₹ 20,00,000.00	₹ 20,00,000/5 years	₹ 20,00,000.00
9	Waste Water Treatment through Bio Digesters for Stations & Depot (as per agency price in India Mart)	₹ 15,80,000.00	₹ 13,30,000.00	₹ 23,60,000.00	₹ 23,60,000.00
10	Effluent Treatment Plant for Depot for 100 KLD (as per agency price in India Mart)	₹ 1,50,000.00	₹ 1,50,000.00	₹ 1,50,000.00	₹ 1,50,000.00
Total Cost in ₹.			**₹ 8,07,79,300**		**₹ 8,34,87,600**
Total in Rs. Lakh			**₹ 807.793**		**₹ 834.876**

*Note: * Included in the Contracts under EHS clause. Hence, no separate cost is estimated for the same.*

Source Backup :

***Oil Interceptor with Silt Trap @ ₹ 0.12 lakh/Unit (as per agency price in India Mart) + Surcharges of ₹ 3,000/unit*	*Unit source enclosed*
***Training and Extension (LS)** (as per the current expenses on Training aids, fees for preparation of Training modules and arrangement)*	*-*
***Envi. Management Unit/Cell (LS) (as per the current price of Office & office items on rent basis and remuneration for Experts and Assistants)*	*-*
***Waste Water Treatment through Bio Digesters for Stations & Depot (DRDO) (Approx. Price of DRDO Bio-digester 500 lit – Rs. 25,000/- to 10 KLD 2 lakhs + Installation and other Surcharges ₹ 5,000)*	*Unit source enclosed*
***ETP for Depot ₹ 1,00,000 for 1to 5 KLD (₹ 1,00,000 /- per unit of 1 - 5 KLD + Surcharges & Implementation charges of approx. ₹ 50,000/- LS)*	*Unit source enclosed*
EHS Training and Extension (as per the current expenses on Training aids, fees for preparation of Training modules and arrangement)	*Estimated Cost*
Environment Management Unit/Cell (LS) (as per the current price of Office establishment & office items on rent basis and remuneration for Experts and Assistants; and other expenses) - (Cost estimate is for 3 Years of Construction and 2 Years of Operation Stage)	*Estimated Cost*
Ecological Monitoring (Seasonal Assessment of Water body and Biodiversity - Flora) ₹ 20000/- LS per assessment	*Estimated Cost*

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Chapter 12. Conclusions

The Environmental Impact Assessment Report for the proposed BSRP Corridors ie., Corridor 1 - KSR Bengaluru City to Devanahalli, Corridor 2 - Baiyyappanahalli Terminal to Chikkabanavara, Corridor 3 - Kengeri to Whitefield and Corridor 4 - Heelalige to Rajanukunte provides the detailed information of baseline environmental condition, project improvement details and positive and negative environmental and social impacts of the project. After detailed assessment following conclusions are drawn for implementation of the project.

The proposed project will enhance rural-urban connectivity, ease traffic congestion, and provide a cleaner mobility solution to lakhs of daily commuters. It will play a key role to boost economic progress of the state. The project will enhance the air quality in Bengaluru city due to introduction of Suburban Railway as there will be drastic reduction in vehicular traffic resulting in the reduction in greenhouse gas emissions. It was also revealed in the public interactions that, the proposed project will help in resolving the traffic congestion of Bengaluru and enhance the overall environmental condition of the region.

To mitigate the risks & impacts during construction and operation stages of the project, a comprehensive environmental management and monitoring plan has been prepared using the ESS of WB, the EIB & the KfW, General EHS guidelines, Railway specific EHS Guidelines and other relevant Good International Industry Practices (GIIPs) and guidelines stipulated in Environmental Impact Assessment Notification for linear projects by MoEFCC. With this, the proposed project is unlikely to cause any significant adverse effects on the surrounding environment. To make the project environmentally sound and sustainable, the EMP will be made part of the contractual/bid document and will be ensured that, the implementation of EMP measures are contractors responsibility under the supervision and guidance of GC and K RIDE.

The Project will reduce the use of personal vehicles, increase the transit mode share and will contribute to community re-development through the stimulation of future concentrated and mixed land use, as well as a positive business environment. It will contribute to environmental sustainability initiatives by reducing regional car trips, enhance community livability and reducing greenhouse gas (GHG) emissions. Project operation is expected to have a positive effect on air quality since the Project will use an EMU train which is exhaust-free and quieter compared to diesel and locomotive-drawn multiple units. As such, the Project's contribution to the cumulative impacts particularly during the operation would be positive.

During project operations, due to existing high background noise levels along portions of the alignment caused by the existing volume of road traffic in the area and vicinities, receptors may experience a low to moderate noise impact close to the proposed stations and maintenance depots. This will be mitigated by an operating schedule of day time and erection of site specific noise attenuation panels at the stations such that the Project's contribution to cumulative impact on noise is considered not significant. Vibration levels associated with project operations (i.e., train passing by) will be largely imperceptible.

On the socio economic front the project has both positive and negative impact. As there is very minimum impacts of land acquisition, since BSRP alignments and stations are proposed within Indian Railway Land. There is insignificant impact on livelihood and economic activities of the project area.

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On the other hand accessibility and connectivity increases. Thus, the time of travel between project localities shall reduce significantly. With the advent of the Suburban railway the vehicle operating and congestion of roads is expected to go down substantially.

Based on the foregoing, the Project along with related infrastructure development projects within the area will result in positive long-term benefits in air quality, public health, safety, and travel time savings and connectivity. No adverse residual effects to human health will occur as a result of project construction or operation. While exposure to elevated noise levels, fugitive dust and gaseous emissions will occur in proximity to project work sites during construction, due to their short-term, localized nature, these effects are expected to be minor. Project operations will benefit the general public by contributing to the long-term improvement of air quality in the area. By providing a viable alternative to the use of private vehicles, it will also reduce traffic volumes, relieve traffic congestion, and improve community liveability.

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Chapter 13. Reference

1) Karnataka Disaster Management Plan, 2019-20.
2) Karnataka State Action Plan for Climate Change, 2013-14.
3) Survey of India Toposheets & District Planning Map.
4) Bengaluru Urban and Rural district official website.
5) Ground Water Scenario of Bengaluru Urban and Rural District by Central Ground Water Board.
6) Consultation with Range Forest Officers and District Forest Officer, Bengaluru & Rural Forest Division.
7) Gazette of India Notification for Eco-sensitive Zone for Bannerghatta National Park.
8) Karnataka Disaster Management Plan 2019-20.
9) Karnataka Economic Survey 2020-21
10) Manual Air Quality Monitoring data from CPCB website.
11) WB's Environmental & Social Framework
12) Field Reconnaissance Surveys
13) IFC's Environment, Health and Safety Guidelines for Railways
14) IFC's General Environment, Health and Safety Guidelines
15) Central Public Health & Environmental Engineering Organisation
16) Bengaluru-BDA-RMP-2031-Volume_1_Vision_Document
17) Research Journal of IISc' - Decaying lakes of Bengaluru
18) https://site.bbmp.gov.in/departmentwebsites/Lakes/g4.html - on BBMP Lakes
19) Bengaluru Rural Agriculture profile https://e-krishiuasb.karnataka.gov.in
20) Research Journal of IISc - Water Situation in Bengaluru IISc 2016
21) Karnataka Economic Survey 2020-21
22) Vol 3 Schedule of Rates for Roads & Bridges KAPWD - Final 18-03-2022
23) MoEFCC's Final Eco-Sensitive Zone Notification for Bannerghata National Park

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Annexure 5.1. Survey of India Toposheets Showing 5km Buffer around the BSRP Corridors

Corridor 1: Sampige Line

Route: KSR Bengaluru – Yelahanka – Devanahalli

667

Devanahalli Rly Stn

K.I.A

KSR Bengaluru City

Corridor 1: Sampige Line
Route: KSR Bengaluru – Yelahanka – Devanahalli

77°30'0"E | 77°35'0"E | 77°40'0"E | 77°45'0"E

13°45'0"N | 13°40'0"N | 13°35'0"N | 13°30'0"N | 13°25'0"N | 13°20'0"N

SURVEY OF INDIA TOPO GRID

57G07	57G11	57G15
57G08	57G12	57G16
57H05	57H09	57H13

Tumakuru | Chikkaballapura | Bengaluru (Rural) | Kolara | Bengaluru (Urban) | Ramanagara | Mandya

Devanahalli Rly Stn
K I A
C-1 Sampige Line
Rajanukunte Rly Stn
C-2 Mallige Line
C-4 Kanaka Line
Chikka Banavara Rly Stn
Whitefield In
C-3 Parijaata Line
K S R Rly Stn
Kengeri Rly Stn
Baiyyappanahalli Rly Stn
Heelalige Rly Stn

Legend
NAME
Corridor 1: Sampige Line
Corridor 2: Mallige Line
Corridor 3: Parijaata Line
Corridor 4: Kanaka Line
BBMP Zone Boundary
Zone
BOMMANAHALLI
DASARAHALLI
EAST
MAHADEVAPURA
RR NAGARA
SOUTH
WEST
YELAHANKA
District

Legend
Corridor 1: Sampige Line
Route: KSR Bengaluru – Yelahanka – Devanahalli
Reserved Forest Boundary
Corridor-1 Buffer Area
5 -5 = 10 Km

1 cm = 500 m
0 2.5 5 Km

Corridor 2: Mallige Line

Route: Baiyyappanahalli Terminal – Chikkabanavara

77°25'0"E 77°30'0"E 77°35'0"E 77°40'0"E 77°45'0"E

13°10'0"N 13°5'0"N 13°0'0"N 12°55'0"N

Chikkabanavara Rly Stn

Corridor 2: Mallige Line

Baiyyappanahalli Terminal

HESARGHATTA TANK

NELAMANGALA

LORE NORTH

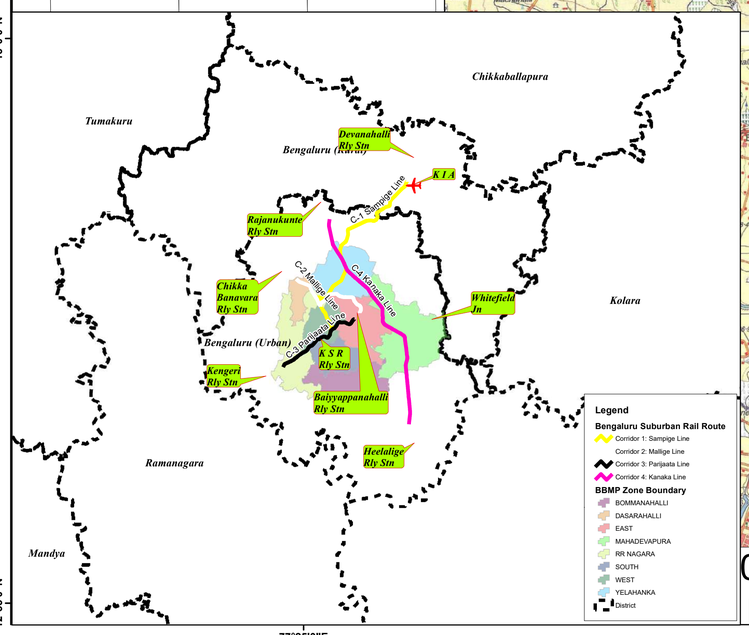
MARASANDRA RESERVED FOREST

BELLANDUR TANK

VARTUR KERE

SURVEY OF INDIA TOPO GRID

57G03	57G07	57G11	57G15
57G04	57G08	57G12	57G16
57H01	57H05	57H09	57H13
57H02	57H06	57H10	57H14



1 cm =500 m

0 2.5 5 Km

Legend

Corridor 2: Mallige Line

Route: Baiyyappanahalli Terminal – Chikkabanavara

Forest Boundary

Minor Forest

Reserved Forest

Corridor-2 Buffer Area

5 -5 = 10 Km

Corridor 3: Parijaata Line

Route: Kengeri – Whitefield

77°30'0"E 77°35'0"E 77°40'0"E 77°45'0"E

13°5'0"N 13°0'0"N 12°55'0"N 12°50'0"N

Corridor 3
Parijaata Line

Kengeri
Rly Stn

Whitefield
Rly Stn

Legend

Corridor 3: Parijaata Line

Route: Kengeri – Whitefield

Forest Boundary

Minor Forest

Reserved Forest

Corridor-3 Buffer Area

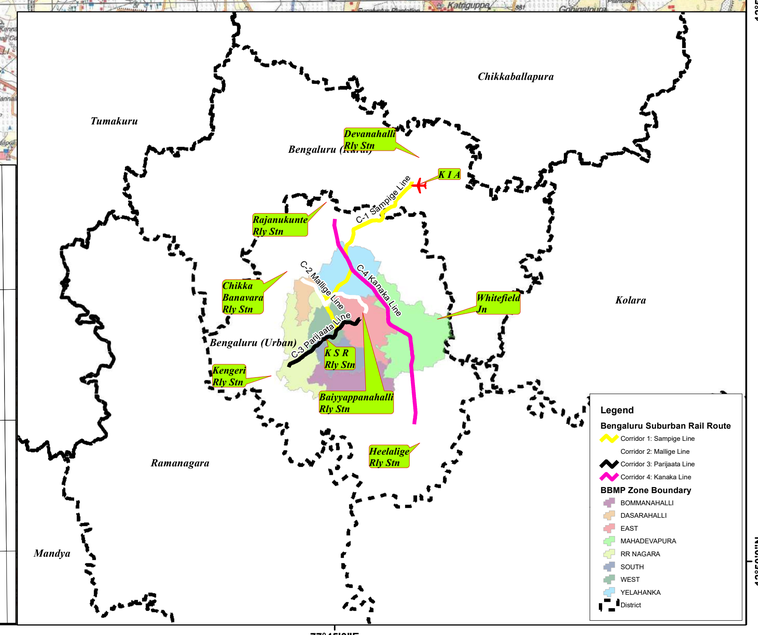
5 -5 = 10 Km

1 cm =500 m

0 2.5 5 Km

SURVEY OF INDIA TOPO GRID

57G03	57G07	57G11	57G15
57G04	57G08	57G12	57G16
57H01	57H05	57H09	57H13
57H02	57H06	57H10	57H14



6 Corridor 4: Kanaka Line

Route: Heelalige – Rajankute

Rajankute Rly Stn

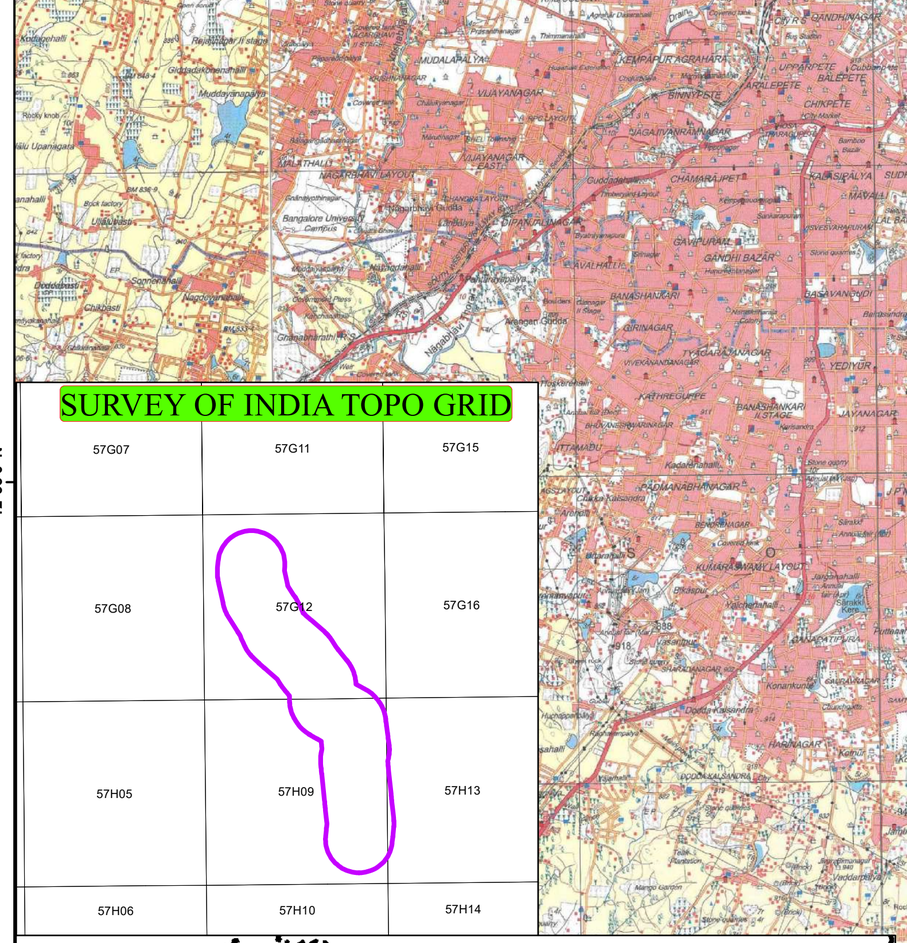
Corridor 4: Kanaka Line
Route: Heelalige – Rajankute

Heelalige Rly Stn

77°30'0"E
77°35'0"E
77°40'0"E
77°45'0"E
13°10'0"N
13°5'0"N
13°0'0"N
12°55'0"N
12°50'0"N

SURVEY OF INDIA TOPO GRID

57G07	57G11	57G15
57G08	57G12	57G16
57H05	57H09	57H13
57H06	57H10	57H14



1 cm =500 m

0 2.5 5 Km

Legend

Corridor 4: Kanaka Line

Route: Heelalige – Rajankute

Reserved Forest Boundary

Corridor-4 Buffer Area

5 -5 = 10 Km

671

Annexure 5.2. Strip Plan Showing Project Alignment with Environmental Features present along the BSRP Corridors

KSR BANGALORE CITY

DEVANAHALLI

-0+700

BUFFER END FOR CORRIDOR-1 @ Km.(+) 0.700

Nightingale Institute of Nursing

-0+650

PRO.SHUNTING NECK

-0+600

-0+550

-0+500

Apartments, LHS, CH:0+600

-0+450

-0+400

-0+350

T348,348A

0.80

0.70

0.60

0.50

fice, LHS, CH:-0+

MANDIR

C.L OF PROP.KSR BENGALURU CITY (SUB-URBAN) STATION (ELEVATED PF's & ELEVATED STATIO (C1 -TOWARDS DEVANAHAL Km.0.000) (C3- FROM KENGERI Km.12.110)

-0+350

-0+300

-0+250

-0+200

-0+150

-0+100

-0+050

-0+000

T13A T13B

T6

PROPOSED SUBURBAN PLA

PROPOSED ISLAND SUBURBAN PLATFO

PROPOSED SUBURBAN PLA

Railway Police Station

0.40

0.50

300

200

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -01 OF 49

KSR BANGALORE CITY

DEVANAHALLI

SRI RAMA BHAJANA MANDIR

HANUMAN TEMPLE, LHS, 0+025

CORRIDOR - 1

OVER HEAD TANK, LHS, 0+180

SRI GANESH TEMPLE, LHS, 0+240

ANUGRAHA COMMUNITY, HOSPITAL, L

C L OF PROP.KSR BENGALURU CITY (SUB-URBAN) STATION
TED PF's & ELEVATED STATION @ LVL -1)
(C1 -TOWARDS DEVANAHALLI Km.0.000)
(C3- FROM KENGERI Km.12.110)

000.00

0.20

0.30

0+000 0+050 0+100 0+150 0+200 0+250 0+300 0+350

11.87 11.83 11.83

24,92 25,05 25,17 25,35 25,6 25,8 25,95 26,04 26,16 26,29 26,49 26,71 26,93 27,14 27,35 27,53 27,71 27,9 28,08 28,26 28,44 28,62 28,8 29 29,23 29,46 29,69 29,92 29,88 29,81 29,73 28,91 28,85 28,57 28,03 27,66 27,31 27,23 26,93

T7 T8 T9 T10 T11A T11B T12 T13

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

LAND SUBURBAN PLATFORM -205m x 12m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

100

000.00

356.00

355.90

355.80

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -02OF 49

KSR BANGALORE CITY

DEVANAHALLI

KENDRIYA VIDYALAYA, LHS, 0+400

Pioneer Majestic Apartments, LHS

Seven Dreams Apartments, LHS

0+350 0+400 0+450 0+500 0+550 0+600 0+650 0+700

0.30 0.40 0.50 0.60

27.23 26.93 26.64 26.26 25.86 25.2 24.55 23.82 23.09 22.1 21.26 20.13 18.95 17.75 16.69 16.7 16.77 19.35 19.35 19.36 19.33 19.38 19.36 19.34 19.36 19.46 19.52 19.54 19.48 19.38 19.53 19.81 20.01 20.07 20.02 19.88 19.72 19.48

T14 T15 T15A T16 T16A T17 T18 T18A T18B

Km.1

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -03OF 49

KSR BANGALORE CITY

DEVANAHALLI

SREE MARIYAMMAN TEMPLE, LHS

Ranka Nest Apartments, LHS, 1+100

Mariyamman Temple, LHS, 0+970

Heaven Baptist Church

Mantri Mall and Mantri Greens Apartment

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PRO.SRIRAMAPURA
(SUB-URBAN) STATION
(AT GRADE PF's & ELEVATED STATION)
(Km.1.450)
(FUTURE STATION)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -04OF 49

KSR BANGALORE CITY

DEVANAHALLI

BBMP Library, LHS, 1+720

PANCHAVATI APARTMENT, LHS, 1+750

Hanuman Temple, LHS, 1+850

Rama Mandir, LHS, Ch:1+850

Deccan Sroop, LHS, 1+900

Ganapati Gutta Temple, LHS, 1+900

Sri Anjaneya Swamy Temple, LHS, 1+920

Sri Kandal Rangaranjani Samiti, LHS, 1+920

Apartments, LHS, Ch:1+970

METRO ALIGNMENT

Sri Chowdeshwari Temple, LHS

Surabhi Apartment, LHS, 2+050

Shree Ramamandira Gudi, LHS, 2+130

Sandalwood Manor, Condominium Complex, LHS, 2+130

Shree Apartment, LHS, Ch:2+160

Maajid E Aamir, RHS, 2+050

A Mataderia, RHS

Km.2

Mukti Mallishwaram, RHS, 2+400

Surabhi Apartment, LHS, 2+340

Apartment, LHS, 2+460

BBMP Junior College and, LHS, 2+500

School, LHS, Ch:2+

Enclave, Apartment, LHS, 2+650

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -05 OF 49

KSR BANGALORE CITY

DEVANAHALLI

SLV Royal Nest, Apartments, LHS CH:2+650

Shree Varada anjaneya Temple, RHS 2+710

Sterling Heights Apartments, RHS CH:2+700

Durga And Radhakrishna Temple, RHS, CH

Manipal Hospital, RHS, CH:2+770

MALLESHWARAM ENCLAVE APARTMENTS

Jagadguru Shankaracharya BBMP Park, RHS,CH:2+850

Elegant West Wood Apartments, RHS, CH:2+980

BBMP Health Centre, LHS, 2+870

Siddhi Vinayaka, Temple, LHS, CH:2+900

Shree Kodandarama Temple, LHS, CH:2+930

Med plus Malleshwaram, LHS, CH:2+850

PROPOSED SUBURBAN FLAT FORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PRO. MALLESWARAM (SUB-URBAN) STATION (ELEVATED PF's & ELEVATED STATION)

MALLESWARAM EXG. IR STATION (Km. 2880)

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -06 OF 49

KSR BANGALORE CITY

DEVANAHALLI

3+050 3+100 3+150 3+200 3+250 3+300 3+350 3+400

3.00 3.10 3.20 3.30

Apartments, RHS, CH:3+030

KT Apartments 22, RHS 3+010

Deluxe SLV Pg, LHS

Prasad Medicals, LHS, CH:3+180

Manjunatheshwara Condominium Complex RHS, CH:3+200

Vibrant High School, RHS, CH:3+220

Anjaneya Swamy Temple, LHS, CH:3+270

Apartments, RHS, CH:3+300

WEST PARK APARTMENTS, RHS, CH:3+400

3+400 3+450 3+500 3+550 3+600 3+650 3+700 3+750

3.40 3.50 3.60 3.70

Apartments, LHS, CH:3+450

SHANMANDIRA, LHS, 3+490

SHRIRAMA, LHS, CH:3+500

UDAYA RANI, NILAYAM, LHS, 3+550

APURNESHWARI TEMPLE

SRI SHAKTHI AMMAN TEMPLE, LHS, CH:3+600

SRI KARUMARI AMMAN TEMPLE, LHS, CH:3+610

SRI BHAKTHA ANJANEYA SWAMY TEMP

Tree Shrine, LHS, CH:3+660

Tree Shrine, LHS, CH:3+700

Axom Health Care, LHS, CH:3+610

SHATHAKSHI, DEVI KARUMARI AMMAN TEMPLE, LHS, CH:3+610

SRI LAXMI VENKATESHWARA

TANYA APARTMENTS

APARTMENTS, RHS, CH:3+

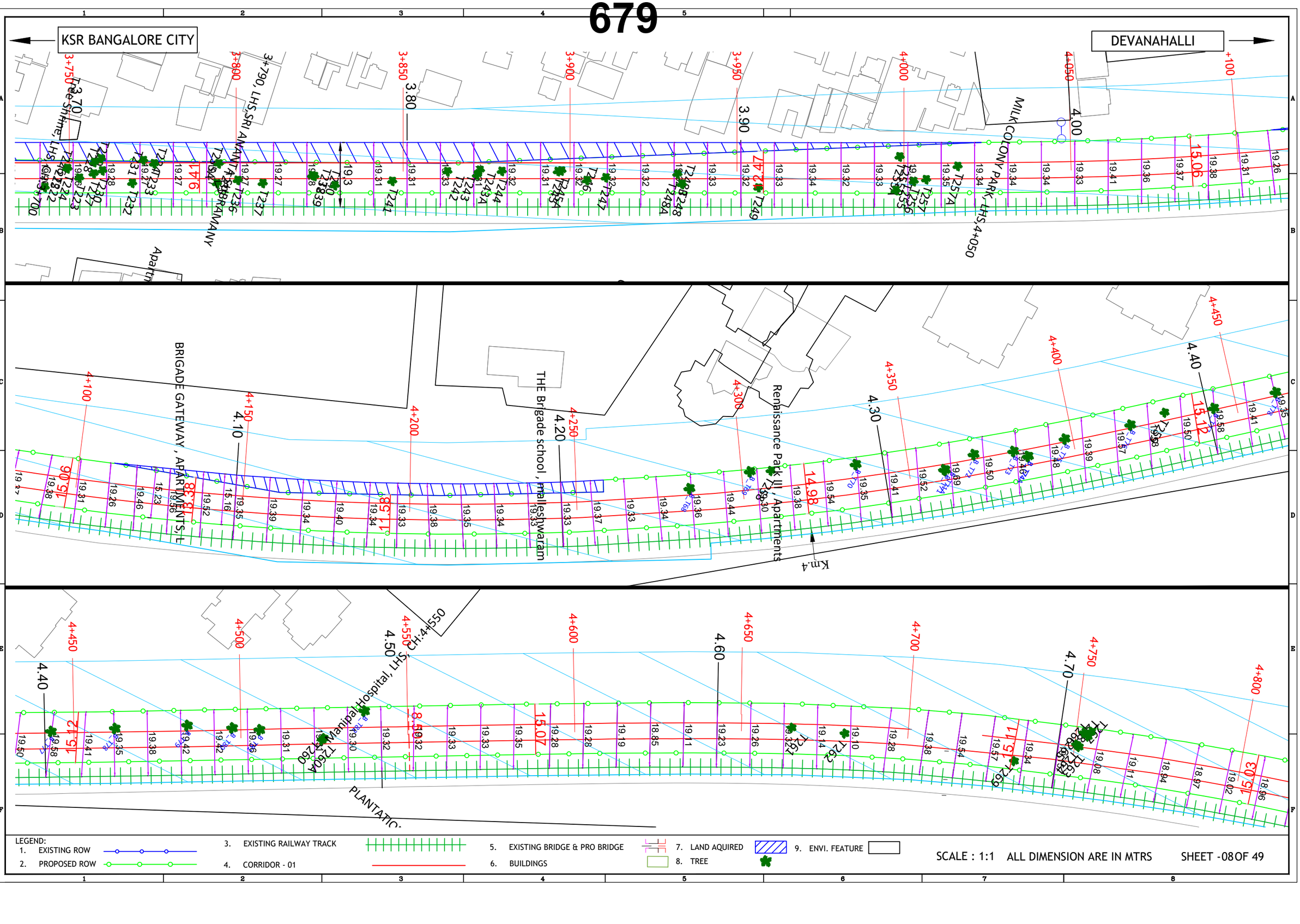
APARTMENTS, RHS, CH:3+

WEST PARK APARTMENTS, RHS, CH:3+

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -07 OF 49


KSR BANGALORE CITY
DEVANAHALLI
MILK COLONY PARK, LHS
BRIGADE GATEWAY , APARTMENTS, L
THE Brigade school , malleshwaram
Renaissance Park III , Apartments
Manipal Hospital, LHS
PLANTATIO
Km.4
CH:4+550
LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE
SCALE : 1:1 ALL DIMENSION ARE IN MTRS
SHEET -08 OF 49

KSR BANGALORE CITY

DEVANAHALLI

4+800 4+850 4+900 4+950 5+000 5+050 5+100 5+150

4.80 4.90 5.00 5.10

15.21 15.80

19.02 18.96 19.10 19.13 19.17 19.31 19.30 19.13 19.01 18.88 18.80 18.72 18.95 19.36 19.98 20.82 21.61 22.73 23.90 24.85 25.61 26.23 26.43 11.47 26.49 26.53 26.56 26.59 26.62 26.63 26.59 26.33 25.84 25.15 24.31 23.22 21.93 20.54

5+150 5+200 5+250 5+300 5+350 5+400 5+450

5.10 5.20 0.00 5.30 0.10 5.40

15.80 15.10 11.83 11.82

GORAVANAHALLI LAXMITEMPLE, LHS

258.34

Km.5

5+450 5+500 5+550 5+600 5+650 5+700 5+750 5+800

5.40 0.20 5.50 0.30 5.60 0.40 5.70 0.50

11.83

PROPOSED ISLAND PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -09 OF 49

KSR BANGALORE CITY

DEVANAHALLI

Vaishnavi Nakshatra Apartment

PROPOSED SUBURBAN

PROPOSED ISLAND P

PROPOSED SUBURBAN

Km.6

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -10OF 49

KSR BANGALORE CITY

DEVANAHALLI

BETHEL PRAYER CHURCH, RHS, 6+

MARANATHA PRAYER HO

SREE ANGALA PARAMESHWARI AMMA TEM

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

7+450 7.40 7+500 7+550 7.50 7+600 7+650 7.60 7+700 7+750 7.70

7+800 7.80 7+850 7+900 7+950 7.90 8+000 8+050 8.00 8+100

Renaissance Reserva, LHS,

MUTHYALA SRI SAI BA

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

CORRIDOR - 1

℄ OF PRO.MUTHYALANAGAR (SUB-URBAN) STATION (ELEVATED PF's & ELEVATEDSTATION) (Km.8.320)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

Muthyalamma Temple, LHS, CH:8+100

Dollers Heights, Apartments, RHS

NATIONAL PUBLIC SCHOOL AND P U College

HUMMING BIRDS, SCHOOL, LHS

Manjushree P G Hostel, LHS:

Chaturveda Apartments, LHS

8+150 8+200 8+250 8+300 8+350 8+400 8+450

8.10 8.20 8.30 8.40

T353 T354 T355 T356 T357 T358 T359 T360

14.41 20.75 20.73 15.05 15.00

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 13OF 49

685

KSR BANGALORE CITY

DEVANAHALLI

8.40

8.50

8.60

8.70

8.80

8.90

9.00

8+500

8+550

8+600

8+650

8+700

8+750

8+800

8+850

8+900

8+950

9+000

9+050

9+100

Chaturveda Apartments, LHS

Marigold Tree P.G Hostel, LHS.

Ramalah Samadhi, RHS, CH:8+750

Nestaway Apartmens, RHS, CH:8+7

Shriram Sadhana Apartments, LHS

Gokul Towers, LHS, CH:9+000

12.15

15.05

14.96

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 14OF 49

KSR BANGALORE CITY

DEVANAHALLI

9+150 9.10 9+200 9.20 9+250 9+300 9.30 9+350 9+400 9.40 9+450 9+500 9.50

R V Residency, Apartment bu

Rescue mission Worship centre,

T397 T410 T412 T407 T408 T411 T413 T415

15.18 15.28 15.25

9+500 9.50 9+550 9+600 9.60 9+650 9+700 9.70 9+750 9+800 9.80 9+850 9+900

Shahi Mahatma Temple, POORNAPRA

CHRIST THE KING CHURCH,

WASTE WATER TREATMENT PLANT CH:

15.28 15.09

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -15 OF 49

KSR BANGALORE CITY

DEVANAHALLI

9+900

9+950

10+000

10+050

10+100

10+150

10+200

9.90

10.00

10.10

10.20

BEL SCHOOL, LHS, CH:9+900

BHAGAWAN ARCADE, RHS, 9+900

ROYAL VILLA APARTMENTS, RHS

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

℄ OF PRO.LOTTEGOLLAHALLI (SUB-URBAN) STATION (ELEVATED PF's & ELEVATED STN.) (KM:14.350) FOR CORRIDOR - 2 (LVL:2)

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -16 OF 49

KSR BANGALORE CITY

DEVANAHALLI

10+200 10.20 10+250 10+300 10.30 10+350 10+400 10.40 10+450 10+500 10.50 10+550

9.52 11.28 13.07 2.14 5.74 15.08 16.40 17.56 18.43 19.09 19.25 19.25 19.26 19.27 19.27 19.28 19.28 19.26 15.07 19.26 19.25 19.27 19.31 19.34 19.32 19.31 19.30 19.33 19.30 19.21 19.25 19.30 19.32 19.31 15.05 19.30 19.32 19.28 19.32 19.34 19.32 19.31

10+550 10+600 10.60 10+650 10+700 10.70 10+750 10+800 10.80 10+850 10+900

19.34 19.32 19.31 19.31 19.33 19.34 15.08 19.32 19.34 19.33 19.33 19.35 19.34 19.33 19.32 19.38 15.11 19.33 19.33 19.31 19.30 19.35 19.32 19.33 19.33 19.32 19.31 19.33 19.32 15.11 19.33 19.32 19.33 19.35 19.34 19.34 19.35 19.32 19.32 19.33

10+900 10.90 10+950 11+000 11.00 11+050 11+100 11.10 11+150 11+200 11.20 11+250

19.35 19.32 19.32 19.33 19.32 19.31 19.31 15.07 19.32 19.33 19.31 19.30 19.30 19.30 19.32 19.32 15.08 19.34 19.34 19.34 19.33 19.34 19.34 19.33 19.33 19.34 19.35 19.33 19.32 19.33 19.33 15.07 19.32 19.32 19.31 19.34 19.36 19.36 19.33 19.33

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -17 OF 49

KSR BANGALORE CITY

DEVANAHALLI

11+250 11+300 11.30 11+350 11+400 11.40 11+450 11+500 11.50 11+550 11+600

VYASA INTERNATIONAL SCHOOL A

UNIQUE CO

FAMILY ENCLAVE APARTMENT,

11+600 11.60 11+650 11+700 11.70 11+750 Kddigehalli, Lake, LHS, CH:11+7 11+800 11.80 11+850 11+900 11.90 11+950

11+950 12+000 12.00 12+050 12+100 12.10 12+150 12+200 12.20 12+250

Jeevan SANSKAR Villa, LHS

ANKUR, HOMES, APARTMEBNT, LHS,

R R RESIDENCY, LHS, 12+150

RAMP ENDS Km.12.300 12+300

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

RAMP ENDS

Km.12.300

GRADE STARTS

12+300

12+350

12+400

12+450

12+500

12+550

12+600

12.30

12.40

12.50

12.60

13.00

13.28

13.25

13.17

15.18

SHRI MUNESHWARA TEMPLE, RHS

Amara Hospetala, hospital, RHS

RAM CHAITANYA APARTMENT, RHS

THE ABODE, RHS, APARTMENT

BALAJI YASH APARTMENT, LHS

Balaji Yash Apartment, LHS

FORTUNA WIND FLOWER, LHS, 12+750

Residency, RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

CORRIDOR - 1

℄ OF PRO.KODIGEHALLI (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED STN.) (Km.12.780)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

SHRI MUNESHWARA TEMPLE, RHS

Amara Hospetala, hospital, RHS

RAM SAMPANNYA APARTMENT, RHS

THE ABODE, RHS, APARTMENT

BALAJI YASH APARTMENT, LHS

Balaji Yash Apartment, LHS

FORTUNA WIND FLOWER, LHS, 12+750

Dwarkamai Residency, RHS

BBMP PARK, RHS, 12+800

SHIV SANKALP APARTMENT, LHS

ATREYA RESIDENCY, RHS, 13+150

PET CONNECT, HOSPITAL, RHS, 13+150

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -20 OF 49

KSR BANGALORE CITY

DEVANAHALLI

KANGAROO WOMAN AND CHILD CARE

KUSHI APARTMENTS, LHS, 13+550

VAISHNAVI ARCADE, RHS, 13+600

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

14+300 14.30 14+350 14+400 14.40 14+450 14+500 14.50 14+550 14+600 14.60 14+650

17.20 17.18 17.25 17.23 17.09 17.30 17.25 17.01 17.21 17.15 17.17 17.15 17.05 16.96 16.87 16.76 17.04 17.24 17.41 17.55 17.64 17.70 13.21 17.75 17.81 17.81 17.79 17.77 17.74 17.73 17.73 17.69 17.69 17.69 17.69 17.68 17.67 13.17 17.68 17.68 17.69

C.L OF PRO. JUDICIAL LAYOUT (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED STN.) (Km.14.960)

AT GRADE ENDS

14+650 14+700 14.70 14+750 14+800 14.80 14+850 14+900 14.90 14+950 15+000 15+010

17.68 17.68 17.69 17.69 17.70 13.11 17.70 17.68 17.73 17.81 18.16 18.43 19.24 20.36 21.76 23.22 24.50 25.54 26.26 26.73 27.58 27.58 27.58 34.02 34.03 34.02 33.98 33.96 33.92 33.92 33.91 33.90 33.89 33.86 33.88 33.89

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

EXISTING SUBURBAN PLATFORM -205m x 7m (9 CARS)

5+000 15+010 15.00 5+050 15+100 15.10 15+150 15+200 15.20 15+250 15+300 15.30 15+350

33.88 33.89 33.90 33.90 33.91 33.92 28.88 28.86 28.68 28.20 27.58 25.65 24.24 22.76 21.35 20.20 19.30 18.79 18.64 18.58 18.58 19.21 19.21 19.21 19.21 19.22 19.22 19.23 19.24 19.25 19.27 19.28 19.30 19.31 19.33 19.34

HRC Ananya Apartment LHS, STERLING DEWBERRIES, LHS, APARTM

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -22OF 49

KSR BANGALORE CITY

DEVANAHALLI

15+350 15+400 15+450 15+500 15+550 15+600 15+650 15+700

15.40 15.50 15.60 15.70

15+4

SLV INDUSTRIES, LHS

HINDUSTAN PETROLEUM,

15.32 15.18

15+750 15+800 15+850 15+900 15+950 16+000 16+050 16+100

15.80 15.90 16.00

15.12 14.95 14.98

16+100 16+150 16+200 16+250 16+300 16+350 16+400 16+450

16.10 16.20 16.30 16.40

15.08 15.17 10.29

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

16+450 16+500 16+550 16+600 16+650 16+700 16+750 16+800

16.50 16.60 16.70 16.80

16+690, LHS, LAKE

RMZ Galleria Residences

16+750 16+800 16+850 16+900 16+950 17+000 17+050 17+100 17+150 17+200 17+250 17+300 17+350 17+400 17+450 17+500

16.80 16.90 15.20 17.00 15.30 17.10 15.40 17.20 15.50 GOVT PU AND FIRST GRADE COLLEGE 17.30 15.60 17.40 15.70

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

SHRINIVAS HOSPITAL, LHS

JAIN TEMPLE, RHS, 17+650

SHRI VEN

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

℄
OF
PRO.YELAHANKA
(KM: 18.380)

(SUB-URBAN STATION)
(ELEVATED PFs & ELEVATED STN.)
FOR CORRIDOR - 1
SBC TO DHL Via YPR (LVL:1) ON RH SIDE
&
(ELEVATED PFs & ELEVATED STN.)
FOR CORRIDOR - 4
HLE TO RNN Via CSDR (LVL:1) ON LH SIDE
(KM: 37.825)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 26OF 49

KSR BANGALORE CITY

DEVANAHALLI

POND, LHS, CH:1+600

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

19+900 2.00 19+950 20+000 2.10 20+050 20+100 2.20 20+150 20+200 2.30 20+250

19.29 19.24 19.40 19.41 14.95 19.38 19.37 19.36 19.38 19.37 19.36 19.34 19.33 18.95 19.00 19.02 19.08 19.10 19.12 19.20 19.25 19.29 19.33 15.06 19.22 19.25 19.25 19.25 19.26 19.29 19.29 19.30 19.31 19.33 19.35 19.35 19.34 15.07 19.33 19.31 19.33

20+250 20+300 2.40 20+350 20+400 2.50 20+450 20+500 2.60 20+550 20+600 2.70

19.33 19.31 19.33 19.34 15.08 19.33 19.33 19.33 19.19 19.20 19.22 19.23 19.24 19.25 19.27 19.29 19.30 15.11 19.32 19.34 19.32 19.32 19.32 19.33 19.32 19.33 19.33 19.33 19.33 19.33 19.33 15.09 19.33 19.33 19.31 19.34 19.36 19.37 19.33 15.08 19.36 19.33

20+600 2.70 20+650 2.80 20+700 20+750 20+800 2.90 20+850 20+900 3.00

19.34 19.36 19.37 19.33 19.36 15.08 19.33 19.37 19.34 19.31 19.14 19.30 19.38 19.47 19.42 19.38 19.50 15.07 19.48 19.37 19.38 19.37 19.40 19.41 19.37 19.38 19.39 19.46 19.48 19.39 19.37 19.34 18.93 19.37 15.18 19.30 19.42 19.47 19.61 19.18 16.06

RAMP ENDS

Km. 20.930

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -28OF 49

KSR BANGALORE CITY

DEVANAHALLI

3.00 3.10 3.20 3.30

20+900 20+950 1+000 1+050 21+100 21+150 21+200 21+250

PROPOSED SUB

PROPOSED SUI

RAMP ENDS

AT GRADE STARTS

Km. 20.930

3.30 3.40 3.50 3.60

21+200 21+250 21+300 21+350 21+400 21+450 21+500

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

℄ OF PRO.NITTE MEENAKSHI (SUB-URBAN) STATION (AT GRADE PF's &ELEVATED STATION) (Km.21.330)

3.70 3.80 3.90

21+550 21+600 1+650 21+700 21+750 21+800 21+850 21+900

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

701

KSR BANGALORE CITY

DEVANAHALLI

Gantigapalli, Lake, LHS, ch1.4

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

702

KSR BANGALORE CITY

DEVANAHALLI

22+900 5.00 22+950 23+000 5.10 23+050 23+100 5.20 23+150 23+200 5.30 23+250

17.39 17.34 17.34 17.34 17.34 17.45 17.46 17.37 17.20 17.21 17.25 17.07 17.07 17.07 16.74 16.48 16.17 16.62 16.52 16.47 16.41 16.36 16.31 16.26 16.22 16.18 16.15 16.11 16.08 16.07 16.05 16.02 16.01 16.00 15.99 15.99 15.99 16.01

18.17 13.20 13.20

23+250 5.40 23+300 23+350 5.50 23+400 23+450 5.60 23+500 23+550 5.70 23+600

15.99 15.99 15.99 16.01 16.02 16.03 16.04 16.05 16.06 16.07 16.09 16.11 16.12 16.10 16.08 16.06 16.03 16.03 16.02 16.07 16.13 16.25 16.39 16.56 16.80 16.98 17.10 17.16 17.20 17.23 17.27 17.30 17.29 17.34 17.28 17.15 17.16 17.16

13.20 12.87 13.26

5.70 23+600 23+650 5.80 23+700 23+750 5.90 23+800 23+850 6.00 23+900 23+950

17.28 17.15 17.16 17.16 17.14 17.10 17.09 17.09 17.11 17.16 17.21 17.26 17.28 17.30 17.32 17.34 17.36 17.37 17.39 17.41 17.43 17.44 17.45 17.45 17.44 17.44 17.43 17.43 17.43 17.44 17.44 17.45 17.44 17.43 17.42 17.41 17.40 17.39

13.18 29.01 11.74

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -31 OF 49

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KSR BANGALORE CITY

DEVANAHALLI

23+950 24+000 6.10 24+050 24+100 6.20 Nellukunte Lake, LHS, CH:6+200 24+150 24+200 6.30 24+250 24+300 6.40

24+300 6.40 24+350 24+400 6.50 24+450 24+500 6.60 24+550 24+600 6.70 24+650

24+650 24+700 6.80 24+750 24+800 6.90 24+850 24+900 7.00 24+950 25+000 7.10

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -32 OF 49

KSR BANGALORE CITY

DEVANAHALLI

25+000 7.10 25+050 25+100 7.20 25+150 25+200 7.30 25+250 25+300 7.40 25+350

17.42 17.42 17.42 10.41 17.43 17.43 17.43 17.43 17.43 17.43 17.43 17.43 17.44 17.48 17.46 17.56 17.66 18.06 18.12 18.35 18.71 19.02 8.98 19.28 19.63 19.61 19.86 19.80 19.54 19.55 19.12 18.96 19.52 18.40 18.19 18.03 14.63 4.79 18.02

25+350 7.50 25+400 25+450 7.60 25+500 25+550 7.70 25+600 7.40 25+300 25+650

18.57 18.40 18.19 9.59 18.03 14.63 18.02 18.25 18.14 18.35 18.28 18.17 9.71 18.34 18.08 18.14 18.11 18.07 18.34 18.23 18.27 18.18 18.23 3.96 18.28 18.27 18.55 18.57 18.73 18.83 18.74 18.81 18.72 18.64 18.56 14.76 18.46 18.37 18.33

25+650 7.80 25+700 25+750 7.90 25+800 25+850 8.00 25+900 25+950 26+000 8.10

18.22 18.14 18.06 13.20 17.99 17.95 17.91 17.86 17.81 17.76 17.71 17.66 17.61 17.56 17.51 17.46 17.41 17.37 17.32 17.27 17.23 17.20 18.18 17.15 17.11 17.15 17.20 17.51 18.04 18.84 19.84 21.09 22.33 23.55 24.49 25.31 25.84 13.20 26.11 33.25 38.24

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -33 OF 49

KSR BANGALORE CITY

DEVANAHALLI

26+000 8.10 26+050 26+100 8.20 26+150 26+200 8.30 26+250 26+300 8.40

GL OF PRO. BETTAHALASURU (SUB-URBAN) STATION (AT GRADE PF's &ELEVATED STATION) (Km.26.120)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

25.31 25.84 26.11 33.25 33.24 33.22 33.20 33.18 33.18 33.17 33.17 33.18 33.19 33.18 33.17 33.15 33.14 33.12 33.11 33.10 33.09 33.08 33.07 33.06 33.05 33.04 25.72 25.46 24.97 24.21 23.17 22.07 20.97 19.87 18.82 18.15 17.55 17.37

26+300 8.40 26+350 26+400 8.50 26+450 26+500 8.60 26+550 26+600 8.70 26+650

20.97 19.87 18.82 18.15 17.55 13.35 17.37 17.19 17.09 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 13.19 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10

KSR BANGALORE CITY

DEVANAHALLI

9.10 9.20 9.30 9.40

27+000 27+050 27+100 27+150 27+200 27+250 27+300 27+350

Tree Shrine, RHS, CH:9+210

Over Head Tank, LHS, CH:9+450

20.31 18.15

17.09 17.10 17.11 17.53 17.04 17.05 17.06 17.08

9.50 9.60 9.70

27+400 27+450 27+500 27+550 27+600 27+650 27+700

Over Head Tank, LHS, CH:9+450

12.62 98.01 10.81

17.09 17.10 17.11 17.12 17.13 17.14

9.80 9.90 10.00 10.10

27+700 27+750 27+800 27+850 27+900 27+950 28+000 28+050

10.74 11.09 12.55

17.08 17.09

REVANA SIDDESHWARA INSTITUTITUTE OF TECHNOLOGY

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -35 OF 49

KSR BANGALORE CITY

DEVANAHALLI

28+000 10.10 28+050 28+100 10.20 28+150 28+200 10.30 28+250 28+300 10.40 28+350

12.81 13.08 12.82

28+350 28+400 10.50 28+450 28+500 10.60 28+550 10.70 28+600 28+650 28+700

Over Head Tank, LHS, CH:10+70

12.81 18.03 18.20

28+700 10.80 28+750 28+800 10.90 28+850 28+900 11.00 28+950 29+000 11.10 29+050

12.38 12.20 12.06

Chikkajala Lake, ...

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -36 OF 49

KSR BANGALORE CITY

DEVANAHALLI

Chikkajala Lake, RHS, CH:11+200

Channahalli, kalyani, RHS

PRO. DODDAJALA
(SUB-URBAN) STATION
(AT GRADE PF's & ELEVATED STATION)
(Km.30.070)

PROPOSED SUBURBAN PLATFORM -205m x 7m

PROPOSED SUBURBAN PLATFORM -205m x 7m

Openwell, LHS, CH:12+000

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -37 OF 49

KSR BANGALORE CITY

℄ OF PRO. DODDAJALA (SUB-URBAN) STATION (AT GRADE PF's &ELEVATED STATION) (Km.30.070)

DEVANAHALLI

MEENUKUNTE GRAMA PANCHAYAT, RHS,

Shree Muneshwara Temple, LHS

Apartment cum Clinic, LHS, CH:1

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

30+950 31+000 31+050 31+100 31+150 31+200 31+250 31+300

13.10 13.20 13.30 13.40

11.46 12.16 11.77

16.27 16.47 16.37 16.56 16.51 16.46 16.43 16.25 16.23 16.13 16.04 15.95 15.88 15.85 15.83 15.79 15.76 15.72 15.70 15.68 15.64 15.60 15.56 15.53 15.50 15.53 15.58 15.64 15.84 15.96 16.22 16.39 16.40 16.70 16.79 16.96 17.13 17.12

31+350 31+400 31+450 31+500 31+550 31+600 31+650 31+700

13.50 13.60 13.70 13.80

Overhead Tank, LHS, CH:13+7

12.69 11.95 13.20

17.36 17.49 17.49 17.38 17.42 17.43 17.38 17.43 16.55 17.24 17.10 16.86 16.79 16.61 16.51 16.40 16.29 16.23 16.16 16.08 16.00 15.95 15.95 15.94 16.20 16.53 16.84 17.18 17.49 17.48 17.44 17.33 17.14 16.94 16.77 16.60 16.43 16.26

31+700 31+750 31+800 31+850 31+900 31+950 32+000 32+050

13.80 13.90 14.00 14.10

13.27 13.28 12.80 13.37

16.60 16.43 16.26 16.09 15.91 15.72 15.58 15.46 15.38 15.58 15.78 16.11 16.56 16.94 17.33 17.26 17.25 17.31 17.29 17.37 17.39 17.37 17.26 17.26 17.25 17.26 17.07 17.24 17.20 17.04 17.08 17.03 16.93 16.93 17.07 17.10 17.19 17.16 16.95

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

32+050 14.20 32+100 32+150 14.30 32+200 14.34 32+250 14.40 32+300 32+350 14.50 32+400

90 13.18 6.91

14.50 32+400 32+450 14.60 32+500 32+550 14.70 32+600 32+650 14.80 32+700

6.79 90 6.90 6.13 32+750

32+750 32+800 90 32+850 5.65 32+900 15.00 32+950 33+000 15.10 33+050 33+100

5.27 6.06 13.13 13.22 13.32

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

33+000 15.10 33+050 33+100 15.20 33+150 33+200 15.30 33+250 33+300 15.40 33+350

17.14 17.10 13.20 17.10 17.13 17.37 17.11 16.98 16.90 17.04 17.13 17.12 17.13 17.11 17.14 17.13 16.94 16.75 16.83 16.96 16.99 17.07 17.03 17.08 17.10 17.10 17.10 6.48 17.10 17.10 17.10 17.10 17.10 17.12 17.10 16.92 16.77 16.73 8.63

33+350 33+400 15.50 33+450 33+500 15.60 33+550 33+600 15.70 33+650 33+700

16.92 16.77 16.73 8.89 16.73 16.91 17.07 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.10 17.09 17.08 17.07 16.99 16.82 16.93 17.05 17.08 5.74 17.10 17.13 17.15 17.18 17.20 17.22 17.25 17.25 17.23 17.20

33+650 33+700 15.80 33+750 33+800 15.90 33+850 33+900 16.00 33+950 34+000 16.10

6.21 17.18 17.20 17.22 17.25 17.26 17.23 17.20 17.18 17.15 17.13 17.10 17.08 17.05 17.03 17.00 16.98 16.96 6.59 16.95 16.93 16.91 16.91 16.98 17.04 17.11 17.12 17.04 16.90 16.76 16.62 16.48 16.34 7.04 16.20 16.06 15.92 15.78 15.64 15.50 15.36

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -41 OF 49

KSR BANGALORE CITY

DEVANAHALLI

C OF PRO.AIRPORT TRUMPHET (SUB-URBAN) STATION (AT GRADE PF's &ELEVATED STATION) (Km.34.220)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

ANJANEYA TEMPLE, RHS, CH:17+000

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

35+000 35+050 35+100 35+150 35+200 35+250 35+300 35+350

17.10 17.20 17.30 17.40

35+350 35+400 35+450 35+500 35+550 35+600 35+650

17.50 17.60 17.70

35+600 35+650 35+700 35+750 35+800 35+850 35+900 35+950

17.70 17.80 17.90 18.00

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

OF
PRO.AIRPORT KIADB
(SUB-URBAN) STATION
(AT GRADE PF's &ELEVATED STATION)
(Km.36.150)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS

KSR BANGALORE CITY

DEVANAHALLI

36+900 19.00 36+950 37+000 19.10 37+050 37+100 19.20 37+150 37+200 19.30 37+250

37+250 37+300 19.40 37+350 37+400 19.50 37+450 37+500 19.60 37+550 37+600

37+600 19.70 37+650 37+700 19.80 37+750 37+800 19.90 37+850 37+900 20.00 37+950

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 45OF 49

KSR BANGALORE CITY

DEVANAHALLI

37+950 38+000 38+050 38+100 38+150 38+200 38+250 38+300

20.10 20.20 20.30

38+300 38+350 38+400 38+450 38+500 38+550 38+600 38+650

20.40 20.50 20.60 20.70

HOYSALA BROXIA, LHS, 38+650

38+650 38+700 38+750 38+800 38+850 38+900 38+950 39+000

20.80 20.90 21.00

HOYSALA BROXIA, LHS, 38+650

SRI SHANESHWARA SWAMY TEMPLE,

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 46OF 49

KSR BANGALORE CITY

DEVANAHALLI

39+000 39+050 39+100 39+150 39+200 39+250 39+300 39+350

21.10 21.20 21.30 21.40

39+350 39+400 39+450 39+500 39+550 39+600 39+650 39+700

21.50 21.60 21.70

39+700 39+750 39+800 39+850 39+900 39+950 40+000 40+050

21.80 21.90 22.00 22.10

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -47OF 49

KSR BANGALORE CITY

DEVANAHALLI

40+100 40+050 40+150 40+200 40+250 40+300 40+350

22.10 22.20 22.30 22.40

12.42 12.40 12.40

Km.40.550

AT GRADE ENDS

RAMP STARTS

40+350 40+400 40+450 40+500 40+550 40+600 40+650 40+700

22.50 22.60 22.70

12.40 12.40

40+700 40+750 40+800 40+850 40+900 40+950 41+000

22.80 22.90 23.00

12.41 14.12 14.10

Bharath Petroleum ,RHS: Ch:23+150

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -48OF 49

720

KSR BANGALORE CITY

DEVANAHALLI

40+950 41+000 23.10 41+050 41+100 23.20 41+150 41+200 23.30 41+250 41+300

16.69 18.14 18.87 19.39 19.60 19.63 19.52 19.58 19.64 19.74 19.74 19.70 19.67 19.64 19.58 18.94 18.29 17.65 17.00 16.45 16.04 15.69 15.40 15.10 15.21 15.29 15.19 15.34 15.95 17.00 18.50 20.19 21.55 23.12 24.42 25.88 26.02 26.43

Rd, CH:23+150

℄ OF PRO.DEVANAHALLI (SUB-URBAN) STATION (ELEVATED PF's & STATION) (SUB. Km.41.400)

23.40 41+300 41+350 41+400 23.50 +50 +100 23.60 +150 +200 23.70 +250

25.88 26.02 26.43 26.75 27.06 27.37 27.69 28.00 28.32 28.63 28.94 29.26 29.57 29.88 30.20 30.51 30.83 31.14 31.46 31.46 31.43 31.40 31.38 31.35 31.33 31.30 31.27 31.24 31.21 31.19 31.16 31.13 31.10 31.07 31.04 31.01 30.98 30.95

13.53 13.53 13.53 13.53 13.53 13.53

PROPOSED SUBURBAN PLATFORM -210m x 7m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7m (9 CARS)

Burial Ground, Devanahalli, LHS

Shreeram Roads Enterprises,Car Se

℄ OF DEVANAHALLI EXG. IR STATION @ Km.23.540

Pond, LHS, CH:23+700

23.70 +200 +250 +300 23.80 +350 +400 23.90 +450

31.19 31.16 31.13 31.10 31.07 31.04 31.01 30.98 30.95 30.93 31.09 31.42 31.75 32.08 32.40 32.80 33.13 33.46 33.66 33.63 33.38 32.92 32.32 31.61 30.78 29.85 28.80

13.53 13.53 13.53

TOWARDS CHIKBALLAPUR/KOLAR

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR - 01
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND AQUIRED
8. TREE
9. ENVI. FEATURE

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET -49 OF 49

BAIYAPPANAHALLI

CHIKKABANAWARA

EXG.IR. GRADIENT

LHS

Sapthagiri Maharishi Apartments

Earthern Summer, Apartments, LHS

Bumble Rock, LHS, CH:-850

Karthik Residency, LHS, CH:-850

Suryodaya Enclave Apartments, L

EY HOMES3 LHS, CH:-740

FUTURE BUFFER END

A R Nest, Apartments, LHS, CH:-

ments, LHS, CH:-

000.058+0

000.750+0

000.650+0

30.000

CORRIDOR-2 SUB-URBAN TRACK

DOWN LINE

UP LINE

CORRIDOR-4 SUB-URBAN TRACK

CORRIDOR-4

EXG.RAILWAY BOUNDARY

PROPOSE

EXG.RAILWAY BOUNDARY

12

32.234 6.199 6.965 8.010 9.826 11.593 13.209 14.700 16.060 17.314 18.454 19.395 20.360 21.140 21.856 22.416 22.859 23.185 23.395 23.487 23.462 23.320 23.060 22.684 22.191 21.581 20.855 20.013 19.055 17.981 16.792 15.489 14.072 12.542 10.898 9.142

ACKS

BOUNDARY

START OF CORRIDOR 2 AT IR CH 204.677 & BSRP -0.964

204/700

PRO. SRJ ; CH: -0+918.543

R R Guest Homes, RHS, CH:-750

204/800

PRO. SRJ ; CH: -0+843.543

Jesus Grace Church, RHS, CH:-750

New Pratham Public school, RHS,

204/900

KIDS CASTLE, Preschool, RHS

HOUSE

Sai Nilayam Apartments, RHS, CH

Elegance, APARTMENTS, RHS

SLC PG BOYS, RHS, CH:-800

RH

205/000

APARTMENT

Nanda nandini boys PG, RHS, CH:

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 1 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

FUTURE BUFFER END

Gopalan Grand Mall, RHS, CH:-550

-0+450.000

TO BANGALORE CITY

PUBLIC TOILET

ROTARY

GOVT PUBLIC SCHOOL

-0+350.000

SCHOOL PARK

TEMPLE

TO BE DISMANTLED

BUILDING AREA

-0+250.000

BMRCL TRACKS

-0+150.000

EXISTING LINE

EXISTING UP MAIN LINE

CORRIDOR-2

FUTURE ROR

EXISTING TRACK

BMRCL TRACK

CORRIDOR-4

Skyline RK Atlantis, apartments

APARTMENT

RHS

205/200

205/300

205/400

205/500

KR PURAM

GITANJALI LAKE VIEW B+4 BLD

PRO. SRJ ; CH: -1+242.485

PRO. SRJ ; CH:-1+115

ACP08

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

BUILDING AREA

-0+250.000

BMRCL TRACKS

EXG.TRACK TO BE SLEWED

4.907

25.00

22.00

-0+188.362

R1200

PRO. SRJ ; CH: -1+194.15

-0+150.000

PRO. QUADRUPLING LINES

R 2000

343700

343650

343600

EXG.Compound Wall

7.34

EXG.ROR NO.533 @ CH:205550, 6X6.10m PSC SLAB

PROPOSED TO BE EXTEND

-0+050.000

AS PER FSR CHAINAGE
@ Km.0.000

CHIKKABANAWARA

SADANANDANAGAR, Park, LHS

K P Apartments, LHS, CH:205+700

0+000.000

0+050.000

0+100.000

FUTURE ROR

PRO.DOUBLING

EXISTING LINE

EXISTING TRACK

12.204

7.800

12.267

5.300

7.500

DOWN LINE

UP LINE

OVER RUN LINE 120m

PRO.STABLING LINES 5.300

OVER RUN LINE 120m

FM

CORRIDOR-4

4.108

5.612

PRO. SRJ ; CH: -1+242.485

RHS

BMRCL TRACK

JALI LAKE
B+4 BLD

205/400

205/500

205/600

205/700

TACP08

TACP09

SERVICE Road

ROAD

EXG RAILWAY BOUNDA

HOUSES

SwamiVivekana

OUTER RING ROAD EXTENSION 8.5 M

SC: 0+494.903

CS: 0+519.570

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 3 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

7.800

32.819

32.369

8½

PRO.SUBURBAN RAILWAY BOUNDARY

STABLING LINE - CSL 260m

STABLING LINE - 2 CSL= 260m

Maha ganapathi

RHS

205/900

Apartments, RHS,

RHS

206/000

BAIYAPPANAHALLI

CHIKKABANAWARA

0+450.000

0+500.000

0+550.000

0+600.000

0+650.000

0+700.000

0+750.000

0+800.000

EXG.RAILWAY BOUNDARY

32.349

27.477

17.691

13.646

8.519 PRO.SUBURBAN RAILWAY

OVER RUN LINE 120m

OVER RUN LINE 120m

2199.10 sqm

Gopalan Aristocrat, RHS

S R Sapphire, Apartment, RHS

Apartment, RHS, CH:206+150

RESTAURANT, RHS, CH:206+250

Apartment, RHS, CH:206+200

Residential Building, RHS

Apartments, RHS, CH:206+300

KMJ Woodwinds, Apartments, RHS,

206/100

206/200

206/300

206/400

RHS

RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

N

0+800.000

0+850.000

0+900.000

0+950.000

1+000.000

1+050.000

1+100.000

1+150.000

EXG.RAILWAY BOUNDARY

PRO.DOUBLING

SUB-URBAN TRACK

EXG.RAILWAY BOUNDARY

2199.10 sqm

773.77 sqm

PROPOSED SUBURBAN PLATFORM -205m x 7 m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7 m (9 CARS)

DOWN LINE

UP LINE

4.400

11.747

19.521

12.689

23.344

12.825

25.307

26.340

BWSSB OFFICE RHS, CH:206+500

APARTMENT, RHS, CH:206+600

Ashok Seth, Apartments, R

LNR Building, RHS, CH:206+650

Taskites Apartments, RHS, CH:

206/500

206/600

206/700

206/800

RHS

RHS

RHS

L
OF
PRO. KASTURINAGAR
(SUB-URBAN) STATION
(KM:1.115)

BAIYAPPANAHALLI

CHIKKABANAWARA

N

1+100.000

1+150.000

1+200.000

1+250.000

1+300.000

1+350.000

1+400.000

1+450.000

EXG.RAILWAY BOUNDARY

PRO.SUBURBAN RAILWAY BOUNDARY

PROPOSED SUBURBAN PLATFORM -205m x 7 m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7 m (9 CARS)

4.400

6.925

12.781

26.649

26.340

26.314

17.996

Petrol Pump, RHS, CH:206+90

Red Apartments, RHS, CH:207+00

PG in Banasawadi, RHS, CH:207+0

Apartments, RHS, CH:207+090

Apartment, RHS, CH:207+100

Taskites Apartments, RHS, CH:

206/800

206/900

207/000

207/100

RHS

RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 5 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

1+450.000 1+500.000 1+550.000 1+600.000 1+650.000 1+700.000 1+750.000 1+800.000

EXG.RAILWAY BOUNDARY

HDFC Bank ATM, RHS, CH:207+190

PLR Homes, RHS, CH:207+290

PRP PHOENIX Apartment,

Apartment, RHS, CH:207+100

409.8728 sqm

EXG.RAILWAY BOUNDARY

PRO.SUBURBAN RAILWAY BOUNDARY

17.485 17.034 7.800 4.400 5.000

207/100 207/200 207/300

RHS RHS

SUB-URBAN TRACKS

SE = 50mm
TCL = 690m
V = 80kmph

BAIYAPPANAHALLI

CHIKKABANAWARA

1+800.000 1+850.000 1+900.000 1+950.000 2+000.000 2+050.000 2+100.000 2+150.000

PRO.DOUBLING

Ramaiah Arcades, RHS, CH:207+460

EXG.RAILWAY BOUNDARY

PMR Apartments, RHS, CH:207+640

PRO.DOUBLING

Vinayaka Meadows, RHS, CH:207+700

Bethesda Full Gospel AG church

ACKS BOUNDARY

EXG.RAILWAY BOUNDARY

DOWN LINE

UP LINE

11310 sqm

PRO.SUBU

25.883 20.229 17.012 13.747

207/500 207/600 207/700 207/800

RHS RHS

BAIYAPPANAHALLI

CHIKKABANAWARA

2+150.000 2+200.000 2+250.000 2+300.000 2+350.000 2+400.000 2+450.000 2+500.000

EXG.RAILWAY BOUNDARY

PRO.DOUBLING

PRO.SUBURBAN RAILWAY BOUNDARY

13.747 15.499 15.834

207/800 207/900 208/000 208/100

RHS RHS

Regals Apartmen

Residential

Apartm

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

EXG.RAILWAY BOUNDARY

APARTMENT,LHS, CH:20

OF
PRO. SEVA
(SUB-URBAN
(AT GRADE PF's & ELE
(KM:2/850 / I

PROPOSED SUBURBAN PLATFORM -205m x

208/200

208/300

208/400

208/500

RHS

OF
PRO. SEVANAGAR
(SUB-URBAN) STATION
(AT GRADE PF's & ELEVATED STATIONS)
(KM:2/850 / IR 208/510)

RAILWAY AREA

TOWARDS MEMU SHED

TOWARDS SALEM

CH:2400

FLYOVER

65.0m

AN PLATFORM -205m x 12 m (9 CARS)

DOWN LINE

UP LINE

11310 sqm

208/500

208/600

208/700

208/800

55.820

RHS

BAIYAPPANAHALLI

CHIKKABANAWARA

SKYTECH Infinite Platform Corporation

Hope foundation, social Organis

Mandini provision Store, CH:209

Paniel Assembly of god Church

RAILWAY BOUNDARY

CORRIDOR-2

480.14 sqm

416.0113 sqm

208/900

209/000

209/100

55.820

RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

Silver Oak Apartments, LHS

Husain Manzil, Housing complex,

Putthu kovil (Panjalammaltemple,

Ushasadan Apartments, LHS, CH:2

Sai Vivek Apartments, LHS,

Atlantis Apartments, LHS

Imran SM Pasha, Apartment, LHS

HINDU Temple, LHS, CH:209400

Paniel Assembly of god Church

3+550.000

3+600.000

3+650.000

3+700.000

3+750.000

3+800.000

3+850.000

8.5

FM

R=218M

R=220M

R=875M

5.30

CH:209358
16.82 m

CH:209300

CH:209400

CH:209500

CH:209200

8.874

12

FM/TS

BS

EXG.ORL 120 m LONG

52.876

35.796

209/200

209/300

209/400

209/500

RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

Sai Vivek Apartments, LHS,

Atlantis Apartments, LHS

Oyster Green Apartments, LHS,

Christ Union Church, LHS

N

PRO.BANASWADI (BAND)
STATION FROM SA
@ CH: 209/680

BAIYYAPPANAHALLI
(WTT) KM:207/070

(UP) (DN)

2.610 kms 7.505 kms

3.790 kms

EXG.HEBBAL STN
(WTT) KM:217/185

PRO.IBS
KM:213/470

BAIYYAPPANAHALLI
(WTT) KM:207/070

(UP) (DN)

2.710 kms 7.405 kms

EXG.HEBBAL STN
(WTT) KM:217/18

LHS, CH:2

3+850.000

3+900.000

3+950.000

4+000.000

4+050.000

4+100.000

4+150.000

4+200.000

EXG.STAFF QTRS

EXG.STAFF QTRS

CIRCULATION AREA

EXG.STATION BUILDING
TO BE REMOVED

EXG.PF SHELTER

EXG.PF SHELTER

EXG.PF SHELTER

EXG.PF SHELTER

PF-1

PF-2

EXG.RD-1 LOOP LINE CSL - 805 m

EXG.RD-2 MAIN LINE CSL - 751 m

EXG.RD-3 LOOP LINE CSL - 801 m TO BE R

EXG. ISLAND PLATFORM NO.2, 450 m LONG A

PROPOSED SUBURBAN PLATFORM -205m x 7 m (9 CARS)

PROPOSED SUBURBAN PLATFORM -205m x 7 m (9 CARS)

CH:209500

CH:209600

CH:209700

CH:209800

7.800

35.708

32.707

DOWN LINE

UP LINE

1374.56sqm

APPROACH ROAD

CH:209721
46.50 m

209/500

209/600

209/700

209/800

RHS

RHS

The Nest Apartment, RHS, CH:209+700

APARTMENT, RHS, CH:209+800

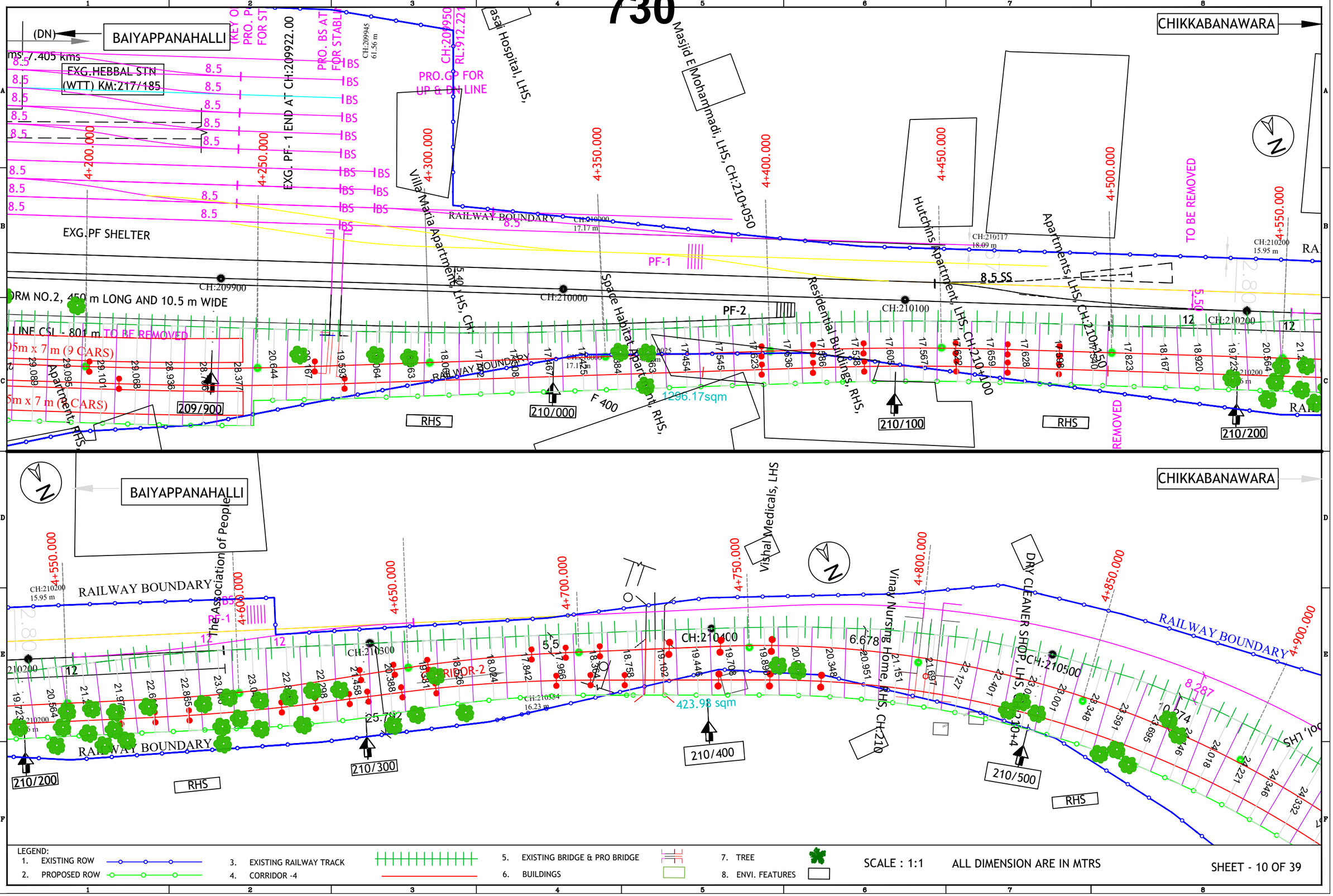
Apartment, RHS, CH:209+900

CL OF PRO. BANASWADI (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED STATION) (KM:4.170 - IR KM: 209/800)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS


BAIYAPPANAHALLI
(DN)
EXG.HEBBAL STN
(WTT) KM:217/185
ms 7.405 kms
EXG. PF- 1 END AT CH:209922.00
PRO. BS AT FOR STABLE
PRO.GP FOR UP & DN LINE
CH:209950
RL:912.221
CH:209945
61.56 m
4+200.000
4+250.000
4+300.000
4+350.000
4+400.000
4+450.000
4+500.000
4+550.000
EXG.PF SHELTER
RAILWAY BOUNDARY
CH:210000
17.17 m
PF-1
PF-2
CH:209900
CH:210000
CH:210100
CH:210200
CH:210117
18.09 m
CH:210200
15.95 m
8.5 SS
TO BE REMOVED
Masjid E Mohammadi, LHS, CH:210+050
Hutchins Apartment, LHS, CH:210+100
Apartments, LHS, CH:210+150
Residential Buildings, RHS,
Spade Habitat Apartment, RHS,
Villa Maria Apartment, LHS, CH
Asaji Hospital, LHS,
ORM NO.2, 450 m LONG AND 10.5 m WIDE
LINE CSL - 801 m TO BE REMOVED
05m x 7 m (9 CARS)
5m x 7 m (CARS)
209/900
210/000
210/100
210/200
RHS
F 400
1296.17sqm
CHIKKABANAWARA
BAIYAPPANAHALLI
The Association of People
Vishal Medicals, LHS
Vinay Nursing Home, RHS, CH:210
DRY CLEANER SHOP, LHS, CH:210+4
4+550.000
4+600.000
4+650.000
4+700.000
4+750.000
4+800.000
4+850.000
4+900.000
RAILWAY BOUNDARY
CH:210200
15.95 m
CH:210300
CH:210400
CH:210500
CORRIDOR-2
423.98 sqm
210/200
210/300
210/400
210/500
RHS
LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES
SCALE : 1:1
ALL DIMENSION ARE IN MTRS
SHEET - 10 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY BOUNDARY

EXG.RAILWAY BOUNDARY

Eunice English High School, LHS

Manjhil English School, LHS, CH

Manjhil Kindergarten School, LHS

Siddhartha PU College, RHS, CH:

Masjid-e-farjeed, LHS, CH:210+83

Daanish Chicken Center, LHS

Money mart Financial

Shree Durgadevi guddi, RHS, CH:

Sunny side Apartment, RHS,

CH:210600

CH:210700

CH:210800

CH:210900

CH:211000

CH:211100

CH:211200

210/600

210/700

210/800

211/000

211/100

211/200

RHS

41.549

43.207

89.19 sqm

41.678

52.636

DOWN LINE

UP LINE

CL OF
KAVERI NAGAR (FUTURE STATION)
(SUB-URBAN) STATION
(AT GRADE PF's & ELEVATED STATION)
(KM:5.470)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

E Allahu Mohammed Hussain

5+600.000 5+650.000 5+700.000 5+750.000 5+800.000 5+850.000 5+900.000 5+950.000

7.800

7.80

35.816

211/300 211/400 211/500 211/600

EXG.RAILWAY BOUNDARY

RHS RHS

SUBURBAN TRACK

2662.70 sqm

BAIYAPPANAHALLI

CHIKKABANAWARA

Indira Membrial School, LHS, CH

Masjid E Owais Qarni, LHS, CH:21

5+950.000 6+000.000 6+050.000 6+100.000 6+150.000 6+200.000 6+250.000 6+300.000

RAILWAY BOUNDARY

DOWN LINE

UP LINE

6.354 7.801 29.616

SUBURBAN TRACKS

Akshay Tiffin Centre, RHS, CH:2

Ayesha Masjid RHS, C

4.440

2662.70 sqm

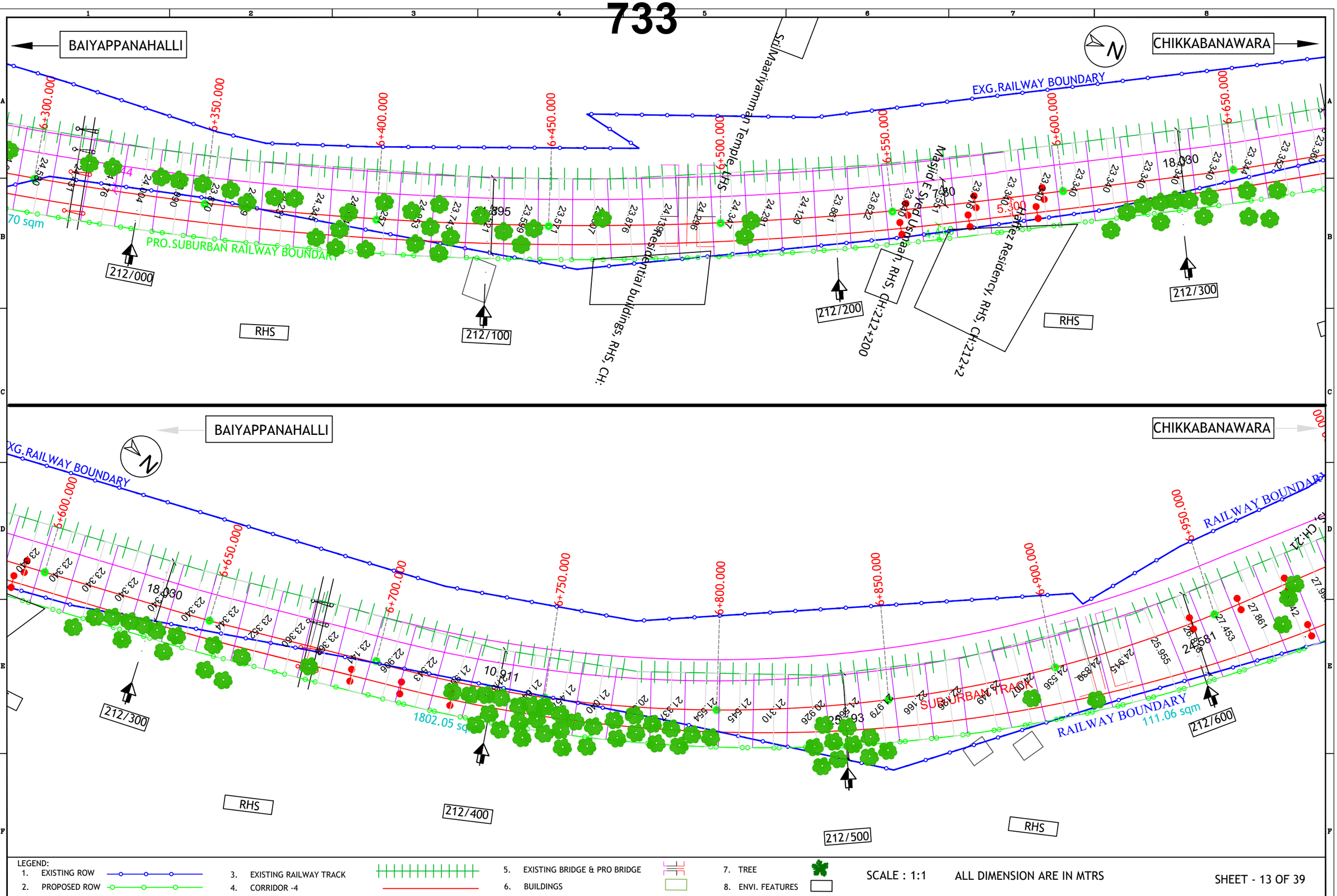
RHS 211/700 211/800 211/900 RHS

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 12 OF 39


BAIYAPPANAHALLI
CHIKKABANAWARA
N
EXG.RAILWAY BOUNDARY
6+300.000
6+350.000
6+400.000
6+450.000
6+500.000
6+550.000
6+600.000
6+650.000
Sri Maariyamman Temple, RHS
Residential Buildings, RHS, CH:
Masjid E Syed Usman, RHS, CH:212+200
Petrol Bunk
Residency, RHS, CH:212+2
70 sqm
PRO.SUBURBAN RAILWAY BOUNDARY
212/000
212/100
212/200
212/300
RHS
BAIYAPPANAHALLI
CHIKKABANAWARA
EXG.RAILWAY BOUNDARY
6+600.000
6+650.000
6+700.000
6+750.000
6+800.000
6+850.000
6+900.000
6+950.000
RAILWAY BOUNDARY
CH:21
1802.05 sqm
SUBURBAN TRACK
RAILWAY BOUNDARY
111.06 sqm
212/300
212/400
212/500
212/600
RHS
RHS
LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES
SCALE : 1:1
ALL DIMENSION ARE IN MTRS
SHEET - 13 OF 39

CL OF PRO. NAGAWARA (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED STATION) (KM:7.140)

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY BOUNDARY

State Bank Of India, LHS, CH:21

DOWN LINE

UP LINE

PROPOSED SUBURBAN PLATFORM -285m x 12m

Masjid E Aqsa, RHS, CH:212+850

Hoasanna Mandir, Church, Nagawa

Beacon English High School, LHS

National Academy Public School,

10.766

34.615

29.779

82.10 sqm

4.400

212/600

212/700

212/800

212/900

213/000

213/100

213/200

213/300

RHS

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY BOUNDARY

EXG.RAILWAY BOUNDARY

SUB-URBAN TRACK

DOWN LINE

UP LINE

PRO.SUBURBAN RAILWAY BOUNDARY

PROPOSED SUBURBAN PLATFORM 420.0m x 12mts

1981.76 sqm

39.34 sqm

CL OF PRO. KANAKANAGAR (SUBURBAN) STATION (AT GRADE PF's & ELEVATED STATION) (KM:8.620)

School, LHS

Regal Engineering Industry, LHS

Stratford Public English High School

Koplz Diamond Hill Apartment, L

Nava Kunj Apartment, LHS, CH:213+500

Bangalore one, LHS, CH:213+550

Chamundeshwari pharma, RHS

Apartments, LHS, Aashraya, CH:213+

Sunni Masjid E Bahrib Nawaz, RHS

Indian Evangelical Church, RHS

Auto Garage, CH:2

Apartment, LHS, CH:213+650

National Academy Public School

National College, RHS, CH:214+00

Kanakanagar Railway Park, LHS,

213/300

213/400

213/500

213/600

213/700

213/800

213/900

214/000

214/100

214/200

214/300

RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 15 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

Maruthi Polyclinic, LHS, CH:213

Shree Sai KRUPA Apartments, LHS

SNN CLERMONT Apartment, RHS, CH

Crystal Apartments, LHS, CH:214

EXG.RAILWAY BOUNDARY

RAILWAY BOUNDARY

DOWN LINE

UP LINE

SUBURBAN TRACK

3841.90 sqm

RHS

214/400

214/500

214/600

214/700

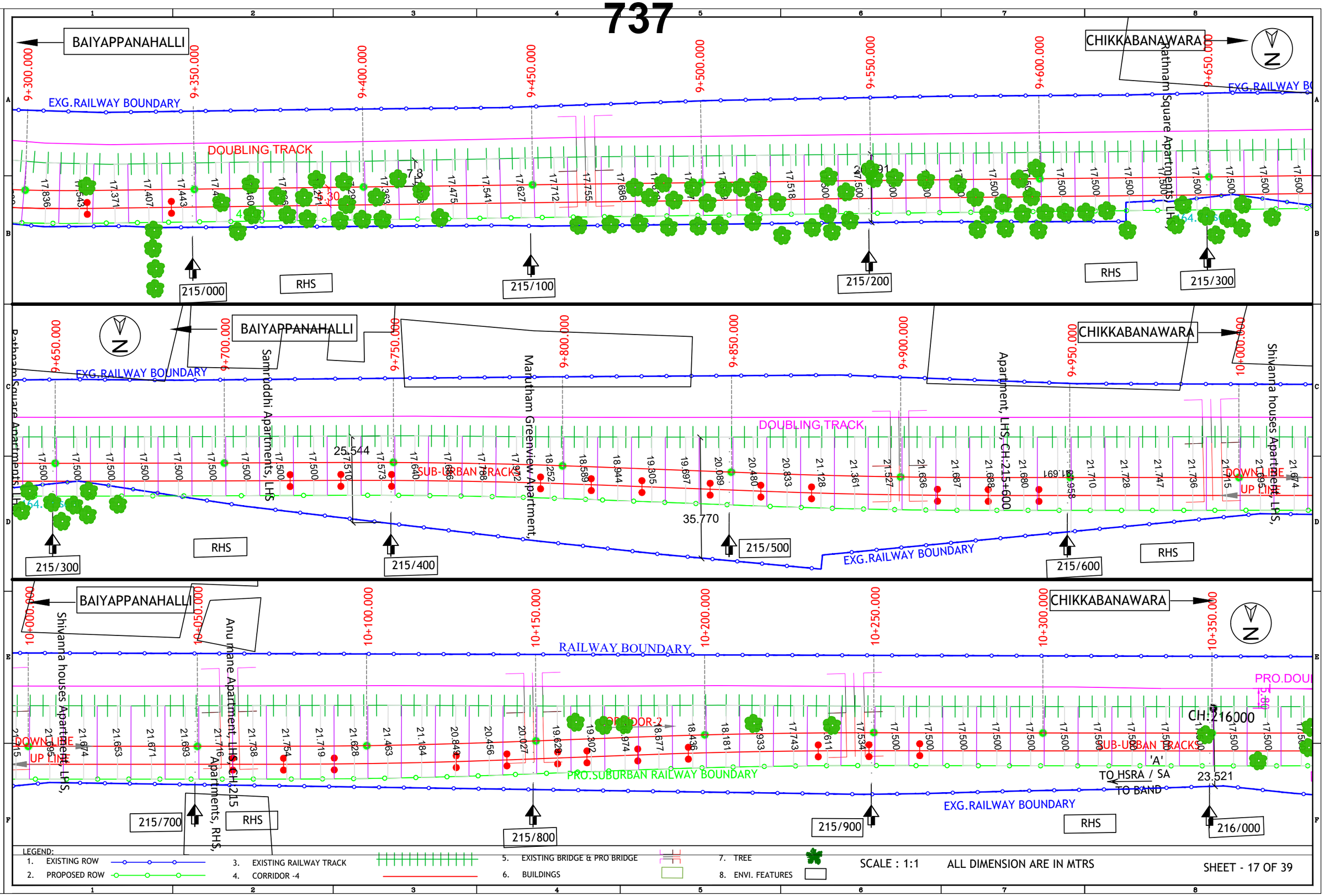
214/800

214/900

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS



SHEET - 17 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY BOUNDARY

PRO.DOUBLING

10+350.000 10+400.000 10+450.000 10+500.000 10+550.000 10+600.000 10+650.000 10+700.000

CH:216000 CH:216100 CH:216200 CH:216300

216/000 216/100 216/200 216/300

RHS RHS

1074.22 sqm

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY BOUNDARY

EXG.RAILWAY BOUNDARY

10+700.000 10+750.000 10+800.000 10+850.000 10+900.000 10+950.000 11+000.000 11+050.000

CH:216400 CH:216500 CH:216600 CH:216700

216/400 216/500 216/600 216/700

RHS RHS

1074.22 sqm 1303.71 sqm

DOWN LINE

UP LINE

BAIYAPPANAHALLI

BOUNDARY

CHIKKABANAWARA

RAILWAY BOUNDARY

RAILWAY BOUNDARY

PRO PF SHELTER

PF-02

11+050.000 11+100.000 11+150.000 11+200.000 11+250.000 11+300.000 11+350.000 11+400.000

CH:216700 CH:216800 CH:216900 CH:217000

216/700 216/800 217/000

RHS RHS

APPROACH ROAD

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

CL OF PRO. HEBBAL (SUB-URBAN) STATION (ELEVATED PF's & STATION) (KM:11.525)

PRO.IBS KM:213470

KM:3.715

11+400.000 | 11+450.000 | 11+500.000 | 11+550.000 | 11+600.000 | 11+650.000 | 11+700.000 | 11+750.000

PRO. PF SHELTER

PRO. RD-4 CSL-765m (FM TO FM)

PRO. RD-3 CSL-765m (FM TO FM)

CH:217100 | CH:217200 | CH:217300 | CH:217400

PROPOSED SUBURBAN PLATFORM -205m x 7m

PROPOSED SUBURBAN PLATFORM -205m x 7m

EXISTING BUILDING

APPROACH ROAD

SERVICE ROAD

217/100 | 217/300

RHS | RHS

BAIYAPPANAHALLI

CHIKKABANAWARA

11+750.000 | 11+800.000 | 11+850.000 | 11+900.000 | 11+950.000 | 12+000.000 | 12+050.000 | 12+100.000

BURIAL GROUND

RAILWAY BOUNDARY

APPROACH ROAD

P/F-02 SHELTER

PRO. HL PLATFORM PF-1 600m LONG & 6.5m WIDE

PRO. PF SHELTER

CH:217400 | CH:217500 | CH:217600 | CH:217700

UP LINE

DN LINE

6087.37 sqm

217/500 | 217/600 | 217/700

RHS | RHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

N

AD

APPROACH ROAD

ROAD

Apartment, LHS, CH:217+900

EXG.GATE LODGE

SSF

EXG.GATE LODGE TO BE DISMANTLED

CH:217800

CH:217900

12+100.000

12+150.000

12+200.000

12+250.000

12+300.000

12+350.000

12+400.000

12+450.000

12+500.000

12+550.000

12+600.000

12+650.000

12+700.000

12+750.000

12+800.000

OVER RUN LINE 22m LONG

RAILWAY BOUNDARY

TRACK MACHINE SIDING

EXG.RAILWAY BOUNDARY

3.550

6087.37 sqm

2127.00 sqm

217/800

217/900

218/000

218/100

218/200

218/300

218/400

RHS

LHS

L.C.No.148,TRAFFIC,'B2'CLASS,MANNED,Interlocked,
TVU=20050 Dated May 18. PRO. TO BE CLOSED
PRO.TO BE CONSTRUCTION OF RUB IN LIEU
OF LC.148 AT CH:217/700

PROPOSED SUB URBAN AT LEVEL - 1

Bregade Senate 2 Corporate office

IR TRACK CROSSING AT LEVEL

SUB-URBAN TRACKS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

12+800.000 12+850.000 12+900.000 12+950.000 13+000.000 13+050.000 13+100.000 13+150.000

2127.00 sqm

EXG.RAILWAY BOUNDARY

PRO.SUBURBAN RAILWAY BOUNDARY

3.550

DN LINE

UP LINE

2127.00 sqm

EXG.RAILWAY BOUNDARY

4.725

1.976

1.654

10.231

11.70

5.800

5.800

DOUBLING TRACK

EXG.RAILWAY BOUNDARY

EXG.RAILWAY BOUNDARY

LHS

218/500

218/600

218/700

LHS

218/800

BAIYAPPANAHALLI

CHIKKABANAWARA

13+150.000 13+200.000 13+250.000 13+300.000 13+350.000 13+400.000 13+450.000 13+500.000

2127.00 sqm

Whispering Meadows, LHS, CH:218

Bollars Comfort Apartments, LHS

SMC Beverly Villas Apartments,

3.550

11.709

7.708

7.800

5.800

DOUBLING TRACKS

218/800

LHS

218/900

219/000

219/100

LHS

BAIYAPPANAHALLI

CHIKKABANAWARA

13+500.000 13+550.000 13+600.000 13+650.000 13+700.000 13+750.000 13+800.000 13+850.000

EXG.RAILWAY BOUNDARY

CORRIDOR-2

Apartments, LHS, CH:219+300

3975.30 sqm

4.725

6.931

3.382

3.626

CH:219300

CH:219400

CH:219500

DOUBLING TRACK

219/500

EXG.RAILWAY BOUNDARY

LHS

219/200

219/300

219/400

LHS

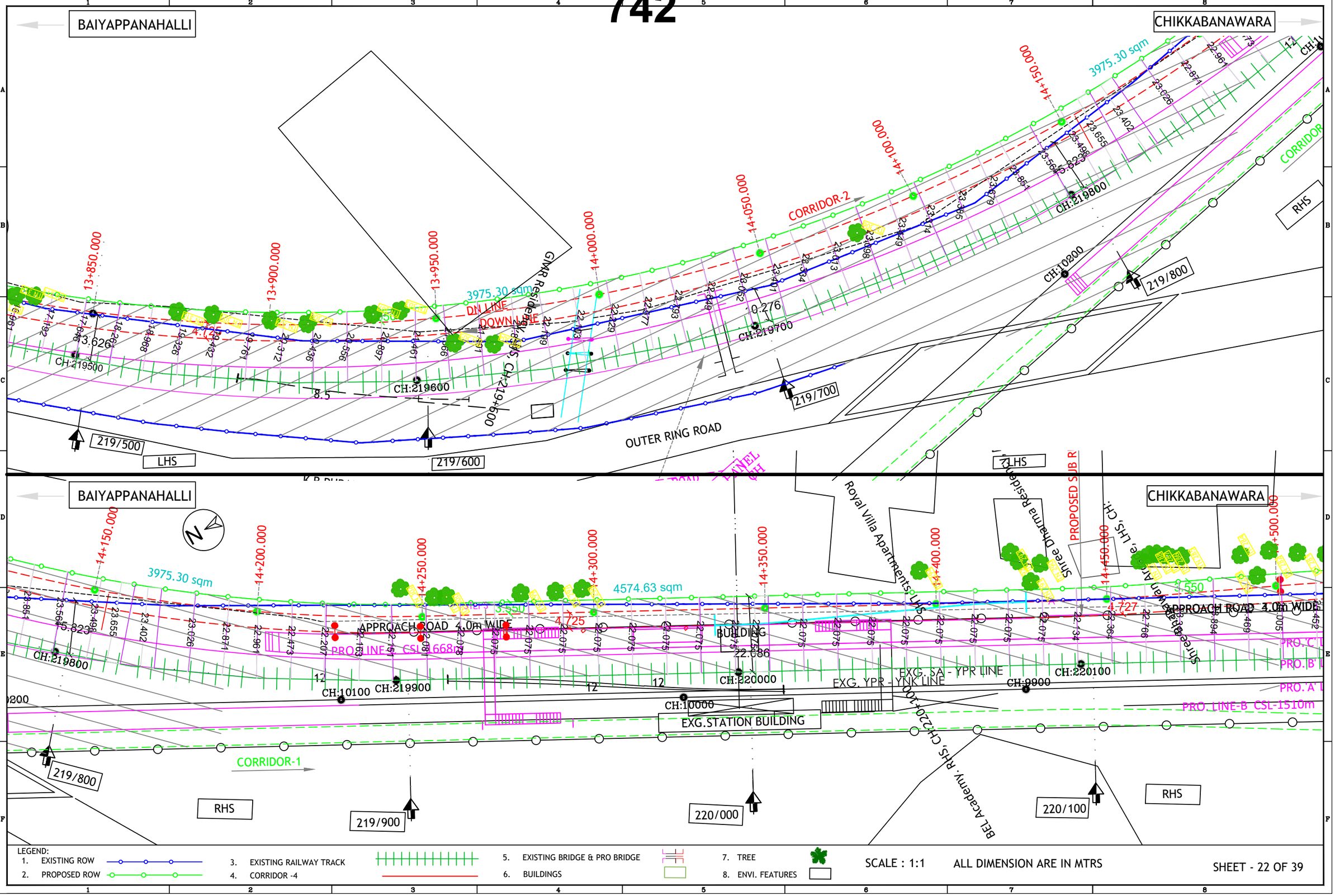
LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 21 OF 39


BAIYAPPANAHALLI
CHIKKABANAWARA
13+850.000
13+900.000
13+950.000
14+000.000
14+050.000
14+100.000
14+150.000
3975.30 sqm
DN LINE
DOWN LINE
CORRIDOR-2
CORRIDOR
RHS
LHS
CH:219500
CH:219600
CH:219700
CH:219800
CH:10200
219/500
219/600
219/700
219/800
OUTER RING ROAD
GMR Esi Hospital
3.626
8.5
0.276
14+150.000
14+200.000
14+250.000
14+300.000
14+350.000
14+400.000
14+450.000
14+500.000
4574.63 sqm
APPROACH ROAD 4.0m WIDE
PRO.LINE CSL-668m
BUILDING
22.636
CH:10100
CH:219900
CH:10000
CH:220000
CH:0900
CH:220100
EXG. SA - YPR LINE
EXG. YPR - YNK LINE
EXG.STATION BUILDING
PRO.LINE-B CSL-1510m
CORRIDOR-1
219/900
220/000
220/100
Royal Villa Apartments LHS
Shree Dharma Residency
PROPOSED SUB R
BEL Academy. RHS, CH:220+200
LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES
SCALE : 1:1
ALL DIMENSION ARE IN MTRS
SHEET - 22 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

CL OF PRO. LOTTEGOLLAHALLI (SUB-URBAN) STATION (ELEVATED PF's & STATION) (KM:14.650)

APPROACH ROAD

NEW BEL ROAD

CORRIDOR-2

PROPOSED SUBURBAN PLATFORM -205m x 7m

4574.63 sqm

14+500.000 14+550.000 14+600.000 14+650.000 14+700.000 14+750.000 14+800.000 14+850.000

CHRIST THE King Church, LHS, CH

Samath Sadan, LHS, CH:14+800

N

LOAD 4.0m WIDE

PRO.'C' LINE

PRO.'B' LINE

PRO.'A' LINE

B CSL-1510m

CH:9800 CH:220200 CH:9700 CH:220300 CH:9600 CH:220400 CH:9500 CH:220500

EXG.TRACK TO BE SLEWED

PROPOSED SUBURBAN PLATFORM -205m x 7m

PROPOSED SUBURBAN PLATFORM -205m x 7m

PATH WAY

189.00

220/200

220/300

220/400

220/500

CORRIDOR-1

EXG. PF- 1 END AT

BR. NO. 529A AT CH:220234.00
(ROB) PSC GIRDER; 3X16.96m
PRO.TO BE RETAINED

LHS

Shani Mahatmaswamy Temple, RHS,

CORRIDOR

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 23 OF 39

BAIYAPPANAHALLI

CHIKKABANAVARA

14+800.000

14+850.000

14+900.000

14+950.000

15+000.000

15+050.000

15+100.000

15+150.000

4574.6 sqm

57.06 sqm

CORRIDOR-2

UP LINE

DN LINE

EXISTING RAILWAY TRACKS

ROAD BOUNDARY LINE

BUILDINGS

HOME

CANAL

Ashwin Vidyalaya, LHS, CH:14+95

Onnshakthi Temple, CH:15+000

Athumanasa Church, RHS, CH:15+

Ashwathakatte, RHS, CH:15+

CH:9500

CH:220500

220/500

CH:9400

CH:220600

220/600

CH:9300

CH:220700

220/700

CH:9200

CH:220800

CORRIDOR-1

PRO.'C' LINE

PRO.'B' LINE

PRO.'A' LINE

EXG. RLY BOUNDARY

TO YPR

Shani Mahatmaswamy Temple, RHS,

EXG.CURVE NO.47 (RHS)
FOR UP & DN LINES (YNK)
R = 437.5 m,D = 4.0°
TRL= 80 m
TCL = 660 m
SE = 105mm
V = 75 kmph

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

15+150.000 15+200.000 15+250.000 15+300.000 15+350.000 15+400.000 15+450.000 15+500.000

BUILDINGS

Trinity Assembly of God Church, LHS, CH:15+250

Dr Parlanganwal Clinic, LHS, CH:15+300

1464.54 sqm

1464.54 sqm

15+500.000 15+550.000 15+600.000 15+650.000 15+700.000 15+750.000 15+800.000 15+850.000

HMT MAIN ROAD

Shree Muneshwara Temple, RHS, CH:15+600

1464.54 sqm

130.38 sqm

PRO.SUBURBAN RAILWAY BOUNDARY

BAIYAPPANAHALLI

CHIKKABANAWARA

15+850.000 15+900.000 15+950.000 16+000.000 16+050.000 16+100.000 16+150.000 16+200.000

Covid Emergency Hospital, LHS, CH:15+950

BBMP Park, RHS, CH:15+950

Prakash Sekar

586.06 sqm

Garden stall Lodging & P G, RHS, CH:16+050

P R Public School, LHS, CH:16+050

PRO.CURVE NO.56A(UR)

R=83m D = 3.0°

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

BUILDINGS

16+200.000

16+250.000

16+300.000

16+350.000

16+400.000

16+450.000

16+500.000

16+550.000

Ayyappa Temple LHS, CH:16+430

RAILWAY PARALLEL

National English School, RHS, CH: 16+400.94

Jeethu Enamel Works, ch:16

DN LINE

UP LINE

60.359

PRO.CURVE NO.58A(LEVEL:1)
R = 218.75m, D = 8.0°
A =23°51'7"
TL = 46.20m

Apartments, LHS, CH:16+600

BAIYAPPANAHALLI

CHIKKABANAWARA

16+550.000

BBMP RUB PROPOSAL

16+600.000

(SUB-URBAN) AT RHS TO LHS (Km 16.689)

CL OF PRO. TRACK CROSSING

PRO.CURVE NO.59A(LEVEL:1)
R = 218.75m, D = 8.0°
A =44°49'5"
TL = 90.20m
CL = 171.11 m
RL = 00 m
= 55mm
0 kmph

16+650.000

16+700.000

TP2- PRO. CURVE 59A(LEVEL:1) - CH: 16+734.93

16+750.000

16+800.000

16+850.000

17+000.000

CORRIDOR-2

CORRIDOR-1

KM 06

SHED

RAILWAY COLONY ROAD

VSPL Crescent, Apartment, LHS,

Vaishnavi Nakshatra Apartments,

16+900.000

ROAM 205m x 12m

205m x 7m

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY COLONY ROAD

RAILWAY COLONY ROAD

RAILWAY COLONY ROAD

RAMP RUB PROPOSAL

CL OF PRO. TRACK CROSSING

SUB-URBAN) AT 17/1 TO THIS RJTS (Km 16.689)

16+650.000

16+700.000

16+750.000

16+800.000

17+000.000

17+100

17+200

17+300

CURVE: 39A(LEVEL:1) ; CH: 17+205.98

TP2- PRO. CURVE: 39A(LEVEL:1) ; CH: 16+734.93

CORRIDOR-2

BSRP CORRIDOR-2 LINE -2 AT LEVEL -1

LINE -1 AT LEVEL -2

BSRP CORRIDOR-1 LINES AT LEVEL-2

Golden Grand Apartments, LHS, C

SHED

KM 06

06/000

06/100

06/200

PRO. FOB

PRO. STA

UP LINE

DN LINE

LB

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 27 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

RAILWAY COLONY ROAD

RAILWAY COLONY ROAD

SUBURBAN TRACKS CORRIDOR - 1

PRO. TRACK FOR 3RD ENTRY ROAD 5 CSR 650m

PRO. PF. 5.50M WIDE 540M LENGTH

PRO. TRACK FOR 3RD ENTRY ROAD 4

PRO. ISLAND PF. 10.50M WIDE 540M LENGTH

PRO. TRACK FOR 3RD ENTRY ROAD 3

PRO. TRACK FOR 3RD ENTRY ROAD 2

PRO. ISLAND PF. 10.50M WIDE 540M LENGTH

PRO. STATION BUILDING

PRO. FOB

PRO. CIRCULATING AREA

17+500

17+400

17+300

06/600

06/500

06/400

06/300

Apartments, LHS, CH:17+500

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

KM 222

BAIYAPPANAHALLI

CHIKKABANAWARA

56.67 64.05 66.04 68.50 71.35 74.23 77.12 80.00 83.04 86.54 90.51 94.62 98.73 102.85 106.96 110.93 114.41 117.42 119.96 122.05 123.68 124.86 125.59 125.90 125.11 124.07 123.13 122.62 122.61 122.58 122.80 123.05 122.85 123.83 121.83 121.40 120.97 120.69

8.0

8.0

8.0

8.0

8.0

8.0

17+600

17+800

17+900

17+700

06/900

06/800

06/700

06/600

WATER RECYCLING PLANT

RHS

RHS

N

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 29 OF 39

750

BAIYAPPANAHALLI

CHIKKABANAWARA

BUILDINGS

222/700

222/800

222/900

35,184

KM 222

KM 07

86.69 86.69 86.69 86.69 87.49 88.30 89.11 89.924 90.795 91.796 92.798 93.799 94.827 95.927 97.027 99.534 99.227 100.327 101.45

4.725

8.5

CORRIDOR - 1

SUBURBAN TRACKS CORRIDOR

07/200

18+200

07/100

18+100

07/000

18+000

DN LINE

UP LINE

40.68 42.56 45.41 46.37 47.66 48.94 50.23 50.23 52.81 54.09 60.64 56.67 64.05 66.04 68.50 71.35 74.23 77.12 80.00

06/900

17+900

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 30 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

RUB

BRAB

EXG.BR NO.411A @ CH:07/500-6

18+500

18+400

18+300

07/400

07/300

07/200

RHS

RHS

Km.18.350 RAMP STARTS AT GRADE ENDS

SLEEPER FACTORY

SUBURBAN TRACKS CURRIDOR-1

BAIYAPPANAHALLI

CHIKKABANAWARA

1 LINE PEST CONTROL 220m

PRO.TO BE EXTD AS 1X

18+500

18+600

18+700

18+800

07/600

07/700

07/800

LHS

LHS

LHS

RAILWAY BOUNDARY

13.033

12m

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

752

BAIYAPPANAHALLI

CHIKKABANAWARA

EMERGENCY RERAILING

31 x 23

.ITY

12m PAVED ROAD

CL
JALAHALLI
(SUB-URBAN) STATION
(AT GRADE PF's & ELEVATED STN.)
(Km.19.005)
(FUTURE)

PROPOSED SUBURBAN PLATFORM -205m x 12m

PROPOSED SUBURBAN PLATFORM -205m x 12m

22219.64 sqm

HMT Plnat Nursery, LHS, CH:19+1

DOWN LINE

UP LINE

13.314

13.64

8.044

7.63

9.88

07/800

07/900

08/000

08/100

LHS

LHS

RAILWAY BOUNDARY

RAILWAY BOUNDARY

LB

LB

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 32 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

HMT Bhat Nursery, LHS, CH:19+1

DOWN LINE

UP LINE

SUBURBAN TRACKS

CAR WASHING

PROPOSED SUBURBAN BOUNDARY

RAILWAY BOUNDARY

RAILWAY BOUNDARY

RAILWAY BOUNDARY

RAILWAY BOUNDARY

LB

LB

HMT MAIN ROAD

08/100

08/200

08/300

08/400

LHS

LHS

LHS

19+100

19+200

19+300

19+400

77.498

73.483

68.870

66.678

63.699

60.711

57.789

54.765

52.181

50.733

50.171

49.613

49.037

48.474

47.883

47.340

46.767

46.190

45.620

45.050

44.568

44.024

43.385

42.761

42.192

41.623

41.054

40.501

39.929

39.372

38.866

38.357

36.419

35.704

34.972

34.427

33.880

19.465

13.314

14.172

5.300

7.8

14.334

7.070

9.886

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 33 OF 39

BAIYAPPANAHALLI

CHIKKABANAWARA

19+400 19+500 19+600 19+700 19+800 19+900 20+000 20+100 20+200 20+300

RAILWAY BOUNDARY

Tata Aquila Heights, LHS

SUBURBAN TRACKS

EXCL. UP MAIN LINE

BRIDGE NO: 409

14.334 12.644 13.152 13.995

7.070 6.378 7.065

08/400 08/500 08/600 08/700

LHS

PROPOSED SUBURBAN BOUNDARY

HMT WATCH FACTORY ROAD

DOWN LINE 4.550

UP LINE 5.360

13.995 14.584 14.802 16.166

7.065 7.128 10.577 10.857

08/700 08/800 08/900 09/000

KM 09

PROPOSED SUBURBAN PLATFORM -205m x 7m

EXG. UP MAIN LINE

EXG. DOWN MAIN LINE

16.166 19.511 10.857

09/000 09/100 09/200 09/300

Prestige

CL OF PRO. SHETTYHALLI (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED ST (Km 20.335)

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

SHEET - 34 OF 39

BAIYAPPANAHALLI

CL OF PRO. SHETTYHALLI (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED STN.) (Km 20.335)

PROPOSED SUBURBAN PLATFORM -205m x 7m

PROPOSED SUBURBAN PLATFORM -205m x 7m

EXG. UP MAIN

EXG. DOWN MAIN

09/300

20+300

20+400

20+500

09/500

20+600

CHIKKABANAWARA

245.94 sqm

RAILWAY BOUNDARY

09/400

09/600

PIPE

N

BAIYAPPANAHALLI

20+600

20+700

20+800

008/60

20+900.000

CHIKKABANAWARA

EXG.RAILWAY BOUNDARY

HINDU Temple

4.400

5.300

24.363

Jamia Masjid

09/700

09/800

09/900

Shree Swamivivekanandha pre & Higher primary

BAIYAPPANAHALLI

20+900.000

21+000.000

006/60

21+100.000

21+200.000

CHIKKABANAWARA

PROPOSED SUBURBAN BOUNDARY

UP LINE

DOWN LINE

23.118

18.971

10.757

Shree Swamivivekanandha pre & Higher primary School

Vidya Public School, RHS

Ministries Church

Shani mahatma Temple,

EXG.RAILWAY BOUNDARY

LHS

09/900

10/000

10/100

10/200

N

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

21+200.000

21+300.000

21+400.000

21+500.000

3525.48 sqm

PROPOSED SUBURBAN BOUNDARY

4.400

10.73

5.360

2.794

10/200

10/300

10/400

10/500

LHS

LHS

LHS

EXG.RAILWAY BOUNDARY

N

BAIYAPPANAHALLI

CHIKKABANAWARA

21+500.000

21+600.000

21+700.000

21+800.000

4.400

25.848

10/500

10/600

10/700

10/800

LHS

LHS

LHS

EXG.CURVE NO.16(R)
A=54°21'30"

N

BAIYAPPANAHALLI

CHIKKABANAWARA

21+800.000

21+900.000

22+000.000

22+100.000

RAILWAY BOUNDARY

PROPOSED SUBURBAN BOUNDARY

4.400

25.848

5.300

UP LINE

DOWN LINE

SUBURBAN TRACKS

7.80

10/800

10/900

11/000

11/100

LHS

LHS

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

22+100.000

22+200.000

22+300.000

22+400.000

PRO.SUBURBAN RAILWAY BOUNDARY

SUBURBAN TRACKS

5.300

4.400

5.300

12

12

12

7.80

11/100

LHS

11/200

Ganesha Temple, RHS, C

11/300

LHS

11/400

EXG.RAILWAY BOUNDARY

Dha

BAIYAPPANAHALLI

CHIKKABANAWARA

22+400.000

22+500.000

22+600.000

22+700.000

RAILWAY BOUNDARY

PRO.SUBURBAN RAILWAY BOUNDARY

SUBURBAN TRACKS

24.605

5.300

5.300

LHS

11/400

11/500

11/600

11/700

LHS

Dha

EXG.RAILWAY BOUNDA

BAIYAPPANAHALLI

CHIKKABANAWARA

22+700.000

22+800.000

22+900.000

23+000.000

RAILWAY BOUNDARY

4.400

5.300

5.300

SUBURBAN TRACKS

UP LINE

DOWN LINE

11/700

LHS

11/800

11/900

LHS

12/000

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

CL OF PRO. MYADARAHALLI (SUB-URBAN) STATION (AT GRADE PF's & ELEVATED STN.) (Km.23+220)

23+000.000 | 23+100.000 | 23+200.000 | 23+300.000

Residential building,LHS, CH:12+280

2487.80 sqm

UP LINE

DOWN LINE

PROPOSED SUBURBAN PLATFORM - 225m x 12m

19.979

18.115

5.399

12/000 | 12/100 | 12/200 | 12/300

LHS

Residential building,LHS, CH:12+280

Kruthika Heights, LHS, CH:12+350

4.400

5.370

8.138

12/300 | 12/400 | 12/500 | 12/600

23+300.000 | 23+400.000 | 23+500.000 | 23+600.000

Mahaveer Apartment, LHS, CH:12+800

RAILWAY BOUNDARY

57.68 sqm

National [Public School, RHS, CH:12+900

69.377

72.278

35.386

10.910

23.563

12/700 | 12/800 | 12/900 | 13/000

23+700.000 | 23+800.000 | 23+900.000 | 24+000.000

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

BAIYAPPANAHALLI

CHIKKABANAWARA

24+000.000

69.377

4.400

UP LINE

DOWN LINE

26.004 27.843 29.693 31.542 33.392 35.242 37.070 38.549 39.564 40.128

Royal Nest Apartments, LHS, CH: 24+100.000

740.36 sqm

Tulip Boys & Girls PG , lhs, ch

24+200.000

40.724

37.773

SANDED END AS PER RDSO DRG.NO. T.347 TO BE DISMANTLED

33.00

PROPOSED SUBURBAN PLATFORM -205m x 7m

PROPOSED SUBURBAN PLATFORM -205m x 7m

C/L OF PRO. CHIKKABANAVARA (SUB-URBAN) AT GRADE STATION (Km. 24.306)

24+300.000

COMMON LOOP LINE

FP

NB

UP MAIN LINE

DN MAIN LINE

PQRS SIDING

13/000

LHS

13/100

SQRS

OLD SQRS

PRO.OHE &

RAILWAY BOUNDARY

13/200

SANDED END AS PER RDSO DRG.NO. T.347

RAIL BARRICADING

BS

BS

13/300

BORE WELL

TREE

(DN)

(UP)

C/L OF CHIKKABANAVARA STATION AT CH:13.280m

BAIYAPPANAHALLI

CHIKKABANAWARA

24+300.000

C/L OF PRO. CHIKKABANAVARA (SUB-URBAN) AT GRADE STATION (Km. 24.306)

24+400.000

24+422.50

CIRCULATING AREA

SANDED END AS PER RDSO DRG.NO. T.347 TO BE DISMANTLED

33.00

PROPOSED SUBURBAN PLATFORM -205m x 7m

PROPOSED SUBURBAN PLATFORM -205m x 7m

STATION BUILDING AS PER CEO DRG.NO. SB/3E (50.49X5.96)

FOOT OVER BRIDGE 2.50m WIDE

NB

PASS. PF. SHELTER 48.00m LONG

H.L. PLATFORM 434m LENGTH AND 11.0M

ROAD NO. 1 CSL = 712m

ROAD NO. 2 CSL = 712m

H.L. PLATFORM 420m LENGTH AND 11.0M

ROAD NO. 3 CSL = 750m

ROAD NO. 4 CSL = 691m

H.L. PLATFORM 420m LENGTH AND 6

ROAD NO. 5 CSL = 691m

COMMON LOOP LINE

FP

UP MAIN LINE

DN MAIN LINE

RAIL BARRICADING

BS

BS

LHS

BORE WELL

TREE

33.00

13/300

PQRS SIDING 270.0m LONG (12BFRS) WITH AUXIEARY TRACK

13/400

13/500

APPROACH ROAD 3.0m WIDE

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. CORRIDOR -4
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. TREE
8. ENVI. FEATURES

SCALE : 1:1

ALL DIMENSION ARE IN MTRS

KENGERY

WHITEFIELD

Government High School and GFGC

Petrol Pump:LHS, CH:12+550

Railway Quarters, LHS, CH:-200

Anjaneya Temple, RHS:12+410

-0+450 -0+400 -0+350 -0+300 -0+250 -0+200 -0+150 -0+100

12.70 12.60 12.50 12.40

C L
OF
PRO.KENGERI
(SUB-URBAN) STATION
(ELEVATED PF's & STATION)
Km.0.000
For CORRIDOR-1

-0+100 -0+050 0+000 0+050 0+100 0+150 0+200

12.30 12.20 12.10

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 01 OF 25

KENGERY

WHITEFIELD

0+200 0+250 0+300 0+350 0+400 0+450 0+500 0+550

Sri Shashini Hospital

S R Fuels(Nayara), LHS, CH:0+350

Sujata House, Apartment Building

KGC Hospital, LHS, CH:0+400

12.00 11.90 11.80

0+550 0+600 0+650 0+700 0+750 0+800 0+850 0+900

National Public School Kengeri,

BDA Convention centre and shopp

BDA Apartments, RHS, CH:11+800

11.70 11.60 11.50 11.40

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 02 OF 25

KENGERY

WHITEFIELD

0+900 0+950 1+000 1+050 1+100 1+150 1+200 1+250

MBR Shangri La Apartments RHS,

11.40 11.30 11.20 11.10

1+250 1+300 1+350 1+400 1+450 1+500 1+550 1+600

11.00 10.90 10.80 10.70

1+600 1+650 1+700 1+750 1+800 1+850

Orchids The International School

SRI SAI PEARL PARK Apartment,

BIMS College RHS,CH:10+300

10.70 10.60 10.50 10.40

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 03 OF 25

KENGERY

WHITEFIELD

SRI SAI PEARL PARK, Apartment,

BIMS College, RHS, CH:10+300

White Palace Convention Hall

SH7/Hoodi Station Road

Study at Hoodi

HPCL Petrol Bunk.

HPCL Petrol Bunk. RHS, Ch:9+650

Quarters, LHS,CH:9+300

Chamundeshwari Engineering work

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 04 OF 25

KENGERY

WHITEFIELD

Skandashree 2 Apartments, LHS

Shree Hanuman Temple, RHS,

Panchavati Biological Park, LHS

Shree Hanuman Temple, RH

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 05 OF 25

PRO.JN
(SUE
(AT GRADE

KENGERY

WHITEFIELD

3+600 3+650 3+700 3+750 3+800 3+850 3+900 3+950

Canal crossing, CH:8+400

L
OF
PRO.JNANA BHARATHI HALT
(SUB-URBAN) STATION
AT GRADE PF's &ELEVATED STATION)
(Km.3.650)

8.60 8.50 8.40

3+950 4+000 4+050 4+100 4+150 4+200 4+250 4+300

Sports Authority of india, LHS,

8.30 8.20 8.10 8.00

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 06 OF 25

KENGERY

WHITEFIELD

C L
OF
PRO.NAYANDAHALLI
(SUB-URBAN) STATION
(AT GRADE PF's &ELEVATED STATION)
(Km.4.750)

4+650 4+700 4+750 4+800 4+850 4+900 4+950 5+000

5+000 5+050 5+100 5+150 5+200 5+250 5+300 5+350

7.60 7.50 7.40 7.30 7.20 7.10 7.00

Shree ganesh Metal industries

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 07 OF 25

KENGERY

WHITEFIELD

5+350 5+400 5+450 5+500 5+550 5+600 5+650 5+700

Shalini Chakra Industries, LHS

Global Public School,LHS,Chand

6.90 6.81 6.80 6.70 6.60

5+700 5+750 5+800 5+850 5+900 5+950 6+000 6+050

Global Public School,LHS,Chand

Masjide mehraj ul momineen, LB

6.50 6.40 6.30 6.20

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 08 OF 25

KENGERY

WHITEFIELD

6+050 6+100 6+150 6+200 6+250 6+300 6+350 6+400

Masjid E Hussain Abbas Sunni Ma

Lake, RHS,CH:6+000

Masjid Salmania, RHS, CH:6+900

Government, Urdu Primary Sc

6.20 6.10 6.00 5.90

30.27

6+400 6+450 6+500 6+550 6+600 6+650 6+700

Masjid Salmania, RHS, CH:6+900

Government, Urdu Primary School

Sobakath tower, L

Indira Residency, RHS, CH:5+820

5.90 5.80 5.70 5.60

11.52 66.91 15.52

LEGEND:

1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 09 OF 25

KENGERY

WHITEFIELD

Chitrakoota Montessori, LHS

Vijayanagar

Vijaya International Public School

St. Michael's High School, LHS

C\L
OF
PRO.KRISHNADEVARAYA HALT
(SUB-URBAN) STATION
(AT GRADE PF's & ELEVATED STATION)
(Km.7.550)

LEGEND:
1. EXISTING ROW
2. PROPOSED ROW
3. EXISTING RAILWAY TRACK
4. PROP. CORRIDOR3 RAILWAY TRACK
5. EXISTING BRIDGE & PRO BRIDGE
6. BUILDINGS
7. LAND ACQUIRED
8. TREE
9. ENVI. FEATURES

SCALE : 1:1 ALL DIMENSION ARE IN MTRS SHEET - 10 OF 25