ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR

GOREGAON MULUND LINK ROAD

PROJECT BY

MUNICIPAL CORPORATION OF GREATER MUMBAI

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CHAPTER 01 INTRODUCTION

1.1 PREAMBLE

Mumbai is popularly known as Commercial Capital of India and also known as city of seven islands. The city's position as on industrial and port city, along with its cultural and economic facilities, has caused the MCGM and immediately surrounding areas to grow at a much faster rate than any other area of India.

Mumbai City district is spread over an area of 527 SqKm The population of Mumbai Metropolitan Region increased from 19.3 million in 2001 to 22.8 million in 2011 - a decadal growth rate of 17.8%. Mumbai's position as on industrial and port city, along with its cultural and economic facilities, has caused the Municipal Corporation of Greater Mumbai (MCGM) and immediately surrounding areas to grow at a much faster rate than other area of Maharashtra and India. As a result, the metropolitan area is developed more rapidly than its ability to provided adequate and attractive facilities. The population within the MCGM limit increased from 2.8 million in 1951 to 4.2 million in 1961. As on today the population of Mumbai is 12.47 million (As per 2011 Census). Thus, it can be seen that the population of the Mumbai which has area of 527 SqKm, has increased tremendously leading to numbers of traffic related problems. In order to resolve the above traffic related problems, the MCGM has decided to take up the work of construction of Goregaon Mulund Link Road (GMLR) as a major East-West link.

1.2 PURPOSE OF THE EIA STUDY

Development of Expressway project is generally intended to improve the economic and social welfare of the people. At the same time, it may also create adverse impacts on the surrounding environment. People and properties may be in the direct path of road works are affected. The environmental impacts of highway projects include damage to sensitive eco-systems, soil erosion, changes to drainage pattern and thereby ground water, interference with wild life movement, loss of productive agricultural lands, resettlement of people, disruption of local economic activities, demographic changes and accelerated urbanization. Highway development and operation therefore, be planned with careful consideration of the environmental impact. To minimize these adverse effects that may be created by the highway development projects, it is necessary to conduct the Environmental Impact Assessment and identify the necessary mitigation measures to be adopted by the project at various stages right from the project concept to construction and operation phase of the project.

1.3 ABOUT PROJECT PROPONENT - MUNICIPAL CORPORATION GREATER MUMBAI

Bombay was the first British Indian possession, which came as a part of the royal dowry in 1661 to King Charles II of England on his marriage to the Portuguese princess, Infanta Catherine de Braganza. Ironically enough, Bombay also set the stage for the birth of the country's historic freedom movement, as well as for some of its major landmarks, including Gandhiji's 1942 call to the British to "Quit India". It was in Bombay that the Indian National Congress was born in 1885. It led the country's struggle for political independence and indirectly to the liquidation of the British Empire.

The name "Bombay" was changed to "Mumbai" by the Corporation Resolution No. 512 dated August 12, 1996, Maharashtra Act, XXV of 1996

During the period between the rise and fall of the British Empire, Bombay gradually developed into a town, a city and a metropolis of world renown. Today, the Brihanmumbai Mahanagarpalika covers an area of 480.24 sq.kms with a population of 1,19,14,378 as per the census of 2001. The metropolis accounts major portion of India's international trade and government revenue, from being one of the foremost centers of education, science and technological research and advancement

It is also pertinent to note that Mumbai's all-round growth owed a lot to the early development of the system of local government under British rule.

1.4 PROJECT BACKGROUND

As the city of Mumbai, due to its Geographical constraints has grown in a linear manner. The historical development of Greater Mumbai is characterized by concentration of commercial and business activities in the Island city in the South and development of predominantly residential activity towards the North along the Western and the Eastern Suburbs. The transportation corridors in Mumbai have also therefore evolved longitudinally traversing along the North – South axis with very few East-West linkages. With rapid growth of the Eastern and Western suburbs of Greater Mumbai in the last few decades, an urgent need was felt for strengthening of the East–West road connectivity between the eastern and western suburbs. Thus, Municipal Corporation of Greater Mumbai has proposed to develop Goregaon-Mulund Link Road of leghth 12.3 km including Tunnel 4.7 km underneath Sanjay Gnashi National Park. Connecting points are Near Dindoshi Flyover on WEH and near Airoli Junction on EEH

The transportation Study carried out by M/s Wilbur Smith and Associates, as early as 1963, hademphasized the need for development of the East-west linkages for Greater Mumbai. Four major East-West link roads were then planned for connecting the Suburbs to minimize travel time and cost.

Several studies thereafter have been carried out by MCGM and MMRDA with a view to improve the traffic and transportation problems of the city and suburban. One of the studiescarried out by MMRDA through M/s Consulting Engineers Services (CES)

India Pvt. Ltd. in the year 2003 wherein a Master Plan for Road Network Improvement and Traffic Dispersal in Greater Mumbai was proposed.

The report of M/s CES, has indicated that the Goregaon Mulund Link Road is one of the major link that needs to be developed on priority for connecting Western Suburbs in Goregaon and Eastern Suburbs in Mulund.

1.5 TERMS OF REFERENCE (TOR)

- The proposed project was considered in 174th Meeting of Expert Appraisal Committee (Infra 1), Ministry of Environment, Forest & Climate Change held on 9th August 2017 reccomonded additional ToR for the project.
- Then the project was reconsidered in 177th Meeting of Expert Appraisal Committee (Infra 1), Ministry of Environment, Forest & Climate Change held on 16th October 2017 and recommended additional ToR to notified in the standard ToR applicable for highways.
- Subsequently, the Additional Municipal Commissioner (Project), Municipal Corporation of Greater Mumbai (BMC), Mumbai requested for modification in the minutes of the meeting with a request to exempt the public hearing for this project and also for collection of 3 months data instead of 12 months data for biodiversity study as recommended. The request of the proponent was considered by EAC (Infra 1), MoEF&CC held on 29th November, 2017 and it was decided that no exemption can be given for Public Hearing as the proposal involves land acquisition and Rehabilitation and Resettlement (R & R) issues.
- The project was then again considered in 183rd Meeting of Expert Appraisal Committee (Infra 1), Ministry of Environment, Forest & Climate Change held on 24th January 2017 regarding reduction of time period for conducting Biodiversity study from 12 months to 3 months.

  However, since the proposed tunnel is passing under the Sanjay Gandhi National Park, comments from Additional Director General (Wildlife), MoEF&CC was obtained to firm up the TOR. The Wildlife wing has suggested to carry out following additional studies/assessments to minimize the negative impacts as well as for undertaking adequate mitigation measures:
  - Impact on the aquifers beneath the National Park.
  - Impact on the fossorial (burrowing) wildlife.
  - Impact on the Tap root system of trees.
  - Best practices adopted worldwide in similar projects.
  - The impact studies should be conducted over one year.

1.6 ENVIRONMENTAL CLEARANCE PROCESS

As per the EIA notification of 14th September 2006 and its amendment dated 1st December 2009, highway projects are divided into two categories as mentioned below:

Project activity		Category with threshold limit		Conditions if Any
(1)	(2)	(3)	(4)	(5)
7(f)	Highways	(i) New National High ways; and (ii) Expansion of National High ways greater than 30 kms involving additional right of way greater the 20 m involving land acquisition and passing through more than one state	(i) All New State High way projects; and (ii) State Highways expansion project project in hilly terrain (above 1,000 m AMSL) and ecologically sensitive areas	General Condition shall apply Note: Highway include Expressway

The environmental clearance process for all projects will comprise a maximum of four stages. These four stages in sequential order are:

Stage (1)-Screening

In case of category 'A' projects or activities, this stage will entail the scrutiny of an application seeking prior environmental clearance made in Form 1 by the MoEF for determining whether or not the project or activity requires further environmental studies for preparation of an Environmental Impact Assessment (EIA) for its appraisal prior to the grant of environmental clearance depending upon the nature and location specificity of the project.

Stage (2)- Scoping

'Scoping' refers to the process by which the EAC in the case of Category 'A' projects or activities, and SEAC in the case of Category 'B1' projects or activities, including applications for expansion and/or modernization and/or change in product mix of existing projects or activities, determine detailed and comprehensive TOR addressing all relevant environmental concerns for the preparation of an EIA report in respect of the project or activity for which prior environmental clearance is sought. The EAC or SEAC concerned shall determine the TOR on the basis of information furnished in the prescribed application Form 1 including TOR proposed by the applicant, a site visit by a sub-group of EAC or SEAC concerned only if considered

necessary by the EAC or SEAC concerned and other information that may be available with the EAC or SEAC concerned.

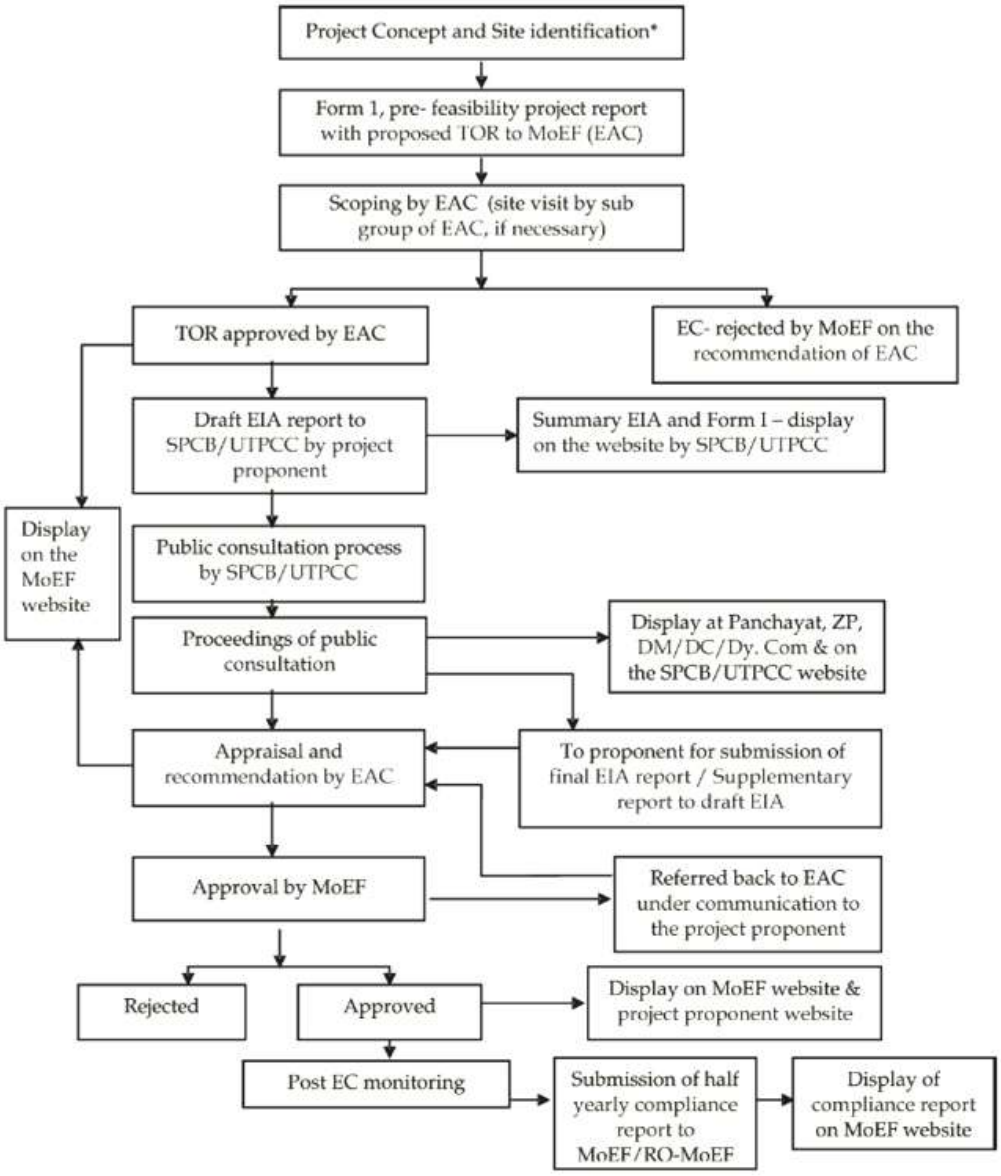
Stage (3)- Public consultation

"Public consultation" refers to the process by which the concerns of local affected persons and others who have plausible stake in the environmental impact of the project or activity are ascertained with a view to taking into account all the material concerns in the project or activity design as appropriate. All Category 'A' and Category 'B1' projects or activities shall undertake Public consultation, except the following:

- Expansion of Roads and Highways which do not involve any further acquisition of land
- All projects or activities concerning national defence and security or involving other strategic considerations as determined by the Central Government
- After completion of the public consultation, the applicant shall address all the material environmental concerns expressed during this process, and make appropriate changes in the draft EIA and EMP. The final EIA report, so prepared, shall be submitted by the applicant to the concerned regulatory authority for appraisal. The applicant may alternatively submit a supplementary report to draft EIA and EMP addressing all the concerns expressed during the public consultation

Stage (4) - Appraisal

Detailed scrutiny by the EAC or SEAC of the application and other document like the Final EIA report, outcome of the public consultations including public hearing proceedings, submitted by the applicant to the regulatory authority concerned for grant of EC. Flow-charts depicting these stages to obtain the prior environmental clearance for Highways projects are presented in Figure 4 & Figure 5



* The proponent should apply for CRZ clearance, as per applicability

Figure 1-Prior Environmental Clearance Process for Category A Projects

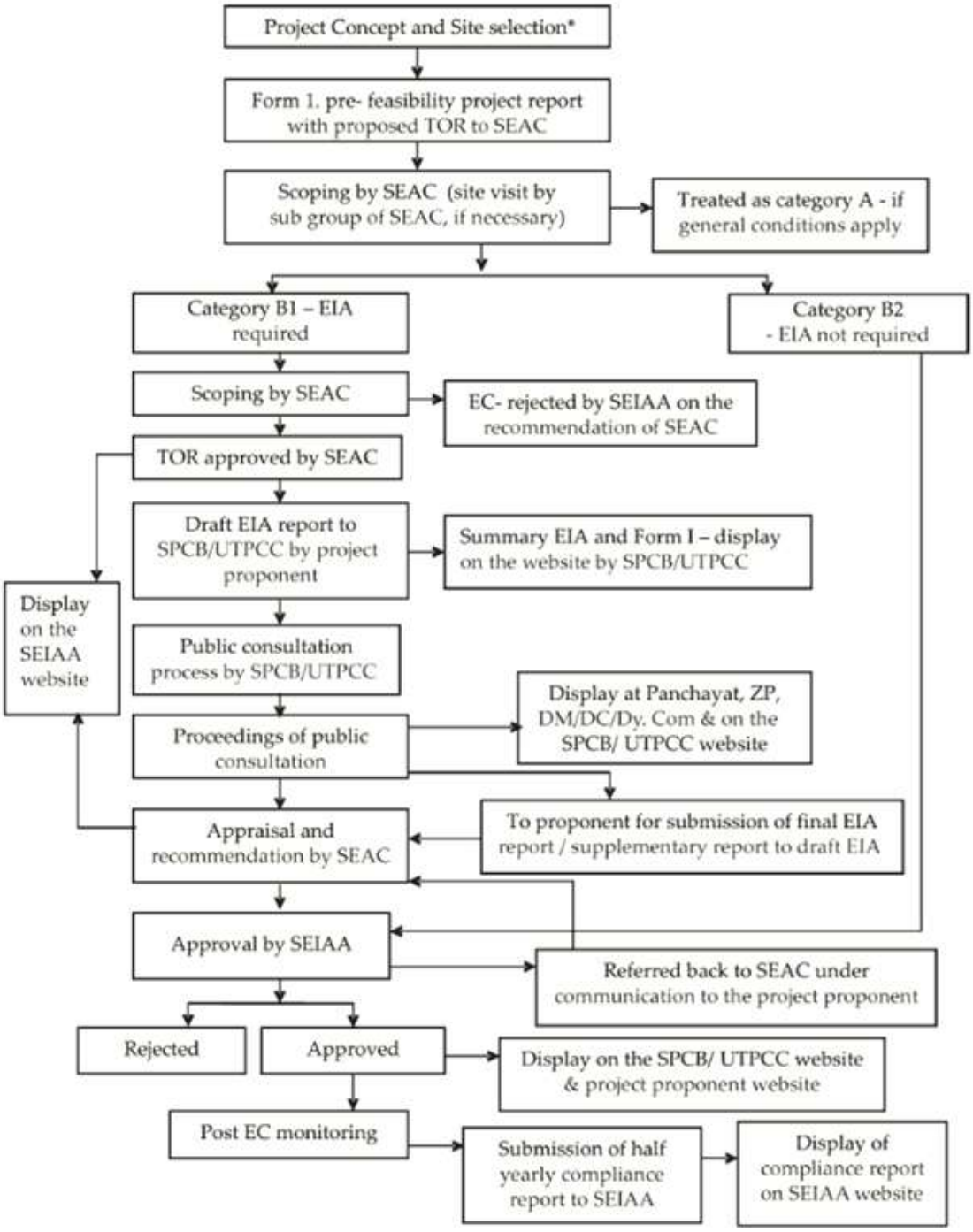


Figure 2- Prior Environmental Clearance Process for Category B Projects

1.7 ENVIRONMENTAL IMPACT ASSESSMENT

An environmental impact assessment (EIA) is an assessment of the possible impact positive or negative-that a proposed project may have on the environment, together

consisting of the natural, social and economic aspects. Its purpose is to identify, examine, assess and evaluate the likely and probable impacts of a proposed project on the environment and, thereby, to work out remedial action plans to minimize adverse impact on the environment. It is an important management tool for ensuring the justified use of natural resources during developmental process. The Ministry of Environment Forests (MoEF) New Delhi has issued the Environmental Impact Assessment Notification on 14th September, 2006, which makes prior environmental clearance mandatory for the development activities listed in its schedule.

1.7.1 Purpose of this Environmental Impact Assessment (EIA)

The purpose of this Environmental Impact Assessment (EIA) study is to provide information on the nature and extent of environmental impacts arising from the development of the proposed project and related activities with a view to define an Environmental Management Plan (EMP) to minimise adverse environmental impacts.

M/s Global Management and Engineering Consultants International is appointed as EIA Consultants to carry out the Environmental Impact Assessment (EIA) study for the proposed project site incorporating baseline data for various Environmental Components, viz, air, water, noise, land and biological along with the parameters of human interest and to prepare Environmental Management Plan (EMP) for mitigation adverse impacts.

1.7.2 Significance of the EIA study

Environmental Impact Assessment (EIA) of a project ensures accountability of all the environmental impacts of the various project activities right from the stages of project initiation. The study incorporates the various environmental issues into planning and design stages of the project. It further guarantees the initiation of the various steps for minimization of the identified project impacts and assures a careful consideration of the different project alternatives. An exhaustive EIA process is inclusive of the various steps as described below:

Screening, Scoping, consideration of alternatives, Baseline data collection, Impact prediction Assessment of alternatives, delineation of mitigation measures and environmental impact statement, Environmental Management Plan Decision – monitors the clearance conditions.

The Rapid EIA of the proposed project was undertaken to achieve the following goals:

- ✓ Identification of the various project activities and their potential impacts on the environment.
- ✓ Generation of a comprehensive information database for the project planning team on the nature of environmental risks posed by the project activities, such as

human health effect, habitat loss, pollution levels and change in land use pattern among other issues.

- ✓ Careful consideration of the different alternatives for the project activities that may have serious consequences on the environment.
- ✓ Improving the overall decision-making process and ensuring that project options under consideration, are environmentally sound and sustainable.

The key objectives of the study are as follows:

- ✓ Including the viable environmental options into micro planning of the project.
- ✓ Providing mitigation measures as may be required for the successful implementation of the overall project.
- ✓ Providing an Environment Management Plan for the site, considering the likely environmental issues and mitigative action plans in the near future.
- ✓ Providing a Disaster Management Plan for making sound arrangements for emergency preparedness at the time of natural or man-made disasters.

1.7.3 Scope of work

Following inception meeting and various site surveys, the study area for the EIA project was defined.

The EIA study is primarily based on collection of baseline information and assessment of short-term as well as long-term impacts. In order to fulfill these objectives a three-phased approach to the study was followed:

Phase I: Data Collection and Description of the Baseline Environment;
Phase II: Assessment and Evaluation of potential Environmental Impact of the project;
Phase III: Development of recommendations including an EMP and Disaster Management Plan (DMP) for improving the environmental features of the project on a long term.

The three phases of the Environmental Impact Assessment study includes the various activities/tasks for exhaustive coverage of the various issues and concerns for the project site. The description of each task has been done in the following sections in accordance with the Environmental Impact Assessment guidelines of Ministry of Environment & Forests and Climate Change, Government of India, Asian Development Bank and World Bank for similar type of projects.

1.7.4 Approach and methodology

The general approach followed for carrying out the EIA for the project is summarized in the enclosed flow chart on the following page.

1.7.5 Primary Reconnaissance Survey

Primary reconnaissance survey was conducted within the proposed alignment. Reconnaissance survey was conducted from **February 2018 to January 2019.** The survey was conducted at both the ends of the alignment.

1.7.6 Baseline study

Baseline study comprised generation of primary data and collection of secondary data. Primary survey including environmental monitoring was conducted for the project area to gather information on the following environmental attributes.

- Air quality in respect of, PM_{10}, $PM_{2.5}$, SO_X, NO_X, CO etc.
- Noise Levels
- Surface Water Quality
- Ground Water Quality
- Soil Quality
- Ecology and Bio-diversity

Secondary data was collected on the following aspects to supplement the primary data in order to assess the baseline environmental setup. The data was gathered on –

- Geological and physiological characteristics
- Meteorological data – rainfall, humidity, temperature, wind speed and wind direction
- Land use pattern
- Flora and Fauna (Ecology & Bio- Diversity)

1.7.7 Project Impact Assessment

Impacts of the project on environment both during construction phase and operation phase was assessed against the baseline biophysical information and proposed activities. Baseline information along with predicted air quality and noise levels data were compared with the National Standards stipulated by regulatory agencies like CPCB and MoEF & CC. Qualitative assessment of the impacts of increased noise level, water and soil pollution due to project on public health, animal and surrounding vegetation has been assessed.

1.7.8 Formulation of Mitigative Measures

The standard guidelines of MoEF & CC and other regulatory agencies were considered to suggest different / alternative mitigative measures. Trade –off and multi –alternative analysis was carried out arrive at the most appropriate measures to minimize the negative impacts of the project.

1.7.9 Environmental Management Plan

Environmental Management Plan (EMP) is prepared after identifying, predicting and evaluating the significant impacts on each component of the environment with a view

to maximize the economic benefits from the project. Post-project Environmental Monitoring program is also detailed in the report.

1.8 VALIDITY OF ENVIRONMENTAL CLEARANCE

The prior environmental clearance granted is valid for a period of five years. The regulatory authority concerned may extend this validity period by a maximum period of five years.

1.9 POST ENVIRONMENTAL CLEARANCE MONITORING

In respect of category A projects, it shall be mandatory for the project proponent to make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the district or state where the project is located and in addition, this shall also be displayed in the project proponent's website permanently.

In respect of category B projects, irrespective of its clearance by MoEF, the project proponent shall prominently advertise in the newspapers indicating that the project has been accorded environmental clearance and the details of MoEF website where it is displayed.

The project management shall submit half-yearly compliance reports in respect of the stipulated prior environmental clearance terms and conditions on 1st June and 1st December of each calendar year. All such reports shall be public documents. The latest such compliance report shall be displayed on the web site of the concerned regulatory authority.

1.10TRANSFERABILITY OF ENVIRONMENTAL CLEARANCE

A prior environmental clearance granted for a specific project or activity to an applicant may be transferred during its validity to another legal person entitled to undertake the project or activity on application by the transferor or the transferee with a written "No objection" by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which the prior environmental clearance was initially granted, and for the same validity period.

1.11 GENERIC STRUCTURE OF ENVIRONMENTAL IMPACT ASSESSMENT DOCUMENT

In terms of the EIA notification of the MOEF dated 14 September 2006, the generic structure of the EIA document shall be as under:

Chapter No.	Chapter Title	Description
Chapter 1	**Introduction**	This chapter contains the general information on the port sector, major sources of environmental impact in respect of port projects and details of the environmental clearance process.
Chapter 2	**Project Description**	This chapter should cover the description of the project, such as the type of project, need for the project, project location, project layout, cargo handling methods, utilities and services, and the project implementation schedule, estimated cost of development etc
Chapter 3	**Analysis of Alternatives (Technology & Site)**	This chapter should cover details of various alternatives both in respect of location of site and technologies to be deployed, in case the initial scoping exercises consider such a need.
Chapter 4	**Description of Environment**	This chapter designs the heart of the manual, since it is in this chapter that the proponent shall give the comprehensive data on the existing and additional data collected by him on the baseline environmental data in the study area as well as in the surrounding area that is likely to be affected by the proposed activity.
Chapter 5	**Anticipated Environmental Impact and Mitigation Measures**	This chapter should cover the anticipated impact on the environment and mitigation measures. The method of assessment of impact including studies carried out, modeling techniques adopted to assess the impact where pertinent should be elaborated in this chapter. It should give the details of the impact on the baseline parameters, both during the construction and operational phases and the mitigation measures to be implemented by the proponent.
Chapter 6	**Environmental Monitoring Programme**	This chapter should cover the planned Environmental Monitoring Program. It should include the technical aspects of monitoring the effectiveness of mitigation measures
Chapter 7	**Additional Studies**	This chapter should cover the details of the additional studies, if any, required in addition to

Chapter No.	Chapter Title	Description
		those specified in the TOR and which are necessary to cater to more specific issues applicable to the particular project. These studies may be suggested either by the proponent itself or the regulatory authority.
Chapter 8	**Project Benefits**	This chapter should cover the benefits accruing to the locality, neighbourhood, region and nation as a whole. It should bring out details of benefits by way of improvements in the physical infrastructure, social infrastructure, employment potential and other tangible benefits.
Chapter 9	**Environmental Cost Benefit Analysis**	This chapter should cover Environmental Cost Benefit Analysis of the project, if recommended by the Expert Appraisal Committee at the scoping stage.
Chapter 10	**Environmental Management Plan**	This chapter should comprehensively present the Environmental Management Plan (EMP), which includes the administrative and technical setup, summary matrix of EMP, the cost involved to implement the EMP, both during the construction and operational phases.
Chapter 11	**Summary and Conclusions**	This chapter makes the summary of the full EIA report condensed to ten A-4 size pages at the maximum. It should provide the overall justification for implementation of the project and should explain how the adverse effects are proposed to be mitigated
Chapter 12	**Disclosure of Consultants Engaged**	This chapter should include the names of the consultants engaged with their brief resume and nature of consultancy rendered.

1.12 ENVIRONMENTAL STANDARDS AND CODE OF PRACTICES

Statutory permissions and clearances required during construction and operation of the project are as under:

Sr. No	Act / Rules	Applicability	Authority
1	Environment Protection Act 1986	The project activities should maintain emission standards	MoEF&CC; DoE, State Govt.; CPCB; MPCB

Sr. No	Act / Rules	Applicability	Authority
2	Environmental Impact Assessment Notification- 14th Sep 2006 and subsequent amendments	Project covered under EIA Notification and Environment Clearance to be taken	MoEF&CC at Centre & SEIAA at states
3	National Environment Appellate Authority Act (NEAA) 1997	Grievances by public regarding non- compliance of EC conditions can be	NEAA
4	Forest (Conservation) Act, 1980. The Forest (Conversion) Rules1981	There are 166.485 ha of reserve forest in the alignment	MoEF&CC
5	MoEF circular (1998) on Linear Plantation on roadside, canals and railway lines modifying the applicability of provisions of Forest (Conversation) Act, to Linear Plantation	Applicability of Forest Conservation Act to road-side strip plantations	MoEF&CC
6	The Schedule Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 and Amendment Rule 2012.	Not Applicable	MoEF&CC
7	The Provision of Panchayat Act 1996	Not Applicable	Gram Sabha
8	Wildlife Protection Act 1972	No Wildlife Sanctuary or National Park is involved	Chief Conservator Wildlife; Forest Department
9	Air (Prevention and Control of Pollution) Act, 1981	Emissions from machinery and vehicle should be checked time to time during construction.	MPCB
10	Water (Prevention and Control of Pollution) Act 1974	Various parameters in effluents from construction sites and workshops are to be kept below the prescribed standards	MPCB
11	Noise Pollution (Regulation & Control) Rules, 2000	DG sets at construction sites and workshops should be provided with acoustics	MPCB

Sr. No	Act / Rules	Applicability	Authority
		enclosures.	
12	Public Liability and Insurance Act 1991	Shall be taken as per requirements	MPCB
13	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules1989	All vehicles shall obtain PUC certificates	Motor Vehicle Department
14	National Highway Act, 1956 and amended 1997	Requirement for land acquisition to accommodate to project	NHAI
15	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	Requirement for land acquisition to accommodate to project	Ministry of Rural Development and Affair

CHAPTER 02: PROJECT DESCRIPTION

2.1 INTRODUCTION

Mumbai is popularly known as Commercial Capital of India.The city and the metropolitan region surrounding the city have grown rapidly over the past few decades. The population within the MCGM limit has increased from 4.2 million in 1961 to today's 12.44 million (As per 2011 Census). The growth of vehicular traffic is no exception. The city currently has close to 25 lakhs of vehicles with 500 new vehicles being registered every day. With the present road network of about only 2000 km, it is becoming difficult to handle the traffic. In order to improve the level of service, MCGM has carried out various studies in the past through reputed consultants and have identified new road links that would help decongest the existing road network. With the growth of residential and commercial development in the city, there has been an increase in demand for adequate infrastructure improvement in the suburbs to ensure proper connectivity. It has become necessary to address these issues on priority.

2.2 PROJECT BACKGROUND

As the city of Mumbai, due to its Geographical constraints has grown in a linear manner. The historical development of Greater Mumbai is characterized by concentration of commercial and business activities in the Island city in the South and development of predominantly residential activity towards the North along the Western and the Eastern Suburbs. The transportation corridors in Mumbai have also therefore evolved longitudinally traversing along the North – South axis with very few East-West linkages. With rapid growth of the Eastern and Western suburbs of Greater Mumbai in the last few decades, an urgent need was felt for strengthening of the East–West road connectivity between the eastern and western suburbs. Thus, Municipal Corporation of Greater Mumbai has proposed to develop Goregaon-Mulund Link Road of leghth 12.3 km including Tunnel 4.7 km underneath Sanjay Gnashi National Park. Connecting points are Near Dindoshi Flyover on WEH and near Airoli Junction on EEH

The transportation Study carried out by M/s Wilbur Smith and Associates, as early as 1963, hademphasized the need for development of the East-west linkages for Greater Mumbai. Four major East-West link roads were then planned for connecting the Suburbs to minimize travel time and cost.

Several studies thereafter have been carried out by MCGM and MMRDA with a view to improve the traffic and transportation problems of the city and suburban. One of the studiescarried out by MMRDA through M/s Consulting Engineers Services (CES) India Pvt. Ltd. in the year 2003 wherein a Master Plan for Road Network Improvement and Traffic Dispersal in Greater Mumbai was proposed.

The report of M/s CES, has indicated that the Goregaon Mulund Link Road is one of the major link that needs to be developed on priority for connecting Western Suburbs in Goregaon and Eastern Suburbs in Mulund.

2.3 PROJECT DESCRIPTION

Twin Tube Tunnel Road Project- 4.7Km (3+ 3 Lan,e) Missing Link of Existing Goregaon Mulund Link Road for connectivity of road from East to West corridor of Mumbai. The details of proposed alignment are given in Table 3 below:

Relevance of the project: It is the missing link proposal which, if completed would provide the much needed East-West connection in the Suburbs, while at the same time ensure protection of the environs of SGNP and Aarey colony. The project assumes enormous significance as it will help meet the following important objectives.

- To augment much needed road connectivity between eastern and western suburbs
- To propose an alignment along the shortest route
- To establish a high speed, high capacity, East-West link
- To plan the link without adversely affecting environment, SGNP, Aarey & the lakes

Table 1 Details of the Project

Sr. No.	Description	Values	Remarks
1	Length	12.3 km	Tunnel – 4.7km underneath SGNP
2	Number of lanes	4+4 lane at grade Tunnel -3+3 lanes Elevated-3+3 lanes	
3	Proposed Structure	Twin tunnels in National Park area and approach roads on both sides.	
4	Connecting Points	Near Dindoshi Flyover on WEH and near Airoli Junction on EEH	

2.3.1 Project coverage, master plan, phasing and scope:-

The project of tunnel forms part of the GoregaonMulundLink road. The GMLR is already

reflected as a 45.70 mt wide Development Plan road in the sanctioned revised Development Plan of Greater Mumbai. The alignment of the Tunnel is also reflected in the draft Development Plan for Greater Mumbai 2034.

The widening of the existing roads along the alignment of MGLR is already undertaken separately in a phasewise manner. The Twin Tube Tunnel with approach road is now being proposed under this project with a view to complete the missing link and ensure east west connectivity.

The tunnel construction will be undertaken on a Design Build Contract basis. The details of the proposed tunnel are as under:

- Length of Twin tunnel underneath SGNP – 4.7 km
- Difference between two Tunnel – 15 m
- Tunnel Diameter – 14.2 m
- Tunnel depthvarying from 20mt to 220 mt
- To avoid invasive activity, Tunneling methodology is proposed by use of TBM only without any shaft inside SGNP
- Ventilation inside tunnel proposed by way of artificial means
- Area of Tunnel underneath SGNP - 21.50. Ha approx

2.3.2 Capacity

The configuration of Road Tunnel is 3 lane + 3 lane for traffic from East to West vis sa vis West to East. The total capacity traffic Total volume PCU/Day anticipated is 28271nos from Mulund and 40230 nos from Goregaon for projection for the horizon period 2042

2.4 LOCATION OF THE PROJECT

Tunnel Alignment passes through Hilly terrain of Geology profile comprising Basalt and Breccia as per Geotechnical Investigation report. Tunnel and Approach Alignment level is matched with existing at grade road on both ends. The project involves Partial resettlement of R/R at Khidiapada and Film City side of Entry and Exit of Tunnel which is beyond the SGNP boundary.

Based on Geotechnical Investigation and topographic survey within SGNP, the alignment has been fixed in such a way that

1. There will be no land acquisition inside SGNP
2. R & R will be minimum
3. There will be minimum disturbance during construction.
4. Shortest Route Alignment.
5. Alignment will be planned consistent with the DP road.

The underground tunnel is proposed on this alignment near film city in such a way that the tunnel passes underneath the Sanjay Gandhi national park area without disturbing the premise of SGNP in any way whatsoever. The project also does not involve any land acquisition within Sanjay Gandhi National Park. As an underground Tunnel is proposed along this alignment, it can be ensured that there is minimum

disturbance to flora and faunaand there is no adverse effect to the water supply system and the lakes situated in the area.

The exit point of the tunnel on Mulund side is located at Khindipada outside the SGNP premise and hence it will not involve any land acquisition in SGNP area. The alignment has been planned with minimum land acquisition beyond SGNP area and maximum benefit to local traffic and through traffic. Google image showing location of GMLR alignment is given in Figure 3 & 4. The Village Map with Tunnel Alignment given in Figure 5 below:

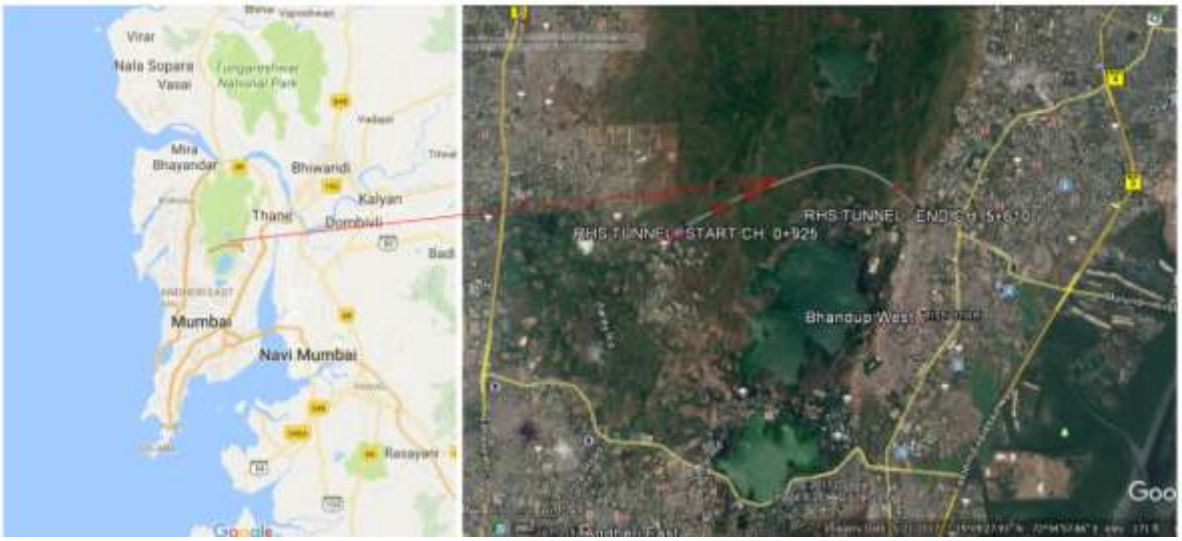


Figure 3 -Location of theProject

Figure 4- Google Impage showing GMLR Alignment

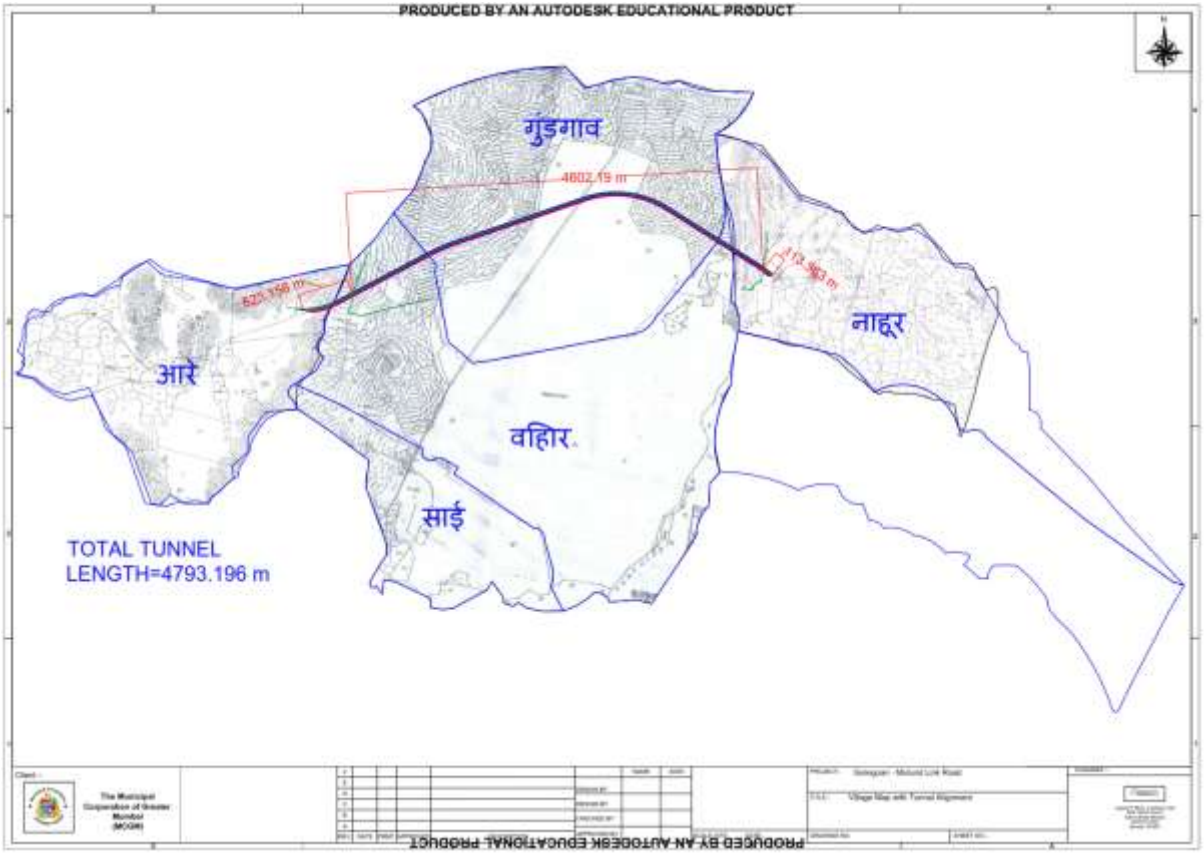


Figure 5-Village Map with Tunnel Alignmen

2.5 NEED OF THE PROJECT

The MMRDA had also carried out Comprehensive Transportation Study (CTS) for Mumbai Metropolitan Region (MMR) with an objective of preparing a Comprehensive Transport Plan for MMR for the horizon period ending 2031. The study has proposed extensive transport network for the travel needs of MMR for the horizon period up to 2031. The proposed road transport corridors included several missing links, which provide faster transport connectivity between Greater Mumbai and rest of the region as well as the road networks within the city.

In order to ease the traffic congestion and to improve inter-urban road and rail infrastructure, Mumbai Metropolitan Region Development Authority (MMRDA),the nodal agency responsible for the planning and development of region's infrastructure has thereafter evolved many projects for the development of region under Mumbai Urban Transport Projects (MUTP).With a view to supplement the efforts under MUTP,MMRDA had also embarked upon an ambitious programme of infrastructure development in Mumbai region under Mumbai Urban Infrastructure Project (MUIP). The East West link roads were identified as priority roads. The three major east-west corridors connecting WEH & EEH in Mumbai Suburbs mentioned below formed part of MUIP.

1) Santacruz-Chembur Link Road (SCLR)
2) Andheri-Ghatkopar Link Road (AGLR)
3) Jogeshwari-Vikhroli Link Road (JVLR)

All the three above mentioned major links roads providing east- west connectivity for the suburbs have become fully operational. All these link roads are now reaching their saturation limits resulting in traffic congestion and delay during peak hours. The need to augment the east-west connectivity has therefore become very crucial and is required to be addressed to on war footing.

The GMLR is the fourth and the most important east- west link planned for providing the much needed connectivity for the suburbs. The GMLR envisages road connectivity from Western Express Highway at Goregaon in the Western suburb to Eastern Express Highway at Mulund in the Eastern suburb. The completion of the GMLR will vastly decongest the existing road network of the Mumbai's suburbs.

Presently, this link of varying road width is in operation on both the eastern and the western suburbs. On the eastern suburb, the road is existing from E.E.H. to Khindipada junction, while on the Western suburb the road exists from W.E.H. to Film City. The presently existing road varies in width from 15m to 45.70m, although the proposed final width of GMLR as reflected in the sanctioned revised D.P. of 1991 is 45.70m.

The stretch of GMLR between Film city and Khindipada Junction forms the missing link. The missing link is reflected in the Development Plan sanctioned by the State Government in 1991-92 as a 45.70 mt wide D.P. road. The said proposed D.P. Road passes through Sanjay Gandhi National Park (SGNP) and has therefore not been developed. This East-West link is therefore incomplete and does not serve the intended purpose. It has therefore become necessary to explore the possibility of constructing this missing link to ensure complete connectivity along this GoregaonMulund link road. The possibility of exploring various options to develop this missing link has therefore been initiated by MCGM.

2.6 TERRAIN AND LAND USE OF THE ALIGNMENT

The region is hilly with elevations between 30 m (98 ft) and 480 m (1,570 ft). The park encompasses two lakes, Vihar Lake and Tulsi Lake, which meet part of the city's water requirements. For this project ha agricultural/ barren land and 166.485 ha of forest land is proposed to be acquired.

2.7 CLIMATE

Mumbai, being on the seacoast, experiences a tropical savanna climate with a heavy southwest monsoon rainfall of more than 2100 millimeters a year. Mumbai experiences three seasons– summer from March to May, monsoon between June and September and winter during October to February. The city receives heavy

rainfall during monsoon and relative humidity is quite high during this season. Similarly, winds are generally moderate but pick up during monsoon months. The mean minimum temperature is 16.3°C and the mean maximum temperature is 32.2°C a t Santacruze. The normal annual rainfall over the district varies from about 1800 mm to about 2400 mm. It is minimum in the central part of the district around Kurla (1804.9 mm). It gradually increases towards north and reaches a maximum around Santacruze (2382.0 mm)

2.8 TRAFFIC & DEMAND STUDIES

The following studies and technical guidelines were used as the design basis for this project:

- "Comprehensive Transportation Study for Mumbai Metropolitan Region or TRANSFORM", by LEA associates dated July 2008 identified regional vehicular growth rates for Mumbai. With 2008 as the base year, Transfor provided a travel demand model for the Mumbai Metropolitan Region with traffic volume projections for 2016, 2021, 2031.The current study uses growth factors identified in Transform for projecting 2-wheeler and 4-wheeler traffic.
- "Highway Capacity Manual (HCM) 2000" mentions the criteria of level of service (LOS) on the basis of volume to capacity (v/c) ratio. It also defined LOS in terms of traffic density (veh/Km). The current study uses HCM 2000 guidelines for arriving respective LOS for the horizon years
  2022, 2032 & 2042.

- "IRC 106-1990 Guidelines for Capacity of Urban Roads in Plain Areas" suggests capacity thresholds and design service volumes corresponding to the different lane configurations for urban roads. The current study uses the standard passenger car unit factors identified by IRC 106 to convert heterogeneous traffic volumes observed in the filed into homogeneous traffic volumes for analysis purposes. The current study also uses recommendations from IRC 106 to project daily traffic volumes based on the observed peak hour volume.

- "Road Tunnels Manual", by the World Road Association (PIARC), dated September 2011 suggests that tunnels generally have greater roadway capacities than similar sections in open. It was reasoned that this was due to the higher level of attention paid in a tunnel, as well as the greater smoothness and regularity in the flow of vehicles due to the absence of sudden manoeuvres. The present study considers these findings mentioned in the Road Tunnels Manual.

- "IRC 108-2015 Guidelines for Traffic Forecast on Highways" by the Indian Road Congress provides an overview of the traffic forecasting process. The current study relates vehicle population with one or more logically derived

independent variables to derive the elasticity of transport demand for future traffic projections.

Additionally the following data collection tasks were carried out to build upon the findings of the above reports and guidelines:

- Existing Traffic Volume Surveys-A classified turning movement count study was carried out at different locations in the MMR region surrounding Sanjay Gandhi National Park. The volume thus obtained was converted into trips and later the same were projected for obtaining future scenario (2022, 2032 & 2042) volumes and trips generated.

- Origin & Destination (OD) Surveys - OD surveys were conducted at different locations in the MMR region surrounding Sanjay Gandhi National Park to identify traffic likely to be diverted from the existing vicinity corridors to the proposed GMLR. Desire line diagrams were prepared based on the OD counts to illustrate the extent of interaction between zones present on study area.

- Elastic demand growth model - The data for the Net State Domestic Product of Maharashtra State and the increase in registered vehicles for the past 10 years was considered for the purpose of modelling. Traffic demand for future scenarios were estimated using elastic demand growth models. The yearly percentage increase in the traffic volume was calculated and the corresponding traffic demand was projected for the Year 2022, 2032 & 2042 scenarios.

2.8.1 Design Traffic

In 2008 LEA Associates produced Comprehensive traffic study report for Mumbai with forecasted growth of private vehicle on Mumbai Metropolitan Region (MMR) for the design year of 2031. The current study uses the same trend line for forecasting the growth of private vehicle. TABLE A illustrates the forecasted growth of private vehicle population of MMR.

Table 2 - Forecasted Growth of Private Vehicle Population of MMR

Year	Greater Mumbai (Veh/1000persons)	Rest of MMR (Veh/1000persons)	MMR (Veh/1000persons)
2006	95	134	110
2011	112	180	139
2016	132	228	171
2021	153	270	204
2026	175	304	236
2031	197	329	266

The design traffic was analysed based on following criteria.

- Trips with a high probability of shifting to GMLR
- Trips with a lower probability of shifting to GMLR
- Trips that would not shift to GMLR

Sr.No.	Criteria	2022	2032	2042
1	Trips Surely Shift(PCU/Day)	49008	57175	61019
2	Trips that may shift(PCU/Day)	6009	7010	7482
3	Total design volume (AADT) (PCU/Day)	55017	64185	68501
4	Design hourly volume (PCU/hr)	6602	7702	8221

2.9 TECHNOLOGIES INVOLVED FOR DESIGN, CONSTRUCTION, EQUIPMENT AND OPERATION

Advance Technology Tunnel Boring Machine of 14.2 m approx. will be used for Tunneling work below Sanjay Gandhi National Park. RCC Segmental Lining will be used for Surface permanent lining of Tunnel. RCC road pavement will be constructed by Paver machine and all advance technology for surveillance, firefighting equipment's, ventilation system, Substations at both ends and Control room to monitor the traffic will be installed in Tunnel.

2.10 UTILITIES REQUIRED

2.10.1 Land Requirement (Acquisition)

Land Acquisition is under process, after calculation of area of land, type of land and the market rate R & R plan will be designed. R/R settlement and Land acquisition is already in progress which is beyond the Sanjay Gandhi National Park boundary.

2.10.2 Water Requirement

Total Water required dueing construction phase of the project will be 92KL/Day. The water requirement for construction phase will be fullfilled from MCGM water supply.

2.10.3 Power Requirement

Power required during construction and operation will be acquired from the MSEB

2.10.4 Manpower Requirement

Total manpower requirement during construction phase will be Total 500 nos.

2.10.6 Public infrastructure

Existing GMLR Road will be used for transportation of construction material during construction phase.

2.10.7 Equipment & Machineries

- Tunnel Boring Machine

- Heavy Crane
- Excavator
- Dozer
- Pavers etc

2.10.8 Solid Waste generation

Total Muck generated during construction phase will be 23 Million cubic metre

2.10 PROJECT BENEFITS

- The travel time will get reduced by almost one hour between Mulund and Goregaon
- Traffic congestion on Western Express Highway and the Link Roads will be substantially reduced
- Saving in Fuel Consumption to a substantial extent
- Cutting of about 2224 trees will be avoided
- Win- win situation as Road Link gets established without disturbing SGNP, Aarey and the city's lakes

2.11 PROJECT COST & SCHEDULE

- 4-years period is anticipated for completion of project.
- Estimated cost of development of the project is Rs 2000 Crores approx.

CHAPTER 3 – ANALYSIS OF ALTERNATIVES

3.1 Introduction

The study carried out by M/s CES suggested certain alternative to the alignment originally proposed in the D.P. of the MCGM. In view of the report of M/s CES and the alternative alignment suggested by them, MCGM had appointed separate technical consultant M/s Pentacle Consultants (India) Pvt Ltd. to prepare a Detailed Project Report.M/s Pentacle Consultant Pvt ltd had in the year 2015prepared a Detailed Project Report on alternative alignment for GMLR. In the DPR M/s Pentacle had in their report suggested some options.

3.2 Elevated road from WEH to EEH

Among thesuggested options, the alignment comprising of an Elevated corridor connecting WEH near Goregaon Flyover and EEH near Mulund running along Aarey milk colony, Powai Lake and Bhandup Complex area along Trunk Main water line was proposed as the best option and the detailing has been carried out by them for this option. The option has approx 13.6km of an elevated road with 1.7km connector and 1.5km at grade road at entry/exit at WEH & EEH respectively. The alignment passes along existing Aarey Road in Aarey colony and then through Bhandup Complex up to Mulund. The alignment further traverses to Khindipada on existing Goregaon Mulund Link Road crosses LBS Marg and end up on EEH as shown in figure: 2.1

Figure 6- Proposed GMLR Connectivity (Based on M/s Pentacle study 2015)

M/s. Padeco co. Ltd. has carried out the peer review of the Detail Project Report submitted by M/s. Pentacle. After reviewing the various options mentioned in the DPR submitted by M/s Pentacle, M/s Padeco have indicated that the elevated corridor option proposed in the DPR has lot of constraints. The alignment proposed in the DPRsubmitted by M/s Pentacle passes through Aarey colony and will cause adverse impact on the prevailing ecology and environment. It will also involve cutting of large number of trees within the Aarey colony and Bhandup Water treatment complex. The alternative will also jeopardize the safety and security of water supply system at Bhandup Complex.

In order to offset the adverse impact on the environment and to limit the constraints of landacquisition and tree cutting, the peer review consultant has suggested an alignment
involving construction of a tunnel underneath SGNP as the most desirable option. The proposal envisages a twin tunnel of length of 4.7 Km. below SGNP starting at Film city at Goregaon and exiting at Khindipada at Mulund. In view of the proposed tunnel, the length of the proposed GoregaonMulund link road will get shortened to about 12.3km. The proposed alignment starts near Dindoshi Flyover on Western Express Highway and connects the Eastern Express Highway near Nahur crossing LBS marg. The salient features of the proposed option based on desktop study areas given below Table 2.1.

Sr.No	Description	Value	Remarks
1	Length	12.3km	Tunnel – 4.7km underneath SGNP
2	Number of lanes	4+4 lane at grade Tunnel -3+3 lanes Elevated-3+3 lanes	
3	Proposed Structure	Twin tunnels in National Park area and approach roads on both sides.	
4	Connecting Points	Near Dindoshi Flyover on WEH and near Airoli Junction on EEH	

Based on Geotechnical Investigation and topographic survey within SGNP, the alignment has been fixed in such a way that
1. There will be no land acquisition inside SGNP
2. R & R will be minimum
3. There will be minimum disturbance during construction.
4. Shortest Route Alignment.
5. Alignment will be planned consistent with the DP road.

Figure 7 GMLR Proposed Tunnel Alignment Option by M.s Padeco Co ltd

The underground tunnel is proposed on this alignment near film city in such a way that the tunnel passes underneath the Sanjay Gandhi national park area without disturbing the premise of SGNP in any way whatsoever. The project also does not involve any land acquisition within Sanjay Gandhi National Park. As an underground Tunnel is proposed along this alignment, it can be ensured that there is minimum disturbance to flora and faunaand there is no adverse effect to the water supply system and the lakes situated in the area.

The exit point of the tunnel on Mulund side is located at Khindipada outside the SGNP premise and hence it will not involve any land acquisition in SGNP area. The alignment has been planned with minimum land acquisition beyond SGNP area and maximum benefit to local traffic and through traffic.

A comparative table of the proposed Tunnel project and the earlier Elevated option suggested by M/s Pentacle is tabulated below to finalize the most preferred alternative.

Table 3 Pros and Cons of GMLR Proposed Alignment Options

Sr. No.	Item	Elevated Corridor Option of M/s Pentacle	Tunnel Option from M/s Padeco	Remarks
		Advantage/ Disadvantage	Advantage/ Disadvantage	
A	**Physical Infrastructure**			
1	Number of lanes for each direction	2 lanes	3 lanes	Need more than 2 lanes in future for elevated option
2	Length of corridor	19 Km with 13.5km of elevated corridor	About 12.30km with 4.7km tunnel	Elevated corridor adversely affects the ecology of Aarey colony
3	D.P road provision	No D P Road provision from Aarey road to Bhandup complex	Major portion is on DP	
B	**Road User Benefits**			
1	Travel time	Not significantly reduced	reduced considerably	Travel time will be reduced to half in case of tunnel alignment
2	Connecting roads	2 connectors proposed along the corridor.	No intermediate connection	
3	Travel cost	with length not reduced significantly and corridor being congested, there will be	Considerable saving in fuel cost	Elevated corridor should be minimum of 3 lanes for each direction
		no significance saving in fuel cost & travel time		
C	EIA Impact	Plenty of tree cutting is envisaged	Tree cutting is minimum	

CHAPTER 04: BASELINE ENVIRONMENTAL STATUS

4.1 GENERAL

This section of the report gives description of the existing Environmental Studies within the project area, which constitutes the baseline for the study. Natural conditions are often critical when designing and constructing infrastructure works. The assessment of baseline studies of the appropriate environmental parameters, which may be affected by the project implementation, is a pre-requisite for any Environmental Impact Assessment (EIA) study.

EIA is often mandatory requirement for planning of infrastructure and marine structures. The EIA determines the environmental consequences of the project prior to construction, assessment of environmental impact due to construction, its impact on existing baseline environmental parameters and importantly on land use and socio-economic parameters. The entire data has been collected through actual physical surveys and observations, literature surveys, interaction with locals, government agencies and departments. This chapter describes the baseline environment settings in the area and will throw light, its effect on day-to-day environment.

In order to investigate likely impacts due to commissioning of proposed project, the consultants, Global Management and Engineering Consultants International carried out estimation of impacts based on data generated, secondary data as well as literature studies. Field monitoring for meteorological conditions, ambient air quality, water quality, noise quality, etc. has been carried out in one season, which constitutes major portion of the baseline environmental studies. In addition to these important parameters, certain aspects like land use, socio-economic studies etc. are covered during the study period. This information is based on secondary information sources and constitutes remaining part of the baseline environmental studies. It is brought to the notice of the authorities that, since the project is of the development kind and not like conventional industry project. Therefore the impact on existing baseline of environmental parameter will be very restricted and of temporary in nature. These are further controlled and minimized by adopting various mitigation measures. Even during operational phase the impact on environmental settings will be negligible and will be controlled by adopting proper Environment Management Plan (EMP). These aspects have been studied in depth with reference to the proposed project and baseline data has been presented in this chapter.

4.2 STUDY AREA

As the proposed project is linear structure, i.e. highway the study area was selected of 10 km radius of the alignment. Prior to start of actual baseline study reconnaissance survey was conducted throughout the alignment. The survey was conducted to find out ecological features like water bodies, vegetation cover, barren lands; geographical features such as plains; villages in the vicinity etc. and primarily

to decide location for ambient air quality, noise level, soil quality, water quality monitoring. The list of villages selected for Air, Noise, Soil & Water baseline quality study are is given in Table 6 below. The Google image showing study area is given below as Fig. 8.

Table 4-Environmental Monitoring Locations

Sr. no.	Name of Village	Location Code
	Ambient Air Quality Monitoirng Locations	
1.	Near SGNP gate	AAQ 01
2.	Western Express Highway	AAQ 02
3.	Aarey Road	AAQ 03
4.	Near Mhada Colony	AAQ 04
5.	Near Lakshmi Udyog Nagar	AAQ 05
6.	Kisan Nagar	AAQ 06
7.	Amar Pada	AAQ 07
8.	Near Salpa Devi Pada	AAQ 08
9.	Near SGNP gate	AAQ 09
10.	Western Express Highway	AAQ 10
	Ambinet Noise Level Monitoirng Locations	
1.	Near Vallabh Bhai Patel Vidhyalay	NL 01
2.	Near Sanjay Gandhi National Park	NL 02
3.	Near Tata Power Residential Colony	NL 03
4.	Near Aalap Hospital	NL 04
5.	Near Shahid Vijay Salaskar Udhyan	NL 05
6.	Near Oberoi Mall	NL 06

7.	Near St. Pius School	NL 07
8.	Near Lodha Fiorenza	NL 08
9.	Near Jogeshwari Vikhroli Link Road	NL 09
10	Near WEH Metro Station	NL 10
	Surface Water Quality Monitoring Locations	
1.	Goregaon	SW 1
2.	Borivali	SW 2
3	Dahisar	SW 3
	Ground Water Quality Monitoirng Locations	
1.	Andheri	GW 1
2.	Goregaon Filmcity	GW 2
3.	Dahisar	GW 3

Figure 8-Environmental Study Area

4.3 BASELINE ENVIRONMENTAL STATUS

The baseline Environmental Studies was conducted during Sept 2017 to Dec 2017

4.3.1 Land Environment

TOPOGRAPHY & GEOLOGY OF MUMBAI

Mumbai consists of two distinct regions: Mumbai City district and Mumbai Suburban district, which form two separate revenue districts of Maharashtra. The city district region is also commonly referred to as the Island City or South Mumbai. The total area of Mumbai is 603.4 km2. Of this, the island city spans 67.79 km2, while the suburban district spans 370 km2, together accounting for 437.71 km2 under the administration of Brihan Mumbai Municipal Corporation (BMC). The remaining area belongs to Defence, Mumbai Port Trust, Atomic Energy Commission and Borivali National Park, which are out of the jurisdiction of the BMC. Mumbai lies at the mouth of the Ulhas River on the western coast of India, in the coastal region known as the Konkan. It sits on Salsette Island, partially shared with the Thane district. Mumbai is bounded by the Arabian Sea to the west. Many parts of the city lie just above sea level, with elevations ranging from 10 m to 15 m; the city has an average elevation of 14 m. Northern Mumbai is hilly, and the highest point in the city is 450 m at Salsette in the Powai-Kanheri ranges. Sanjay Gandhi National Park (Borivali National Park) is located partly in the Mumbai suburban district, and partly in the Thane district, and it extends over an area of 103.09 km2

The original seven islands of Bombay consisted of 22 hills. Most of them were razed to fill in the shallows to connect the islands. The hills still standing today are:

- Malabar Hill — the highest point in the city area
- Cumbala Hill
- Antop Hill
- Sewri Hill
- Gilbert Hill
- Worli Hill
- Pali Hill
- Mazgaon Hill
- Sion Hill
- Mahakali Hill
- Golanji Hill
- Pulshachi Dongri
- Salamati Hill

There are three hill ranges with the city limits. The Ghatkopar Hills are present near the station of Ghatkopar. The hill range runs parallel to the Central Railway track and is inhabited by slums. During the monsoon season, landslides are common. The Trombay Hills occupy a large portion of Trombayon the eastern part of the city. The highest hill is about 302 metres above sea level. The Powai Hills are present north of the city. The Borivali National Park occupies most of the region. The Vihar and Tulsi Lakes are present within the hills. The highest point of the metropolis, at 450 metres, is located in this region. There are three lakes in the city. The Vihar Lake and the Tulsi Lake are present within the National Park and supply part of the city's drinking water. The Powai Lake is immediately south of these two. Back Bay is the largest bay in the city. The coastline of Back Bay is an inverted C-shaped region 4 kilometres in length, and Marine Drive is located along this stretch. North of Marine Drive is Worli Bay. In the centre of the bay is the tomb of Haji Ali, a 13th century Muslim saint. The bay perimeter is about two kilometres in length. Mahim Bay is the second largest bay in the city. The Mithi River empties into the Mahim Creek which drains into the bay. The border between the city and its suburbs bisects the bay. To the north lies Bandra and to the south, Mahim. Mumbai has numerous creeks with close to 71 km2 of creeks and mangroves along its coastline. The Vasai Creek to the north and Thane Creek to the east separates Salsette Island from the mainland. Within the city the Malad (or Marve) Creek and the Gorai (or Manori) Creek inundate the suburban region. The Mahim Creek forms the border between the two districts. On the eastern front, a large creek—the Thane Creek—is present. There are also the Mahul Creek and the Mahim Creek.

Existing Landuse of Mumbai

As per the Landuse growth management report of MCGM, for year 1971 to 2001. The Built up area has more than doubled during theis periods from about 25% in

1971 to about 52% in 2001. Shift in land cover is primarly from coastal wetlands and forest/agricultural lands.

The industrial land about 3 to 4% has remained constatnt which may be atirbuted to the shift in the city's economy from manufacturing to the service sector. The area of land under airport and harbor has also remained constat, though it appears to be high in 1971 due to the inclusion of beach and RTZ land under this category of classification in the year.

Coastal wetlands have experienced substantial decerese from about 29% in 1991 to 19% in 1991, similarly the land under forests (reserved Sanjay Gandhi National Park) and agricultural / planations (Madh Gorai areas) has reduced from 32% in 1971 to 19% in 2001.

The converstion of wetlands to built-up areas occurred largly (upto 15% of total land) during 1971-1991 while during 1991 to 2001, substantial areas(upto 12% of the total land of foresr/plantations were converted to built-up ares of residential commercial uses.

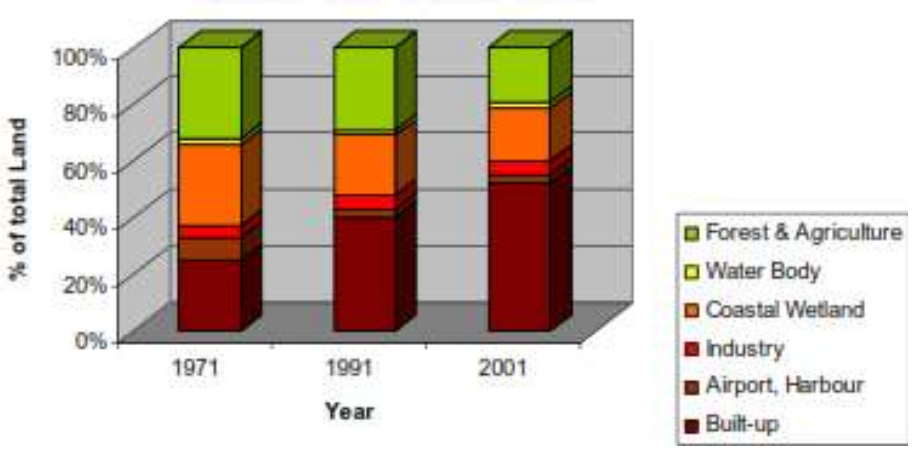


Figure 9 - Landuse Land Cover in Grater Mumbai 1971-2001

The following table 7 & Figure 10 presents the landuse/cover in Greater Mumbai area based on iterpretation from remotely sensed data and satellite images.

Table 5 Exisitng landuse/cover in Greater Mumbai 2001-03

Category	2001		2002		2003	
	Area (sq.km)	Percent	Area (sq.km)	Percent	Area (sq.km)	Percent
Residential area	63.92	13.93	64.20	13.55	64.30	13.54
Mixed Residential	108.57	23.61	109.04	23.01	110.00	23.15
Commercial Area	2.71	0.59	3.08	0.65	3.20	0.67
Industrial Area	28.69	6.25	29.50	6.23	29.50	6.21
Recreational	5.28	1.15	5.30	1.12	5.30	1.12
Public/Semi Public	1.43	0.31	1.43	0.30	1.53	0.32

Airport	5.70	1.24	5.70	1.20	5.70	1.20
Open Space	24.05	5.24	24.00	5.06	22.78	4.80
Open Scrub	57.47	12.52	56.28	11.88	55.20	11.62
National Park/ Sanctuary	34.54	7.53	34.54	7.29	34.54	7.27
Transportation	10.11	2.20	10.11	2.13	10.11	2.13
Harbor/Port	2.80	0.61	2.80	0.59	2.80	0.59
Mangrove	54.32	11.84	54.81	11.57	60.20	12.67
Vegetated mud flat	1.81	0.39	10.51	2.22	9.02	1.90
Tidal/mud flat	1.68	0.37	5.63	1.19	0.80	0.17
Marshy/Swampy	11.32	2.47	10.03	2.12	11.01	2.32
Barren rocky /rocky outcrop	2.33	0.51	2.32	0.49	2.32	0.49
Sandy area	3.09	0.67	3.72	0.79	3.50	0.74
Salt Pans	11.82	2.58	11.41	2.41	12.83	2.70
Stone Quarry	0.18	0.04	0.18	0.04	0.18	0.04
Aquatic Weed	7.63	1.66	7.99	1.69	7.98	1.68
Lake/Tank	8.70	1.90	9.32	1.97	9.31	1.96
Resticted areas/no data	10.96	2.39	11.96	2.52	12.96	2.73
Total	**458.91**	**100.00**	**473.87**	**100.00**	**475.06**	**100.00**
Source: Environmental Status Report 2004-05, MCGM						

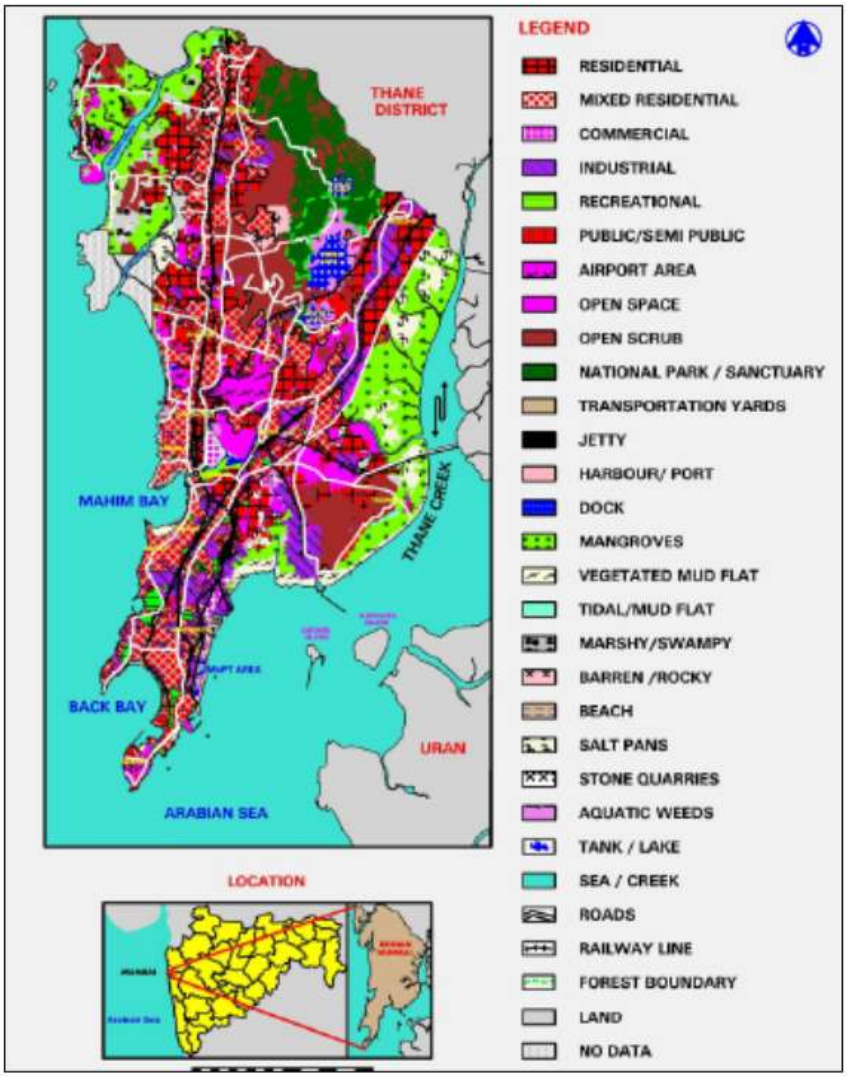


Figure 10 - Exisitng Landuse of Greater Mumbai 2003

TERRAIN AND LAND USE OF THE ALIGNMENT

Tunnel Alignment passes through Hilly terrain with elevations between 30 m (98 ft) and 480 m (1,570 ft) of Geology profile comprising Basalt and Breccia as per Geotechnical Investigation report. Tunnel and Approach Alignment level is matched with existing at grade road on both ends. The project involves Partial resettlement of R/R at Khidiapada and Film City side of Entry and Exit of Tunnel, which is beyond the SGNP boundary. The park encompasses two lakes, Vihar Lake and Tulsi Lake, which meet part of the city's water requirements. For this project ha agricultural/ barren land and 166.485 ha of forest land is proposed to be acquired.

4.3.1.3 Soil Quality (Geotechnical Investigation report)

The Soil Quality Monitoring Locations are given in Figure 8. The results of the monitoring are represented in Table 8 below.

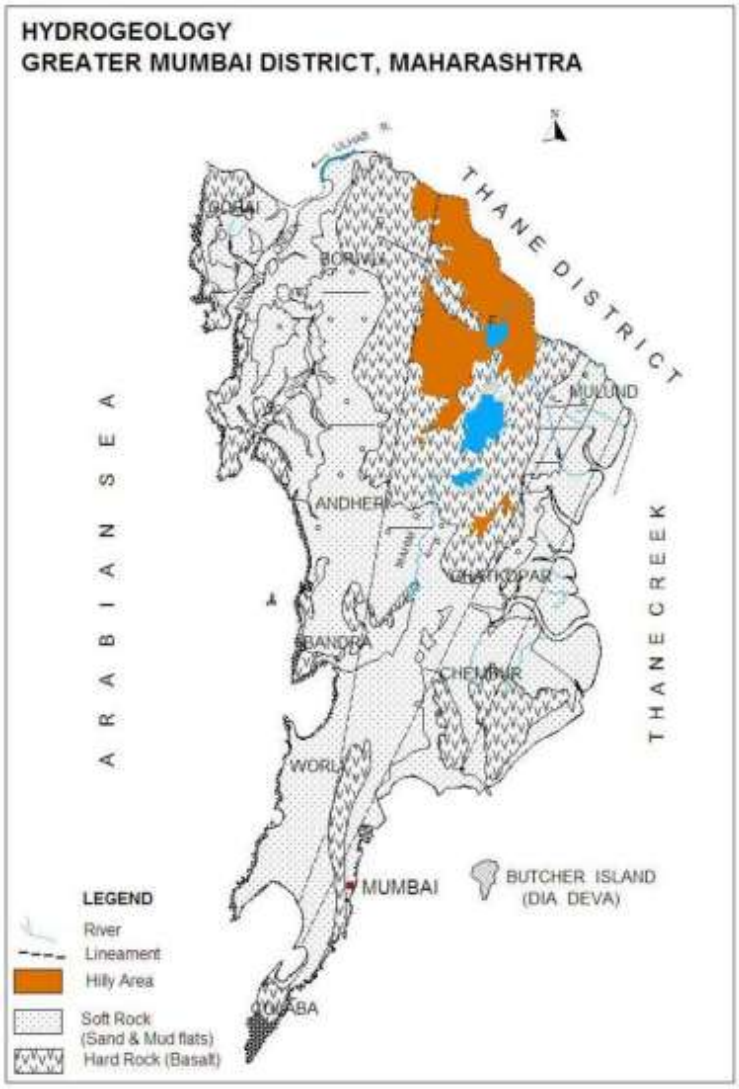
Table 8-Soil Quality Monitoring Report

Parameters	**Locations**	
	Thane	**Dahisar**
Conductivity	360	1670
SAR	1.16	1.25
Ca	0.88	0.57
Mg	0.18	0.05
Sodium	0.85	0.7
Potassium	0.27	0.11
Total Phosphorus	0.14	0.28
Total Nitrogen	0.02	0.09
Moisture Content	4.9	5.8

4.3.2 Water Environment

Hydrology of Mumbai

The entire district is underlain by basaltic lava flows of upper Cretaceous to lower Eocene age. The shallow Alluvium formation of Recent age also occurs as narrow stretch along the major rivers flowing in the area. A map depicting the hydrogeological features is shown in Figure 2.



Water Level Scenario

Central Ground Water Board periodically monitors 3 National Hydrograph Network Stations (NHNS) in the district, four times a year i.e. January, May (Premonsoon), August and November (Postmonsoon).

Depth to Water Level – Premonsoon (May-2011)

The premonsoon depth to water levels monitored during May 2011 ranges between 2.67 m bgl and 4.25 m bgl. The depth to water levels during premonsoon occurs in 2.0 to 5.0 m depth range.

Depth to Water Level – Postmonsoon (Nov.–2011)

The depth to water levels during postmonsoon (Nov. 2011) in major part of the district ranges between 2 and 5 m bgl. The Shallow water levels of < 2 m bgl areobserved in small area in southern part of the district.

Seasonal Water Level Fluctuation (May to Nov 2011)

Seasonal water level fluctuation between premonsoon and postmonsoon of 2011 have been computed and observed that seasonal it ranges from 0- 2.0m.

Water Level Trend (2001 – 2011)

Trend of water levels for premonsoon and postmonsoon periods for last ten years (1998-2007) have been computed for 3 NHNS. Analysis of long term water level trend data indicates rise of water levels i n t he range of 0.02 to 0.04 m/year during premonsoon and rise in the range of 0.02 to 0.05 m/year during postmonsoon. This marginal rise in water level may be due to leakages from water supply pipe lines.

Study area

Surface Water

Availability of Water from Surface Water Sources:

The entire Greater Mumbai is an urban area. All the major surface water reservoirs located in surrounding districts which are situated on major rivers, Lake and Dam are used for water supply. These rivers are the Vaitarna, the Ulhas, which originate in Konkan region, and other rivers are the Patalganga and the Amba. Even though these rivers do not flow through Greater Mumbai but their basins form the major source of surface water for Greater Mumbai as a whole for its domestic and industrial consumption. The Mumbai Hydrometric Area (MHA) under Department of Irrigation, Government of Maharashtra, comprises these four river basins. They have a total catchment area of 5756 Sq. Km. The total surface water potential of MHA is estimated to be 10439 Million Cubic Meter (MCM) at 75% dependabilityand 7869 MCM at 90% dependability.

Water supply to Mumbai city is dependent on six lakes viz Tulsi, Vihar, Tansa, Upper Vaiterna, Bhatsa and Mumbai III. The source wise water supply through lakes is given in Table 9 :

Table: 9 Water Supply Sources to Greater Mumbai City.

Sources	Yield (MLD)	Percent
Tulsi	18	0.54
Vihar	110	3.28
Tansa	417	12.45
Upper Vaitarana	1025	30.60
Bhatsa	1650	49.25
Mumbai III	150	4.48
Sub Total	**3350**	**100**
En-route Supply	**120**	**-3.58**
Total Water Supply	**3230**	**96.42**

Source: Ground Water Information Greater Mumbai District Maharashtra, Govt Of India Ministry Of Water Resources Central Ground Water Board

The surface water bodies within the study area of 10 km redii of the project are

- Vihar Lake
- Powai Lake
- Tulsi Lake
- Mithi River
- Thane Creek
- Malad Creek
- Raila Devi Lake
- Upvan Lake
- Talo Pali / Masunda Lake
- KAchrali Lake
- Siddheshwar Lake
- Brahmala Lake
- Jail Lake
- Ambe Ghosale Lake

4.3.2.2 Water Quality

4.3.2.2.a Surface water

The water surface samples were collected from eight numbers of locations and were analyzed for physic-chemical and biological parameters. The details of surface water sampling locations are represented in Table 27 & Figure 12. Standards for drinking water Drinking water standards (BIS: IS: 10500, 1991) aregiven in table the results of the monitoring are represented in Table 10

Table 10 : STANDARDS FOR DRINKING WATER DRINKING WATER STANDARDS
(BIS: IS: 10500, 1991)

Sr. No.	Parameters	Prescribed limits	
		Desirable	Permissible
1	Colour (Hazen Unit)	5	25
2	Odour	Essentially free	
3	Taste	Agreeable	
4	Turbidity (NTU)	5	10
5	pH	6.5	8.5
6	Hardness, As $Caco_{3,}$ mg/l	300	600
7	Iron, As Fe , mg/l	0.30	1.00
8	Chloride, As Cl , mg/l	250	1000
9	Residual Chlorine, only when Water is Chlorinated	0.20	-
10	Total Dissolved Solids, mg/l	500	2000
11	Calcium, As Ca, mg/l	75	200
12	Magnesium, As Mg, mg/l	30	100
13	Copper, As Cu, mg/l	0.05	1.50
14	Sulphate, As $So_{4,}$ mg/l	200	400
15	Nitrate, As N, mg/l	45	100
16	Fluoride, As F, mg/l	1.00	1.50
17	Cadmium, As Cd, mg/l	0.01	NR
18	Lead, As Pb, mg/l	0.05	NR
19	Zinc, as Zn , mg/l	5	15

20	Chromium, as Cr, mg/l	0.05	NR
21	Arsenic, as As, mg/l	0.05	NR
22	Antimony, As Sb, mg/l	0.006	NR
23	Aluminium, as Al, mg/l	0.030	0.200
24	Barium, as Ba, mg/l	2	NR
25	Beryllium, as Be, mg/l	Nil	0.0002
26	Cyanide, as Cn, mg/l	0.05	NR
27	Mercury, as Hg, mg/l	0.001	NR
28	Manganese, as Mn, mg/l	0.10	0.30
29	Selenium, as Se, mg/l	0.01	NR
30	Boron, as B, mg/l	1.00	5.00
31	Alkalinity, as $Caco_{3,}$ mg/l	200	600
32	Pesticides, ug/l	Nil	0.001
33	Phosphate, as $Po_{4,}$ mg/l	NG	
34	Sodium, as Na, mg/l	NG	
35	Potassium, as K, mg/l	NG	
36	Nickel, as Ni , mg/l	NG	
37	Pathogens A)Total Coliform No/dl B)Faecal Coliform No/dl	1	10
38	Radioactivity: -Beta Particles -Alpha Particles -Radium	0-4 millirem/year 0-15 picocuries/year 0-05 picocuries/year	

NR- No relaxation, NG - No guideline

Table 11-Surface water quality of the study area

Sr. No.	Parameters	Unit	Water Sample - Station – SW1- Goregaon	Water Sample - Station – SW2- Borivali	Water Sample - Station – SW3- Dahisar
1	Temperature	^{0}C	32	32	32
2	pH	-	6.93	7.36	6.78
3	Colour	Hazen	1	1	1
4	Turbidity	NTU	25.3	17	32.9
5	TSS	mg/l	120	60	132
6	Nitrite as NO_2	mg/l	<0.005	<0.005	<0.005
7	O & G	mg/l	<0.5	<0.5	<0.5
8	Total Hardness as $CaCO_3$	mg/l	193	126	218
9	Sulphate as SO_4	mg/l	27	24	26.4
10	Fluoride as F	mg/l	2.6	2.5	2.4
11	Nitrate as NO_3	mg/l	2.67	2.13	2.73
12	Chloride as Cl	mg/l	129	94	174

Conlusion

Surface water was collected from the nallahs flowing below the Western express highway. The water from the nallahs is already polluted due to the anthropogenic activities.

4.3.2.2.c Ground Water

Ground Water Quality

Mumbai CGWB is monitoring the ground water quality of the Mumbai district since the last four decades through its established monitoring wells. The objectives behind the monitoring are to develop an overall picture of the ground water quality of the district. During the year 2011, the Board has carried out the ground water quality monitoring of 4 monitoring wells. These wells mainly consist of the dug wells representing the shallow aquifer. The sampling of ground water from these wells was carried out in the month of May 2011 (pre-monsoon period). The water samples after collection were immediately subjected to the analysis of various parameters in the Regional Chemical Laboratory of the Board at Nagpur. The parameters analyzed, include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO) and Fluoride (F). The sample collection, preservation, storage, transportation and analysis were carried out as per the standard methods given in the manual of American Public Health Association for the Examination of Water and Wastewater (APHA, 1998). The ground water quality data thus generated was first checked for completeness and then the validation of data was carried out using standard checks. Subsequently, the interpretation of data was carried out to develop the overall picture of ground water quality in the district in the year 2011.

Suitability of Ground Water for Drinking Purpose

The suitability of ground water for drinking purpose is determined keeping in view the effects of various chemical constituents in water on the biological system of human being. Though many ions are very essential for the growth of human, but when present in excess, have an adverse effect on human body. The standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS-10500-91, Revised 2003) were used to decide the suitability of ground water. The classification of ground water samples was carried out based on the desirable and maximum permissible limits for the parameters viz., TH, NO and F prescribed in the standards and is given in **Table-5**.

The perusal of **Table-5** shows that the concentrations of all the parameters are the within the desirable limit of the BIS standards. It is also seen from the **Table-5** that the potability of ground water in the wells is not much affected. Overall, it can be concluded that the ground water quality in the wells monitored in the district is within the BIS Standard condition.

The quality of ground water of deeper aquifer is brackish to slightly saline in some localities such as Colaba, Dharavi, and Khar as observed from BMC data. This may be due to ingress of seawater. In view of this it is suggested that the bore wells drilled especially along the coastal areas should be pumped at the optimum discharge, so that it does not result in sea water ingress.

Ground water Quality of Study area

In order to access the quality of ground water the ground water samples were collected from the dugwell located within the agricultural land near the proposed alignment. Total 3 numbers of samples were collected and analyzed. The details of sampling locations are represented in Table & Figure 13. The results of the monitoring are given in Table 12.

Groundwater Monitoring Results

Table 12 - Location

Physical Parameters	**Results**			**Limits**
Sample	**Andheri GW1**	**Goregaon GW2**	**Dahisar GW3**	
Colour, Hazen	Colourless	Colourless	Colourless	5 (15) Max
Odour	Un objectionable	Un objectionable	Un objectionable	Un objectionable
Taste	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity, NTU	2.6	3.7	3.4	1 (5) Max
PH	7.79	7.86	7.82	6.5-8.5 Max
Total Hardness as Caco3, Mg/l	172	189	158	200 (600) Max
Chloride as Cl, Mg/l	118	137	128	250 (1000) Max
Total Iron as Fe, Mg/l	0.08	0.06	0.04	0.3 Max
Total Dissolved Solids, Mg/l	1247	1359	1179	500 (2000) Max
Sulphates as So4, Mg/l	134	156	116	200 (400) Max
Nitrates as No3, Mg/l	37.4	41.2	36.1	45 Max
Fluorides as F, Mg/l	2.36	2.81	2.49	1.0 (1.5) Max
Lead as Pb, Mg/l	BDL	BDL	BDL	0.01 Max

Copper as Cu,Mg/l	BDL	BDL	BDL	0.05 (1.5) Max
Manganese as Mn,Mg/l	BDL	BDL	BDL	0.1 (0.3) Max
Phenolic Compound as C6H5OH,Mg/l	BDL	BDL	BDL	0.001 (0.002) Max
Mercury as Hg,Mg/l	BDL	BDL	BDL	0.001 Max
Cadmium as Cd,Mg/l	BDL	BDL	BDL	0.01 Max
Selenium as Se, Mg/l	BDL	BDL	BDL	0.01 Max
Arsenic as As,Mg/l	BDL	BDL	BDL	0.05 Max
Cyanide as Cn,Mg/l	BDL	BDL	BDL	0.05 Max
Zinc as Zn, Mg/l	1.08	1.17	0.96	5 (15) Max
Detergent as MBAS, Mg/l	BDL	BDL	BDL	0.2 (1.0) Max
Chromium as Cr+6 ,Mg/l	BDL	BDL	BDL	0.05 Max
Total Alkalinity as Caco3,Mg/l	153.6	161.4	147.2	200 (600) Max
Aluminum as Al,Mg/l	BDL	BDL	BDL	0.03(2) Max
Boron as B, Mg/l	BDL	BDL	BDL	0.5(1) Max
Bacteriological Analysis Coliform,MPN/100Ml E-Coli/Ml	Nil Negative	Nil Negative	Nil Negative	10 Max Negative

Observation & Conclusion

Ground water samples were collected from three different locations around the alignment. Groundwater quality is quite good. However, turbidity at all the three locations is higher than its desirable limits with 3.7 max at malad but all are below the permissible limits. Total dissolved solids are within permissible

limits which varies from 1100 to 1400 Mg/l range but exceed than desirable limits. Fluorides are higher than permissible limits. All other parameters are well within the desirable limits.

4.3.3 Air Environment

4.3.3.1 Climate & Rainfall

4.3.3.2 Ambient Air Quality

The proposed alignment is passing underneath SGNP. Hence, air pollution is not an issue in section of roads where it is passing through tunnel and through rural area. Air pollution is observed in sections of road where it is passing through urban areas particularly due to existing traffic and industries. To establish baseline air quality 10 monitoring locations were identified along the proposed alignment.. The air quality monitoring has been carried out according to the 16th November, 2009 Notification. The results of the monitoring are represented in Table 13 below. The National Ambient Air Quality Standards 2009 are given as Table 14.

Table 13 - Ambient Air Quality of study area

Concentration of Air Pollutants			Sulphur Dioxide (SO2)	Oxides of Nitrogen (NOx)	Particulate Matter (PM_{10})	Particulate Matter ($PM_{2.5}$)	Ozone (O_3)	Lead (Pb)	Carbon Monoxide (CO)	Ammonia (NH_3)	Benzene (C_6H_6)	Benzo(a)pyrene (BaP)	Arsenic (As)	Nickel (Ni)
Units			$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	mg/m^3	$\mu g/m^3$	$\mu g/m^3$	ng/m^3	ng/m^3	ng/m^3
Standards			80	80	100	60	100	1.0	2	400	5	1	6	20
Locations	1	SGNP station 1	18.32	18.66	65.36	38.62	17.14	<0.01	<0.4	3.44	<2.1	<0.1	<0.42	<0.42
	2	SGNP station 2	19.45	19.01	68.32	39.41	19.32	<0.01	<0.4	4.01	<2.1	<0.1	<0.42	<0.42
	3	Near SGNP gate (Kireshwar temple)	23.61	24.98	95.83	56.25	24.62	<0.01	<0.4	5.34	<2.1	<0.1	<0.42	<0.42
	4	Western Express Highway	21.5	23.82	91.67	57.08	18.37	<0.01	<0.4	5.70	<2.1	<0.1	<0.42	<0.42
	5	Aarey Road	19.44	20.77	83.33	46.25	22.64	<0.01	<0.4	4.90	<2.1	<0.1	<0.42	<0.42
	6	Near Mhada Colony	19.27	20.57	70.83	39.67	19.36	<0.01	<0.4	4.66	<2.1	<0.1	<0.42	<0.42
	7	Near Lakshmi Udyog Nagar	20.14	20.37	74.21	48.31	20.21	<0.01	<0.4	3.91	<2.1	<0.1	<0.42	<0.42
	8	Kisan Nagar	20.54	21.54	84.14	48.21	21.36	<0.01	<0.4	5.24	<2.1	<0.1	<0.42	<0.42

	9	Amar Pada	21.21	22.74	75.64	42.78	20.78	<0.01	<0.4	4.25	<2.1	<0.1	<0.42	<0.42
	10	Near Salpa Devi Pada	22.21	23.41	82.45	47.19	22.85	<0.01	<0.4	5.64	<2.1	<0.1	<0.42	<0.42

Observation and Conclusion

The status of the ambient air quality in the study area was established by carrying out monitoring for air quality parameters like $PM_{2.5}$, PM_{10}, SO_2 and NO_X at 10 locations in the study area (08 = out side SGNP + 2= Inside SGNP). The data presented is average for 24 hours.

The maximum average values of $PM_{2.5}$ were 57.08µg/m^3 and minimum of 38.62 µg/m^3. The $PM_{2.5}$ values are below permissible level (60µg/m^3).

Also the PM_{10} values are below permissible level (100µg/m^3).The maximum 95.83µg/m^3 and a minimum 65.36µg/m^3 in the study area. The SOx and NOx values recorded at all the study areas is lower than the permissible limit. The range of SOx varied from 18.32µg/m^3 to 23.61µg/m^3 while NOx varied from 18.66µg/m^3 to 24.98 µg/m^3.

The average values of PM_{10} and PM $_{2.5}$ are due to the busy main road where lot of vehicular movement is observed outside SGNP. It include BEST buses, transportation vehicle, truck, tempo, rickshaws etc. even contributing NOx and SOx values also.

All the other parameters are well below the permissible limits. The MCGM project incorporates all the mitigation measures during the construction and operational phase thereby not deteriorating the existing air quality.


BANDRA
ANDHERI
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Actual site Images of AAQ Monitoring

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Table 14 6-National Ambient Air Quality Monitoring Standards (Cpcb)

Pollutant	Time Weighted Average	Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area (notified by Central Government
Sulphur Dioxide (SO_2), μgm^3	Annual 24 Hours**	50 80	20 80
Nitrogen Dioxide as NO_2, μgm^3	Annual 24 Hours**	40 80	30 80
Particulate Matter (size less than 10□m) or PM_{10} μgm^3	Annual 24 Hours**	60 100	60 100
Particulate Matter (size less than 2.5□m) or PM2.5 μgm^3	Annual * 24 Hours**	40 60	40 60
Ozone (O3) μgm^3	8 hours** 24 Hours**	100 180	100 180
Lead (Pb) μgm^3	Annual * 24 Hours**	0.50 1.0	0.50 1.0

Pollutant	**Time Weighted Average**	**Industrial, Residential, Rural & Other Area**	**Ecologically Sensitive Area (notified by Central Government**
Carbon Monoxide (CO) mg/m^3	8 Hours** 1 Hour**	02 04	02 04
Ammonia (NH_3) μgm^3	Annual * 24 Hours**	100 400	100 400
Benzene (C_6H_6) μgm^3	Annual *	05	05
Benzo (a) pyrene (BaP)particulate phase only nm^3	Annual *	01	01
Arsenic (AS) μgm^3	Annual *	06	06
Nickle (Ni) nm^3	Annual *	20	20

Source: Central Pollution Control Board Notification dated 18th November 2009

** Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week hourly at uniform intervals*

*** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

4.3.4 Noise Environment

Noise level monitoring was conducted on at 12 numbers of locations within study area (10= out side SGNP + 2= Inside SGNP) to understand the baseline noise levels. The results of the monitoring are represented in Table 15 below. The ambient noise standards as per Noise Rules 2000 are given as Table 16.

Table 15 -Noise Levels in study area

LOCATION		SGNP Station 1	SGNP Station 2	Near Metro Station Western Express Highway	Near Lodha Fiorenza (Highrise) next to Hub mall	St. Pius School near Goregaon Checknaka	Oberoi mall near GM Link road	Shahid Vijay Salaskar Udhyan	Near Aalap Hospital	Near Tata Power Residential Colony	Near SGNP (Kireshwar temple)	Near Vallabh Bhai Patel Vidhyalay	Near Jogeshwari-Vikhroli Link Road
Hourly L_{eq}	**6:00**	42.65	40.81	70.3	67.2	67.1	70.4	67.9	68.6	67.5	71.5	67.5	71.5
	7:00	43.25	44.1	73.7	69.2	68.9	74.8	68.1	69.1	67.9	72.9	68.0	73.9
	8:00	44.21	45.32	75.8	71.6	69.6	77.9	71.9	70.6	70.9	76.3	68.9	75.8
	9:00	44.71	44.92	75.2	71.8	71.2	77.4	72.8	70.7	72.1	77.2	70.7	78.1
	10:00	45.09	46.65	77.5	73.3	71.5	79.6	73.0	71.2	73.2	79.6	71.3	79.8
	11:00	45.31	45.98	78.9	73.9	73.1	81.7	73.6	73.4	73.9	81.2	72.9	80.1
	12:00	46.32	45.78	81.7	75.8	74.6	83.9	74.9	74.9	74.0	84.1	73.4	82.5
	13:00	45.67	46.31	80.3	75.1	74.9	79.2	75.7	75.5	74.9	82.3	74.8	80.6
	14:00	44.98	45.88	81.0	74.3	73.2	79.1	74.6	74.4	75.1	82.8	73.1	81.9

	15:00	43.28	44.91	78.1	74.1	74.1	80.5	73.1	75.9	73.1	81.9	74.6	80.6
	16:00	43.08	44.30	77.0	73.2	73.9	79.1	74.3	75.5	73.8	82.6	73.2	81.1
	17:00	43.36	43.46	73.5	71.1	74.3	80.3	75.1	76.1	75.0	82.7	74.1	82.3
	18:00	42.66	43.11	75.6	73.2	75.1	81.7	77.2	75.1	76.9	83.7	75.5	83.7
	19:00	43.22	43.02	76.1	74.4	73.2	82.0	76.4	74.3	76.5	84.0	73.3	82.0
	20:00	43.64	43.69	72.9	70.9	72.1	83.8	72.9	73.9	73.0	83.5	72.6	80.8
	21:00	43.87	44.02	73.2	70.1	70.2	79.1	73.2	71.1	73.5	81.4	70.0	79.1
	22:00	42.61	42.22	70.6	68.5	69.7	72.7	70.1	70.5	70.6	79.0	68.9	77.7
	23:00	41.16	41.89	67.3	67.9	67.2	69.4	69.3	69.8	69.5	77.3	67.3	69.6
	0:00	40.41	40.98	68.5	67.5	67.0	70.6	68.5	68.4	69.0	74.2	66.9	70.1
	1:00	40.51	40.23	67.0	67.1	65.2	69.1	67.4	65.1	68.1	72.0	65.3	69.5
	2:00	39.45	39.72	66.3	65.7	64.1	68.0	66.7	64.6	66.3	69.2	64.2	68.3
	3:00	38.98	40.1	67.4	64.8	64.2	69.3	65.3	64.2	66.0	68.3	64.0	68.9
	4:00	39.21	39.78	69.1	64.1	63.8	69.2	65.1	64.5	65.5	69.4	63.5	69.5
	5:00	42.87	42.21	68.8	65.3	65.7	69.7	65.9	65.1	64.2	71.1	64.9	69.5

Table 16 -Average Noise Levels in study area

All values are in dB(A)

Location Code	Location	Average Day	Average Night
NL 01	SGNP station 1	43.99	40.65
NL 02	SGNP station 2	44.38	40.89
NL 03	Near Vallabh Bhai Patel Vidhyalay	77.40	68.30
NL 04	Near Sanjay Gandhi National Park(Kireshwar temple)	73.11	69.52
NL 05	Near Tata Power Residential Colony	72.8	69.8
NL 06	Near Aalap Hospital	79.7	77.7
NL 07	Near Shahid Vijay Salaskar Udhyan	73.5	71.8
NL 08	Near Oberoi Mall	73.7	70.6
NL 09	Near St. Pius School	73.2	71.9
NL 10	Near Lodha Fiorenza	80.9	79.5
NL 11	Near Jogeshwari Vikhroli Link Road	72.5	69.9
NL 12	Near WEH Metro Station	80.0	77.7

Conclusion

The day time noise levels were observed to be ranging from 72.2 dB(A) to 80.9 dB(A). Highest noise level of 80.9 dBA was recorded at Near Lodha Fiorenza. The night time noise levels for the 10 locations ranged between 68.30 dB(A) to 79.5 dB(A) with highest value being recorded at at Near Lodha Fiorenza 79.5 dB(A). Lowest noise levels of 69.52dB(A) were recorded at Near Sanjay Gandhi National Park

The day time noise levels were observed within national park at station 1 and station 2 are 43.99 and 44.38 respectively as well as the night noise levels were observed within national park at station 1 and station 2 are 40.65 and 40.89 respectively. The assessment of the noise levels at the specified locations in the project area clearly

indicates that the existing environment in the project is in from potential causes of noise pollution.

Table 17 -Permissible Noise Level (CPCB Standards)

Area	Category of Area	Permissible Limit	
		Leq Day time	Leq Night time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note – 1 Day time is reckoned in between 6.a m and 10 p.m.
Note – 2 Nighttime is reckoned in between 10 p.m. and 6 p.m.

4.36 Ecology & Biodiversity

SGNP's biodiversity is greatly influenced by elements of the Sahyadri Hills to the east, and over the years, the changes brought about by human impact have brought in numerous species while having affected the survival of several others.

The most dominating habitat-type here is the Forest habitat. Of flowering plants alone, an estimated 1300 species exist in SGNP. Much of the forest here conforms to the southern mixed-deciduous forest, dominated by the Tectona- Albizzia- Terminalia- Holarrhena- Firmiana- Dalbergia- Garuga- Grewia- Adina- Ficus- Madhuca- Caraya- Butea and bamboo composition. This is most evident in the lowlands and up along the hill slopes.

On the upper slopes and in some of the secluded, narrow valleys and stream-beds, there are elements of semi-evergreen, and also some evergreen flora. The few small patches of true Asoca (Saraca asoca) are magical, dense and deep green always, so striking against the leaf-fall of the deciduous all around, the flash of a Blue mormon butterfly, the rambling whistling of a Malabar whistling-thrush, the fluty notes of a Brown-cheeked fulvetta.

Bamboo is quite widespread, especially in the lower areas, and the teak – bamboo forest community with its characteristic bird-life and general make-up is easily evident. The Karvi (Strobilanthes) is a widespread shrub that constitutes the understorey of vast stretches of the forest here; this abundant shrub, while visible all through, even as dry stalks during summer, is most flamboyant when it blooms once after every seven years. The rich purplish flowers, in their millions, erupt during late-July and early-October of the flowering years and attract much faunal life, from insects to birds, mammals and herpetofauna.

Biodiversity Report is attached as annexure 2

CHAPTER 05: ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

5.1 INTRODUCTION

This chapter deals with the assessment of project impacts on environment. Mitigative measures are suggested to minimize the likely negative impacts. An environmental management plan is also suggested along with an estimate of environmental costs as an input for evaluation the economic feasibility of the project.

The project will have impacts of varying magnitude on different environmental components. These impacts could be categorized as-
Primary impacts, i.e. impacts which occur as a direct result of the project activities
Secondary and tertiary impacts, i.e. impacts that occur as a result of primary impacts.

Impacts could occur during the construction phase as well as during the operational phase. Impacts during these phases are discussed separately in this chapter.

In view of the above study, we will sub divide the key environmental factors into 3 groups:-
In respect of existing status
In respect of construction phase and
In respect of operation phase

The type and magnitude of the impacts is entirely site specific. In order to logically analyze situation on a probable scale, following standards have been devised for the project under consideration to quantify the impact:

- 0 = No Impact
- 1 = Negligible
- 2 = Mild
- 3 = Moderate
- 4 = Significant
- 5 = Severe

Utility of the above noted qualitative scale is that it can be used as a method to approximately indicate varying order of caution while dealing with different stretches of the projectrefer Table 71.

Table 7-List of Possible Environment Impacts due to Proposed Project

Sr. No.	Attributes	Proposed Development Impact Marks	Mitigative measures
1	Project Location	3	Though, the tunel is proposed under SGNP area so their is minimal change in land use pattern
2	Soil Slippage	1	Proper soil engineering and foundation designs and structural protection
3	Rock Quarrying	1	Material will be obtained from authorized agencies
4	Air quality	2	Provision of adequate monitoring during operational phase, no changes in this line during construction period due to proper mitigative measures.
5	Water Quality	2	Treatment & Disposal
6	Noise Quality	1	Proper noise control management plan during construction period, noise barriers in terms of thick vegetation proposed.
7	Land use	2	The proposed alignment is underground hence there will be no or minimal change in land use
8	Reduction in built habitation of structures	1	Not Applicable
9	Displacement of population	1	Commercial and residential structures will be affected
10	Heritage / Archaeology	1	Alignment is passing approximately from 3 km from Canheri caves. No significant impact on the caves is predicted as the alignment will be underground.
11	Socio - economy	1	Better employment opportunities, improved economic status, increase in commercial and business opportunity.
12	Loss of Environmental Aesthetics	1	The proposed alignment is underground hence there will be no or minimal change in land use

Note: The total negative impact is only 17 where severe most could have been 5 x 12 = 60. So negative impact is 28% to positive impact is 72%. As the total positive impact of the project is 72%, therefore, it can be concluded that this is an environment friendly project.

5.2 IMPACT DURING CONSTRUCTION PHASE

The impact during construction will be localized and short term with permanent changes in use of surrounding land as compared to the current conditions. Impact will be primarily related to the civil works and less intensive impact is expected during erection of the equipment and trial operation. The details are given in the section below.

5.2.1 Land Environment

Land use changes

The implementation of the Project will cause minimum or no impact on landuse. As a part of project proceedings huge amount of solid waste will be generated in the form tunnel excavations, muck etc. Disposal of these excavated materials without any proper management may pose a problem to environment.

Movement of construction machinery, vehicles during construction especially haul roads will lead to physical disruption of soil.

5.2.1.1 Loss of agricultural land

No agricultural land will be affected during implementation of this project.

5.2.1.2 Solid Waste generation

- During construction phase there will be generation of solid waste due to construction activities as well as from labour camps. The waste generated will be stored will be temporarily stored at designated place.

- The quantity of debris generated during construction work due to demolision and excavation work

Mitigation Measures

Proper compensation will be provided for acquisition of agricultural land Excavated earth will be majorly used for site preparation and backfilling. Remaining excavated earth if any, will be disposed off at designated place. Indiscriminate dumping would be avoided. Other waste from construction will be disposed of safe. Indiscriminate settlement of workers should be avoided. The solid waste generated from labour camps will be disposed of in environmentally safe manner.

Debris Management

Waste generated from construction activity includes construction debris in the form of soil and rubble, excavated materials and waste from land clearing activities. The

excavated material generated at site used for refilling and soil used for landscaping and gardening if suitable.

The following measures will be taken in the proposed development to ensure the proper waste management plan during construction phase of the project.

- Segregation or sorting of waste at its source will be practiced to minimise the negative effects of the waste.
- The debris material shall be used for backfilling and leveling if suitable. Other waste will be disposed off through authorized contractor.

5.2.2 Soil Environment

Top-soil is a valuable resource for the vegetation. Accordingly, it shall be saved from proposed alignment that will be disturbed during road construction.

5.2.2.1 Loss of Topsoil

There will be minimum loss of topsoil as the alignment will be passing underground.

Excavations is an important activity, which have impact on land environment.

Mitigation Measure

Topsoil Conservation

Prior to excavation or filling top soil shall be removed.

The topsoil removed shall be stored in earmarked areas. The topsoil stock / heap are prone to erosion, hence proper erosion control measures shall be provided. Mixing of topsoil with excavated material shall be avoided. All the top soil will be preserved separately at earmarked site away from other construction materials at site so as to avoid mixing with other materials or contamination. The topsoil removed shall be reused in green area development.

Mitigation measures to avoid impacts on soil

To avoid loss of topsoil the ROW shall be marked in order to restrict movement of machineries and vehicles within the ROW only. Due to use of TBM the area to be excavated will be restricted only to the diameter of the TBM machine. To avoid contamination due to leakage or spillage the chemicals such as bitumen, oil, diesel, paint etc shall be stored in earmarked place with proper platform with catch pits etc.

5.2.3 Air Environment

The alignment will be passing under the ground of SGNP area. The ambient air quality in entire stretch of the alignment is within the limits of National Ambient Air Quality Standard 2009.

5.2.3.1 Dust Generation

During construction phase dust will generated due to –

- Construction activities such as excavation, drilling, cement mixing and stone crushing etc.
- Vehicular movement to and fro from construction site

- Loading and unloading of construction material like stone, aggregates, cement etc.
- High speed wind from stock piles of excavated material, cement, aggregates etc.

5.2.3.1 Gaseous Emissions

The air emission such as CO, NOx, SO2, PM can be generated due to operation of - Construction machineries and vehicles DG sets

Mitigation Measures

To control the air pollution during construction phase following measures will be adopted –

- During excavation, drilling process the site will be barricaded.
- Proper management of construction vehicle traffic.
- Construction material will be stored in designated place.
- For dust suppression water sprinkling will be carried out on roads used for movement of construction vehicles.
- Proper and regular maintenance of construction equipments.
- Wind barricades for storage area will be provided.
- Vehicle in good condition and with PUC certificate will be used during construction phase.
- Construction material will be transported through covered vehicles.
- DG set will be provided with a stack of adequate height.
- Workers will be provided with face mask to avoid inhalation of air pollutants.

5.2.4 Noise Environment

During construction works, temporary changes in acoustic characteristics of the environment and settlements will take place. This will be a result of concentration of working construction and machinery used. The noise level will increase temporarily in the close vicinity of various construction activities and vehicles and earthmoving equipment situated at the openings of the tunnel. The major sources of noise pollution during construction are movement of vehicles for transportation of construction material, waste materials to/from the construction site and the noise generating activity at the construction site itself.

The Contractor shall develop and adopt effective measures both in terms of management and the technologies applied to minimize noise levels, particularly near settlements.

During construction phase the high noise will be generated from following activities-

- Operation of construction machineries such as DG set excavators etc.
- Construction activities such as drilling, excavation, concrete mixing etc.
- Movement of heavy vehicles carrying construction material
- Loading and unloading of construction material

Mitigation Measures

- Barricading the construction site will helps in limit the noise within construction site
- Proper maintenance of machineries and vehicles
- Use of construction vehicles which are properly maintained and with PUC.
- Provision of mufflers, padding to reduce vibration, which will in turn reduce the noise
- Provision of ear muffs/plugs to the workers working near high noise generating machineries
- Proper maintenance of path used for construction vehicle to reduce smooth flow and reduce noise
- Carrying noise generating activities in day time only
- Transportation of construction material during non-peak hours

5.2.5 Water Environment

5.2.5.1 Water use

Water will be obtained from Minicipal Corporation of Mumbai.

Mitigation Measures

- Avoid wastes of water from existing sources.
- Rainwater harvesting structure should be constructed at the settlement area,
- The unlined roadside drains in stretches should be connected to water bodies like nallas/ rivers/ drains near the culverts and bridges

5.2.5.2 Wastewater generation

- Sewage Generation - The water used for domestic purpose by construction workers will generated.

Mitigation Measures

- The proponent will ensure use of ready mix concrete to maximum extent. Adequate quantity of water will be used for contruction purpose.
- Workers camp will be provided with mobile toilet. STP of adequate capacity will be provided to treat the sewage at rest areas.

5.2.5.3 Drainage

- Incidence of water stagnation due to obstruction of drainage on the on-set of monsoon. Incidence of accidents in case of blockage of drainage spouts that create water pool on road.
- Increase of flood duration due to obstruction of natural drainage in construction of high embankment. Blockage of existing drainage in courses of earth work. Construction of high embankment road may act as a barrier to the flow of runoff

water in absence of adequate cross drainage structures. Runoff water quantity may increase near the project area due to the paved surface of the subproject road.

Mitigation Measures

- Adequate drains facilities (longitudinal, median and chute drains) should be provided along the road to facilitate the stability of road carriageway. It prevents soil erosion also.
- Existing drainage and cross drainage structures should be duly augmented, wherever necessary, to accommodate high discharges to avoid flooding and formation of water pool. Adequate new drainage and cross drainage structures should be provided for smooth runoff to avoid water stagnation.
- Inspection of existing drainage spouts before the on-set of monsoon.
- Adequate facilities of drainage at construction site in order to avoid stagnant water pools that also lead to soil erosion and incidence of diseases.
- Standard erosion and sediment control measures will be used, and spill prevention best management practices will be followed during construction
- Debris accidentally introduced into streams will be promptly removed
- Streambanks, vegetation, and streambeds will be restored immediately after construction
- All other appropriate Best Management Practices will be followed

5.2.5.4 Water Resources Disturbance / Contamination

5.2.5.4.a Surface water Resources

In the project, surface water is not being affected as the alignment is underground tunnel.

- Mixing of surface runoff from construction site
- Dumping of solid waste from construction activities or labour camps
- Construction workers Washing of clothes or bathing near surface water bodies
- During monsoon runoff from construction site

5.2.5.4.b Ground water Resources

- Disposal of solid waste on land can form leachate and contaminate ground water by percolation
- Spill or leakage of oil or chemicals in storage area
- Spill or leakage of oil from construction machineries or vehicles
- Disposal of waste in the dugwell near the project site
- Percolation of spilled oil / chemicals in ground water during monsoon

Mitigation Measure

- To avoid contamination due to leakage or spillage the chemicals such as bitumen, oil, diesel, paint etc shall be stored in earmarked place with proper platform with catch pits etc.
- Solid waste generated from labour camp will collected in dustbins.

- The waste will be segregated.
- The recyclable waste will be give to authorized vendor and the other waste will be disposed off to SWM facility.
- Indiscriminate settlement of workers should be avoided.
- The solid waste generated from labour camps will be disposed of in environmentally safe manner.
- The storage area will be covered during monsoon.
- Construction vehicles will be properly maintained to avoid leakage.
- The impact of increase in turbidity and siltation can be mitigated by providing coffer dams and silt trap around the foundation site before start of piling/drilling works.

5.2.6 Socio-economic Environment

5.2.6.1 Loss of Livelihood

Proposed project will be an underground hence there will be minimum impact on loss livelihood only small area will be acquired at the end of the tunnels. Rehabilitation and Resettelement will be provided to the affected peoples.

5.2.6.2 Loss of Houses

There will be loss of few slums for which R&R will be worked out as per the rules and regulations.

Mitigation Measures

Land Acquisition is under process, after calculation of area of land, type of land and the market rate R & R plan will be designed. In lieu of monetary compensation it is contemplated under land Pooling Scheme that 25% / 30% developed NA Plot will be alloted to the concerned landlord/person affected, depending upon type of land to be aquired along with annuity for 10 years.

5.2.7 Ecology & Biodiversity

Refer annexure 2

Mitigation Measures

Refer annexure 2

5.3 IMPACTS DURING OPERATION PHASE

5.3.1 Soil Environment

No significant impacts are predicted other than those resulting from neglected protection works in erosion prone areas and failure to maintain re-vegetated areas along the alignment, and debris disposal sites.

Mitigation measures

- To prevent soil erosion along the embankment during operation phase, regular monitoring inspections should be undertaken to ensure that drainage, bridge approaches and re-vegetated areas are maintained and strengthened to prevent reoccurrence of soil erosion.
- To control erosion at slopes plantation of grasses and shrubs to restore the vegetative cover on denuded slope help in arresting the surface erosion.
- The slopes are initially demarcated, graded and uniformally levelled. Seeding of locally available grasses will be done. The rolls of the coir/jute netting are then spread out on the slope prepared as above. The edges of the netting are firmly anchored in the ground using iron nails. Due to the 'check dam' action, erosion of soil is prevented during rains and the danger of seeds and nutrients being washed away along with top soil is stopped. Thus, vegetation takes roots quickly and grows to cover the entire slope.

5.3.2 Air Environment

Operation stage impacts will not be as severe as the construction stage impacts and they will be confined generally to a ribbon development close to edge of the pavement. After the completion of road project, smoothened new pavement and widened roads reduces fugitive dust emissions. Reduction in the vehicular emissions is due to more uniform speed and less frequent acceleration and deceleration of vehicles. The levels of SO, NOx, CO and HC are likely to come down to a greater extent by the operating vehicles of new roads with extensive savings on consumption of fuel. However there may be localized impact with increase in number of vehicles (traffic) running on the road, adulterated fuel supply and poor maintenance of vehicle, which spreads down depending on wind direction and wind speeds. There will be continued enhancement of air pollution due to increase in number of vehicles on the improved roads over a period of design life.

Mitigation measures:

During operation stage of the project, vehicular emissions of pollutants (PM10, PM2.5, CO, SO2, NOx shall be monitored at approved representative locations against the National Standards. Regular monitoring of air quality along the project area should help to ensure air pollutants within permissible limits.

5.3.3 Noise Environment

The proposed alignment is passing underground. During operation phase noise levels will be slightly increased due to movement of vehicles and development of rest areas.

Mitigation Measures

- Noise barriers will be provided at sensitive receptors can reduce long-term noise levels associated with road project.
- Traffic management measures such as prohibition on use of horns and speed restrictions at noise sensitive areas reduce roadway noise levels.

- A regular monitoring programme should help to ensure the control of noise pollution under prescribed limits.

5.3.4 Water Environment

5.3.4.1 Drainage

Hydrology of the project area is least impacted during operation stage, if all design criterion are taken into consideration during design.

Mitigation measures

Regular maintenance of drains by removing the silt and dirt before the start of monsoon will prevent choking of drains.

5.3.4.2 Water Resources Disturbance / Contamination

5.3.4.2.a Surface water resources

Surface water contamination may result from storm water containing oil and grease, metals and other pollutants released by vehicles on the roadway. Storm water may also contain nutrients and herbicides used for management of vegetation in the right of way.

Proposed project also decrease the permeability of the paved and unpaved shoulder area by decreasing the ground water recharge and increasing in run off aftermaths of road construction. Surface runoff also increases due to paved impervious surface of main carriageway.

The accidental spills of oils, fuels and other hazardous chemicals on the roads during operational phase will pollute nearby water courses of the area.

Mitigation measures

During operation stage, regular cleaning of chocked / blocked or damaged drainage provision are necessary to avoid operational impact.

Monitoring of water quality to comply with Water (Prevention and Control of Pollution) Act will have better control over the quality maintenance.

5.3.4.2.b Ground water resource

No significant impact on ground water during operation phase.

Mitigation measures

The design of the alignment will be planned such that no aquifer will be affected due to the tunnels.

5.3.5 Socio-Economic Environment

The proposed project can be viewed as a time saving tool for the Mumbai city, which will bring substantial social and economic development in the region. The social benefits arising due to the project will be triggered off due to improved (quick) accessibility to various services. The possible direct and indirect positive impacts are listed below.

- The immediate benefits of road construction and improvement will come in the form of direct employment opportunities for the roadside communities and

specially those who are engaged as wage labourers, petty contractors and suppliers of raw materials.

- Improved road network will reduce traffic and pollution caused by it;
- Essential and emergency services can be availed fast like schools, health centre, public distribution system etc.

5.3.6 Ecology & Biodiversity

Refer Annexure 2

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES
CONSTRUCTION PHASE

Sr. No.	Environmental Parameters	Impact Attributes	Degree of Impacts	Mitigation Measures	Implementing Organization
1	Physiography	Disturbance in relief feature	Mild	Will be achieved by systematic planning and designing of the project activities	Promoter through prospective contractor
2	Land resources	Change in land use	Mild	Will be achieved by systematic planning and implementation	Promoter through prospective contractor
3	Human resources	No adverse impact	Negligible	Will be achieved by systematic planning and resources	Promoter through prospective contractor
4	Ecology	Ecological resources – Flora & Fauna	Mild	4.7 km Alignment will be passing under the Sanjay Gandhi National Park. As the proposed alignment is underground the impact to the ecology will be minimum	Promoter through prospective contractor
5	Environmental aesthetics values	Removal of trees & green strips along the road have impacts on landscape & aesthetic values of the area	Moderate	Loss of vegetation will be kept minimum as far as possible during site clearance.	Promoter through prospective contractor
6	Utility &	Removal of utility line like	Negligible	Shifting and elevation of utility lines will	Promoter, MSEB,

Sr. No.	Environmental Parameters	Impact Attributes	Degree of Impacts	Mitigation Measures	Implementing Organization
	infrastructural facilities	electrical poles, telephone poles, transformer, HT & LT lines		be done in consultation with concerned Government Organisations.	telecommunication dept. & line dept. of GoM.
7	Sub-surface hydrology	There are dugwells within the proposed alignment	Negligible	Whenever possible, care is taken to avoid its relocation by judicious engineering road design.	Promoter through prospective contractor
8	Religious places	--	--	--	--
9	Geology	Not much affected	Negligible	Systematic planning and implementation	Promoter through prospective contractor
10	Air quality	Short term deterioration of air quality due to generation of fugitive dust.	Moderate	➢ Trucks carrying soil sand stone, will be covered to avoid spilling ➢ Fugitive dust sources will be sprayed with water to suppress dust. ➢ Emissions from vehicles & machinery will be checked regularly & maintained properly to confirm to National and State Emission Standards	Promoter through Prospective Contractor (PC)

Sr. No.	Environmental Parameters	Impact Attributes	Degree of Impacts	Mitigation Measures	Implementing Organization
11	Noise level	Increased noise levels due to project activities	Mild	➢ All the equipments will be duly lubricated, maintained in good working condition to minimize noise levels. ➢ Stationary construction equipments will be placed as far as possible from dense habitation. ➢ Provision of protection devices (ear plugs) to be provided to the workers operating in the vicinity of high noise generating machineries.	Promoter through Prospective Contractor (PC)
12	Ecological resources – Flora & Fauna	Refer Annexure 2	Moderate	Proper care will be taken to maintain eco-balance	Promoter through Prospective Contractor (PC)
13	Land use	There will be change in land use	Mild	Proper management planning will be achieved.	Promoter through Prospective Contractor (PC)
14	Accident hazards and safety	Short term impacts from road accidents	Mild	Proper maintenance of the machinery.	Promoter through prospective contractor (PC)

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES
OPERATION PHASE

Sr. No.	Project Related Issues	Actions to be Taken	Responsible Organisation
1	Prevention of Road side Squatters or indirect Urban Sprawls	➢ Involve land use planning agencies like the Revenue Department at all levels during operation stage. ➢ Plan and control development activity. ➢ Removal, cleaning of squatter and temporary hutments of construction workers once construction activities has been completed.	P & C in consultation local body
2	Road Safety and Traffic Management	➢ Adequate number of proper & legible signs will be installed along the road. ➢ Prepare and administer a monitoring system on road/ accidents.	P & C in consultation with Traffic Police
3	Air Quality	➢ Monitor periodically ambient air quality at selected sites. ➢ Confinement and absorption of the pollutants at source by creating vegetation along the length. ➢ Enforcing different control measures to check pollution (e.g. catalytic converters, unleaded petrol, proper serving etc.)	P & C in consultation with MPCB
4	Noise level	➢ Monitor periodically ambient noise level at selected sites. ➢ Thick vegetation along the road for attunation of noise ➢ Provision of noise wherever is required	P & C in consultation with MPCB
5	Water Quality	➢ Monitor periodically water quality for establishing the change of water quality, if any, and assessing its potentiality of surviving aquatic flora and fauna and for irrigation use.	P & C and MPCB

6	Soil Characteristics	➢ Periodic monitoring of soil quality at specified distance for assessing contamination by vehicular emissions. ➢ Checking the overflow of spillage from the carriageway by promoting growth of vegetation cover along the road shoulders and preventing overflow to green belt.	P & C in consultation with authorities.
7	Maintenance of Avenue trees	➢ Plantation will be undertaken by the concession company on an aggressive note along the opening of the tunnel. ➢ Employment of local population for maintenance avenue plantation.	P & C in consultation with authorities and State forest Department
8	Human Health and Safety	➢ Vulnerable stretches, which are prone to accidents, will be identified. ➢ Adopt Safety measures and other control measure for regulating traffic in such areas by: o Installing proper road signs, marking along the whole stretch of the tolled highway in the form of cautioning, informatory and mandatory signs of gantry mounted overhead sizes. o Installing precautionary roads signs for controlling vehicle a speed in urban areas and curve stretches.	P & C in consultation with authorities.

CHAPTER 06: ENVIRONMENTAL MONITORING PROGRAMME

6.1 GENERAL

Monitoring is an essential component for sustainability of any developmental project. It is an integral part of any environmental assessment process. Any development project introduces complex inter-relationships in the project area between people, various natural resources, biota and the many developing Forces. Thus, a new environment is created. It is very difficult to predict with complete certainty the exact post-project environmental scenario; hence, monitoring of critical parameters is essential in the post-project phase.

Monitoring of environmental indicators signal potential problems and facilitate timely prompt implementation of effective remedial measures. It will also allow for validation of the assumptions and assessments made in the present study. Monitoring becomes essential to ensure that the mitigation measures planned for environmental protection function effectively during the entire period of projects Operation. The data so generated also serves as a data bank for prediction of post-project scenarios in similar projects.

6.2 PERFORMANCE INDICATORS

The physical, biological and social components, which are significant in affecting the environment at critical locations, have been suggested as Performance Indicators. The following specific environmental parameters can be qualitatively measured and compared over a period of time and therefore selected as Performance Indicators for monitoring due to their regulatory importance and the availability of standardized procedures and relevant expertise.

- Air quality with respect to PM10, PM2.5, NOx, SO2 and CO at selected locations.
- Water quality with reference to BOD, COD, suspended solids, turbidity, alkalinity, oil and grease at selected water bodies.
- Noise level at sensitive locations (institutions, hospitals, religious places)

6.2.1 Ambient Air Quality (AAQ) Monitoring

The air quality is recommended for monitoring through an approved agency in the process of ToR. The monitoring of air sampling should be conducted at the location of Crusher plant, Hot Mix Plant, Stockyards Batching plant, Haul roads. In addition to these, air quality should also be monitored near the storage sites having aggregates, sands etc. The parameters recommended for monitoring during construction are:

- Particulate Matter,
- PM10,
- PM2.5
- Sulphur Dioxide,
- Oxides of Nitrogen, and
- Carbon monoxides,

6.2.2 Water Quality

Water quality should be monitored monthly till completion of construction after that the monitoring should be carried-out at quarterly basis, to cover seasonal variations, by any recognized agency. Water quality shall be analyzed by applying the standard technique.

6.2.3 Ambient Noise Monitoring

The monitoring of noise sampling should be conducted near noise generating machineries such as crusher plant, DG set and near noise generating construction activities etc. In addition to these, noise quality should also be monitored near the peripheral area of the Alighnment and sensitive sites and residential areas exist within 2km radius of project road.

6.2 ENVIRONMENTAL MONITORING

6.2.2 Monitoring During Construction and OperationPhase

During construction and Operation phase regular monitoring of various environmental parameters i.e. Air, Water, and Noise etc. will be carried in order to keep check on the levels of pollution due to the project related activities. The details of monitoring plan during construction and Operation phase are given in Table 74 below:

Table 8-Environmental Monitoring Programme

Component	Parameters	Monitoring			Institutional responsibility
		Location (Chainage)	Frequency	Duration	Implementation
Construction Phase					
Air	PM10, PM2.5, SO2, NOx, CO	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season for 3years	Continuous 24 hours	Contractor and MCGM
Noise	Noise levels on dB (A) scale	At 8 locations	Twice a week for 2 weeks in each location in every season for 3years	Continuous 24 hours	Contractor and MCGM
Surface Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 8 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Ground Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 3 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Soil	Monitoring of Pb, oil and grease	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons for 3years	-	Contractor and MCGM
Operation Phase					
Air	PM10, PM2.5, SO2, NOx, CO	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season for a year	Continuous 24 hours	Contractor and MCGM

Component	Parameters	Monitoring			Institutional responsibility
		Location (Chainage)	Frequency	Duration	Implementation
Noise	Noise levels on dB (A) scale	At 8 locations	Twice a week for 2 weeks in each location in every season for a year	Continuous 24 hours	Contractor and MCGM
Surface Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 8 locations	Twice a week for 2 weeks in each location in every season for a year	-	Contractor and MCGM
Ground Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 3 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Soil	Monitoring of Pb, oil and grease	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons for 1years	-	Contractor and MCGM

6.2.3 Cost Estimation of Environmental Monitoring Programme

Component	Quantity	Unit Rate(Rs)	Total Cost (Rs)
Construction Phase			
Air	At 8 locations for 3 seasons in a year for 3 years (24samples in one season at one location. 72 samples in 3 seasons at one location. 216 samples in 3 years at one location. So 4320 samples at 20 locations in 3years.	15000/ sample	64800000
Noise	At 8 locations for 3 seasons in a year for 3 years (24samples in one season at one location. 72 samples in 3 seasons at one location. 216 samples in 3 years at one location. So 10800 samples at 50 locations in 3years.	4000/ sample	43200000
Surface Water	At 08 locations for 3 seasons in a year for 3 years (24samples in one season at one location. 72 samples in 3 seasons at one location. 216 samples in 3 years at one location. So 1728 samples at 8 locations in 3years.	12000/ sample	20736000
Ground Water	At 3 locations for 3 seasons in a year for 3 years (9 samples in one season at one location. 27 samples in 3 seasons at one location. 81 samples in 3 years at one location. So 81 samples at 3 locations in 3years.	12000/ sample	972000
Soil	At 2 locations for 3 seasons in a year for 3 years (6 samples in one season at one location. 18 samples in 3 seasons at one location. 54 samples in 3 years at one location. So 54 samples at 2 locations in 3years.	8000/ sample	432000
Sub- Total of Construction Phase (A)			**130140000**
Operation Phase			
Air	At 8 locations for 3 seasons in a year for 3 years (24samples in one season at one location. 72 samples in 3 seasons at one location. 216 samples in 3 years at one location. So 4320 samples at 20 locations in 3years.	15000/ sample	64800000
Noise	At 8 locations for 3 seasons in a year for 3 years (24samples in one season at one location. 72 samples in 3 seasons at one location. 216 samples in 3 years at one location. So 10800 samples at 50 locations in 3years.	4000/ sample	43200000
Surface	At 08 locations for 3 seasons in a year for 3 years	12000/	20736000

Water	(24samples in one season at one location. 72 samples in 3 seasons at one location. 216 samples in 3 years at one location. So 1728 samples at 8 locations in 3years.	sample	
Ground Water	At 3 locations for 3 seasons in a year for 3 years (9 samples in one season at one location. 27 samples in 3 seasons at one location. 81 samples in 3 years at one location. So 81 samples at 3 locations in 3years.	12000/ sample	972000
Soil	At 2 locations for 3 seasons in a year for 3 years (6 samples in one season at one location. 18 samples in 3 seasons at one location. 54 samples in 3 years at one location. So 54 samples at 2 locations in 3years.	8000/ sample	432000
Sub- Total of Operation Phase (B)			**130140000**
Total Environmental Monitoring Cost (A+B)			**260280000**

CHAPTER 07: ADDITIONAL STUDIES – DISASTER MANAGEMENT PLAN AND PUBLIC CONSULTATION

7.1 GENERAL

The Disaster Management is aimed to ensure safety of life, to protect environment, to safeguard installation and rescue operations in order of priorities. The objective of a Disaster management plan is to localize a Disaster and contain its effect to the greatest extent so as to minimize its impact on life, environment and property. Response to Disaster, in the absence of a well-defined plan, would be arbitrary, leading to overemphasis of actions of some actions and absence of other critical actions. A formal plan for managing Disaster is, therefore, necessary.

The purpose of the disaster management plan is to identify potential probable accidents/ emergency situations, establish and maintain procedures to address or prevent such situations, as well as to test the effectiveness/ review/ revise such procedures periodically. Generally the most of the accidents will be confined within the construction camp boundaries during construction phase and within the RoW of Highways during operation phase. This section of the report presents an outline of disaster management plan for the proposed GMLR.

7.2 RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

Provision and plan for risks has been made at various stages. The risk may be due to accident, Vehicles crossing barriers of road, fire, sabotage, earthquake, spillage of oil and chemicals on the road. This would, depending upon the type and intensity, involve disasters in terms of loss of life and damage to the road apart from disruption of traffic. Therefore to avoid and minimize this, disaster and emergency management plays a very important role.

7.2.1 Objective of Disaster Management Plan

The purpose of the DMP (Disaster Management Plan) is to identify the roles, responsibilities, and tasks/functions to be performed in all disaster recovery operations. Thus objective is -

- To increase awareness among of officials of the project on the issues involved in disaster recovery,
- To provide explanations of roles and responsibilities and
- To provide guidelines for disaster recovery operations.
- To localize the emergency and, if possible eliminate it; and
- To minimize the effects of the accidents on people and property.

Elimination will require prompt action by operators and works emergency staff using, for example, fire-fighting equipment, emergency due to collision and submergence etc. Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

7.2.2 Risk Analysis

Risk may be defined as the potential realization of unwanted consequences of an event (i.e. the product of the probability of an event and the consequences of the event). Both the probability of occurrence of an event and the magnitude of its consequences are thus involved. Acceptance criteria can be established either in the form of a predefined set of "Risk Acceptance Criteria" or in the form of "Optimum cost criteria".

The Risk acceptance criteria are normally imposed by the authorities to reflect the willingness of people and society to accept risks. Optimum cost criteria are Acceptance Criteria based on cost effectiveness analysis comparing the cost of the road strengthening and protection measures against the benefits of risk reduction. The analysis should take into account consequence of collision, such as

- Damage to road
- Damage to the users of the road
- Inconvenience cost of society and business
- Social losses
- Damages to the environment

The risk acceptance criteria are intended to cover the aggregate probability of accident due to several types of causes such as fire and explosion. For this project it is recommended that specific evaluation should be carried out for:

- Importance of the road connection to the public and society, to business and industry, to the national defense etc.
- Fatality risk in the case of high traffic volume
- Cost effectiveness of improving the safety for the road.

7.2.2.1 Fatality Acceptance Criteria

The risk categories are

- Individual fatality risk
- Societal risk (i.e. number of fatalities in an accident and the number of events per year)
- To achieve low fatality risk
- Ensure a low probability of bride disruption
- Introduce bridge use warning systems on the bridge
- Build deflective type cofferdam systems in forms which would not disrupt the navigational channels.

7.2.2.2 Optimum and acceptance criteria

a) Damage to the expressway – direction consequences to the expressway owner are:

- Cost of the salvaging the wrecked part of the road
- Cost of repair/replacement of the road

- Loss of revenue during repair/replacement of the road
- Additional costs of repair/replacement due to more strict requirements of the Authorities after the accident

7.2.2.3 Damage to the users of the expressway

- Injuries and loss of lives – cost values for fatalities
- Damage to vehicles and goods

7.2.2.4 Damage to vehicles

Direct consequences to the vehicle owner are:

- Loss of lives
- Cost of salvaging the vehicle
- Cost of repair/replacement of the vehicle
- Loss of income during the period or repair
- Damage to goods carried on the vehicle
- Claims for compensation form road owner and users.
- Increased insurance costs

7.2.2.5 Inconvenience costs to Society and Business

Road and rail inconvenience costs, strategic importance of the road,

- Alternative routes available.
- Traffic interruption cost – traffic congestion due accident
- Business and social loss

7.2.2.6 Damage to environment

- Cost of repair of the road
- Cost of physical restoration
- Ecological problems – immediate/long term.

7.3 POSSIBLE TYPE OF DISASTER

In roads & highways project, during construction and operation phases, disaster may occur due to the following:

- Floods
- Earthquake
- Biological Disaster or Epidemic of Human/ livestock/ crops
- Fire
- Explosion
- Fuel Oil spillage
- Electrocution
- Hazardous materials releases
- Transportation accidents
- Terrorism / War
- Some of the hazards will be dealt with Government procedure for Natural hazards and calamities.

7.4 EMERGENCY PREPAREDNESS PLAN

Emergency Preparedness Plan (EPP) should be prepared in advance to minimize the after effects of disaster. The basic approach towards preparedness for any major disaster or emergency situation will comprise of the following activities:

- Identification of potential disaster
- Establish an Disaster Management Committee & their role and responsibilities
- Linkage with other emergency plans
- Development of Disaster Response Plan
- Training of the personnel
- Response operations; should always cover these four phases –
- Discovery and alarm
- Evaluation, notification and plan invocation
- Containment and countermeasures
- Cleanup and disposal

7.4.1 Identification of Hazardous Area

During Construction Phase: Construction camps of contractors where fuel oil and other hazardous materials are planned to be stored.

7.4.1.1 During Operation Phase

- Tankers / Vehicles carrying explosives and hazardous materials on Main Carriageway / Service Roads
- Refueling Stations at wayside amenities

7.5 ORGANIZATIONAL STRUCTURE

The Disaster Management Cell (DMC) will be the apex planning body and will play a major role in preparedness and mitigation of any disaster. The cell will have the following key functions:

- Preparation of comprehensive Disaster Management Plan.
- Setting up of Emergency Control Centre during emergency situations
- Coordination with District Disaster Control Room
- To supervise emergency response measures in case of any emergency
- Keep track of predictable natural hazard events such as floods, drought, fire and earthquakes etc.
- Periodic monitoring of Emergency Response Plans and the corresponding procedures of individual establishment
- Organize post-Disaster evaluation and update DMP accordingly
- Prepare reports and document on Disaster events of road section and surrounding areas and submit the same to District Control Room The documents shall include:
- Source & Cause of Disaster
- Description of the response efforts.

- Recommendation for preventive & mitigation measures.
- Plan for upgrading emergency preparedness and response plan

The Disaster Management Cell will have the following departments/ teams:

7.5.1 Disaster Tracking Unit

The primary function of this unit shall be to keep track of predictable natural hazards such as floods, drought, fire and earthquakes, etc. The unit shall continuously coordinate with the Regional Meteorological Centre (RMC) and Indian Meteorological Department (IMD), in order to monitor disaster warnings and weather conditions in the region. On account of any extreme event predictions, the unit shall communicate the same to the DMC which will issue warnings in the entire Investment Region.

7.5.2 Disaster/ Emergency Response Team

The Disaster/ Emergency Response Team shall perform the following functions:

- Advise the DMC as to whether the declaration of an emergency is recommended;
- Advise the DMC on the need to designate all or part of road section as an emergency area;
- Appoint an Emergency Control Centre;
- Determine if the location and composition of the Emergency Control Centre are appropriate;
- The Emergency Response Team shall form an Emergency Control Centre in case of any emergency situations. The Team shall coordinate with other agencies such as:
- Fire Brigade
- Police Department
- Hospitals / Ambulance
- Technical Departments such as Factory Inspectorate, Pollution Control Board etc
- Local Authorities/ District Administration

7.5.3 Training Centre

The training centre shall be responsible for the following activities:

- Dissemination of information about the Comprehensive Disaster Management Plan
- Organize capacity building workshops for the personnel of Disaster Management Cell
- Organize training programs such as mock drills, emergency evacuation procedures in schools, offices, residential colonies and industrial areas
- Work in association with Residential Welfare Associations and Industrial Groups for creating awareness about the disaster preparedness.

Apart from the above teams, information dissemination between Disaster Control Room and Disaster Management Committee will be there.

7.5.4 Disaster Control Room

In order to control the disaster more effectively a Disaster Control Room will be established at construction camps of contractor. During operation phase, it will be established as far as possible at midway of road length. The planned facilities at Disaster Control Room are as follows:

7.5.4.1 During Construction Phase

- Layout of construction camp showing all areas specially oil storages, transfer locations, oil dispensers, etc.
- Alignment Map of Project roads
- Hazard identification chart, names of personnel working in each shift, assembly points at construction camp
- List of habitations and industrial installations and their population in the vicinity of construction camp in a radius of 3 km
- Mobile Telephone numbers of all key personnel
- External telephone connections
- Public address system
- Rechargeable and battery operated torch lights and invertors
- List of Medical Facilities available within 10 km of the construction camp
- Muster Roll of employees
- Note pads and ball pens to record message received and instructions to be passed through runners through designated persons
- The blow up copy of Layout plan showing areas where accident could occur
- Accident mock drill is to be made part of routine exercise

7.5.4.2 During Operation Phase

- List of all employees of concessionaire working in the project with telephone numbers
- Map showing Project roads and surroundings in a radius of 3.0 km
- List of medical Facilities in a radius of 10 km around 'Emergency Control Center'
- Public address system
- Rechargeable and battery operated torch lights and invertors
- Note /Pads and pens to record message received and instruction be passed through runners
- First Aid kits in 5-10 numbers
- One ambulance at each 'Emergency Control Centre'
- Tie up with the neighbouring hospitals for referring any accidental victims to the hospital
- Portable fire extinguishers carry to accidental site.
- Accidental drill is to be made part of routing exercise

7.5.5 Traffic Surveillance Monitoring and Control System

Traffic surveillance shall be carried on the by-pass road. The project has built in sophisticated state of the art traffic management and control system. Signals will be used for controlling traffic on reversible lanes during emergency such as accidents, fire etc. lane use signals consisting of red, amber and green lights for permitting or prohibiting the use of specific lanes or to alert the impeding prohibition of lane use will also be used. All road signs shall be of retro refectories type and made of high intensity grade sheets with encapsulated lens type reflective sheets.

Mainly air pollution is contributed by vehicular emission. It is necessary to establish vehicular emission check center, in order to estimate contribution of vehicular pollution load and to identify the polluting vehicles.

7.6 EMERGENCY RESPONSE

Effective command and control starts with a clear definition of the overall command and control structure, and description of the duties of key personnel with specific responsibilities for emergency response. The control of emergencies will consider the minimum number of persons required to provide an adequate response to emergencies.

- All emergencies occurring as a result of project activities shall be managed as per following order of priorities:
- Preservation of Life (self, team, community)
- Protection of the Environment
- Protection or Property/ assets
- Preservation of Evidence

7.7 ROLES & RESPONSIBILITIES

The roles and the responsibilities of various departments during emergency situations as defined in Section have been discussed in the following

7.7.1 Emergency Control Centre (ECC)

The emergency control centre shall be formulated in case of emergency situations by the Disaster Management Committee. The ECC shall be chaired by the head of Regional Development Authority head and will have representatives from Police, Fire Department, Hospitals, Factory Inspectorate and District Administration. The ECC shall perform the following functions:

- Co-ordinate the acquisition, distribution and scheduling of various modes of transport (i.e. public transit, school buses, trains and trucks) for the purpose of transporting persons and/or supplies, as required;
- Determine if additional transport is required for evacuation or transport of persons and/or supplies;

- Discontinue utilities or services provided by public or private concerns without reference to any consumers in the region, or when continuation of such utilities or services constitutes a hazard to public safety within an emergency area;
- Disperse people not directly connected with the operations who by their presence are considered to be in danger or whose presence hinders in any way the efficient functioning of emergency operations;
- Authorize the evacuation of those buildings or sections within an emergency area which are themselves considered to be dangerous or in which the occupants are considered to be in danger from some other source;
- Authorize casualty collection and evacuation in support of emergency health care authorities;
- Coordinate with other departments such as Police, Fire Department etc.
- Arrange for services and equipment from local agencies not such as private contractors, volunteer agencies etc.;
- Arrange for accommodation and welfare, on a temporary basis, of any residents who are in need of assistance due to displacement as a result of the emergency;
- Arrange assistance from senior levels of Government as per requirements

The following information and equipment shall be available at ECC:

- Intercom, telephone
- P and T telephone
- Breathing apparatus
- Fire suit/ gas tight goggles/ gloves/ helmets
- Hand tools, wind direction/ velocities indications
- Public address megaphone, hand bell, telephone directories (internal, P and T)
- Emergency lamp/ torch light/ batteries
- Emergency shut-down procedures
- List of key personnel and list of Emergency Co-coordinators
- Duties of key personnel
- Address with telephone numbers and key personnel, emergency coordinator, essential employees.
- Important address and telephone numbers including Government agencies, neighboring industries and sources of help, outside experts, chemical fact sheets population details

7.7.2 Police Department

The Police Department shall perform the following actions:

- The overall responsibility of police shall be to maintain law and order during and post disaster situation in the context of disaster management.
- Prepare a departmental disaster response plan and Standard Operating Procedure in which roles and responsibilities are clearly defined. The plan and SOP shall be submitted to the DMC;
- Prepare a database of nodal person at State, District and Taluka level and share with DMC;

- Police personnel shall be trained in search and rescue (flood rescue, collapse structure, rope rescue, etc) during normal time and database of such trained personnel shall be shared with the DMC;
- Overall traffic management (access roads to disaster site, roads to be made one-way, to be blocked, alternate routes, etc) and patrolling
- Provide security in transit and relief camps, affected areas, hospitals and medical centers and identify areas to be cordoned off;
- Establish communication with the ECC, District Control Room and nearest Police station to the disasters site;
- Additional deployment of police, if required, to inquire into and record of deaths;
- Provide convoys for relief materials;
- A public information system to be activated for passing information related to injured, dead, missing persons, etc.
- Regularly conduct mock drill by simulating different disasters to check preparedness, coordination and scope of improvement and a report shall be submitted to the DMC;
- Assist DMC and ECC in evacuation of people from the vulnerable areas.

7.7.3 Fire Department

The Fire Department shall perform the following actions:

- The overall responsibility of fire department shall be to undertake the emergency fire evacuation procedures effectively and efficiently;
- Prepare a departmental disaster response plan and Standard Operating Procedure in which roles and responsibilities are clearly defined. The plan and SOP shall be submitted to the DMC
- Prepare a database of nodal person at State, District and Taluka level and share with DMC;
- Fire personnel shall be trained in fire evacuation procedures during normal time and database of such trained personnel shall be shared with the DMC;
- Establish communication with the ECC, District Control Room and nearest Fire station to the disasters site;
- Additional deployment of fire safety personnel, if required, to inquire into and record of deaths;
- Regularly conduct mock drill by simulating different disasters to check preparedness, coordination and scope of improvement and a report shall be submitted to the DMC;
- Assist DMC and ECC in evacuation of people from the vulnerable areas;

7.7.4 Health Department

The Health Department shall perform the following actions:

- The overall responsibility of health department is to undertake the emergency heath activities in the aftermath of disasters and take measures to check the outbreak of epidemic in the post disasters situation effectively and efficiently;

- Prepare a departmental Emergency Health Management Plan including, hospital specific plan shall also be prepared. Apart from plan, SOP shall be prepared which clearly delineates the roles and responsibilities;
- The plan shall cover mass casualty management, triage (prioritization of patients), trauma counseling, mobile team which may be deployed at sites, procedure for coordinating with private hospitals and availing its services, etc.
- A database of nodal officer at State, district and hospital specific shall be prepared for emergency health services and shared with the DMC;
- Periodic review of the stock emergency medicines and equipment required during the disasters;
- The epidemic surveillance and water quality monitoring shall be done at transit camps, relief camps, affected areas and feeding centers;
- The central warehouse shall be kept informed for dispatch of supplies likely to be needed, to hospitals, on an emergency priority basis;
- Establish communication with the ECC District Control Room, Police and the medical team at the disasters site;
- A public information system to be activated for passing information related to patients admitted at the hospital;
- Mock drill on mass casualty management at hospital level shall be organized twice in year. The mock drill shall check the activation and response time of emergency medical teams, coordination with other agencies, areas of improvement, etc. The report shall be submitted to the DMC;
- The medical officers and staffs shall be trained in triage (system for prioritization of patients).

7.8 EMERGENCY CONTROL PROCEDURE

7.8.1 For Natural Calamity

In the event of occurrence of natural calamity during the construction phase, all work will be suspended and all construction material will be shifted to the safer location. In order to minimize losses/ damages to pavement, incomplete CD structures during the heavy rains the inventory of material storage at site will be kept to a minimum during rainy period i.e. May to September. During the operation phase, in the event occurrence of Natural Calamity the concessionaire will stop traffic on the highway and will guide the traffic at time of closure for follow up of safer route. The traffic will be regulated right from receipt of warning. The emergency control centre will be in direct contact with the district administration for their advice for the steps taken for the traffic control and other assistance.

7.8.2 For Hazard

The onset of emergency will in all probability commences with a major fire or explosion and shall be detected by the member of staff on duty at construction camp/on Highways. If located by a staff member on duty, he (as per site emergency procedure of which he is adequately briefed) will go to the nearest fire alarm call

point, break glass and trigger off the fire alarms. He will also try to inform about location and nature of fire/ accident to the Site Main Controller on mobile phone.
In accordance with work emergency procedure, the following key activities will immediately take place to intercept and take control of emergency:

- The fire group will arrive at the site of incident with fire fighting controls
- Site Main Controller will commence his role from the Control Centre
- The First Aid Group will take care of injured
- Site Main Controller will be directing and deciding a wide range of desperate issues. In particular DMC has to decide and direct:
- Whether fire fighting and first aid groups require reinforcement of man power and facilities
- Whether the facility is to be shut down or more importantly kept running
- Respond to any large size complaints from outside public and to assess an offsite impact arising out of the onsite emergency.
- When the incident has eventually been brought under control as declared by the fire fighting group, the Site Main Controller shall visit himself personally for:
    - An assessment of total damage and prevailing conditions with particular attention to possibility of re escalation of emergency, which might of the time being, be under control.
    - Inspection of other facilities, which might have been affected by impact of incident.
    - Based on visit, Site Main Controller will finally declare and communicate termination of emergency and authorize step by step restoration of normal operation of the refuelling and storage facility. The fire siren will be sounded with all CLEAR SIGNAL.
    - During entire period of emergency the site will remain out of bounds to external visitors except:
        - External Fire Personnel;
        - External hospital ambulance staff;
        - Local Government;
        - Insurance authorities;

7.8.2.1 Alarm System to be followed during Disaster

Suitable alarms will be developed after establishment of construction camp/opening of Highways for traffic and these will be explained to each personnel working at the Highways. The alarm will also be displayed at office for the information of visitors.

7.8.2.2 Actions to be taken on Hearing the Warning Signal

On receiving the disaster message following actions will be taken:
Fire Fighting group, first aid group shall reach the ECC
Team members will remain ready in their respective sections for further instructions

7.8.3 For Petroleum Product Leakage

In the event of massive spillage of HSD/ Gasoline/ Kerosene/ Furnace oil the spilled quantity should be reclaimed from the storm drainage channels/ rain water harvesting pits. The traces of the products may be absorbed in sand or cotton rags. The spilled area at main carriageway/ service road should be thoroughly washed with water or any neutral solvent to avoid any slippage or skidding. All effect should be made that spilled oil does not enter surface water body.

7.8.4 Head-on Collision /Vehicle Accident on the road

The major risk involved in this type of Disaster fatal or high degree of injury. Early response will be in terms of well-equipped ambulance with paramedical team reaching on the site. This will help in rescue of passengers from the accident site and will be taken to the nearest hospital. If need so arises the patient can be taken to one of the major and super specialty hospital in the area.

7.8.5 Spillage and Leakages of Oil On the road

This Disaster can occur during a leak or spillages of oil or fuel carrying tankers met with an accident on the road. The various risks involved in these are danger of skidding of other vehicles due to spillages. Risk of catching fire depends upon the flash point of the material. The early response in this case will be stoppage of vehicular movement immediately by using communication system and towing the damaged vehicle in order to make traffic easier. It is important to carry out mopping operations to collect oil spilled on the road. The clean- up procedure is of immense importance in order to avoid further hazards and consequences.

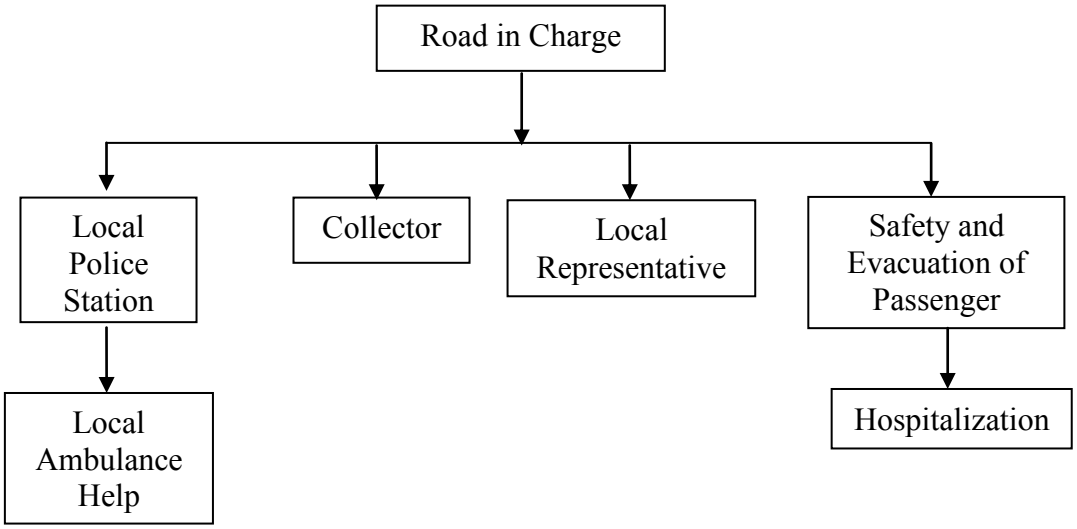

Figure 11-DMP for Accident Risk Scenario

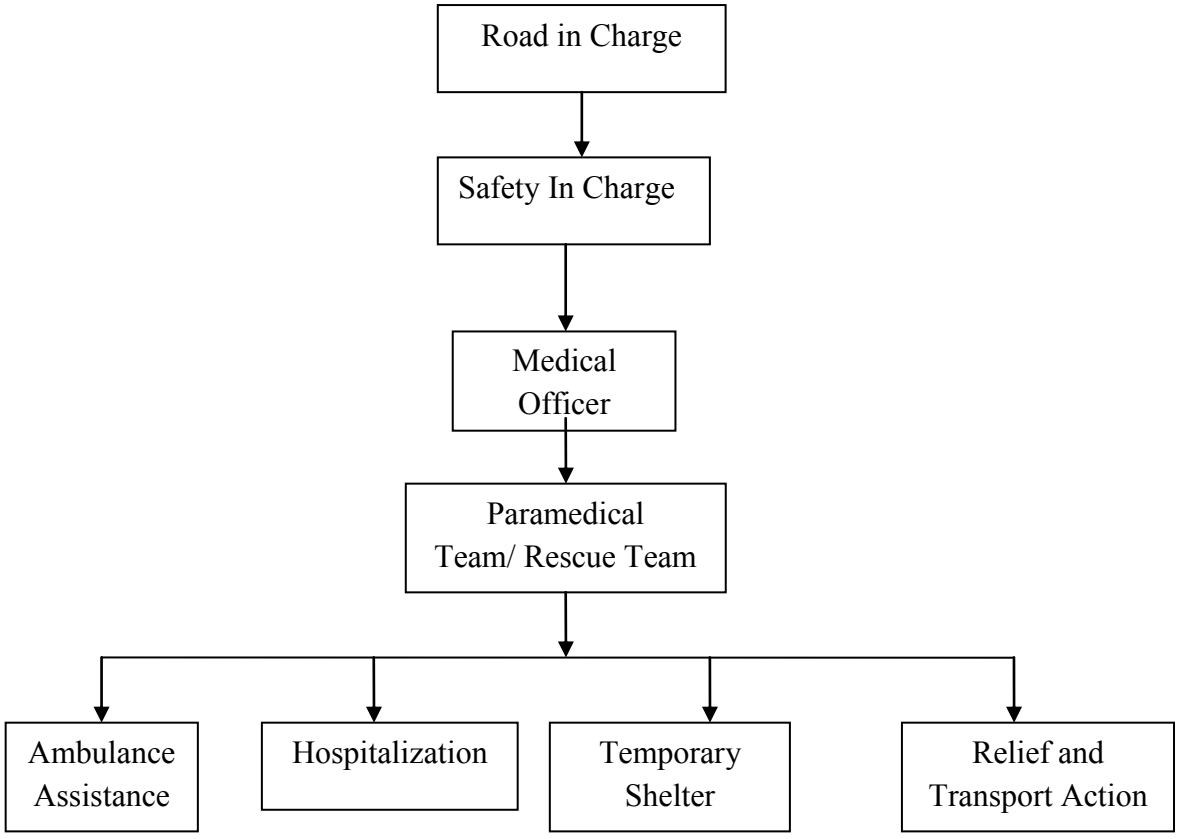

Figure 12-DMP for Medical Safety Scenario

7.9 Public Consultation

Public consultation will be carried out in Chairmanship of Collectors, MPCB, MCGM and Engineering Consultants Pedico. The public consultation details will be added to EIA after conducting the public consultation.

CHAPTER 08 PROJECT BENEFITS

8.1 INTRODUCTION

This chapter of the EIA underlines the benefits from the proposed GMLRproject. The benefit includes environmental as well as environmental benefits.

8.2 SALIENT FEATURES OF THE PROJECT CORRIDOR

Sr. No	Salient Feature	Details
1.	Project Stretch	Twin Tube Tunnel Road Project- 4.7Km (3+ 3 Lan,e) Missing Link of Existing Goregaon Mulund Link Road for connectivity of road from East to West corridor of Mumbai.
2.	Width of Road	4+4 lane at grade Tunnel -3+3 lanes
3	Land Use	The alignment will be underground in the 4.7 km section of SGNP
10	Road Safety	Appropriate safty measures will be used while implementation of project. Retro reflective road signage will be provided for better night visibility
12	Road User Facilities	Emergency telephones, Traffic Aid Posts, Medical Aid posts will be provided along the proposed project
13	Forest Land	The alignment will be underground in the 4.7 km section of SGNP
14	Cost of the project	Estimated cost of development of the project is Rs 2000 Crores approx

8.3 PROJECT BENEFITS

- The travel time will get reduced by almost one hour between Mulund and Goregaon
- Traffic congestion on Western Express Highway and the Link Roads will be substantially reduced
- Saving in Fuel Consumption to a substantial extent
- Cutting of about 2224 trees will be avoided

Win- win situation as Road Link gets established without disturbing SGNP, Aarey and the city's lakes

8.4 PROPOSED IMPROVEMENT

Proposed GMLR will be beneficial for rapid The underground tunnel is proposed on this alignment near film city in such a way that the tunnel passes underneath the Sanjay Gandhi national park area without disturbing the premise of SGNP in any

way whatsoever. The project also does not involve any land acquisition within Sanjay Gandhi National Park. As an underground Tunnel is proposed along this alignment, it can be ensured that there is minimum disturbance to flora and faunaand there is no adverse effect to the water supply system and the lakes situated in the area.

The exit point of the tunnel on Mulund side is located at Khindipada outside the SGNP premise and hence it will not involve any land acquisition in SGNP area. The alignment has been planned with minimum land acquisition beyond SGNP area and maximum benefit to local traffic and through traffic.

The following facilities are proposed be provided along the corridor:

- Emergency telephones @ every 5km
- Ambulance and Towing Facilities
- Quick Response Vehicle (QRV)

Wayside Amenities:

- Street Lighting
- Digitized Signage
- Light Cutters
- Junction Beautification
- Tunnel Lighting
- Ventilation facilities in tunnel

Information Technology includes:

- Traffic Surveillance and enforcement
- CCTV
- Optical Fiber Ducts (OFC) in median for multiple network
- Traffic Safety Measures

CHAPTER 09 - ENVIRONMENT MANAGEMENT PLAN

9.1 INTRODUCTION

Impact assessment helps in identifying potentially damaging aspects of a proposed project. Based on the findings of the impact assessment, Environment Management Plan is devised to minimize adverse impacts and enumerated various steps to be taken for improvement of the environment.

However due to no major adverse impact on the Air, Water, Land, Biological Environment due to the project, the Environment Management Plan shall not be very complicated and only regular Monitoring of ambient air quality, water quality, noise level monitoring and soil quality monitoring shall be carried out as per the requirements.

All persons working near the noise generation equipments shall use Personal Protective Equipment such as earplugs muffs and closely monitored for implementation. All workers should be made aware of adverse effect high noise levels through training program; this will ensure proper implementation of mitigation majors.

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. A project may have identified proper mitigation measures but without a management plan to execute it, the desired results may not be obtained. The present chapter on Environment Management Plan envisages proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities.

The following issues have been addressed in this EMP:

- Mitigation measures for abatement of the undesirable impacts caused during construction and operation stages
- Details of management plans
- Institutional set up for implementation of the EMP
- Post project environmental monitoring programme to be undertaken after commissioning of the project
- Expenditures for environmental protection measures.

The EMP is proactive in nature and should be upgraded if new facilities or modification of existing facilities, with environmental concerns, come up at a larger stage.

EMP included four major elements:

Commitment and policy: the project will strive to provide and implement the Environmental Management Plan that incorporates all issues related to air, land and water

Planning: this includes identification of environmental impacts, legal requirements, and setting environmental objectives. The various potential impacts are discussed under chapter 5

Implementation: this comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.

Measurement and Evaluation: this includes monitoring, corrective actions, and record keeping.

The EMP's that will be put into place consist of those during construction and operating stages of the project and includes the following elements:

- Hazardous and Solid Waste Management
- Air Pollution Control and Management
- Noise Control and Management
- Plantation, Landscaping and Land Management
- Occupational, Safety and Health Issues
- Best Management Practices
- Energy Conservation
- Environmental Monitoring
- Emergency Response Plans for Emergency Scenarios
- Environmental Management System

9.2 SUMMARY OF CRITICAL IMPACTS/ ISSUES

The major impacts due to different project activities and their mitigation measures have been identified in Chapter 5. These measures together constitute part of Environmental Management Plan (EMP). Environmental study carried out by the consultants has highlighted the following critical features of the project (Table 75).

Table 9-Critical Impacts / Issues

Sr. No	Issues	Description
1.	Ambient Air Quality	During construction air and noise pollution may increase and would require mitigation.
2.	Ambient Noise Level	In the operation stage air quality and noise levels are generally expected to improve. However, measures would be taken to contain pollution due to increased vehicular traffic near the project area.
3.	Ecology	No terrestrial or marine ecosystem is involved at present in and around the project
4.	Water Quality	During construction all the care will be taken to avoid any water bodies issues
5.	Land Use Pattern	Land use patter will remain same after project

		completion.

In the Environmental Management Plan (EMP), impact mitigation and monitoring requirements are specified and the institutional arrangements for implementation of the project identified. The EMP also includes the cost of implementing mitigation and monitoring requirements.

9.3 IDENTIFICATION OF IMPLEMENTING AUTHORITY

The responsibility for the implementation of the EMP will be with the Promoter and Contractor (P & C). An environmental management cell (EMC) will be established by the P & C for implementing the mitigative measures. To mobilize the appropriate expertise to design diverse type of mitigation measures. The P & C need to be collaborating with order institutions in the public and private sector viz. State forest Department, State Public Health Engineering Department, State Traffic Department, and State Police Department etc. The EMC will ensure timely implementation of various mitigative measures at different stages of the project i.e. during construction and operation stage and the completion of the project within scheduled time frame.

In addition, an Environmental Officer will be appointed by project authorities for management of the project with the objective of reviewing and assessing the progress made by the concession company in implementing the suggested mitigative measures.

9.4 IMPLEMENTATION OF RECOMMENDED MITIGATION MEASURES

Different activities to be addressed in the management plan have been considered and discussed in detail in Table 76. This table presents an inventory of tasks to be performed for environmental management. The mitigation measure for the impact is made a part of proposed activities. The major instruments of environmental management will be monitoring performance of the construction by the EMC. The conditions, which must fulfilled documents, are suggested below:

- All necessary measures and precautions will be cited so that the execution of the works and all associated operations on site or off- site are carried out in conformity with statutory and regulatory environmental requirements.
- Necessary measures and precautions to avoid nuisance or disturbance arising from the execution of the works will be included, preferably at the source it self.
- Wastes such as spoil or debris or silt from the sites will be immediately removed and the affected areas will be restored to their original state.

9.5 MONITORING PLAN

The regular components of monitoring and its frequency have been identified in Table 77. The air and noise quality monitoring will be performed at the same locations where baseline monitoring was carried out. Environment Management Cell (EMC) Constituted by the P & C will be the prime agency for monitoring all activities. Project promoters will supervise all activities and accordingly advise the P & C to improve on areas where any shortcomings are observed. The EMC will provide all the monitoring results to project promoters who will keep a record of all information and suggest suitable measures to be adopted by the Contractor if any aspect is found to be diverting from the anticipated values/ standards.

9.6 ENVIRONMENTAL TRAINING

The Environment Management Cell (EMC), in addition to implementing and monitoring different environmental attributes, will also be actively involved in imparting training and raising environmental awareness of Construction Engineers/ Contractors and other staff members/ workers so as to enable them take the environmental aspects into consideration as and when required. In the long run, the EMC can impart additional and specialized training in environmental management of the road and building construction system.

9.7 BUDGETS FOR ENVIRONMENTAL MANAGEMENT PLAN

The mitigative measures suggested in the preceding chapters forms costs related to measures incorporated into engineering design; project scheduling, site planning and preparation of tender documents. The cost on this account will be covered with the construction budget and should not be seen as items of cost for implementing Environmental Management Plan. The estimated environmental cost considered here includes:

During Construction phase

- Provision of air, noise, and dust vegetative barrier/ special screens- both side of project area
- Dust suppression
- Solid barrier to check noise pollution for sensitive receptors like school etc.
- Solid waste management due to construction activity.

During Operation phase

- Air pollution monitoring
- Noise monitoring
- Water quality monitoring

The environmental cost is consists of monetary value of the mitigative measures adopted to minimise the negative impact of project on environment. Environmental cost is divided into two categories, i.e. capital cost and operation and maintenance cost. Capital cost is the cost of all the structural measures proposed for

environmental protection during construction phase while the operation an maintenance cost include the cost of monitoring air, noise, soil and water and maintaining the structural measures over project life.

Table 10-Reporting of the Major- Parameters and Responsible Organization
CONSTRUCTION PHASE

Sr. No	Project Related Issue	Action to be Taken	Responsible Organisation
1	Utilities	➢ Initiate and complete the process of shifting the utilities	Contractor and MCGM in consultation with the local Electricity Department and Telecom Department
2	Traffic management	➢ Secure assistance from local police for traffic control during construction phase. Safety measures will also be undertaken by installing road signs and making for safe and smooth movement of traffic	Contractor and MCGM
3	Noise Level	➢ Stationary equipment will be placed as far as possible form inhabited areas to minimise objectionable noise impacts ➢ Provisions for mufflers for stone crushing plants ➢ Proper maintenance machinery and vehicles ➢ Construction activities strictly prohibiting between 10 pm and 6 pm near habitation ➢ Provision of using ear plugs by workers being exposed high noise levels ➢ Vegetative and solid barrier along inhabitant centre and sensitive receptor	Contractor and MCGM
4	Air Quality	➢ Vehicles and machineries will be regularly maintained so that emissions conform to National and State Standards. ➢ Vehicles carrying construction material will be covered by traps to avoid spilling and blowing by wind ➢ Asphalt mixing if required will be over 500 m away form any communities. ➢ Vegetative barrier along inhabitant centers.	Contractor and MCGM

5	Water Quality	➢ Construction during non- monsoon near natural drain and water bodies. ➢ Construction of oil trap ditches along the stretch of the road.	Contractor and MCGM
6	Soil Erosion	➢ Strengthening of soil strata during pilling	Contractor and MCGM

OPERATION PHASE

Sr. No.	Project Related Issues	Actions to be Taken	Responsible Organisation
1	Prevention of Road side Squatters or indirect Urban Sprawls	➢ Involve land use planning agencies like the Revenue Department at all levels during operation stage. ➢ Plan and control development activity.	Contractor and MCGM in consultation with the State Revenue and Planning.
2	Road Safety and Traffic Management	➢ Adequate number of proper & legible signs will be installed along the road. ➢ Prepare and administer a monitoring system on road/ accidents.	MCGM and State Traffic Police.
3	Air Quality	➢ Monitor periodically ambient air quality at selected sites.	Contractor and MCGM in consultation with MPCB
4	Noise level	➢ Monitor periodically ambient noise level at selected sites. ➢ Minimization of use of horns near sensitive locations/ silence zones with the help of sign boards at proper places ➢ Noise barrier is proposed for4.5kms along the proposed expressway to mitigate the impact of noise on habitats.	Contractor and MCGM in consultation with MPCB
5	Water Quality	➢ Monitor periodically water quality for establishing the change of water quality, if any, and assessing its potentiality of surviving aquatic flora and fauna and for irrigation use.	MPCB
6	Soil Characteristics	➢ Periodic monitoring of soil quality (mainly Pb) at specified distance for assessing contamination by vehicular emissions.	Contractor and MCGM in consultation with MPCB

		➢ Checking the overflow of spillage from the carriageway.	
7	Human Health and Safety	➢ Vulnerable stretches, which are prone to accidents, will be identified. ➢ Adopt Safety measures and other control measure for regulating traffic in such areas by: ➢ Installing proper road signs, marking along the whole stretch of the tolled highway in the form of cautioning, informatory and mandatory signs of gantry mounted overhead sizes. ➢ Installing precautionary roads signs for controlling vehicle a speed in urban areas and curve stretches.	Contractor and MCGM in consultation with MPCB.

9.8 DETAILS OF MANAGEMENT PLANS

9.8.1 Air Environment Management

The ambient air quality in entire stretch of the alignment is within the National Ambient Air Quality Standard 2009. To control the air pollution during construction phase following measures will be adopted –

- During excavation, drilling process the site will be barricaded.
- Proper management of construction vehicle traffic.
- Construction material will be stored in designated place.
- For dust suppression water sprinkling will be carried out on roads used for movement of construction vehicles.
- Proper and regular maintenance of construction equipments.
- Wind barricades for storage area will be provided.
- Vehicle in good condition and with PUC certificate will be used during construction phase.
- Construction material will be transported through covered vehicles.
- DG set will be provided with a stack of adequate height.
- Workers will be provided with face mask to avoid inhalation of air pollutants.

9.8.2 Noise Environment Management

- Barricading the construction site will helps in limit the noise within construction site
- Proper maintenance of machineries and vehicles
- Noise barriers will be provided at sesnsitive locations.
- Use of construction vehicles which are properly maintained and with PUC
- Provision of mufflers, padding to reduce vibration, which will in turn reduce the noise
- Provision of ear muffs /plugs to the workers working near high noise generating machineries
- Proper maintenance of path used for construction vehicle to reduce smooth flow and reduce noise
- Carrying noise generating activities in day time only
- Transportation of construction material during non-peak hours

9.8.4 Water Requirement & Wastewater Management

- Avoid wastes of water from existing sources.
- Rainwater harvesting structure should be constructed at the settlement area,
- The unlined roadside drains in rural stretches should be connected to water bodies like nallas/ rivers/ drains near the culverts and bridges
- The proponent will ensure use of ready mix concrete to maximum extent. Construction water runoff if any will be collected in clarifier. The clear water will be reused for construction.
- Workers camp will be provided with mobile toilet. The sewage generated will be disposed off through septic tank followed by soak pit.

- To avoid contamination due to leakage or spillage the chemicals such as bitumen, oil, diesel, paint etc shall be stored in earmarked place with proper platform with catch pits etc.
- Solid waste generated from labour camp will collected in dustbins. The waste will be segregated. The recyclable waste will be give to authorized vendor and the other waste will be disposed off to SWM facility.
- Indiscriminate settlement of workers should be avoided. The solid waste generated from labour camps will be disposed of in environmentally safe manner.
- The storage area will be covered during monsoon.
- Construction vehicles will be properly maintained to avoid leakage.
- The impact of increase in turbidity and siltation can be mitigated by providing coffer dams and silt trap around the foundation site before start of piling/drilling works.

9.8.5 Land Acquisition

Land Acquisition is under process, after calculation of area of land, type of land and the market rate R & R plan will be designed.

9.8.6 Solid and Hazardous Waste Management Plan

During construction phase there will be generation of solid waste due to construction activities as well as from labour camps. The waste generated will be stored will be temporarily stored at designated place.

- Proper compensation will be provided for acquisition of agricultural land
- Excavated earth will be majorly used for site preparation and backfilling. Remaining excavated earth if any, will be disposed off at designated place. Indiscriminate dumping would be avoided.
- Other waste from construction will be disposed of safe.
- Indiscriminate settlement of workers should be avoided. The solid waste generated from labour camps will be disposed of in environmentally safe manner.

9.9 ENVIRONMENTAL MONITORING PLAN

The purpose of the monitoring programme is to ensure that the envisaged purpose of the project is achieved and results in desired benefits. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. The broad objectives are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To evaluate the adequacy of Environmental Impact Assessment
- To suggest improvements in management plan, if required
- To enhance environmental quality
- To satisfy the legal and community obligations

9.10 PERFORMANCE INDICATORS

The physical, biological and social components identified to be particularly significant in affecting the environment at critical locations have been suggested as Performance Indicators and are listed below:

- Air quality with respect to PM10,PM2.5, NOx, SO2 and CO
- Noise levels around sensitive locations
- Occupational health monitoring
- Accident frequency

Table 11-Environmental Monitoirng Plan

Component	Parameters	Monitoring			Institutional responsibility
		Location (Chainage)	Frequency	Duration	Implementation
Construction Phase					
Air	PM10, PM2.5, SO2, NOx, CO	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season for 3years	Continuous 24 hours	Contractor and MCGM
Noise	Noise levels on dB (A) scale	At 8 locations	Twice a week for 2 weeks in each location in every season for 3years	Continuous 24 hours	Contractor and MCGM
Surface Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 8 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Ground Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 2 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Soil	Monitoring of Pb, oil and grease	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons for 3years	-	Contractor and MCGM
Operation Phase					
Air	PM10, PM2.5, SO2, NOx, CO	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season for a year	Continuous 24 hours	Contractor and MCGM

Component	Parameters	Monitoring			Institutional responsibility
		Location (Chainage)	Frequency	Duration	Implementation
Noise	Noise levels on dB (A) scale	At 8 locations	Twice a week for 2 weeks in each location in every season for a year	Continuous 24 hours	Contractor and MCGM
Surface Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 8 locations	Twice a week for 2 weeks in each location in every season for a year	-	Contractor and MCGM
Ground Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 2 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Soil	Monitoring of Pb, oil and grease	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons for 1years	-	Contractor and MCGM

9.11 BUDGETS FOR ENVIRONMENTAL MANAGEMENT PLAN

The environmental cost is consisting of monetary value of the mitigative measures adopted to minimize the negative impact if any of project on environment. Environmental cost is divided into two categories, i.e. capital cost and operation and maintenance cost. Capital cost is the cost of all the investment measures proposed for environmental protection during construction phase while the operation and maintenance cost include the cost of running and operating of these measures such as monitoring air, noise and water and maintaining the investment measures over project life. Budgets for Environmental Management Plan for Construction Phase and Operation Phase are given in Table 78 below.

Table 12-Budgets for Environmental Management Plan - Construction Phase and Operation Phase

Components	Construction Phase Capital Cost in Lakh	Operation Phase O & M Cost in Lakh
Environmental Monitoring Cost	2151.36	717.2
Sewage Treatment Plant	30	6
Rain Water Harvesting System including O&M cost (Included in Estimated Civil Cost) at atgrade road area	235.492	-
Solid Waste Management	38	3
Energy Saving Measures	40	4
Occupation Health & Safety Training	20	2
Total	**2521.852**	**732.2**

CHAPTER 10: SUMMARY AND CONCLUSION

10.1 PREAMBLE

Mumbai is popularly known as Commercial Capital of India.The city and the metropolitan region surrounding the city have grown rapidly over the past few decades. The population within the MCGM limit has increased from 4.2 million in 1961 to today's 12.44 million (As per 2011 Census). The growth of vehicular traffic is no exception. The city currently has close to 25 lakhs of vehicles with 500 new vehicles being registered every day. With the present road network of about only 2000 km, it is becoming difficult to handle the traffic. In order to improve the level of service, MCGM has carried out various studies in the past through reputed consultants and have identified new road links that would help decongest the existing road network. With the growth of residential and commercial development in the city, there has been an increase in demand for adequate infrastructure improvement in the suburbs to ensure proper connectivity. It has become necessary to address these issues on priority.

PEDICO Pvt. Ltd has appointed M/s. Fine Envirotech Engineers, to carry out the Environmental Impact Assessment studies and to assist the Client in obtaining Environmental Clearance and Forest Clearance.

10.2 PROJECT BACKGROUND

As the city of Mumbai, due to its Geographical constraints has grown in a linear manner. The historical development of Greater Mumbai is characterized by concentration of commercial and business activities in the Island city in the South and development of predominantly residential activity towards the North along the Western and the Eastern Suburbs. The transportation corridors in Mumbai have also therefore evolved longitudinally traversing along the North – South axis with very few East-West linkages. With rapid growth of the Eastern and Western suburbs of Greater Mumbai in the last few decades, an urgent need was felt for strengthening of the East–West road connectivity between the eastern and western suburbs. Thus, Municipal Corporation of Greater Mumbai has proposed to develop Goregaon-Mulund Link Road of leghth 12.3 km including Tunnel 4.7 km underneath Sanjay Gnashi National Park. Connecting points are Near Dindoshi Flyover on WEH and near Airoli Junction on EEH

The transportation Study carried out by M/s Wilbur Smith and Associates, as early as 1963, hademphasized the need for development of the East-west linkages for Greater Mumbai. Four major East-West link roads were then planned for connecting the Suburbs to minimize travel time and cost.

Several studies thereafter have been carried out by MCGM and MMRDA with a view to improve the traffic and transportation problems of the city and suburban. One of the studiescarried out by MMRDA through M/s Consulting Engineers Services (CES)

India Pvt. Ltd. in the year 2003 wherein a Master Plan for Road Network Improvement and Traffic Dispersal in Greater Mumbai was proposed.

The report of M/s CES, has indicated that the Goregaon Mulund Link Road is one of the major link that needs to be developed on priority for connecting Western Suburbs in Goregaon and Eastern Suburbs in Mulund.

10.2.1 Project Location

Tunnel Alignment passes through Hilly terrain of Geology profile comprising Basalt and Breccia as per Geotechnical Investigation report. Tunnel and Approach Alignment level is matched with existing at grade road on both ends. The project involves Partial resettlement of R/R at Khidiapada and Film City side of Entry and Exit of Tunnel which is beyond the SGNP boundary.

Based on Geotechnical Investigation and topographic survey within SGNP, the alignment has been fixed in such a way that

1. There will be no land acquisition inside SGNP
2. R & R will be minimum
3. There will be minimum disturbance during construction.
4. Shortest Route Alignment.
5. Alignment will be planned consistent with the DP road.

The underground tunnel is proposed on this alignment near film city in such a way that the tunnel passes underneath the Sanjay Gandhi national park area without disturbing the premise of SGNP in any way whatsoever. The project also does not involve any land acquisition within Sanjay Gandhi National Park. As an underground Tunnel is proposed along this alignment, it can be ensured that there is minimum disturbance to flora and faunaand there is no adverse effect to the water supply system and the lakes situated in the area.

The exit point of the tunnel on Mulund side is located at Khindipada outside the SGNP premise and hence it will not involve any land acquisition in SGNP area. The alignment has been planned with minimum land acquisition beyond SGNP area and maximum benefit to local traffic and through traffic. Google image showing location of GMLR alignment is given in Figure 3 & 4. The Village Map with Tunnel Alignment given in Figure 5 below:

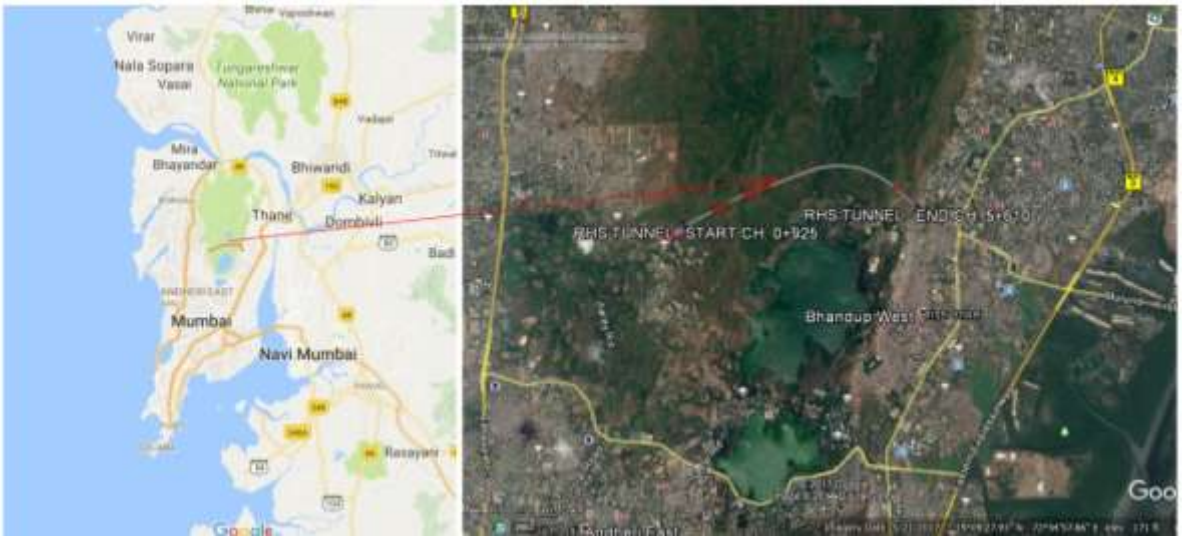

Figure 13 -Location of theProject

Figure 14- Google Impage showing GMLR Alignment

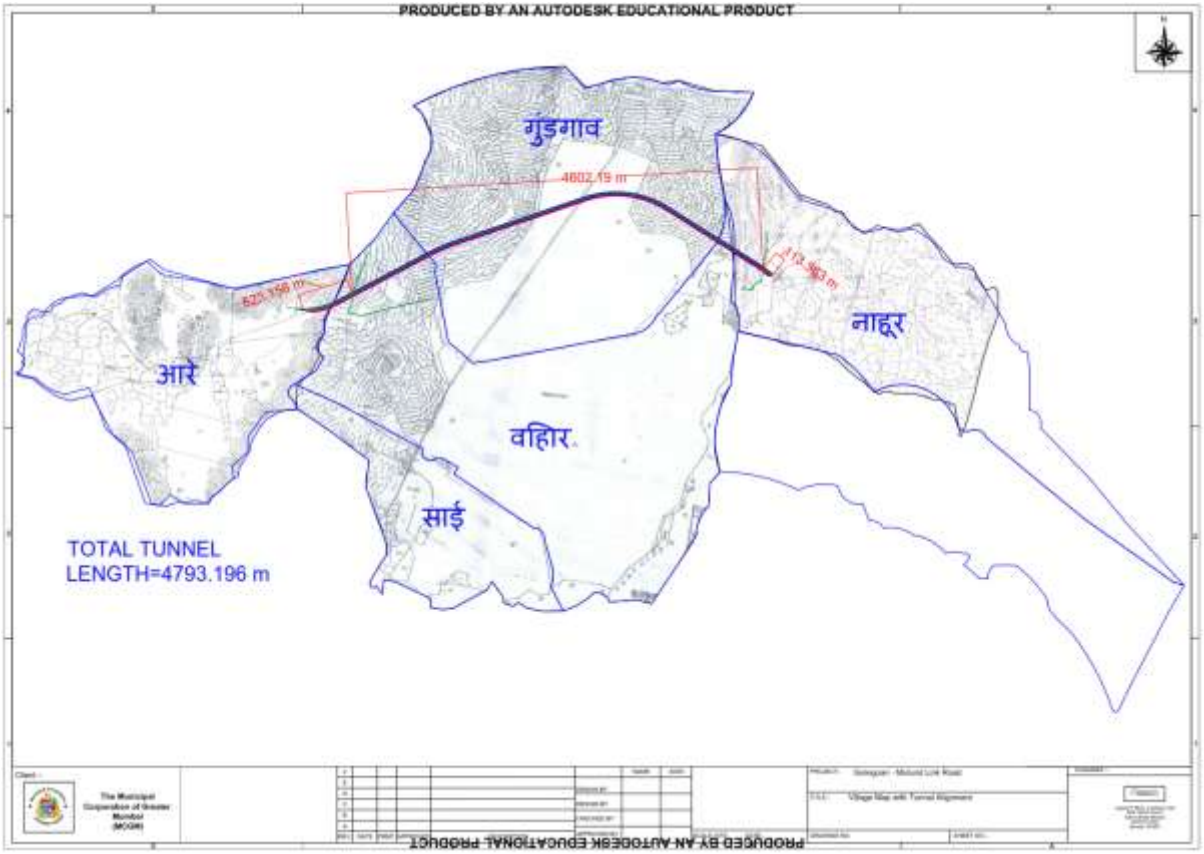

Figure 15-Village Map with Tunnel Alignmen

PROJECT BENEFITS

- The travel time will get reduced by almost one hour between Mulund and Goregaon
- Traffic congestion on Western Express Highway and the Link Roads will be substantially reduced
- Saving in Fuel Consumption to a substantial extent
- Cutting of about 2224 trees will be avoided

Win- win situation as Road Link gets established without disturbing SGNP, Aarey and the city's lakes

10.3 DESCRIPTION OF THE ALIGNMENT

SALIENT FEATURES OF THE PROJECT CORRIDOR

Sr. No	Salient Feature	Details
1.	Project Stretch	Twin Tube Tunnel Road Project- 4.7Km (3+ 3 Lan,e) Missing Link of Existing Goregaon Mulund Link Road for connectivity of road from East to West corridor of Mumbai.
2.	Width of Road	4+4 lane at grade Tunnel -3+3 lanes

Sr. No	Salient Feature	Details
3	Land Use	The alignment will be underground in the 4.7 km section of SGNP
10	Road Safety	Appropriate safty measures will be used while implementation of project. Retro reflective road signage will be provided for better night visibility
12	Road User Facilities	Emergency telephones, Traffic Aid Posts, Medical Aid posts will be provided along the proposed project
13	Forest Land	The alignment will be underground in the 4.7 km section of SGNP
14	Cost of the project	Estimated cost of development of the project is Rs 2000 Crores approx

10.4 LAND AQUISITION

Land Acquisition is under process, after calculation of area of land, type of land and the market rate R & R plan will be designed.

10.5 UTILITY REQUIREMENT

10.5.1 Raw Material

Various raw materials such as Cement, Steel, Bitumen, Stones & Aggregates etc will be required for constriction of proposed expressway.

10.5.2 Water Requirement

The water requirement for domestic purpose will be fulfilled though potable water sources and for construction work water from MCGM shall be used.

10.5.3 Power Requirement

Power will be acquired from MSEB.

10.5.5 Man Power Requirement

For construction phase manpower employed will be 500 nos. which will include skilled, semi-skilled workers, technicians, engineers, managers and other professionals for both construction phase and operational phases

10.6 PROJECT COST

Total cost of the proposed project is Rs.2000 Crores

10.7 BASLINE ENVIRONMENT

The baseline Environmental Studies was conducted during Sept 2017 to Dec 2017

10.7.1 Soil Quality

The Soil Quality Monitoring Locations are given in Figure 8. The results of the monitoring are represented in Table 8 below.

Table 8-Soil Quality Monitoring Report

Parameters	**Locations**	
	Thane	**Dahisar**
Conductivity	360	1670
SAR	1.16	1.25
Ca	0.88	0.57
Mg	0.18	0.05
Sodium	0.85	0.7
Potassium	0.27	0.11
Total Phosphorus	0.14	0.28
Total Nitrogen	0.02	0.09
Moisture Content	4.9	5.8

I

10.7.2 Air Quality

The status of the ambient air quality in the study area was established by carrying out monitoring for air quality parameters like $PM_{2.5}$, PM_{10}, SO_2 and NO_X at 8 locations in the study area. The data presented is average for 24 hours.

The maximum average values of $PM_{2.5}$ were 57.08µg/m^3 and minimum of 39.67µg/m^3. The $PM_{2.5}$ values are below permissible level (60µg/m^3).

Also the PM_{10} values are below permissible level (100µg/m^3).The maximum (95.83µg/m^3) and a minimum 70.83 (µg/m^3) in the study area. The SOx and NOx values recorded at all the study areas is lower than the permissible limit. The range of SOx varied from 19.27µg/m^3 to 23.61µg/m^3 while NOx varied from 20.37 µg/m^3 to 24.98 µg/m^3.

The average values of PM_{10} and $PM_{2.5}$ are due to the busy main road where lot of vehicular movement is observed. It include BEST buses, transportation vehicle, truck, tempo, rickshaws etc. even contributing NOx and SOx values also.

All the other parameters are well below the permissible limits. The MCGM project incorporates all the mitigation measures during the construction and operational phase thereby not deteriorating the existing air quality.

10.7.3 Noise Environment

The day time noise levels were observed to be ranging from 72.2 dB(A) to 80.9 dB(A). Highest noise level of 80.9 dBA was recorded at Near Lodha Fiorenza. The night time noise levels for the 10 locations ranged between 68.30 dB(A) to 79.5 dB(A) with highest value being recorded at at Near Lodha Fiorenza 79.5 dB(A). Lowest noise levels of 69.52dB(A) were recorded at Near Sanjay Gandhi National Park.

The assessment of the noise levels at the specified locations in the project area clearly indicates that the existing environment in the project is in from potential causes of noise pollution.

10.7.4 Water quality

10.7.4.1 Surface Water Quality

Surface water was collected from the nallahs flowing below the Western express highway. The water from the nallahs is already polluted due to the anthropogenic activities.

10.7.4.2 Ground Water

Ground water samples were collected from three different locations around the alignment. Groundwater quality is quite good. However, turbidity at all the three locations is higher than its desirable limits with 3.7 max at malad but all are below the permissible limits. Total dissolved solids are within permissible limits which varies from 1100 to 1400 Mg/l range but exceed than desirable limits. Fluorides are higher than permissible limits. All other parameters are well within the desirable limits.

10.8 Ecology & Biodiversity

10.8.1 Flora in the study area

10.8.2 Fauna in the study area

Refer Annexure II

10.9 ANTICIPATED IMPACT & MITIGATION

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES
CONSTRUCTION PHASE

Sr. No.	Environmental Parameters	Impact Attributes	Degree of Impacts	Mitigation Measures	Implementing Organization
1	Physiography	Disturbance in relief feature	Mild	Will be achieved by systematic planning and designing of the project activities	Promoter through prospective contractor
2	Land resources	Change in land use	Mild	Will be achieved by systematic planning and implementation	Promoter through prospective contractor
3	Human resources	No adverse impact	Negligible	Will be achieved by systematic planning and resources	Promoter through prospective contractor
4	Ecology	Ecological resources – Flora & Fauna	Mild	4.7 km Alignment will be passing under the Sanjay Gandhi National Park. As the proposed alignment is underground the impact to the ecology will be minimum	Promoter through prospective contractor

5	Environmental aesthetics values	Removal of trees & green strips along the road have impacts on landscape & aesthetic values of the area	Moderate	Loss of vegetation will be kept minimum as far as possible during site clearance.	Promoter through prospective contractor
6	Utility & infrastructural facilities	Removal of utility line like electrical poles, telephone poles, transformer, HT & LT lines	Negligible	Shifting and elevation of utility lines will be done in consultation with concerned Government Organisations.	Promoter, MSEB, telecommunication dept. & line dept. of GoM.
7	Sub-surface hydrology	There are dugwells within the proposed alignment	Negligible	Whenever possible, care is taken to avoid its relocation by judicious engineering road design.	Promoter through prospective contractor
8	Religious places	--	--	--	--
9	Geology	Not much affected	Negligible	Systematic planning and implementation	Promoter through prospective contractor

10	Air quality	Short term deterioration of air quality due to generation of fugitive dust.	Moderate	➢ Trucks carrying soil sand stone, will be covered to avoid spilling ➢ Fugitive dust sources will be sprayed with water to suppress dust. ➢ Emissions from vehicles & machinery will be checked regularly & maintained properly to confirm to National and State Emission Standards	Promoter through Prospective Contractor (PC)
11	Noise level	Increased noise levels due to project activities	Mild	➢ All the equipments will be duly lubricated, maintained in good working condition to minimize noise levels. ➢ Stationary construction equipments will be placed as far as possible from dense habitation. ➢ Provision of protection devices (ear plugs) to be provided to the workers operating in the vicinity of high noise generating machineries.	Promoter through Prospective Contractor (PC)
12	Ecological resources – Flora & Fauna	Refer Annexure 2	Moderate	Proper care will be taken to maintain eco-balance	Promoter through Prospective Contractor (PC)

13	Land use	There will be change in land use	Mild	Proper management planning will be achieved.	Promoter through Prospective Contractor (PC)
14	Accident hazards and safety	Short term impacts from road accidents	Mild	Proper maintenance of the machinery.	Promoter through prospective contractor (PC)

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES
OPERATION PHASE

Sr. No.	Project Related Issues	Actions to be Taken	Responsible Organisation
1	Prevention of Road side Squatters or indirect Urban Sprawls	➢ Involve land use planning agencies like the Revenue Department at all levels during operation stage. ➢ Plan and control development activity. ➢ Removal, cleaning of squatter and temporary hutments of construction workers once construction activities has been completed.	P & C in consultation local body
2	Road Safety and Traffic Management	➢ Adequate number of proper & legible signs will be installed along the road. ➢ Prepare and administer a monitoring system on road/ accidents.	P & C in consultation with Traffic Police

3	Air Quality	➢ Monitor periodically ambient air quality at selected sites. ➢ Confinement and absorption of the pollutants at source by creating vegetation along the length. ➢ Enforcing different control measures to check pollution (e.g. catalytic converters, unleaded petrol, proper serving etc.)	P & C in consultation with MPCB
4	Noise level	➢ Monitor periodically ambient noise level at selected sites. ➢ Thick vegetation along the road for attunation of noise ➢ Provision of noise wherever is required	P & C in consultation with MPCB
5	Water Quality	➢ Monitor periodically water quality for establishing the change of water quality, if any, and assessing its potentiality of surviving aquatic flora and fauna and for irrigation use.	P & C and MPCB
6	Soil Characteristics	➢ Periodic monitoring of soil quality at specified distance for assessing contamination by vehicular emissions. ➢ Checking the overflow of spillage from the carriageway by promoting growth of vegetation cover along the road shoulders and preventing overflow to green belt.	P & C in consultation with authorities.
7	Maintenance of Avenue trees	➢ Plantation will be undertaken by the concession company on an aggressive note along the opening of the tunnel.. ➢ Employment of local population for maintenance avenue plantation.	P & C in consultation with authorities and State forest Department

8	Human Health and Safety	➢ Vulnerable stretches, which are prone to accidents, will be identified. ➢ Adopt Safety measures and other control measure for regulating traffic in such areas by: o Installing proper road signs, marking along the whole stretch of the tolled highway in the form of cautioning, informatory and mandatory signs of gantry mounted overhead sizes. o Installing precautionary roads signs for controlling vehicle a speed in urban areas and curve stretches.	P & C in consultation with authorities.

10.10 EMERGENCY CONTROL PROCEDURE

10.10.1 For Natural Calamity

In the event of occurrence of natural calamity during the construction phase, all work will be suspended and all construction material will be shifted to the safer location. In order to minimize losses/ damages to pavement, incomplete CD structures during the heavy rains the inventory of material storage at site will be kept to a minimum during rainy period i.e. May to September. During the operation phase, in the event occurrence of Natural Calamity the concessionaire will stop traffic on the highway and will guide the traffic at time of closure for follow up of safer route. The traffic will be regulated right from receipt of warning. The emergency control centre will be in direct contact with the district administration for their advice for the steps taken for the traffic control and other assistance.

10.11 For Hazard

The onset of emergency will in all probability commences with a major fire or explosion and shall be detected by the member of staff on duty at construction camp/on Highways. If located by a staff member on duty, he (as per site emergency procedure of which he is adequately briefed) will go to the nearest fire alarm call point, break glass and trigger off the fire alarms. He will also try to inform about location and nature of fire/ accident to the Site Main Controller on mobile phone.

In accordance with work emergency procedure, the following key activities will immediately take place to intercept and take control of emergency:

- The fire group will arrive at the site of incident with fire fighting controls
- Site Main Controller will commence his role from the Control Centre
- The First Aid Group will take care of injured
- Site Main Controller will be directing and deciding a wide range of desperate issues. In particular DMC has to decide and direct:
- Whether fire fighting and first aid groups require reinforcement of man power and facilities
- Whether the facility is to be shut down or more importantly kept running
- Respond to any large size complaints from outside public and to assess an offsite impact arising out of the onsite emergency.
- When the incident has eventually been brought under control as declared by the fire fighting group, the Site Main Controller shall visit himself personally for:
- An assessment of total damage and prevailing conditions with particular attention to possibility of re escalation of emergency, which might of the time being, be under control.
- Inspection of other facilities, which might have been affected by impact of incident.
- Based on visit, Site Main Controller will finally declare and communicate termination of emergency and authorize step by step restoration of normal operation of the refuelling and storage facility. The fire siren will be sounded with all CLEAR SIGNAL.

- During entire period of emergency the site will remain out of bounds to external visitors except:
    - External Fire Personnel;
    - External hospital ambulance staff;
    - Local Government;
    - Insurance authorities;

10.11.1Alarm System to be followed during Disaster

Suitable alarms will be developed after establishment of construction camp/opening of Highways for traffic and these will be explained to each personnel working at the Highways. The alarm will also be displayed at office for the information of visitors.

10.11.2 Actions to be taken on Hearing the Warning Signal

On receiving the disaster message following actions will be taken:
Fire Fighting group, first aid group shall reach the ECC
Team members will remain ready in their respective sections for further instructions

10.11.3 for Petroleum Product Leakage

In the event of massive spillage of HSD/ Gasoline/ Kerosene/ Furnace oil the spilled quantity should be reclaimed from the storm drainage channels/ rain water harvesting pits. The traces of the products may be absorbed in sand or cotton rags. The spilled area at main carriageway/ service road should be thoroughly washed with water or any neutral solvent to avoid any slippage or skidding. All effect should be made that spilled oil does not enter surface water body.

10.11.4 Head-on Collision /Vehicle Accident on the road

The major risk involved in this type of Disaster fatal or high degree of injury. Early response will be in terms of well-equipped ambulance with paramedical team reaching on the site. This will help in rescue of passengers from the accident site and will be taken to the nearest hospital. If need so arises the patient can be taken to one of the major and super specialty hospital in the area.

10.11.5 Spillage and Leakages of Oil On the road

This Disaster can occur during a leak or spillages of oil or fuel carrying tankers met with an accident on the road. The various risks involved in this is danger of skidding of other vehicles due to spillages. Risk of catching fire depends upon the flash point of the material. The early response in this case will be stoppage of vehicular movement immediately by using communication system and towing the damaged vehicle in order to make traffic easier. It is important to carry out mopping operations to collect oil spilled on the road. The clean- up procedure is of immense importance in order to avoid further hazards and consequences.

10.12 PROJECT BENEFITS

- The travel time will get reduced by almost one hour between Mulund and Goregaon
- Traffic congestion on Western Express Highway and the Link Roads will be substantially reduced
- Saving in Fuel Consumption to a substantial extent
- Cutting of about 2224 trees will be avoided

Win- win situation as Road Link gets established without disturbing SGNP, Aarey and the city's lakes

10.12.1 Proposed Improvement

Proposed GMLR will be beneficial for rapid The underground tunnel is proposed on this alignment near film city in such a way that the tunnel passes underneath the Sanjay Gandhi national park area without disturbing the premise of SGNP in any way whatsoever. The project also does not involve any land acquisition within Sanjay Gandhi National Park. As an underground Tunnel is proposed along this alignment, it can be ensured that there is minimum disturbance to flora and faunaand there is no adverse effect to the water supply system and the lakes situated in the area.

The exit point of the tunnel on Mulund side is located at Khindipada outside the SGNP premise and hence it will not involve any land acquisition in SGNP area. The alignment has been planned with minimum land acquisition beyond SGNP area and maximum benefit to local traffic and through traffic.

The following facilities are proposed be provided along the corridor:

- Emergency telephones @ every 5km
- Ambulance and Towing Facilities
- Quick Response Vehicle (QRV)

Wayside Amenities:

- Street Lighting
- Digitized Signage
- Light Cutters
- Junction Beautification
- Tunnel Lighting
- Ventilation facilities in tunnel

Information Technology includes:

- Traffic Surveillance and enforcement
- CCTV
- Optical Fiber Ducts (OFC) in median for multiple network
- Traffic Safety Measures

10.13 ENVIRONMENTAL MONITOIRNG PROGRAMMME

Component	Parameters	Monitoring			Institutional responsibility
		Location (Chainage)	Frequency	Duration	Implementation
Construction Phase					
Air	PM10, PM2.5, SO2, NOx, CO	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season for 3years	Continuous 24 hours	Contractor and MCGM
Noise	Noise levels on dB (A) scale	At 8 locations	Twice a week for 2 weeks in each location in every season for 3years	Continuous 24 hours	Contractor and MCGM
Surface Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 8 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Ground Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 2 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Soil	Monitoring of Pb, oil and grease	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons for 3years	-	Contractor and MCGM
Operation Phase					

Component	Parameters	Monitoring			Institutional responsibility
		Location (Chainage)	Frequency	Duration	Implementation
Air	PM10, PM2.5, SO2, NOx, CO	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season for a year	Continuous 24 hours	Contractor and MCGM
Noise	Noise levels on dB (A) scale	At 8 locations	Twice a week for 2 weeks in each location in every season for a year	Continuous 24 hours	Contractor and MCGM
Surface Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 8 locations	Twice a week for 2 weeks in each location in every season for a year	-	Contractor and MCGM
Ground Water	pH, BOD, COD, Turbidity, Total Hardness, TDS, SS etc	At 2 locations	Twice a week for 2 weeks in each location in every season for 3years	-	Contractor and MCGM
Soil	Monitoring of Pb, oil and grease	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons for 1years	-	Contractor and MCGM

Chapter 11-DISCLOSURE OF CONSULTANT ENGAGED

"MUNICIPAL CORPORATION OF GREATER MUMBAI (MCGM)" for carrying out the above mention study have entrusted "Fine Envirotech Engineers".

We are one of the leading environmental and environmentally related infrastructure project consultants and completed no. of prestigious projects in the country. It includes Rs. 6,000 Crore project of Sewri- Nhava Sheva sea link i.e. Mumbai Trans Harbour Link project, Rs. 500 Crore of Inland Passenger Water Transport (IPWT) project. We have been also associated with major industrial houses in India, which includes ELDER PHARMA, DUPHAR GROUP, RUNWAL GROUP (ARIANE PHARMA), VINATI ORGANICS, ETC. along with FINOLEX group, CABOT India, NITCO group, ISPAT group, INDIAN OIL CORPORATION LTD., SAHARA group, etc.

We have been also associated with various commercial development projects and companies. This includes RUNWAL GROUP, MATOSHREE REALTORS, FRAVASHI GROUP, SOLITUDE, PWD DEPT., etc. This project consultancy includes designing and commissioning of Sewage Recycling plants, Green Belt development, storm water design, etc.

We have our **Lead Office** in Mumbai at:

102, HIREN INDUSTRIAL ESTATE,
MOGUL LANE, MAHIM
MUMBAI - 400 016.
MAHARASHTRA.

To cater the needs of Industrial Corporate Houses in remaining part of the state, we have offices at **Pune** and **Aurangabad**. We also have presence in the state of Goa and have office at Ponda. We also have our liasoning offices with our staff at Solapur, Kolhapur, Satara and Nagpur.

We have full-fledged office consisting of total of 5 Nos. of Computers operated by engineers themselves along with all the infrastructure facilities. The computers are loaded with different types of programs to cater various requirements.

The technical team is led by **Dr. U. S. Kulkarni** and is assisted by 5 nos. of Engineers. There are 3 nos. of field teams for carrying out various Surveys, Monitoring Programs, Operation and Maintenance. We also have resident engineers who are responsible for their regions. In all **FINE ENVIRO** is fully self-sufficient, technically competent and therefore can handle any project irrespective of its size and capacity.

A.2. ABOUT OUR ENGINEERING/ARCHITECT OFFICES:

FINE ENVIRO's entire Engineering and Architectural work is being carried out at 2 separate offices in Mulund, Mumbai and also at Pune. Both the offices have their locational advantage with respect to peripheral industrial developments and are very well connected by the State Highways and by Airports. These offices have their own Team Leaders and they independently handle the Engineering and Architectural drawings with the help of their strong technical team. These engineering offices carry out following jobs in general.

- Preparation of all drawings viz. layout, hydraulic, GA, RCC etc.
- Preparation of Summary Sheets for bill of quantities
- Preparation of Comparative Statements
- Design of columns, beams, slabs, etc.

We have facility to carry out Detailed Designing, Structural Designing, and Fabrication Drawings at our above offices.

A.3. ABOUT OUR LABORATORY:

This is our heart of the Consultancy Services as we carry out various feasibility and treatability studies before designing a particular project. The laboratory is fully sophisticated and computerized and moreover it is FDA approved laboratory. One can carry out any no. of chemical, physico-chemical analysis of water and wastewater using various analytical instruments. Such a facility of water, wastewater, air monitoring and noise measurements is also available in Pune.

CURRICULUM VITAE

OF

DR. UMESH S. KULKARNI M.Sc., Ph.D)

<table>
<tr><td colspan="2">Dr. Umesh S. Kulkarni</td></tr>
<tr><td>Name of firm</td><td>FINE ENVIROTECH ENGINEERS</td></tr>
<tr><td>Profession</td><td>Expert: Environment, Ecology, Health & Socio- Economic.</td></tr>
<tr><td>Date of birth</td><td>12-03-1964</td></tr>
<tr><td>Years with the firm</td><td>25 YEARS</td></tr>
<tr><td>Nationality</td><td>INDIAN</td></tr>
<tr><td>Membership of professional societies</td><td>Associate Member - FICCI
American Solid Waste Association (ASWA)
Indian Water Works Association (IWWA)
Water Environment Federation (WEF)
Indian Institute of Environment Sciences (IIES)
International Eco – Tourism Society (IETS)
Associate member – Indo Brazilian Society
Member - Maharashtra Economic Development Corporation (MEDC)</td></tr>
<tr><td>Key qualifications</td><td></td></tr>
<tr><td>Education</td><td></td></tr>
<tr><td>(year)</td><td>Ph.D. (Treatment of Industrial Wastewater Chemical Engineering)</td></tr>
<tr><td></td><td>Dept. of Chemical Technology (UDCT), University of Mumbai.</td></tr>
<tr><td></td><td>M. Sc. (Physical Chemistry)</td></tr>
<tr><td></td><td>University of Mumbai</td></tr>
<tr><td></td><td>B. SC. (Chemistry)</td></tr>
<tr><td></td><td>University of Mumbai</td></tr>
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<tr><td>English</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Hindi</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
</table>
</td></tr>
</table>

	Marathi	Yes	Yes	Yes

APPOINTED AS A COMITTEE MEMBER ON ENVIRONMENTAL CELL OF **Mumbai Metropolitan Region Development Authority (MMRDA)**

APPOINTED AS A COMITTEE MEMBER ON ENVIRONMENTAL CELL OF **CITY AND INDUSTRIAL DEVELOPMENT CORPORATION OF MAHARASHTRA LTD (MMRDA)**

APPOINTED AS A COMITTEE MEMBER ON ENVIRONMENTAL COMITTEE OF **DISTRICT ENVIRONMENT APPRAISAL COMITTEE, RAIGAD (DEAC)**

APPOINTED AS AN TECHNICAL MEMBER ON **MAHARASHTRA POLLUTION CONTROL BOARD (MPCB)**

RECENTLY APPOINTED BY **UDD, GOVT OF MAHARASHTRA** AS AN EXPERT MEMBER - ENVIRONMENT ON THE **TECHNICAL COMMITTEE FOR HIGH RISE CLEARANCES** FOR THE **ULHASNAGAR MUNICIPAL CORPORATION - JULY 2015**

RECENTLY APPOINTED AS AN EXPERT MEMBER - ENVIRONMENT BY **UDD, GOVT OF MAHARASHTRA** FOR REVISED **DEVELOPMENT PLAN (DP)** FOR THE **ULHASNAGAR MUNICIPAL CORPORATION 2014-15**

APPOINTED AS AN EXPERT MEMBER - ENVIRONMENT AT **NATIONAL Hydro - Electric Power Corporation (NHPC)** by **Ministry of Power, New Delhi**

NOMINATED AS AN FOUNDER MEMBER - ENVIRONMENT IN THE COMMITTEE WHICH FORMULATED BIO-MEDICAL RULES by **Ministry of Environment and Forests, New Delhi**

APPOINTED AS VICE PRESIDENT OF THE INDO-BRAZIL CHAMBER OF COMMERCE

PROFESSIONAL EXPERTISE **:** 1. Environmental Infrastructure Projects

2. Public Health and Bio-Medical Waste Sciences

3. Environment & Ecological Sciences

4. Hazardous Waste Management / Municipal Waste Management

5. Eco – Tourism

6. Development of Large Industrial Areas pertaining to Environmental Aspects.

7. Environment Impact Assessment (EIA)

8. ISO 14001

9. Water Audit and Water Conservation

10. Lake Ecology and Restoration

PROFESSIONAL ACHIEVEMENTS : a. Appointed as Expert member on Steering Committee of **FICCI**, Western Region

b. Appointed as Expert Member on Advisory Committee of **National Hydroelectric Power Corporation (NHPC)** on the Environmental Aspects, Ministry of Power, New Delhi.

c. Nominated as Expert Member on Committee Formulation of Bio-Medical Rules – 1998 by **Ministry of Environment and Forest, New Delhi, (MoEF)**

d. Appointed as Technical Board Member of ***Maharashtra Pollution Control Board*** **(MPCB),** Government of Maharashtra.

e. Nominated as an Expert member of Indian Institute of Rural Development (IIRD - Joint Venture with Govt. of Rajasthan, WHO, UNDP etc.)

f. Member – Industrial and Environment Committee of Indian Merchant's Chambers (IMC).

ASSOCIATED CORPORATES : 1. **Director** – Ashok Alco-Chem Ltd.

2. **Director** – Ashok Alco Bio-Chem Ltd.

3. **Director** – Vivid Chemicals Ltd.

4. **CEO** – International Infrastructure Projects and Labs. (IIPL)

RECENT PUBLICATIONS:-

- Three Environmental Impact Assessment Research papers have been accepted to be published in WIT Press Journal of Sustainable development and planning at **Wessex University of Technology, United Kingdom in May, 2012, 2014 AND 2013**

- No. of research papers have been published in India and Foreign Journals including **Indian Journal of Environment, American Chemical Society, Journal of Public Health** etc
- Also delivered and presented no of research papers in person at various **International Conferences at USA and Singapore**
- Recently presented research paper at **5TH European Conference on Environment and Ecology at Prague, Czech Republic, in Oct.-2001**
- Attended no. of **Conferences and Exhibitions at USA, UK, France,Singapore in the past**

PATENTS:-

- Involved in application of an Indian Patent for **"Separation and Recovery of micro level Lignin from Bagasse (Pulp Effluents)"**
- Recently selected as qualified for **Government of Maharashtra for carrying out Water and Energy audits as per World Bank standards**

BRIEF LIST OF PROJECTS

1. EIA & Public Hearing for Inland Passenger Water Transport Project on West Coast of Mumbai, for MSRDC.
2. EIA & Public Hearing for Inland Passenger Water Transport Project on East Coast of Mumbai, for MSRDC.
3. CRZ Clearance Proposed dredging works to clear navigational waterways and the channels of the creeks and rivers of Thane district by The Collector, Thane, Maharashtra.
4. CRZ Clearance Proposed dredging works to clear navigational waterways and the channels of the creeks and rivers of Raigad district by The Collector, Raigad, Maharashtra.
5. Environment Clearance for Development of Vadhavan Port at Vadhavan, Dahanu by JNPT and MMB.
6. CRZ clearance for proposed shipyard project of Pipavav Shipyard, Taluka Rajula, District Amreli for Pipavav Shipyard Limited
7. Clearance from MPCB, MCZMA, MoEF for port at Nandgaon by M/s. JSW Infrastructure Ltd.
8. CRZ and EC for "Development of Dighi Port at Rajpuri Creek Inlet, Raigad district, For M/s. Dighi Port Pvt. Ltd
9. CRZ and EC For "Multipurpose Terminal Facility" At Chanje Village, Karanja Creek, Raigad For M/S. Karanja Terminal & Logistics Private Limited
10. Environment Clearance for proposed Marina facilities at the North of Zuari River Kargwal Constructions Pvt. Ltd
11. CRZ and EC for Proposed Development of Lavgan Port for M/s. Lavgan Dockyard Pvt. Ltd.

12. Environment Clearance, CTE for proposed Jaigad Dockyard by Chowgule Steamships Ltd
13. Environment Clearance for Construction of Coast Guard Station on plot 18/1, Mouje-Agardanda, Murud-Janjira, Raigad by The Commander, ICGS
14. Environment Clearance for Up-gradation and expansion of existing ship repair and ship building facility for Konkan Barge Builders Pvt. Ltd.,
15. Environment Clearance for Construction of Jetty/s and Stacking Yard at Balekeri Port, M/S. Coastal services,
16. CRZ and EC for Proposed development of Jaigad Port- (Now M/s Angre Port Pvt Ltd) for M/s Jaigad Port Infrastructure Pvt. Limited
17. Environment Clearance for proposed expansion of Captive Jetty from 331.5 m to 1800 m by ISPAT industries Ltd
18. Environment Clearance for Proposed Captive Marine Terminal at Mithpaur by Tata Chemicals Ltd
19. Preparation of EIA and obtaining CRZ Clearance for the proposed deepening and widening of JN port channel and Mumbai harbor channel by Jawaharlal Neharu Port Trust, Sheva, Navi Mumbai.
20. Preparation of EIA and obtaining CRZ Clearance for the Coastal Berth at JN port area by Jawaharlal Neharu Port Trust, Sheva, Navi Mumbai.
21. Environment Clearance for proposed bridge on Mandovi river Goa by GSIDC
22. Environment Clearance for proposed bridge on Zuari river Goa by Goa PWD
23. Development of Mangrove Park at Manori by MMRDA
24. CRZ and Environmental Clearance for Chh. Shivaji Maharaj Statue in the Arabian Sea for PWD, Govt of Maharashtra
25. CRZ clearance from MCZMA and MoEF, New Delhi for Proposed Western Corridor of DFCC (Phase 2) from JNPT to Borigaon (The. Talasari) for Indian Railways, GoI.
26. Environmental Clearance including EIA for MSRDC for their Mumbai Trans Harbor Link project (MTHL).
27. Environmental Clearance including EIA for MSRDC for their Versova- Bandra Sea Link Project.
28. Coastal Road for extension of National Highway 4-B at Dronagiri, for CIDCO, Maharashtra state – consist of coastal road, fly over bridges, etc.
29. Environmental Clearance including EIA for National Highway Authority of India (NHAI) for their 100 km. Pune -Solapur project.
30. Environmental Clearance Ropeway project at Kalyan Haji Malang Gad by PWD, Maharashtra
31. Environmental Clearance Ropeway project at SaptashringiMandir at Vani,Nashik
32. CRZ Clearance Ropeway project between Janki Chhati to Yamunotri, Uttarkashi
33. Preparation of EIA and obtaining CRZ clearance for deepening and widening of existing JN Port & Mumbai Port channel
34. Preparation of EIA and Biodiversity studies for obtaining CRZ clearance for proposed coastal berth
35. Obtaining Environment clearance from SEAC for expansion of existing facilities of Amri Chemical Ltd., Aurangabad
36. Obtaining Environment clearance from SEAC for expansion of existing facilities of Finkem Chemical Ltd., Aurangabad
37. Obtaining environmental clearance for the Prime Minister Awas Yojana for following kokan projects,

- Shirdhon
- Bhandarli 80,81
- Bhandarli 13
- Gotheghar
- Khoni

38. Obtaining Environment clearance for BDD chawl Worli, MHADA, Mumbai
39. Obtaining CRZ clearance for Mumbai Coastal road- south part proposed by MCGM, Mumbai.
40. Preparing EIA of ADB format for the proposed Metro line 2A and 7 proposed by MMRDA.
41. Environment & CRZ Clearance for Development of Waste to Energy Project at Deonar Dumping Ground, Mumbai
42. Forest Clearance for Eastern Freeway (Anik Panjarpol Link Road) at Village - Saltpan, Tal – Mumbai
43. Forest Clearance for Construction of Uran Bye Pass Road, Raigad
44. Forest Clearance for Golf Course at Kharghar, Navi Mumbai
45. Forest Clearance for Construction of New Creek Bridge Between Thane Municipal Limit, at Village – Kalwa & Rabodi, District – Thane
46. Forest Clearance for Malad Waste Water Treatment Plant by MCGM, Mumbai
47. Forest Clearance for Prioirity Sewer Tunnels by MCGM, Mumbai
48. Forest Clearance for Construction of Charkop & Mankhurd Metro Car Depot. By MMRDA, Mumbai
49. Forest Clearance for Development of Waste to Energy Project at Deonar Dumping Ground, Mumbai
50. Forest Clearance for Pune Solapur Highway, NHIA, IL & FS.
51. Coastal Road from Palm Beach Road to Airoli for NMMC.
52. Environmental Clearance including EIA for MSRDC for their Peddar Road Via Duct
53. Katraj By-pass road for NHAI
54. Environmental Clearance including EIA for RITES and GOI for 7 Air Stripes in the state of Maharashtra.
55. Zarap – Patradevi state highway for Public Works Dept., Ratnagiri, Maharashtra, 21 km stretch with 2 river crossing bridges.
56. Thane-Bhiwandi-Vadpa Special State Highway for Public Works Dept., Thane, Maharashtra – consist of 10km road and 3 nos. of bridges across Thane creek.
57. Environmental Clearance including EIA for National Highway Authority Of India (NHAI) for their project at Ahmedabad.
58. Environmental Clearance including EIA for National Highway Authority Of India (NHAI) for their project at Ahmedabad.
59. Four-laning and strengthening of Dharbhanga to Jhanjharpur section of National Highway- 57, in the state of Bihar (km 70/000 to km 110/000) by National Highways Authority of India (NHAI)
60. Four laning to Jalna Deulgaon Raja Berala SH-176 in km. 148/00 to 76/00 with construction of Deulgaon Raja Bypass length 5.41 km. by G.O.M. Public Works Department, Buldhana
61. Four laning from Berala fata Chikhali Amdapur Khamgaon to N.H.6 , Length 67.00 Km

by G.O.M. Public Works Department, Buldhana

62. Construction of Coastal Road for Dighi Port connecting to NH-17 by IL&FS Transportation Networks Limited.
63. Proposed construction of two lane approach road for existing Mankule Bridge situated across Kharnai Creek in Mankule & Dherand Village by Office of the Executive Engineer Alibag Public Works Division
64. Environmental Clearance including EIA for Dighi Port.
65. Environmental Clearance including EIA for 1st ever Special Economic Zone in India – Navi Mumbai SEZ on 1250 Ha area.
66. Environmental Clearance including EIA for Pharmaceutical SEZ at Kalamboli on 350 acre of area for NMSEZ Pvt. Ltd.
67. Environmental Clearance including EIA for Engineering SEZ at Kalamboli on 170 acre of area for NMSEZ Pvt. Ltd.
68. Environmental Clearance including EIA for 2000 MW Gas based Power Project for NMSEZ Pvt. Ltd.
69. 1st Hazardous Waste Inventarisation Project was carried out in association with Dept. of Environment and Forests, Govt. of India and Central Pollution Control Board.
70. Appointed as an Advisor - Environment of 1st ever Floatel (Floating Hotel in Sea) near Mumbai.
71. Appointed as a Consultant - Environment & Ecology for Ambey Valley Lake City project at Lonavala by Sahara India Ltd. The project after completed will be a Mega City project.
72. Appointed as Consultant to Indian Institute Of Rural Development (IiRD), which is a conglomerate of World Bank, UNICEF, etc. and other central government departments and authorities.
73. Carrying out feasibility study report for Lake Restoration and Beautification of 15 lakes in Thane Municipal Area.
74. Preparation of Comprehensive Environmental Survey Status Report on solid waste, air pollution, sewerage and other related issues for M/s. HINDUSTAN MAX-GB (India) Ltd., Pimpri, and Pune.
75. Preparation of Comprehensive Environmental Survey Status Report on solid waste, air pollution, sewerage and other related issues for M/s. GODREJ INDUSTRIES LTD, Valia, and Gujarat.