FINAL

AECOM

Environmental Assessment/ Environmental Management Plan for “Trespass control FOB works on Central & Western Railway under MUTP-III Project” in Mumbai

Mumbai Railway Vikas Corporation Limited

16 Aug 2023

Delivering a better world

Prepared for:

Mumbai Railway Vikas Corporation Limited

Prepared by:

AECOM India Private Limited
19th Floor
Building No.5
Tower C
Cyber City
Gurgaon 122002
Haryana
India

CIN: U74210KA2005PTC037770

T: +91 124 4682700/800
aecom.com

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Abbreviations

Sr. No	Abbreviation	Extension
1	AAQ	Ambient Air Quality
2	AAS	Atomic Absorption Spectroscopy
3	AC	Alternating current
4	ACM	Asbestos Containing Material
5	ACM	Asbestos Containing Material
6	AIIB	Asian Infrastructure Investment Bank
7	ALARP	As Low As Reasonably Practicable
8	ASS	Auxiliary Sub Station
9	BaP	Benzo(a)Pyrene
10	bgl	Below Ground Level
11	BIS	Bureau of Indian Standards
12	BMTPC	Building Material & Technology Promotion Council
13	BOD	Biochemical Oxygen Demand
14	BUTP	Bombay Urban Transport Project
15	C&D	Construction & Demolition
16	CaCO3	Calcium Carbonate
17	CBI	Computer Based Interlocking
18	CCTV	Closed-circuit television
19	CGWA	Central Ground Water Authority
20	CGWB	Central Ground Water Board
21	CHWTSDF	Common Hazardous Waste Treatment Storage and Disposal Facility
22	CO	Carbon Monoxide
23	COD	Chemical Oxygen Demand
24	CPCB	Central Pollution Control Board
25	CR	Central Railways
26	CT	Census Town
27	CT	Census Town
28	CWR	Continuous Welded Rails
29	dB	Decibel
30	DFC	Dedicated Freight Corridor
32	DFCC	Dedicated Freight Corridor Corporation
33	DFCCIL	Dedicated Freight Corridor Corporation of India Limited
34	DG	Diesel Generator
35	DGMS	Director General of Mines Safety

36	DMU	Diesel-electric multiple unit
37	DO	Dissolved Oxygen
38	DPR	Detailed Project Report
39	EA	Environment Assessment
40	EC	Electrical Conductivity
41	EC	Environmental Clearance
42	EIA	Environment Impact Assessment
43	EMG	Environmental Management Group
44	EMP	Environment Management Plan
45	EMT	Environment Management Team
46	EMU	Electrical Multiple Units
47	EPA	Environmental Protection Act
48	EPC	Engineering, Procurement and Construction
49	ESHSMP	Environment, Social, Health & Safety Management Plan
50	ESZ	Eco-sensitive Zone
51	FF	Flat Footed
52	FGD	Focused Group Discussion
53	FOB	Foot Over Bridge
54	GBV	Gender-based violence
55	GHG	Green House Gas
56	GIS	Geographical Information System
57	GOI	Government of India
58	GOM	Government of Maharashtra
59	GPS	Global Positioning System
60	GRM	Grievance Redress Mechanism
61	HC	Hydrocarbons
62	ICAR	Indian Council of Agricultural Research
63	IFC	International Finance Corporation
64	ILO	International Labour Organization
65	IMD	Indian Meteorological Department
66	IUCN	International Union for Conservation of Nature
67	JNPT	Jawaharlal Nehru Port Trust
68	KLD	Kilolitre per Day
69	kmph	Kilometer per Hour
70	KV	Kilovolt
71	KVA	Kilovolt Amperes
72	KW	Kilowatt

73	LCD	Liquid Crystal Display
74	LED	Light-emitting diode
75	LPCD	Liter per capita per day
76	LPG	Liquefied petroleum gas
77	LPKM	Liter per Kilometer
78	LWR	Long Welded Rails
79	M	Municipality
80	M Corp.	Municipal Corporation
81	M.CI.	Municipal Council
82	m/s	Meter per second
83	MBC	Monoblock Concrete Sleepers
84	mbgl	Metres below ground level
85	MGL	Mahanagar Gas Ltd.
86	MMR	Mumbai Metropolitan Region
87	MMRDA	Mumbai Metropolitan Region Development Authority
88	MoEF&CC	Ministry Of Environment, Forest And Climate Change
89	MRVC	Mumbai Railway Vikas Corporation
90	MSEDCL	Maharashtra State Electricity Distribution Company Limited
91	MTNL	Mahanagar Telephone Nigam Ltd.
92	MUTP	Mumbai Urban Transport Project
93	MVA	Megavolt Amperes
94	NAAQS	National Ambient Air Quality Standards
95	NAAQSN	National Ambient Air Quality Standards in respect to Noise
96	NABL	National Accreditation Board for Testing
97	NGO	Non-governmental organization
98	NOC	No Objection Certificate
99	NOx	Nitrogen oxides
100	NPK	Nitrogen, Phosphorus and Potassium
101	NT	Near Threatened
102	O&M	Operation and Maintenance
103	PHPDT	Peak hour peak direction traffic
104	PIA	Project Implementing Agency
105	PMC	Project Management Consultant
106	PPE	Personal Protective Equipment
107	PPV	Peak Particle Velocity
108	PRO	Public Relation Officer
109	PUC	Pollution Under Check

110	PUC	Pollution Under Control
111	RFCTLARR	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act
112	RMC	Ready Mix Concrete
113	RO	Reverse osmosis
114	RoW	Right of Way
115	RSS	Receiving Sub Station
116	RSS	Receiving Sub Station
117	SAR	Sodium Absorption Ratio
118	SC	Scheduled Caste
119	SEIAA	State Environment Impact Assessment Authority
120	SHE	Safety, Health and Environment
121	SO2	Sulphur dioxide
122	ST	Scheduled Tribe
123	STD	Sexually transmitted diseases
124	STI	Sexually Transmitted Infections
125	TDS	Total Dissolved Solids
126	TMT	Thermo Mechanically Treated
127	TOR	Terms of Reference
128	TPH	Total Petroleum Hydrocarbon
129	TCFS	Thane Creek Flamingo Sanctuary
130	ULB	Urban Local Body
131	WHO	World Health Organization
132	WPA	Wildlife Protection Act

Executive Summary

Every year thousands of people lose their life or are injured due to trespassing on the railway tracks in the mid sections. To minimize or eliminate the trespassing there is a need to study the suburban railway system focusing on accessibility issues, reasons for trespassing, existing facilities, further development as per development plans, at the mid sections. As informed by Government railway police (GRP) and Railway Protection Force (RPF), the number of accidental deaths & injuries are increasing day by day as the numbers of passengers are increasing. As a result of increased commuter volume at the stations, the station capacities are required to be upgraded. MUTP III is in progress and will lead to similar capacity enhancements. There is urgent need for additional circulating space by provision of elevated decks, interconnection between Foot Over Bridges (FOBs) and improving entry/exit points.

The locations and details of trespass control measures were finalized after site visits, studying alternatives available, studying the feasibility at site and consultation with stakeholders by MRVC. FOBs, platforms, connecting decks and other facilities will be created which will prevent overcrowding, improve access to platform and facilitate dispersal of commuters. Escalators/ elevators will be beneficial to the persons with special needs. The trespass control activities will also improve East West connectivity. The improved infrastructure will provide safe access to commuters and will reduce accidents and deaths due to trespassing.

Mumbai Railway Vikas Corporation (MRVC) will be the implementing agency, responsible for execution of the project. MRVC will be supported in implementation activities by Mumbai Metropolitan Regional Development Authority (MMRDA). The cost of the project is shared equally by MoR & GoM. MRVC (hereafter referred to as ‘client’) wanted to undertake Environmental Assessment/ Audit (EA), preparation of Environmental Management Plan (EMP) for Trespass control FOB works on Central Railway & Western Railway Project. MRVC has appointed AECOM India Pvt. Ltd. as Environmental Consultants for the same.

Objectives of EIA study

- Identify possible environmental issues to be addressed during the construction and operation of the proposed project;
- Recommend appropriate preventive and mitigation measures to eliminate or minimize pollution, environmental & social disturbances, ensuring compliance with environmental laws and regulations applicable;
- Recommend suitable institutional mechanisms to monitor and supervise effective implementation of respective EMP;
- Identifying and proposing alternative actions that may help in abating environmental or socio-economic impacts due to the project;
- To include post project monitoring and supervision mechanism in EMP to ensure its effective implementation; and
- Integrating mitigative measures with environmental action plans and management systems so that they can be implemented, monitored and suitable corrective action can be taken in case of deviations.

Overall, the project will be implemented within applicable Indian legal framework \. As per the current regulations of Government of India, Railway projects do not require conducting Environmental Impact Assessment (EIA) studies for obtaining Environmental Clearance (EC) under EIA Notification 2006.

As informed, the land requirement for the proposed project is kept at minimum and wherever feasible railway land will be utilised. Approximately, 150-170 persons are likely to work during peak construction activity. Labour camp / camps will be set up at appropriate and suitable locations. Wherever feasible, local labour will be involved for unskilled work. Total workforce in the labour camps will be about 150.

During construction phase, water required for domestic requirements of workers and civil works will be taken from municipal water supply / local vendors / ground water sources with permissions from respective agencies, supplied by tankers on site. Since this is FOB or trespass control work only no additional station areas or passengers projected due to this work. During operation phase, existing water requirement for passengers at stations will continue from existing water supply at existing stations.

All the raw material like sand, cement, aggregate steel etc. will be sourced through contractors as per the specifications of Indian Railways.

Delineation of the Study Area

In the case of the present EA study, ‘Project Site’ is project location and ‘Buffer Area’ is considered as Direct Impact Zone as 100 m on either side of proposed project location/site so that it covers the ROW, additional railway land and considerable land outside the railway boundary covering sensitive receptors such as habitations, natural sensitive features, agriculture land, educational institutes, religious places, etc. The ‘Project Site’ and the ‘Buffer Area’ collectively constitute the Area of Influence (AoI) of the project and are hereinafter collectively referred to as the ‘Study Area’.

Baseline Environmental Profile

Baseline environmental profile for project stretch were carried out by undertaking site investigations such as site reconnaissance survey, mapping of sensitive receptors as apart of baseline environment monitoring.

Air Quality: The monitoring of air quality at 03 locations was carried out by an NABL & MoEF&CC accredited laboratory for 24 hours as per NAAQ Standards for parameters like PM10 and PM2.5, NOx, SO_2, O_3, CO, NH_3, C_6H_6, Benzo(a)pyrene, Lead, Arsenic, Nickel. The results indicated that levls were within NAAQS 2009.

Water Quality: The monitoring of water quality at 01 location for surface water and 01 location for groundwater was carried out as per IS 10:500 Standards and CPCB guidelines. Analysis of the results indicated parameters were within permissible limits.

Noise and Vibration Levels: Noise & vibration levels were monitored at 05 locations in study area as per CPCB guidelines and Permissible limits of ground vibration specified by Director General of Mines Safety (DGMS) through its Circular No. 7 of 1997 to be followed for Vibration level monitoring. As per the Indian standards permissible noise levels and considering railways to be in the industrial operations, noise levels were observed to be slightly more at Virar and Badlapur and considerably higher at Ghatkopar station. Similarly, for the night level noise Badlapur was observed to be lower than the permissible levels. These could be due to anthropogenic activities at station areas, railway operations and nearby commercial areas.

Ecology: The ecological baseline data forms the basis for assessing potential impacts of the project on the ecology of the project area and suggesting measures to mitigate any significant adverse impacts anticipated. Geographically, the Study Area for all the sites forms a part of the western coastal plains of the state of Maharashtra. Ecologically, the Study Area mainly consists of highly modified habitats, largely urban areas comprising built up interspersed with avenue plantations, arable lands and occasional small patches of near natural habitats, such as natural and regenerated tree cover, relic trees and shrublands. A few natural habitats include seasonal and perennial surface waterbodies including streams, pools and lakes.

The biodiversity sampling towards the environmental assessment was conducted collectively at 10 locations within 100 m radius of each project site. Primary observations on flora, fauna and habitats were recorded at each of these sampling locations.

Legal and Administrative Framework

All the applicable policies, rules and regulations by MoEF&CC, Indian Railways and other best practices have been considered for preparation of Environment Management Plan.

No Project Scenario The Central and Western Railway suburban system of the Indian Railways has taken up the issue of trespassing, seriously and is putting in sincere efforts to curb this menace. Apart from various infrastructural measures, viz. provision of boundary walls, track dividers, foot over bridges and escalators, the behavioural pattern of persons, crossing the tracks was studied. Many accidents take place on the entire system of the Indian Railways

(IR), due to unlawful trespassing which can be avoided/controlled by development of the proposed project/facilities like additional FOB’s with increased width, staircases, escalators with double discharge facility, skywalks, construction of additional platforms etc. The same would help Western and Central Railways to achieve the “Zero death mission” which is to deal effectively with the problems of trespassing and to minimise the casualties. No project scenario might not only affect the outcomes of the initiatives but could also in-turn increase such incidents due to the increasing population in the city.

Stakeholder Consultation

EIA team carried out consultations at various levels level with trespassers and daily commuters, Fence-line and local community, Local Labourers. Consultation at institutional level with project investors, MRVC, municipal corporations, Revenue/Tehsil offices and with regulatory authorities like MPCB, PWD, local fire department, etc. within the project area during site reconnaissance. Overall stakeholders see the project as beneficial project. EMP has been developed to address the same.

Impact Assessment

The activities which will be carried out during construction and operation phase are considered for identifying impacts of the project. The activities during construction phase include clearing the ground for construction activity, dismantling / demolition activities before construction, establishment and operation of the labour camps, access control and barricading, relocation and arrangements of utility lines for construction works, collection of construction material, transfer of construction materials; storage, handling and disposal of solid, hazardous and construction and demolition waste material; excavation works and foundation works, assembling and its mechanical installation of pre-fabricated components, operation and maintenance (O&M) of all machineries, electrical works as installation of overhead electrical structures, signalling post, power sub-station, etc. The operation phase would include activities like operation and maintenance of newly built FOB’s, other ancillary facilities, etc.

Environment components considered for impact identification are as follows:

- Air Quality: Fugitive dust, gaseous emissions, fuel emissions, emissions from diesel generator sets, odour nuisance, traffic congestion at rail crossings
- Water Quality: Water usage, water contamination, effect on the existing storm water drain
- Land: Soil erosion, flooding, soil contamination, loss of soil/ land degradation
- Noise & Vibration: Noise & vibration due to machine and vehicle movement, construction activities, maintenance activities
- Biodiversity: Felling of trees, disturbance to ecology and biodiversity
- Community Health & Safety: higher noise levels, aesthetic changes, health and safety of community
- Occupational Health & Safety: safety of workers Exposure to hazardous materials, impact on community infrastructures, mechanical vibrations

The critical environmental impacts are identified based on type of impact, nature of impact, likelihood of occurrence, extent, duration, intensity and significance.

Environment, Social, Health and Safety Management Plan

Environment and related Social, Health and Safety Management Plan (ESHSMP) has been prepared, based on the identified environmental attributes and type of the impacts. The main environmental attributes consist of air, water, noise and vibration, land, flora-fauna, occupational health and safety and environmental health and safety. To cover all the environmental attributes, ESHSMP has been divided into following components.

- Air Quality Management Plan
- Water Quality Management Plan
- Soil Quality & Erosion Management Plan

- Noise and Vibration Management Plan
- Ecology / Biodiversity Management Plan
- Solid and Hazardous Waste Management
- Asbestos Waste Management Plan
- Plant Site/Labour Camp Management Plan
- Construction Area Management Plan
- Traffic Management Plan
- Construction / Occupational Health and Safety Management Plan
- Community Health and Safety
- Environmental Monitoring Plan

Table E-1-1: Salient Features of the Project

Sr. No.	Environmental Impacts	Applicable Project Activities	Details of Project Activities	Mitigation Measure
1.	Water withdrawal/ consumption from ground and surface water source	- Excavation works and foundation works (pile and concrete)	- Water requirement is expected for the duration of 2 years during construction	- The contractor shall arrange for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected. - Sourcing water from authorized sources
2.	Noise due to construction work	- Excavation works and foundation works (pile and concrete) - Improved infrastructure such as new FOB's Staircases, escalators etc. at railway stations, other facilities	- Noise levels will increase due to vehicular movement for material transportation and use of heavy machinery & vehicles	- Construction of boundary wall of the railway premises at the locations where habitations are located very close to the railway boundary - Trees plantation as a noise barrier
3.	Impact on health and safety of workers	- All the project activities during construction and operation stages	- It is envisaged that construction activities will be carried out at 4 different railway stations i.e. Ambarnath, Ambarnath, Badlapur, Klawa and Virar. Separate labour camps will be set up. The construction work is expected to have total of 150-170 labours	- The building and other construction workers' (regulation of employment and conditions of service) act, 1996 requirements shall be followed. - All hazardous chemicals and materials shall be stored in dedicated area and covered. - Ensure that a readily available first-aid unit and access to the ambulatory services - All machinery and equipment should be covered with acoustic materials. - Comprehensive traffic management plan should be prepared - The labour camp should be adequately drained to avoid the accumulation of stagnant water. - Drains and ditches within the labour camp area should be disinfected - The contractor will ensure good health and hygiene of all workers to prevent sickness and epidemics. - The workers should all be screened for the health problems before being considered for employment.

Sr. No.	Environmental Impacts	Applicable Project Activities	Details of Project Activities	Mitigation Measure
				- Regular health check-up and immunization camps should be organized for the workers and nearby population. - After completion of the construction; the contractor shall ensure the complete removal of the labour camps. - The contractor shall also comply with The Factories Act, 1948 and all the other relevant acts/rules applicable as per the Ministry of Labour and Employment, Government of India.
4.	Dust and gaseous emission from heavy machinery and vehicles	- Clearing the ground for construction activity - Dismantling / demolition activities before construction - Transportation of construction material - Setting up the Ready-Mix Concrete (RMC) Plant - Excavation works and Foundation works (Pile and concrete) - Transportation of construction materials - Launching of heavy steel girders - Assembling and its mechanical installation of pre-fabricated components	- Vehicle movement for material transportation, loading and unloading of material, installation and operation of DG sets, dismantling activities, earthwork, etc. will generate dust and gaseous emission	- Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered. - Loading and unloading of construction materials, earthwork, unpaved haulage roads other dust prone areas and construction yard shall be provided with water spraying arrangement. - Vehicular pollution check (PUC) for all the vehicles - The excavated material shall be stored properly - Ready-Mix Concrete plant for commercial purposes should be installed at a site with a buffer zone of approximately 100 m distance from human habitation of 1000 population or more and major road and should not be located within 200 m from schools, colleges, hospitals and courts. All the machinery and equipment shall be regularly maintained. - The construction workers shall be provided with all requisite Personal Protective Equipments (PPEs) like helmet, face masks, etc. - As far as possible, transport the material during night time (8 pm to 5 am). - Procure material only from approved quarry areas - Air quality monitoring for the same parameters, which were monitored during the baseline studies, shall be implemented by the Contractor by hiring the services of the NABL accredited / MoEF&CC notified laboratory

Sr. No.	Environmental Impacts	Applicable Project Activities	Details of Project Activities	Mitigation Measure
5.	Impact on Health and Safety of communities	- All the project activities during construction and operation stages	- The duration of the construction activity is envisaged as 2 years which will generate inconvenience to the local community due to barricading, traffic, increase in worker population, etc. and issues related to health and safety of the community	- Work area should be barricaded and provided with measures to prevent trespassing. - All exhaust should be provided stacks to release of gaseous emission at safe height. - Efforts shall be made to avoid the storage of hazardous chemicals near any residential area. - The Contractor shall deploy a team for Safety, Health and Environment management on the construction site as specified in SHE manual prepared by MRVC.
6.	Loss of productive soil due to construction activities	- Establishment and operation of the labour camps - Transportation of construction material - Storage, handling and disposal of solid, hazardous and construction and demolition waste material - Setting up the Ready-Mix Concrete (RMC) Plant - Excavation works and foundation works (Pile and concrete) - Operation and maintenance of all machineries	- The loss of the productive soil will happen due to creation of new access road for material movement, movement of vehicles.	- To prevent soil compaction in the adjoining productive lands beyond the RoW, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.
7.	Impact on ecology	- Clearing the ground for construction activity - Dismantling / demolition activities before construction	- No tree survey is done yet. Number of trees to be cut or trim is not yet enumerated.	- Tree felling, clearing of vegetation and trimming of trees (if any) in accordance with the relevant regulations - Plan for compensatory planting - MRVC shall not allow introduction of exotic species

1. Introduction

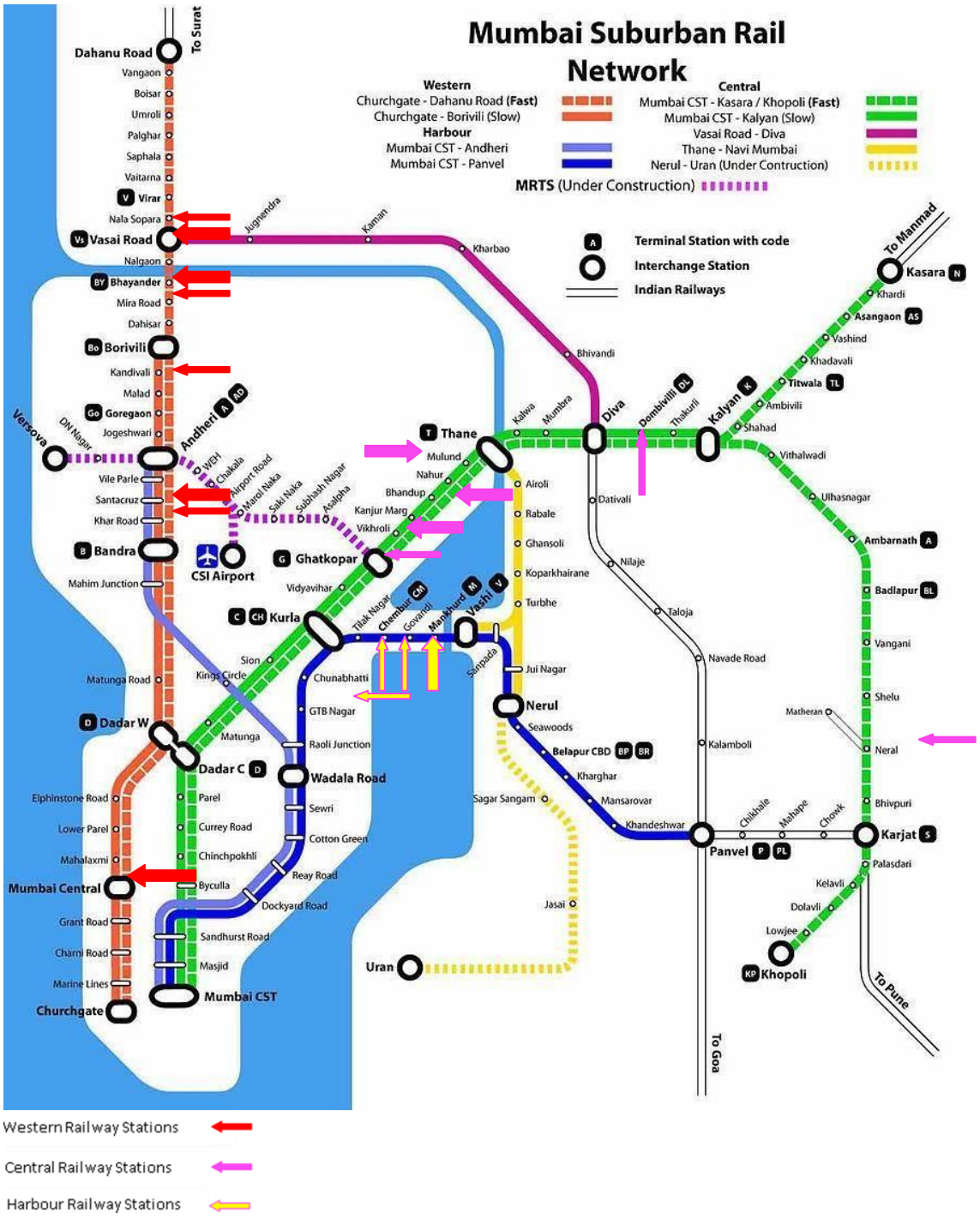
Mumbai is the most populous city of India and is also the financial, commercial and entertainment capital of India. With the increasing population in the Metropolitan Region of Mumbai, there is ever growing demand of passenger traffic on the suburban railway system. Key aspect of transportation in Mumbai is the overwhelming dependency on suburban railway system. The Mumbai Suburban Railway system is operated by Indian Railways two zonal divisions Western Railways (WR) and Central Railways (CR). The fast commuter rail corridors on Central Railway as well as Western Railway are shared with long distance and freight trains, while inner suburban services operate on exclusive parallel tracks. Western Railways operates the Western Line and Central Railways operates the Central Line, Harbour Line, Trans-Harbour Line as well as the Vasai Road-Diva-Panvel line (Figure 1-1 below). The Mumbai Urban Transport Project (MUTP) was designed with a vision to improve the mass transportation services in Mumbai and meet the steadily growing demand of the Mumbai Suburban Railway System. Ministry of Railways and Government of Maharashtra have jointly set-up the Mumbai Railway Vikas Corporation (MRVC) in 1999 for implementation of the railway projects under MUTP. MRVC has accordingly completed MUTP Phase I in 2012; and MUTP Phase II in 2021.

Mumbai’s suburban railway network is the busiest commuter train system with 8.2 million people using the trains to commute daily. Annually, the suburban railways transport 2.95 billion passengers, which is about a third of the world’s population. Due to extensive reach of Mumbai Suburban Railway across the Mumbai Metropolitan Region and its intensive use by the local suburban population, the Mumbai Suburban Railway suffers from excessive overcrowding. Over 7,000 passengers are packed in a 12-car rake during peak hours as against the rated carrying capacity of 3,600. The capacity enhancement work under MUTP I & II have resulted in increase in Railway corridors and conversion of all 9 car rakes into 12 car rakes. Further, augmentation of services and increase of length of trains to 15 coaches is underway. These additional services have increased commuter volume at the station and therefore station capacities are required to be upgraded. MUTP III is in progress and will lead to similar capacity enhancements. There is urgent need for additional circulating space by provision of elevated decks, interconnection between Foot Over Bridges (FOBs) and improving entry/exit points.

MRVC has decided to carry out Environment Assessment (EA) of all components under MUTP-III with an objective to minimize the overall environmental impacts during the construction and operation phases of these projects. MUTP III is being partly funded by the AIIB. AIIB’s ESMF policy and procedures for EA are to ensure that development options under consideration are environmentally sound and sustainable, and that any environmental consequences are recognized early and suitably mitigated in the project design. To strengthen the railway network in the Mumbai and its suburban area, MMRDA has initiated numerous projects under MUTP. MUTP (rail component) so far has 3 phases i.e., Phase-I, Phase-II and Phase-III. MUTP Phase-III has been sanction in 2011 under which Environmental Assessment/Audit for “Trespass control FOB works on Central Railway & Western Railway (hereafter referred to as ‘project’) has been sanctioned. Mumbai Railway Vikas Corporation (MRVC) will be the implementing agency, responsible for execution of the project. MRVC will be supported in implementation activities by Mumbai Metropolitan Regional Development Authority (MMRDA). The cost of the project is shared equally by MoR & GoM.

MRVC (hereafter referred to as ‘client’) wanted to undertake Environmental Assessment/ Audit (EA), preparation of Environmental Management Plan (EMP) for Trespass control FOB works on Central Railway & Western Railway Project. MRVC has appointed AECOM India Pvt. Ltd. as Environmental Consultants for the same.

Figure 1-1 given below presents the drawing of Sub-urban railway network of Mumbai.



Source: RITES Final Resettlement Plan Report, January-2022

Figure 1-1: Existing Sub-urban railway network of Mumbai

1.1 Project Background

Due to the capacity enhancement work, conversion of all 9 car rakes into 12 car rakes under MUTP I & II and increase in length of trains to 15 coaches which is underway, the commuter volumes at the stations have increased. MUTP III is also in progress and will lead to similar capacity enhancements. Therefore, station capacities are required to be upgraded by the provision of elevated decks, interconnection between Foot Over Bridges (FOBs) and improving entry/exit points, etc. Mumbai Railway Vikas Corporation (MRVC) intends to improve 05 Railway Stations in Mumbai Suburban Railway by upgrading the level of passenger amenities by way of new

constructions/renovations including improvement of the foot over bridges, walkways, station buildings, platform surfaces, circulating area to better standards so as to serve the need of the passenger. Station Improvement is proposed on 05 stations. (As per TOR shared by the Client). Out of these 05 stations, 4 are on the Central line of Central Railway and 01 is located on western line of Western Railway. The list of proposed 05 stations for improvement is shown in **Table 1-1**. During tender stage it was communicated by MRVC that out of the below 05 stations, land acquisition is required only at Badlapur. As communicated by MRVC in later stage private land acquisition will not take place at any of the stations. The existing railway and government land will be utilized for station improvement project.

Table 1-1: Proposed Locations for improvement

Sr. No.	Railway Network	Railway Line	Railway Station
1.	Central Railway	Central Line	Ambarnath
2.			Badlapur
3.			Ghatkopar
4.			Kalwa
5.	Western Railway	Western Line	Virar

1.2 Need for the Project

Every year thousands of people lose their life or are injured due to trespassing on the railway tracks in the mid sections. To minimize or eliminate the trespassing there is a need to study the suburban railway system focusing on accessibility issues, reasons for trespassing, existing facilities, further development as per development plans, at the mid sections. As informed by GRP and RPF, the number of accidental deaths & injuries are increasing day by day as the numbers of passengers are increasing. The main reasons of mid- section trespassing are:

- Low risk perception about getting hit by trains while trespassing.
- Damaged compound walls along the railway boundary at the stations
- Lack of access-controlled boundary walls along the railway RoW boundaries.
- Absence of barriers to trespassing like fencing; inadequate provisions of alternatives to trespassing like FOB/underpasses etc;
- Limited connectivity (flyovers, skywalks) connecting Eastern and Western sides of the station and areas other than platform results in trespassing.
- Poorly designed station layout (approach road, PRS counter, toilet blocks, parking etc.)
- Human settlement along the track also leads to regular trespassing by the inhabitants.
- Social indifference/acceptance and perceived legality of trespassing as default behaviour.

Main reasons for trespassers[1] fatality are:

- Poor conspicuousness of approaching trains due to sharp curves.
- Overconfidence and lack of alertness.
- Many of the fatalities occurred when victim was busy in mobile/earphones/electronic device.

[1] *This practice is punishable under Section 147 of the Railways Act, "Nobody should cross the track at any given instance," the public must use rail overbridges, underground subways, and foot-over bridges to cross railway track.*

- The conflict between light emanating from the human settlement parallel to the railway track and the main headlight of the moving train confuses the trespasser to judge the distance of the train during night-time.
- Suicide accounts for about 20-30% of trespassing fatalities and out of remaining trespassing accidents[2], majority are taking place near busy stations where both level of trespassing and train. Trespassing cases increases during festival seasons like Ganesh Chaturthi, Diwali, Vishwakarma puja etc.

Taking the trespassing issue into prime consideration, MRVC had undertaken various projects in the past for providing remedial measures to minimize the trespassing on railway tracks. The primary objective of MRVC in this project is to ensure commuter safety by providing an effective solution to reduce mid- trespassing is to create facilities that ensure East West connectivity. The trespass control facilities include: Foot over bridges (FOB), railing & barricades, fenced pathways, link ways (connecting decks), boundary walls, re-organization of built-spaces such as booking office, toilet blocks etc. and providing facilities, which improve East West connectivity and easy movement of commuters e.g. Escalators, elevators and walkways.

1.3 Purpose and Structure of Report

The overall contents of the EIA report have been prepared as per the generic structure of EIA Notification 2006. The content of EIA report is briefly described in **Table 1-2**.

Table 1-2: Contents of EIA report

Chapter Number	Section	Brief Description
E	Executive Summary	Executive Summary of EIA report.
1	Introduction	This section covers project background; Scope and Methodology; and Structure of the report.
2	Description of Project	Presents a description of the existing project area and description of proposed project components
3	Legal and administrative framework and applicable policies	Presents the key regulatory framework applicable to proposed project. Also, the list of the environment related clearances or permissions required for the project is given this section.
4	Environmental & Socio-economic Baseline	Presents description of the baseline environmental profile which mainly includes observations of site reconnaissance survey, land use, ecology & biodiversity and baseline environmental condition of air, water, noise, soil and vibration
5	Stakeholder Engagement and Consultation	Includes identification of stakeholders, details of consultations
6	Environment Impact Assessment and Mitigation Measures	Includes impact identification through scoping, assessment of impact, mitigation measures and evaluation of significance of residual impacts. Includes mitigation measures to the impacts identified to avoid, limit or compensate for the impacts caused by the project.
7	Alternative Analysis	This section includes alternatives analysis with respect to site and project
8	Environmental Management Plan	This section covers Environment Management Plan for air, water, noise & vibration, soil, etc. along with proposed institutional mechanism and environment budget for implementation of these management plans
	Appendices	Present the project related documentations, other attachments and documents supporting the information of the EIA study report

[2] *Accident/Incident data for AmbarnathAmbarnath, Badlapur and Virar sites are provided by MRVC and mentioned in the Annexures*

2. Description of Project

The capacity enhancement work under MUTP I & II have resulted in increase in Railway corridors and conversion of all 9 car rakes into 12 car rakes. Further, augmentation of services by quadrupling of Virar -Dahanu section, doubling of Panvel-Karjat section and increase of length of trains to 15 coaches is underway. These additional services have increased commuter volume at the station and therefore station capacities are required to be upgraded. MUTP III is in progress and will lead to similar capacity enhancements. There is urgent need for additional circulating space by provision of elevated decks, interconnection between Foot Over Bridges (FOBs) and improving entry/exit points.

MRVC has accordingly completed MUTP Phase I in 2012; works of MUTP Phase II & MUTP III are under progress and expected to be completed by 2024-25.

MUTP III comprises of following components.

a) Quadrupling of Virar-Dahanu Road section admeasuring 63 Running Kilometer (RKm) on Western Railway.

b) Double line corridor on Panvel-Karjat section admeasuring 28 RKm on Central Railway.

c) Elevated corridor link between Airoli- Kalwa admeasuring 3 RKm on Central Railway.

d) Trespass control in Mid-section on suburban system of Mumbai at 22 locations.

e) Procurement of additional rolling stocks comprising of 565 EMU cars (47 rakes of 12 Car rakes).

Trespass control in Mid-section on suburban system of Mumbai” EA study at 36 locations has been carried out and EMP has been finalized to mitigate potential impacts of the project in MUTP Phase I and II. This component mainly involves reduction of death/injury due to trespass by commuters/local people across railway tracks, by provision of FOB, boundary wall, pathways, link-ways etc. During execution of trespass control work, intervention work at 3 locations (km 7/3 Mahalaxmi-Lower Parel, km 16/03 Kurla-Vidyavihar) were dropped due to various reasons. Further, FOB’s have been constructed/under construction/planned at following 09 locations but EA study is yet to be done at the locations mentioned in the table below.

The improved infrastructure will provide safe access to commuters and will reduce accidents and deaths due to trespassing as mentioned in the table 2-1 below.

Table 2-1: Outline of the project components for trespass control work

Sl. No.	Name of Site (As per TOR)	Geographical Co-ordinates
I.	**Environmental Assessment Study**	
a.	Km 67/6, BUD (M) FOB with deck- Planned	19.166789°N, 73.239561°E
b.	Km 60/4-6: Virar FOB – planned	19.45806 °N, 72.81157° E
c.	Km 68/14-16: Badlapur-Vangani FOB– Planned.	19.16254°N, 73.24629° E
d.	Km 35/3-4 Kalwa FOB connecting west side with platforms – Planned.	19.19530° N, 72.99627° E
e.	Km 59/26-28 Ambernath (KJT end) FOB– Planned.	19.20936°N, 73.1867°E
II.	**Environmental Audit**	
a.	Km 59/26-28: Ambernath (N) FOB - Commissioned	19.21068°N, 73.1836° E
b.	Km 67/16-18: Badlapur (S) FOB – Commissioned	19.166500°N, 73.240936°E
c.	Km 67/3, Ambarnath- Badlapur Home-PF BUD - under construction	19.166889°N, 73.239571°E
d.	Km 19.300, Ghatkopar (M) FOB with deck on east side – under construction.	19.08559°N, 72.90862°E

Sl. No.	Name of Site (As per TOR)	Geographical Co-ordinates
III - **Replacement locations for Environmental Assessment Study** [3]		
a.	Km 67/20, BUD home platform- Planned considered instead of Km 67/6, BUD (M) FOB with deck- Planned	19.16697°N, 73.23883°E
b.	Km 59/37-39 Ambernath (KJT end) FOB– Planned considered instead of Km 59/26-28 Ambernath (KJT end) FOB– Planned.	19.20936°N, 73.1867°E

Source: TOR provided by the client and *confirmation of locations and scope shared by client. Email dated: 03/04/2023, 9:10 PM*

The locations and details of trespass control measures were finalized after site visits, studying alternatives available, studying the feasibility at site and consultation with stakeholders by MRVC. FOBs, platforms, connecting decks and other facilities will be created which will prevent overcrowding, improve access to platform and facilitate dispersal of commuters. Escalators/ elevators will be beneficial to the persons with special needs. The trespass control activities will also improve East West connectivity. The improved infrastructure will provide safe access to commuters and will reduce accidents and deaths due to trespassing.

The proposed project involves construction of FOBs, middle deck, staircases, and escalators for ease of movement of daily commuters.

Considering that the project components listed above are geographically scattered and are fairly large & if not carefully designed and constructed, can have environmental impacts, MRVC intends to carry out a detailed Environmental Assessment /Environmental Audit (Environmental Assessment at those locations where FOBs are at planning stage & Environmental Audit at those locations where FOBs are Commissioned/under construction) of the above 09 additional component of trespass control works. The Environmental Management Plan (EMP) shall be developed as a part of EA study and will be integrated into the relevant project contracts for implementation.

As per the current regulations of Government of India, Railway projects do not require conducting Environmental Impact Assessment (EIA) studies for obtaining Environmental Clearance (EC) under EIA Notification 2006. MUTP III is being partly funded by the AIIB, MRVC intended to carry out an EIA study of proposed project and develop an Environmental Management Plan (EMP) to integrate relevant environmental and social safeguards into the project development stages.

The present report is prepared to document the studies/assessment conducted by environment, social and ecology and biodiversity teams covering details on field surveys and the information collected by environmental/social/ecological experts during the visit. The objectives of the study and the methodology adopted for assessment are described below

2.1 Objectives of the Study

The objectives of the EIA study are:

- To Identify possible environmental issues to be addressed during the , construction and operation of the proposed project.
- Recommend appropriate preventive and mitigation measures to eliminate or minimize pollution, environmental & social disturbances, ensuring compliance with environmental laws and regulations applicable.
- Recommend suitable institutional mechanisms to monitor and supervise effective implementation of respective EMP
- Identifying and proposing alternative actions that may help in abating environmental or socio-economic impacts due to the project;
- To include post project monitoring and supervision mechanism in EMP to ensure its effective implementation

[3] *Confirmation of locations and scope shared by client. Email dated: 03/04/2023, 9:10 PM*

Integrating mitigative measures with environmental action plans and management systems so that they can be implemented, monitored and suitable corrective action can be taken in case of deviations.

2.2 Methodology Adopted for Study

EIA report identifies the relevant environmental concerns and focuses on potential impacts that may occur due to the construction and operation of proposed project. Based on the collected baseline data, the status of the existing environment in the area and capacity to bear the impact is analysed. Based on this analysis, the mitigation measures for minimizing the impacts have been suggested in the EIA/EMP study. The detailed methodology for assessment was shared in Interim report submitted to the Client. A brief of methodology adopted for undertaking the environmental and social impact assessment study is as provided in **Figure 2-1.**

- Scoping is made concerning environmental aspects, timeframes, and geographic scope.
- Desk-based review of project related documents
- Site Reconnaissance survey to understand site specific issues.
- Baseline noise level, air, water, soil, ecology and biodiversity data collection of the site through primary and secondary data source surveys/sources.
- Identification of environmental and social impacts associated with the project with respect to applicable national regulations
- Analysing alternative solutions with respect to site and technology
- Identification of impacts due to various project activities in construction & operation phase and related mitigation measures
- Development of Environmental Management plan along with responsibility matrix

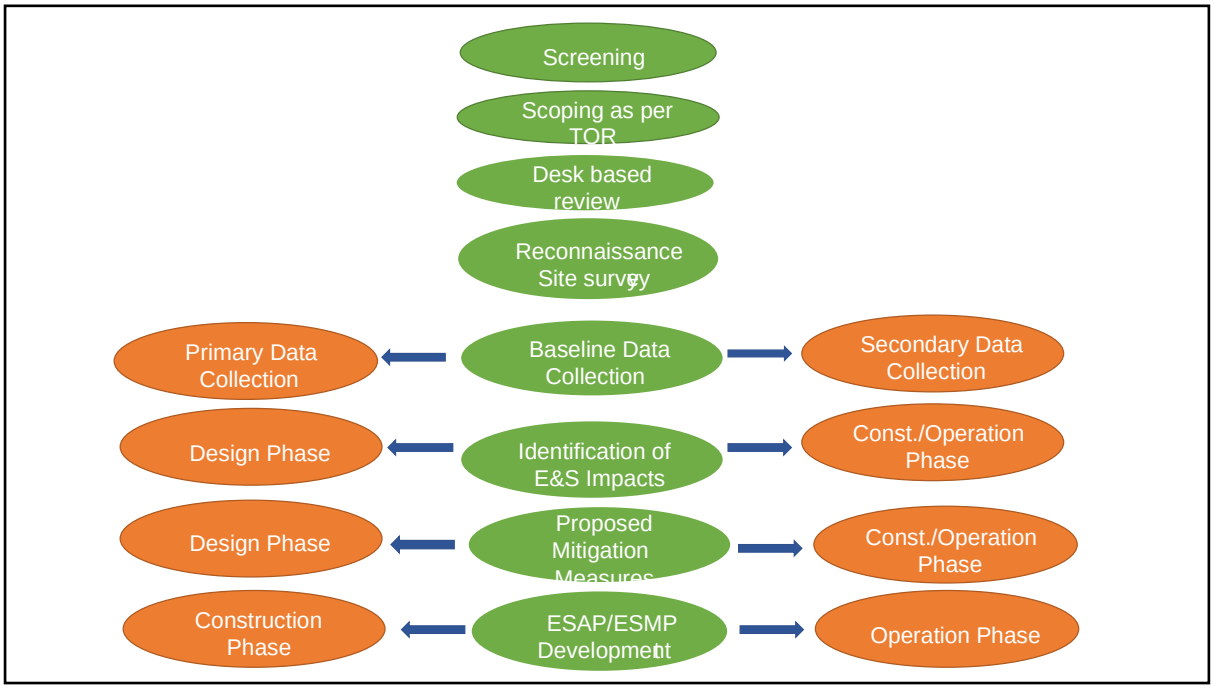


Figure 2-1: Approach and Methodology adopted for EA/ EIA Study of the Project

2.3 Resource Requirement

The section below gives details of the resource required for the project.

2.3.1 Land Details

As per information shared, the land for all FOB locations is under the possession of MRVC. The land detail of all the FOB locations is in **Table 2-2** given below.

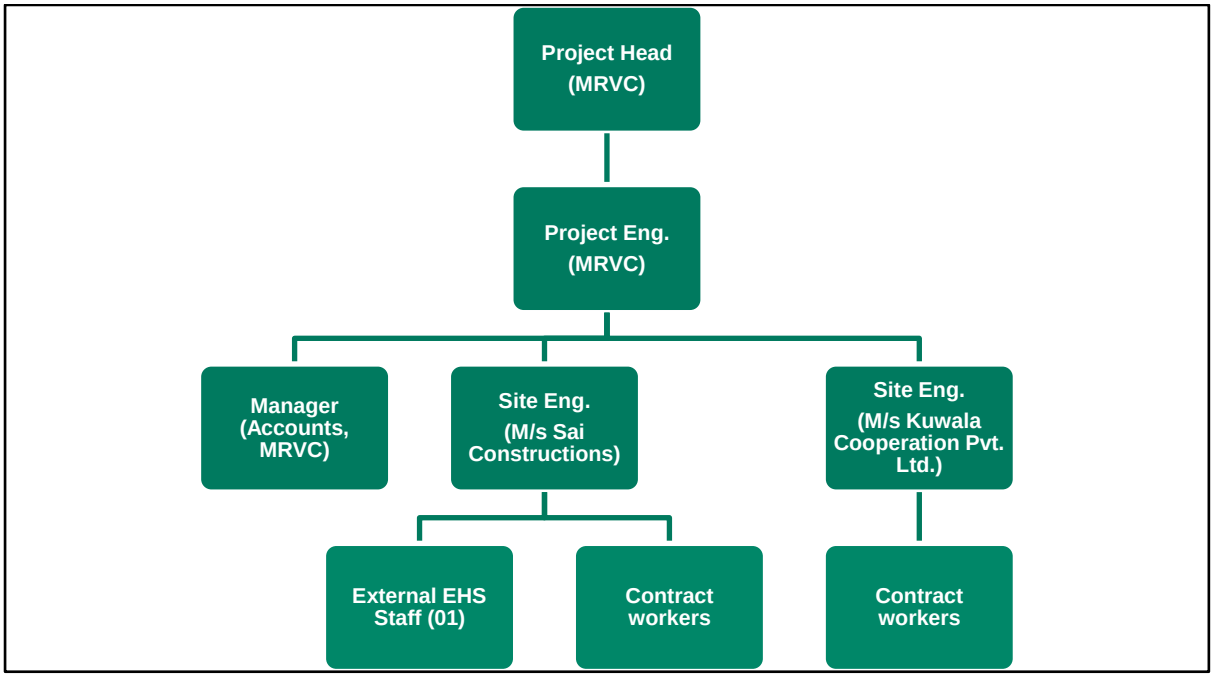
Table 2-2: Land Details

FOB Location	Total land Required (in meter^2)	Status
km 67/20, BUD Home platform- Planned	1792.00	The construction for the BUD home platform was identified to be under process. The site team informed that the construction work had started since February 2023 and shall be completed by February 2024. The MRVC site team further added that the land for the given FOB was acquired before year 1853 (*year since Mumbai sub-urban railways started its operations*); and is under possession of Indian Railways; however, no land document pertaining to it was shared with AECOM for review.
km 60/4-6: Virar FOB - planned	203.40	The construction for the FOB with deck was identified to be under process. The site team informed that the construction work had started since January 2023 and shall be completed by January 2024. The MRVC site team further added that the land for the given FOB was acquired before year 1853 (*year since Mumbai sub-urban railways started its operations*); and is under possession of Indian Railways; however, no land document pertaining to it was shared with AECOM for review.
km 68/14-16: Badlapur-Vangani FOB– Planned.	NA	The given FOB sites were identified to be under-planning stage during AECOM's site visit. It was further informed by MRVC site team that the project/ FOB shall be commissioned by 25th March 2024; however, no exact detail pertaining to starting of construction work was given. MRVC site team also added that no fresh lands have been procured for the construction of given FOBs, as the land is reportedly under possession of Indian Railways. AECOM carried out detailed consultations with identified fence-line communities, trespassers etc. details pertaining to it has been given below.
km 35/3-4 Kalwa FOB connecting west side with platforms – Planned.	NA	
km 59/37-39 Ambarnath (KJT end) FOB– Planned	NA	

Source: Consultation with MRVC Site team

2.3.2 Workforce Detail

MRVC has developed a site level team for managing the site level construction and operation activities, **Figure 2-2** below give details of the same. The Project Head and Project Engineer appointed by MRVC are reportedly the key personnel who looks after the overall construction and operational activities. Further, details of pay-roll staff, contractors and contract workers are given below.



Source: MRVC Site Team

Figure 2-2: Site level Organization Structure

2.3.2.1 Direct staff

As per information, MRVC has engaged total three staff (03) at site level. The site level activity is being headed by Project Head and day-to-day activity is managed by Project Engineer. In-addition MRVC has also engaged one (1) staff for managing Accounts for the ongoing site level construction activities.

2.3.2.2 Contract workers

During site visit and consultation with MRVC site team and contractors it was identified that MRVC has engaged two contractors namely M/s Sai Construction Pvt. Ltd for FOB at km. 67/20 BUD Home platform and M/s Kuwala Cooperation Pvt. Ltd for FOB at km. 60/4-6 Virar.

During site visit it was identified that contractor M/s Sai Construction Pvt. Ltd. has engaged one (1) external EHS person for providing EHS trainings to MRVC site team and contract workers engaged for construction and operational activities. The workers engaged by both the contractors informed to be engaged for nine (09) hours duty and for 6 days a week.

The three other FOB locations namely, km 68/14-16 (Badlapur- Vangini), km 35/3-4 (Kalwa), and km 59/37-39 (Ambarnath, Karjat end) were identified to be under planning stage during site visit, thus no contract workers were reported to be engaged at these locations. The **Table 2-3** below, gives a detail of total contractors at both the under-construction FOB locations visited by AECOM.

Table 2-3: List of Contractors Currently Engaged

FOB Locations	Contractors	Activity
Km 67/20, BUD Home platform - Planned	M/s Sai Construction Pvt. Ltd.	Contractor
	M/s Manish workers	Sub-contractor for fabrication work
	M/s Krishna Workers	Sub-contractor for civil work
	M/s Bacchu Workers	Sub-contractor for piling work
	M/s Chhabban Workers	
	M/s Banwari workers	Sub-contractor for furnishing & tile work
Km 60/4-6: Virar FOB - planned	M/s Kuwala Cooperation Pvt. Ltd.	Contractor
	M/s Dubey Constructions	Sub-contractor for civil work

FOB Locations	Contractors	Activity
	M/s Munna Constructions	Sub-contractor for fabrication work
	M/s Ramavtar Constructions	Sub-contractor for GI work
	M/s Vipin Constructions	Sub-contractor for civil work

Source: AECOM site visit

Note: No details pertaining to contract workers engaged at the time of site visit was shared with AECOM, thus no details pertaining to it has been shared in the report.

During site reconnaissance and further consultation with contractors it was reported that the migrant workers were engaged by their respective contractors directly in some other construction work (prior to the current FOB work) located in Mumbai and not through any sub-contractor/ Khatadar/ Sardar; also, they did not migrate from their respective home state for this particular FOB construction/employment opportunity, thus AECOM understands that they shall not be considered as “inter-state migrant workmen” as per Section 2 (b) and 2(e) of the “The Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979”.

2.3.3 Water Requirement

During the project construction phase, water is required for civil work and domestic purposes such as drinking and washing by the construction workers and staff.

During construction phase, water required for domestic requirements of workers and civil works will be taken from municipal water supply / local vendors / ground water sources with permissions from respective agencies. Water would be supplied by tankers on site. MRVC along with its subcontractors will ensure that the water is taken from authorized sources/dealers. 10k ltrs of water tankers will be procured from the local vendors daily during the construction phase which will be the responsibility of the EPC contractor.. Bisleri Cans of 20 ltrs capacity will be provided at the labour camps. Number of labours are yet to be confirmed however 5-6ltrs per labour of drinking water will be required. Labours were known to be staying near the construction site where the water for bathing will be provided from the municipal water supply.
As the proposed project involves construction of FOBs, staircases and escaltors only, therefore water demand during operation phase can be considered as nil.

2.3.4 Construction Material

Construction materials such as sand, aggregates, cement, crushed sand, Thermo Mechanically Treated (TMT) bars of various sizes, mild steel, structural steel, paints, etc will be procured from the licenced quarry/RMC plants and railway approved vendors. EPC contractor will ensure the availability of legal/statutory documents of vendors supplying the raw materials for the project.

2.3.5 Power

As informed by MRVC officials, EPC contractors deployed for the project sites will obtain a separate power connection and power meter through Maharashtra State Electricity Distribution Corporation Limited (MSEDCL). In case of emergency DG sets will be used by the contractors. EPC contractors to further ensure that only acoustic DG set complying with CPCB norms will be used during the construction phase of the project.

Waste Generation

During the construction phase, waste will get generated and improper handling and storage of waste such as municipal waste or hazardous waste like waste oil, grease, corrugated roofing sheets containing Asbestos fibres, soaked cotton with oil/grease, etc. could lead to leachate which can contaminate ground water or surface water body. Other wastes include waste from paints and their cans and bitumen during paint works and road construction respectively. Untreated discharge of domestic effluent from toilets set up for workers can contaminate surface or groundwater sources.

Solid Waste

Municipal waste would be generated due to workers in labour camp and other workers during construction phase.

The contactor shall discuss the matter related to number of labours, quantity of solid waste generated and suitable method of the waste disposal with urban local bodies/panchayat where the labour lamp is located. Based on guidance from the local bodies/panchayat, the arrangements regarding solid waste disposal shall be done. The contractor shall manage the solid waste on their own by taking following steps:

- Domestic solid waste at construction labour camp should be segregated into biodegradable and non-biodegradable waste.
- Efforts shall be made that bio-degradable waste is composted through pit-composting/bin-composting.
- The non- biodegradable and recyclable waste shall be sold off. Non-biodegradable and non-saleable waste shall be disposed of with help of local municipal waste disposal system, wherever feasible.
- The contractor shall identify local construction waste disposal site in congruence with local authority to dispose any construction and demolition waste generated.
- Waste generated during and after construction will be disposed in accordance with relevant National and State laws and Regulations.

Hazardous waste

Hazardous waste will be generated during the construction activity includes used oil, grease, fabrics soaked with oil and grease. Quantity of these wastes are yet to known however, adequate weather protection ,labelling ,spill arrest mechanisms and paved surface to be provided for storage of hazardous waste materials .Tie up with MPCB/CPCB approved hazardous waste collection vendor shall be executed by EPC Contractor to ensure that all the hazardous waste generated on the sites will be disposed of in accordance with the Hazardous waste management and transboundary movement rules .2016. Further, inventory of hazardous waste generated and handed over to recycler shall be maintained on site.

Construction and demolition waste

C&D waste that will be generated from the construction activities is the responsibility of the EPC contractor that:

- It should be segregated from all other types of wastes and should be stored at a separate location.
- Contractor shall reuse the C&D waste generated from the construction activities to the extent possible.
- The contractor shall dispose the C&D waste in pre identified locations approved by Solid waste management department of Urban local bodies (ULBs)
- Waste generated during construction shall be quantified ,reused and disposed in accordance with relevant National and State laws and Regulations

2.3.6 Wastewater

The construction works for the development of project will entail generation of wastewater. from labour camps which will be sent to septic tank. As these are FOB projects, there will not be wastewater generation during operation phase.

2.3.7 Project Schedule

The construction activities of proposed project are likely to be completed in the period of next two years

3. Applicable Legal / Reference Framework

It is understood that the proposed trespassing control for FOB projects at various locations are not covered under the Environmental Regulatory Framework of the Ministry of Environment, Forests and Climate Change (MoEFCC) for Environmental Impact Assessment. The Asian Infrastructure Investment Bank Safeguard Policies which are applicable to the Project were reviewed such that the project gets designed and implemented with full compliance to the requirements of these policies.

3.1 Applicable Legislation

The Project will be implemented within the Indian legal framework (both Central and State / Region level) and will also comply with the safeguard policies and framework of the AIIB. Safeguard Policies of AIIB, which are applicable to the Project, are being reviewed such that the Project gets designed and implemented with full compliance to the requirements of these policies.

3.2 Applicable Indian Legal Requirements

All the applicable Policies, Rules and Regulations by Government of India (GOI), Government of Maharashtra (GOM) and Indian Railways and other best practices in Occupational Health and Safety and Disaster Management will be considered while preparing ESMP and ESAP of the project. There are various Acts, Rules and Notifications applicable for different environmental components such as Air Pollution, Water Pollution, Noise Pollution, C&D waste management, Hazardous Materials Handling and Transport, Forest and Wildlife. The applicable acts and regulations are tabulated in **Table 3-1** below:

Table 3-1: Applicable Legal Regulations for the project

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
01.	Air (Prevention and control of Pollution) Act, 1981	Section 21 of the Air Act specifies that no person shall without the consent of the State Board establish or operate any industrial plant in any air pollution control area. It is also provided in the statute that industrial units cannot discharge any pollutants into the air in excess of the standards of the standards prescribed by the State Pollution Control Boards. The States are required to prescribe such "Emission Standards" for different categories of industries and automobiles after consulting the Central Board and monitoring its Ambient Air Quality.	Project activities will lead to generation of air emissions from various construction / project activities, operation of DG sets, etc.	Client and Contractors	Client and Contractors to ensure that all emissions generated from the project activities should be within applicable emission standards, National Ambient Air Quality Standards (NAAQS). Further, the contractor should ensure that all the vehicles employed for project execution possess a valid Pollution Under Control (PUC) certificate.
02.	Water (Prevention and control of Pollution) Act, 1974	The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988. One of the important provisions of the Water Act, 1974 is to maintain and restore the 'wholesomeness' of our aquatic resources. Under Water Act 1974, Sewage or pollutants cannot be discharged into water bodies including lakes and it is the duty of the state pollution control board to intervene and stop such activity.	Project activities will lead to generation of wastewater due to construction of labour camps.	Client and Contractor	Client and Contractors to ensure that no untreated wastewater generated from the project activities should be discharged into open lands, other water bodies without the permission of the competent authorities.
03.	The Noise Pollution (Regulation & Control) Rules, 2000	The Noise Rules were notified in 2000 under the Environment (Protection) Act, 1986. These rules aim at regulating and controlling the noise producing and generating sources	The project will lead to noise generation from various sources like construction activities, machinery operations, DG set operations, etc.	Client and Contractors	Client and contractors should ensure that National Ambient Air Quality Standards in respect to Noise (NAAQSN) are not exceeded.

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
		with the objective of maintaining the ambient air quality standards in respect of noise.			All machineries and equipment’s should be well maintained. DG sets should be provided with acoustic enclosure comply relevant norms related to noise.
04.	Environmental Protection Act, 1986 Environment (Protection) Rules, 1986 (Schedule VI, Part E)	Section 3(1) of the Act empowers the Centre to” take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution". It also authorizes the government to make rules on any aspect related to environmental protection. The Act also provides that no industries can discharge any solid, liquid or gaseous substances beyond the permissible limits as laid down by the Central Government on its behalf,	Applicable Various environmental acts & rules are prepared under this act which will be applicable to various activities of project.	Client and Contractors	Client & contactors will have to ensure that project adheres to the various clauses laid down in the Act.
05.	Manufacture, Storage, and Import of Hazardous Chemicals Rules,1989	Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 are made under the provisions of Environmental Protection Act, 1986. These rules specifically deal with hazardous chemicals and prescribe the manner in which Storage and import of chemicals should be done.	Applicable during the storage of various categories of hazardous waste on site	Client and Contractors	Client and contractor should ensure that storage of Hazardous Chemicals should be done as per the regulations mentioned in the Rules, 1989 are made under the provisions of Environmental Protection Act, 1986.
06.	Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016	These rules aim at providing control for the generation, collection, treatment, transport, import storage and disposal of hazardous wastes. The main objective of this regulation is to establish a control	Applicable if hazardous waste from categories as mentioned in this regulation (Schedule I, II & III) are generated during project construction, operation, maintenance activities, etc.	Client and Contractors	Client and contractor should ensure that hazardous wastes shall be sent or sold to an authorised user or shall be disposed of in an authorised disposal facility

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
		mechanism for the management of hazardous waste.	A letter from GoI Ministry of Railway Board via letter number 2007/RS(S)/709/10 dated 09.12.2013 has advised Railways/PU's to follow the rules[4].		
07.	Municipal Solid Waste Management Rules, 2016	The rules require waste generator to segregate and store the waste generated in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors.	Applicable During construction phase, solid waste of proposed project may be generated from excavation of soil, scraps metal, construction debris, etc.		Client and contractors should ensure that solid waste is segregated, stored and disposed as per the regulation.
08.	Construction and Demolition Waste Management Rules 2016	Rules provide guidelines to handling and disposal of waste resulting from construction, re-modelling, repair, and demolition of any civil structure of individual or organisation or authority who generates construction and demolition waste such as building materials, debris, rubble.	Applicable Construction / demolition waste is envisaged to be generated during project construction activities,	Client and Contractor	Client & Contractors should ensure that construction and demolition waste is stored within the premise or get the waste deposited at collection centre so made by the local body or handover it to the authorized processing facilities of construction and demolition waste. It should be ensured that there is no littering or deposition of construction and demolition waste to prevent obstruction to the traffic or the public or drains.
09.	Indian Electricity Act 2003 and Rules, 1956	An Act to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry,	Construction stage of the project involves procurement of electrical cables, electrical equipment's /fixtures etc.	Client and Contractor	Client and Contractors to ensure that all the electrical supply lines and apparatus to be of sufficient power ratings and to be insulated

[4] http://indianrailways.gov.in/railwayboard/uploads/directorate/stores/downloads/Scrap_Circulars/9_09_12_2013.pdf

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
		promoting competition therein, protecting interest of consumers and supply of electricity to all areas. All supply lines and apparatus to be of sufficient power ratings and to be insulated properly to ensure safety of humans and animals.			properly to ensure safety of humans. Also,
10.	Maharashtra Felling of Trees (Regulation) Act, 1964 (as amended) Maharashtra felling of Trees (Regulations) Amendment Rules 2005	This Act makes provision for regulating the felling of certain trees in the State of Maharashtra, for the purpose of the preservation thereof, and for the protection of the soil against erosion. There are restrictions on felling of 15 species of trees which are specified in the Schedule of the said Act, (called as "Scheduled Trees") without the previous permission of the concerned authority.	Applicable Cutting of trees is envisioned at some sites during the implementation of the project.	Client and contractors	Client & contractors should ensure that permission from relevant authorities is taken before tree cutting for any project activity along with necessary compensatory afforestation in accordance to the regulation.
11.	The Maharashtra (Urban Areas) Protection and Preservation of Trees Act, 1975 (Mah. XLIV of 1975) amended as Maharashtra Act No. IX of 2021. L. A. Bill No. III of 2022	The act has been enacted for the purpose of protection and preservation of trees in urban areas in the State, by regulating felling of trees and providing for planting of adequate number of new trees in those areas. The act also provides protection and conservation priority to the heritage trees across the state.	Applicable Cutting of trees is envisioned at some sites during the implementation of the project.	Client and contractors	Client & contractors should ensure that permission from relevant authorities is taken before tree cutting for any project activity along with necessary compensatory afforestation in accordance to the regulation.
12.	The Wildlife (Protection) Act, 1972/ The Wildlife (Protection) Amendment Act, 2022	The Government of India enacted Wildlife (Protection) Act 1972 with the objective of effectively protecting the wild animals, birds and plants of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The act was last amended in December 2022	Applicable The Study Area contains faunal species listed in Schedule IV and V of the Act.	Client and contractors	Client & contractors should ensure that project adheres to the various clauses laid down in the regulations. No project related person involves in any poaching, smuggling and illegal trade in wildlife and its derivatives

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
13.	Plastic Waste Management (Amendment) Rules, 2022	To address the issue of plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste, Ministry of Environment, Forest and Climate Change has notified Plastic Waste Management (Amendment) Rules, 2018, amended in 2021,2022	Generation of plastic waste is envisaged for the proposed project like package material, cartons, etc for construction material or material for maintenance activities, etc.	Client and Contractors	Client & Contractors should ensure minimization of generation of plastic waste, segregation of the same at source and segregated storage. Segregated waste should be handed over to urban local body or gram panchayat or agencies appointed by them or registered waste pickers', registered recyclers or waste collection agencies.
14.	Central Ground Water Authority (CGWA) Guidelines to regulate and control Ground Water Extraction in India (With effect from 01.06.2019)	In order to comply with various directions of the Hon'ble NGT and to address various shortcomings in the existing guidelines of ground water extraction, the Central Ground Water Authority (CGWA), Ministry of Water Resources, River Development and Ganga Rejuvenation on 12th December 2018 notified revised guidelines for ground water extraction vide notification S.O. No. 6140 (E), which will be effective from 1st June 2019. The revised guidelines aim to ensure a more robust ground water regulatory mechanism in the country.	Applicable if the project indulges in abstraction of ground water as a source of water for construction, activities.	Client and Contractors	Client / contractor should ensure in case of usage of ground water, NOC from CGWA is undertaken for the abstraction of ground water.
15.	Central Motor Vehicles Rules, 2015	Central Motor Vehicle Act was enacted in 1988. It implies that no person shall drive any motor vehicle and no owner of a motor vehicle shall cause or permit the vehicle to be driven in any public place or in any other place unless the vehicle is registered.	Construction stage of the project involves the movement of construction vehicles	Client and Contractors	Client and Contractor to ensure that all the construction vehicles should have a valid Pollution Under Control (PUC) certificate. All the operators should posses a valid driving license.

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
16.	E-Waste Management Rules, 2016 (as amended)	These rules shall apply to every manufacturer, producer, consumer, bulk consumer, collection centres, dealers, e-retailer, refurbisher, dismantler and recycler involved in manufacture, sale, transfer, purchase, collection, storage and processing of e-waste or electrical and electronic equipment listed in Schedule I of this regulation.	Applicable if e-waste from electrical and electronic equipment listed in Schedule I of this regulation are generated during construction stage of the project.	Client and Contractors	Client and contractor should ensure that e-waste generated by the project is channelized through collection centre or dealer of authorised producer or dismantler or recycler or through the designated take back service provider of the producer to authorised dismantler or recycler.
17.	Railways Act, 1989; and Land Acquisition (Special Railway Projects) Rules, 2016	The Railways Act, 1989 is an Act to regulate all aspects of rail transports. It came into force in 1989, replacing the Railways Act of 1890. The Act provides in detail the legislative provisions regarding railway zones, construction and maintenance of works, passenger, and employee services. The Section 20A (1) of the Act gives power to acquire land, etc. where the Central Government is satisfied that for a public purpose any land is required for execution of a special railway project, it may, by notification, declare its intention to acquire such land.	The given Act shall be applicable as the project is located on IR land and the construction is carried out for Mumbai railways by MRVC	Client	No action required. Reportedly, the land had already been acquired by IR before year 1853 (year since Mumbai railways started its operations); and is under possession of Indian Railways
18.	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR), 2013; Maharashtra Land Revenue Code 1966; and Maharashtra Land	The RFCTLARR Act, 2013 is an Act of Indian Parliament that regulates land acquisition and lays down the procedure and rules for granting compensation, rehabilitation and resettlement to the affected persons in India. The Act has provisions to provide fair compensation to those whose land is taken away, brings transparency to the process of acquisition of land to set up factories or buildings, infrastructural projects and assures rehabilitation of those affected.	The RFCTLARR 2013 Act shall be applicable in case the project acquires any fresh land for the project. The Maharashtra Land Revenue Code 1966; and Maharashtra Land Revenue (Amendment) Act, 2017 shall be applicable in-case the project purchases or leases any land for the project.	Client	No action required. Reportedly, the land had already been acquired by IR before year 1853 (year since Mumbai railways started its operations); and is under possession of Indian Railways

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
	Revenue (Amendment) Act, 2017	The Maharashtra Land Revenue Code of 1966 governs (further amended in 2017) the land revenue administration in Maharashtra.			
19.	The Payment of Wages Act, 1936, amended in 2005; and The Minimum Wages Act, 1948,	The Payment of Wages Act of 1936 (Act) is primarily intended to help industrial workers who do not earn a lot of money. It covers all employees who work in a factory, through a subcontractor, or directly with the railway administration, and those who operate in the industrial sector, as defined in the Act. The Minimum Wages Act, 1948 is an Act to provide for fixing minimum rates of wages in certain employments; whereas it is expedient to provide for fixing minimum rates of wages in certain employments.	The given Act shall be applicable, as the project has engaged staff and contract workers on salary and/ or minimum wages basis for the on-going construction activities and reportedly shall engage more contract workers for the project location which are under planning stage currently.	Client and Contractors	The contractors shall ensure that they adhere to the given Act and pay minimum wages to their workers.
20.	Workmen's Compensation Act, 1923; and The Equal Remuneration Act 1976	Workmen’s Compensation Act 1923 is an Act to provide for the payment of certain classes of employers to their workmen of compensation for injury by accident; whereas it is expedient to provide for the payment by certain classes of employers to their workmen of compensation for injury by accident. The Equal Remuneration Act 1976 is an Act to provide for the payment of equal remuneration to men and women workers and for the prevention of discrimination, on the ground of sex, against women in the matter of employment and for matters connected therewith or incidental thereto.	The given Act shall be applicable, as the project has engaged staff and contract workers on salary and/ or minimum wages basis for the on-going construction activities and reportedly shall engage more contract workers for the project location which are under planning stage currently.	Client and Contractors	The contractors shall ensure that they adhere to the given Act and give compensation and equal remuneration to their workers.
21.	The Child Labour (Prohibition and Regulation) Act, 2016; and The Bonded Labour (Abolition) Act 1976	The Child Labour (Prohibition and Regulation) Act, 2016 is an Act to prohibit the engagement of children in all occupations and to prohibit the engagement of adolescents in hazardous	The given Act shall be applicable, as the project has engaged staff and contract workers for the on-going construction activities and reportedly shall engage more	Client and Contractors	The contractors shall ensure that they do not engage any child labour or forced labour during their construction phase.

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
		occupations and processes and the matters connected therewith or incidental thereto. The Bonded Labour (Abolition) Act 1976 is an Act to provide for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of the weaker sections of the people and for matters connected therewith or incidental thereto.	contract workers for the project location which are under planning stage currently.		
22.	Maharashtra Labour Welfare Fund Act, 1953	An Act to provide for the constitution of a Fund for the financing of activities to promote welfare of labour in the State of Maharashtra. The mission of this welfare fund is to create social, educational, and financial advancement for laborers, by promoting welfare schemes, programs, and facilities to the eligible and registered workers of the various sections of society in the state of Maharashtra.	The given Act shall be applicable, as the project has engaged staff and contract workers for the on-going construction activities and reportedly shall engage more contract workers for the project location which are under planning stage currently.	Client and Contractors	MRVC and their contractors shall ensure that they adhere to the given act.
23	The Contract Labour (Regulation & Abolition) Act 1970, Central Rules, 1971; and The Contract Labour (Regulation and Abolition) (Maharashtra Amendment) Act, 2016	The Contract Labour (Regulation and Abolition) Act, 1970 is an Indian law that aims to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith. As per the review of document MRVC has obtained Principal employer license having its Registration No.: CLRA/ ALCMUMBAI3/ 2020/R-18, and Acknowledgement No.: ACKCLRA2020-3732426; however, the given license was not identified to have details pertaining to contractors namely, M/s Sai Construction Pvt. Ltd. and M/s Kuwala Cooperation Pvt. Ltd.	The given Act shall be applicable as the project has engaged more than 50 contract workers for the construction work	Client and Contractors	Contractor to obtain updated "Principal Employer license" having details of all contractors from labour department as per Section 4 (a), Section 7 of the CLRA Act, 1970; and CLRA Amendment Act, 2016, in-case the project engages 50 or more workers for the project. Similarly, the respective contractors shall have to obtain "Contract Labour License" as per Section 4 (a), Section 12 of the CLRA Act, 1970; and CLRA Amendment Act, 2016, in-case the contractors engage 50 or

Sl. No.	Applicable Legal Regulation	Summary	Applicability	Responsible Party	Required Action
					more workers for the construction work.
24.	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	An Act to regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health, and welfare measures and for other matters connected therewith or incidental thereto.	The given Act shall be applicable as the project has engaged and shall engage more contract workers for the FOB construction work.	Client and Contractors	MRVC is recommended to obtain BOCW license for the ongoing construction/ and upcoming construction work
25.	Registration under EPF under The Employees’ Provident Funds and Miscellaneous Provisions Act, 1952	The Employees' Provident Funds and Miscellaneous Provisions Act, 1952 is a legislation that provides a kind of social security to the industrial workers. The Act covers three schemes, i.e., PF (Provident Fund scheme), FPF (Family Pension Fund scheme) and EDLI (Employees Deposit Linked Insurance scheme). The Act was introduced in stages and came into force in its entirety by 1st November 1952.	The given Act shall be applicable, as the project has engaged staff and contract workers for the on-going construction activities and reportedly shall engage more contract workers for the project location which are under planning stage currently.	Client and Contractors	The contractors engaged by MRVC are recommended to ensure that they adhere to the given act; and their staff and workers are given EPF benefit.
26.	Registration under “ESIC” under The Employees State Insurance Act, 1948	An Act to provide for certain benefits to employees in case of sickness, maternity and ‘employment injury’ and to make provision for certain other matters in relation thereto.		Client and Contractors	The contractors engaged by MRVC are recommended to ensure that they adhere to the given act; and their staff and workers are given ESIC benefit.

3.3 Applicable Asian infrastructure investment Bank (AIIB) Policies

AIIB requires environmental assessment (EA) of projects proposed for its financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making. The Environmental and Social Standards, together with their Annexes, sets out the mandatory requirements that apply to the Borrower and projects[5].

The assessments conducted towards this project will cover the requirements laid out in AIIB Policy on Environment & Social Framework. Details of each of the Environmental and Social Standard are presented in **Table 3-2.**

Table 3-2: Environmental and Social Standards Applicable for the Project

Sl. No.	Applicable Environmental and Social Standard	Applicability
1.	ESS1: Environmental and Social Assessment and management	ESS1 is to achieve the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. It applies to all projects supported by the Bank. Applicability of ESS1 will be assessed for this project.
2.	ESS2: Labour acquisition and involuntary resettlement	ESS2 sets out to address impacts of Project-related land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land or assets, or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood). It applies to all project workers, be it direct, contracted, community and primary supply workers. Not applicable as project does not involve any land acquisition and is being developed on existing railway land. MRVC site team also added that no fresh lands have been procured for the construction of given FOBs, as the land is reportedly under possession of Indian Railways.
3.	ESS3: Indigenous people	This ESS sets out the requirements to respect for Indigenous Peoples' identity, dignity, human rights, economies and cultures, as defined by the Indigenous Peoples themselves, so that they: (a) receive culturally appropriate social and economic benefits; (b) do not suffer adverse impacts as a result of Projects; and (c) can participate actively in Projects that affect them. It applies to all projects supported by the Bank. Applicability of ESS3 will be assessed for this project. Not applicable as project does not involve any land acquisition and is being developed on existing railway land. MRVC site team also added that no fresh lands have been procured for the construction of given FOBs, as the land is reportedly under possession of Indian Railways.

3.4 Applicable Environmental Standards

3.4.1 Ambient Air Quality

As per the IFC EHS guidelines (April 2007), "the ambient air quality standards are ambient air quality levels established and published through national legislative and regulatory processes and ambient quality guidelines refer to ambient quality levels primarily developed through clinical, toxicological, and epidemiological evidence (such as those published by the World Health Organization)". National Ambient Air Quality Standards (NAAQS), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given ***Table 3-8***:

[5] AIIB-Environmental-and-Social-Framework_ESF-November-2022-final.pdf

Table 3-8: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO_2), µg/m^3	Annual*	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM_{10}, µg/m^3	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or PM $_{2.5}$, µg/m^3	Annual*	40	40
	24 Hours**	60	60
Ozone (O_3), µg/m^3	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m^3	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO), mg/m^3	8 Hours**	2	2
	1 Hour**	4	4
Ammonia (NH_3), µg/m^3	Annual*	100	100
	24 Hours**	400	400
Benzene (C_6H_6), µg/m^3	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m^3	Annual*	1	1
Arsenic (As), ng/m^3	Annual*	6	6
Nickel (Ni), ng/m^3	Annual*	20	20

**Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval*

***24 hourly or 8 hourly or 1 hourly value as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.*

3.4.2 Ambient Noise Standards

As per the EHS guidelines of IFC, for residential, institutional and educational area, the one hourly equivalent noise level (Leq hourly) for daytime (6.00 a.m. to 10.00 p.m.) is **55 dB (A)** while the Leq hourly for night time (10.00 p.m. to 6.00 a.m.) is prescribed as **45 dB (A).** Noise standards notified by the MoEF&CC vide gazette notification dated 14th February 2000 based on the *A- weighted equivalent noise level (Leq)* are as presented in ***Table 3-9***.

Table 3-9: Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A) Leq	
		Day time	Night time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone*	50	40

**Silence zone is defined as area up to 100 m around premises of hospitals, educational institutions and courts. Use of vehicle horns, loudspeakers and bursting of crackers are banned in these zones.*

3.4.3 Noise Standards for Occupational Exposure

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act.

Table 3-10: Standards for Occupational Noise Exposure

Total Time of Exposure per Day in Hours (Continuous or Short-term Exposure)	Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107
½	110
¼	115
Never	>115

No exposure in excess of 115 dB (A) is to be permitted.

For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.

4. Environmental and Socio-Economic Baseline

The section provides primary and secondary information on the baseline condition of the physical, biological and social environment around the proposed project area.

Primary baseline information was collected on site from project area and area of influence. Existing information sourced from scientific literature (published and freely available in public domain), project studies like DPR, technical reports, were used wherever available.

Activities that facilitated establishment of the baseline data in the report include site reconnaissance survey, ecological survey, environmental monitoring, processing of satellite imagery and secondary data review from established sources such as Indian Meteorological Department (IMD) and Census of India amongst others.

4.1 Site Reconnaissance Surveys

Site reconnaissance surveys of the project areas were conducted to understand the general characteristics of the project areas.

Site Reconnaissance Survey

Site reconnaissance survey which involved systematic observations made on foot for general examination of the study area were conducted prior to the detailed field study.

Reconnaissance surveys include collecting primary information necessary for evaluating the proposed project locations and identify areas of concern. Following observations were made:

- The land for the given FOB is already under possession of Indian Railways and no fresh land shall be procured for the same.
- Details on daily consumption of natural resources and sources of raw material procurements were collected
- Material stacking (gravels, iron bars etc.) was observed near the construction area
- Observations at KM 60/4-6 on floristic and faunal species, habitats were recorded. Vegetation of the Project area comprises a few trees, shrubs and herbs spreading along the rail tracks and in open areas between the tracks. Of this vegetation, some trees and shrubs are likely to be cut off for construction of the FOB.
- Receptors were identified for air, noise, vibration monitoring during reconnaissance survey, along with the identification of sources of ground/surface water

4.2 Delineation of the Study Area

In the case of the present EA study, ‘Project Site’ is project location and ‘Buffer Area’ is considered as Direct Impact Zone as 100 m radius of proposed project location/site. The ‘Project Site’ and the ‘Buffer Area’ collectively constitute the Area of Influence (AoI) of the project and are hereinafter collectively referred to as the ‘Study Area’.

All the baseline environmental profiling including environmental monitoring, biodiversity studies, socio-economic studies and public consultations were carried out within the Study Area.

4.3 Environment Baseline

The Project Sites proposed for FOBs are located in three districts, namely, Thane, Mumbai and Palghar of Maharashtra State of India.

The following sections give details of project sites with reference to regional environmental baselines details.

4.3.1 Physiography

Thane district forms part of western slope of Sahyadri hill range[1]. This hill range passes through the eastern part of the district. Major part of the district constitutes rugged and uneven topography, characterized by high hills and steep valleys. Physio graphically, the district can be divided into two broad divisions - undulating hilly tract and coastal plain in western part.

Mumbai district is broad and flat terrain flanked by north – south trending hill ranges. The hill ranges form almost parallel ridges in the eastern and western part of the area. The Powai – Kanheri hill ranges are the other hills extending in the eastern and central part running NNE – SSW. The maximum elevation of the area is 450 m above mean sea level (amsl) at some of the peaks of hill ranges. Trombay island has north – south running hills with maximum elevation of 300 m above man sea level. Malbar, Colaba, Worli and Pali hills are the isolated small ridges trending north – south in the western part of the district[2] Greater Mumbai is located on the western most periphery of the Maharashtra State. The city in the past (year 1885) was comprised of elongated shaped group of seven islands viz., Bombay, Mazgaon, Matunga, Mahim, Worli, Soyster Rode and Old Woman’s Island which over the period of time, have been connected to mainland by series of reclamation measures such as filling of narrow creeks etc.[3]

Palghar district has steep slopes of the Sahyadri in the east, the land falls through a succession of plateaus in the north and centre of the district to the Ulhas River valley in the south[4].

All the project areas are situated in the urban areas and on a relatively flat terrain. Nearest water body is 1kms Thane creek on Kalwa site and Ulhas river at the Ambarnath location.

4.3.2 Climate

As the project sites are located in Palghar, Mumbai and Thane Districts of Maharashtra, but are part of Mumbai Metropolitan Region Development Authority (MMRDA) region, the climate and meteorological details, the data from India Meteorological Department stations - Mumbai (Bombay) (Santa Cruz) is presented here which is closest to the proposed project alignment.

Temperature

As per the Climatological Normal (1970-2000), in Winter maximum mean temperature recorded as 35.9°C, and minimum mean temperature was recorded as 12.9°C. In summer maximum mean temperature rise to 38.0°C, whereas lowest was accounted as 17.0°C. July to September is regarded as monsoon season with highest and lowest mean temperature recorded as 33.2°C and 22.8°C.

Humidity

As per the Climatological Normal (1970-2000), relative humidity does not change drastically. Annual mean was observed to be 73%.

Wind

Annual wind rose prepared from daily surface wind data surface wind data recorded at 0300 UTC for 1981 to 2010 indicates that, the winds were from southwest (SW) to west (W), followed by the winds from northeast (NE) to east(E). The annual wind rose suggests highest wind speeds, those greater than 7 meter/second (mps) come from west southwest (WSW) direction. **Table 4-1** provides climatological profile of Mumbai. **Figure 4-1** provides wind rose for Mumbai.

[1] Ground Water Information, Thane District, Maharashtra-2013
[2] Greater Mumbai (cgwb.gov.in)
[3] Greater Mumbai (cgwb.gov.in)
[4] https://en.wikipedia.org/wiki/Palghar_district

Table 4-1: Climatology Profile of Mumbai (Bombay) (Santa Cruz) 1981-2010

Months	Temperature (°C)		Relative Humidity	Mean Wind speed (kmph)	Monthly Total Rainfall (mm)
	Maximum	Minimum	Percentage		
January	31.1	17.3	70	5.6	0.3
February	31.3	18.2	68	6.5	0.4
March	32.8	21.4	69	7.1	0.0
April	33.2	24.2	69	7.8	0.1
May	33.6	27	70	9.2	11.3
June	32.4	26.6	79	10.9	493.1
July	30.4	25.5	85	12.2	840.7
August	30	25.1	86	11	585.2
September	30.7	24.8	85	6.9	341.4
October	33.4	23.8	74	5.3	89.3
November	33.7	21.3	63	5.2	9.9
December	32.4	18.5	65	5.1	1.6
Annual Mean	32.08	22.81	73.58	7.73	198

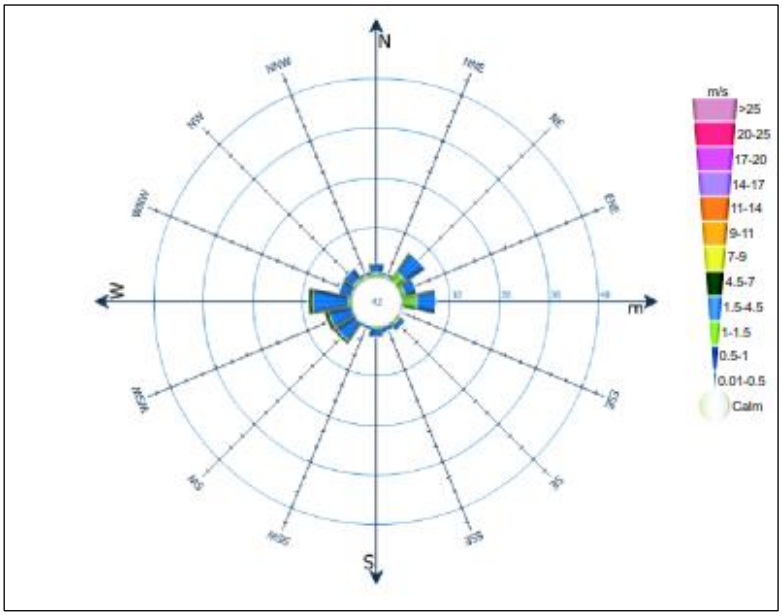


Figure 4-1: Windrose Mumbai (Bombay) (Santa Cruz) 1981-2010

Rainfall

As per the Climatological Normal (1981-2010), Mumbai (Bombay) (Santa Cruz) has annual mean rainfall of 2373.4 mm. Highest rainfall was recorded in monsoon in July, near about 840.7mm.

The normal annual rainfall over the Thane district ranges from 1900 mm to 2600 mm. The analysis of rainfall data of the Raigad district indicates that normal annual rainfall over the district ranges from 2200 mm to more than 3000 mm in the plains and it is above 5000 mm in the hills.

Taluka-wise annual rainfall for the past ten years is presented in **Table 4-2, Table 4-3**and **Table 4-4.**

Table 4-2: Average Annual Rainfall in mm for Mumbai-Suburban district

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2017	0	0	0	0	3.5	523.2	869.6	950.3	603.2	83.6	0	75.8
2018	0	0	0	0	0	792.5	1138.8	235.2	73.1	3.8	0	0
2019	0	0	0	0	0	515.7	1464.8	574	1115.7	75	109.3	1.3
2020	0	0	0	0	0	395	1502.6	1240.1	549.1	141.2	0	7.3
2021	0.2	0.3	0	0	243.4	961.4	1122.7	337.8	741.6	11.2	26.9	96.1

Table 4-3: Average Annual Rainfall in mm for Palghar district

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2017	0	0	0	0	0.8	715.7	1238.7	698.1	371.5	120.3	0	60.8
2018	0	0	0.7	0	0.2	534.2	1473.1	342.6	40.4	7.2	0	0
2019	0	0	0	0	0	373.6	1589.6	952.6	967.6	78.3	56.8	1.2
2020	0	0	0	0	0	251.6	664.6	1466	204.1	68.9	0	20.6
2021	0.1	0	0	0	218.2	585	912	419.3	865.4	49.7	8.1	97.1

Table 4-4: Average Annual Rainfall in mm for Thane district

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
2017	0	0	0	0	1.3	681.4	1153.8	950.5	458.1	182.5	0	22.7
2018	0	0	0	0	0	687.9	1349.3	412.9	90.8	7	2.1	
2019						503	1656.3	892.7	1032.8	135.1	26.9	0
2020	0	0	0	0	0	386.4	779.9	1364.2	371.9	123.6	0	2.1
2021	0	0	0	0	62.4	718.4	1084.1	361.6	810.7	142.2	53	55.3

Source: Customized Rainfall Information System (CRIS) (imd.gov.in)

Note :(1) The District Rainfall in millimetres (R/F) shown below are the arithmetic averages of Rainfall of Stations under the District.

(2) % Dep. are the Departures of rainfall from the long period averages of rainfall for the district.

(3) Blank Spaces show non-availability of Data.

4.3.3 Hydrogeology

The entire Mumbai 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. The ground water exists in fractures, joints, vesicles and in weathered zone of Basalt. The occurrence and circulation of ground water is controlled by vesicular unit of lava flows and through secondary porosity and permeability developed due to weathering, jointing, fracturing etc., of Basalt. The ground water occurs under phreatic, semi confined and confined conditions. The leaky confined conditions are also observed in deeper aquifers. Generally, the phreatic aquifer range down to depth of 10 m bgl. The yields of the wells are the functions of the permeability

and transmissivity of aquifer encountered. This varies with location, diameter and depth of wells. There are mainly two types of ground water structures i.e., dug wells and borewells in the area. The yields of the dug wells vary from 10 to 1000 m^3 /day, whereas that of borewells ranges between 50 and 1000 m^3 /day tapping the promising aquifer in the depth range of 40 to 60 m bgl. Even though the borewells drilled in the area by both official and private agencies, are in large number, no adequate data regarding areal extent of the aquifer is available. The borewells in low lying area are affected by saline water whereas in upland areas the quality is potable.[1]

In Thane district, major rock type covering about 80% of the district is Deccan trap Basalt of Upper Cretaceous to Lower Eocene age. Coastal alluvium is other formation occurring mainly in western parts of the district. The pre-monsoon depth to water level ranges from 0.50 to 14.60 m bgl. In Thane district, the coastal alluvium occurs from north of Chikhaley to Dahanu and extends to Palghar, Virar, Vasai and Nalasopara in the south. The depth to water level ranging between 2 to 5 m bgl and 5 to 10 mbgl were observed in major part of the district, whereas water level more than 10 mbgl were observed as patches. The post monsoon water level ranges from 1.20 to 6.90 mbgl. Thane in category of groundwater development is categorised under the “Safe Zone”[2].

Thane district forms part of western slope of Sahyadri hill range[3]. This hill range passes through the eastern part of the district. Major part of the district constitutes rugged and uneven topography, characterized by high hills and steep valleys. Physiographically, the district can be divided into two broad divisions - undulating hilly tract and coastal plain in western part.

Palghar district has steep slopes of the Sahyadri in the east, the land falls through a succession of plateaus in the north and centre of the district to the Ulhas River valley in the south[4].

Figure 4-2 and **Figure 4-3** depicts hydrogeology of Mumbai district and Thane and Palghar districts respectively as per which the project areas fall in the area with hard strata profile

[1] Greater Mumbai (cgwb.gov.in)
[2] Ground Water Information - Thane District, Maharashtra, CGWB, 2013
[3] Ground Water Information, Thane District, Maharashtra-2013
[4] https://en.wikipedia.org/wiki/Palghar_district

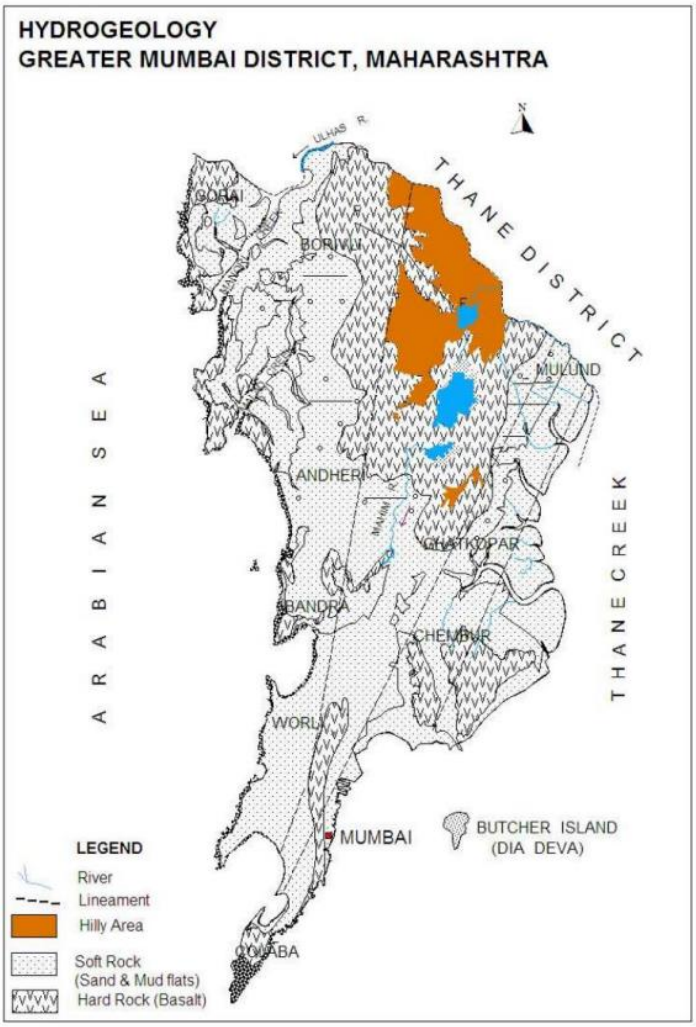


Figure 4-2: Hydrogeology Map of Mumbai-Suburban district

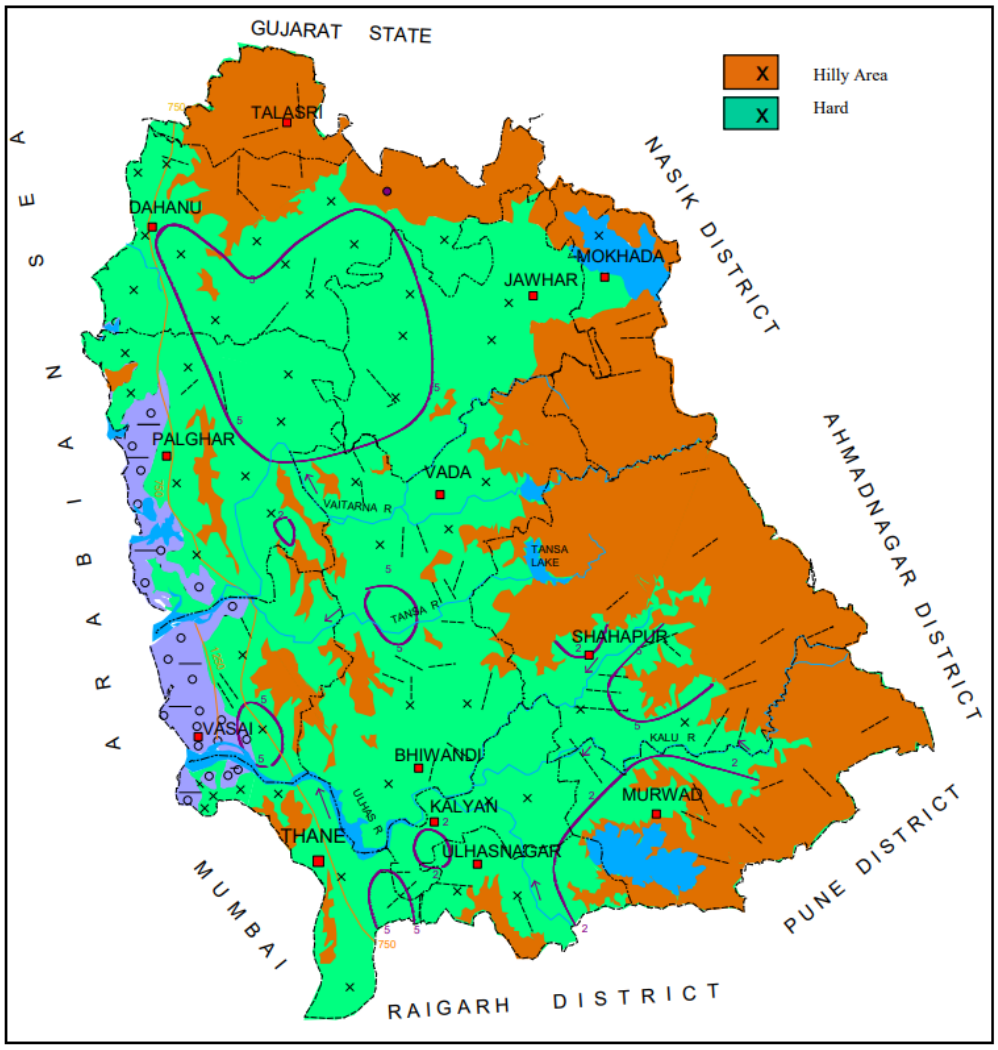


Figure 4-3: Hydrogeology Map of Thane and Palghar district

4.3.4 Drainage

The area around the Mumbai district is drained by Mahim, Mithi, Dahisar and Polsar rivers. These small rivers near the coast, form small rivulets which intermingle with each other resulting in swamps and mud flats in the low-lying areas.

Streams and tributaries of Vaitarna and Ulhas River form the main drainage network in Thane. The four main tributaries of river Vaitarna are Surya, Tansa, Deharaja and Pinjal Rivers. Ulhas River is the other important river in the district. Many small creeks are found all along the western coast in Thane district. The bigger creeks are Bhiwandi, Chinchani, and Dahanu Creeks.

Palghar is crossed by 2 main rivers, that is Vaitarna and Surya. Many small streams occur during monsoon season which take their rise in eastern norther part of the district, and, flow west and south across the district.

River Vaitarna originates in Sahyadri mountain ranges near Trimbakeshwar, Nashik. Vaitarna River is just 2 km away from India’s second longest river Godavari. The Vaitarna basin lies between East longitude of 720 45’ to 730 35’ and North latitude of 190 25’to 200 20’. Tanasais it’s left bank tributary and Pinjal, Dehraja, Suryaare its right bank tributaries. Vaitarna has a confluence with the Tanasajust before it entersthe Arabian Sea. Jhowand Wadhiv is lands lieinitsestuary. Arnala Is landliesoffitsmouth. It has three majordams– Dhamni, Tansa, Modaksagar which supply water to Mumbai.[1]

[1] - Intigrated DDMP by Vivekanand Kadam Augast2020.docx (s3waas.gov.in)

Study area of 100 mtrs considered for this project consists of following waterbodies around:

a) Ambarnath location (59/37-39)-- drain at approximately 76 mtrs
b) Vangani (68/14-16)—Gao devi lake at 120 mtrs.

4.3.5 Land Use

Table 4-5 below presents details of land use and land cover details of the study area.

Table 4-5: Land Use and Land Cover Details of The Proposed study Area

Site: Km 59/37-39 Ambarnath (N)

LULC Class	Total Area (sq.m)	Percent Area (%)
Built-up Land	18188.18	57.97
Drain	976.09	3.11
Railway Land	5559.47	17.72
Roads	2554.62	8.14
Vegetation	4096.50	13.06
Grand Total	**31374.94**	**100**

Site: Km 35/3-4 Kalwa FOB

LULC Class	Total Area (sq.m)	Percent Area (%)
Builtup Land	6935.35	22.10
Railway Land	19158.10	61.06
Roads	750.92	2.39
Vegetation	4530.57	14.44
Grand Total	**31374.94**	**100**

Site: Km 67/20 Badlapur Home PF BUD

LULC Class	Total Area (sq.mtrs.)	Percent Area (%)
Builtup Land	16130.73	51.41
Railway Land	7459.78	23.78
Roads	2035.55	6.49
Vegetation	5748.87	18.32
Grand Total	**31374.94**	**100**

Site: Km 68/14-16 Badlapur - Vangani

LULC Class	Total Area (sq.m)	Percent Area (%)
Builtup Land	12736.16	40.53
Open Land	2269.76	7.22
Railway Land	4098.95	13.04
Roads	3425.47	10.90
Vegetation	8897.03	28.31
Grand Total	**31427.38**	**100**

Site: Km 60/4-6 Virar FOB planned

LULC Class	Total Area (sq.m)	Percent Area (%)
Builtup Land	14090.19	44.92
Railway Land	6759.49	21.55
Roads	3612.34	11.52
Vegetation	6907.37	22.02
Grand Total	**31369.38**	**100**

4.3.6 Geology

In Thane and Palghar district, most of the soil is derived from trap (Basaltic) rocks and can be classified into three broad categories based on the characteristics and relationship with topographic set up.

- Soil of Coastal Lands with Residual Hills - These soils are slightly deep, poorly drained, fine soils on gentle sloping land and very fine soil on sloping land. These soils are calcareous and occur along the coast of Vasai, Palghar and Dahanu.
- Lighter Coloured soils - These soils are occurring on the undulating, elongated hills and intervening valleys. These are medium to deep greyish in colour, poor in fertility, clayey to loamy in nature, shallow in depth and coarse in texture. These soils are known as Varkas and are suitable for rice. These soils occur on the eastern part of the district.
- Black Coloured Soil- These soils occur on plains in the middle and eastern part of the district along the valleys

In the district of Mumbai, two types of soils have been observed in the district viz., medium to deep black and reddish soil.

In Palghar district, the Deccan Trap Basalt of upper Cretaceous to lower Eocene is the major rock formation. The water level in major part of the district ranges from 3-7 mbgl. The depth to water levels during post-monsoon (Nov. 2019) ranges between 2.90 m bgl (Mokhada) to 7.05 m bgl (Wada). Palghar in category of groundwater development, is categorised under the "Safe Zone".

4.3.7 Natural Disasters[1]

The hazards faced by regions which also include the study areas are illustrated below based on various details available in public domain and data from Think Hazard portal[2].

Seismicity

As per the Think Hazard portal, all the three districts fall under the medium category which means that there is a 10% chance of potentially damaging earthquake shaking in your project area in the next 50 years.[3] As per Indian Zone Map, Mumbai, Thane and Palghardistrict is lies in Zone III. Earthquake and its secondary effects like fires, chemical spills, landslides etc. An earthquake is a phenomenon that occurs without warning and involves violent shaking of the ground and everything over it. Earthquakes are tectonic in origin; that is the moving plates are responsible of the occurrence of the violent shaking. The occurrence of an earthquake in a populated area may cause numerous casualties, injuries, and extensive property damage. As per the Maharashtra State Disaster Management Plan, project area falls under 'earthquake moderate damage risk zone (MSK VII)'. The seismic zoning map of Maharashtra region is given in **Figure 4-4**.

[1] Maharashtra State Disaster Management Plan, April 2016

[2] ThinkHazard is a new web-based tool enabling non-specialists to consider the impacts of disasters on new development projects.

[3] ThinkHazard - Thane - Earthquake

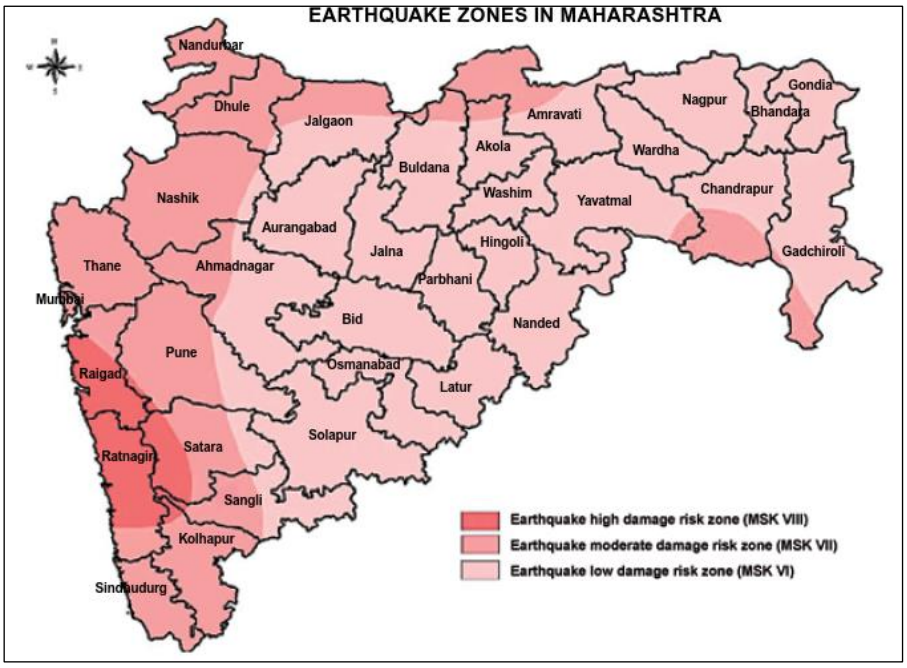


Figure 4-4: Seismic Zonation Map of Maharashtra

Floods

As per the ThinkHazard portal all the three districts are classified as high for coastal flood which means that “potentially-damaging waves are expected to flood the coast at least once in the next 10 years”. Urban flood is classified as medium for Mumbai district which means that “there is a chance of more than 20% that potentially damaging and life-threatening urban floods occur in the coming 10 years” whereas thane and Palghar districts falls under high category.[1]

Floods are meteorological events conditioned by the characteristics of the drainage basins. Floods are extreme events, usually triggered by extreme precipitation (river/inland floods) and/or storms (coastal floods). If these rainfalls exceed the retention capacity of the basins, drainage is increasing both in speed and volume and causes floods. Three different types of flooding are evident in Mumbai: localized flooding due to inadequate drainage; flooding due to overflows from Mithi River, where settlements have taken place in the flood plains, and flooding due to combination of high tides and high river flows. Localized flooding occurs mainly due to informal settlements in the drain path, improper drainage network, reduction in drain capacity due to siltation. Land use practices, solid waste management practices and drainage maintenance in the city have influenced flood hazard. Mumbai is located on the windward side of the Western Ghats of India and receives high rainfall, both in magnitude and intensity, due to orographic effect from strong westerly southwesterly monsoon flows over the Arabian Sea. 70 % of the average annual rainfall occurs in July and August and 50 % of this occurs in just two or three events. During these two or three events, it usually rains uniformly over the city and severe flooding occurs in many parts of the city. Average rainfall is around 2000mm of which 70% of the rainfall is received during July and August. The original geography of the area is intercepted by a network of creeks, rivers and system of drains that play a major role in storm water drainage in Greater Mumbai. This Storm Water Drainage (SWD) network of rivers, major and minor nallas, underground drains and closed pipes is also affected by tidal variation while releasing water into the sea.[2]

Being located in coastal area, Thane, and Palghar experience considerable rainfall. Most floods are flash floods due to nallah-overflows and poor drainage systems. Urban area along the proposed project area has faced water logging in rainy season when high rainfall is observed along with hightides and uncleaned storm water lines.

Fire Hazard

[1] ThinkHazard - Thane
[2] Disaster Management Plan- City.pdf (mcgm.gov.in)

Being located near developed or developing urban areas, fire hazard can be observed due to large number of closely built buildings, continuous moving traffic near Kalwa and Badlapur-Vangani location, high-rise buildings with inadequate fire-fighting facilities, commercial activities, small, medium and heavy hazardous industries, etc.

Landslides

Landslides/slope failures constitute major natural hazards in Mumbai and are common in parts of its suburban regions specifically in the areas located in close proximity of the natural hill slopes and cutslopes of abandoned stone quarries etc. During the last two decades, the incidences of landslides/slope failures caused excessive loss to life and property in parts of Mumbai urban agglomeration, after heavy rainfall. Geomorphologically, the area forms part of western Konkan plain/coast, comprising Residual hills, ridges with intervening valleys, piedmont zones, Coastal plains, sand bars, mud flats and rock cut benches. Geologically the study area exposes basaltic lava flow sequences belonging to the Bombay Volcanic Province (BVP) comprising varied basic and acidic volcanic rocks including basalt, agglomerate, tuff, trachyte, rhyolite, andesite with intertrappean beds. The hill slopes are either barren rocky slopes or are overlain by thin silty to clayey overburden soil and colluvium skirting the hill slopes. Based on the landslide related studies, rock slide/fall with debris flow type of failures are identified in Mumbai U/A.[1]

As per the ThinkHazard portal, all the three districts fall under the high category which means that this area has rainfall patterns, terrain slope, geology, soil, land cover and (potentially) earthquakes that make localized landslides a frequent hazard phenomenon but all project sites are located along existing railway track in well developed urban area.[2]

Draught

Being located in western coastal region of Maharashtra, If the rainfall is poor or uneven within the monsoon months (long dry spells), it could be very damaging for crops. Also, in many parts, hard basalt rock in the region does not allow filter or storage of water. So, when there is scanty rainfall, the scarcity of water both for drinking water and cultivation is acute. As per the Maharashtra State Disaster Management Plan, 2016, Thane, and Palghar districts are not in the draught prone area. **Figure 4-5** provides draught prone areas of Maharashtra.

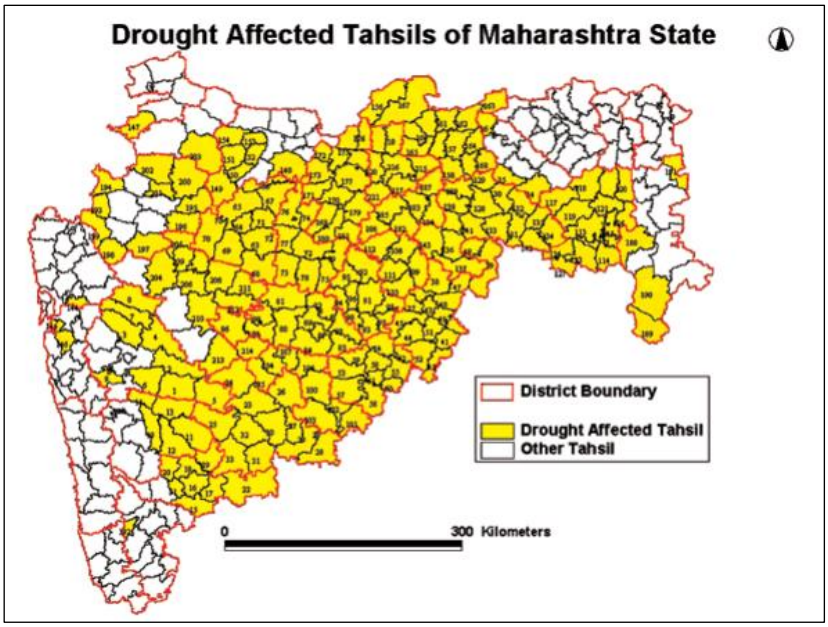


Figure 4-5: Draught Prone Areas of Maharashtra

Source: Maharashtra State Disaster Management Plan, April 2016

Cyclones

[1] Disaster Management Plan- City.pdf (mcgm.gov.in)
[2] Think Hazard - Mumbai Suburban - Landslide

Mumbai used to be congregation of seven tiny islands. The city is surrounded on three sides by water; the Arabian Sea and Harbour Bay to the west and Thane creek to the east and it is just 10- 15 meters above sea level. Mumbai is considered one of the largest megacities in the world and one of the world’s top 10 centres of commerce. In terms of population, Mumbai is currently ranked fourth in the world after Tokyo, Mexico City, and New York. It is the capital of the leading industrial, commercial and financial hub of India. Being a Coastal city, Mumbai is prone to cyclones and heavy winds.

In the Arabian Sea, severe cyclonic storm has been recorded in past which have affected Maharashtra coast. The coastal areas of Thane, Raigad and Palghar area comes under ‘wind & cyclone moderate damage risk zone – A (44m/s)’[1]. In the rural areas, the damage is primarily to lives, crops and to housing. It may also affect the irrigation infrastructure. The damage to forest and plantations, when it occurs, has a long-term effect, and takes a much longer period for restoration. In urban areas, both transport and communication receive a serious damage, in addition to loss of life and shelter. Mumbai is a coastal city which has faced many threats of cyclones in the recent past. **Figure 4-6** provides Flood risk in Maharashtra.

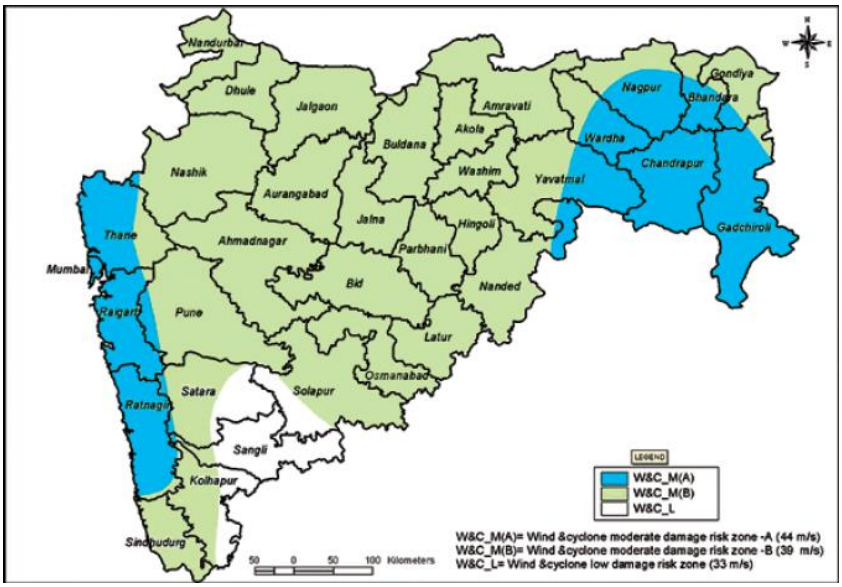


Figure 4-6: Flood Risks in Maharashtra

4.4 Environmental Baseline

To establish the current ambient environmental quality status, monitoring in the Study Area were conducted during months of May and June, 2023 by a NABL accredited laboratory – Ultratech Environmental Consultancy and Laboratory.

Table 4-6 Locations for Ambient Environmental monitoring

Location Code (AAQ: Ambient air quality)	Location Description	Location Coordinates
AAQ 1	Badlapur Railway Station	Lat:19°10’00.90” N Long: 73°14’23.33” E
AAQ 2	Virar Railway Station	Lat:19°27’29.2” N Long: 72°48’41.8” E
AAQ 3	Ghatkopar Railway Station	Lat:19°05’5.23” N Long: 72°54’32.07” E
GW 1	Kalwa Railway Station	Lat:19.19538°N Long: 72.99653°E
GW 2	Virar Railway Station	Lat:19.45827°N Long: 72.81153°E

[1] Maharashtra State Disaster Management Plan, April 2016

Location Code (AAQ: Ambient air quality)	Location Description	Location Coordinates
SW 1	Badlapur Station	Lat:19.16248°N Long: 73.24646°E
NV-01	Badlapur Railway Station near 68/14	Lat:19°10'00.7" N Long: 73°14'23.30" E
NV-02	Virar Railway Station near PF 4A	Lat: 19°27'29.5" N Long: 72°48'4.8" E
NV-03	Ghatkopar Railway Station East side	Lat:19°5'8.26" N Long: 72°54'31.59" E
NV-04	Ambarnath Railway Station near PF-3	Lat:19.20936°N Long:73.1867°E
NV-05	Kalwa Railway Station near booking office	Lat: 19.19538°N Long: 72.99653°E

4.5 Air, Water, Noise and Soil Baseline

4.5.1 Air level Monitoring

Selection of Sampling Locations

Three (03) locations along the proposed FOB sites have been identified were the assessment of ambient air quality. The air quality monitoring locations have been selected based on following criteria:

- Important receptor locations (i.e., Railway stations, habitations, hospitals, schools, prominent villages, ecologically sensitive areas, etc.)
- Existing and proposed construction sites along the corridor
- Predominant wind direction
- Availability of power

The details of the ambient air quality monitoring stations carried out for 24 hrs. are given in the **Table 4-6** above and the results against each location is mentioned in the **Table 4-7** below:

Table 4-7: Ambient Air Quality Monitoring sample analysis

S. No.	Test Parameter	Unit	Test result (Badlapur)	Test result (Virar)	Test result (Ghatkopar)
1	Sulphur dioxide (SO_2)	$\mu g/m^3$	BDL	BDL	BDL
2	Nitrogen dioxide (NO_x)	$\mu g/m^3$	20	19	23
3	Particulate matter (PM_{10})	$\mu g/m^3$	81	62	73
4	Particulate matter ($PM_{2.5}$)	$\mu g/m^3$	22	25	31
5	Carbon monoxide (CO)	mg/m^3	0.7	0.4	1.1
6	Hydrocarbon (as methane)	ppm	0.8	0	0.8

Parameters for Monitoring

The baseline air quality status of the study area was primarily assessed by monitoring the following parameters:

a. Particulate matter (PM_{10} and $PM_{2.5}$)
b. Gaseous pollutants (NO_x, SO_2, CO and CH_4)

Sampling and analysis methods adopted were as prescribed by Central Pollution Control Board (CPCB) guidelines and Bureau of Indian Standard (BIS) codes of practice.

Methodology for Monitoring

The ambient air quality monitoring was carried out in accordance with guidelines of Central Pollution Control Board (CPCB) June 1998 and National Ambient Air Quality Standards (NAAQS), November 2009. Air quality monitoring was carried out by an NABL and MoEF accredited laboratory for 24 hours a day for Particulate Matter (PM10 and $PM_{2.5}$), Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NOx), 8 hours a day for Carbon Monoxide (CO).

Interpretation

As per the monitoring results, ambient air quality at all the locations were found to be within the prescribed limits as per NAAQS. Comparative analysis of the three station shows that $PM_{2.5}$ concentration was highest at Ghatkopar and lowest at Ghatkopar whereas PM_{10} levels were highest for Badlapur and least for Virar.

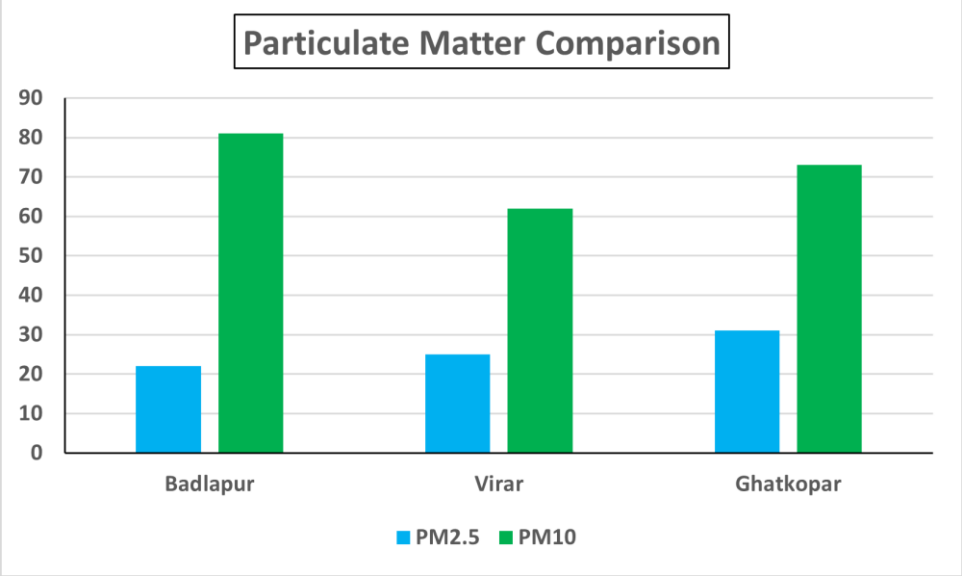


Figure 4-7: Particulate matter comparison of the monitoring sites

4.5.2 Noise and Vibration level Monitoring

Monitoring of Noise and Vibration levels were conducted at three (03) and five (05) locations respectively across the proposed FOB locations in May-June 2023.

Methodology for Monitoring

A thorough field reconnaissance was conducted for all the project site. The entire study area was divided into semi urban and rural stretch with different types of habitations on both sides of the proposed FOB location. Since the locations had similar set of soil profile, habitations, topography and considering other factors like density of houses/habitations, sensitive receptors, transportation intersections/nodes, high traffic locations, five (05) monitoring locations for Vibration monitoring were finalized. Details of the sampling locations are given in the **Table 4-6** above and the results against each location are provided in the table are presented in **Table 4-8*8*** ***and 4-9***.

Table 4-8: Vibration Level Monitoring Results

S. No.	Location	Time (Hrs)	Vibration Reading (mm/sec)
Ghatkopar Railway Station			
1	Track No 05 Ghatkopar railway station	12:07	1.2
2	Ghatkopar station platform No 04	12:10	1.1
3	Ghatkopar station platform No 03	12:12	1.2
4	Ghatkopar station platform No 02	12:15	2.1
5	Ghatkopar station No 01 Entrance	12:18	1.1
Virar Railway Station			
6	Platform 4A	16:10-16:15	0.2

S. No.	Location	Time (Hrs)	Vibration Reading (mm/sec)
7	Platform 3A	16:20-16:25	0.3
Kalwa Railway Station			
8	Platform No.01	12:06	1.9
9	Platform No.02	12:11	1.5
10	Platform No.03	12:17	2.1
11	Platform No.04	12:25	1.3
12	Platform No.05	12:33	2.2
Badlapur Railway Station			
13	Platform No.03	9:40	1.5
14	Platform No.02	10:03	2.1
15	Platform No.01	10:07	2.9
16	Home Platform Point 01	10:11	2.3
17	Home Platform point 02	10:16	1.8
Amberanth Railway Station			
18	Platform No 01	10:00	1.8
19	Platform No 02	10:10	2.3
20	Platform No 03	10:15	1.8

Table 4-9: Noise Level Monitoring Results

S. No.	Location	Noise Level (dB)
Ghatkopar Railway Station Near Railway Track No 5		
1	L_{10}	76.3
2	L_{50}	67.4
3	L_{90}	63
4	L_{eq} (Day)	92.5
5	L_{eq} (Night)	82.6
Virar Railway Station opposite Platform No 4A		
6	L_{10}	79.8
7	L_{50}	69.5
8	L_{90}	66.6
9	L_{eq} (Day)	77.6
10	L_{eq} (Night)	70.5
Badlapur Railway Station Near Platform No 1		
11	L_{10}	77.4
12	L_{50}	67.1
13	L_{90}	64.2
14	L_{eq} (Day)	75.2
15	L_{eq} (Night)	68.1

Ambient Noise Monitoring Standards in respect of Noise prescribed in Noise Pollution (Regulation and Control) Rules, 2000 (see rule 3(1) and 4(1)) were adopted for noise monitoring. Permissible limits of ground vibration specified by Director General of Mines Safety (DGMS) through its Circular No. 7 of 1997 will be considered for Vibration level monitoring.

Interpretation[1]

As per Noise standards notified by the MoEF&CC vide gazette notification dated 14th February 2000 and considering railways to be in the commercial operations, noise levels were observed to be more at Virar and Badlapur and considerably higher at Ghatkopar station. Similarly, for the night level noise Badlapur was observed to be lower than the permissible levels. These could be due to anthropogenic activities at station areas, railway operations and nearby commercial areas.

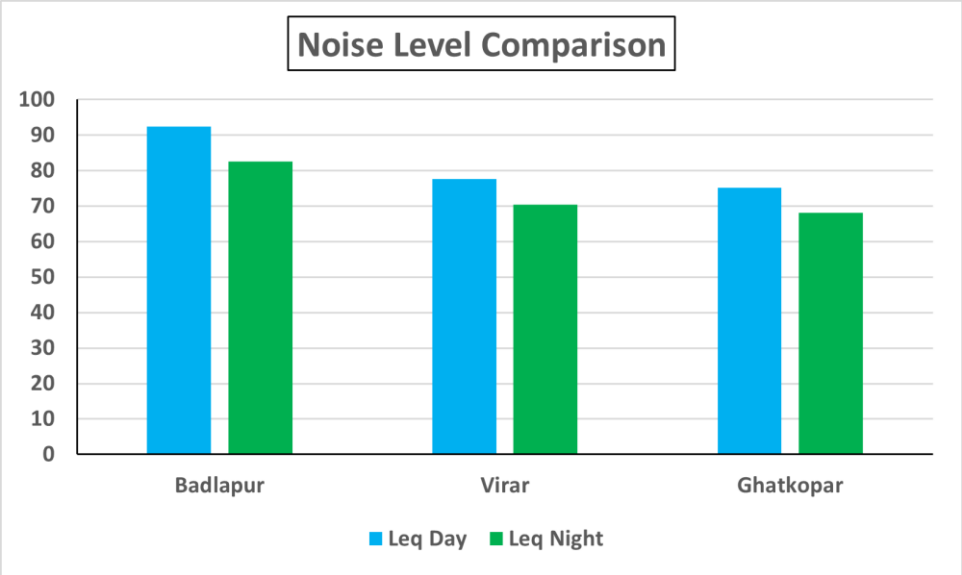


Figure 4-8: Noise Level Comparison of the monitoring sites

4.5.3 Ground Water Quality Monitoring

Two (02) ground water samples were collected mainly from dug wells and tube wells which are used for drinking purpose by the residents along the proposed FOB/trespass control sites. (Kalwa and Virar site)

Selection of Sampling Locations

Two (02) ground water samples were collected from the Study Area for the analysis of groundwater. Details of the sampling location are given in the **Table 4-6** above and the results against each location is mentioned in **Table 4-11**.

Parameters for Monitoring

Key parameters mentioned in BIS 10500:2012 Drinking Water Standards except pesticides, radio-active materials, PCB, PAH and Tri-halomethanes were analysed in all collected ground water samples.

Methodology for Monitoring

The groundwater samples were analysed as per the approved CPCB guidelines. Analysis results were compared with BIS 10500:2012 Drinking Water Standards to identify any deviation from the permissible limit. Reference analytical method used by the laboratory is summarized in table below.

Table 4-10: Reference Methods Adopted for Groundwater Samples Analysis

Sl. No.	Parameters	Reference Method
1	pH	APHA 23rd Ed. 4500-H+ B
2	Colour	APHA 23rd Ed. 2120 B
3	Taste	APHA 22nd Ed., 2160 A

[1] Guidelines for Noise & Vibrations, Metro Rail Transit system. Ministry of Railways, India (indianrailways.gov.in), *the document says that "In India, the noise pollution is governed by "The Noise Pollution (Regulation and control) Rules, 2000". As per Para 11(vi) of the Act, railway locomotives enjoy a statutory protection under the Indian Railway Act. 1989 against any action for the noise created thereby. There is no provision in the Act which provides for regulation of noise by railway locomotives. Section 16 of the Act gives statutory authority for the use of locomotives to railway administration*"

Sl. No.	Parameters	Reference Method
4	Odour	APHA 23rd Ed. 2150 B
5	Turbidity	APHA 23rd Ed. 2130 B
6	Total dissolved solids	APHA 23rd Ed. 2540 B
7	Hardness (total)	APHA 23rd Ed. 2340 C
8	Alkalinity	APHA 23rd Ed. 2320 B
9	Calcium	APHA 23rd Ed. 3500-Ca B
10	Residual free chlorine (RFC)	APHA 23rd Ed. 4500-CL- F
11	Boron	APHA 23rd Ed. 4500-B C
12	Chloride	APHA 23rd Ed. 4500-Cl- B
13	Sulphate	APHA 23rd Ed. 4500- SO4-2- E
14	Fluoride	APHA 23rd Ed. 4500-F D
15	Nitrate	APHA 23rd Ed. 4500-NO3- B
16	Chloramine (as CL2)	APHA 23rd Ed. 4500-CL G
17	Phenolic compounds	APHA 22nd Ed.,-2012-5330 D
18	Sulphide	APHA 23rd Ed. 4500- SO4-2- D
19	Mineral Oil	APHA 23rd Ed. 5520 B
20	Ammonia (as total ammonia-N)	APHA 23rd Ed. 4500-NH3 F
21	Anionic Detergents	APHA 23rd Ed. 5540 C
22	Chromium	APHA 23rd Ed. 3111 B
23	Cyanide as CN	APHA 23rd Ed. 4500-CN- D
24	Zinc	APHA 23rd Ed. 3111 B
25	Metal-Aluminium	IS:3025(PART 55)2003
26	Metal-Arsenic	APHA 23rd Ed. 3114 C
27	Metal-Barium	APHA 23rd Ed. 3500-Ba
28	Metal-Cadmium	APHA 23rd Ed. 3111 B
29	Metal-Copper	APHA 23rd Ed. 3111 B
30	Metal-Iron	APHA 23rd Ed. 3111 B
31	Metal-Lead	APHA 23rd Ed. 3111 B
32	Metal-Magnesium	APHA 23rd Ed. 3500-Mg B
33	Metal-Manganese	APHA 23rd Ed. 3111 B
34	Metal-Mercury	APHA 23rd Ed. 3112 B
35	Metal-Molybdenum	IS 3025 (Part 2) 2002
36	Metal-Nickel	APHA 23rd Ed. 3111 B
37	Metal-Selenium	APHA 23rd Ed. 3114 B
38	Metal-Silver	Annex J of IS 13428:2005
39	MPN	APHA 23rd Ed. 9221 C
40	E-Coli	APHA 23rd Ed. 4500-H+ B

Table 4-11: Ground Water Sampling Results

S. No.	Test Parameter	AL(PL)	Test Result (Kalwa)	Test Result (Virar)
1	Color	5(15)	BDL	BDL
2	Turbidity	1(5)	BDL	BDL
3	pH	6.5-8.5 (NR)	7.8	7.3
4	Total dissolved solids	500(2000)	75	421
5	Total hardness	200(600)	40	191

6	Total alkalinity	200(600)	31	242
7	Cyanide	0.1 (NR)	BDL	BDL
8	Sulphate	200(600)	5	32
9	Chlorides	250(1000)	6	51
10	Nitrates	250(1000)	0.3	0.8
11	Oil and grease		BDL	BDL
12	Calcium	75(200)	10	41
13	Magnesium	30(100)	4	22
14	Boron	0.5 (1.0)	BDL	BDL
15	Lead	0.01 (NR)	BDL	BDL
16	Iron	0.3 (NR)	0.13	BDL
17	Mercury	0.001 (NR)	BDL	BDL
18	Selenium	0.01 (NR)	BDL	BDL
19	Zinc	5(15)	0.13	BDL
20	Cadmium	0.003(NR)	BDL	BDL
21	Fluorides	200(600)	BDL	BDL
22	Anionic surfactants	0.2(1)	BDL	BDL
23	Phenolic compounds		BDL	BDL
24	Aluminium	0.03(2)	BDL	BDL
25	Sulphide		BDL	BDL
26	Barium	0.7(NR)	1.6	1.6
27	Copper	0.05(1.5)	BDL	BDL
28	Manganese	0.1(0.3)	BDL	BDL
29	Molybdenum	0.07(NR)	BDL	BDL
30	Nickel	0.02(NR)	BDL	BDL
31	Silver	0.1(NR)	BDL	BDL
32	Odour	Agreeable	Agreeable	Agreeable
33	Taste	Agreeable	Agreeable	Agreeable
34	Hexavalent chromium	0.05 (NR)	BDL	BDL
35	Chloramines	4 (NR)	BDL	BDL
36	Total chromium	0.05 (NR)	BDL	BDL
37	Residual free chlorine	0.2 (1)	BDL	BDL
38	Arsenic	0.01 (0.5)	BDL	BDL
39	Total chloriform		BDL	BDL
40	E.coli	Shall not be detectable in any 100 ml sample	Absent	Absent
41	F.coli		BDL	BDL

**AL=Allowable limit*
PL= Permissible limit
BDL= Below detection limit

Interpretation

Concentrations against all the parameters for ground water monitoring measured at both (Kalwa and Virar) the locations were observed to be under the permissible limits.

4.5.4 Drinking Water Quality Monitoring

One (01) Drinking water sample is collected mainly from the facilities provided at the proposed FOB/trespass control sites (Badlapur station).

Selection of Sampling Locations

After preliminary reconnaissance survey, one (01) location was identified for the collection of drinking water within the Study Area. During the site visit, it was observed that the proposed construction activity does not crosses any surface water body.

Details of sampling locations are given in the **Table 4-6** above and the results against each location are presented in the **Table 4-12**

Table 4-12: Drinking Water Sampling Results

S. No.	Test Parameter	AL (PL)	Test Result
1	Color	5(15)	BDL
2	Turbidity	1(5)	BDL
3	pH	6.5-8.5 (NR)	7.8
4	Total dissolved solids	500(2000)	67
5	Total hardness	200(600)	33
6	Total alkalinity	200(600)	30
7	Cyanide	0.01 (NR)	BDL
8	Anionic surfactants	-	BDL
9	Sulphide	0.05 (NR)	BDL
10	Barium	0.7 (NR)	BDL
11	Copper	0.05 (1.5)	BDL
12	Manganese	0.1 (0.3)	BDL
13	Sulphate	200(600)	6
14	Chlorides	250(1000)	7
15	Nitrates	250(1000)	0.8
16	Calcium	75(200)	9
17	Magnesium	30(100)	3
18	Iron	0.3(NR)	0.12
19	Fluoride	200(600)	BDL
20	Phenols	0.005(NR)	BDL
21	Boron	0.5 (1)	BDL
22	Selenium	0.01(NR)	BDL
23	Zinc	5(15)	1.19
24	Silver	0.1(NR)	BDL
25	Odour	Agreeable	Agreeable
26	Taste	Agreeable	Agreeable
27	Chloramines	4(NR)	BDL
28	Total chromium	0.05(NR)	BDL
29	Molybdenum	0.07(NR)	BDL
30	Nickel	0.02(NR)	BDL
31	Aluminium	0.03(0.2)	BDL
32	Residual chlorine	0.2(1)	BDL
33	Mercury	0.001(NR)	BDL
34	Oil and grease	-	BDL
35	Cadmium	0.003(NR)	BDL
36	Lead	0.01(NR)	BDL
37	Hexavalent chromium	-	BDL
38	Total coliform	Shall not be detectable in any 100 ml sample	BDL
39	E.coli	Shall not be detectable in any 100 ml sample	Absent
40	F.coli	-	BDL

**BDL= Below detection limit*
AL=Allowable limit
PL= Permissible limit

Parameters for Monitoring

In total, thirty-five (35) parameters were chosen for monitoring water quality at the selected location, as per IS 2296 and CPCB classification of surface water.

Interpretation

Concentrations against all the parameters for drinking water monitoring measured at the monitoring location was observed to be under the permissible limits.

Methodology for Monitoring

The surface water characteristic was assessed against the water quality criteria as per CPCB guidelines for water resources for all physicochemical and bacteriological parameters. Reference analytical methods used by the laboratory are summarized in **Table 4-13** below:

Table 4-13: Methods Adapted for Water Quality Analysis

Sl. No.	Parameters	Reference Method
1	pH	APHA 23rd Ed. 4500-H+ B
2	Colour	APHA 23rd Ed. 2120 B
3	Odour	APHA 23rd Ed. 2150 B
4	Temperature	APHA 23rd Ed. 2550 B
5	Conductivity	APHA 23rd Ed. 2510 B
6	Turbidity	APHA 23rd Ed. 2130 B
7	Total suspended solids	APHA 23rd Ed. 2540 D
8	Total dissolved solids	APHA 23rd Ed. 2540 B
9	Hardness (total)	APHA 23rd Ed. 2340 C
10	Alkalinity	APHA 23rd Ed. 2320 B
11	Calcium	APHA 23rd Ed. 3500-Ca B
12	Dissolved Oxygen (DO)	APHA 23rd Ed. 4500-O- C
13	Chemical Oxygen Demand (COD)	APHA 23rd Ed. 5220 B
14	Biochemical Oxygen Demand (BOD) 3 Days @ 27ºC	APHA 23rd Ed. 5210 D
15	Boron	APHA 23rd Ed. 4500-B C
16	Chloride	APHA 23rd Ed. 4500-Cl- B
17	Sulphate	APHA 23rd Ed. 4500- SO4-2- E
18	Fluoride	APHA 23rd Ed. 4500-F D
19	Nitrate	APHA 23rd Ed. 4500-NO3- B
20	Phosphate as PO4	APHA 23rd Ed. 4500-P D
21	Phenolic compounds	APHA 23rd Ed. 5330 D
22	Chromium	IS:3025 (PART 52) 2003
23	Zinc	APHA 23rd Ed. 3111 B
24	Metal-Aluminium	IS:3025(PART 55)2003
25	Metal-Arsenic	APHA 23rd Ed. 3114 C
26	Metal-Cadmium	APHA 23rd Ed. 3111 B
27	Metal-Copper	APHA 23rd Ed. 3111 B
28	Metal-Iron	APHA 23rd Ed. 3111 B
29	Metal-Lead	APHA 23rd Ed. 3111 B
30	Metal-Magnesium	APHA 23rd Ed. 3500-Mg B
31	Metal-Manganese	APHA 23rd Ed. 3111 B
32	Metal-Mercury	APHA 23rd Ed. 3112 B

33	Metal-Selenium	APHA 23rd Ed. 3114 B
34	Faecal Coliform	APHA 23rd Ed. 9221 E
35	Total Coliform	APHA 23rd Ed. 9221 C

4.6 Ecology and Biodiversity Baseline

This section of the report provides a summary of the terrestrial ecology assessment undertaken for the project. It outlines the study area’s existing ecological conditions. The resulting ecological baseline data forms the basis for assessing potential impacts of the project on the ecology of the project area and suggesting measures to mitigate any significant adverse impacts anticipated.

4.6.1 Delineation of the Study Area

This sub-section delineates the study area covered by the biodiversity assessment. It also briefly describes the geographical and ecological status of the delineated area.

The overall area covered by the assessment includes the following constituent areas:

a) The footprint of the project, hereafter referred to as the ‘Project Site’;

b) The area contained within a 100m buffer of the Project Site (estimated to contain potential ecological receptors of any direct project-related impacts), hereafter referred to as the ‘Buffer Area’

The ‘Project Site’ and the ‘Buffer Area’ collectively constitute the Area of Influence (AoI) of the project and are hereinafter collectively referred to as the ‘Study Area’.

4.6.2 Description of the Study Area

Geographically, the Study Area for all the sites forms a part of the western coastal plains of the state of Maharashtra. Ecologically, the Study Area mainly consists of highly modified habitats, largely urban areas comprising built up interspersed with avenue plantations, arable lands and occasional small patches of near natural habitats, such as natural and regenerated tree cover, relic trees and shrublands. A few natural habitats include seasonal and perennial surface waterbodies including streams and pools.

4.6.3 Methodology

The biodiversity baseline is based on primary data which was collected through the fieldwork. The data recorded for floristic species was focused on higher flora, namely Angiosperms and Gymnosperms, while that for faunal species was focused on higher fauna, namely Vertebrates, including Mammals, Birds, Reptiles, Amphibians and Fishes.

Primary data towards the biodiversity baseline was collected through sampling conducted at ten (10) locations in the study area of all the Project Sites. The biodiversity sampling locations were selected with a focus on the AIIB Policy on Environment & Social Framework mandated aspects, namely species, habitats and ecosystem services, of the Study Area. The selection was based on secondary information obtained through desk studies, to ensure that the sampling locations proportionately represent the perceived Habitat and Ecosystem Services profile of the Study Area.

Table 4-14 below presents the details of the sampling locations, including the location ID assigned to each site, a location description stating the habitat-type/s associated with the location and the location coordinates of the site.

Table 4-14: Details of Biodiversity Sampling Locations

Location ID	Location Description	Location co-ordinates
BD1	Stream near Ambarnath Kalyan end FOB	19°12'40.99"N, 73°11'2.05"E
BD2	Vegetation near AmbarnathKalyan end FOB	19°12'36.35"N, 73°11'1.98"E
BD3	Vegetation near Ambarnath Karjat end FOB	19.209132° N, 73.186268° E
BD4	Gaodevi Lake near Badlapur Vangani end FOB	19.162519° N, 73.245057° E
BD5	Vegetation near Badlapur Vangani end FOB	19.162430° N, 73.245899° E
BD6	Vegetation near Badlapur Vangani end FOB	19° 9'47.11"N, 73°14'45.88"E

BD7	Vegetation at Kalwa FOB connecting west side with platforms project site	19°11'41.57"N, 72°59'44.87"E
BD8	Arable land near Kalwa FOB connecting west side with platforms	19°11'43.38"N, 72°59'43.16"E
BD9	Vegetation near Virar FOB	19°27'28.04"N, 72°48'42.22"E
BD10	Vegetation near Virar FOB	19°27'28.79"N, 72°48'40.30"E

Source: AECOM Primary Survey

4.6.4 Species Profile of the Study Area

This sub-section presents details of the floral and faunal species recorded from the Study Area during the site visit conducted on 23-24 March and 5-6 April 2023.

Recorded Floral Species

A total of 35 floristic species were recorded in the Study Area of all the sites during the primary survey. These include 24 tree, 3 shrub and 1 palm species, which would be part of the perennial groundcover of the Study Area, and 5 herb species and 2 climber species, which would be part of the annual or seasonal groundcover of the Study Area. None of the floral species recorded in the Study Area are listed in any Schedule of the Indian Wildlife (Protection) Act, 1972.

Table 4-15 presents the details of each floral species recorded in the Study Area, including its scientific and common name, habit and botanical family to which it is assigned.

Table 4-15: Details of Floristic Species

S. No.	Scientific Name	Vernacular Name	Habit	Family
Km 67/20, Badlapur Home PF BUD				
1	*Azadirachta indica*	Kadunimb	Tree	Meliaceae
2	*Tabebuia rosea*	Tabebuia	Tree	Bignoniaceae
3	*Muntingia calabura*	Panchara	Tree	Muntingiaceae
4	*Ricinus communis*	Earand	Shrub	Euphorbiaceae
5	*Leucaena leucocephala*	Subabhul	Tree	Mimosaceae
Km 68/14-16: Badlapur-Vangani FOB				
1	*Ceiba pentandra*	Samali	Tree	Malvaceae
2	*Ficus hispida*	Bokeda	Shrub	Moraceae
3	*Pithecellobium dulce*	Vilayati Chinch	Tree	Mimosaceae
4	*Colocasia esculenta*	Alu	Herb	Araceae
5	*Muntingia calabura*	Panchara	Tree	Muntingiaceae
6	*Ricinus communis*	Earand	Shrub	Euphorbiaceae
7	*Leucaena leucocephala*	Subabhul	Tree	Mimosaceae
8	*Terminalia catappa*	Jangali Badam	Tree	Combretaceae
9	*Ficus religiosa*	Pimpal	Tree	Moraceae
10	*Cucumis* sp.	-	Climber	Cucurbitaceae
11	*Ipomoea* sp.	-	Climber	Convolvulaceae
12	*Thespesia populnea*	Bhend	Tree	Malvaceae
Km 59/37-39 Ambarnath (KJT end) FOB				
1	*Terminalia catappa*	Jangali Badam	Tree	Combretaceae
2	*Muntingia calabura*	Panchara	Tree	Muntingiaceae
3	*Monoon longifolium*	Khota Ashok	Tree	Annonaceae
4	*Ficus religiosa*	Pimpal	Tree	Moraceae

S. No.	Scientific Name	Vernacular Name	Habit	Family
5	*Eucalyptus* sp.	Nilgiri	Tree	Myrtaceae
6	*Ficus benghalensis*	Vad	Tree	Moraceae
7	*Mangifera indica*	Amba	Tree	Anacardiaceae
8	*Delonix regia*	Gulmohar	Tree	Fabaceae
9	*Peltophorum pterocarpum*	Tambad Sheng	Tree	Caesalpiniaceae
10	*Cocos nucifera*	Naral	Palm	Arecaceae
11	*Ricinus communis*	Erand	Shrub	Euphorbiaceae
Km 60/4-6: Virar FOB				
1	*Muntingia calabura*	Panchara	Tree	Muntingiaceae
2	*Ficus religiosa*	Pimpal	Tree	Moraceae
3	*Ziziphus mauritiana*	Bor	Tree	Rhamnaceae
4	*Ricinus communis*	Erand	Shrub	Euphorbiaceae
5	*Datura metel*	Dhotra	Shrub	Solanaceae
6	*Ficus racemosa*	Umber	Tree	Moraceae
7	*Achyranthes aspera*	Aghada	Herb	Amaranthaceae
8	*Ficus benghalensis*	Vad	Tree	Moraceae
9	*Mangifera indica*	Amba	Tree	Anacardiaceae
10	*Cordia dichotoma*	Bhokar	Tree	Boraginaceae
11	*Syzygium cumini*	Jambhul	Tree	Myrtaceae
12	*Terminalia chebula*	Hirda	Tree	Combretaceae
13	*Ficus hispida*	Bokeda	Shrub	Moraceae
14	*Trema orientale*	Ghol	Tree	Cannabaceae
Km 35/3-4 Kalwa FOB connecting west side with platforms				
1	*Trema orientale*	Ghol	Tree	Cannabaceae
2	*Mangifera indica*	Amba	Tree	Anacardiaceae
3	*Monoon longifolium*	Khota Ashok	Tree	Annonaceae
4	*Ficus benghalensis*	Vad	Tree	Moraceae
5	*Peltophorum pterocarpum*	Tambad Sheng	Tree	Caesalpiniaceae
6	*Ficus religiosa*	Pimpal	Tree	Moraceae
7	*Ficus hispida*	Bokeda	Shrub	Moraceae
8	*Sterculia guttata*	Kukar	Tree	Sterculiaceae
9	*Cocos nucifera*	Naral	Palm	Arecaceae
10	*Ricinus communis*	Erand	Shrub	Euphorbiaceae
11	*Samanea saman*	Gulabi Shirish	Tree	Mimosaceae
12	*Alternanthera sessilis*	Chubuk Kata	Herb	Amaranthaceae
13	*Muntingia calabura*	Panchara	Tree	Muntingiaceae
14	*Cleome viscosa*	Pivala Tilwan	Herb	Cleomaceae
15	*Ficus racemosa*	Umber	Tree	Moraceae
16	*Terminalia catappa*	Jangali Badam	Tree	Combretaceae
17	*Euphorbia* sp.	-	Herb	Euphorbiaceae
18	*Artocarpus heterophyllus*	Phanas	Tree	Moraceae

Figure 4-9 given below presents a photographic log of some of the floral species and habitats recorded in the Study Area.

Syzygium cumini tree near Virar Project Site

Ficus religiosa tree near Virar Project Site

Vegetation at Kalwa Project Site

Mangifera indica tree at Kalwa Project Site

Vegetation near Badalapur project site

Gaodevi Lake near Badlapur Vangani end FOB

Figure 4-9: Photographic log of some of the floral species recorded in the Study Area

Source: AECOM Primary survey

As observed during the site visits, canopy vegetation including trees and shrubs and ground cover comprising herbs, grasses and climbers at Project Sites are likely to be cleared off for construction of the FOBs. At Km 60/4-6: Virar FOB Project Site, excavation work was under progress on the day of AECOM’s site visit. A few trees and shrubs along eastern and western boundaries of the proposed Project Site have been observed to be cleared and trimmed. As informed by the site representative, no tree cutting and pruning permits have been obtained for the project.

At proposed Project Site Km 35/3-4 Kalwa FOB connecting west side with platforms, vegetation removal is likely to be done for site preparation. As per the information shared by the site representative, no tree survey has been done until the date of site visit.

Recorded Faunal Species

This section presents the higher faunal species, namely vertebrates, comprising mammals (01 species), birds (11 species) and reptiles (01 species) recorded during the primary survey within Study Area of all the proposed sites. **Table 4-16** presents the details of each faunal species recorded in the Study Area, including its scientific and common name, group and the Schedule of India’s Wildlife Protection Act, 1972 (WPA) under which the species is listed.

Table 4-16: Details faunal species recorded in the Study Area

S. No.	Scientific Name	Common Name	Group	WPA Schedule*
Km 67/20, Badlapur Home PF BUD				
1	*Microcarbo niger*	Little Cormorant	Aves	IV
2	*Psilopogon haemacephalus*	Coppersmith Barbet	Aves	IV
3	*Columba livia*	Common Pigeon	Aves	-
4	*Egretta garzetta*	Little Egret	Aves	IV
Km 68/14-16: Badlapur-Vangani FOB				
1	*Milvus migrans*	Black Kite	Aves	IV
2	*Corvus splendens*	House Crow	Aves	V
3	*Columba livia*	Common Pigeon	Aves	-
Km 59/37-39 Ambarnath (KJT end) FOB				
1	*Calotes versicolor*	Indian Garden Lizard	Reptiles	-
2	*Psilopogon haemacephalus*	Coppersmith Barbet	Aves	IV
3	*Columba livia*	Common Pigeon	Aves	-
Km 60/4-6: Virar FOB				
1	*Calotes versicolor*	Indian Garden Lizard	Reptiles	-
2	*Cinnyris asiaticus*	Purple Sunbird	Aves	IV
3	*Centropus sinensis*	Southern Coucal	Aves	-
4	*Milvus migrans*	Black Kite	Aves	IV
5	*Corvus splendens*	House Crow	Aves	V
6	*Columba livia*	Common Pigeon	Aves	-
Km 35/3-4 Kalwa FOB connecting west side with platforms				
1	*Lonchura punctulata*	Scaly-breasted Munia	Aves	IV
2	*Saxicoloides fulicatus*	Indian Robin	Aves	-
3	*Centropus sinensis*	Southern Coucal	Aves	-
4	*Pycnonotus cafer*	Red-vented Bulbul	Aves	IV
5	*Milvus migrans*	Black Kite	Aves	IV
6	*Corvus splendens*	House Crow	Aves	V
7	*Funambulus pennantii*	Five-striped Palm Squirrel	Mammals	IV

Source: AECOM Primary survey

4.6.5 Biodiversity Values

The floral species profile of the Study Area of all the Project Sites is composed of a mix of native and alien species. The vegetation includes some large trees, of both native and alien species, with dense, spreading canopies. The biodiversity value of the vegetation lies mainly in the following aspects:

a) habitat features, such as feeding, roosting, breeding and nesting sites provided to urban fauna of the highly modified urban Study Area

b) ecosystem services, such as shade, water regulation, temperature regulation and aesthetic value provided to the local community in and around the all Project Sites

c) at Km 35/3-4 Kalwa FOB, a a land parcel located about 15m towards west of the proposed Project Site is utilized for agricultural practices which provide ecosystem services in terms of food to the local residents

4.6.6 Findings on Designated Areas

Designated areas include legally protected areas notified by the Government of India as National Parks, Wildlife Sanctuaries, Reserve Forests, Protected Forests, Ramsar Wetlands, UNESCO Man & Biosphere Reserves or UNESCO World Natural Heritage Sites, as well as internationally recognized areas, such as, Important Bird and Biodiversity Areas, Key Biodiversity Areas or Alliance for Zero Extinction Sites.

- **Km 67/20, Badlapur Home PF BUD**

The nearest designated area with respect to the Project Site is an unnamed reserved forest located approximately 2km west of the site.

- **Km 68/14-16: Badlapur-Vangani FOB**

The nearest designated area with respect to the Project Site is an unnamed reserved forest located approximately 1.2 km southwest of the site.

- **Km 59/37-39 Ambarnath (KJT end) FOB**

The nearest designated area with respect to the Project Site is an unnamed reserved forest located approximately 4.5 km south of the site.

- **Km 60/4-6: Virar FOB**

The nearest designated area with respect to the Project Site is an unnamed reserved forest located approximately 1.5 km east of the site.

- K**m 35/3-4 Kalwa FOB connecting west side with platforms**

The nearest major legally protected area with respect to the Project Site is Thane Creek Flamingo Sanctuary (TCFS). It is nationally designated as a Wildlife Sanctuary, qualifying as a Category IV International Union for Conservation of Nature (IUCN) Protected Area. It is part of an area proposed as a Ramsar Wetland by the Maharashtra State Government in February 2022. It is also internationally recognized as an Important Bird and Biodiversity Area (IBA) and a Key Biodiversity Area (KBA). The TCFS, as well as its notified Eco-sensitive Zone (ESZ), are situated approximately 1.5km southwest of the Project Site.

Sources: Survey of India, toposheets- E43A16_47A16; E43B4_47E4; E43B8_47E8; E43A15_47A15; BirdLife International (2023) Important Bird Area factsheet: Thane Creek. Downloaded from http://datazone.birdlife.org/site/factsheet/18281 on 26/06/2023;

Key Biodiversity Areas Partnership (2023) Key Biodiversity Areas factsheet: Thane Creek. Extracted from the World Database of Key Biodiversity Areas. Developed by the Key Biodiversity Areas Partnership: BirdLife International, IUCN, American Bird Conservancy, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Re:wild, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, World Wildlife Fund and Wildlife Conservation Society. Downloaded from http://www.keybiodiversityareas.org/ on 26/06/2023; Thane Flamingo Sanctuary proposed to be first Ramsar site from MMR | Deccan Herald.

4.7 Socio-economic baseline

This section provides an understanding of the following aspects:

- Administrative set up of the project sites,
- Demographic profile of the municipal areas and/ or villages in the project area,
- Social groups present,
- Vulnerable groups identified,
- Livelihood profile of the community,
- Land use patterns in the area,
- Common property resources,
- Social and physical infrastructure available in terms of the education and health infrastructure and
- Water supply for irrigation and drinking purposes, sanitation facilities and connectivity.

This understanding is based on the secondary information available at district, sub-district, and town/ municipal area level (as per Census of India 2011) as well as informed during consultations undertaken by AECOM during the site visit.

4.7.1 Approach

In-order to develop a social baseline and further carry out an impact assessment for the project, a participatory approach was adopted. The participatory approach was taken with an understanding that, it will integrate the local understanding and perspective of local community into the impact & risk identification and its mitigation measure. The purpose of such an approach was to allow for:

- The validation of the information available from secondary sources through the information made available by the local community, both qualitative and quantitative;
- Development of the socio-economic baseline on the basis of a combination of primary and secondary qualitative and quantitative data; and
- An understanding to be developed of the local community’s perception of the project and its activities and the possible impacts from the same and the desirable mitigation measures.

4.7.1.1 Primary Data/ Information Collection/ Site Consultations

As part of the “baseline data collection” process, consultations were undertaken with the local stakeholders identified for the project. The **Table 4-17** provides list of the consultations undertaken as part of the site visit.

Table 4-17: Consultations undertaken during the site visit

Date	Stakeholder Details	Remarks
23/03/2023	MRVC site team	Regarding up-coming construction work and land status
23/03/2023	Supervisors of both the contractors, i.e., M/s Sai Constructions Pvt. Ltd and M/s Kuwala Cooperation Pvt	To understand detail of construction work, scope, and workers to be engaged
23-25/ 03/ 2023 and 05/04/2023	Commuters and Trespassers	To understand their concerns, issues and suggestions
	Fence-line community and local community	To understand their concerns, issues and suggestions
	Auto drivers near Badlapur Auto stand	To understand the trespassing trend and any accident taken place in recent past

As part of these consultations, an attempt was made to develop an understanding of the stakeholder group’s key concerns and expectations from the project, the stakeholder group’s perception of the project and to triangulate the secondary information available on the area.

4.7.1.2 Review of Secondary Information

For establishing the social baseline for the study area, a review of the secondary information available in the public domain was undertaken. The list of secondary sources of information used is as follows:

- District Census Handbook, Thane and Palghar
- Primary Census Abstract data of India, 2011
- Village Directory Census data of India, 2011; and
- Agricultural Contingency plan

4.7.1.3 Study Area Profile

The Direct Impact zone/ or core zone for the baseline studies has been considered as the Project Area/ location, where FOB is/ shall be exactly located. Most of the project impacts are anticipated in the Core zone area. The Buffer zone up to 100 metre stretch on either side of the proposed alignments has been considered for identification of sensitive receptors, if any, through desktop research.

The socio-economic baseline chapter shall give details of "Study Area". Further details pertaining to study area municipal towns and/ or villages along with their tehsil and Districts are detailed out below in **Table 4-18**.

Table 4-18: Study Area Municipal Town

S. No.	Study Area Villages	Tehsil	District
1.	Badlapur	Ambarnath	Thane
2.	Vangani	Jawhar	
3.	Kalwa	Thane	
4.	Ambarnath	Ambarnath	
5.	Virar	Vasai	Palghar

4.7.2 State Profile: Maharashtra

Maharashtra state was formed on 1st May 1960 after a long struggle for special state for Marathi language speaking people through "Sanyukta Maharashtra Movement".

It is a state in the western peninsular region of India occupying a substantial portion of the Deccan Plateau. It is bordered by the Arabian Sea to the west, the Indian states of Karnataka and Goa to the south, Telangana to the southeast and Chhattisgarh to the east, Gujarat and Madhya Pradesh to the north, and the Indian union territory of Dadra and Nagar Haveli and Daman and Diu to the northwest. The state is the second-most populous state in India and the second-most populous country subdivision globally.

For ease of administration, the state is divided into 6 divisions and 36 districts, with the state capital being Mumbai, the most populous urban area in India, and Nagpur serving as the winter capital, which also hosts the winter session of the state legislature. Godavari and Krishna are the two major rivers in the state.

The State comprises of a population of 112,374,333 individuals, which is pre-dominantly rural, forming 54.78 % of the State's total population. The sex ratio in the State is 929, which is lower than that of India which stands at 943 females per 1000 males as per census 2011 data.

The literacy rate of Maharashtra is nearly 82.34 %, which is higher than that of the country, at 74.04%. The male literacy rate is relatively higher, at 88.38 % while the female literacy rate is 75.87 % which is higher than the national female literacy rate of 65.46 %. **Table 4-19** given below presents the demographic profile of Maharashtra state.

Table 4-19: Demographic Profile of Maharashtra

Attribute	Number	% of India
Area (sq. km)	3,07,713	9.37
Total population	112,374,333	7.87
Males	58,243,056	7.91

Females	54,131,277	7.85
Sex ratio	929	NA
Percentage of rural Population	54.78	NA
Percentage of urban population	45.22	NA
Percentage of SC population	11.81	NA
Percentage of ST population	9.35	NA
Total literacy rate	82.34	NA
Male Literacy rate	88.38	NA
Female Literacy Rate	75.87	NA

Source: Census of India 2011 data

4.7.2.1 District Profile: Thane

Thane is one of the few industrially advanced districts in the state of Maharashtra. The revised area of the district is 4,214 sq.km The industrial area developed is very prominent in Thane, Kalyan, Ulhasnagar, Ambarnath, Bhiwandi talukas of the districts. Economic and social development of more than half of the district is due to industrialization. Due to increasing industrialization, large scale employment has been generated to skilled and unskilled workers. Although the mineral production is not very much in the district, the business of sand excavation for the construction works on a large scale in Mumbra, Thane and Ghodbunder.

4.7.2.2 District Profile: Palghar

Palghar District was formed in year 2014 by the Maharashtra State government. The district is bounded by Thane and Nashik Districts on the east and northeast, and by Valsad District of Gujarat state and Union Territory of Dadra and Nagar Haveli on the north. The Arabian Sea forms the western boundary, while Vasai-Virar is part of Mumbai Metropolitan Region. As per the Brief Industrial Profile of the District, it covers 4,69,699 hectares of the total geographical area in a total 1008 villages and 3818 sub-villages as well as 477 Gram Panchayats.

4.7.2.3 Tehsil Profile: Ambarnath, Jawhar, Thane and Vasai

The Study Area tehsils, namely Ambarnath, Jawhar[1] and Thane falls under Thane District, while Vasai tehsil falls under Palghar District.

The Table 4-20 below further states that the literacy rate in Thane Tehsil is 79.38%, which is higher than the literacy rate at Ambarnath, Jawhar, and Vasai Tehsil. Jawhar has the lowest literacy rate, i.e., 47.88% among all the tehsils. Similarly, the female literacy rate was identified to be lowest at Jawhar tehsil level, i.e., 41.43% followed by 59.28% of Palghar District. **Table 4-20** given below presents the demographic profile of tehsils in the Study Area.

Table 4-20: Demographic Profile of Tehsils/ Talukas

Attribute	Ambarnath Tehsil	Jawhar Tehsil	Thane Tehsil	Vasai Tehsil	Thane District	Palghar District
Population	5,65,340	1,40,187	37,87,036	13,43,402	11,060,148	5,50,166
% of SC Population	13.40	1.03	6.79	3.98	6.60	4.96
% of ST Population	6.40	91.64	1.98	7.32	13.95	14.10
% Total Literacy Rate	76.89	47.88	79.38	76.77	84.53	66.65
% Male Literacy Rate	80.64	54.48	82.13	80.02	88.72	72.23
% Female Literacy Rate	73.13	41.43	76.63	73.50	79.77	59.28

Source: Census of India 2011 data

[1] *2018041350.pdf (s3waas.gov.in)*

4.7.3 Demographic Profile

There is total 05 municipal town that fall within 100-meter radius of the FoB sites/ project. The total population of Study Area as per 2011 Census of India data is 16,65,697 living in 3,95,096 households. The largest municipal town in terms of population is Virar Municipal town having its population of 2,91, 229.

The table below clearly states that the condition of literacy is good at the Study area, i.e., 88.66% literacy rate. The female literacy rate at the study area is 85.21% in comparison to 91.74% male literates.

Similarly, the vulnerable community, i.e., SC & ST, is 11.34% in the study area; out of which 6.84% is SC population and 4.50% is ST population. The municipal town wise population details are provided below in **Table 4-21**.

Table 4-21: Demographic Profile of Study Area

Sl No.	Sub District Name	Census Town	Households	Population	Average HH size	Sex Ratio	SC%	ST%	Literacy Rate	Male Literacy Rate	Female Literacy Rate
1.	Ambarnath	Badlapur (CT)	41902	174226	4	928	14.63	3.93	91.72	94.45	88.80
2.	Jawhar	Vangani (CT)	2915	12628	4	911	16.23	7.13	83.70	88.60	78.31
3.	Thane	Kalwa (CT)	643	2978	5	909	3.12	2.62	85.11	93.36	75.88
4.	Ambarnath	Ambarnath (CT)	58407	253475	4	912	13.96	3.81	87.22	91.00	83.07
5.	Vasai	Virar (M Corp)	291229	1222390	4	886	4.17	4.70	88.57	91.53	85.22
		Total	**3,95,096**	**16,65,697**	**4**	**894**	**6.84**	**4.50**	**88.66**	**91.74**	**85.21**

Source: Census of India 2011 data

4.7.3.1 Gender Profiles

The census data 2011 of the Study Area states that the Sex Ratio in the Study Area municipal towns is 894 females per thousand males.

4.7.3.2 Social stratification

As per community consultations and review of census data, 2011, it has been identified, that the entire “Study Area” falls under urban category. The **Figure 4-10,** below clearly states that the SC population in the Study area is 6.84%; and the ST population is 4.50%.

The figure below clearly shows that the SC population in the Study area is higher than the average SC population at tehsil and District level; while the ST population lowest at Study area level (4.50%) and highest at tehsil level (i.e., 26.84%)

The livelihood pattern of SC population does not significantly differ from the general community. Further, according to the discussions with the local community, the SC and ST communities in the area is also engaged in service sector and “Other” employment activities like general and OBC communities in the area.

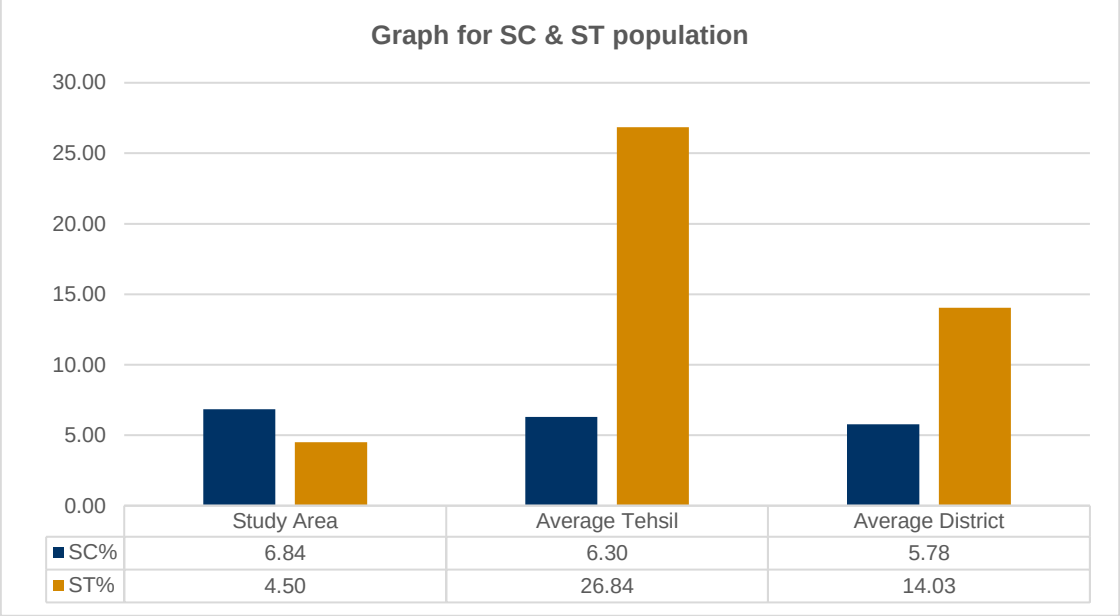


Figure 4-10: Proportion of SC and ST Population in the Study Area vis-à-vis Tehsil & District

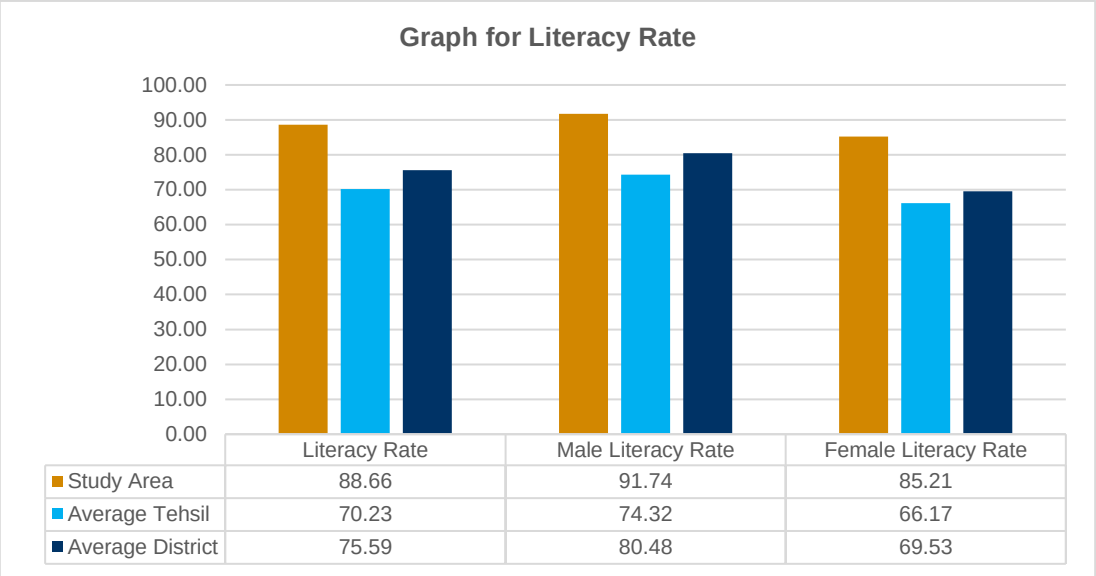
Source: Census of India 2011 data

As per observation and further consultations with the local community, there is no caste-based discrimination in terms of habitation patterns; the various caste groups reside together in settlements, that are homogenous in nature. In addition, there are no differences across the social groups in terms of access to resource and other economic opportunities.

4.7.4 Literacy Profile

The overall literacy rate is highest at the Study area level and lowest at the tehsil level., refer **Figure 4-11** below. Similarly, the male and female literacy rates are highest at the Study area level, i.e., 91.74% and 85.21% respectively; and lowest at the tehsil level, i.e., 74.32% and 66.17%

Contrary to the given below data, the youth and local community during consultations in the Study area informed AECOM team that the enrolment of both boys and girls have improved in past one decade. The local community also added that the level of literacy and enrolment of girl students for higher studies has significantly improved in last one decade, due to increase in schools, colleges in every area.



	Literacy Rate	Male Literacy Rate	Female Literacy Rate
Study Area	88.66	91.74	85.21
Average Tehsil	70.23	74.32	66.17
Average District	75.59	80.48	69.53

Figure 4-11: Literacy Rate in Study Area (in %)

Source: Census of India 2011 data

AECOM team during their consultation understood that most of the local communities residing in the Study area have immigrated from other states like, Gujarat, Bihar, Uttar Pradesh for better employment opportunities and education facilities for their children. Further, primary details could not be ascertained as no focus group discussion/ or consultation was carried out with larger group.

4.7.5 Livelihood Profile

Based on the 2011 Census data, the total working population in the Study Area is 39.17%. Out of the total working population, 90.65% is categorised as main workers ((i.e., those who have worked for a period of 6 months); and remaining 9.35% are marginal workers (i.e., those who have not worked for a period of 6 months). The proportion of “Other workers” comprising of households engaged in services and small to large businesses is 93.19%.

There is a very less proportion of cultivators and agricultural labourers, comprising of only 3.95% of the total population. The remaining 2.86% of the total working population is engaged in household industry. The data below also indicates that the local working population is mostly dependent on secondary sector, i.e., services, businesses etc., and are exploring/ keen in finding employment in sectors such as industries, trades, and services due to abundant opportunities in private sector, public sector, industries, factories etc. in in the area. The **Table 4-22** lists the working population in the study area and **Figure 4-12** given below depicts key occupational profile aspects.

Table 4-22: Table working population in the Study Area

Sl No.	Tehsils	Census Town	Total Workers	Main Workers	Cultivators	Agricultural Labours	HH Workers	Other Workers	Marginal Workers	Cultivators	Agricultural Labours	HH Workers	Other Workers
1	Ambarnath	Badlapur (M Cl)	65255	55750	826	775	1227	52922	9505	259	486	456	8304
2	Jawhar	Vangani (CT)	4645	4161	86	43	107	3925	484	23	36	41	384
3	Thane	Kalwa (CT)	1078	962	375	24	54	509	116	36	16	2	62
4	Ambarnath	Ambarnath (CT)	91407	85272	398	423	1652	82799	6135	52	60	225	5798
5	Vasai	Virar (M Corp)	490018	445274	6871	10477	12400	415526	44744	2072	2426	2471	37775
		Study Area	**652403**	**591419**	**8556**	**11742**	**15440**	**555681**	**60984**	**2442**	**3024**	**3195**	**52323**

Source: Census of India 2011 data

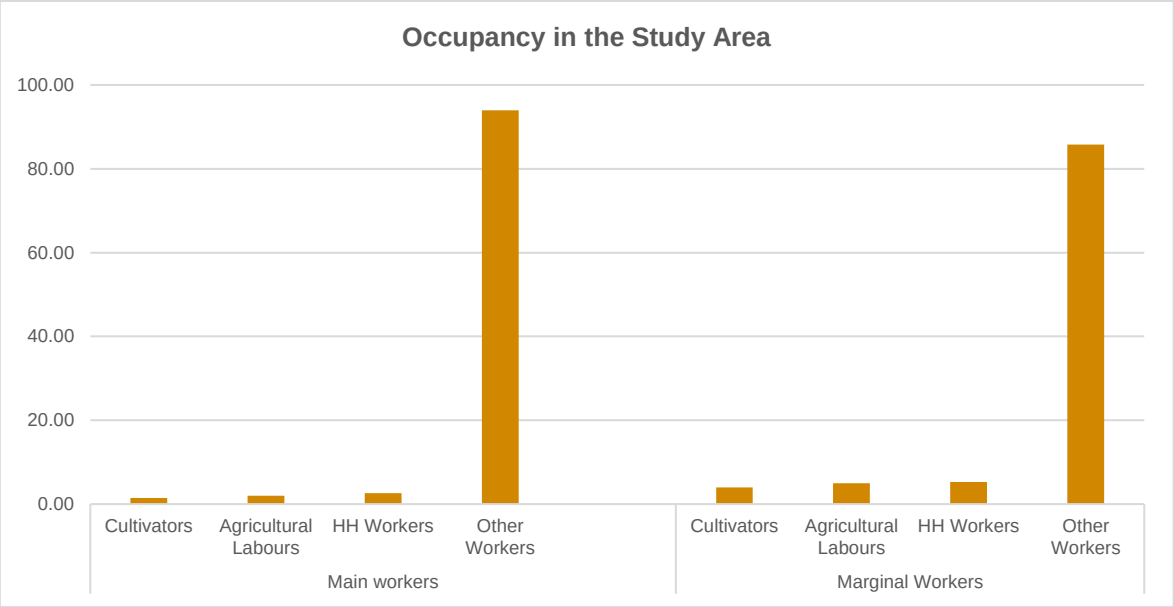


Figure 4-12: Key Occupational Profile Aspects

Source: PCA Data, 2011[1]

4.7.5.1 Social and Physical Infrastructure

The review of Census data, 2011 and secondary sources indicate that the study area falls under municipal town/ urban area, refer Table 4-18 and Table 4-21 above. The section below gives detail of all the infrastructures identified in the Study Area.

4.7.5.1.1 Drinking Water supply & Sanitation

As per the review of Census data, 2011, the drinking water supply sources in the study area include treated tap water; however, there are few areas in the study area, i.e., Vangani where the tap water supplied to every household is untreated. Further, based on the review of census data and consultation with local community, it was understood that the tap water supply is provided by Municipality and City and Industrial Development Corporation (CIDCO[2]).

Local community in Study area added that they have this tap water facility for the past many years, i.e., duration not confirmed. It can be understood from **Table 4-23** that all the census tows in the Study area have access to tap water (both treated and un-treated) and handpump in Ambarnath only.

There are no other water sources in the study area such as well, bore-well, river or canal. The local community during consultation informed that although they do not face any water crisis, however during peak summer season, some pockets/ or areas/ apartments face water crisis for few days or weeks.

Table 4-23: Source of water and drainage in the Study Area

Census Town	Tap Water-Treated	Tap Water- Untreated	Hand Pump	Drainage System
Badlapur (M Cl)	Available	NA	NA	NA
Vangani (CT)	NA	Available	NA	Closed
Kalwa (CT)	Available	NA	NA	Closed
Ambarnath (M Cl)	Available	NA	Available	NA
Vasai-Virar City (M Corp)	Available	NA	NA	NA
Census Towns with water sources	**04**	**01**	**01**	**02**

Source: Census of India 2011 data

1 (India - Census of India 2011 - Maharashtra - Series 28 - Part XII A - District Census Handbook, Thane (censusindia.gov.in)

2 City and Industrial Development Corporation - Wikipedia

The table above also give details pertaining to the drainage system existing during year 2011 in the Study area. The data above clearly state that Vangani and Kalwa have closed drainage system, while in other census towns there was no drainage system identified. The local community during consultation informed AECOM team that the condition of closed drainage system has improved in last one decade. The wards under every municipality have developed closed and cemented drainage system across the entire study area.

The **Table 4-24** below further give details of the toilet facilities in the Study area. The total number of toilet pits in the study area is 321, while total flush/ pour flush toilet infrastructures are 1,79,185 in number; rest others are 1,760.

Table 4-24: Toilet facility in the Study Area

Census Town	Toilet-Pit	Toilet-Flush/ Pour Flush	Toilet-Others
Badlapur (M Cl)	0	41000	66
Vangani (CT)	4	681	8
Kalwa	NA	NA	NA
Ambarnath(M Cl)	0	18301	157
Vasai-Virar City (M Corp)	317	119203	1529
Study Area	**321**	**1,79,185**	**1,760**

Source: Census of India 2011 data

4.7.5.1.2 Education

The **Table 4-25**, gives details of the educational infrastructures in the Study area. There are 186 Govt. primary schools, 229 private primary schools, 146 Govt. Middle schools, 234 Pvt. Middle schools, 54 Govt. secondary schools and 203 Pvt. Secondary schools.

Table 4-25: Educational Infrastructure in the Study Area

Villages	Govt Primary Schools	Private Primary Schools	Govt Middle Schools	Pvt Middle Schools	Govt Secondary Schools	Pvt Secondary Schools	Govt Senior Secondary Schools	Private Senior Secondary Schools
Badlapur (M Cl)	18	35	4	49	0	30	0	3
Vangani (CT)	5	1	4	2	2	1	1	0
Kalwa	2	0	1	0	0	0	0	0
Ambarnath (M Cl)	95	64	78	57	30	52	10	8
Vasai-Virar City (M Corp)	66	129	59	126	22	120	8	20
Study Area	**186**	**229**	**146**	**234**	**54**	**203**	**19**	**31**

Source: Census of India 2011 data

AECOM understands that the status of education infrastructure is good at the study area level and has also improved in last one decade. The local community informed that the college going students, both girls and boys depend highly on the local railways for commuting.

The identified students of one Pvt. Middle school, Badlapur informed that they have to cross the railway line daily two times a day due to unavailability of any access route. The nearest access route to go on the other side/ school's side is nearly two km from their residential area, thus they have to trespass the railway line daily.

4.7.5.1.3 Health Facilities

In the Study Area, there are 03 Allopathic hospitals, 22 Dispensary health centres, and 03 Family welfare centres and 03 maternity child welfare centres.

In-addition the Study area has also got 04 TB hospitals, 05 veterinary hospitals and 02 mobile health clinic centres. The local community during consultation informed that there are many health institutions and private hospitals in the vicinity like TATA hospital, Reliance hospital etc.

Also, there are many small private clinics of physician allopathic and homeopathic doctors. The local community majorly depend on these local clinics in their area; and in-case of any major ailments they approach the government and/ or private hospitals. **Figure 4-13** presents number of health facilities in the study area.

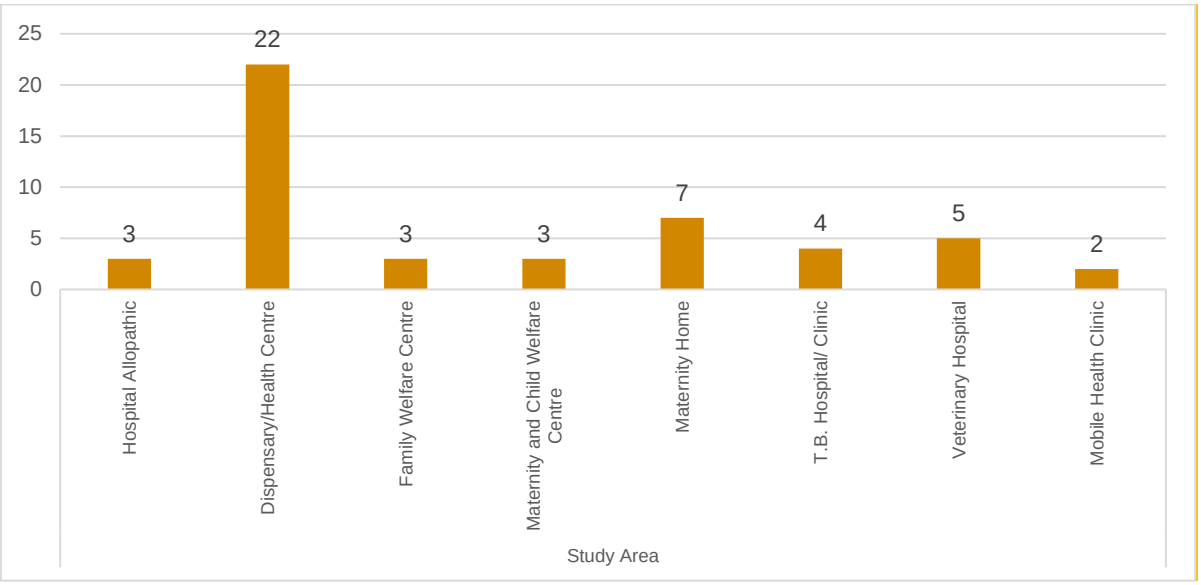


Figure 4-13: Number of Health facility amongst core zone and buffer zone

Source: Census Data, 2011

The status of private hospitals and clinics have improved in last one decade. The Mumbai city (including other areas) have been a major hub of hospitals and doctors for nearby districts and states like Bihar, Uttar Pradesh, Gujarat etc.

5. Stakeholder Engagement and Consultation

The disclosure of project information and consultations with stakeholders is important part of stakeholder engagement. A brief overview of the requirements of public disclosure and stakeholder consultation applicable to this project is provided in table below. **Table 5-1** given below presents the Overview of Disclosure and Stakeholder Consultation Requirements as per AIIB's E&S Framework.

Table 5-1: Overview of Disclosure and Stakeholder Consultation Requirements

Institution	AIIB E&S Framework	Requirements
AIIB	Section 18 of ESF and Section 23 of ESS1	• The Bank believes that transparency and meaningful consultation are essential for the design and implementation of a Project and works closely with its clients to achieve these objectives. • Meaningful consultation is a process that begins early and is ongoing throughout the Project. It is inclusive, accessible and timely, and is undertaken in an open manner. It conveys adequate information that is understandable and readily accessible to stakeholders in a culturally appropriate manner and in turn, enables the consideration of stakeholders' views as part of decision-making. • Stakeholder engagement is conducted in a manner commensurate with the risks to, and impacts on, those affected by the Project. In the context of a Project in which the Bank determines that there are risks of retaliation against the Project's stakeholders, or of other threats to their safety, it seeks to work with the Client so that the Client avoids or minimizes such risks.

5.1 Stakeholder Identification and Categorization

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/ organization because it can affect or be affected by the Project/ organization's actions, objectives, and policies". Stakeholders thus vary in terms of degree of interest, influence and control they have over the project. While those stakeholders who have a direct impact on or are directly impacted by the project are known as Primary Stakeholders, those who have an indirect impact or are indirectly impacted are known as Secondary Stakeholders. Keeping in mind the nature of the project and its setting, the key stakeholders have been identified and listed in the **Table 5-2** below.

Table 5-2: Key Stakeholder Group Categorization

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
Community	• Trespassers and commuters; • Fence-line and local community; • Local Labourers; • contract labours;	• Opinion Holders; and • Community leaders
Institutional Stakeholders	• Project investors • Developers & EPC contractors; • Municipal Corporation; • Revenue officials/ Tehsil Officials,	• Fence-line Institutions/ Infrastructure • Local Political Groups, i.e., both ruling and opposition parties at Municipality level, Zila parishad, tehsil level & District level; • Civil Society/ Local NGOs

Government Bodies/ Regulatory Authorities	• District Administration
	• Regulatory Authorities
	  ○ Mumbai Railway Vikas Corporation Ltd.
	  ○ Maharashtra Pollution Control Board;
	  ○ Central Pollution Control Board (CPCB)	

Stakeholder Groups	Primary Stakeholders	Secondary Stakeholders
	○ Ministry of Environment Forest and Climate Change (MoEF&CC) ○ Local Fire Authority; ○ Public Works Department; ○ Ministry of Road Transport and Highways ○ State Authorities; ○ District Collector and Revenue Department; ○ Block Development Officer & Patwari ○ Central Electrical Authority through C.E(P&D) Mumbai; ○ Department of Telegraph – Communication, Govt. of Maharashtra; ○ Department of Labour & Employment, Govt. of Maharashtra; ○ Wildlife Warden, State Forest Department; ○ District and State Forest Department, MoEF&CC.	
Other Groups	-	• Media; • Other on-going projects in the area.

5.2 Stakeholder Mapping

"Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of stakeholder mapping is to:

- Identify each stakeholder group;
- Study their profile and the nature of the stakes;
- Understand each group's specific issues, concerns as well as expectations from the project; and
- Gauge their influence on the Project.

Based on such an understanding, the stakeholders are categorised into High Influence/ Priority, Medium Influence/ Priority and Low Influence/ Priority.

The stakeholder engagement starts in the early stages of the project, also needs to be included in the impact assessment and risk identification process and continues across the life cycle of the project. The stakeholder analysis also shapes the stakeholder engagement strategy for the project and needs to be continuously updated Stakeholder analysis also helps to integrate the impacts and risk identified in the project designing and during the implementation stages to help company better addresses the associated impacts with the project. **Table 5-3** given below presents the details of stakeholder significance and engagement requirement.

Table 5-3: Stakeholder Significance and Engagement Requirement

	Category	**Likelihood of Influence on/ by Stakeholder**		
		Low	**Medium**	**High**
Magnitude of Influence/ Impact	Negligible	Negligible	Negligible	Negligible
	Small/ Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large/ High	Moderate	Urgent	Urgent

5.3 Stakeholder Analysis

The table below provides the profile of the key stakeholders who might have certain direct or indirect impact. These stakeholders have also been classified in accordance with the level of influence they might have over the project as well as their priority to the project proponent in terms of importance. The influence and priority have both been primarily rated as:

- ***High Influence:*** This implies a high degree of influence of the stakeholder on the project in terms of participation and decision making or high priority to engage with the stakeholder;
- ***Medium Influence:*** This implies a moderate level of influence and participation of the stakeholder in the project as well as a priority level to engage the stakeholder which is neither highly critical nor are insignificant in terms of influence;
- ***Low Influence:*** This implies a low degree of influence of the stakeholder on the project in terms of participation and decision-making or low priority to engage that stakeholder;
- ***Negligible Influence:*** This signifies a negligible or no influence of stakeholder on the project or project on the stakeholder, both in terms of decision-making and participation for/ during the project cycle.

The intermediary categories of “low to medium” or “medium to high” implies, that their influence will could vary in that particular range, subject to its context, specific conditions, and responses for the project from the community.

The coverage of stakeholders as stated above includes any person, group, institution, or organization that is likely to be impacted (directly or indirectly) or may have interest/ influence over the project. Keeping this wide scope of inclusion in stakeholder category and the long life of project, it is difficult to identify all potential stakeholders and gauge their level of influence over project at the outset of the project. Therefore, project proponent is advised to consider this stakeholder mapping as a live document that should be revised in a timely manner, to make it comprehensive for any given time-period. **Figure 5-1** given below presents the photographic records of the stakeholder consultations in the study area. **Table 5-4** presents the details of stakeholder analysis.

Figure 5-1: Stakeholder Consultations Undertaken in the Project Area

Source: AECOM Site visit March 2023

Table 5-4: Stakeholder Analysis

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
Primary Stakeholders					
Trespassers and commuters	These are the stakeholders who shall be directly impacted by the upcoming FOBs. The trespassers and commuters are from the fence-line areas and/ or nearby areas and railway commuters. They cross the railway track currently in absence of any FOB and will be main beneficiaries of these upcoming FOBs.	• The major concern of the commuters and trespassers are that the construction work of these FOBs should be on priority basis. • The commuters informed that they have to cross the railway track at several locations in absence of any FOB currently. • The commuters informed during consultation that the upcoming FOBs will provide them an easy, safe access route for daily commuting. • AECOM also carried out consultation with school children at Badlapur site. The students informed that their school is located on the other side of the railway track and the access route is nearly 2 km from the other side. They have been crossing the railways track everyday twice, as there is no nearby access route.	• The stakeholder groups' influence on the project pertains to the smooth functioning of the project and the timely completion of the project activities.	• AECOM team carried out random consultations with identified commuters and trespassers at several locations such as Virar, Badlapur, etc. • The commuters during consultation informed that they have to cross the railway track at several locations in absence of any FOB currently. They further added that the upcoming FOBs will provide them an easy, safe access route. Also, this will avoid the accidental instances due to crossing of railway tracks.	Influence of Stakeholder: Medium Influence of Project: High
Fence-line and local community	The fence-line communities and local communities live in the close proximity to upcoming FOBs or access the railway tracks on daily/ frequent basis; thus, the fence-line community and local community forms an important stakeholder group. The review of census data states that the total population of Study	• The expectations and concern of this group from the project is to, ○ Receive benefits from the project in terms of easy and smooth commuting. ○ The fence-line community and auto-drivers at the Badlapur site also informed that there have been several	• The stakeholder groups' influence on the project pertains to the smooth functioning of the project and the timely completion of the project activities.	• As per consultation with fence-line community, the upcoming FOBs will generate employment opportunities for local construction workers during the construction phase; • The upcoming FOB and fencing of existing access route (via railway track) post completion of FOB work will avoid future accidents.	Influence of Stakeholder: High Influence of Project: High

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	Area is 16,65,697. This population mostly depend on the local railway for daily commuting.	accidental cases due to railway track crossing (exactly at the location where FOB is proposed).			
Municipal Corporation	• The review of census data, 2011 states that all the project locations (considered for the given study) fall under municipal area. • The Municipal Corporation is one of the local self-governing bodies for urban areas where the population is more than one million. These areas are mostly metropolitan cities. This body of local governance was accorded with a number of responsibilities and powers as part of the 74th Amendment to the Constitution. • As part of this, most of the urban development schemes and funds for central schemes are channelled through this body of governance. • In addition, it is the government body, who is bestowed with the decision- making authority for infrastructure & economic development and social justice. The project may need several permissions during construction phase from respective municipal department, i.e., for utility shifting, use of municipal road area (one such permission was	• Key expectation will include local employment generation during construction phase by engaging local workers; ○ FOB construction and betterment of access route; ○ No hindrance in other commercial activities and traffic in the fence-line area during construction phase; ○ No conflict with fence-line community, trespassers and community during construction work;	• Municipal Corporations play an important role in overall mobilization and shaping the perception and opinions of the people in the project area; • They play an important role in getting project related permissions, local support and smooth completion of construction work.	• Consultations revealed that the project is expected to have a positive impact over this stakeholder group through enhancing the existing access route for fence-line communities and other commuters	Influence of Stakeholder: High Influence of Project: Medium

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	identified to be taken for Ghatkopar location, a copy of permission granted was shared with AECOM) etc. Thus, in order for the smooth and proper functioning of the project, the Consent of the Municipal Corporation is imperative.				
Regulatory Authorities	Key regulatory authorises are as follows: - The primary authority for the given project is MRVC (Mumbai Railway Vikas Corporation Ltd.); - Public Works Department; - Indian Railways - Power evacuation/ grid connectivity authority; • This stakeholder group also comprises of central, state and district level regulatory authorities. These authorities influence the project in terms of establishing policy, granting permits and approvals for the project, monitoring, and enforcing compliance with the applicable rules and regulations.	• The key expectations of the regulatory authorities is ensuring that the project proponent meets all the statutory compliances and that the project operations are undertaken as per the conditions put forth by the authorities and after having obtained all the necessary permits.	• The project has ensured compliance with the relevant guidelines and policy recommendations as per the Indian Railways and State Govt. • The project needs permission and coordination with the respective departments such as PWD department, local Revenue Office, Electricity Department etc.	The influence of the project on the stakeholder pertains to the role the project will play in the development of Project in the area.	Influence of Stakeholder: High Influence of Project: Low
District/ Taluka Administration	• Government bodies at three levels would administer the land allotment in the project area, i.e., at the district level, at the block/ taluka level and	• The overall opinion of the local authorities is positive towards the project owing to the fact that, no fresh land is being encroached for the project and secondly, that the	• The construction phase will require a number of permissions and support from the local administration.	• The project is expected to have a positive influence over the local administration by extending support through these authorities or by collaborating to undertake	Influence of Stakeholder: High Influence of Project: Low

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	at the Municipality level in each census town. • The local administration in this regard refers to the district and block level administration comprising of the offices of the Taluka Development Officer, District Collectors, and Revenue officer etc. The revenue department would be responsible for land allotment, registration of land lease, mutation, updating and records and transfer of land. • The revenue department (sub registrar) at the block/ tehsil level would be responsible for documentation/ registration of land encroachment, purchase, mutation and updating of records.	project may create some local employment and other opportunities in the form of local contractors, hiring local vehicles, dependence on local products/ goods etc. • The key concern would however remain that the project operations are carried out smoothly with minimal negative impact on the local community.	• The procedural complication can cause significant project delay.	any community development activities.	
Developers, Contractors, and Sub-contractors	• MRVC is the Developer, which will appoint contractors during construction phase and operational phase. The contractors for construction phase shall be responsible for engaging skilled and semi-skilled workers, construction etc. while the contractors during operations phase may provide other manpower required, if any.	• The major concern of these stakeholders is smooth functioning of the project without any litigation or community conflict; • Timely payment of their agreed contract amount from developers.	• The contractors and sub-contractors play an important role during the project construction phase.	• The project is still in pre-construction phase. • Civil construction work will absorb some amount of local people during the construction phase of the project. • Migrant workforce, as reported, will be employed for specific semi-skilled tasks under civil works. • Operation phase may involve very few locals to be employed, i.e., as semi-skilled and skilled staff etc.	Influence of Stakeholder: High Influence of Project: High

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
Local labourers and Migrant contract labourers	This group is comprised of skilled and semi-skilled workers, that would be involved in the project on a contract basis. This group is most likely to comprise of skilled & semi-skilled migrant workers involved in the construction work of the project, associated facilities construction. Also, there would be semi-skilled workers, possibly engaged from nearby areas as supervisors for construction sites.	The primary concerns and expectations of the stakeholder group pertaining to the project is as follows: • The role of the project in continued economic opportunity, work generation and a source of income; • Timely settlement of dues and payments in keeping with the legal requirements; • Continued work opportunities; and • Adequate accommodation facility to migrant workers; • Safety at work.	• This stakeholder group is critical for the smooth functioning and timely implementation of the project • This group may also play an important role in the formation of public opinion towards the project	The influence of the project on the group pertains to the roles of the project in the continuance of economic opportunities, timely payment of wages and ensuring the health and safety of the workers.	Influence of Stakeholder: Medium Influence of Project: High
Secondary Stakeholders					
Opinion Holders and Community Leaders	This stakeholder group is comprised of those individuals of the local community who hold traditional and rational power. These stakeholder group members include the elders, community and political leaders in the Study area and play a critical role in the decision making in the local community	• The expectations and concerns of this group from the project are: ○ Receiving benefits from the project in terms of employment and development of infrastructure and the community ○ Minimal disturbance to the community in regard to access issues, pollution, and influx of migrant workers	• This group, though powerful enough to affect the functioning of the Project in their vicinity; and • May play an important role in the public opinion formation, and smooth completion of construction work and functioning of operational phase.	These groups due to their social status, may already have access to a number of economic benefits from the other Projects, and thus may not be completely dependent upon the Project for access to development opportunities	Influence of Stakeholder: Medium Influence of Project: Medium
Fence-line Institutions/ Infrastructure	This stakeholder group is comprised of health and education institutions in the nearby areas or/ fence-line areas of the project. The institutions in the immediate vicinity of the project are primary schools	The main concerns and expectations of the group from the project pertain to: • No hindrance in the accessibility of the institutions;	The influence of the group on the project pertains to the role played by these institutions in the opinion formation and timely completion of project activities.	The influence of the project on the group pertains to the role of the project in development of these institutions	Influence of Stakeholder: Low Influence of Project: Medium

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	in the villages, nearby residential and commercials areas.	• Contribution of the project towards the overall development of the area; and • Timely and adequate disclosure of information pertaining to the project like any closure/deviation of road, machinery movements, etc.			
Political Parties	This stakeholder group is comprised of political parties, which are active in the area. This group plays a critical role in sensitization of the population and creation of the public opinion	The key expectations and concerns of the group from the project include: • The role of the project in the overall development of the area; • The impact of the project on the commuters and local community; and • Timely disclosure of information pertaining to the project activities.	• The influence of this stakeholder group on the project pertains to the role of the political parties in the formulation of public opinion towards the project.	The influence of the project on the group is expected to be extremely limited, as the scale of the project is very limited and considering that all the construction activities shall be carried out on IR land, including labour camps	Influence of Stakeholder: Medium Influence of Project: Low
State Administration	The state administration is comprised of the state level agencies of the various departments/ authorities such as industries department, revenue department, labour department and land department etc.	The main expectations and concerns of the stakeholder group from the project include: • Compliance to the regulatory requirements for the project; • Project's role in the development of the area; and • Timely disclosure of the information pertaining to project activities.	This stakeholder group is also critical for obtaining of the various permits/ clearances required for the commissioning of the project	The influence of the project on the stakeholder pertains to the role that, project will enhance the transportation and commuting facility in the city.	Influence of Stakeholder: Medium Influence of Project: Low
Media	The media, comprising of both print and visual media, has a presence in the Study area. They are known to have played an extremely important role in generating	The main expectations and concerns of the stakeholder from the project include: • Compliance to the regulatory requirements for the project;	The influence of the stakeholder group on the project is likely to pertain to the opinion formation amongst other stakeholders towards the project	The influence of the project on the stakeholder is likely to be limited due to the nature of the project activities	Influence of Stakeholder: Low Influence of Project: Low

Relevant Stakeholders	Profile	Concerns and Expectations from the project	Influence of Stakeholder on Project	Influence of Project on Stakeholder	Influence Rating
	awareness amongst the community.	• Project’s role in the development of the area; • Maintenance of positive relationship with the local community and other stakeholders; • Timely disclosure of information in regard to the project activities; • Creating no ruckus among local community and authority by developers; and • Leading to no community un-rest or any kind of conflict among people and land lessors.			
Other on-going projects in the area	This stakeholder group is comprised of companies and/ or institutions involved in construction of other infrastructure development activities in the area.	The main expectations and concerns of the stakeholder from the project include: • Project’s role in the development of the area and the formulation of public opinion towards it; • The creation of undue expectations from other projects due to project activities, i.e., permission of using municipal area for project activities, water usage for commercial/ construction purposes, using of area for labour camps, storage area etc.	The influence of the stakeholder group on the project is likely to pertain to the development of commuter, trespassers, and other public opinion towards MRVC and IR projects in the area	The influence of the project on the stakeholders pertains to the role the project will play in the development of smooth transportation facilities in the project area and the formulation of public opinion towards it.	Influence of Stakeholder: Low Influence of Project: Low

Summary of overall stakeholder influence is presented in the **Table 5-5** below.

Table 5-5 Summary of overall stakeholder influence

Stakeholder Category	Relevant Stakeholders	Magnitude of Influence/Impact	Likelihood of Influence on/by Stakeholder	Overall Rating of Stakeholder Influence
Primary stakeholder	Trespassers and commuters	High	Medium	High
	Fence-line and local community	High	High	High
	Developers and Contractors	High	High	High
	Local Labourers and Migrant contract labourers	High	Medium	High
	Municipal Corporation	High	Medium	High
	Regulatory Authorities	Medium	High	Low
	District/ Tehsil Administration	Medium	High	Low
Secondary Stakeholders	Fence-line Institutions	Medium	Medium	Low
	Other On-going Projects in the area	Low	Low	Low
	Media	Low	Low	Low

6. Environmental & Social Impacts and Mitigation Measures

This chapter identifies potential environmental impacts due to the proposed project.. AECOM collected and compiled the environmental baseline data for environmental attributes from primary and secondary sources. The primary sources include site visits, visual inspection, field studies, monitoring and analysis. The secondary sources include the books, reports, maps and documents from various government and non-government organizations on subject matter. The methodology proposed to be adopted for data collection, impact analysis, preparation of environmental management and monitoring plans is highlighted in brief, in the following paragraphs. The impact analysis covers the project activities whose impacts are significant enough to exceed accepted environmental standards.

At present the pre-construction activities including site survey, geotechnical investigation, which formed the basis of the design of the project have been completed and the construction phase is on-going. Hence, the impacts for construction and operation phase have been considered for impact identification. These impacts are considered on different aspects of the environment including environmental components, ecological parameters and the socio-economic parameters. The environmental impacts have been identified and analysed to evaluate their significance.

6.1 Environmental Impacts & Mitigation Measures during Construction phase

The overall environmental & social impacts that are possible during construction phase are given in sections below in Table 6-2 ,6-3. Being liner project, these impacts will be limited to construction area along the proposed project alignment. These impacts will be prevalent during construction period, which is estimated as 2 years.

6.1.1 Air Quality

Dust emissions and gaseous emissions can adversely affect air quality and cause environmental nuisance to surrounding areas. The construction activities that will take place onsite and vehicular movement are expected to result in air emissions.

Site Clearance for Construction Activity

Site clearance would involve land levelling to achieve desired height for the FOB foundations, temporary slabs above the drain, if that is used for keeping the construction material and deport cum workshop area. At some places it may involve dismantling or demolition activities of any existing structures which requires demolition or structural changes. Site clearance would include activities such as excavation, land levelling, knocking or cutting down of any building, structure, removal of trees, clearing of shrubs and vegetation, etc.

The access to project sites is characterized by paved and unpaved roads. Widening and strengthening of existing paved/unpaved road will be required for transportation of equipment and construction material to the site. These activities will have an impact on the air quality as these activities will lead to dust generation by the machines, vehicle movement, hand-tools, and falling/collapsing parts of the building/structures.

Establishment and Operation of The Labour Camps

The labour camps will be set up by the contractor at suitable location as per need at nearby locations from project activity areas. The likely impacts caused will include emissions due to use of wood or other biomass fuels in camps for cooking purposes. With the lack of awareness, there could be instances of open air burning of solid and other waste which could lead to harmful greenhouse gas emission into the environment. Additionally, odour nuisance caused by unscientific management of waste could be a concern for the adjacent habitation.

Raw Material Usage

Various construction material as soil, aggregates, cement, crushed sand, steel bars and railings, tiles etc. will be required for the construction activities. The construction material will be transported in dumpers/trucks to the project

site. Improper handling, storage and transportation of the raw material would cause dust emissions leading to increased levels of particulate matter.

Disposal of Waste Material

Improper handling, transportation and disposal of solid, hazardous, construction and demolition waste material can cause dust emissions leading to increased levels of particulate matter. Solid waste generated due to project activities can affect/ contaminate the quality of air through activities such as illegal open air burning of waste. Open air burning of solid and hazardous waste could lead to harmful greenhouse gas emission into the environment.

Setting up the Ready-Mix Concrete (RMC) Plant

No ready-Mix concrete (RMC) plant will be set up at any of the construction sites and RMC will be procured from the nearby RMC plants on contractual basis. Movement of the vehicle carrying the ready-mix concrete can cause the particulate matter in the air to increase leading to heath concerns to the employees and neighbouring premises and adversely affect amenity.

Assembling and Mechanical installation

The prefabricated material assembled at site will be installed using mechanical instruments which would envisage vehicular emissions.

DG sets

DG set of small capacity will be used as it was known that the electrical connection will be provided by railways which has less chances of electrical shutdown and during the construction phase only small mixers will be used for concrete mixing and major portion of this requirement will be met through RMC which will be procured through a third-party vendor.

These all activities are envisaged for limited period till the construction is in progress. Being a liner project, project area is very limited. The proposed alignment is mostly within the existing Railway land and along existing railway lines. Hence the impacted area would be comparatively small.

Mitigation Measures

Fugitive Dust Control

- Water sprinkling / spraying arrangements at unpaved roads, material storage area, earthwork area
- Covered transport of material to prevent fugitive dust
- Demolition debris to be kept in controlled area and sprayed with water mist to reduce debris dust
- Construction & demolition waste to be stored and disposed as per Construction & demolition waste regulations Management Rules, 2016 on sites identified by Municipal Corporation/ ULBs by Contractor
- Workers to be provided with all requisite PPEs like helmet, face masks
- Procure material only from approved quarry areas

Vehicular Emissions Control

- PUC for all vehicles to be used for project
- Regular vehicle maintenance to control the vehicular emissions
- Low sulphur diesel usage for project vehicles and equipments
- Traffic management plan so that vehicle idling time is reduced at railway crossings and project areas
- Alternate access routes usage so that nearby settlements have limited exposure to traffic and related emissions, as feasible

DG Set Emission Control

- Use of CPCB compliant DG sets so that emission norms are met
- Low sulphur diesel usage for DG sets to be used for project activities

- Stacks of adequate height as per CPCB norms to be provided for DG set stacks
- Regular DG set maintenance to control the emissions
- Placement of DG sets to be done in such a way that they are located as far as possible from nearby settlements

Odour Nuisance

- Waste segregation at source to separate out bio-degradable, recyclable waste like and inert waste.
- Bio-degradable waste to be composted through pit-composting/bin-composting
- In areas, where local body provides biodegradable waste collection facility, same should be used.
- Waste disposal at regular intervals with help of approved vendor / municipal body

Emission Due To Bio-Mass Fuels

- Usage of LPG cylinders
- Use of common/community kitchens
- no trees to be cut for firewood

6.1.2 Water Quality & Quantity

Site Clearance for Construction Activity

The site clearance would involve the clearing of shrubs and vegetation, etc. Improper planning of project construction activities could lead to flow obstruction/changes in course of waterways, temporary blockage. Impact on existing storm water drainage would be a key concern. Any untreated waste discharge from construction activity which get into water streams or soil erosion may also pollute local streams. Widening/ new construction of roads could result in the alteration of drainage unless proper cross drainage structures are provided and may also lead to waterlogging of adjacent lands.

Pile foundation will be carried out which will have concrete foundation. A pile foundation usually consists of a base of spread footing or grillage supported by piles at their bottom. Temporary barricades will be constructed so that the water flow will not spread in the nearby area which might have chances to meet the existing stream/drain. These structures will be removed after completion of the construction work.

Water will be required during construction activities for civil work and for domestic use by workers. Water will be sourced from municipal water supply / local vendors / ground water sources with permissions from respective agencies. Water would be supplied by tankers on site. This can lead to demand on water supply / source for project duration.

10k ltrs of water tankers will be procured from the local vendors daily during the construction phase which will be the responsibility of the EPC contractor.

Establishment and Operation of the Labour Camps

In case of labour camp, the water requirement during construction phase may go up depending on the number of labours in labour camp. Any runoff wastewater from the labour camps or open defecation can lead to contamination of surface water or ground water resources.

Bisleri Cans of 20 ltrs capacity will be provided at the labour camps. No of labours are yet to be confirmed however 5-6ltrs per labour of drinking water will be required. Labours were known to be staying near the construction site where the water for bathing will be provided from the municipal supply.

Raw material

Various construction material as soil, aggregates, cement, crushed sand, oil, chemicals, paints, etc will be required for the construction activities. Improper transportation, handling or storage can lead to spillage which can contaminate storm water and surface water and could also eventually contaminate ground water. The storage of all the materials if kept in open areas during rainy season can also lead to contamination of the groundwater, soil and can also get mixed in the drainage system.

Waste Disposal

Improper handling and storage of waste such as municipal waste or hazardous waste like waste oil, grease, corrugated roofing sheets containing Asbestos fibres, soaked cotton with oil/grease, etc. could lead to leachate which can contaminate ground water or surface water body. Contamination of intertidal area can occur due to solid and liquid waste generated during construction activities. Untreated discharge of domestic effluent from toilets set up for workers can contaminate surface or groundwater sources.

Ready-Mix Concrete (RMC) Plant

As per the information received no RMC plant will be setup at the site rather concrete will be procured from the RMC through a third party.

Mitigation Measures

Water Usage and sourcing

- Water sourcing to be done considering water availability and supply to nearby communities
- Approval from CGWB to be taken for groundwater withdrawal
- Dewatering water to be reused for construction purpose like dust suppression (wherever required)

Impact on Quality of Ground and Surface Water

- Fuel oil, chemicals, paints, etc. to be stored on impervious surface with containment
- Spill control arrangement / kit to be made available at all material and chemical storage areas
- All material and chemicals storage areas to be located away from water source
- No vehicle parking or maintenance to be carried out near water source
- Wastes storage & disposal in an environmentally accepted manner and as per relevant regulations
- Mobile toilets with septic tanks to be used
- Adequate care shall be taken not to install mobile toilets in the natural drainage areas.
- The open defecation shall not be permitted.
- Labour camp and toilets to be located away from water bodies and all the wastewater from the toilets need to be directed towards soak pit to restrict spillage.

Disturbance to Natural Drains

- Regular maintenance of storm water drains to avoid water logging
- Channelization of drains to be done to ensure that flow and direction of water course is not changed
- Turfing of embankment slopes should be carried out (wherever required)

Vector Borne Diseases

- Fumigation and spraying of anti-mosquito breeding disinfectant should be carried out to control the vectors in the nearby water bodies and in the labour camps
- Supply of adequate quantity of drinking water to workers
- Drinking water should meet IS 10500:2012 drinking water specifications

6.1.3 Soil and Land Environment

Site Clearance

The site clearance or earthwork would involve removal of soil cover and earth material. Earthworks firstly require surface layers to be removed along with removal of vegetation cover. Removal of vegetation cover will lead to exposure of the soil layers. Earth sourced from other locations or construction debris generated during demolitions work can be used for filling materials wherever required. Earthwork can be required for improvement of, laying of

drainage, installing pumps, laying pipes, building storage tanks and building culverts (drains) which allow rainwater to flow underneath, and away from the FOBs and platforms.

Soil erosion and loosening of the topsoil due to earthwork and land filling works is anticipated. Excavation and foundation work will change the land use of proposed site. Excavation works associated with this project may lead to increased soil erosion at the project site and release of sediments into the drainage systems, especially if construction works are done during the rainy seasons. Physical changes in land through excavation, filling of low-lying areas, fragmentation, altered topology and drainage pattern is envisaged.

The demolition of the existing structures will lead to generation of waste building materials as debris, rubble, wood, metal, etc., which could lead to contamination of soil it has been stored at. Contamination due to leakage from DG sets are envisaged if proper secondary containment or spill kits are not provided.

The construction activities such as settling of labour camps, laying of utility lines and tracks, setting up a ready-mix concrete plant, signalling etc. will require clearing of the ground. The clearing activities will have an impact on the environment as the activities will lead to dust generation, loss of productive soil cover, compaction of soil.

Change of Land use

Given the small scale of the project and activities involved, i.e., construction of FOBs at 5 number of railway stations on the existing railway land no major changes in the land use are anticipated as they will be on railway land. However, minor change in land use is expected at proposed Kalwa FOB location due to demolition of existing railway buildings (if any) and vegetation removal.

Visual Impacts

The construction of proposed project will bring about a change in visual look due to project construction activities. As the project is proposed along exiting rail project / railway lines, there will be limited change in visual impacts in the area.

Establishment and operation of the labour camps

Solid waste generated from labour camp if dumped on adjacent land could lead to contamination of the soil quality of the surrounding area. Fuels and oils for cooking if not stored or handled properly could cause to leaks of waste onto the soil causing contamination.

Waste material

During construction phase, hazardous waste such as waste oil, grease, corrugated roofing sheets containing Asbestos fibres, soaked cotton with oil/grease will be generated. Construction activities would lead to solid waste generation including sand, concrete, gravel, stone, bricks, plastic, paper, wood, metal, glass, along with hazardous waste such as petrochemical products, etc. These dumped at the project site or outside the sound boundary could lead to contamination of the land resources. Loss of soil due to construction activities and illegal dumping of solid and hazardous waste could be of prime concern. Solid wastes such as construction rubble, garbage and discarded topsoil may impact soil quality. Accidental spillage of fuels and lubricant oils may contaminate soil.

Vehicles and machinery

Usage operation and maintenance (O&M) of vehicles would involve use of oil, grease and other lubricants. Leakage or accidental spillage of these lubricants/oil could lead to contamination of land. There are also other soiled materials like soaked cotton with oil/grease that would be generated during the O&M process, which is not handled lawfully could be detrimental to contamination of land.

Mitigation Measures

Erosion Control

- Earth material from excavation / cutting to be used for filling, construction of embankments, etc.
- Construction work to be avoided in monsoon
- Top soil to be conserved and reuse
- Usage of approved and licensed borrow pits and quarry sites for construction material

Soil Compaction

- Restricted movement of construction machinery and equipments outside project area
- Turfing, stone pitching and regular checking of the same

Soil Contamination

- Fuel, oil, chemical, etc. to be stored on impervious surface with secondary containment
- Spill control arrangement / kit to be made available at all material and chemical storage areas
- Wastes storage & disposal in an environmentally accepted manner and as per relevant regulations
- Hazardous waste shall be managed as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended
- Mobile toilets with septic tanks to be used
- The open defecation shall not be permitted.
- Labour camp, construction material storage area, etc. will be cleared after project work completion

6.1.4 Noise & Vibration

Levels of noise and vibrations typical of construction works will be generated during the construction phases. Elevated noise and vibration levels within the site area could have an adverse impact on the health and safety of the project workers, the residents, passers-by and other persons and animal within the vicinity of the project site. The environmental impact anticipated in the project is the increment in ambient noise level due to various project activities.

Site Clearance for construction activity

Site clearance along with demolition activities will lead to noise and vibration by the machines, hand-tools, and falling/collapsing parts of the building/structures. Increase in noise level can be due to operation of heavy vehicles, construction work, use of DG sets etc.

Heavy vehicles and machinery

The prime sources of noise levels during the construction phase are the construction machinery, DG sets and the vehicular noise due to material movement at the site. Hence, operation & maintenance of all heavy vehicles and machinery will carried out as based on type of machinery and vehicle, maintenance schedule. This would reduce the noise level due to smooth functioning of the machineries.

Excavation works and Foundation works

The noise levels created by construction equipment will vary greatly depending on equipment used for the operation of excavation. Piling activity and open excavation method (cut and cover) can cause great vibration and settlement impact on structures. Project location like Badlapur-Vangani consists of structures like residential apartments, temple and shopping area inside the study area of 100 mtrs. considered.

The resulting vibrations of the walls and floors of buildings cause secondary radiation of noise called ground-borne noise. Together with vibration impact, ground-borne noise could have unpleasant impact to inhabitant areas. Vibration resulting from heavy earth moving equipment is expected to impact on human settlements, educational institutions, health facilities and commercial centres. This effect will however be localized and temporary in duration.

Labour camps

Establishment of Labour camps and operation of DG sets would lead to increased levels of noise generation.

Raw material movement

Vehicular noise from heavy vehicles utilized to deliver construction materials envisages noise and vibration impacts on nearby habitation, through which they pass. handling and storage of raw materials at the site could also envisage noise pollution if not carried out in systematic way.

Noise will be generated during transportation i.e. from the use of machinery/equipment including bulldozers, generators, tippers and concrete mixers and the heavy trucks delivering construction materials.

Launching of Girders

Noise may be significant impact at open construction sites during transportation and launching of steel girders from fabrication yards to construction sites, especially at night-time.

Assembling and Mechanical installation

Noise and vibration during metal fabrication and assembly is also envisaged. Assemblage of prefabricated material at site through mechanical instruments would envisage increased noise and vibration. But with the reduced time the impact would be for a very limited time and within the project boundary.

6.1.4.1 Vibration

Ground Vibration Ground vibrations are produced whenever there is moving load or impact on the ground. Main source of ground vibrations is; traffic including rail and road, pile driving, movement of construction machinery and use of Vibro compactors. Ground vibrations depend on the force (impact) of the source and the distance. They decrease with the distance.

$V \alpha Q/D$

where V is the vibrations, Q is the impact, and D is the distance from the source to the point of observation.

These vibrations are easy to control by use of better cushioning materials, better quality sleepers and absorbent materials if vibrations are very high. India has no specified limits for this kind of vibrations. Limits for ground vibrations in India or are covered by the Director General of Mines Safety in circular number 7 of 1997. Following **Table 6-1** is the gist allowable vibrations limit under the circular.

Table 6-1: Allowable vibrations limit under the circular

Type Of Structures	Dominant Excitation Frequency		
	< 8 Hz	8 – 25 Hz	> 25 Hz
A) Buildings / Structures not belonging to the owner.			
Domestic Houses / Structures (Kacha, Brick and Cement).	5	10	15
Industrial buildings (RCC and Framed Structure).	10	20	25
Objects of Historical Importance and Sensitive structures.	2	5	10
B) Buildings belonging to the owner with limited span of life.			
Domestic Houses / Structures (Kacha, Brick and Cement).	10	15	25
Industrial buildings (RCC AND framedStructure)	15	25	50

Impact due to piling, construction activities could be related to vibrations.

Mitigation Measures

Noise & Vibration due to Equipment & Machinery

- Usage of vibration dampers, noise silencers or acoustic enclosure for noise generating equipment & machinery
- Regular maintenance of the equipment and compliance with occupational safety and health standards
- Stationary noise making equipment's to be placed along un-inhabited stretches
- Construction activities to be limited to day time
- Usage of personal protective equipment's and job rotation
- Metal Fabrication and assembling activities to be carried out away from settlements

Metal Fabrication and Assembling

- Acoustic enclosures and a routine maintenance of equipment's

- Metal fabrication and assembling activities to be carried out away from settlements

Noise & Vibration Due to DG Sets

- DG sets to be fitted with acoustic enclosures
- Minimal usage of DG sets

6.1.5 Biodiversity

Removal of Vegetation

- As observed during the site visits, some trees along with any non-tree vegetation occupying any project-related construction sites, would be lost as an impact of the project. A tree survey for enumeration of trees to be cut down is not yet done.
- Removal or pruning of the tree-vegetation at the Project Site is likely to cause a loss of or disturbance to feeding, roosting, breeding or nesting habitats used by the urban fauna of the Study Area, which may include loss of active nests containing eggs or nestlings.
- The removal of non-tree vegetation, which includes mainly herbaceous ground vegetation, may cause injury or death of ground-dwelling or fossorial fauna, as well as long-term loss of habitat for the said fauna, which is likely to include mainly herpetofauna, that is, amphibians and reptiles. However, no herpetofaunal species of major conservation concern are known to be associated with the Project Site.

Levelling or Grading of Land

- Any excavation and landfilling towards the levelling or grading alter current soil-profiles, change soil properties and disrupt sub-soil habitats. As a result, the current soil and hydrological regimes, along with any related ecosystem services, may also get degraded.
- The excavated material if not disposed properly, could cause the disturbance in natural soil and vegetation profile of the selected dumping site.

Artificial Illumination

- Use of artificial lighting during night-time will lead to unnatural illumination in the habitats in the vicinity. Such interruption of the natural night period by light is known to disrupt the natural biological cycles of many floristic and faunal species.

Mitigation Measures

- Trees must be checked for presence of active nests, before any felling or pruning activities. Additionally, the main regional breeding season from approximately June to September, could be avoided with respect to tree felling or pruning activities.
- Any active nests found in trees scheduled for felling or pruning must be allowed to remain undisturbed while the nest is occupied. Alternatively, the said nests could be rescued and rehabilitated to the extent possible.
- Ground vegetation must be checked for presence of herpetofauna prior to vegetation removal activities. Additionally, a herpeto faunal expert or rescuer, ideally referred by the Forest Department or an appropriate local conservation institution, must be deployed to rescue and rehabilitate any herpetofauna occupying the concerned area.
- Any plantation being carried out in or near the Project Site must preferentially include species native with respect to the Study Area.
- Any plantation being carried out in or near the Project Site must be planned to preferentially include as many plant-forms (herbs, shrubs, creepers, climbers, trees and bamboos) as possible.
- Construction activity to be avoided during night hours

- Poaching to be strictly banned
- Worker awareness program on Environment and Wildlife Conservation
- No introduction of exotic species due to project
- The excavated material to be used back-filling at the Project Site to the extent possible

6.1.6 Occupational Health & Safety

Site Clearance

Construction workers will be exposed to risks of accidents and injuries. These can happen from accidental injuries due to hand tools, construction equipment cuts from sharp edges of objects, fall from height, risk of vehicular accidents, etc. Other injuries may result from workers operating equipment without adequate training or with lack of personal protective equipment (PPE), or extended exposure to outdoor weather resulting in heat related lethargy. The effect of repeated mechanical shocks and vibration from construction work and locomotives on the employees could be harmful.

Launching of Girders

Girders made of mild steel will be launched at all the proposed FOB locations. These construction activities envisage manual work in addition to machineries. This could lead to accidents and mishaps if instructions and trainings are not provided. The workers engaged in work at height activities may fall or slip from the scaffolding or ladders which may result in minor injuries such as muscle sprain or major ones such as ligament tear, fractures, haemorrhage depending on the height at which they are working. Eye injuries can happen due to flash or sparks emanating from the welding arc, if proper PPEs are not used.

Workers at the construction site will require sanitation facilities during construction period, which if not well maintained and cleaned, may lead to occurrences of illnesses such as cholera, hepatitis, typhoid, etc.

Electrical works as installation of Overhead electrical structures

Overhead electrical structure will be developed to supply electrical power for signalling, points and other systems which would need laying cables in surrounding areas to the line of route, as well as the construction of several electrical cabinets. Electrical installations and works envisages health and safety hazards due to electrical shock or fire hazard. Electrocution could lead to injuries and even deaths if work is carried out without proper safety precautions and PPEs. Electrical/ Fire Hazards can lead to shocks, electrical burns, and fire and/or explosion hazards.

Establishment and operation of the labour camps

Health and safety concerns could be envisaged due to unhygienic housing conditions. Sanitation facilities, if not well maintained and cleaned, may lead to occurrences of illnesses such as cholera, hepatitis, typhoid etc. Water stagnation could act as creation of temporary breeding habitats for mosquito/other vectors of disease.

Construction projects are associated with an increase in sexually transmitted diseases such as Sexually Transmitted Infections (STI) due to the influx of workmen.

Handling, storage and Transportation of Raw material

The workers involved in activities such as loading and unloading, storage and placing of raw materials etc. are susceptible to risks viz., physical injuries and trip/ fall hazards. Transportation of raw material could potentially cause congestion of traffic and could also lead to accidents.

Waste material

If the waste and debris are not stored in designated areas, with signages, trip and fall hazards could occur. Exposure to hazardous materials like asbestos (if used in any capacity) could eventually lead to health hazard Construction waste/spoils along with organic waste may lead to health problems if not disposed of properly to the employees.

Mitigation Measures

- Safety, health and environment management as per applicable regulations
- Contract will compile to Safety, Health and Environment (SHE) Manual of client
- Contractor will prepare a contract specific SHE plan
- Comprehensive traffic management plan to be prepared and implemented
- Training to be provided to workers about hazards related to the job, usage of tool box, health and safety.
- Regular maintenance of the equipment and compliance with occupational safety and health standards
- Provision of job specific personal protective equipments to workers
- Provision of readily available first-aid unit and access to the ambulatory services
- Working, living conditions and other benefits/facilities to be provided as per applicable regulations like The building and other construction workers’ (regulation of employment and conditions of service) act, 1996, The Factories Act, 1948, The Contract Labour (Regulation and Abolition) Rules, 1971, Contract Labour (Regulation And Abolition), 1973, Workmen’s Compensation Act, 1923 & Rules 1924 Minimum Wages Act, 1948 Inter-State Migrant Workmen’s (Regulation of Employment & Conditions of Service) Act, 1979, etc.
- The contractor should comply with the World Bank accepted guidelines on “Workers’ accommodation: processes and standards- a guidance note by IFC and the EBRD”.
- The contractor shall also comply with all the other relevant acts/rules applicable as per the Ministry of Labour and Employment, GoI
- Development of Asbestos management plan for handling material containing asbestos
- Pre employment and on job medical check-up for workers
- Fumigation and spraying of anti-mosquito breeding disinfectant should be carried out to control the vectors in the nearby water bodies and in the labour camps
- Supply of adequate quantity of drinking water to workers
- Drinking water should meet IS 10500:2012 drinking water specifications
- Equipment and machinery to be as per the design safety and industrial standards
- Regular inspection and maintenance all machinery, equipment, tools, rail lines, etc.
- Safety signages usage
- Regular inspection and maintenance of the rail lines and facilities shall be carried out to ensure track stability and integrity in accordance with national track-safety standards

6.1.7 Community Health & Safety

During construction phase, various project components will result in an increased level of dust and particulate matter emissions, as well as high traffic load, which in turn will directly and temporarily impact the local community. If improperly managed, there is a risk of nuisance and health effects.

Site Clearance, Earth works/Landfill works

Poor quality of air environment caused due to fugitive dust from site clearance work, vehicular and DG set emissions could lead to health problems to the neighbouring community. Electrical installations and works envisages health and safety hazards due to electrical shock or fire hazard, if community is exposed to the same.

Any disturbance or access restriction to common infrastructure that are important to the local community like impacts on religious places (Hanuman Temple near proposed Kalwa FOB location) and marketplace near proposed

FOB location at Ambarnath Km 59/37-39 (KJT end) can lead to social unrest, if not managed properly. It is anticipated that inadequate or improper stacking of raw materials/construction materials and unregulated movement of construction machinery/vehicles might impact local residents in the study area.

Excavation, Foundation works, Earth works/Landfill works and fabrication of steel structures

Risks of injuries and accidents may occur to local people if the site is not well secured to prevent falls at excavated areas and any accidents by construction vehicles. Temporary aesthetic concerns like visual blight, signages, especially during the nighttime may occur. Water stagnation and creation of temporary breeding habitats for mosquito/other vectors of disease can pose as health hazard. Construction noise & noise could cause disturbance to the neighbouring communities.

Electrical works as installation of Overhead electrical structures

Electrocution and fire hazard due to erection of overhead electrical structure pose health hazard to nearby communities if proper precautions are not taken or project hazards are not communicated to communities.

Establishment and operation of the labour camps

Labour influx may cause conflict with community due to different cultural behaviour and sharing of local resources. The social impact associated with the labour accommodation or setting up labour camp (onsite) is anticipated in the form of conflict between labours and contractors /community, if not managed properly.

Handling, storage and Transportation of Raw material

These activities have potential to directly impact the traffic flow along the right of way. This could also increase the chances of accidents in the area, if proper road safety measures and precautions are not followed.

Waste management

Fall and trip hazard, inconvenience may occur if construction waste is dumped at non designated areas or at common property or pedestrian pathways. Wastewater and contaminated hazardous waste, if disposed adjacent to any settlement or any non-designated areas, could lead to contamination of soil or water. Any disposal of liquid waste at non designated area can lead to stagnation and conditions favourable for breeding of mosquito/other vectors of disease.

Mitigation Measures

- Barricading and prevention of trespassing
- Storage of fuel, oil, chemicals away from residential area
- Work scheduling to avoid any nuisance to nearby community
- Display appropriate safety signage in local language
- Regular inspection and maintenance of the rail lines and facilities shall be carried out to ensure track stability and integrity in accordance with national track-safety standards
- Alternative options for movement of locals should be provided.
- Fumigation and spraying of anti-mosquito breeding disinfectant should be carried out to control the vectors in the nearby water bodies and in the labour camps
- The open defecation shall not be permitted at labour camp and work areas.
- Avoid storage of hazardous waste, chemicals, oil, etc. near settlements
- DG sets, RMC pants, mobile toilets to be placed away from settlements
- Heavy noise generating work activities will be avoided at night time
- Regular maintenance of construction machinery, equipments, DG sets, etc. so that noise, vibration, emissions are well within prescribed limits of Indian regulation and international best practices

- Avoid use of community access road or land for storage of material, parking or heavy vehicle movement
- Traffic management planning
- Relocation of community utilities like water lines, likely to be impacted, to nearby suitable places with proper permissions
- Access to work areas to be prohibited for locals and passers-by.
- Contractors should display appropriate signage in local language at the construction sites to make the travellers aware of the ongoing work.

6.1.8 Impacts During Operation Phase of The Project

The proposed project involves construction of FOBs, middle deck, staircases, and escalators for ease of movement of daily commuters. However, considering the nature and magnitude of the project, no negative impacts have been envisaged during operational phase of the project. MRVC is providing additional infrastructure (creation of new FOBs, staircases, and escalators) at the stations for which operation and maintenance activities will be taken care by MRVC/ Concerned department of central/western railway.

6.2 Socio-Economic Impacts & Mitigation Measures

Given below are the socio-economic impacts identified for the project.

6.2.1 Impacts during the construction& Operational phase

Given below are the social impacts assessed by AECOM team due to the upcoming FOB construction work.

6.2.1.1 Impact on employment opportunities

The social baseline conditions in the Study Area suggest that major working population are engaged in “Other work” i.e., services, business etc.; the population of cultivators and agricultural labourers are limited only to 3.95% of the entire workers in the Study Area settlements.

The construction phase will provide a boost to the local employment, as temporary and permanent employment opportunities/ jobs are expected to be created in the period, which will lead to hiring people from local and distant areas based on the skill set required.

As informed, Project would require approximately 70-80 skilled and semiskilled labour per day for the duration of the construction phase. A higher number of semi-skilled labourers is required to be engaged for construction activities, which may be sourced from other districts and/ or states available. Additionally, there would be some skilled labour required that may be available locally, that would also lead to spike in economic activity in the area, during construction phase. This would lead to better business opportunities for smaller sub-contractors/ vendors in the area, that would provide services like, transportation, raw materials etc.; also, it would boost the economic activities of petty shops in the vicinity of construction sites and accommodation facilities.

There will be migrant workers and employees (semi-skilled/ skilled/ highly skilled) working for project activities such as construction of FOBs, skywalks, access route etc. These migrant labourers will be sub-contracted contracted by respective contractors engaged by MRVC during the construction phase as there is high availability of migrant workforce in the local area. The migrant labourers may be employed particularly in civil works. The local labourers will also be employed, based on their skill set and requirement, such as, they may be engaged as supervisors, sub-contractors, security etc. as and when required.

Enhancement measures

- The sourcing of local labour wherever possible should be encouraged for the contractor and sub-contractors and in all major construction activities, with tracking;
- Employment of members of SC-STs and Women Headed households should be considered on priority by the contractor and their sub-contractors, based on availability of required skill sets and same should be documented;

- Engagement of local vendors, to the extent possible, for the goods and services required for the project during construction phase should be encouraged and tracked;
- The project proponent will establish a mechanism to audit subcontractors and suppliers with respect to utilizing local labour and resources and require tracking across the construction Phase;
- Provision of Grievance Redressal Mechanism to all the key stakeholders in order to raise and register their grievance with respect to information sharing related to jobs and opportunities for vendor-ship.

6.2.1.2 Migrant Labours and Related Impacts

The project was identified to be under construction stage for two locations namely, km 67/20, BUD Home platform location and km 60/4-6, Virar FOB location at the time of site visit; while under-planning stage for three FOB locations namely, km 68/14-16, Badlapur-Vangani FOB, km 35/3-4 Kalwa FOB connecting west side with platforms, and km 59/37-39 Ambarnath (KJT end) location. The MRVC site team informed that they shall complete the construction work for all the FOBs and start the operations latest by March 2024.

It was informed during consultation with site team that the project has engaged M/s Sai and M/s Kuwala for other sites/ FOB construction sites. The same contractors shall be engaged for up-coming construction work. The project would require approximately 70- 100 skilled, semi-skilled staff and workers per day for each FOB location. The contractors may engage migrant workers from Bihar, Uttar Pradesh, Odisha etc. states. The contractors shall also provide temporary accommodation facilities to migrant workers.

During site visit at Virar (km 60/4-6) location it was observed that MRVC has engaged contract workers for the excavation work; and staff at Badlapur (km. 67/20 (BUD)) location. The non local workers engaged by M/s Banwari workers (a subcontractor engaged by M/s Sai Constructions Pvt. Ltd.) and other sub-contractors have been given accommodation facility in the under-construction site office building and one associated room/ structure in the site office compound at Ambarnath station, while 10-12 workers have been provided temporary accommodation facility near the under-construction site of Ambarnath-Badlapur Home-PF BUD at km 67/3 (not in the given EA scope).

The in-migration of workers from outside the area will result in an increased risk of conflict and social unrest due to cultural differences between the labourers, trespassers, commuters, fence-line community and the local community. Similarly, the in-migration may also lead to spread of communicable diseases due to contact and interaction among the labourer and the local community. Moreover, lack of proper sanitation or waste management facilities may also result in outbreak and transmission diseases. The in-migration will also result in increased pressure on basic facility such as water etc.

Mitigation measures

The recommended measures to mitigate the impacts related to the in-migrant labourers include:

- A formal “Contractor management policy or/ code of conduct” in order to ensure that labours are engaged on the basis of contract labour licences, national and state regulations and no forced or child labours are engaged;
- Quarterly health screening of all the employed labourers at the project site by the contractor/sub-contractor;
- Maintenance of hygiene of the labour camp;
- Provision of floor mats/mattresses and ensuring electricity connection for day to day activities with access to light and fan facility in their room;
- Providing the commuters, trespassers, fence-line community and the local community an understanding of the project activities and the possible health and safety risks associated with the same through informative pamphlets, posters, community engagement etc.;
- Avoiding presence of unsanitary conditions and better facilities in the campsite, such as safe drinking water, proper waste collection and disposal system, etc.

6.2.1.3 Community, Health & Safety

Fence-line community, commuters, trespassers in the Study Area within 100-meters project radius may experience health and safety associated impacts on account of the following factors;

- Movement of material and machinery from the storage area/ camps to the construction sites may lead to accident risks affecting commuters and local population;
- There will be noise and vibration related impacts from construction site resulting in disturbance to residents in the vicinity of construction areas/ sections;
- Other health and safety issues will be risk or/ the chances of falling of materials from a height at construction site on workers and commuters;
- Labour influx in construction camps may enhance potential risk of communicable diseases (infectious and vector-borne), if external labour will be sourced from outside the region;
- Conflicts with local community resulting from disagreements over other issues and local impacts.
- Shifting of utilities will result in disturbance to the local community in immediate vicinity of the Project area. Utility shifting activities will pose safety hazards to the commuters and residing communities due to excavation, shifting of power lines, etc. and may result in access restrictions.

Key receptors would be surrounding community in the Study Area, commuters, trespassers, especially in close vicinity of construction camps and existing users of the upcoming FOB area.

Mitigation measures

The following risk mitigation measures are suggested to minimize the potential risks/ hazards to community:

- As part of the stakeholder engagement and information disclosure process, the community will be provided with an understanding of the activities to be undertaken and the precautions taken for safety;
- The project will also propagate health and safety awareness amongst the workers, fence-line community and commuters;
- The contractor shall maintain safe distance of the proposed construction camps from main commuting area, schools, hospitals, etc. in order to avoid interactions with community hotspots and hence risks of accidents;
- The Contractor shall be informed about EHS practices that are expected from its workers during the construction phase engagement.
- The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect, and maintain such barricades, including signs, marking, flags, lights and flagmen for the formation and protection of traffic approaching or passing through the Project area under construction.
- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started.
- The contractor will ensure availability of safe corridors and crossings of pedestrian / bicyclists, trespassers, commuters etc. where paving activities are located in inhabited areas, based on needs of the local community. The contractor will also install barriers, traffic calming devices, signs, signals and markings to avoid pedestrian from crossing hazardous sections.
- The contractor shall be required to adhere to accommodation guidelines detailed out in Section 8.14 below, for the labour camps in terms of provisions, sanitation facilities, etc. thus limiting the probability of diseases and infections in the local community on account of improper management of waste;
- The movement of workers from the project site and labour camps should be regulated and similarly the project boundary and labour accommodation to check for unauthorized visitors/ outsiders entering the site in order to avoid any possible tensions between the migrant workforce and host community;
- The Contractor shall put in place a grievance redressal mechanism to allow for the workers and community members to report any concern or grievance related to project activities.

6.2.1.4 Impact due to utilities re-routing and shifting

As per information shared by MRVC site team, there are utilities like, sewer line, water pipeline, telephone line, electricity line, drainage line etc. which shall be shifted or re-routed post getting adequate permission from concerned authorities.

The shifting of these utilities may lead to service hindrance for the communities using it. Also re-routing activities may hinder the accessibility of commuters.

Mitigation measures

The contractor shall be taking additional coordination and suitable site specific mitigation measures to ensure minimising disruption period because of utilities re-routing. These additional measures will be;

- Avoid crowded time period for re-routing work, for mobilisation of heavy vehicles and machinery to construction locations;
- Avoid closure of shops, regular access to residences. Shops and houses will continue to have regular access during all hours of the day as construction activities requiring access control will be undertaken during the night, with prior intimation to the residents/shopkeepers, and access will be disturbed only for a few hours;
- Traffic re-routing will follow a plan to not block access
- Advance intimation in surrounding community on potential disruption hours because of utilities shifting

6.3 Impact Identification Matrix

Once the project impacts were identified for the different activities of the project, the level of impact that may result from each of the activities has been assessed based on subjective criteria. These are detailed out in the sections below.

Key elements have been taken into consideration based on standard environmental assessment methodologies.

- Type of impact
- Nature of impact
- Likelihood of Occurrence
- Extent
- Duration
- Intensity
- Significance

Table 6-2 present details of impact classification criteria.

Table 6-2: Impact Classification Criteria

Subjective Criteria	Type of Impact	Details
Type of Impact	Positive Impact	Impact that will be considered to represent an improvement on the baseline or introduces a positive change.
	Negative Impact	Impact that will be considered to represent an adverse change from the baseline or introduces a new undesirable factor.
Nature of Impact	Direct impact	Impact that will result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality)
	Indirect impact	Impact that will result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
	Cumulative Impact	Impact that will act together with other impacts (including those from concurrent or planned future third-party activities) to affect the same resources and/or receptors as the Project
Likelihood of occurrence	Unlikely	Impact will be unlikely to occur.
	Likely	Impact will be likely to occur under most conditions.
	Definite	Impact will occur.
Extent	On-site	Impact that will be limited to the boundaries of the development site

Subjective Criteria	Type of Impact	Details
	Local	Impact that will affect an area in a radius of 5 km around (area of influence) the development site.
	Regional	Impact that will affect regionally important environmental resources or are experienced at a regional scale which is beyond 5 km from the development site
	National	Impact that will affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences
Duration	Temporary	Impact is predicted to be of short duration and intermittent/occasional
	Short-term	Impact is predicted to last only for the duration of the construction period
	Long-term	Impact is predicted to continue for the life of the Project but ceases when the project stops operating.
	Permanent	Impact is predicted to cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the project lifetime.
Intensity	Negligible	Impact on the environment and community will not be envisaged to be detectable
	Low	Impact on the environment and community is expected to affect in such a way that natural functions, processes and livelihood are not envisaged to be affected
	Medium	Impact on the environment is expected to cause alteration of environment but natural functions, processes and livelihood are envisaged to continue, although in a modified way.
	High	Impact will affect the natural functions, processes and livelihood and these will be envisaged to be altered to the extent that they will temporarily or permanently cease (come to an end).
Significance	Negligible Significance	Impact of negligible significance (or an insignificant impact) is where a resource or receptor (including people) will not be affected in any way by a particular activity, or the predicted effect is deemed to be ‘negligible’ or ‘imperceptible’ or is indistinguishable from natural background variations.
	Minor Significance	An impact of minor significance is one where an effect will be experienced, but the impact magnitude is sufficiently small (with and without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value.
	Moderate Significance	An impact of moderate significance is one within accepted limits and standards. The emphasis for moderate impacts is on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP).
	Major Significance	An impact of major significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors.

The impacts on the key environmental components and its significance during the different stages of the project have been discussed in detail in the following **Table 6-3** and sections below.

Table 6-3: Impact Identification

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
Impact Assessment for the activities applicable to Trespass control FOB works on Central Rly & Western Rly under MUTP-III project																						
1	Activity: Clearing the ground for construction activities like project area, setting up of site offices, fabrication yards, labour camps, etc.																					
	Air Quality	Dust and gaseous emissions from heavy machinery, vehicles and ground clearing																				
	Air Quality	Emissions from diesel DG sets																				
	Air Quality	Odour nuisance due to accumulated waste material																				
	Water Quality	Impact on existing storm water management																				
	Land	Loss of productive soil due to clearance activity																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Noise and Vibration	Noise and Vibration due to diesel DG sets																				
	Fauna and Flora	Felling of Large trees																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to cutting of tree branches and shrubs																				
	Fauna and Flora	Disturbance to aquatic flora, fauna breeding during construction additional piling for doubling																				
	Occupational Health and Safety	Health impacts on the workers due to emissions from heavy equipment’s and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impact on Health and Safety of communities																				
	Environmental Health and Safety	Impact on sensitive receptors like religious places, hospitals, schools, places of heritage importance etc																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Environmental Health and Safety	Disturbance to sensitive / vulnerable PAFs/ settlements																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/ signages																				
	Land area clearing required for FOB construction	Disturbance to commuters and fence-line community																				
2	Activity: Dismantling/ Demolition activities																					
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles and ground clearing.																				
	Air Quality	Emissions from diesel DG sets																				
	Air Quality	Traffic congestion at rail crossings																				
	Water Quality	Impact on existing storm water management																				
	Land	Land erosion and flooding due to change in physical setting such as alterations/ high																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		embankments, filling in low lying areas, altered topography, drainage pattern																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and Vibration due to diesel DG sets, JCB’s ,Piling activities, breaker heads etc.																				
	Fauna and Flora	Felling of Large trees located within the private premises																				
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to cuttings of tree branches and shrubs																				
	Occupational Health and Safety	Exposure to higher noise levels and repeated mechanical shocks and/or vibration from dismantling activities																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Impacts on amenities/ facilities in an area including cultural and community properties (market, gathering spaces, playgrounds, etc.)																				
	Environmental Health and Safety	Impact on common infrastructure in an area including hand pumps, common wells, toilets, electric lines/poles, access roads, pedestrian routes, etc.																				
	Environmental Health and Safety	Impact on sensitive receptors like religious places,																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		hospitals, schools, places of heritage importance etc																				
	Environmental Health and Safety	Disturbance to tribal/ sensitive / vulnerable PAFs/ settlements																				
	Environmental Health and Safety	Visual blight/ aesthetic issues due to construction, signages																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signages																				
3	Activity: Establishment and operation of labour camps																					
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles and ground clearing.																				
	Air Quality	Emissions from diesel DG sets																				
	Air Quality	Odour nuisance due to improper management of solid waste																				
	Air Quality	Increased air pollution along nearby roads due to																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		newly introduced vehicular traffic																				
	Air Quality	Emissions due to use of wood or other bio mass fuels in camps																				
	Water Quality	Impacts on quality of ground and surface water due to discharge of untreated wastewater																				
	Water Quality	Water stagnation and creation of temporary breeding habitats for mosquito/ other vectors of disease																				
	Water Quality	Impact on existing storm water management																				
	Land	Loss of productive soil due to construction activities																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Land	Soil contamination due to fuels/ oil spills																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and vibration due to metal fabrication and assembling etc																				
	Noise and Vibration	Noise and Vibration due to diesel DG sets																				
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to cuttings of tree branches and shrubs																				
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Impact on common infrastructure in an area including hand pumps, common																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		wells, toilets, electric lines/poles, access roads, pedestrian routes etc.																				
	Environmental Health and Safety	Visual blight/ aesthetic issues due to construction, signages																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage's																				
4	Activity: Access control and barricading																					
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles.																				
	Air Quality	Increased air pollution along nearby roads due to newly introduced vehicular traffic																				
	Water Quality	No Impact																				
	Land	Loss of productive soil due to barricading																				
	Land	Compaction of land due to movement of heavy vehicles																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and Vibration due to metal fabrication and assembling etc																				
	Noise and Vibration	Noise and Vibration due to DG sets, braker heads, piling activities etc.																				
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to cuttings of tree branches and shrubs																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Community severance due to lack of access																				
	Environmental Health and Safety	Impacts on amenities/ facilities in an area including cultural and community properties (market,																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		gathering spaces, playgrounds, etc.)																				
	Environmental Health and Safety	Impact on common infrastructure in an area including, electric lines/poles, access roads, pedestrian routes etc.																				
	Environmental Health and Safety	Visual blight/ aesthetic issues due to construction, signages																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage's																				
	Environmental Health and Safety	Impact on mobility o differently abled people																				
5	Activity: Relocation arrangements of utility lines for construction works																					
	Sourcing and Transportation of Construction Materials and equipment	Traffic congestion, dust and pollution emission																				
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles and																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		relocation/ installation of utility lines																				
	Air Quality	Emissions from DG sets, JCB, Backhoe, and other construction vehicles																				
	Water Quality	Damage to water lines																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and Vibration due to operation of DG sets, JCB, Backhoe, and other construction vehicles																				
	Fauna and Flora	No impact																				
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
6	Activity: Storage and Transfer of Construction material to site (as in Sand, cement, aggregates, steel bars)																					
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles and quarrying activity																				
	Air Quality	Increased air pollution along nearby roads due to newly introduced vehicular traffic																				
	Water Quality	Water stagnation and creation of temporary breeding habitats for mosquito/ other vectors of disease																				
	Land	Land erosion and flooding due to change in Regional physical setting such as alterations/ oxbows/high embankments, filling in low lying areas, altered topography, drainage pattern																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Land	Loss of productive soil due to construction activities																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and Vibration due to operation of DG sets and movement of construction machinery/vehicles.																				
	Fauna and Flora	Felling of Large trees																				
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to cuttings of tree branches and shrubs																				
	Occupational Health and Safety	Exposure to higher noise levels and repeated mechanical shocks and/or vibration from machinery																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Improved income and economic profile of the area																				
7	Activity: Assembling and mechanical installation of prefabricated girders and components near/ around work site																					
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles, assembling and mechanical installation																				
	Air Quality	Emissions from diesel DG sets																				
	Water Quality	Loss of seasonal flood plains																				
	Water Quality	Water stagnation and creation of temporary breeding																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		habitats for mosquito/ other vectors of disease																				
	Land	Loss of productive soil due to fabrication activities																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Land	Soil contamination due to fuels/ oil spills																				
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and Vibration due to metal fabrication and assembling etc																				
	Noise and Vibration	Noise and Vibration due to cutting, bending and grinding of metals.																				
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Improved income and economic profile of the area																				
	Environmental Health and Safety	Visual blight/ aesthetic issues due to construction, signages																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage’s																				
8	Activity: Excavation, Foundation and Piling activities /works; and other construction works																					
	Establishment and Use of Labour Camp/ Accommodation	It will have an impact on land use and resources like water. Also have impact on fence-line community																				
	Engagement of local and migrant workers	It will have an impact of socio-economic fabric of the study area. Also, may have an impact on community health, and safety.																				
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery,																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		vehicles and earth works																				
	Air Quality	Emissions from diesel DG sets																				
	Water Quality	Impacts on quality of ground and surface water																				
	Water Quality	Flooding/erosion due to Flow obstruction/changes in the stream courses in canals/creeks/natural courses and increased sedimentation																				
	Water Quality	Water stagnation and creation of temporary breeding habitats for mosquito/ other vectors of disease																				
	Land	Land erosion and flooding due to change in Regional physical setting such as alterations/ oxbows/high embankments, filling in low lying areas,																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		altered topography, drainage pattern																				
	Land	Loss of productive soil due to excavation activities																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Noise and Vibration	Increase in Noise level																				
	Noise and Vibration	Noise and Vibration due to DG sets and heavy construction vehicles like JCB, Tripper, Prime Earthmover, Crane etc.																				
	Occupational Health and Safety	Exposure to higher noise levels and repeated mechanical shocks and/or vibration from machinery																				
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Impact on sensitive receptors like religious places, hospitals, schools, places of heritage importance etc																				
	Environmental Health and Safety	Disturbance to tribal/ sensitive / vulnerable PAFs/ settlements																				
	Environmental Health and Safety	Visual blight/ aesthetic issues due to construction, signages																				
	Environmental Health and Safety	Design safety and associated impacts																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage’s																				
	Environmental Health and Safety	Design safety and associated impacts																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage's																				
9.	Activity: Storage, handling and disposal of solid, hazardous and C&D waste material																					
	Air Quality	Dust and Gaseous emissions in atmosphere from heavy machinery, vehicles																				
	Air Quality	Odour nuisance																				
	Air Quality	Increased air pollution along nearby roads due to newly introduced vehicular traffic																				
	Water Quality	Impacts on quality of ground and surface water due to run off/ leachate from waste material																				
	Water Quality	Loss of seasonal flood plains if waste storage area is created in flood plain area																				
	Land	Loss of productive soil due to storage/ disposal of waste material in open land																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Land	Compaction of land due to movement of heavy vehicles																				
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to trimming of tree branches and shrubs																				
	Fauna and Flora	Disturbance to breeding locations/nesting sites / habitats																				
	Occupational Health and Safety	Heath impacts on the workers due to continuous exposure to the waste material																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
10	Activity: Construction of the Ancillary facilities like Yard, Platforms, Ticketing Area, PRS Counter Parking area, etc.																					
	Air Quality	Dust and Gaseous emissions in atmosphere from																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		heavy machinery, vehicles.																				
	Air Quality	Increased air pollution along nearby roads due to newly introduced vehicular traffic																				
	Water Quality	Impact on existing storm water management																				
	Land	Land erosion and flooding due to change in Regional physical setting such as alterations/ oxbows/high embankments, filling in low lying areas, altered topography, drainage pattern																				
	Land	Compaction of land due to movement of heavy vehicles																				
	Noise and Vibration	Noise and vibration due to machineries																				
	Fauna and Flora	Felling of Large trees (if any)																				
	Fauna and Flora	Disturbance in local ecology and bio-diversity due to																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
		cuttings of tree branches and shrubs																				
	Occupational Health and Safety	Heath impacts on the workers due to emissions from heavy equipment and other mobile sources																				
	Occupational Health and Safety	Impact on safety of workers																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage's																				
11	Activity: Improved trespass control Infrastructure such as Newly constructed wide FOB's , Platforms, Staircase and other facilities																					
	Air Quality	No Impact																				
	Water Quality	No Impact																				
	Land	No Impact																				
	Land	Change in land use pattern																				
	Noise and Vibration	No Impact																				
	Fauna and Flora	No impacts																				

Sr no.	Environmental & Social Attribute	Environmental & Social Impact	Type and Nature of Impact					Significance- Magnitude												Likelihood		
			Impact Type		Impact Nature			Extent				Duration				Intensity – Bio Physical and Socio- Economic				Likelihood		
			Positive	Negative	Direct	Indirect	Cumulative	On-Site	Local	Regional	National	Temporary	Short Term	Long Term	Permanent	Negligible	Low	Medium	High	Unlikely	Likely	Definite
	Environmental Health and Safety	Impact on safety of daily commuters																				
	Environmental Health and Safety	Impacts on Health and Safety of communities																				
	Environmental Health and Safety	Impacts on amenities/ facilities in an area including cultural and community properties (market, gathering spaces, playgrounds, cemeteries, gaochar land)																				
	Environmental Health and Safety	Impact on common infrastructure in an area including new foot over bridges, toilets, PRS counters/staircases, access routes, pedestrian routes etc.																				
	Environmental Health and Safety	Design safety and associated impacts																				
	Environmental Health and Safety	Visual impacts due to use of reflective materials/signage’s																				

7. Analysis of Alternatives

An efficient suburban rail system running across the Mumbai Metropolitan Region (MMR) is at the core of the transport system of Mumbai city. This suburban rail system is one of the most crowded and overloaded suburban systems in the world carrying around 7.6 million people in more than 2900 train service every day. Mumbai is the largest and the most populous metropolis in the country and the projected population of total MMR is 34.0 million by 2031. Some of the key features of the Existing Mumbai Suburban railways are[27]

- The Suburban Railway System in Mumbai is the most complex, densely loaded and intensively utilized system in the world.
- It has the highest passenger density in the world – More than 8 million commuters travel everyday.
- Two zonal Railways, Western Railway (WR) and Central Railway (CR), operate the Mumbai Suburban Railway System.
- It is spread over an expanse of 385 route kms.
- The suburban services are run by Electric Multiple Units (EMUs)
- 277 rakes (train sets) of 12-car & 15-car composition are utilized to run more than 3000 train services.
- It is operated on 25 KV AC power supply from overhead catenary

MRVC in Phase–III of MUTP has Trespass control in Mid-section on suburban system of Mumbai at 22 locations.

The physical, socio-economic and environmental factors are analysed for the Project sites. Analysis of physical environment includes evaluation of transportation infrastructure, material sourcing, disposal of waste material, land, analysis of biological features as tree cover, quality of air, water, noise and other environment features. Analysis of socio-economic environment includes evaluation of overall socio-economic development of the area. .

7.1 Location and Land

Due to provisions of FOB and availability of railway land where the construction will be or is being done is on railway land, so land acquisition will be minimised. The financial, environmental and social costs can be kept minimum considering the availability of railway land and road approaches near the existing alignment, major settlement near stations.

7.2 No Project Scenario

Every year thousands of people lose their life or are injured due to trespassing on the railway tracks in the mid sections. No project scenario will lead to continuation of this situation/increase such incidents due to the increasing number of commuters. Accident data provided by the client for various sites are mentioned in Appendix A.

7.3 With Project Scenario

Every year thousands of people lose their life or are injured due to trespassing on the railway tracks in the mid sections. To minimize or eliminate the trespassing there is a need to study the suburban railway system focusing on accessibility issues, reasons for trespassing, existing facilities, further development as per development plans, at the mid sections. As informed by GRP and RPF, the number of accidental deaths & injuries are increasing day by day as the numbers of passengers are increasing. Trespass control projects will support in limiting these impacts.

Due to project, employment opportunity will rise leading to income level increase opportunity for unskilled/ semiskilled/skilled people to work in the project during construction stage.

[27] Welcome to Mumbai Railway Vikas Corporation Ltd. (indianrailways.gov.in)

8. Environment Management and Monitoring Plan

Environment Management Plan (EMP) and related social, health & safety aspects has been prepared, based on the identified environmental attributes and type of the impacts. The main environmental attributes consist of air, water, noise and vibration, land, flora-fauna, occupational health and safety and environmental health and safety. To cover all the environmental attributes, EMP has been divided into following components.

- Air Quality Management Plan
- Water Quality Management Plan
- Soil Quality & Erosion Management Plan
- Noise and Vibration Management Plan
- Ecology / Biodiversity Management Plan
- Solid and Hazardous Waste Management
- Asbestos Waste Management Plan
- Construction & demolition Waste Management Plan
- Plant Site/Labour Camp Management Plan
- Construction Area Management Plan
- Traffic Management Plan
- Commuter Management Plan
- Construction / Occupational Health and Safety Management Plan
- Community Health and Safety
- Environmental Monitoring Plan

Responsibility: Client will have the responsibility for ensuring that all its Contractors and sub-contractor work in the preview of the guidelines provided. Client (through the implementing agency) should conduct periodic monitoring to keep a check on work areas during entire duration of the project for implementation for Environment and related Social, Health & Safety Management Plan (ESHSMP).

8.1 Air Quality Management Plan

During site clearance, construction activities, project operation and maintenance, original site conditions and environmental settings should be maintained, as far as possible. Natural tree cover should be maintained which will help in containing dust emission from construction activities within site.

Air quality will be affected by various emissions due to fuel combustion from the operation of construction equipment, diesel generating sets and machines; emissions due to use of wood or other bio mass fuels in camps, fugitive emissions from vehicles used for the transportation of construction materials and localized increased traffic congestion in construction areas. During the construction phase, there will be increased vehicular movement for the transportation of materials to the project site.

The Central Pollution Control Board (CPCB) has set up standards with regard to the ambient air quality levels and emission levels. These standards will have to be met, and stipulations to the effect will be provided in construction

contract agreement. In addition, the following measures should be implemented to minimize impacts on air quality in the project areas.

Construction and decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. A secondary source of emissions may include exhaust from diesel engines of earth moving equipment, as well as from open burning of solid waste on-site. Measures to consider for the reduction and control of air emissions from construction and decommissioning sites include:

I. Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone)

II. Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content

III. Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements

IV. Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition

V. Managing emissions from mobile sources as follows :

a. Regardless of the size or type of vehicle, fleet owners / operators should implement the manufacturer recommended engine maintenance programs;

b. Drivers should be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits;

The following mitigation measures should be incorporated to avoid/reduce the potential impacts.

Construction Phase:

- Wherever feasible, site area which is under construction activity should be barricaded / provided with screens, as feasible.
- Loose and fine materials like sand and fine aggregates shall be covered with green nets or tarpaulin sheets during transportation and in storage area.
- Loading and unloading of construction materials, stockpiling of the construction material, earthwork, unpaved haulage roads, other dust prone areas and construction yard shall be provided with water spraying arrangement.
- Demolition debris shall be kept in controlled area and sprayed with water mist to reduce debris dust.
- All the project vehicles should have valid Pollution under Control (PUC) certificate. Ensure regular maintenance of project vehicles.
- Ready-Mix Concrete (RMC) plant for commercial purposes should be installed at a site with a buffer zone of approximately 100 m distance from human habitation of 1000 people or more and major road (National/ State Highway, major district roads, main roads in city areas) and should not be located within 200 m from schools, colleges, hospitals and courts. All the machinery and equipment shall be regularly maintained.
- Vehicles speed (entering the construction site in railway land) to be restricted to 10-20 km/hr.
- Procure material only from MPCB approved licenced quarry areas, with all valid permissions and approvals.
- Air quality monitoring for the parameters, which were monitored during the baseline studies and as per relevant permits (like Consent to Establish, Consent to Operate from State Pollution Control Board, etc.)

shall be carried out by the Client / Contractor by hiring the services of the laboratory which is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) / MoEF&CC notified. An appropriate sampling port location must be ensured in for all emission stacks (if any).

- All the machinery and construction equipment’s to be used on site should be of such design that they comply to applicable national air emission norms.
- DG sets shall be Central Pollution Control Board (CPCB) compliant.
- Low sulphur diesel should be used in DG sets as well as machinery, wherever possible.
- Liquefied petroleum gas (LPG) cylinders or community kitchens may be provided in the labour camps to avoid any tree cutting for fuel wood.
- Burning of the waste shall not be carried out at the construction site and labour camps.
- Domestic solid waste generated at construction labour camps should be segregated. The non-biodegradable and recyclable waste should be sold off to recyclers. Efforts shall be made to carry out composting of bio-degradable waste through pit-composting/bin-composting. Non-biodegradable, non-recyclable waste should be disposed of to local municipal waste facility.
- Comprehensive traffic management plan should be drawn up by the contractor and get the approval from client.
- Plan the transportation of the material to site to avoid traffic congestion at existing foot over bridges, vehicle parking areas and entry exit gates of the railway stations.
- As far as possible, it is recommended for the areas /stations with heavy footfall of daily commuters to transport the material during night time.

8.2 Water Quality Management Plan

Contamination of water on land i.e. surface water and ground water contamination can happen due to various construction activities. Leakage/spillage of chemicals, oil, improper disposal of waste, etc. can act as major source of water contamination. Also, proper drainage facilities will be constructed during the construction stage to avoid overflow or contamination with natural flow paths especially during the rainy season. The contractors will maintain account of the usage of oil, has inbuilt technical methods and procedures for oil monitoring mechanism, and has mitigation plan for any oil spillage. Following mitigation measures should be incorporated to avoid/reduce the potential impacts.

Construction Phase:

- The contractor shall arrange for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.
- Water required for domestic and construction use should be taken from sources which have valid permission / permits for the same. In case of use of ground water, appropriate permission from Central Ground Water Board should be obtained for the same.
- All wastes arising from the construction should be disposed in an environmentally accepted manner.
- Any water obtained during dewatering shall either be re-used for construction purpose or recharge to the ground water at suitable aquifer levels. If reuse or groundwater recharge is not possible, then the contractor shall discharge water obtained from dewatering to the nearby drainage system with necessary permissions.
- Any domestic waste water e.g. sewage should be disposed of suitably with help of septic tank. Adequate care shall be taken not to install mobile toilets in / near the natural drainage areas. Open defecation should not be permitted.
- Any effluent generated should be pre-treated and then reused or disposed as per relevant regulations.

- No vehicles or equipment should be parked, re-fuelled or repaired near water bodies. Temporary paved areas should be constructed to be used while refuelling the machineries
- Machinery and vehicles should be thoroughly checked for the presence of leaks if any. Drip pans should be provided with vehicles with leaks to prevent it from reaching the nearby water body.
- All equipment operators, drivers, and warehouse personnel should be trained in immediate response for spill containment and eventual clean-up.
- All equipment operators, drivers and workers shall be provided with training in immediate response for spill containment and eventual clean-up. Emergency response procedures and reporting shall be made readily available by the contractor in simple and local language.
- Fuel oil, chemicals, etc. should be stored away from water sources, on paved impervious surface and secondary containments for spills collection should be provided.
- Spill control kits should be available for control of any accidental spillage of oil, fuel or chemicals.
- Labour construction camps should be located away from habitation and water course.
- The piling work which may increase sedimentation level of the water body shall be undertaken during low flow period.
- Wherever required, storm water / drainage lines will be provided for proper management of storm water drainage lines to collect/connect surface runoff (during monsoon) from the project site.
- Anti-mosquito / larvicide should be used to control vector borne disease.
- Sludge from sanitary wastewater treatment systems should be disposed in compliance with local regulatory requirements, in the absence of which disposal has to be consistent with protection of public health and safety, and conservation and long term sustainability of water and land resources.

8.3 Soil Quality & Erosion Management Plan

Though being a confined project, limited land will be required for the construction of FOB’s and proposed project will change the earlier land use of the project area. Sand, cement, aggregate, steel etc. will be used for construction of trespass control facilities. This will require earth material to be procured. Soil pollution, erosion can happen if construction work is not planned properly. Following mitigation measures should be incorporated to avoid/reduce the potential impacts:

Construction Phase:

- Prior to the start of the construction, the contractor should submit work schedules to the client for carrying out temporary and permanent erosion/sedimentation control works as are applicable for the items of clearing and grubbing and drainage excavation.
- During monsoon construction work shall be avoided at erosion prone location.
- Only approved and licensed borrow pits and quarry sites should be used for procurement of construction material.
- Earth material generated during excavations should be used for land levelling on site.
- Top soils from sites should be conserved and restored after excavation is over.
- Any excess earth material like excess soil or sediments should be used site levelling.
- If required, excess earth material should be disposed of at designated locations with due permissions from concern regulatory/municipal bodies.
- To prevent soil compaction in the adjoining lands beyond the project area, the movement of construction vehicles, machinery and equipment shall be restricted to the designated haulage route.

- Fuel, chemicals, and lubricants should be stored on impervious surface area at the predefined storage location with secondary containment provision. The storage area should be provided with gentle slope to a corner and connected with a chamber to collect any spills.
- Spill control kits should be available for control of any accidental spillage of oil, fuel or chemicals `.
- Domestic solid waste at construction labour camp should be segregated into biodegradable and non-biodegradable waste. The non- biodegradable and recyclable waste shall be sold off. Efforts shall be made that bio-degradable waste is composted through pit-composting/bin-composting.
- All efforts should be made to minimize the hazardous waste generation. Unavoidable hazardous waste shall be managed as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

8.4 Noise and Vibration Management Plan

Noise and vibration due to construction activities and equipment’s could cause disturbance to the neighbouring community and area which are under close proximity to the project. Ambient noise and vibration level may increase temporarily in the close vicinity of various construction activities, maintenance workshops of vehicles and earthmoving equipment. This noise and vibration level will attenuate far with increase in distance from the source. In general, impact due to noise and vibration during construction activities will be minimal to inhabitants since most of the activities are restricted to the daytime in existing railway (premises) station area where there is routine movement of trains and commuters. However, there may be sensitive locations especially schools and hospitals that are closer to the worksites where increase in the noise and vibration level may be felt due to use of construction equipment and increased traffic movement. Following mitigation measures should be incorporated to avoid/reduce the potential impacts:

Construction Phase:

During construction and decommissioning activities, noise and vibration may be caused by the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people. Some recommended noise reduction and control strategies to be considered in areas close to community areas include:

- Avoiding or minimizing project transportation through community areas.
- Noise levels at construction sites shall be compliant with Environment (Protection) Rules, 1986 (Schedule VI, Part E) the noise generation standards applicable for construction equipment, machinery and vehicles.
- All in-built noise-silencing devices such as silencers and mufflers shall be maintained and any defective device shall be promptly replaced. Equipment's shall be maintained so as to avoid any abnormal noise.
- Noise generation due to vibration of loose parts during operation, unstable foundation at temporary installations etc. shall be immediately attended and rectified.
- Stationary DG sets, if provided at the construction site shall adhere to noise emission guidelines and regulations The Environment (Protection) (Second Amendment) Rules latest amendment Rules http://www.tn.gov.in/sta/Cmvr1989.pdf
- All construction equipment and machinery should be timely serviced and properly maintained.
- Construction activity and timing should be regulated to minimize the intensity of the noise impact.
- As far as possible, noise generating construction activities should be restricted to day time.
- Construction equipment and machinery should be fitted with silencers, vibration dampers or isolated using acoustic medium, wherever possible.
- Stationary noise making equipment’s shall be placed along un-inhabited stretches.
- Personal protective equipments (PPEs) like earplugs or earmuffs should be provided to the workers.

- Workers exposed to high noise or vibrations should work on job rotations.
- Construction of boundary wall of the railway premises at the locations where habitations are located very close to the railway boundary can be considered.
- The construction equipment and machinery, DG sets should be fitted with acoustic enclosures and a routine maintenance of construction equipment shall be carried out to control the noise levels from these sources.
- Metal fabrication and assembling activities should be carried out in away from nearby settlements.
- Use of DG sets and other construction machinery / equipment’s should be kept minimum.

8.5 Ecology / Biodiversity Management Plan

As per the information shared by the site representatives, tree cutting will be carried out for the project. The site team was not aware about the permissions and procedures for the tree cutting and pruning as applicable for the projects. The client has not initiated any procedures for tree felling or pruning as applicable. As informed, the vegetation clearings will be done by PWD. At proposed Km 60/4-6: Virar FOB Project Site, roofs and walls of labour accommodation huts are constructed using wood logs procured from outside.

Following mitigation measures should be incorporated to avoid/reduce the potential impacts:

Construction & Operation Phase:

- All requisite permissions should be obtained prior to starting any construction works
- Tree felling, clearing of vegetation and trimming of trees in accordance with the India railway Works manual, 2000 along with the prescribed compensatory planting should be carried out.
- Planting native trees/plants during the landscaping stage of a project can increase the biodiversity in an area.
- MRVC shall not allow introduction of exotic species with known environmental setbacks.
- MRVC should avoid using wood material for construction to the extent possible
- MRVC should not allow any workers to use wood as a fuel
- Avoid cutting of tree branches and shrubs to the extent possible.
- All work areas shall be smoothened and graded in a manner to conform to natural appearance of the landscape.
- Awareness program on Environment and Wildlife Conservation shall be provided to the work force.
- Dumping and disposal of construction wastes should be done as per C&D waste Management Rules 2016

8.6 Solid and Hazardous Waste Management

Waste generated during project construction phase will be from construction area and labour camp. Unacceptable solid waste disposal practices such as open dumping of solid waste and poor sanitation facilities needs to be regulated. These practices lead to pollution of surrounding environment, contamination of water bodies and increase adverse impact to the aquatic; terrestrial lives and general public inhabited in the area. The segregation, storage and disposal of various wastes generated at site should be as per relevant applicable national regulations. Following mitigation measures should be incorporated to avoid/reduce the potential impacts:

- All wastes generated at project site and labour camps will be segregated at source. Separate waste collection bin should be provided for different types of waste.

- Municipal solid waste should be segregated, stored and disposed as per Solid Waste Management Rules, 2016.
- Bins for storage of bio-degradable wastes should be painted green, those for storage of recyclable wastes shall be white and those for storage of other wastes shall be black.
- Efforts shall be made that bio-degradable waste is composted through pit-composting/bin-composting.
- Domestic and construction waste like recyclables viz. paper, plastic, glass, scrap metal waste etc. will be properly segregated and stored in designated waste bins/containers and periodically sold to local recyclers. Non-biodegradable and non-saleable waste shall be disposed of with hep of local municipal waste disposal system.
- All construction and demolition waste should be handled as per Construction and Demolition Waste Management Rules, 2016.
- Other waste (such as solid waste) does not get mixed with construction and demolition waste and should be stored and disposed separately. The construction and demolition waste should be kept within the project area or get the waste deposited at collection centre so made by the local body or handover it to the authorised processing facilities of construction and demolition waste.
- It should be ensured that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains.
- The contractor shall identify local construction waste disposal site in congruence with local authority to dispose any construction and demolition waste generated.
- Construction and decommissioning activities may pose the potential for release of petroleum based products, such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. These materials may also be encountered during decommissioning activities in building components or industrial process equipment. Measures for prevention, minimization, and control of these impacts include:
- Providing adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids,
- Using impervious surfaces for refuelling areas and other fluid transfer areas
- Training workers on the correct transfer and handling of fuels and chemicals and the response to spills
- Providing portable spill containment and clean-up equipment on site and training in the equipment deployment
- Assessing the contents of hazardous materials and petroleum-based products in building systems (e.g. PCB containing electrical equipment, asbestos-containing building materials) and process equipment and removing them prior to initiation of decommissioning activities, and managing their treatment and disposal according to statutory requirements.
- Assessing the presence of hazardous substances in or on building materials (e.g., polychlorinated biphenyls, asbestos containing flooring or insulation) and decontaminating or properly managing contaminated building materials
- Register of all hazardous materials used and accompanying material safety data sheet (MSDS) should be maintained.
- Hazardous waste should be disposed to State Pollution control Board authorised agency only. Packaging, labelling, and transport of hazardous and other waste should be done as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Training will be provided to the workers on how to segregate, store, handle and dispose waste.

- The hazardous materials, if stored at the construction site like cylinders, petroleum, spirit, diesel, lubricating oil, paints etc. should be stored as per the statutory provisions of Manufactures, Storage and Import of Hazardous Chemicals Rules, 1989.
- All the hazardous waste should be handled and disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (as amended).
- After completion of the construction; the contractor shall ensure the site and labour camps areas are cleaned, all waste disposed as per relevant regulations and handled over to client.

8.7 Asbestos Waste Management Plan

There is possibility of generation of Asbestos waste if any demolition activity is carried out at existing railway structures. Asbestos fibres are primarily an inhalation hazard resulting in carcinogenic effect. Hence, if any Asbestos waste is generated then the same needs to be disposed of in safe and environmentally friendly manner as per the applicable regulations and guidelines. The World Banks Group's Environment, Health, Safety Guidelines[28] specify that the use of Asbestos Containing Material (ACM) should be avoided in new buildings and construction or as a new material in remodelling or renovation activities. Following measures shall be adopted by the contractor / client to manage the Asbestos waste:

- The contractor shall carry out removal, repair, and disposal of ACM in a way that it minimizes worker and community asbestos exposure levels.
- The contractor shall develop an Asbestos Management Plan for the existing facilities with ACM. The Asbestos Management Plan shall clearly identify the locations where the ACM is present, its condition (e.g., whether it is in friable form or has the potential to release fibres), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities.
- Asbestos Management Plan shall describe the work in detail in plans and project, including but not limited to the following:
    - Ensuring safe access, restricting access and ensuring adequate lighting while handling
    - Containment of interior areas by Negative pressure enclosure
    - Protection of walls, floors, and other surfaces with plastic sheeting
    - Construction of decontamination facilities for workers and personal protective equipment
    - Overalls fitted with a hood; boots without laces (laced boots are hard to decontaminate); respiratory protective equipment.
    - Removing the ACM using wet methods, and promptly placing the material in impermeable containers
    - Final clean-up with special vacuums and dismantling of the enclosure and decontamination facilities
    - Disposal of the removed ACM and contaminated materials in an approved landfill site as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
    - Other requirements for specific types of ACM, configurations and characteristics of buildings or facilities, and other factors affecting the work shall be enumerated in the plans and specifications.
- Contractor shall notify to the MPCB and client of the removal and disposal according to applicable regulations as indicated in the technical requirements and cooperates fully with representatives of the relevant agency during all inspections and inquiries.

[28] Environmental, Health, and Safety (EHS) Guidelines of IFC: General EHS Guidelines: Occupational Health And Safety

- The construction site will mainly have Asbestos Containing Sheets as roofing material. The contractor shall adopt approved removal method for asbestos removal. Following aspects shall be considered while removing the Asbestos Containing Sheets from the roof.
    - Avoid or minimize breaking the Asbestos Containing Sheets.
    - If fasteners hold the sheets in place, dampen and remove them, and place them in the waste container.
    - If the sheets are bolted in place, dampen and cut the bolts while avoiding contact with the ACS.
    - Remove the bolts or fixings carefully and place them in the waste container.
    - Lower large pieces to the ground. Do not drop them or use rubble chutes. Stack sheets carefully.
    - Where there are several Asbestos Containing Sheets and other large items, place them in a lockable skip.
    - Double-wrap large pieces in 1000-gauge polythene sheeting. Seal with duct tape.
    - Attach asbestos warning stickers.
    - Caution: Avoid crushing Asbestos Containing debris on the ground.
    - Place small pieces in the asbestos waste container and dispose the material as specified in Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
- Contractor shall provide adequate protection to its personnel handling asbestos, including respirators and disposable clothing.

8.8 Plant Site/Labour Camp Management Plan

Improper location and management of construction camps may lead to adverse impacts on environment such as:

- Loss of vegetation due to use of wood as fuel for cooking
- Deterioration of water quality in nearby surface water bodies due to discharge of untreated waste water and solid waste dumping
- Compaction and contamination of soil due to uncontrolled disposal of solid waste
- Poor sanitation may result in transmission of communicable diseases among the workers and the host communities.

Influx of labour during construction will also have impact on social setting of the area such as:

- Risk of social conflict between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources.
- Influx of additional population as family members of workers, traders, suppliers and other service providers due longer timeframe of project, particularly in areas where the local capacity to provide goods and services is limited.
- Increased risk of illicit behaviour and crime as theft, physical assaults, substance abuse, prostitution and human trafficking.
- Gender-based violence as inappropriate and criminal behaviour, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors due to large influx of male labour.
- The presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services.

- The influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs) adding burden on the health infrastructure of the area.
- A significant increase in demand for goods and services due to labour influx may lead to local price hikes and/or crowding out of community consumers.
- Delivery of supplies for construction workers and the transportation of workers can lead to an increase in accidents and traffic issues.

The following mitigation measures shall be implemented to minimize impacts of the project:

- All camps should maintain a minimum distance of 500 m from habitation and water bodies. No productive land should be utilized for construction camp. No construction camp shall be established in eco sensitive area. All sites must be graded, ditched and rendered free from depressions to avoid water stagnation. Safety of the labours should also be considered during the site selection for the labour camps. The labour camp location should not involve trespassing for accessing the construction site.
- Accommodation and ancillary facilities for workers should be erected and maintained to the standards and scales approved by client.
- The Contractor should provide adequate and safe water supply for the use of the workers in labour camp. The contractor shall install RO of adequate capacity for providing safe drinking water to the labours. 1 tap for 25 labours shall be provided for easy access to drinking water.
- The contractor shall also provide water for other domestic usages in the labour camp. Drinking water must meet IS 10500:2012 or WHO drinking water standards. Water quality must be monitored 3 times in a year (once in 4 months) on regular basis.
- All construction camps should be provided with sanitary toilets. The toilets shall be linked to the nearby sewerage system. In case, there is no sewerage system in nearby areas, septic tank / soak pits should be provided in the construction labour camps with the provision to use the overflow for plantation. 1 toilet seat, 1 urinal, 1 wash basin and 1 bathroom for 15 labours shall be provided at the labour camps with availability of sufficient water. The wastewater from the camps should not be allowed to be discharged into existing surface water bodies, wetlands, water logged areas or river.
- The contactor shall discuss the matter related to number of labours, quantity of solid waste generated and suitable method of the waste disposal with urban local bodies/panchayat where the labour lamp is located. Based on guidance from the local bodies/panchayat, the arrangements regarding solid waste disposal shall be done. If there is no possibility of the providing solid waste management service by local bodies/panchayat, the contractor shall manage the solid waste on their own by taking following steps:
    - Domestic solid waste at construction labour camp should be segregated into biodegradable and non-biodegradable waste.
    - Efforts shall be made that bio-degradable waste is composted through pit-composting/bin-composting.
    - The non- biodegradable and recyclable waste shall be sold off. Non-biodegradable and non-saleable waste shall be disposed of by burying the waste in a secured manner.
- LPG cylinders or community kitchens may be provided in the labour camps to avoid any tree cutting for fuel wood.
- At every workplace, the Implementing Agency/Contactor in collaboration with local health authorities will ensure that a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances is made available.
- Drainage system shall be developed in the labour camps to avoid the accumulation of stagnant water in monsoon season. Also, the drainage shall be maintained on regular basis to avoid any chocking or cleaning issues.

- Drains and ditches within the labour camp area should be treated with bleaching powder on a regular basis.
- Access to the ambulatory services should be provided to approach the nearest hospital in case of an emergency.
- The contractor will ensure good health and hygiene of all workers to prevent sickness and epidemics.
- The Contractor should provide a crèche for the children of the workers (if any) in the labour camps.
- The Contractor should ensure that all precautions to protect the workers from insect and pest to reduce the risk to health. This includes the use of insecticides.
- Strict control shall be imposed over alcohol and substance abuse in the labour camp.
- The workers should all be screened for the health problems before being considered for employment. Regular health check-up and immunization camps should all also be organized for the workers.
- After completion of the construction; the contractor shall ensure the complete removal of the labour camps.
- Labour Influx Management Plan:
    - The Contract shall abide by the Gender Policy of the project.
    - The Contractor shall provide information regarding Worker Code of Conduct in local language(s).
    - The Contractor shall provide cultural sensitization training for workers regarding engagement with local community and curbing of gender-based violence.
    - The Contractor shall source the local workforce to the maximum possible extent.
    - The Contractor shall maintain records of gender information as number of women employed, number of toilets available for women and other facilities for children and women.
    - Contractor to hire workers through recruitment offices and avoid hiring “at the gate” to discourage spontaneous influx of job seekers.
    - The Contractor shall pay adequate salaries for workers to reduce incentive for theft;
    - The Contractor shall pay salaries into workers’ bank accounts rather than in cash;
    - Creation of supervised leisure areas in workers’ camp.
    - The Contractor shall keep provision of \sanctions (e.g., dismissal) for workers involved in criminal activities.
    - The Contractor shall arrange for Information campaigns on STDs, substance abuse prevention and management among the workers.
    - The Contractor shall arrange for entertainment and events for workers within camp to reduce incentives for mixing with local community.
    - The Contractor shall arrange for vaccination of workers against common and locally prevalent diseases;
    - The Contractor shall provide track safety training for staff.

8.9 Construction Area Management Plan

During the construction period, there is a possibility nearby communities are affected by project work. Maintaining construction area is important. Following measures shall be adopted to reduce the inconvenience to the commuters.

- Contractor to visit the site and make sure of requirement of temporary alternate approach pathways required during construction, areas for storage of construction material and areas & extent to which

removable barricading may be required for access control. All measures required shall be provided at no extra costs to ensure that commuter’s movement is safe and least affected.

- No casting yard shall be created on productive lands.
- The signage, barricading and other safety and environmental monitoring requirements shall be as per EMP and to be provided at no extra costs.
- The contractor is required to prepare detailed construction methodology plan covering these areas and get the same approved from MRVC before commencement of construction work.
- The contractor shall implement the approved Traffic Management Plan and Material Movement Plan.
- Rehabilitate temporary access roads prior to the contractor leaving the site
- Clearly identify and notify primary routes to the site and issue to all suppliers and Sub- contractors.
- Where new access roads are constructed, this must be done according to design and specifications agreed by MRVC. MRVC shall ensure the aspect related to natural drainage and erosion while finalizing the access roads.
- All damaged roads shall be rehabilitated using suitable measures. In the event of rehabilitation work being required on private roads, such work shall be done as per the agreed condition with the private land owner.
- Access roads should be maintained in good condition by attending to potholes, and storm water damage as soon as these develop due to construction activities
- All the hazardous material shall be stored properly on the construction site.

8.10 Traffic Management Plan

The Contractor shall develop, assess, and implement appropriate management measures for traffic management wherever the construction activity will affect or likely impact the efficiency and safety of road and related transport networks (including traffic flow, access, parking and user safety). Traffic management plan shall be prepared in consultation with the relevant road authority, transport operator, and emergency services, as relevant. This will be required for movement of man, material and machinery to the construction site nearest to the railway premises. A detailed traffic management plan shall be prepared by the contractor for each FOB site and submitted to client for approval. Based on these guidelines Contractor shall prepare detailed traffic management plan and material movement plan and get the same approved by client. The broad guideline for preparation of Traffic Management Plan is as follows:

Construction Phase:

- The basic requirements of Road Traffic Management to be followed during construction activity to ensure that:
    - Road capacity is sufficient to accommodate construction vehicle traffic volumes and that disruptions are minimized
    - Appropriate warning and information signs are installed to provide advance warning of changed traffic conditions
    - Information and guidance are provided on how to make the construction site safe from construction vehicles
    - Understand the requirements of barricades for pedestrians, public transport passengers, motorists, cyclists etc.
    - Work activities are planned and undertaken to minimize any adverse impacts and to ensure that the traffic normalcy is resumed in shortest possible time
    - Suitably trained staff perform daily inspections on implemented Traffic Management Plans

  - Measures for managing parking impacts, including any proposed alternative parking arrangements are developed
  - Pedestrian impacts are identified and managed

- Necessary permissions shall be obtained from traffic department of urban/rural local bodies and Road Authorities such as Commissioner of traffic. Details of the barricade construction, area of enclosure and period of work are required to be submitted to the satisfaction of the authority.
- All vehicles involved in the excavation and/or demolition process and departing the property with demolition materials, spoil or loose matter must have their loads fully covered before entering the public roadway. Prior to the commencement of work, suitable measures are to be implemented to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving the site. It is an offence to allow, permit or cause materials to pollute or be placed in a position from which they may pollute water.
- Loading and Unloading During Construction shall have following requirements:
  - All loading and unloading associated with construction must be accommodated on site.
  - If, during excavation, it is not feasible for loading and unloading to take place onsite, a Works Zone on the street may be considered. Prior approval is required from authorities.
- Any materials, vehicles, refuse, skips or the like, under any circumstances, must not obstruct the public way.
- For special operations including the delivery of materials, and erection and dismantling of on-site tower cranes which warrant the on-street use of mobile cranes, permits must be obtained from authorities for the use.
- In the case of full road closures and partial road closures, which can create significant traffics disruptions, the authorities shall be informed well in advance and necessary permissions to be obtained.
- Mobile cranes operating from the road must not be used as a method of demolishing or constructing a building.
- Special operations and the use of mobile cranes must comply with the approved hours of construction.
- Contractor shall ensure that demolition and construction related impacts (including construction noise and vibration, loading, issues associated with construction workers and vehicles, traffic issues, management of the construction site) from the site can be dealt with expeditiously and cooperatively.
- Traffic Management Plan shall address following sections:
  - Site location and road network
  - Approved development
  - Overall principles for traffic management
  - Hours of work
  - Truck routes
  - Traffic and parking effects
  - Pedestrians
  - Consultation
  - Pedestrian and traffic management plan
  - Construction site access, including the efficient and safe egress and ingress of vehicles
  - The movement of trucks on and off the site to be managed and controlled by appropriately qualified site personnel in accordance with a Safe Work Method Statement and Traffic Control Plans

- Truck movements to and from the site to be restricted. Contractor shall provide a diagram showing designated truck routes
- Parking management, including on and off street and remote parking and access haulage management, including works to facilitate haulage vehicles, the restriction of haulage vehicles in peak traffic periods
- Pedestrian activity across the site access driveways will be managed and controlled by appropriately qualified site personnel
- Appropriately qualified traffic controller’s pedestrian warning signs to be displayed at appropriate locations will supervise reversing movements to and from
- Pedestrian arrangements, construction activity and erection of safety fencing will be provided
- Mass movement of vehicles in and out of construction site such as RMC delivery Trucks
- Debris removal from site etc. – Preferred time non-peak hours
- Restriction on movement of vehicles through congested roads, narrow lanes having sharp turning radius
- Safety in transporting heavy machinery at site such as use of slings, hoists or jacks for blocking or preventing falling or shifting of machinery
- Neutral position of motors / Engines and parking brakes set during parking and stoppage to be ensured
- Speed and overload restrictions
- Compliance under Central Motor Vehicles Rules, 1989 and latest amendments

- Material Movement Plan also shall be prepared by the contractor and submitted to MRVC for approval. The contractor shall ensure the regular movements of the existing trains and safety of the workers while material movement from East to West or West to East.

Traffic Safety

- Construction activities may result in a significant increase in movement of heavy vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents and injuries to workers and local communities. The incidence of road accidents involving project vehicles during construction should be minimized through a combination of education and awareness-raising, and the adoption of procedures. Road safety initiatives proportional to the scope and nature of project activities should include:
- Adoption of best transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:
- Emphasizing safety aspects among drivers
- Improving driving skills and requiring licensing of drivers
- Adopting limits for trip duration and arranging driver rosters to avoid overtiredness
- Avoiding dangerous routes and times of day to reduce the risk of accidents
- Use of speed control devices (governors) on trucks, and remote monitoring of driver actions
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure. Where the project may contribute to a significant increase in traffic along existing roads, or where road transport is a significant component of a project, recommended measures include:
- Minimizing pedestrian interaction with construction vehicles

- Collaboration with local communities and responsible authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present. Collaborating with local communities on education about traffic and pedestrian safety (e.g. school education campaigns)

- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents

- Using locally sourced materials, whenever possible, to minimize transport distances. Locating associated facilities such as worker camps close to project sites and arranging worker bus transport to minimizing external traffic

- Employing safe traffic control measures, including road signs and flag persons to warn of dangerous conditions

- Ensure safety of rail commuters near stacking yard and construction and fabrication sites Ensure safety while transferring construction material at construction site within rail premises. Obtain permission from DRM. Railway Manager) for power and/or operation blocks. As far as possible the blocks will be during non-traffic hours- 2-5 am.

- Compliance to road safety rules

The driver/vehicle operator should be trained in traffic rules, safer/ defensive driving practice, road courtesies etc. Road transportation vehicles should not be loaded with bulk materials beyond the safe clearance Vehicles will have speed restrictions.

8.11 Commuter Management Plan

The Contractor shall provide commuter management plan for the worksites (05 locations) for the safety of daily commuters at the proposed FOB construction sites.

- Contractor to visit the site and make sure of requirement of temporary alternate approach pathways required during construction, areas for storage of construction material and areas & extent to which removable barricading may be required for access control. All measures required to ensure that commuter’s movement is safe and least affected, shall be provided at no extra costs

- The signage, barricading and other safety and environmental monitoring requirements shall be as per ESHSMP and to be provided at no extra costs.

- The contractor is required to prepare detailed construction methodology plan covering these areas and get the same approved from the client/ engineer before commencement of construction work.

- Commuters movement will be affected mainly at Ambarnath Station (59/35), Badlapur station (67/06) , Kopar station, (68/14 Vangani FOB near Badlapur station), Kalwa (35/), and- Virar (66/3) due to major construction work, however, in addition if there are other locations, where commuter movement is affected, contractor to follow Commuter Management Plan at these locations too.

8.12 Construction / Occupational Health and Safety Management Plan

The contractor shall provide labour camps with adequate drainage, clean and sanitary premises, crèches, cooking facilities, adequate and convenient water supply, adequate toilet facilities, and sewage disposal facilities.

- The contractors shall comply with Safety, Health and Environment (SHE) Manual along with contract conditions of client related to safety, health and environment.

- Contractor shall prepare a contract specific SHE plans and submit the same to client. These plans should be based on applicable safety, health and environment regulations e.g. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996, State Building and Other Construction Workers' Rules, Building and Other Construction Workers' Welfare Cess Act, 1996 and Central Rules, 1998, The Factories Act 1948, etc.

- Safety signage / display boards should be provided wherever required to provide awareness about safety, health and environment aspects.
- The sides of excavations/foundations can be supported by sheet piling or bracing to guard against the danger to workers from fall or dislodgement of earth, rock or other materials.
- Training should be provided to workers about hazards related to the job, usage of equipment and machinery, tool box talk, health and safety, etc.
- As project site is located at or adjacent to existing railway station, precautions should be taken while planning work activities considering existing train frequencies, power lines and associated facilities.
- Workers should be provided with adequate personal protective equipments as per the nature of job/work being carried out.
- Workers shall be given job rotation to minimize the impact of higher noise levels and repeated mechanical shocks and/or vibration.
- Preventive maintenance and servicing of equipment and machinery should be done to avoid any incident and breakdown.
- Each machine and tools should be inspected by the operator and supervisor before start of work.
- Regular inspection and maintenance of the rail lines and facilities shall be carried out to ensure track stability and integrity in accordance with national and international track-safety standards.
- Implementation of an overall safety management program equivalent to internationally recognized railway safety programs is prescribed. Work area should be barricaded and provided with measures to prevent trespassing. To further ensure public safety, the right-of-way close to habitation shall be fenced.
- Pre employment and on job medical check-ups should be carried out for all workers along with health fitness certificate.
- All electrical equipment installed shall have appropriate earthing and shock preventive mechanisms.
- Certified machinery and equipment shall be procured, with approved design safety and industrial standards.
- Pre-checks or inspection, maintenance and servicing of all machinery & equipment should be done as per scheduled.
- Contractor / client should ensure that a readily available first-aid kit, access to the ambulatory services, tie-up or details of nearby hospitals are continuously available.
- The management of solid waste, effluents, drains at site and labour camp should be done in such a way that there is no nuisance of odour, breeding habitats for mosquito/other vectors of disease, etc.
- The contractor should comply with the World Bank accepted guidelines on “Workers’ accommodation: processes and standards- a guidance notes by AIIB, IFC and the EBRD”. The contractor shall also comply with standards of International Labour Organization (ILO) and all the other relevant national acts/rules applicable as per the Ministry of Labour and Employment, Government of India.
- Fumigation / anti-mosquito breeding disinfectant should be carried out to control the vectors at site and labour camps.
- The use of corrugated roofing sheets containing asbestos fibers shall be avoided to the maximum extent possible.
- Contractor should provide adequate and safe water supply of drinking water and mobile toilets with septic tank should be provided at project site and labour camp.

- The building and other construction workers’ (regulation of employment and conditions of service) act, 1996 requires that
    - No child labour should be involved in any of the activities
    - Only competent person should allow on heavy work.
    - All equipment and machinery shall be inspected before starting the work and all are certified by the competent person.
    - Every worker should be provided training related to job safety and other hazards related to job.
    - Periodical medical check-ups shall be organized for workers.
    - Each worker shall be given personal protective equipment (PPE) which is mandatory to use while working.
    - Each incident should be reported so that preventive measure can be taken to avoid reoccurrence of such incident.
- All machinery and equipment should be covered with acoustic materials. All exhaust should be provided stacks to release of gaseous emission at safe height.
- Efforts shall be made to avoid the storage of hazardous chemicals near any residential area. Hazardous chemicals shall be labelled and stored in locked facility under authorized person. Contractors shall be required to adopt and maintain safe working practices. Usage of appropriate signage in local language at the construction sites should be displayed generously and visibly to make the travellers aware of the ongoing work. Adequate lighting and fluorescent signage shall be provided at the construction sites.
- The camps should be at sufficient distance from such area and labours should be instructed about not using such areas for trespassing and for other activities.
- Regular SHE audits shall be conducted by the contractor with support of expert technical team on regular basis. The frequency of the audit shall be as per the SHE manual. The audit report shall be submitted to MRVC on timely basis. Based on the suggestions given in the audit report; improvement measures shall be taken by the contractor.
- All accidents and dangerous occurrences shall immediately be informed verbally to the MRVC, followed by a written communication giving brief about incident of accident, date/ time of occurrence. This will enable the MRVC to reach to the scene of accident dangerous occurrences to monitor/ assist any rescue work and/ or start conducting the investigation process so that the evidences are not lost.
- The Contractor shall prepare as required under the relevant rules of State Building and Other Construction Workers' Rules, an Emergency Response Plan for all work sites as part of the Contractor SHE Plan.
- The Contractor shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form is an essential part of safe systems of work for many construction activities.

8.13 Community Health and Safety

Access control and barricading should be done to prevent the entry of unauthorized persons on construction sites which protect people from exposure to construction site activities and any possible accidents. Following additional mitigation measures should be incorporated to avoid/reduce the potential impacts:

- Comprehensive traffic management plan should be prepared to avoid traffic congestion in the region.
- Efforts should be made to avoid heavy vehicle movement during peak traffic hours.
- Use of open ground, community properties, etc. for project activities or parking should not be done without proper permissions of concern authorities.

- The labour camps should be at sufficient distance from nearby habitations and labours should be instructed about not trespassing any other area.
- Efforts should be made to avoid dismantling / misfunctioning of any community infrastructure like road, gas, telecommunication, etc. without prior permission of concern authorities and due intimation to community which will be affected.
- If there is necessary, then contractor should provide other alternative options for locals.
- All community utilities likely to be impacted, such as sources of water, community centre etc. shall be relocated to nearby suitable places.
- The work scheduled should be arranged to avoid any nuisance to nearby communities.
- Use of agricultural land for storage of construction materials and equipment’s should be avoided.
- Work area should be barricaded to ensure public safety and access to such area should be prohibited for locals and passers-by.
- Contractors should display appropriate signage in local language at the construction sites to make the travellers aware of the ongoing work.
- The segregation, storage and disposal of various solid and liquid wastes generated at site should be as per relevant applicable national regulations. Disposal of solid and liquid waste should be done at designated areas with proper permission from concern authorities.
- All construction machinery and equipment’s should be operated and maintained regularly in such a way so that air emission, noise or vibration related impacts are minimal on nearby community.
- Train / Worker Accidents

Railway workers in the vicinity of rail lines are exposed to moving trains. Recommended management strategies include

- Training workers in personal track safety procedures.
- Blocking train traffic on lines where maintenance is occurring (“green zone working”) or, if blocking the line is not feasible, use of an automatic warning system or, as a last resort, human lookouts.

Electric and Magnetic Fields

- Railway workers on electric railway systems may have a higher exposure to electric and magnetic fields (EMF) than the general public due to working in proximity to electric power lines.
- Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program including the following components:
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, and limiting access to properly trained workers
- Implementation of an action plan to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE).

Pedestrian Safety

Trespassers on rail lines and facilities may incur risks from moving trains, electrical lines and equipment, and hazardous substances, among other issues. Measures to minimize, prevent, or control trespassing include:

- Posting of clear and prominent warning signage at potential points of entry to station areas (e.g. main entrance gates, parking, staircases etc.);
- Installation of fencing or other barriers at station ends and other locations to prevent access to tracks by unauthorized persons;
- Local education, especially to young people, regarding the dangers of trespassing;
- Designing stations to ensure the authorized route is safe, clearly indicated, and easy to use;
- Use of closed-circuit television to monitor rail stations and other areas where trespassing occurs frequently, with a voice alarm system to alert trespassers.

8.14 Contract worker Accommodation Plan

As indicated earlier, it was estimated that, during the peak construction phase, approximately 70-100 workers will be employed. While most of the workers in the unskilled and semi-skilled categories will be hired from the neighbouring areas, the manpower requirement in the skilled and highly skilled categories will be sourced from outside the state based on their availability.

The AECOM team during site visit identified that there are two existing labour camps, further, on the basis of consultation with MRVC site team, it was informed that workers' colony/ accommodation shall be established during construction which will provide accommodation to approximately 100 workers. The accommodation will comprise amenities like electricity, fan, cart, mobile charging point, separate toilets, cooking facility, drinking water, domestic water facility etc. the contractors informed that the accommodation facility shall be located near construction sites on IR land. Labour camps are to be developed as per the Worker Accommodation Plan developed by MRVC/ or the contractors to comply with Indian legislation, AIIB and EBRD[29] requirements.

The guidelines/ principles to be followed while undertaking the various key activities during the construction and operations of the labour camp by the EPC Contractor are as follows: -

Design / Construction standard

- The height of the rooms should at least be 10 feet;
- The floor should be constructed from PCC Brick work in cement mortar and cement pointing with truss supporting roof or Prefabricated Insulated plastic-coated sheets;
- The minimum area of each room should be 22.5 square meters and the minimum area per person should be 3.5 square meters;
- Maximum 6 numbers of people should be provided accommodation in one room and all of them should belong to the same gender;
- Separate room should be provided to family members;
- There should be separate entry for Bachelors and workers living with their family members in order to ensure privacy of the family members of the workers;
- All rooms should be provided with at least one window for ventilation and adequate illumination;
- External lighting should be provided in the camp area to allow persons to move safely during the night time;
- Toilets/ drains should be connected to the septic tank and cleaning of the septic tank should be ensured regularly;
- Before construction of the Labour Camp, fire safety assessment should be done of the proposed site by qualified Fire Safety Personnel and all the suggests proposed therein should be incorporated while construction of the Labour Camp;
- Electrical safety norms should be adhered to ensure electrical safety in the Labour Camp e.g. earthing, MCBs, wiring as per electrical load etc.;

[29] Workers’ accommodation: processes and standards A guidance note by IFC and the EBRD

- Adequate drinking water should be provided as per generic standards and the same should be monitored on a monthly basis; and
- Sanitation and drainage should be ensured in order to maintain proper hygiene in the Labour Camp.

Drinking water

- All containers used for distribution of water shall be clearly marked ‘Drinking Water Only’ or equivalent and are not to be used for any other purpose;
- Portable containers used for dispensing of drinking water shall have right fitting lids and equipped with a tap. These containers should be kept clean and free from contamination;
- Tanker trucks used for transporting portable water shall be clearly identified and shall not be used for any other purpose;
- Outlets dispensing non-drinking water – for washing, bathing and toilets shall be marked ‘caution – water unfit for drinking and cooking’; and
- Drinking water should meet national/ local drinking water standards.

Toilet/ Washing/ Showering Facilities

- Adequate toilet/ washing/ showering facilities should be provided in the Labour Camp. The number of toilets and showering facilities will depend on the size of the Labour Camp and the number of workers being accommodated therein;
- Toilet/ Washing facilities should be provided as required to maintain healthy and sanitary conditions in the Labour Camp. Such facilities should be properly maintained and provided with potable water and drainage to prevent pooling of water; and
- The areas shall be checked and cleaned daily by a crew comprising of Sanitation workers. Disinfection of floors, sinks and toilet bowls should be carried out by the EPC Contractor.

Hygiene and housekeeping

- High standard of hygiene and housekeeping shall always be maintained in the Labour Camp;
- The disposal of waste shall be done regularly as required and disposed of in accordance with the applicable local and national regulations;
- Containers for waste materials shall be placed in all areas and cleaned on a regular basis;
- Rubbish should not be dumped or disposed of indiscriminately but shall be stored in sealed rubbish bags at designated collection points for removal by the sanitary crew for disposal;
- No open fires shall be allowed within the Labour Camp; and
- Pest control measures should be in place to control insects and this should include flogging and spraying during the mosquito breeding season.

First aid/ Medical facilities

Access to adequate medical facilities is important to maintain workers’ health and to provide adequate responses in case of health emergency situations. The availability or level of medical facilities provided in the Labour Camp/ Worker’s accommodation is likely to depend on the number of workers living on site, the medical facilities already existing in the neighbouring communities and the availability of transport. However, first aid must always be available in the Labour Camp.

Audit and Inspection

- The Contractors and the caretaker of the Labour Camp shall make a weekly inspection and record the observations along with any required corrective actions.

- The Contractor Site-in-Charge will inspect the Camp on a monthly basis along with the EHS person. The proposed inspection should use the points illustrated in this document as a guiding tool.
- Non-conformances identified must be corrected within the agreed timeline.
- Non compliances observed during the audit will attract penalty which will be decided by the Project Manager in line with the terms and conditions of the Contract.

8.15 Environmental Monitoring Plan

The objective of environmental monitoring plan is to:

- Evaluate the performance of mitigation measures proposed in the EMP
- Suggest improvements in management plan, if required.
- Enhance environmental quality
- Comply with the Statutory and community obligations
- Warn significant deteriorations in environmental quality for further preventive action

This exercise will aid implementation of mitigation measures by way of generating a continuous feedback system in structured format. At the same time, this could be used for conducting corrective action in respect of pitfalls as noticed during inspections. Effectiveness of the proposed mitigation measures during the construction period will be monitored using key environmental performance indicators, which are described below. The key Environmental Performance Indicators that will be used to evaluate the effectiveness of the proposed environmental safeguards in relation to community health and safety in the project area are:

- Air Quality
- Water Quality
- Noise & Vibration Level

Air Quality Monitoring

The air quality monitoring is recommended through NABL accredited and MoEF&CC approved laboratory during the construction phase of the project. The monitoring of air shall be conducted at the location of worksite, material stockyards, and haul roads. Air quality shall be analysed as per the National Ambient Air Quality Standards (2009), CPCB. Parameters: Suspended Particulate Matter (SPM), Particulate Matter (PM2.5 and PM10), Sulphur dioxide (SO2), Nitrogen oxides (NOx), Carbon Monoxide (CO), Hydrocarbons (HC).

Air quality shall be monitored thrice a year (3 seasons) during construction phase and once a year, preferably in winter season, during operation phase and compared with the AAQ monitoring results obtained during the baseline monitoring to record changes in the AAQ and undertake suggested measures to mitigate the adverse impacts. Continuous 24 Hours Monitoring should be carried out. The detailed Ambient Air Quality Monitoring Plan is presented in table below. The additional locations if required; shall be identified by the Contractor with help of Environment Cell of client.

Water Quality Monitoring

Water quality shall be monitored once in 3 months (4 times a year) throughout the project duration to cover seasonal variations and one year after the completion. Water quality shall be monitored through NABL accredited and MoEF&CC approved laboratory. Surface water should be monitored for parameters as per CPCB Designated Best Use classification and groundwater should be monitored for the parameters of IS:10500. The detailed Water Quality Monitoring Plan is presented in table below. The additional locations if required; shall be identified by the Contractor with help of Environment Cell of MRVC.

Noise and Vibration Level Monitoring

Noise and Vibrations are to be monitored for 24 hours at each location to cover maximum train traffic in a day. Following parameters will be recorded while monitoring:

- Noise levels in dBA
- Peak Particle Velocity (PPV) in mm/s
- Acceleration
- Displacement
- Vibration
- Height of the instrument
- Distance of the recording instrument from the existing track

Ambient Air Quality Standards in respect of Noise prescribed in Noise Pollution (Regulation and Control) Rules, 2000 (see rule 3(1) and 4(1)) shall be adopted for noise monitoring. Permissible limits of ground vibration specified by Director General of Mines Safety (DGMS) through its Circular No. 7 of 1997 shall be used for Vibration level monitoring. Continuous 24 Hours Monitoring should be carried out.

The detailed Noise and Vibration Level Monitoring Plan is presented in **Table 8-1.** The additional locations if required; shall be identified by the Contractor with help of Environment Cell of client.

Table 8-1: Environment Monitoring Plan

Sr. No	Environmental Attribute	Sampling location	Criteria for Selection	Responsibility	
				Construction Phase	Construction Phase
1	Ambient Air Quality	Near AmbarnathAmbarnath railway station	Proximity to construction work & increased rail traffic	Once in 3 months (4 times a year)	Client through Contractors
2	Ambient Air Quality	Near Badlapur railway station	Rail movement, constructions and management	Once in 3 months (4 times a year)	Client through Contractors
3	Ambient Air Quality	Near Virar railway station	Proximity to construction work & increased rail traffic	Once in 3 months (4 times a year)	Client through Contractors
4	Ambient Air Quality	Near Kalwa Railway Station	Rail movement, constructions and management	Once in 3 months (4 times a year)	Client through Contractors
5	Ambient Air Quality	At. Ch.68 towards Vangani	Proximity to construction work and sparsely populated area	Once in 3 months (4 times a year)	Client through Contractors
6	Water Resources – Ground Water	Kalwa	Project water demand	Once in 3 months (4 times a year)	Client through Contractors
7	Water Resources – Ground Water	Virar	Project water demand	Once in 3 months (4 times a year)	Client through Contractors
8	Water Resources – Surface Water	Lake near Badlapur Railway Station	Project water demand	Once in 3 months (4 times a year)	Client through Contractors
9	Noise and Vibration Level Monitoring	Near Ambarnath Railway Station	Increased rail traffic, man movement, project activities	Once in 3 months (4 times a year)	Client through Contractors
10	Noise and Vibration Level Monitoring	Near Kalwa Railway Station	Increased rail traffic, man movement, project activities	Once in 3 months (4 times a year)	Client through Contractors
11	Noise and Vibration Level Monitoring	Near Virar Railway Station	Increased rail traffic, man movement, project activities	Once in 3 months (4 times a year)	Client through Contractors
12	Noise and Vibration Level Monitoring	Badlapur Near Ch.68 Towards Vangani	Increased rail traffic, man movement, project activities	Once in 3 months (4 times a year)	Client through Contractors

8.16 Proposed Implementation Mechanism

MRVC is the project-implementing agency for MUTP-III projects. In that role, MRVC is accountable for satisfactory completion of the project works proposed under this Project. As the project implementing agency, MRVC, on behalf of Government of Maharashtra and Indian Railways, is responsible for financing and procuring all the contracts financed by the World Bank loan, as well as for executing the identified works in the field, with due safeguards in consultation with the Western Railways (WR) and Central Railways (CR). MRVC will have contractors for implementation of civil/mechanical/electrical works. Also, MRVC will have a Project Management Consultants (PMC) to supervise the work at all the stages including successful implementation and monitoring of ESHSMP during construction stage. The project timeline will be decided by MRVC. The details of the time line for procurement works, implementation of civil/mechanical/electrical works and activities to be carried out by the respective agencies (i.e. MRVC, Project Management Consultants and Contractors) will be mutually decided between MRVC and the contractor with support of PMC.

For the implementation of the proposed projects under MUTP-III, it is proposed to have Environmental Management Group (EMG) within PMC for environmental management and monitoring. Also, the contractor shall have Environment Management Team (EMT) for successful implementation of ESHSMP. MRVC shall form an Emergency Response Cell which will comprise of combine team members of PMC, the contractor and MRVC. The EMG and EMT shall be formed separately for Mid- Section Trespassing Area.

The team responsible for execution of the EMP and their designated levels of responsibilities are delineated below:

- The Project Proponent – MRVC will be responsible for providing all the necessary funding and administrative support to the ESHSMP; and be ultimately responsible for carrying out the project with total commitment to environmental matters. MRVC will also be responsible to redress the grievances of the stakeholders during construction phase.
- The PMC deployed by MRVC will be responsible to execute the work of all the stages during construction. Contractor shall form an Environment Management Group (EMG) with following designated responsibility.
    - Completion of the work related to successful implementation of EMP during construction stage
    - Monitoring the compliance related to Safety, Health and Environment (SHE) Manual

Contractor’s site team will be responsible for coordinating the activities of monitoring and managing compliance of the ESHSMP. The responsibilities include technical, community and administrative matters related to the ESHSMP, including liaison with the general public in the project area, other parties and regulatory bodies on environmental issues related to the project. The team will also be responsible for keeping the local communities informed of the environmental compliance of the project and properly address any issues of their concern.

EMG shall comprise of following team members having a professional background related to SHE.

- SHE Manager
- Environmental Engineer
- Safety Engineer
- Accident Prevention Officer
- Others; based on the Project Requirements

Adequate, qualified, and trained SHE Professionals with required support staff to be deployed at each worksite at each shift. The supervisors and workmen shall be provided in all the departments related to SHE. The additional staff with other expertise e.g., transportation, fire, occupational health etc shall also be included in the team based on the project requirements. The report related to compliance related to ESHSMP shall be submitted to MRVC on regular basis.

The Construction Contractor and PMC will be responsible for successful implementation of the project. The contractor should ensure full compliance with environmental matters related to construction activities, as laid down in the ESHSMP. The Construction Contractor will ensure that all his workers are properly briefed in environmental

matters in terms of the Dos and Don’ts while they work on the project. The contractor should form an Environment Management Team (EMT) for meeting the requirements of ESHSMP.

The EMT shall comprise of following team members having a professional background related to SHE.

- Chief SHE Manager/Head
- Sr. SHE Manager
- SHE Manager
- Safety Steward
- Sr. SHE Electrical Engineer
- SHE Electrical Engineer
- SHE(Fire) Engineer/ Sr. SHE (Fire) Engineer
- Occupational Health officer with noshing assistant
- Environment Engineer
- Sr. SHE Traffic Engineer
- Maintenance Manager
- Housekeeping Squad
- Labour Welfare Officer
- Others; based on the Project Requirements

Adequate, qualified and trained SHE Professionals with required support staff to be deployed at each worksite at each shift. The supervisors and workmen shall be provided in all the departments related to SHE. The additional staff with other expertise e.g. transportation, fire, occupational health, safety, Environment etc shall also be included in the team based on the project requirements.

The contractor should comply with Safety, Health and Environment (SHE) manual prepared by MRVC. The report related to compliance related to ESHSMP shall be submitted to MRVC on regular basis. Organization Structure for the Implementation of the proposed Project is illustrated in **Figure 8-1**.

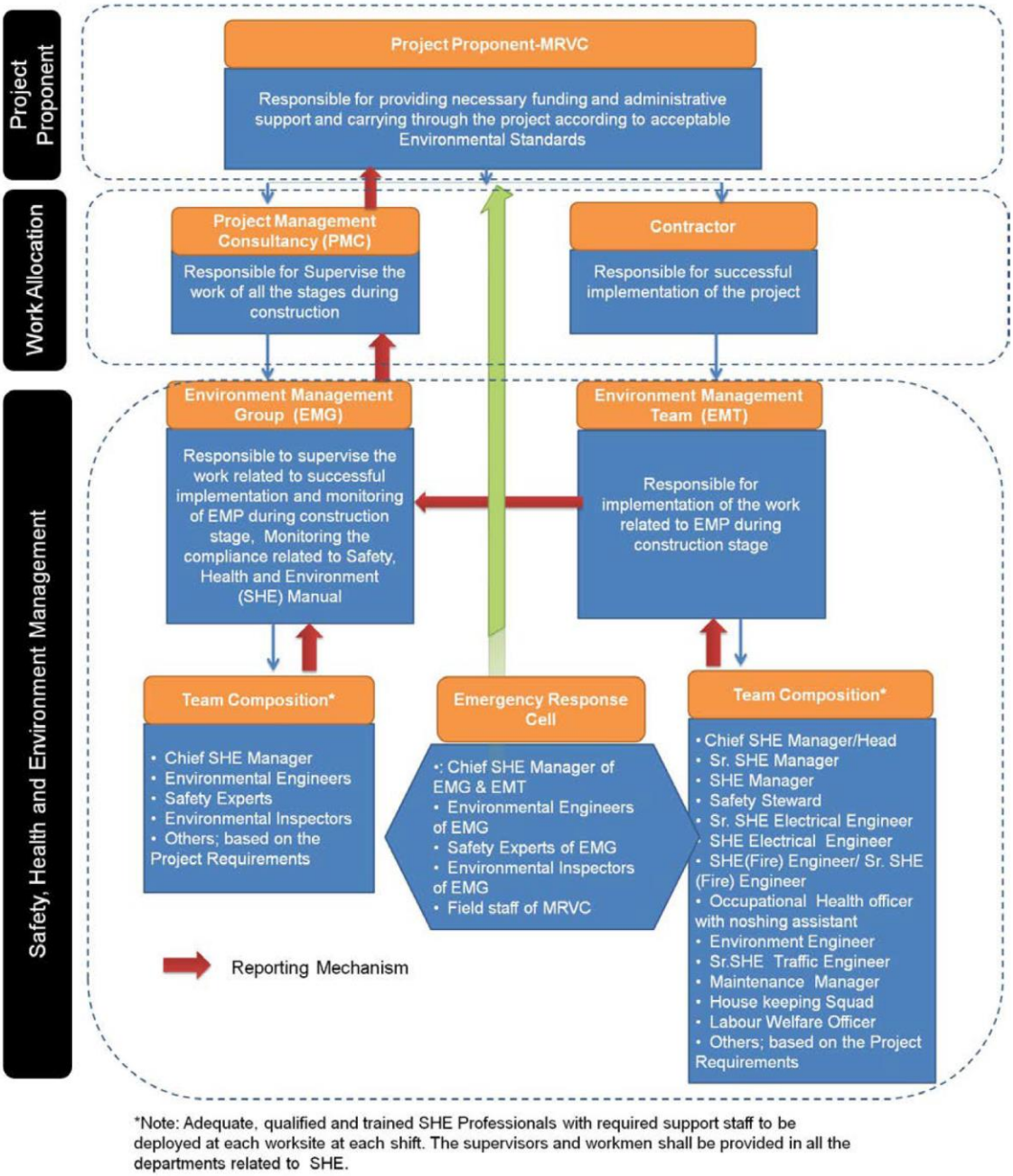


Figure 8-1: Organization Structure for the Implementation of the proposed Project

The Contractor shall be required to submit for approval, and subsequently implement, the Contractor’s ESHSMP in accordance with the Particular Conditions of Contract that includes the agreed Management Strategies and Implementation Plans described in table 8.2 below.

Table 8-2: Environmental, Social Health, and Safety Management Plan (ESHSMP)

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
Pre-Construction Phase: Environmental Social Health & Safety Management Plan (ESHSMP)						
1	Licensed quarries	Since quarrying is a regulated activity and in order to minimize the direct and indirect impacts on land degradation, Contractor shall source aggregate etc., from licensed quarry operator for all construction activities. Contractor shall provide a copy of the valid Licenses to MRVC before final selection of quarry. Client (MRVC) shall be informed well in advance regarding change in the source.	Contractor	Engineer's Representative	Before start of Work and before every change of quarry. Random Inspection of quarry site.	License from authorized source A copy of the valid licenses to be maintained by the contractor.
2	Sand mining	Since sand mining is a regulated activity and in order to minimize the impact on aquatic ecology and land degradation, Contractor shall source sand from a sand mine authorized/ approved by Ministry of Environment and Forest (MoEF&CC). Contractor shall provide a copy of the valid License of mining operator to MRVC before final section of sand mine. Client (MRVC) shall be informed well in advance regarding change in the source.	Contractor	Engineer's Representative	Before start of work and every change of source of sand. Random Inspection of mining site	License from authorized source. A copy of the valid licenses/approval to be maintained by the contractor.
3	Ready Mx Concrete (RMC)	In case Contractor proposes to use ready mix concrete (RMC), it shall be sourced from RMC plants with CTE & CTO from State Pollution Control Board (MPCB)	Contractor	Engineer's Representative	Before start of work and every change of source RMC	A valid copy of NOC/ CTE /CTO State PCB for RMC plant to be maintained by the contractor.

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
4	Clearance of Vegetation and Tree felling	In order to minimize disturbance in local ecology due to clearance of shrubs and bushes and tree trimming & tree felling following is suggested: 1. Avoid cutting of tree branches and shrubs to the extent possible. 2. Planting native trees/plants and enhancing biodiversity of the area through butterfly parks, medicinal plant gardens 3. Clearing of vegetation and trimming of trees in accordance with http://www.indianrailways.gov.in/railwayboard/uploads/directorate/civil_engg/downloads/acs_irpm/irwm.pdf, page 172 clause715 4. Tree trimming/ felling permission from relevant authorities 5. Tree plantation in the ratio of 1: 5 ie. 5 trees to be planted for 1 tree cut. 6. Contractor shall follow the EMP for all the mid section trespassing locations where tree cutting/ trimming is required 7. All locations – Shrubs/ Bushes clearance Central Railway. For Virar- Shrubs/ Bushes clearance Western Railway.	Contractor	Engineer's Representative	Before commencement of actual site work	Permission to trim the tree branches & tree cutting will be obtained from Municipal Corporations/ ULBs /Tree authorities by contractor. A valid copy of NOC/ to be maintained by the contractor.
5	Site preparation	Before start of work the Contractor shall provide silt traps at required locations to avoid soil runoff during monsoon. Contractor shall prepare a construction schedule in such a way that earth work execution is avoided in monsoon.	Contractor	Engineer's Representative	Before start of work	Visual inspection records
Construction Phase: Environmental Social, Health & Safety Management Plan (ESHSMP)						
6.	Transport of materials to site Movement of construction	1. During transportation of materials to construction site, vehicles engaged by the Contractor shall comply with Safety requirements and operate on the road	Contractor	Engineer's Representative	Random checks. Maintain accident/ incident records.	Maintaining accident or incident records and Visual inspection records

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
	machinery/ vehicles Parking of construction vehicles	network enroute to site without causing nuisance/ disturbance. 2. Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered 3. It is recommended to transport the material during night time (10 pm to 5 am) and the prior permissions from the concerned department should also be obtained.				
7.	Rail traffic management	Ensure safety of rail commuters near stacking yard and construction and fabrication sites Ensure safety while transferring construction material at construction site within rail premises. Obtain permission from DRM. (Divisional Railway Manager) for power and/or operation blocks. As far as possible the blocks to be during non-traffic hours	Contractor	Engineer's Representative	Random checks. Maintain accident/ incident records	Maintaining accident or incident records and visual inspection Records
8.	Damage to road surface	1. Heavy equipment (above 15-20 tonnes), crawler-mounted machinery and steel wheel mounted rollers shall be mobilized to construction site without causing any damage to network roads in the city/ urban area. Such heavy equipment shall be preferably mobilized on multi-axial heavy trucks. 2. Use of Heavy equipment results in Soil Compaction which need to be minimized	Contractor	Engineer's Representative	Random checks	Visual inspection record
9	Protection of Air quality monitoring Impact on air quality due to:	The air quality management plan mentioned below to be followed during construction at all locations. 1. Vehicular pollution check for all the vehicles used during construction, operation and	Contractor	Engineer's Representative	Suitable as per construction Needs Air quality monitoring schedule is	Contractor will maintain following records: Air quality monitoring record, Vehicle test

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
	1. Fugitive dust emissions in atmosphere 2. Dust and Gaseous emission from heavy machinery and vehicles Emissions from diesel DG sets	inspection shall be made mandatory. 2. The excavated material shall be stored properly so that it does not generate fugitive emissions. Location of storage areas should be selected such that it is downwind of the habitation area and also there is no run off from the storage site during monsoon. 3. Stockpiling of the construction material and wet spraying of the stockpile to prevent fugitive emissions should be ensured by the Contractor 4. Earthworks shall be sprayed with water during and after compaction of the sub-grade to prevent dust generation wherever practical. 5. All the machinery and equipment shall be regularly maintained. It is recommended to transport the material during night time (8 pm to 5 am) and the prior permissions from the concerned department should also be obtained. This should be included as part of the Contract conditions to be signed with the Contractor. 7. Air quality monitoring for the same parameters, which were monitored during the Environment Impact (EA) studies, shall be monitored by the Contractor by hiring the services of the NABL accredited and MoEF Notified laboratory. MRVC will monitor that the AAQ monitoring program and air pollution control are scrupulously implemented. Air quality during construction phase will be monitored to ensure that the			provided in Table 8-1.	certificates Visual records and checklists, Safety checklist, Equipment maintenance records PUC certificates

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		construction activity does not have adverse impact on environment. 8. DG sets shall be CPCB compliant. 9. An appropriate sampling port location must be ensured in DG sets as prescribed in Emission Standards notified by MOEF&CC, 2013. 10. Low sulphur diesel should be used in DG sets as well as machineries. 11. Air pollutant emissions are regulated under Central Motor Vehicles Rules, All vehicles to comply with this requirement. http://www.tn.gov.in/sta/Cmvr1989.pdf 12. A Separate or master register of vehicle's shall be maintained at construction site office containing details of vehicles under deployment and a copy of PUC certificates.				
10	Protection of water quality 1.Excessive Water withdrawal / Consumption from ground and surface water sources during construction period. 2. Water stagnation and Creation of temporary breeding	The water quality management plan mentioned below to be followed during construction at all locations wherever applicable: 1. The contractor shall arrange for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected 2. Fumigation and spraying of anti-mosquito breeding pesticides should be carried out to control the vectors in the nearby water bodies and on regular basis by the Contractor. Periodic removal of aquatic weed which gives shelter to vectors should be carried out by the Contractor to control the water borne or the vector diseases. 3. The drains should be maintained on	Contractor	Engineer's representative	Suitable as per construction Needs Water consumption details- daily	Maintenance of daily water consumption records along with source by contractor. Maintenance of Records of frequency of storm water drain cleaning where applicable.

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
	habitats for mosquito/other vectors of disease. 3.Impact on existing storm water management	regular basis to avoid waterlogging or flooding.				
11	Noise Levels 1. Noise and vibrations due to Metal Fabrication and assembling etc. 2. Noise & Vibration due to diesel DG sets. 3.Increase in Noise level due to construction activity, machinery movement.	The noise levels management plan mentioned below to be followed during construction at all locations: 1. Noise levels at construction sites shall be compliant with Environment (Protection) Rules, 1986 (Schedule VI, Part E) the noise generation standards applicable for construction (equipment, machinery, and vehicles. 2. All construction equipment and machinery shall be timely serviced and properly maintained to minimize its operational noise and equipment shall comply with occupational safety and health standards. 3. Construction activity and timing shall be regulated to minimize the intensity of the noise impact. 4. Construction equipment and machinery shall be fitted with silencers or isolated using acoustic medium wherever possible. 5. Metal Fabrication and assembling activities should be carried out in area where nearby there are no settlements.	Contractor	Engineer's Representative	Noise level monitoring schedule is Provide in Table 8-1	Maintenance of records of Noise monitoring reports during construction phase to be maintained by contractor Vehicle maintenance records to be maintained as per construction needs

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		6. Use of DG sets shall be kept minimum. 7. The DG sets and other construction equipment and machinery should be fitted with acoustic enclosures and a routine maintenance of the DG sets and other construction equipment's should be carried out to control the noise levels from these sources. 8. Noise levels during construction phase at locations which were monitored during the Environment Impact (EA) studies, shall be monitored by the Contractor by hiring the services of the NABL accredited and MoEF Notified laboratory. MRVC will monitor that the Noise monitoring program and noise abatement measures are scrupulously implemented. Noise levels during construction phase will be monitored to ensure that the construction activity does not have adverse impact on environment.				
12	Land / Soil Contamination due to Fuel /oil spills and other wastes	1. Fuel and lubricants should be stored at the predefined storage location to be identified by the Contractor in consultation with MRVC. The storage area should be paved with gentle slope to a corner and connected with a chamber to collect any spills of the oils. 2. All efforts should be made to minimize the hazardous waste generation. Unavoidable hazardous waste shall be stored at the designated place prior to	Contractor	Engineer's Representative	Monthly	Visual inspection Record Operating procedures, Safety check list, Visual inspection of soil.

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		disposal in the nearest Common Hazardous Waste Treatment Storage and Disposal Facility (CHWTSDF). Prior to transporting the hazardous waste, its packaging must be marked and sent to the CHWTSDF with proper manifests as required by the Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016. 3. Storing of fuel and lubricants shall be on an impervious flooring of at least 6" thick brick/ PCC work lined with polyethylene sheet. Lubricating/oiling equipment installations, fuel/ oil/ lubricant storage areas etc shall be avoided Wherever there is chance of oil spill secondary containment shall be used. If leaks and spills are unavoidable from stationary equipment, layer of dry sawdust or other organic absorbent material shall be provided to prevent contamination of ground.				
13	Compliance to road safety rules	1. The driver should be trained in traffic rules, safer/ defensive driving practice, road courtesies etc. 2. Drivers will have valid driving licenses Road transportation 3. Vehicles should not be loaded with bulk materials beyond the safe clearance. 4. Vehicles will have speed restrictions.	Contractor	Engineer's Representative	Monthly/ Random checks	Maintenance of incident or accident record Incident data/ report from traffic police Copy of driving licenses.

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
14	Transportation and storage of fine materials	1.Storage of material will be mainly at major construction site. 2.The excavated material shall be stored properly so that it does not generate fugitive emissions. Location of storage areas should be selected such that it is downwind of the habitation area and also there is no run off from the storage site during monsoon. 3. Tarpaulin/ Equivalent covering sheets shall be provided while transporting fine material such as cement/sand. Regular sprinkling of water on the surface of material stock to prevent dust generation due to storage and handling.	Contractor	Engineer's Representative	Weekly/ Random checks	Visual inspection. Maintenance of Record of the transport vehicles Records of water sprinkling details
15	Condition of construction vehicles	1. All equipment/ vehicles should be kept in good state of repairs 2. All vehicles registered under Central Motor Vehicle Act 3. There will be no excessive idling of construction vehicles at sites Rules, 2000 shall have valid truck certificate issued by authorized agency throughout their deployment period at construction site. 4. All equipment and machineries to be used shall comply with the design safety. 5. All equipment and machineries shall be inspected and certified by competent person. 6. All equipment and machineries shall comply with industrial standards.	Contractor	Engineer's Representative	Quarterly	Maintenance of equipment maintenance records

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		7. Preventive maintenance and servicing of equipment and machineries should be done to avoid any incident and breakdown. 8. All machine and tools should be inspected by the operator and supervisor before start of work.				
16	Utilities re-routing and shifting	• Minimal disruption period by way of installing alternate utilities prior to clearing utilities in impact area; • Avoid peak traffic hours and crowded period; • Advance intimation before to community before clearings and shifting utilities • Disclosure of GRM process to report pertinent grievances	Contractor	Engineer's representative	Bi-weekly	• Evidence of advance intimation to nearby community; • Evidence of GRM disclosure and Grievance records
17	Engagement of migrant workers and their labour camps	• A formal "Contractor management policy or/ code of conduct" in order to ensure that labours are engaged on the basis of contract labour licences, national and state regulations and no forced or child labours are engaged; • Quarterly health screening of all the employed labourers at the project site by the contractor/sub-contractor; • Maintenance of hygiene of the labour camp; • Provision of floor mats/mattresses and ensuring electricity connection for even one light and fan; • Providing the commuters, trespassers, fence-line community and the local community an understanding of the project activities and the possible health and safety risks associated with the same;	Contractor	Site Head/ Contractors	Monthly	• Contractor Management Plan; • Wage Records; • Grievance Register

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		• Avoiding presence of unsanitary conditions and better facilities in the campsite, such as safe drinking water, proper waste collection and disposal system, etc.				
18	Construction and demolition (C&D) debris generation	1. During interior demolition work above the first floor, debris chutes shall be used. 2. Demolition debris shall be kept in controlled area and sprayed with water mist to reduce debris dust 3. C&D waste will be cleared from the source of generation/ dumpsites and disposed of as per C&D Waste Management Rules on sites identified by Municipal Corporation/ ULBs by Contractor 4. Demolition and Desilting Waste (Management and Disposal) guidelines 2005 setup for Greater Mumbai may be followed in order to recycle the debris as much as possible. C&D activity will be expected at Central Railway Kalwa Station (35/4), AmbarnathAmbarnath Station (59/35):Badlapur station (67/03). However, contractor will follow the ESHSMP for all C&D activities at all locations wherever applicable.	Contractor	Engineer's representative	Monthly	Maintenance of records of permission for disposal of C&D waste, and disposal records.
19	Site Requirements	1. As far as possible the construction labor will not be staying at site/ near construction area. 2. However, depending upon the location of work and number of workers Contractor shall make alternate arrangements for providing water for drinking and sanitation facilities. 3. If there are construction camps, the	Contractor	Engineer's representative	At start of work & Monthly thereafter	Visual inspection, Records

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		contractor shall provide, erect and maintain necessary temporary living accommodation and ancillary facilities such as toilet blocks, potable water supply, canteen etc. as per standards set by various acts (Labor Act1951), Contract Labour Act 1970, Construction Worker Act 1996, Construction Workers Rules 1998, as applicable.				
20	Occupational Health and Safety of and commuters during construction	The building and other construction workers' (regulation of employment and conditions of service) act, 1996 requires that a) No child labor should be involved in any of the activities b) Only competent person should allow on heavy work. c) All equipment's and machinery shall be inspected before starting the work and all are certified by the competent person. d) Every worker should be provided training related to job safety and other hazards related to job. e) Periodical medical checkups shall be organized for workers. f) Each worker shall be given personal protective equipment (PPE) which is mandatory to use while working. g) Each incident should be reported so that preventive measure can be taken to avoid reoccurrence of such incident. h) All hazardous chemicals and materials shall be stored in dedicated area and covered. Signboard and labelling should be done.	Contractor	Engineer's representative	Weekly checks	Visual inspection, Maintenance of Records. Compliance with The building and other construction workers' (regulation of employment and conditions of service) act, 1996. As well as filled permits and safety inspection reports

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		Also, every chemical shall have material safety data sheet (MSDS). i) The stakeholders shall be notified of upcoming activities by displaying the boards containing project details, construction areas, period of construction, alternate routes if any to be followed during construction activity. j) Contractor will obtain necessary permits for performing dangerous operations like high voltage electrical work and install permit system for the workers. k) All work will be carried out in a safe and disciplined manner designed to minimize impacts on neighboring residents and environment. l) The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, earplugs (wherever applicable), masks etc. to the construction workers and staff. (contract as well as permanent staff) m) PPE used by construction workers shall comply with international good practice. n) The contractor will be required to appoint a safety officer who will conduct regular safety inspections at construction sites o) Contractor will ensure good health and hygiene of all workers to prevent sickness and epidemics and shall also provide First aid unit in case of emergency				
21	Environmental Health and Safety	1. First aid facilities shall be provided to the labor at the construction camp/ construction sites.	Contractor	Engineer's representative	Weekly checks	Maintenance of Inspection reports.

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		2. Suitable transport will be provided to facilitate take injured or ill person(s) to the nearest approachable hospital. 3. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness. 4. First Aid Box will be provided at every construction site and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital. 5. In case, the number of labor exceeds 50, the items in the first aid box shall be doubled. 6. Labour Act 1951, Railway Guidelines shall be complied with for first aid facilities.				Contractor will be required to appoint an Accident Prevention Officer (APO) who will conduct regular safety inspections at construction sites. The APO will have the authority to issue instructions and take protective measures to prevent accidents
22	Disposal of solid and hazardous material	1. Solid waste will be sampled and analyzed so that it can be classified as C&D/ Hazardous/ Municipal solid waste. 2. In case of Municipal solid waste, it will be disposed of in accordance with Municipal Solid Waste Management Rules on sites identified by Municipal Corporation/ ULBs by contractor. 3. Waste oil and platform roofs and are made up of Asbestos Cement sheets at (Badlapur station (64/5)and Kalwa Station 35/5) A portion of roofs will be removed where the new FOBs and highwalks are connected to the platforms.	Contractor	Engineer's representative	As per regulation	Maintaining records of waste analysis already dumped at construction site Maintaining hazardous waste inventory and inventory of solid waste and C&D waste

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		4. Apart from this at all locations if waste asbestos is generated, Waste asbestos handling and disposal shall be in line with World Bank requirements and requirements of Ministry of Environment and Forest. Hazardous Waste (Management, Handling & Trans boundary Movement) Rules, 2008 5. All efforts should be made to minimize the hazardous waste generation. Unavoidable hazardous waste such as waste oil shall be stored at the designated place prior to disposal in the nearest Common Hazardous Waste Treatment Storage and Disposal Facility. 6. (CHWTSDF).http://www.bwint.org/dfs/WB-asbestosGuidanceNote.pdfhttp://cpcb.nic.in/Hazardous_waste.php. to be followed.				
23	Communication and Training	1. Communication protocol with stakeholders will be developed for smooth and operation phase thus same to be submitted to MRVC/ Engineer's representative before commencement of work as a first step. The contractor must also follow it during occupation of site. 2. Environmental Monitoring Plan and Proposed Implementing Mechanism & Grievance redressal mechanism cell will be formed and the details will be available on MRVC website. 3. Training and awareness will be created to have safe construction activities and to handle any emergency due to construction work	Contractor	Engineer's representative	Weekly	Contractor to maintain the Training Records

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		4. Training will be provided twice a year, considering construction period as 1.5 years.				
24	Sustainable water/energy source	The measures include green initiatives such as maximum use of natural light at the facilities, energy saving by installation of energy efficient lightings and renewable energy sources such as installation of solar panels etc.	MRVC	Engineer's representative in construction phase and Concerned department of central/Western railway during operation phase	Initial inspection and periodic checks	Visual records
25	Closure of construction activity	1. At the completion of construction, all temporary facilities provided for construction workers shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include: a) Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas. b) Soak pits, septic tanks shall be covered and effectively sealed off. c) Debris (rejected material) should be disposed off suitably d) Ramps created should be leveled 2. Proper documentation of rehabilitation site is necessary. This shall include the	Contractor worked during construction phase of the project	MRVC/ Concerned department of central/western railway	Weekly	Records, Photograph

Sr No.	Environmental Issue	Mitigation measures	Responsibility		Supervision Frequency	Performance Indicator
			Implementation	Supervision		
		following: a) Photograph of rehabilitated site; b) Land owner consent letter for satisfaction in measures taken for rehabilitation of site; Undertaking from contractor that the site is closed as per the requirement				
26	Safety and maintenance of the new facility	Ensure safety, security and preventive maintenance of new facilities created such as skywalks escalators etc. so that the facilities will be safe and hazard free	MRVC	MRVC/ Concerned department of central/western railway	Initial inspection and regular safety checks at periodic intervals	Test certificates
27	Creating user friendly facilities for Physically challenged people or people carrying luggage	Escalators, and elevators will be provided to facilitate the easy movement of Physically challenged people or people carrying luggage at all the proposed FOB locations	MRVC	MRVC/ Concerned department of central/western railway	Initial inspection and regular safety checks at periodic intervals	Test certificates
28	Signage to increase awareness regarding trespassing	Signage and displays will be created at suitable locations at skywalks, FOB and track barricades to spread awareness regarding hazards of trespassing. This will help more people to use the facilities created for preventing the trespassing.	MRVC	MRVC/ Concerned department of central/western railway	Initial inspection and periodic checks	Visual records

8.17 Rapid Response Mechanism

The Contractor shall use Rapid Response Toolkit to address unexpected and potentially urgent Safeguards events or incidents using guideline for Incident Categorization and Notification.

- The Contractor shall classify events or incidents related to social, environmental, occupational health & safety as Indicative, Serious and Severe.
- Indicative is a relatively minor and small-scale event or non-compliance that is limited in its immediate effects but may be indicative of wider-scale issues within a project that could lead to serious or severe incidents or conditions. This exceeds a routine non-compliance in that it appears to be part of a broader pattern of non-compliance that could lead to more serious events.

Examples of Indicative Events

Environmental	Social	Occupational Health and Safety
Small- volume hydrocarbon or chemical spills	Small scale crop damage or livestock deaths.	Chronic underuse of personal protective equipment (PPE) by works contractor
Localized dust, light, or noise pollution	Grievances due to project use of public roads	Local increase in the occurrence of communicable disease
Illegal hunting of wildlife (non-endangered)	Project interference with locally significant events and sites	Numerous minor, but recurring job site injuries
Small volume sediment, pesticide, or fertilizer run-off into local waterways	Vehicle damage to public or private roads caused by Works Contractors	Poor "housekeeping" at site, e.g., littering and random disposal of solid waste
Minor off-site disposal of solid waste from project	Nuisance-level contact between employees and community	Lack of understandable warning or traffic control signage
Poor quality or delayed site restoration and revegetation	Minor instances of inappropriate behaviour of security forces or other Contractor personnel	Multiple "slip and trip" hazards throughout the site
Poorly functioning erosion-control measures	Overloading of local commercial services from use by project personnel	Poorly organized or sporadic health & safety induction and training

Serious is an event or condition that is causing or will cause significant harm to workers or community members, the type or extent of impact that would require an urgent response and that could pose a significant reputational risk for the Bank.

Examples of Serious Events or Conditions

Environmental	Social	Occupational Health and Safety
1. Large-volume hydrocarbon or chemical spills	Widespread crop damage or livestock deaths	Numerous injuries requiring off-site medical attention
2. Poaching of threatened or endangered species, or systematic over-exploitation of local resources	Systematic mistreatment of communities by project workers, incidence of gender-based violence (GBV)	Outbreak of life-threatening communicable disease
3. Large-volume or long-term sediment, pesticide, or herbicide runoff into waterways	Impacts to protected physical cultural resources	Presence of Unexploded Ordinance (UXO) at worksite
4. Large-scale deforestation	Significant incidence of inadequate resettlement compensation	Absence of first aid resources at work site
5. Failure to implement the agreed environmental restoration program	Significant and repeated community impacts from project vehicles and construction activities	Absence of health & safety plan and training

Severe is an event or condition of sufficient seriousness and highly significant harm that it may, in addition to the harm caused, pose a corporate risk to the Bank. Such an event may exceed the Task Team's resources. Resolving the event or condition will also require the notification and engagement of the Bank's Senior Management

Examples of Severe Events or Conditions

Environmental	Social	Occupational Health and Safety
1. Hydrocarbon or chemical spills requiring large-scale remediation	Forced resettlement of communities	Worksite fatalities
2. Systematic poaching or hunting and trafficking of threatened or endangered species	Systematic incidence of GBV	Multiple instances of serious communicable diseases among workforce or community
3. Sediment, pesticide, or herbicide runoff causing permanent damage to waterways	Significant damage to nationally protected environmental areas	Criminal and political attacks at worksite
4. Large-scale deforestation or destruction of internationally recognized critical habitat	Forced labour by project's Works Contractor	No GRM
5. Major river contamination causing decimation of fish population	Repeated human rights abuses by site security forces	Works Contractor is unresponsive regarding ongoing worksite risks of bodily injury

- The Contractor will communicate news of the event according to its category and then proceed with consultation and resolution activities: An Indicative Event is reported by Contractor to Emergency Response Cell and a Serious Event is escalated to Project Proponent (MRVC) and Severe event is escalated to the funding agency.
- The communication shall be immediate within 24-48 hrs of the event.

8.17.1 Progress Monitoring and Reporting Arrangements

A proper strategy is necessary for smooth implementation of the mitigation measures. For the implementation of proposed works under the ESHSMP, it is proposed to have a two-level institutional framework. It is proposed to constitute an Apex Committee to oversee the overall implementation of the proposed works and a Working Level Committee to monitor the implementation of works on the ground level.

The Apex Committee shall comprise of the senior officials from MRVC, Central Railway (CR), Western Railway (WR). The Apex Committee shall be the decision and policy making body to implement the MUTP-III projects including suggested environmental mitigation measures. The Apex Committee will report the progress of the works to the World Bank on a regular basis. Under the Apex Committee, it is proposed to constitute a Working Level Committee to monitor the implementation of the EMP by the appointed Contractor.

The Working Level Committee shall comprise of the Contractor, Project Management Consultant and Field Level Officers from MRVC. The Working Level Committee shall be responsible for implementation of all the proposed mitigation measures on the ground level and will ensure periodic monitoring of environmental parameters outlined in the ESHSMP. It shall ensure full participation of all key stakeholders and meaningful coordination in planning and time bound implementation of the mitigation measures proposed under the ESHSMP. It shall be responsible for co-ordinating with the local administrative bodies and other stakeholders. It shall also oversee the day to day work of all the contractors appointed under this Project and provide a monthly progress report to the Apex Committee.

The proposed institutional framework for implementing and monitoring the works proposed under the EMP is shown in **Figure 8-2.**

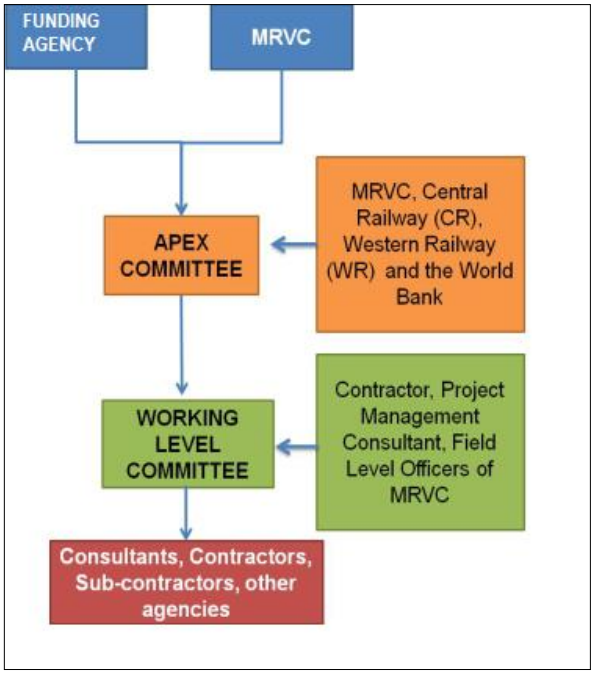


Figure 8-2: Proposed Institutional Framework for Monitoring of ESHSMP

8.17.2 Grievances Redressal Mechanism

Grievance Redress Mechanism (GRM) is an arrangement for receiving, evaluating, and facilitating the resolution of affected people’s concerns, complaints, and grievances about the borrower/client’s social and environmental performance on a project. MRVC will develop a Grievances Redressal Cell to receive and respond to the concerns, complaints, and grievances received from the stakeholders. The phone numbers and communication addresses for grievances will be displayed at various locations near construction site. The grievances will be received by following ways:

- Letter to Grievances Redressal Cell
- Telephonic grievances on the phone number linked to Grievances Redressal Cell. The grievances received telephonically will be noted in the telephonic grievances register.
- Grievances communicated to the field staff of MRVC/PMC/Contractor verbally by the stakeholders. The field staff of MRVC/PMC/Contractor should record the grievances reported verbally and shall also insist the stakeholders to give the written complaint in the format of “sample grievance form” given below in Table 8-3; which will be further given to the Grievances Redressal Cell. The grievances reported to GRC shall be documented/ recorded in the format of “Grievance register” given in below. MRVC will have a Public Relation Officer (PRO) who will redress the concerns, complaints, and grievances raised by the stakeholders with support of concern technical team of MRVC. The PRO will also have qualified support staff. PRO will be a nodal person who will transmit the letter/telephonic grievances register to the respective departments e.g., Civil, Mechanical, Electrical etc. within MRVC. Based on the response received from the technical team, PRO will respond back to the respective stakeholders via letter/email/telephonic communication regarding the complaints. PRO will also pass on the response of concerns, complaints, and grievances to the contactor and PMC for implementation of the actions suggested by MRVC on the grievances.

Table 8-3: Sample Grievance Form

GRIEVANCE REGISTRATION		
Case No.:	**Date:**	
Name: (Optional)		
City/ Location (optional):	**Phone no. (optional)**	
Details of grievance:		
Name of person recording grievances:		
Proposed date of response to grievance:		
Signature of recording person	**Signature/ thumb impression of grievant: (Optional)**	
GRIEVANCE REDRESSAL RESPONSE		
Date of redresses:		
Decision of Public Relation Officer/ PRO (give full details):		
Claimant accepts the outcome:	**Accepted**	**Not accepted**
Signature/ thumb impression of grievant:		
Signature of PRO:		

Source: AECOM

Table 8-4: Grievance Register Format

S. No	Date	Grievance number	Name of Grievant	City/ Location	Details of Grievance	Concerned Department (if internal)	Name of Recording Person	Present Status	Remarks
1.									
2.									
3.									

Source: AECOM

The Grievances which can be addressed shall include but not limited to:

- Noise pollution due to vehicular traffic, machinery etc.
- Air pollution due to construction activities
- Contamination of waterbodies due to disposal of any type of waste such as solid waste from labour camps, construction and demolition waste, oil spills etc.
- Use of productive land for material transportation or storage or labour camps without necessary permissions from concerned authority
- Issues related to compensation for land acquired

- Damage to any cultural or physical resources outside the project area
- Misbehaviour of labour with the local community
- Worker's compensation and overtime related issues
- Any misbehaviour issues among staff and contract workers etc.

The Grievances Redressal Mechanism is presented below in **Figure 8-3**

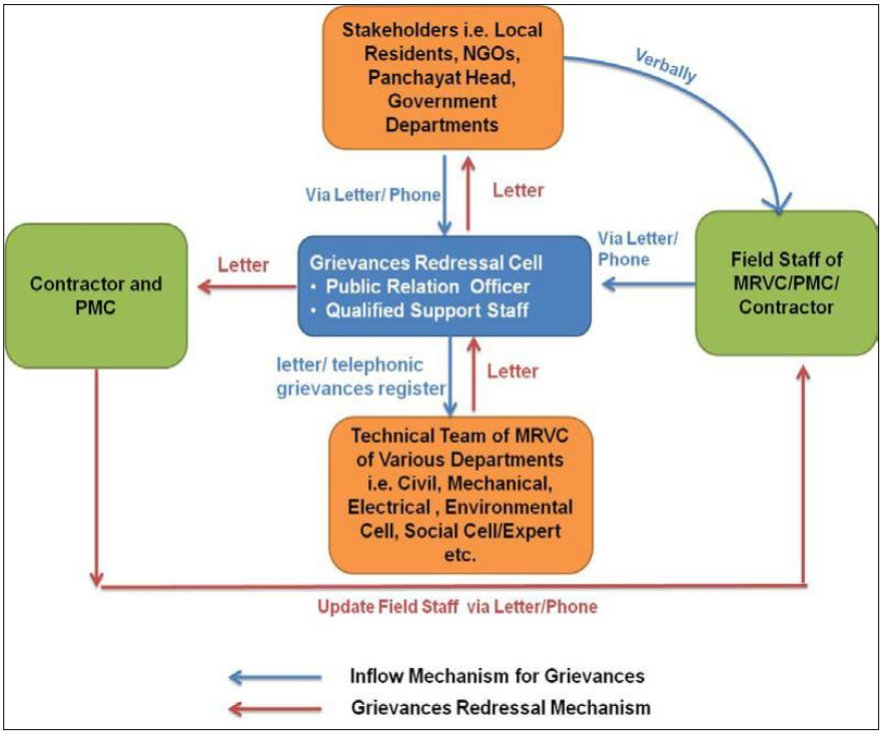


Figure 8-3: Grievances Redressal Mechanism

8.18 Environmental Budget

The indicative costing for implementing ESHSMP mitigation measures is provided in this report. The proposed mitigation costs have been bifurcated in three parts as described below

- Costs which may be incurred by the contractor on environmental measures
- Cost may be incurred by the contractor which is already included as works (Civil/ mechanical/ electrical/labour amenities etc) but, related to Safety, Health and Environment
- Cost to be incurred by MRVC during construction stage of the project.

Following assumptions has been taken while preparing the estimates of expenditure on proposed mitigation measures and EMP.

- Construction duration is considered as 2 years (24 months). Out of total 24 months; work will be on hold during 4 months of monsoon every year. Hence, actual months of construction will be 16 months.
- Number of labors working on construction site will vary based on the type of work proposed at each of the mid-section trespassing location. Hence, average 30 labours per Mid-section Trespassing location is considered. **Table 8-5** and **Table 8-6**, represent a detailed break-up of the estimate of expenditures, which may be incurred on environmental measures during the construction period of the project.

Table 8-5: Cost for ESHSMP - Mitigation Measures under the Scope of Contractor-Environmental

Sr. No.	Component	Stage (Construction/ operation)	Description	Unit	Unit Cost	Quantity	Cost (Indian Rupees)	Note/Assumptions
1	Air Quality	Construction	Dust management by water sprinkling/ spraying in the loading-unloading areas for construction material, stockpile of the excavated material, unpaved haulage roads other dust prone areas and construction yard	INR	10000	05	50,000	5 tankers used for water sprinkling
		Construction	Air Quality Monitoring as per as per the National Ambient Air Quality Standards (2009) at the identified locations	INR	10000	20	2,00,000	5 samples shall be taken. Sampling should be done once in 4 months for the construction duration of 2 years. Average Rate of sampling (Sample collection, analysis and mobilization charges)
2	Noise Quality	Construction	Noise monitoring as per the Noise pollution (Regulation and control) Rules, 2000 containing noise standards for residential, commercial and silent zones during day and night-time	INR	3000	20	60,000	5 samples shall be taken. Sampling should be done once in 4 months for the construction duration of 2 years. Average Rate of sampling (Sample collection, analysis and mobilization charges)
3.	Water Quality	Construction	Water Quality Monitoring as per IS 10500:2012 (except radioactive residues) or Schedule VI of Environment Protection Rules based on the applicability	INR	12000	20	240,000	5 samples shall be taken. Sampling should be done once in 4 months for the construction duration of 2 years. Average Rate of sampling (Sample collection, analysis and mobilization charges)
4	Vibration Level	Construction	Vibration Monitoring as per the standards (ISO Standards on vibration (ISO 2631/2- 1989, ISO 8041-1990, and I SO 4866-1990) or any other international standard to be finalized after discussion with MRVC)	INR	25000	20	500,000	5 samples shall be taken. Sampling should be done once in 3 months for the construction duration of 2 years. Average Rate of sampling (Sample collection, analysis and mobilization charges)
5.	PPE	Construction	Protection devices (earplugs or earmuffs) shall be provided to the workers operating near high noise generating machines	INR	100	1000	100,000	Considering 50% labour working near high noise generating machines and every year 2 times the protection devices are provided for 2 yrs.
6.	Waste Management	Construction	Cost towards hazardous waste management on the site (average)	INR/Ton (direct landfill)	3000	5.72	17,160	Assuming waste oil generated from the vehicles like dumpers, compactors etc. During maintenance 1 vehicle will generate 20 liters of waste oil. The maintenance activity will be done once in 3 months

Sr. No.	Component	Stage (Construction/ operation)	Description	Unit	Unit Cost	Quantity	Cost (Indian Rupees)	Note/Assumptions
								(total 4 times in 1 year and 8 times in 2 years). Assuming total vehicles on the site will be approx. 10. Hence, waste oil generated =20*10*8=1600 liter. Fuel oil density is considered as 890.13 kg/m^3. Now, converting value of liter to ton, 1 liter=0.00089013 Ton; 18000 Liter=1.4 T. Also, approx. 400 sq.m of asbestos with thickness of 3 cm will also be generated. Hence, volume of the asbestos=400*0.03=12 m^3. 1 Cubic Meters into Ton metric ton): For substance (Asbestos) with density: 360 kg/m^3 is 0.36 T. Hence, total waste generated from asbestos=12*0.36=4.32 T
5	Labour camp	Construction	Organizing regular health check-up and immunization camps	INR	5000	300	15,00,000	Assuming health checkup will be conducted once in a year.
6	Safety, Health and Environment	Construction	Provide adequate personal protective equipment’s for the works					
			Hand gloves	INR	300	300	90,000	Assuming PPE will be provided 2 times in a year to all 150 labor. Construction duration is considered as 2 years.
			Safety shoes	INR	2000	300	600,000	Assuming PPE will be provided 2 times in a year to all 150 labor. Construction duration is considered as 2 years.
			Safety googles	INR	200	300	60,000	Assuming PPE will be provided 2 times in a year to all 150 labor. Construction duration is considered as 2 years.
			Safety Reflective jacket	INR	400	300	120,000	Assuming PPE will be provided 2 times in a year to all 150 labour. Construction duration is considered as 2 years.
			Safety Helmets	INR	350	300	105,000	Assuming PPE will be provided 2 times in a year to all 150 labour. Construction duration is considered as 2 years.
		Construction	Regular Training to the workers related to Health and Safety	INR	250	300	75,000	Training is provided 2 times in a year. Construction duration is considered as 2 years. Lumpsum cost is considered
		Construction	Conduct Safety, Health and Environment audit on regular basis	INR	350000	4	14,00,000	Consider audit is conducted twice in a year. Construction duration is considered as 2 years. Standard market cost is considered

Sr. No.	Component	Stage (Construction/ operation)	Description	Unit	Unit Cost	Quantity	Cost (Indian Rupees)	Note/Assumptions
		Construction	First Aid facility on site (First aid kit and first aid room)	INR			20,000	Considering cost of kit as 500 Rs (10 kits) and 15000 movable relief tents (1 tent)
		Construction	Monthly illumination monitoring by lux meter for all the locations	INR	5000	5	25,000	Contractor should purchase 4 lux meter and monitoring shall be done by site supervisor
	TOTAL (A)						51,62,160	

Table 8-6: Cost for ESHSMP - Mitigation Measures under the Scope of Contractor- Works (Civil, Mechanical, Electrical, labour Amenities etc)

Sr. No.	Component	Stage (Construction /operation)	Description	Unit	Unit Cost	Quantity	Cost (Indian Rupees)	Note/Assumptions
1	Air	Construction	Covers for vehicles transporting construction material	INR	Included in the civil cost			
2	Water Quality	Construction	Installation of mobile toilets fitted with anaerobic treatment facility at construction site (1 toilet seat/ 15 labour- within 500 m)	INR	80,000	5	4,00,000	Mobile toilets can be installed within 24 hrs. Mobile toilets requires very less space.
		Construction	Providing drinking water facilities at the construction site (within 500 m)	INR			15,00,000	10 lit/labour/day drinking water consumption is considered. 20-liter water Jar will be provided on the site
		Construction	Turfing of embankment slopes by slope protection frames, dry stone pitching, and masonry retaining walls near water bodies		Included in the civil cost			
3	Noise and Vibration Level	Construction	RCC boundary wall of the railway premises of 2.4-meter height at the locations where habitations are located very close to the railway boundary		Included in the civil cost			
4	Soil Quality	Construction	Turfing of embankment slopes by slope protection frames, dry stone pitching, and masonry retaining walls based on ground conditions		Included in the civil cost			
		Construction	Permission from MCGM/ULB’s to dispose the Construction and Demolition waste to pre-identified dump sites.		Included in the civil cost			

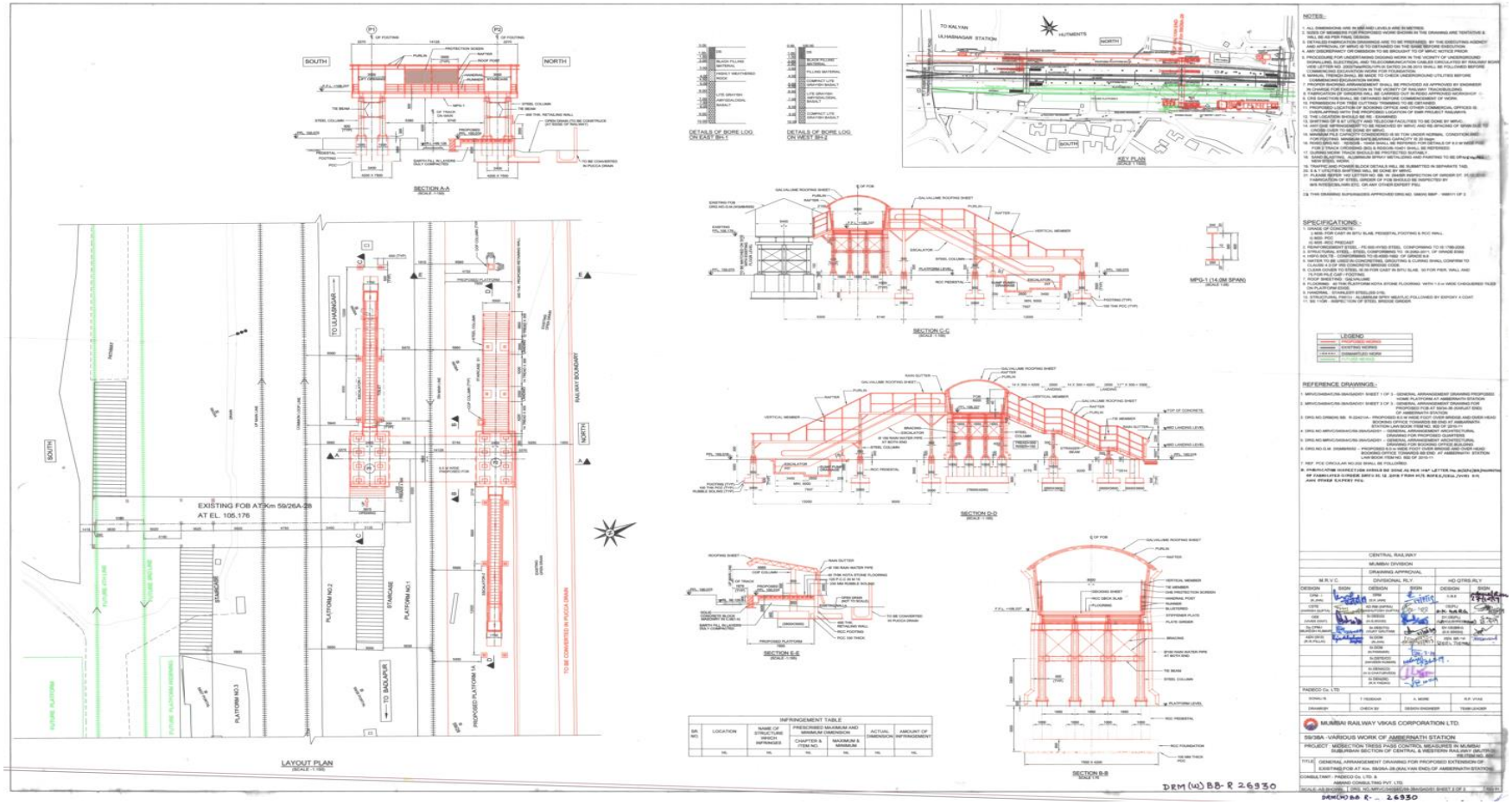
Sr. No.	Component	Stage (Construction /operation)	Description	Unit	Unit Cost	Quantity	Cost (Indian Rupees)	Note/Assumptions
5	labour Camp	Construction	Provision of Sanitary toilets, urinal, bathrooms, wash basin in the labour camps (1 toilet seat, 1 urinal, 1 ash basin and 1 bathroom for 15 labours)	INR	30000	5	1,50,000	As per the World Bank guidelines, 1 toilet seat, 1 urinal, 1 wash basin and 1 bathroom for 15 labours is required. Approx.150 labours will be in labour camp
		Construction	LPG cylinders or community kitchens may be provided in the labour camps to avoid any tree cutting for fuel wood	INR	1000	40	9,60,000	Assuming 4 labours are using 1 LPG cylinder/month. Approx. 150 labours will be there in 5 labour camps
		Construction	Cost towards solid waste management in the labour camps	INR			1,00,000 (Approx)	Assuming the quantity of waste generation is 0.25 kg/person/day. Considering 150 labours will be there in 5 labour camps.
		Construction	Provision of adequate and safe water supply for the use of the workers (RO of 3500 liter/hr. + 1 tap/25 labours)	INR			2,10,000	
		Construction	Water Quality Monitoring as per IS 10500:2012 or WHO drinking water standards for the drinking water provided in labour camps. Water quality must be monitored 3 times in a year (once in 4 months) on regular basis	INR	10000	15	1,50,000	Considering 3 samples in 1 year and construction duration as 16 months
	TOTAL (B)							34,70,000

Total cost for EMP - Mitigation Measures under the Scope of Contractor = Total (A)+Total (B)= 86,32,160 Indian Rupees (Approx.).

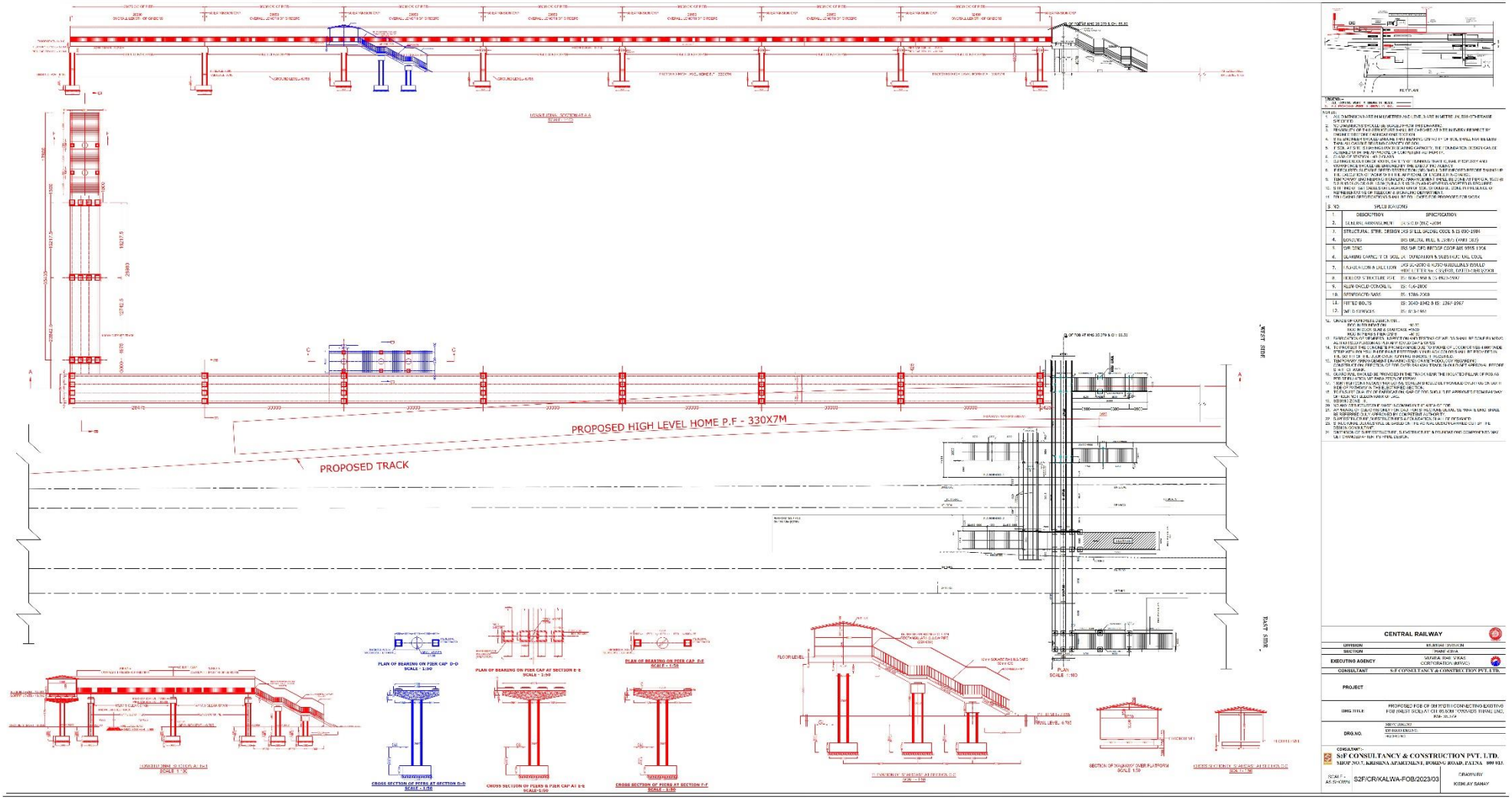
Note: Implementation of mitigation and enhancement measures with respect to air, water, noise, solid waste management, labour amenities, safeguards, health, safety, sanitation and welfare of the labours, etc. shall be the liability of the Contractor and the implementing agencies appointed for implementation of project works. Suitable clause(s) should be incorporated in the contract document so that the contractor is aware about the mitigation and enhancement measures to be implemented by the contractor. The bid/contract price should cover all costs associated with such mitigation measures. No additional payment shall be paid to the Contractor in this regard. This is indicative cost and actual cost may vary depending upon market prices

Appendix A General Arrangement Drawings the FOB Structures

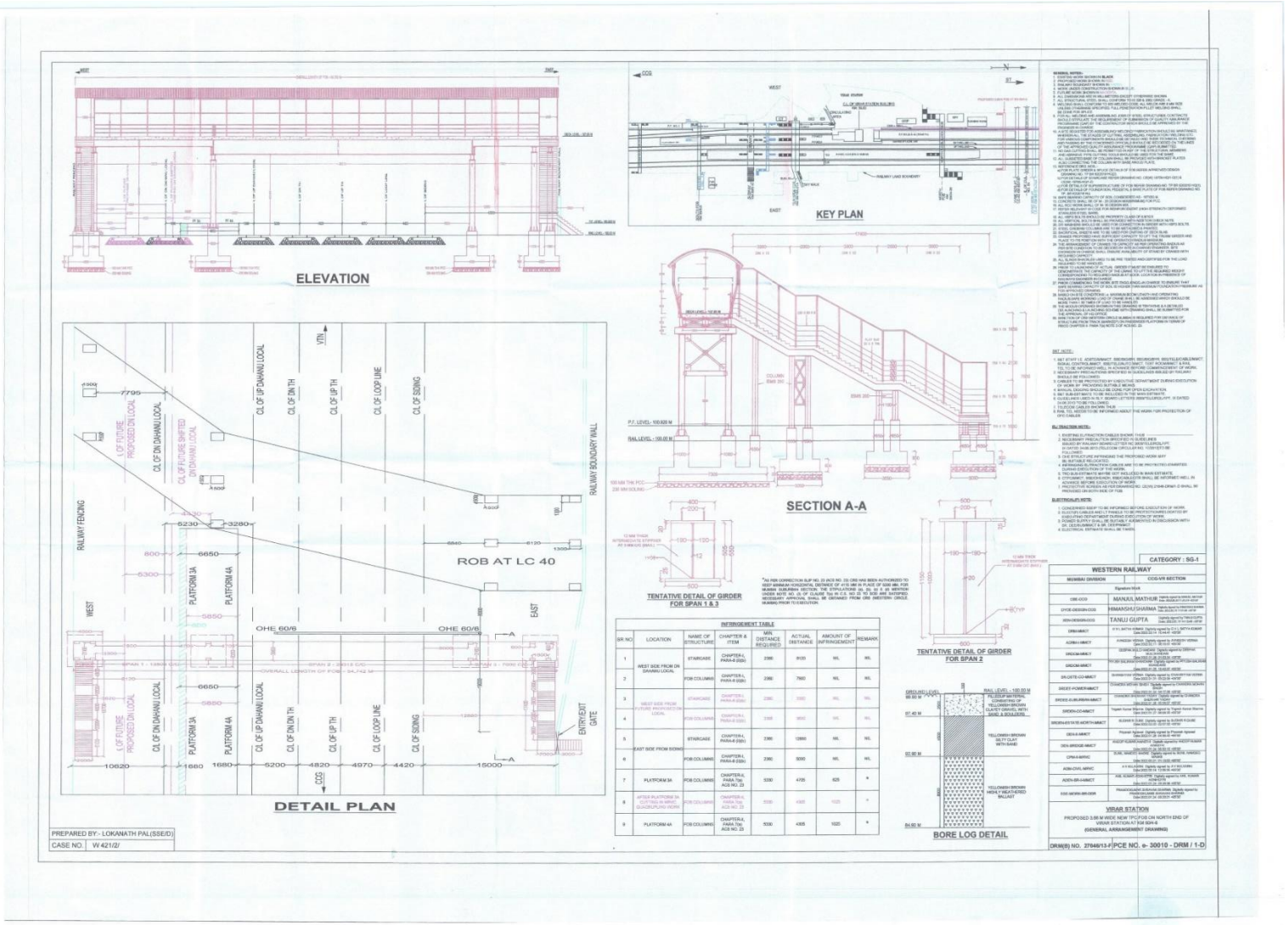
AMBARNATH- GENERAL ARRANGEMENT DRAWING FOR Km. 59 FOB



GENERAL ARRANGEMENT DRAWING FOR Kalwa Km. 35/4 FOB



GENERAL ARRANGEMENT DRAWING FOR Virar Km. 60/4-6 FOB



Appendix B : Photolog

		
Site location for proposed Badlapur-Vangani FOB	*Photo-doc of a consultation with trespassers at Kalwa location*	*Trespassing at the Kalwa station*
		
Proposed project site at Kalwa	*Proposed project site at Virar*	*Residential buildings near proposed project site Badlapur-Vangani end*

Appendix C Land Use Land Cover Maps / Strip Maps

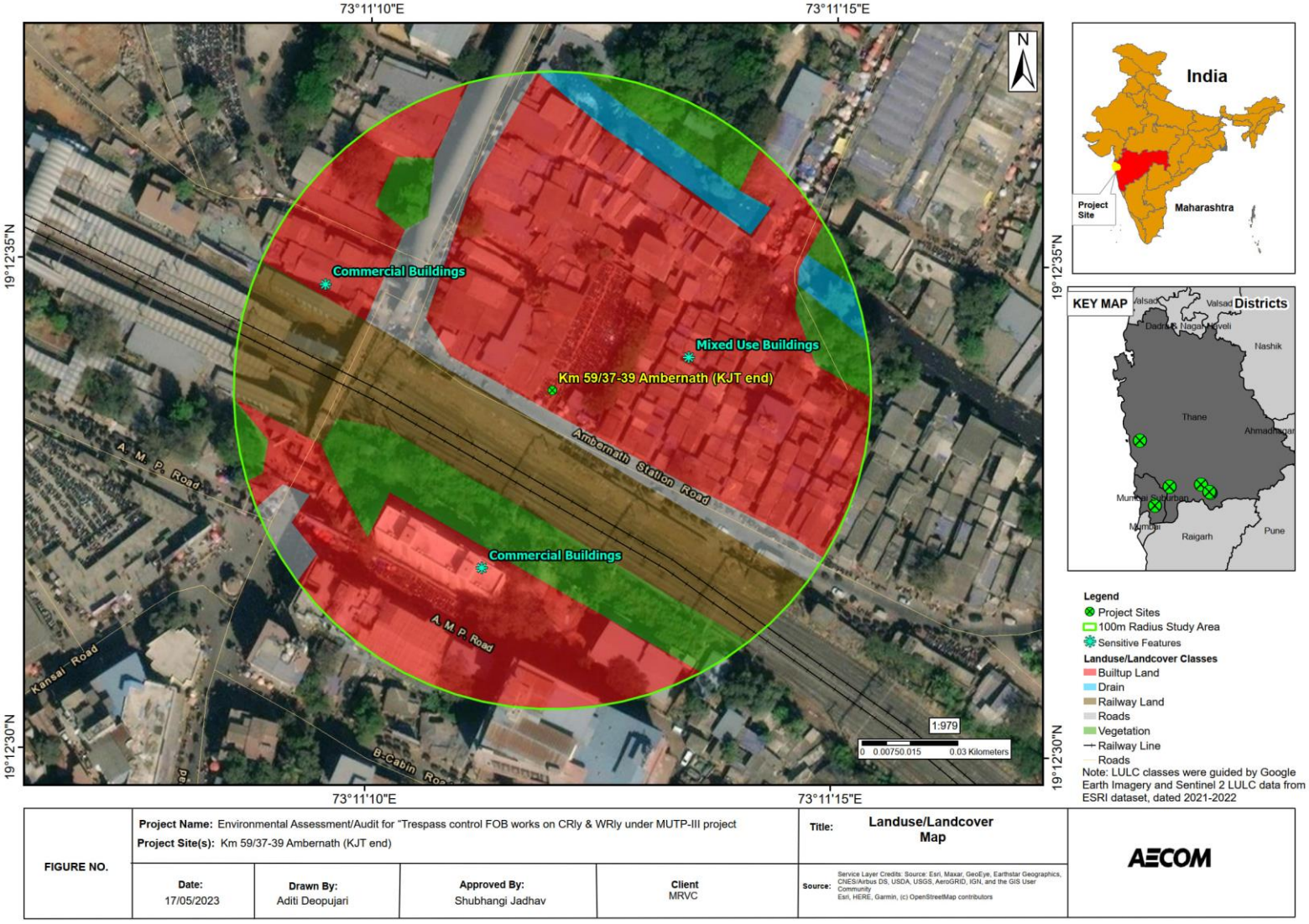


FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 59/37-39 Ambernath (KJT end)			**Title:** Landuse/Landcover Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors

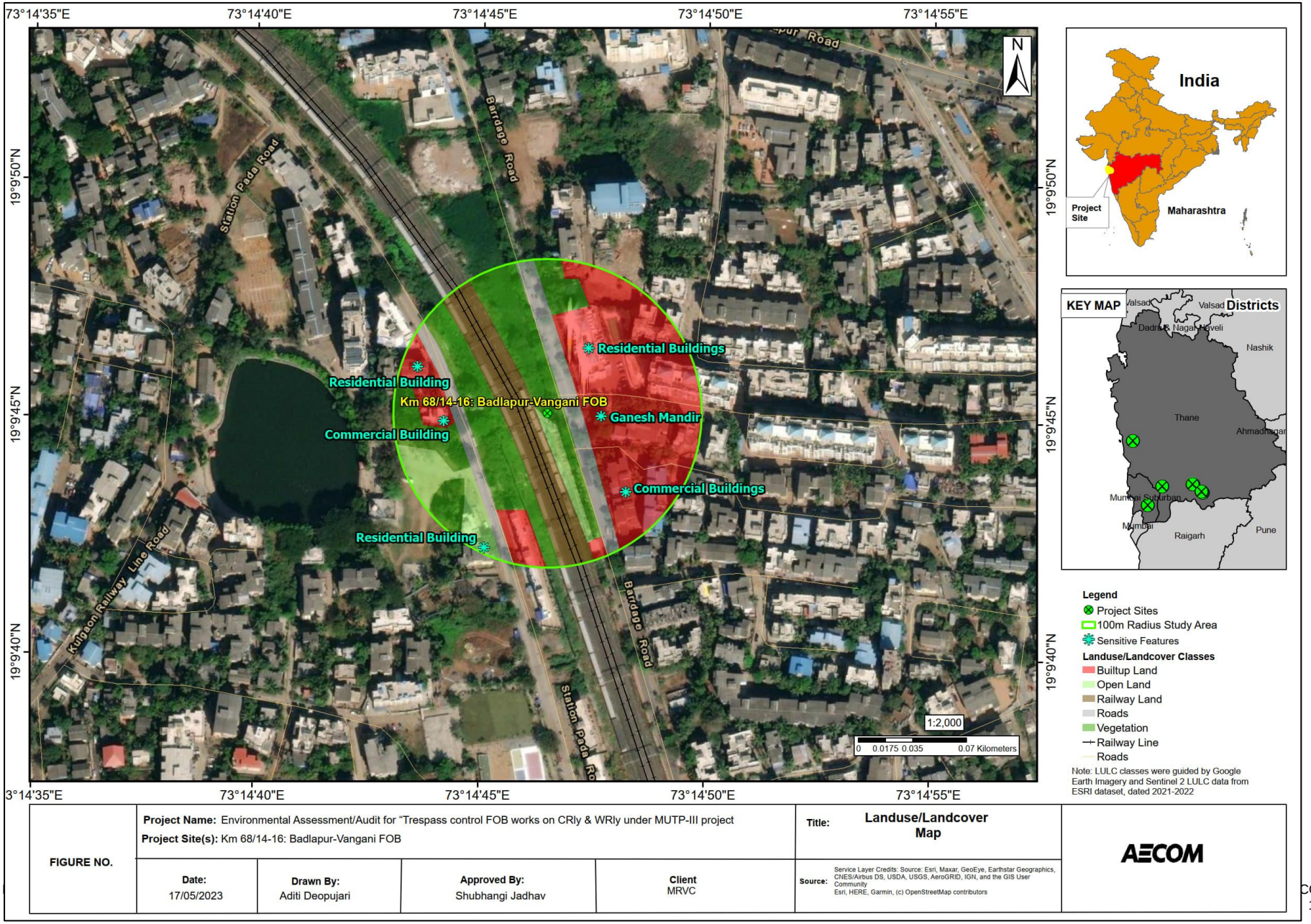


FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 68/14-16: Badlapur-Vangani FOB			**Title:** Landuse/Landcover Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors

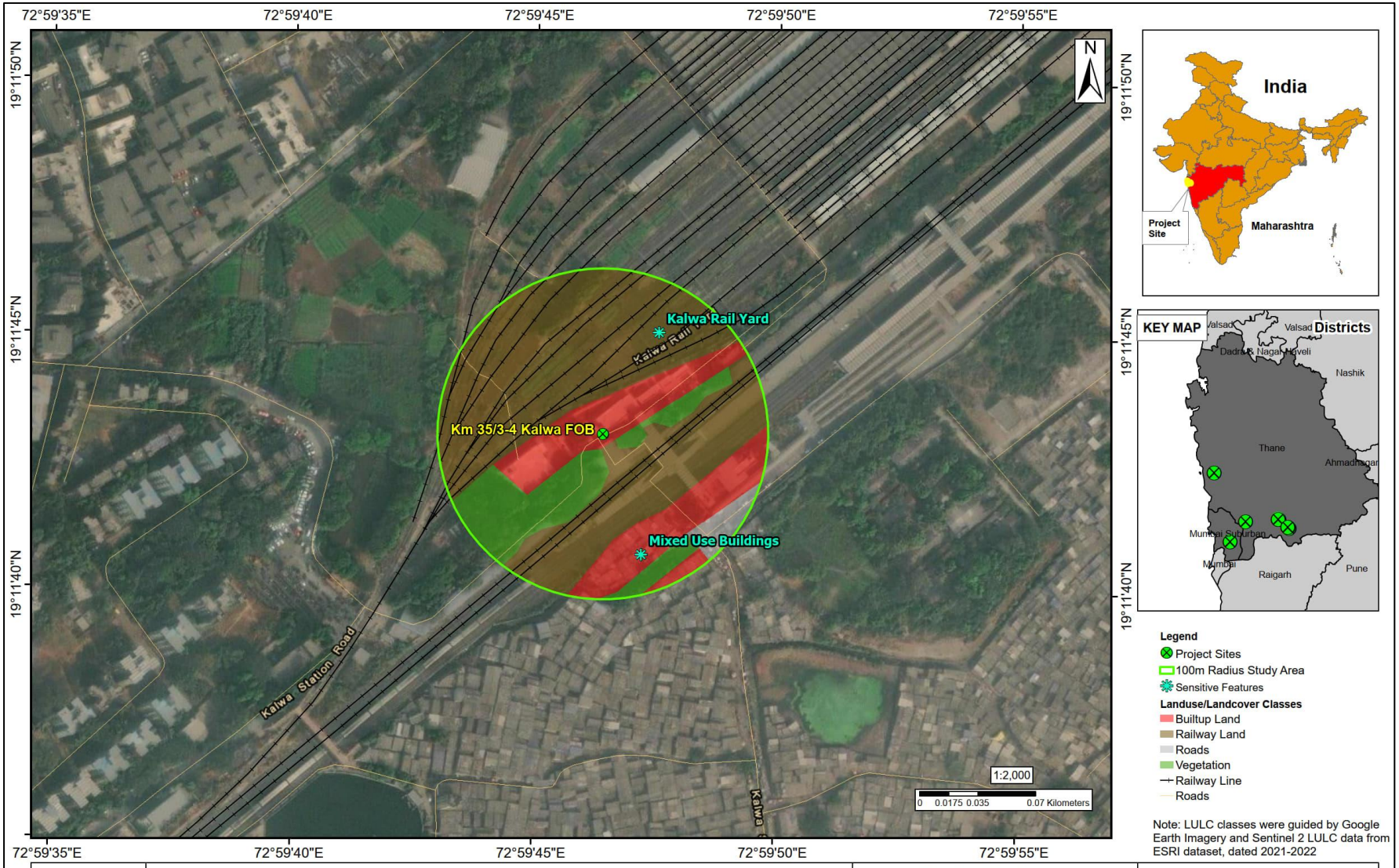
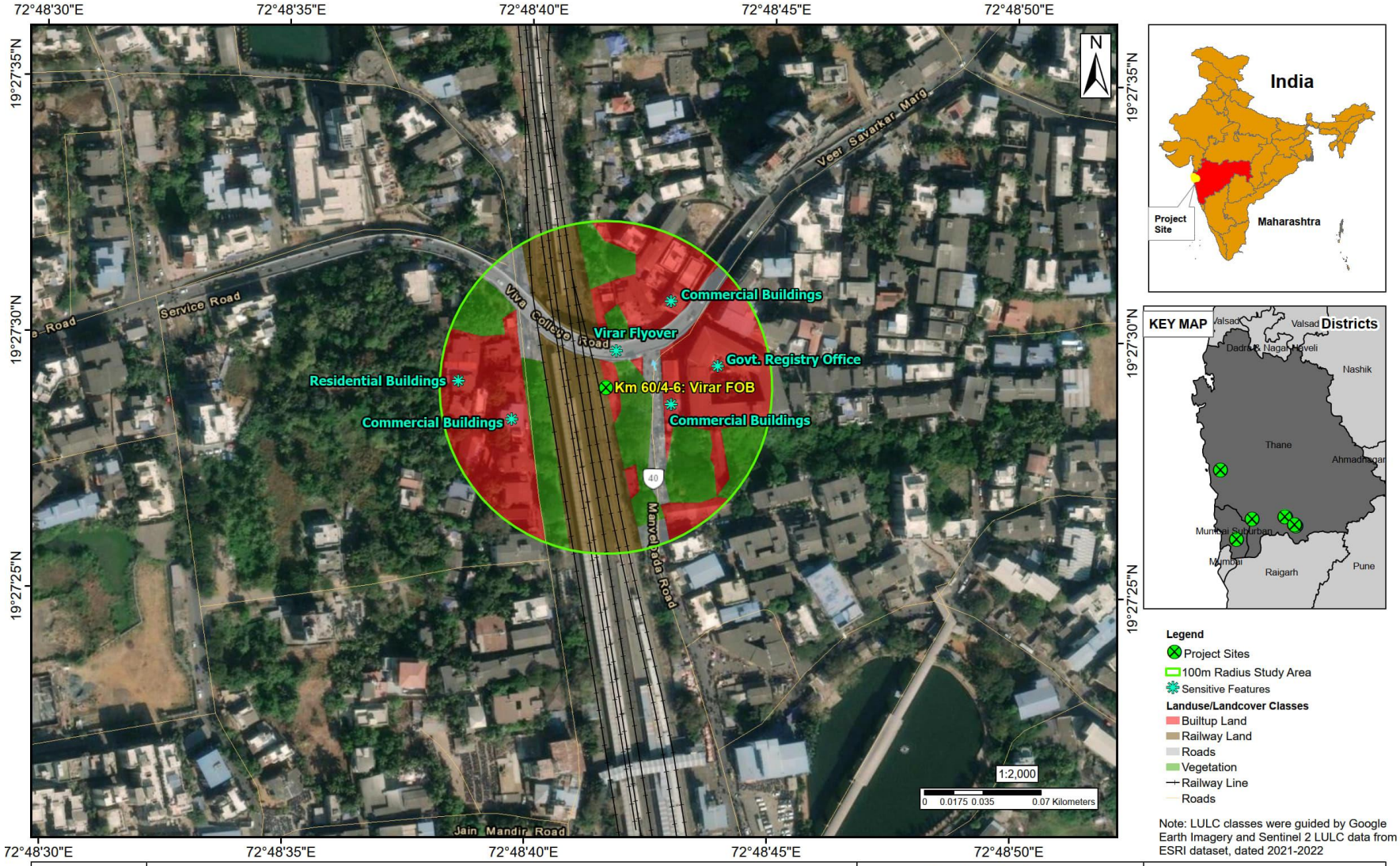


FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 35/3-4 Kalwa FOB			**Title:** Landuse/Landcover Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors



Note: LULC classes were guided by Google Earth Imagery and Sentinel 2 LULC data from ESRI dataset, dated 2021-2022

FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 60/4-6: Virar FOB				**Title:** Landuse/Landcover Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors	

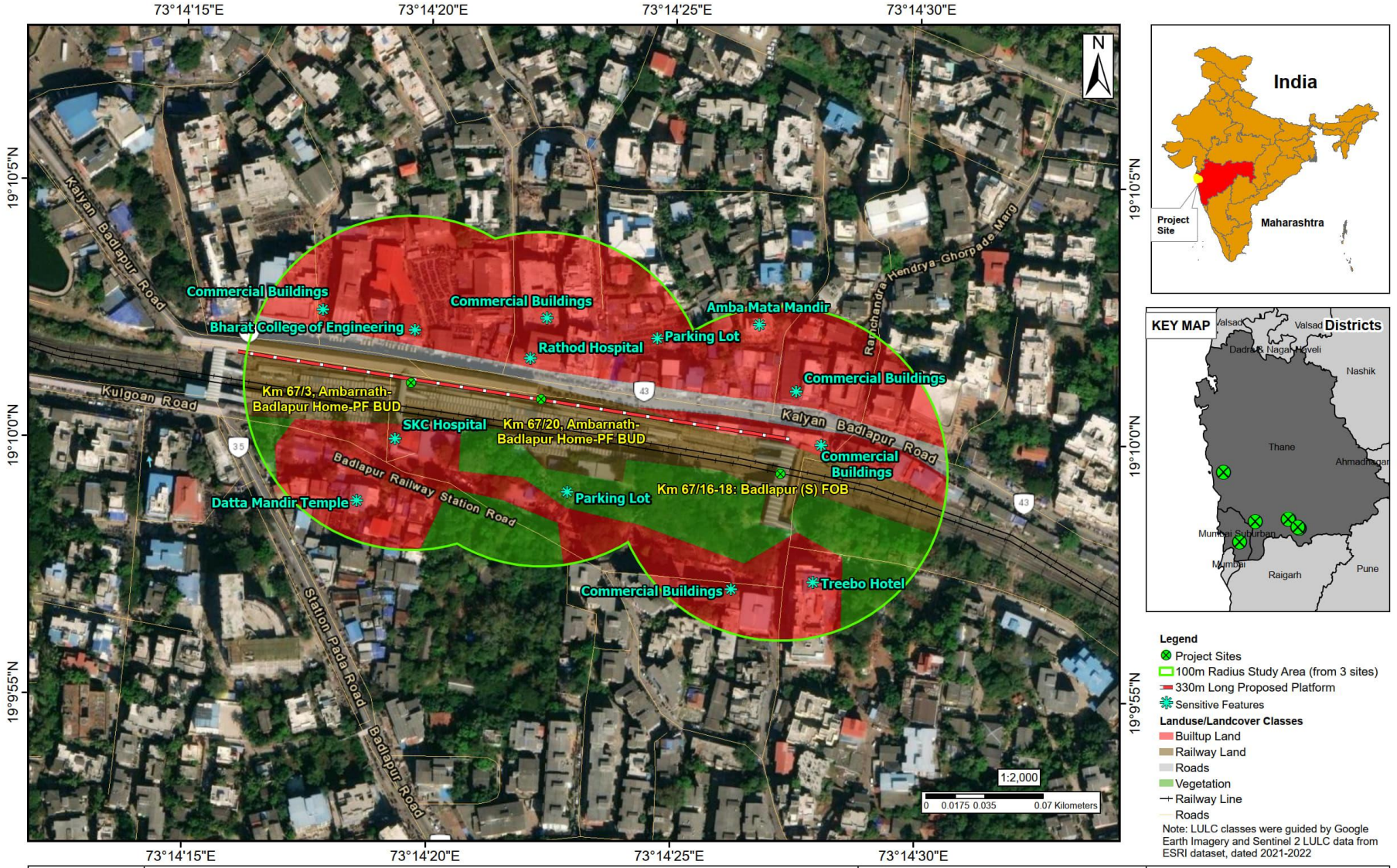


FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 67/16-18: Badlapur (S) FOB; Km 67/3, Ambarnath-Badlapur Home-PF BUD; Km 67/20, Ambarnath-Badlapur Home-PF BUD			**Title:** Landuse/Landcover Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors	

Appendix D Environmental Monitoring Maps

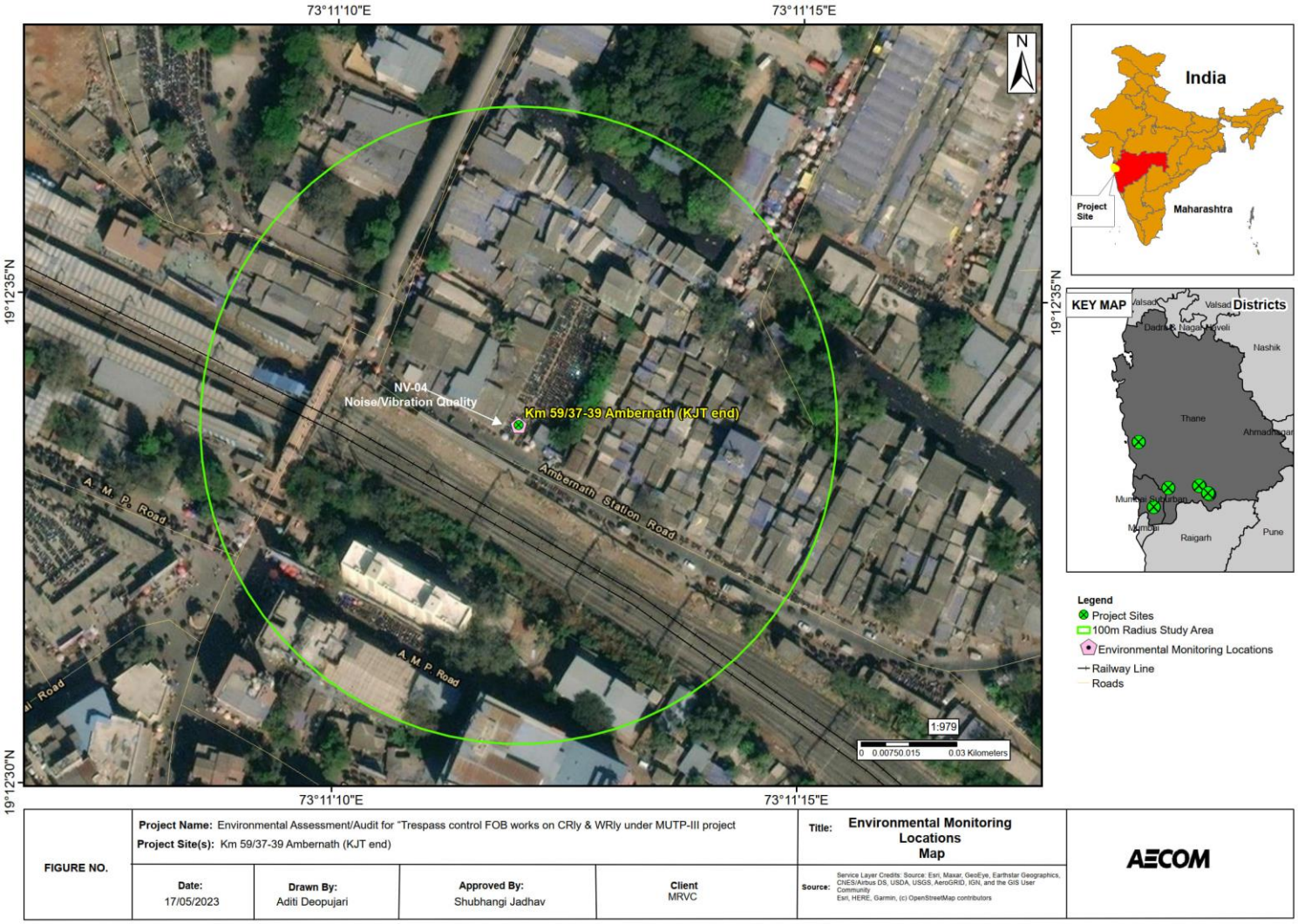


FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 59/37-39 Ambernath (KJT end)			**Title:** Environmental Monitoring Locations Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors

FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 68/14-16: Badlapur-Vangani FOB				**Title:** Environmental Monitoring Locations Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors	

FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 19.300, Ghatkopar (M) FOB				**Title:** Environmental Monitoring Locations Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors	

FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 35/3-4 Kalwa FOB				**Title:** Environmental Monitoring Locations Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors	

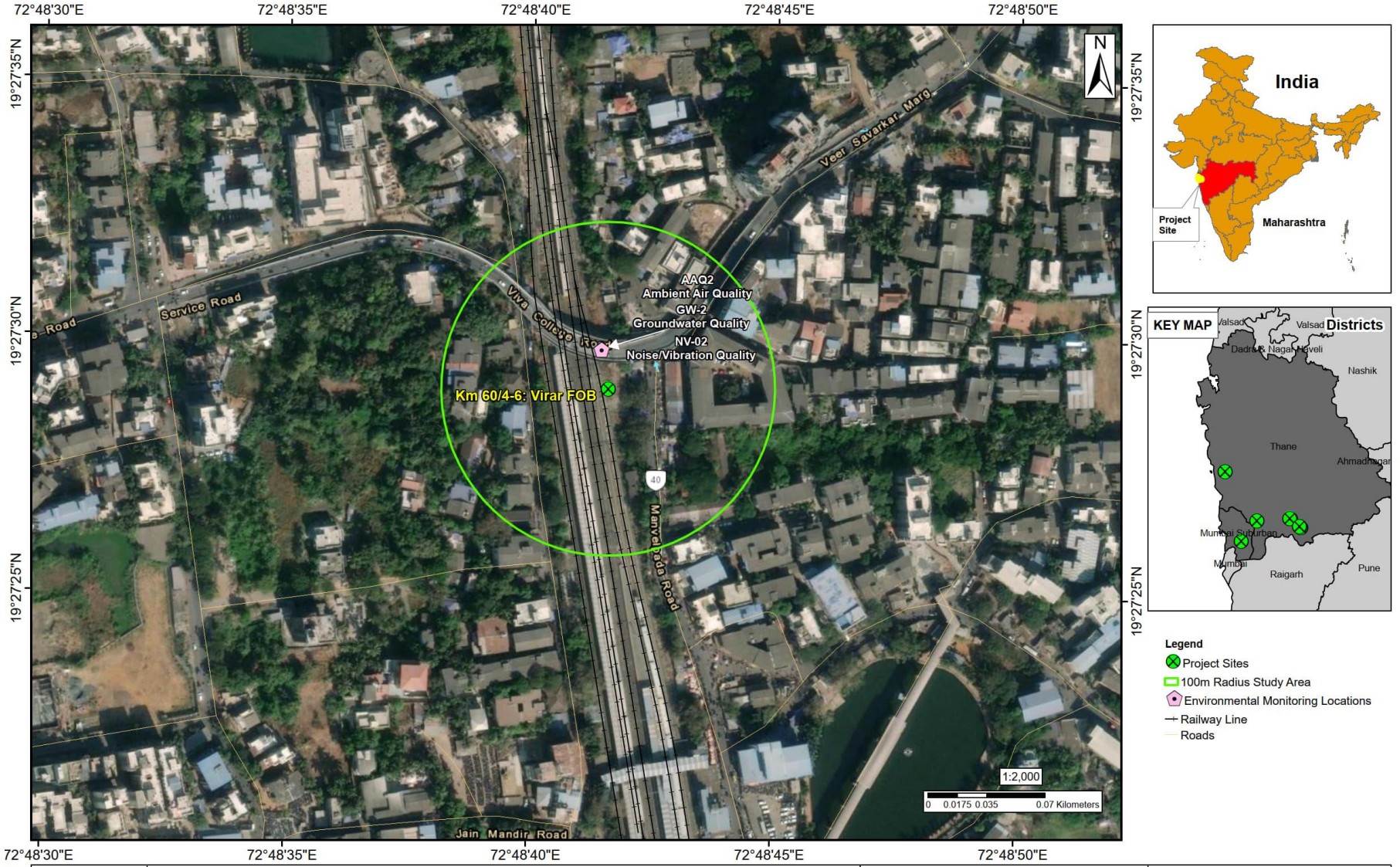


FIGURE NO.	**Project Name:** Environmental Assessment/Audit for “Trespass control FOB works on CRly & WRly under MUTP-III project **Project Site(s):** Km 60/4-6: Virar FOB				**Title:** Environmental Monitoring Locations Map	AECOM
	Date: 17/05/2023	**Drawn By:** Aditi Deopujari	**Approved By:** Shubhangi Jadhav	**Client** MRVC	**Source:** Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community Esri, HERE, Garmin, (c) OpenStreetMap contributors	

Appendix E Accident Data

Sl No.	Name of the Station	Chainage	Year	Total Number of Incidents /Accidents	Categorization of Incidents /Accidents
1.	Ambarnath	Km. 59/21 to 60/1	2020	07	04 natural deaths at Ch. 59/80, 59/25, 59/26A, 59/31-33, 02 run over cases at 59/26 and 59/36-38 and 01 fallen down case at Ch. 59/35.
2.	Ambarnath	Km. 59/21 to 60/1	2021	06	05 TPRO* cases at 60/01-02,59/21-24A, 59/26 A-B, 59/19-20, 59/39 ABH PF3 and 01 others case recorded at Ch. 59/38
3.	Ambarnath	Km. 59/21 to 60/1	2022	17	06 TPRO* cases at 59/27, 59/37-39, 59/39, 59/37,59/26 ,59/29-27. 02 fallen down cases at 59/33 and 59/28. 02 Natural deaths at 59/26 B and 59/35 A (Injury) followed by other miscellaneous cases at 59/31, 59/36-38, 59/37, 59/24 ,59/26 B, and at Ch. 59/26.
4.	Badlapur	Km. 67/03 to 67/33	2020	07	05 TPRO* cases at 67/26, 67/27-30, 67/08, 67/15,67/20 and 02 other miscellaneous cases at 67/17-19 and at Ch. 67/17.
5.	Badlapur	Km. 67/03 to 67/33	2021	07	06 TPRO* cases at 67/17, 67/27, 67/04, 67/28,67/20-18,67/07 BUD to ABH and 01 natural death case at Ch. 67/19.
6.	Badlapur	Km. 67/03 to 67/33	2022	21	05 TPRO* cases at 67/30,67/17,67/28,67/08,67/05 followed by 01 fallen down cases at 67/08, 02 Natural deaths at 67/09 and 67/12 (Injury) followed by other miscellaneous cases at 67/08, 67/10, 67/06-07, 67/25, 67/03 and at Ch. 67/12
7.	Virar	Km. 60/4-6	2021	44	29 TPRO* cases at 60/4-6 and 15 injured cases
8.	Virar	Km. 60/4-6	2022	64	52 TPRO* cases at 60/4-6 and 12 injured cases
9.	Kalwa	Km. 34/1-Km. 36/9	2020	21	07 TPRO* cases at 34/8,35/13-14,36/9, 34/11, 36/14 and 14 Injured cases
10.	Kalwa	Km. 34/1-Km. 36/9	2021	25	04 TPRO* cases at 35/4,35/2,36/4, 34/7-8 and 21 Injured cases
11.	Kalwa	Km. 34/1-Km. 36/9	2022	17	04 TPRO* cases at 34/1, 34/1-2, Kalwa SS (Substation) 35/26,35/4, 36/1 and 13 Injured cases

Accident/Incident data for year 2020,2021 and 2022 provided by MRVC
**TPRO- Tress pass runover*

Appendix F Environmental Monitoring Records

ULTRA TECH (TM)
Environmental Consultancy & Laboratory
Lab.Gazetted by MoEF&CC-Govt. of India
Lab. Accredited by NABL - ISO/IEC 17025:2017 [TC-5600,Valid until 03.08.2024 in the field of Testing]
QCI-NABET Accredited EIA Consulting Organization
STP/ETP/WTP Project Management Consultants
TC-5600
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
For Project: Central Railway and Western Railway [Project No. 60666755],
Mumbai, Maharashtra.

ULR NO. : **ULR-TC560023000003493F**
REPORT NO. : UT/ELS/ REPORT/4725/06-2023
ISSUE DATE : 28/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No.: : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/AA01A
Date & Time of Sampling : 17/06/2023 15:40 Hrs. to 18/06/2023 15:40 Hrs.
Sample Registration Date : 19/06/2023
Analysis Starting Date : 19/06/2023
Analysis Completion Date : 22/06/2023
Ambient Air Temperature : 28.2 °C to 33.1 °C
Relative Humidity : 58.0 % to 80.1 %

AMBIENT AIR QUALITY MONITORING
Location Code : 1
Sample Location : Virar Railway Station Opposite Platform 4A.
GPS Co-ordinates : N 19º27'29.2", E 72º48'41.8"
Sample Collected By : ULTRA TECH
Height of Sampler : 1 Meter
Sampling Duration : 24:00 Hours:Minutes
Sample Lab Code : UT/ELS/415/06-2023

Sr. No.	Test Parameter	Test Method	Test Result	Unit	NAAQMS Industrial, Residential, Rural and Other Area 24 Hrs. or 1 Hr**
1	Sulphur Dioxide (SO_2)	IS 5182 (Part 2) : 2001	BDL[DL=5]	$\mu g/m^3$	80
2	Nitrogen Dioxide (NO_2)	IS 5182 (Part 6) : 2006	19	$\mu g/m^3$	80
3	Particulate Matter (PM_{10})	EPA/625/R-96/010a Compendium Method IO-2.1	62	$\mu g/m^3$	100
4	Particulate Matter ($PM_{2.5}$)	IS 5182 (Part 24) : 2019	25	$\mu g/m^3$	60
5	Carbon Monoxide (CO)†	IS 5182 (Part 10) : 1999	0.4	mg/m^3	4

†: Sampling Period 1 Hr. BDL: Below Detection Limit DL=Detection Limit

Remark/ Statement of Conformity: *The parameters tested above are found to be within 24 hourly TWA of National Ambient Air Quality Monitoring Standard (NAAQMS), Part III- Section IV.*

Sampling Equipment Details	Instrument Used	Lab ID	Make	Model	Sl. No.	Calibration Valid up to
	Respirable Dust Sampler	UT/LAB/192	Polltech	PEM-RDS 9	1118	20/12/2023
	Fine Dust Sampler	UT/LAB/238	Polltech	PEM-ADS 2.5/10µ	1722	03/03/2024

Note:
1. Samples were collected by following laboratory's SOP (UT/LQMS/SOP/AA01A) based on CPCB Guidelines - National Ambient Air Quality Monitoring Series: NAAQMS/2003-04 and respective test methods.
2. This test report refers only to the sample tested.
3. Monitoring area coming under Industrial areas and observed values are relevant to sample collected only.
4. This test report may not be reproduced in part, without the permission of this laboratory.
5. Any correction invalidates this test report.
6. Weather during sampling was Sunny and Clear.
7. *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
8. **Time weighted average 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 monitorings.
9. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4726/06-2023 Dated 28/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH Recognized by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For ULTRA TECH,
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
For Project: Central Railway and Western Railway [Project No. 60666755],
Mumbai, Maharashtra.

ULR NO. : --
REPORT NO. : UT/ELS/ REPORT/4726/06-2023
ISSUE DATE : 28/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

Sampling Plan Ref. No.: : UG02-06/2023
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Sample Registration Date : 19/06/2023
Analysis Starting Date : 19/06/2023
Analysis Completion Date : 22/06/2023
Ambient Air Temperature : 28.2 °C to 33.1 °C
Relative Humidity : 58.0 % to 80.1 %

AMBIENT AIR QUALITY MONITORING

Location Code : 1
Sample Location : Virar Railway Station Opposite Platform 4A.
GPS Co-ordinates : N 19º27'29.2", E 72º48'41.8"
Sample Collected By : ULTRA TECH
Height of Sampler : 1 Meter
Sampling Duration : 24:00 Hours:Minutes
Sample Lab Code : UT/ELS/415/06-2023

Sr. No.	Test Parameter	Test Method	Test Result	Unit	NAAQMS Industrial, Residential, Rural and Other Area 24 Hrs. or 1 Hr**
1	Hydrocarbons as Methane§	IS 5182 (Part 17): 1979	0.8	ppm	--

§: Grab Sample

Remark/ Statement of Conformity: *NIL*

Note:
1. Samples were collected by following laboratory's SOP (UT/LQMS/SOP/AA01A) based on CPCB Guidelines - National Ambient Air Quality Monitoring Series: NAAQMS/2003-04 and respective test methods.
2. This test report refers only to the sample tested.
3. Monitoring area coming under Industrial areas and observed values are relevant to sample collected only.
4. This test report may not be reproduced in part, without the permission of this laboratory.
5. Any correction invalidates this test report.
6. Weather during sampling was Sunny and Clear.
7. *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
8. **Time weighted average 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 monitorings.
9. Parameter is tested are not covered under NABL scope.
10. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4725/06-2023 Dated 28/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH ★ Gazetted by MoEF Govt. of India ★ THANE (W) INDIA PIN-400 601 ★ ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
For Project: Central Railway and Western Railway [Project No. 60666755],
Mumbai, Maharashtra.

ULR NO. : **ULR-TC560023000003494F**
REPORT NO. : UT/ELS/ REPORT/4727/06-2023
ISSUE DATE : 28/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

Sampling Plan Ref. No.: : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/AA01A
Date & Time of Sampling : 20/06/2023 13:30 Hrs. to 21/06/2023 13:30 Hrs.
Sample Registration Date : 22/06/2023
Analysis Starting Date : 22/06/2023
Analysis Completion Date : 26/06/2023
Ambient Air Temperature : 27.5 °C to 33.7 °C
Relative Humidity : 69.3 % to 81.5 %

AMBIENT AIR QUALITY MONITORING

Location Code : 1
Sample Location : Badalapur Railway Station Near Platform No-01 to Loc. Dist. 04 Meter Off Towards West.
GPS Co-ordinates : N 19º10'00.90", E 73º14'23.33"
Sample Collected By : ULTRA TECH
Height of Sampler : 1 Meter
Sampling Duration : 24:00 Hours:Minutes
Sample Lab Code : UT/ELS/487/06-2023

Sr. No.	Test Parameter	Test Method	Test Result	Unit	NAAQMS Industrial, Residential, Rural and Other Area 24 Hrs. or 1 Hr**
1	Sulphur Dioxide (SO_2)	IS 5182 (Part 2) : 2001	BDL[DL=5]	$\mu g/m^3$	80
2	Nitrogen Dioxide (NO_2)	IS 5182 (Part 6) : 2006	20	$\mu g/m^3$	80
3	Particulate Matter (PM_{10})	EPA/625/R-96/010a Compendium Method IO-2.1	81	$\mu g/m^3$	100
4	Particulate Matter ($PM_{2.5}$)	IS 5182 (Part 24) : 2019	22	$\mu g/m^3$	60
5	Carbon Monoxide (CO)†	IS 5182 (Part 10) : 1999	0.7	mg/m^3	4

†: Sampling Period 1 Hr. BDL: Below Detection Limit DL=Detection Limit

Remark/ Statement of Conformity: *The parameters tested above are found to be within 24 hourly TWA of National Ambient Air Quality Monitoring Standard (NAAQMS), Part III- Section IV.*

Sampling Equipment Details	Instrument Used	Lab ID	Make	Model	Sl. No.	Calibration Valid up to
	Respirable Dust Sampler	UT/LAB/172	Polltech	PEM-RDS 9	315	20/12/2023
	Fine Dust Sampler	UT/LAB/242	Polltech	PEM-ADS 2.5/10µ	0522	08/12/2023

Note:
1. Samples were collected by following laboratory's SOP (UT/LQMS/SOP/AA01A) based on CPCB Guidelines - National Ambient Air Quality Monitoring Series: NAAQMS/2003-04 and respective test methods.
2. This test report refers only to the sample tested.
3. Monitoring area coming under Industrial areas and observed values are relevant to sample collected only.
4. This test report may not be reproduced in part, without the permission of this laboratory.
5. Any correction invalidates this test report.
6. Weather during sampling was Sunny and Clear.
7. *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
8. **Time weighted average 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 monitorings.
9. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4728/06-2023 Dated 28/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

ULTRA TECH (TM)
Environmental Consultancy & Laboratory
Lab.Gazetted by MoEF&CC-Govt. of India
Lab. Accredited by NABL - ISO/IEC 17025:2017 [TC-5600,Valid until 03.08.2024 in the field of Testing]
QCI-NABET Accredited EIA Consulting Organization
STP/ETP/WTP Project Management Consultants
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
For Project: Central Railway and Western Railway [Project No. 60666755],
Mumbai, Maharashtra.

ULR NO. : --
REPORT NO. : UT/ELS/ REPORT/4728/06-2023
ISSUE DATE : 28/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

AMBIENT AIR QUALITY MONITORING

Sampling Plan Ref. No.:	: UG02-06/2023	**Location Code**	: 1
Sampling Procedure	: UT/LQMS/SOP/AA01A	**Sample Location**	: Badalapur Railway Station Near Platform No-01 to Loc. Dist. 04 Meter Off Towards West.
Date & Time of Sampling	: 20/06/2023 13:30 Hrs. to 21/06/2023 13:30 Hrs.		
Sample Registration Date	: 22/06/2023	**GPS Co-ordinates**	: N 19º10'00.90", E 73º14'23.33"
Analysis Starting Date	: 22/06/2023	**Sample Collected By**	: ULTRA TECH
Analysis Completion Date	: 26/06/2023	**Height of Sampler**	: 1 Meter
Ambient Air Temperature	: 27.5 °C to 33.7 °C	**Sampling Duration**	: 24:00 Hours:Minutes
Relative Humidity	: 69.3 % to 81.5 %	**Sample Lab Code**	: UT/ELS/487/06-2023

Sr. No.	Test Parameter	Test Method	Test Result	Unit	NAAQMS Industrial, Residential, Rural and Other Area 24 Hrs. or 1 Hr**
1	Hydrocarbons as Methane§	IS 5182 (Part 17): 1979	0.8	ppm	--

§: Grab Sample

Remark/ Statement of Conformity: *NIL*

Note:
1. Samples were collected by following laboratory's SOP (UT/LQMS/SOP/AA01A) based on CPCB Guidelines - National Ambient Air Quality Monitoring Series: NAAQMS/2003-04 and respective test methods.
2. This test report refers only to the sample tested.
3. Monitoring area coming under Industrial areas and observed values are relevant to sample collected only.
4. This test report may not be reproduced in part, without the permission of this laboratory.
5. Any correction invalidates this test report.
6. Weather during sampling was Sunny and Clear.
7. *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
8. **Time weighted average 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 monitorings.
9. Parameter is tested are not covered under NABL scope.
10. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4727/06-2023 Dated 28/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH Recognised by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
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STP/ETP/WTP Project Management Consultants
TC-5600
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Est,Andheri-Kurla Rd, Marol, Andheri-E, Mumbai, India
For Project: Central Railway & Western Railway [Project No. 60666755]
Mumbai, Maharashtra.

ULR NO. : **ULR-TC560023000003292F**
REPORT NO. : UT/ELS/ REPORT/4448/06-2023
ISSUE DATE : 19/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No.: : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/AA01A
Date & Time of Sampling : 06/06/2023 11:30 Hrs. to 07/06/2023 11:30 Hrs.
Sample Registration Date : 07/06/2023
Analysis Starting Date : 07/06/2023
Analysis Completion Date : 09/06/2023
Ambient Air Temperature : 30.6 °C to 35.1 °C
Relative Humidity : 41.0 % to 68.0 %

AMBIENT AIR QUALITY MONITORING
Location Code : 1
Sample Location : Ghatkopar Railway Station Near Track No-05
GPS Co-ordinates : N 19º05'5.23", E 72º54'32.07"
Sample Collected By : ULTRA TECH
Height of Sampler : 1 Meter
Sampling Duration : 24:00 Hours:Minutes
Sample Lab Code : UT/ELS/149/06-2023

Sr. No.	Test Parameter	Test Method	Test Result	Unit	NAAQMS Industrial, Residential, Rural and Other Area 24 Hrs. or 1 Hr**
1	Sulphur Dioxide (SO_2)	IS 5182 (Part 2) : 2001	BDL[DL=5]	$\mu g/m^3$	80
2	Nitrogen Dioxide (NO_2)	IS 5182 (Part 6) : 2006	23	$\mu g/m^3$	80
3	Particulate Matter (PM_{10})	EPA/625/R-96/010a Compendium Method IO-2.1	73	$\mu g/m^3$	100
4	Particulate Matter ($PM_{2.5}$)	IS 5182 (Part 24) : 2019	31	$\mu g/m^3$	60
5	Carbon Monoxide (CO)†	IS 5182 (Part 10) : 1999	1.1	mg/m^3	4

†: Sampling Period 1 Hr. **BDL: Below Detection Limit** **DL=Detection Limit**

Remark/ Statement of Conformity: *The parameters tested above are found to be within 24 hourly TWA of National Ambient Air Quality Monitoring Standard (NAAQMS), Part III- Section IV.*

Sampling Equipment Details	Instrument Used	Lab ID	Make	Model	Sl. No.	Calibration Valid up to
	Respirable Dust Sampler	UT/LAB/237	Polltech	PEM-RDS 9	1022	20/12/2023
	Fine Dust Sampler	UT/LAB/201	Polltech	PEM-ADS 2.5/10µ	22114	03/03/2024

Note:
1. Samples were collected by following laboratory's SOP (UT/LQMS/SOP/AA01A) based on CPCB Guidelines - National Ambient Air Quality Monitoring Series: NAAQMS/2003-04 and respective test methods.
2. This test report refers only to the sample tested.
3. Monitoring area coming under Industrial areas and observed values are relevant to sample collected only.
4. This test report may not be reproduced in part, without the permission of this laboratory.
5. Any correction invalidates this test report.
6. Weather during sampling was Sunny and Clear.
7. *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
8. **Time weighted average 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 monitorings.
9. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4449/06-2023 Dated 19/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH ★ Gazetted by MoEF Govt. of India ★ THANE (W) INDIA PIN-400 601 ★ ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH,**
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
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QCI-NABET Accredited EIA Consulting Organization
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ISO 9001 : 2015
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Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Est,Andheri-Kurla Rd, Marol, Andheri-E, Mumbai, India
For Project: Central Railway & Western Railway [Project No. 60666755]
Mumbai, Maharashtra.

ULR NO. : --
REPORT NO. : UT/ELS/ REPORT/4449/06-2023
ISSUE DATE : 19/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

AMBIENT AIR QUALITY MONITORING

Sampling Plan Ref. No.:	: UG02-06/2023	**Location Code**	: 1
Sampling Procedure	: UT/LQMS/SOP/AA01A	**Sample Location**	: Ghatkopar Railway Station Near Track No-05
Date & Time of Sampling	: 06/06/2023 11:30 Hrs. to 07/06/2023 11:30 Hrs.		
Sample Registration Date	: 07/06/2023	**GPS Co-ordinates**	: N 19º05'5.23", E 72º54'32.07"
Analysis Starting Date	: 07/06/2023	**Sample Collected By**	: ULTRA TECH
Analysis Completion Date	: 09/06/2023	**Height of Sampler**	: 1 Meter
Ambient Air Temperature	: 30.6 °C to 35.1 °C	**Sampling Duration**	: 24:00 Hours:Minutes
Relative Humidity	: 41.0 % to 68.0 %	**Sample Lab Code**	: UT/ELS/149/06-2023

Sr. No.	Test Parameter	Test Method	Test Result	Unit	NAAQMS Industrial, Residential, Rural and Other Area 24 Hrs. or 1 Hr**
1	Hydrocarbons as Methane§	IS 5182 (Part 17): 1979	0.8	ppm	--

§: Grab Sample

Remark/ Statement of Conformity: *NIL*

Note:
1. Samples were collected by following laboratory's SOP (UT/LQMS/SOP/AA01A) based on CPCB Guidelines - National Ambient Air Quality Monitoring Series: NAAQMS/2003-04 and respective test methods.
2. This test report refers only to the sample tested.
3. Monitoring area coming under Industrial areas and observed values are relevant to sample collected only.
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6. Weather during sampling was Sunny and Clear.
7. *Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
8. **Time weighted average 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 monitorings.
9. Parameter is tested are not covered under NABL scope.
10. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4448/06-2023 Dated 19/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH Recognised by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
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ULR -TC560023000003534F
TC-5600
ISO 9001 : 2015
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Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 Email : lab@ultratech.in Visit us at : www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4787/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS : **AMBIENT NOISE LEVEL MONITORING**
Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/N01
Date of Monitoring : 17/06/2023 to 18/06/2023
Sample Lab Code : UT/ELS/416/06-2023
Survey Done By : ULTRA TECH

Sr. No.	Location	Noise Level Reading in dB(A) Leq						
		Time (Hrs)	Day dB(A)			Time (Hrs)	Night dB(A)		
			L_{eq}	L_{min}	L_{max}		L_{eq}	L_{min}	L_{max}
01.	Virar Railway Station, Opposite Platform 4A Co-ordinates: N19°27'29.5"; E 72°48'4.8"	06:00 to 07:00	72.3	53.7	85.7	22:00 to 23:00	73.0	62.9	83.5
		07:00 to 08:00	64.6	52.4	78.6	23:00 to 00:00	72.7	65.3	81.3
		08:00 to 09:00	66.2	63.5	72.5	00:00 to 01:00	70.5	53.1	85.0
		09:00 to 10:00	73.9	72.8	78.2	01:00 to 02:00	66.2	52.3	76.3
		10:00 to 11:00	66.6	66.0	68.9	02:00 to 03:00	54.9	48.9	67.4
		11:00 to 12:00	70.6	70.2	72.5	03:00 to 04:00	68.5	49.3	81.7
		12:00 to 13:00	70.1	69.6	74.0	04:00 to 05:00	71.8	50.8	84.9
		13:00 to 14:00	66.0	65.5	68.8	05:00 to 06:00	71.2	53.1	86.3
		14:00 to 15:00	58.8	48.8	68.0	--	--	--	--
		15:00 to 16:00	71.9	62.5	81.9	--	--	--	--
		16:00 to 17:00	78.0	65.6	90.2	--	--	--	--
		17:00 to 18:00	79.7	65.6	95.0	--	--	--	--
		18:00 to 19:00	78.2	65.0	90.9	--	--	--	--
		19:00 to 20:00	86.7	69.1	95.6	--	--	--	--
		20:00 to 21:00	80.4	66.6	93.0	--	--	--	--
		21:00 to 22:00	75.2	66.9	86.0	--	--	--	--
		L_{10}	79.8			Limits in dB(A) Leq as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (See rule 3(1) and 4(1)) Ambient Air Quality Standards in respect of Noise			
		L_{50}	69.5						
		L_{90}	66.6						
		Day Leq	77.6			65			
		Night Leq	70.5			55			

Remark/ Statement of Conformity: *The observed values for LeqdB(A) for Day Time & Night Time are exceeding the standard limits as per Ambient Air Quality Standards in respect of Noise prescribed in The Noise Pollution (Regulation and Control) Rules, 2000 for Commercial Area.*

Note: 1. Monitoring area coming under Commercial Area.
2. Day Time – 06:00 Hrs to 22:00 Hrs and Night Time – 22:00 Hrs to 06:00 Hrs.

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Sound Level Meter	Make – Lutron; Model – SL4035SD Sr. No. Q685818	Valid up to – 17/08/2023

Note: 1 Measurement was done following laboratory's SOP (UT/LQMS/SOP/N01) based on CPCB's protocol for Ambient Noise Monitoring, July 2015.
2. This test report refers only to the monitoring conducted.
3. This test report may not be reproduced in part, without the permission of this laboratory.
4. Any correction invalidates this test report.

– END OF REPORT –

ULTRA-TECH Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH,**
Meghan Patil
(Authorized Signatory)

Page **1 of 1**

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 Fax : +91-22-2542 96 50 Email : sales@ultratech.in
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ULR -TC560023000003535F
TC-5600
ISO 9001 : 2015
ISO 45001 : 2018

Lab : Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
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TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4788/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/N01
Date of Monitoring : 20/06/2023 to 21/06/2023

AMBIENT NOISE LEVEL MONITORING
Sample Lab Code : UT/ELS/488/06-2023
Survey Done By : ULTRA TECH

Sr. No.	Location	Noise Level Reading in dB(A) Leq						
		Time (Hrs)	Day dB(A)			Time (Hrs)	Night dB(A)		
			L_{eq}	L_{min}	L_{max}		L_{eq}	L_{min}	L_{max}
01.	Badlapur Railway Station, Near Platform No-01 Co-ordinates: N19°10'00.70"; E 73°14'23.30"	06:00 to 07:00	69.9	51.3	83.3	22:00 to 23:00	70.6	60.5	81.1
		07:00 to 08:00	62.2	50.0	76.2	23:00 to 00:00	70.3	62.9	78.9
		08:00 to 09:00	63.8	61.1	70.1	00:00 to 01:00	68.1	50.7	82.6
		09:00 to 10:00	71.5	70.4	75.8	01:00 to 02:00	63.8	49.9	73.9
		10:00 to 11:00	64.2	63.6	66.5	02:00 to 03:00	52.5	46.5	65.0
		11:00 to 12:00	68.2	67.8	70.1	03:00 to 04:00	66.1	46.9	79.3
		12:00 to 13:00	67.7	67.2	71.6	04:00 to 05:00	69.4	48.4	82.5
		13:00 to 14:00	63.6	63.1	66.4	05:00 to 06:00	68.8	50.7	83.9
		14:00 to 15:00	56.4	46.4	65.6	--	--	--	--
		15:00 to 16:00	69.5	60.1	79.5	--	--	--	--
		16:00 to 17:00	75.6	63.2	87.8	--	--	--	--
		17:00 to 18:00	77.3	63.2	92.6	--	--	--	--
		18:00 to 19:00	75.8	62.6	88.5	--	--	--	--
		19:00 to 20:00	84.3	66.7	93.2	--	--	--	--
		20:00 to 21:00	78.0	64.2	90.6	--	--	--	--
		21:00 to 22:00	72.8	64.5	83.6	--	--	--	--
		L_{10}	77.4			Limits in dB(A) Leq as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (See rule 3(1) and 4(1)) Ambient Air Quality Standards in respect of Noise			
		L_{50}	67.1						
		L_{90}	64.2						
		Day Leq	75.2			65			
		Night Leq	68.1			55			

Remark/ Statement of Conformity: *The observed values for LeqdB(A) for Day Time & Night Time are exceeding the standard limits as per Ambient Air Quality Standards in respect of Noise prescribed in The Noise Pollution (Regulation and Control) Rules, 2000 for Commercial Area.*

Note: 1. Monitoring area coming under Commercial Area.
2. Day Time – 06:00 Hrs to 22:00 Hrs and Night Time – 22:00 Hrs to 06:00 Hrs.

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Sound Level Meter	Make – Lutron; Model – SL4035SD Sr. No. Q682239	Valid up to – 17/08/2023

Note: 1 Measurement was done following laboratory's SOP (UT/LQMS/SOP/N01) based on CPCB's protocol for Ambient Noise Monitoring, July 2015.
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For **ULTRA TECH,**
Meghan Patil
(Authorized Signatory)

Page **1 of 1**

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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ULR -TC560023000003179F
TC-5600
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 Email : lab@ultratech.in Visit us at : www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4304/06-2023
ISSUE DATE : 15/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/N01
Date of Monitoring : 06/06/2023 to 07/06/2023

AMBIENT NOISE LEVEL MONITORING
Sample Lab Code : UT/ELS/150/06-2023
Survey Done By : ULTRA TECH

Sr. No.	Location	Noise Level Reading in dB(A) Leq						
		Time (Hrs)	Day dB(A)			Time (Hrs)	Night dB(A)		
			L_{eq}	L_{min}	L_{max}		L_{eq}	L_{min}	L_{max}
01.	Ghatkopar Railway Station, Near Rail Track no. 05 Co-ordinates: N19°5'8.26"; E 72°54'31.59"	06:00 to 07:00	94.0	55.6	109.0	22:00 to 23:00	91.4	60.5	106.5
		07:00 to 08:00	71.8	59.1	83.0	23:00 to 00:00	73.6	60.6	86.5
		08:00 to 09:00	97.7	60.6	113.0	00:00 to 01:00	71.0	57.7	81.6
		09:00 to 10:00	75.9	63.5	89.0	01:00 to 02:00	68.6	55.3	78.1
		10:00 to 11:00	94.4	66.3	112.0	02:00 to 03:00	66.9	55.2	77.5
		11:00 to 12:00	96.6	63.5	111.2	03:00 to 04:00	65.5	53.2	75.7
		12:00 to 13:00	70.6	61.0	82.9	04:00 to 05:00	57.6	46.9	66.6
		13:00 to 14:00	74.9	61.7	87.1	05:00 to 06:00	64.6	56.8	69.9
		14:00 to 15:00	84.6	62.5	99.1	--	--	--	--
		15:00 to 16:00	82.4	62.3	96.8	--	--	--	--
		16:00 to 17:00	82.1	61.9	96.6	--	--	--	--
		17:00 to 18:00	85.9	62.2	103.5	--	--	--	--
		18:00 to 19:00	95.9	62.3	111.1	--	--	--	--
		19:00 to 20:00	93.6	63.5	108.8	--	--	--	--
		20:00 to 21:00	77.6	62.3	90.6	--	--	--	--
		21:00 to 22:00	97.4	63.0	114.1	--	--	--	--
		L_{10}	76.3			Limits in dB(A) Leq as per THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 (See rule 3(1) and 4(1)) Ambient Air Quality Standards in respect of Noise			
		L_{50}	67.4						
		L_{90}	63.0						
		Day Leq	92.5			65			
		Night Leq	82.6			55			

Remark/ Statement of Conformity: *The observed values for LeqdB(A) for Day Time & Night Time are exceeding the standard limits as per Ambient Air Quality Standards in respect of Noise prescribed in The Noise Pollution (Regulation and Control) Rules, 2000 for Commercial Zone.*

Note: 1. Monitoring area coming under Commercial Zone.
2. Day Time – 06:00 Hrs to 22:00 Hrs and Night Time – 22:00 Hrs to 06:00 Hrs.

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Sound Level Meter	Make – Lutron; Model – SL4033SD Sr. No. Q665560	Valid up to – 13/10/2023

Note:
1 Measurement was done following laboratory's SOP (UT/LQMS/SOP/N01) based on CPCB's protocol for Ambient Noise Monitoring, July 2015.
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For **ULTRA TECH,**
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 Fax : +91-22-2542 96 50 Email : sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in Kochi : +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4724/06-2023
ISSUE DATE. : 28/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE. : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No. : UG02-06/2023
Date of Monitoring : 17/06/2023

VIBRATIONS DUE TO PASSING TRAIN
Sample Lab Code : UT/ELS/414/06-2023
Survey Done By : ULTRA TECH

SR NO.	Location	Time (Hrs)	Vibration Reading in mm/sec
1.	Virar Railway Station Platform 4A	16:10 To 16:15	0.2
2.	Virar Railway Station Platform 3A	16:20 To 16:25	0.3

Remark/ Statement of Conformity: *Nil*

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Vibration Level Meter	Make – BASETECH; Model – 2050, Sr. No. 0716-2480	Valid up to – 01/09/2023

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For **ULTRA-TECH,**
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4488/06-2023
ISSUE DATE. : 19/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE. : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No. : UG02-06/2023
Date of Monitoring : 08/06/2023

VIBRATIONS DUE TO PASSING TRAIN
Sample Lab Code : UT/ELS/169/06-2023
Survey Done By : ULTRA TECH

SR NO.	Location	Time (Hrs)	Vibration Reading in mm/sec
1.	Badlapur Railway Station Platform No-03	09:40	1.5
2.	Badlapur Railway Station Platform No-02	10:03	2.1
3.	Badlapur Railway Station Platform No-01	10:07	2.9
4.	Badlapur Railway Station Home Platform Point-01	10:11	2.3
5.	Badlapur Railway Station Home Platform Point-02	10:16	1.8

Remark/ Statement of Conformity: *Nil*

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Vibration Level Meter	Make – BASETECH; Model – 2050, Sr. No. 0716-2480	Valid up to – 01/09/2023

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For **ULTRA-TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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ISO 45001 : 2018

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Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4465/06-2023
ISSUE DATE. : 19/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE. : 22/05/2023

SAMPLE PARTICULARS : **VIBRATIONS DUE TO PASSING TRAIN**

Sampling Plan Ref. No. : UG02-06/2023
Date of Monitoring : 07/06/2023
Sample Lab Code : UT/ELS/141/06-2023
Survey Done By : ULTRA TECH

SR NO.	Location	Time (Hrs)	Vibration Reading in mm/sec
1.	Kalwa Railway Station Platform No-01	12:06	1.9
2.	Kalwa Railway Station Platform No-02	12:11	1.5
3.	Kalwa Railway Station Platform No-03	12:17	2.1
4.	Kalwa Railway Station Platform No-04	12:25	1.3
5.	Kalwa Railway Station Auto Stand (West)	12:33	2.2

Remark/ Statement of Conformity: *Nil*

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Vibration Level Meter	Make – BASETECH; Model – 2050, Sr. No. 0716-2480	Valid up to – 01/09/2023

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For **ULTRA-TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4469/06-2023
ISSUE DATE. : 19/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE. : 22/05/2023

SAMPLE PARTICULARS :
Sampling Plan Ref. No. : UG02-06/2023
Date of Monitoring : 06/06/2023

VIBRATIONS DUE TO PASSING TRAIN
Sample Lab Code : UT/ELS/151/06-2023
Survey Done By : ULTRA TECH

SR NO.	Location	Time (Hrs)	Vibration Reading in mm/sec
1.	Track No-05 Ghatkopar Railway Station	12:07	1.2
2.	Ghatkopar Station Platform No-04	12:10	1.1
3.	Ghatkopar Station Platform No-03	12:12	1.2
4.	Ghatkopar Station Platform No-01	12:15	2.1
5.	Ghatkopar Station No-01 Entrance	12:18	1.1

Remark/ Statement of Conformity: *Nil*

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Vibration Level Meter	Make – BASETECH; Model – 2050, Sr. No. 0716-2480	Valid up to – 01/09/2023

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For **ULTRA-TECH,**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
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ULR -TC560023000003529F
TC-5600
ISO 9001 : 2015
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Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

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Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4766/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS
Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/W01A
Sample Registration Date : 07/06/2023
Date & Time of Sampling : 07/06/2023 at 11:50 Hrs
Analysis Starting Date : 07/06/2023
Analysis Completion Date : 16/06/2023
Sample Collected By : ULTRA TECH
Sample Lab Code : UT/ELS/140/06-2023

WATER SAMPLE ANALYSIS
Sample Type : Ground Water
Sample Location : New Ticket House TAP At Kalwa Station
Sample Quantity & Packing Details : 5 L in Plastic Container

Sr. No.	Test Parameter	Test Method	Test Result	Unit
PHYSICAL PARAMETERS:-				
1.	Colour	APHA 23rdEd. 2120 C	BDL[DL=1]	Hazen
2.	Turbidity	IS 3025 (Part 10) 1984	BDL[DL=0.1]	NTU
CHEMICAL PARAMETERS:-				
3.	pH	IS 3025 (Part 11) 2022	7.8	-
4.	Total Dissolved Solids	IS 3025 (Part 16) 1984	75	mg/L
5.	Total Hardness as $CaCO_3$	IS 3025 (Part 21) 2009	40	mg/L
6.	Total Alkalinity as $CaCO_3$	APHA 23rd Ed. 2320 B: 2017	31	mg/L
7.	Cyanide as CN^-	IS 3025 (Part 27) 1986	BDL[DL=0.02]	mg/L
8.	Sulphate as SO_4^{2-}	APHA 23rdEd. 4500- SO_4^{2-} E	5	mg/L
9.	Chlorides as Cl^-	IS 3025 (Part 32) 1988	6	mg/L
10.	Nitrates as NO_3^--N	IS 3025 (Part 34) 1988	0.3	mg/L
11.	Oil & Grease	IS 3025 (Part 39) 2021	BDL[DL=2]	mg/L
12.	Calcium as Ca	IS 3025 (Part 40) 1991	10	mg/L
13.	Magnesium as Mg	IS 3025 (Part 46) 1994	4	mg/L
14.	Boron as B	IS 3025 (Part 57) 2021	BDL[DL=0.1]	mg/L
15.	Lead as Pb	IS 3025 (Part 47) 1994	BDL [DL=0.6]	mg/L
16.	Iron as Fe	IS 3025 (Part 53) 2003	0.13	mg/L
17.	Mercury as Hg	APHA 23rdEd. 3112 B	BDL[DL=0.0006]	mg/L
18.	Selenium as Se	APHA 23rdEd. 3114 C	BDL[DL=0.003]	mg/L
19.	Zinc as Zn	IS 3025 (Part 49) 1994	0.13	mg/L
20.	Cadmium as Cd	IS 3025 (Part 41) 1992	BDL[DL=0.015]	mg/L
21.	Fluoride as F^-	APHA 23rd Ed. 4500- F- B,D: 2017	BDL[DL=0.2]	mg/L
22.	Anionic Surfactant as MBAS	APHA 23rdEd. 5540 BC	BDL[DL=0.08]	mg/L
23.	Phenolic Compound as C_6H_5OH	UT/LQMS/SOP/W31	BDL[DL=0.001]	mg/L
24.	Aluminium as Al	IS 3025 (Part 55) :2003	BDL[DL=0.5]	mg/L
25.	Sulphide as S^{2-}	IS 3025 (Part 29) 1986	BDL[DL=0.05]	mg/L
26.	Barium as Ba	APHA 23rdEd. 3111 D:	1.6	mg/L
27.	Copper as Cu	IS 3025 (Part 42) :1992	BDL[DL=0.03]	mg/L
28.	Manganese as Mn	APHA 23rdEd. 3111 B	BDL[DL=0.03]	mg/L
29.	Molybdenum as Mo	APHA 23rdEd. 3111 D	BDL[DL=0.9]	mg/L
30.	Nickel as Ni	IS 3025 (Part 54) 2003	BDL[DL=0.6]	mg/L
31.	Silver as Ag	APHA 23rdEd. 3111 B	BDL[DL=0.05]	mg/L

DL – Detection Limit **BDL – Below Detection Limit**

Opinions / Interpretations: *NIL*

Note:
1. Samples was collected using laboratory's SOP (UT/LQMS/SOP/W01A) based on CPCB's Guide Manual: Water & Wastewater Analysis, APHA 23rd Edition and IS3025 (Part 1).
2. This test report refers only to the sample tested.
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4. Any correction invalidates this test report.
5. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4767/06-2023 Dated 29/06/2023 for [illegible]

– END OF REPORT –

ULTRA-TECH Recognized by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For ULTRA-TECH
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

ULTRA TECH (TM)
Environmental Consultancy & Laboratory
Lab.Gazetted by MoEF&CC-Govt. of India
Lab. Accredited by NABL - ISO/IEC 17025:2017 [TC-5600,Valid until 03.08.2024 in the field of Testing]
QCI-NABET Accredited EIA Consulting Organization
STP/ETP/WTP Project Management Consultants
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4767/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/W01A
Sample Registration Date : 07/06/2023
Date & Time of Sampling : 07/06/2023 at 11:50 Hrs
Analysis Starting Date : 07/06/2023
Analysis Completion Date : 16/06/2023
Sample Collected By : ULTRA TECH
Sample Lab Code : UT/ELS/140/06-2023

WATER SAMPLE ANALYSIS

Sample Type : Ground Water
Sample Location : New Ticket House TAP At Kalwa Station
Sample Quantity & Packing Details : 5 L in Plastic Container and 100ml in Sterile Corning Bottle.

Sr. No.	Test Parameter	Test Method	Test Result	Unit
CHEMICAL PARAMETERS:-				
1.	Odor	IS 3025 Part 5	Agreeable	--
2.	Taste	IS 3025 Part 7 & 8	Agreeable	--
3.	Hexavalent Chromium	IS 3025 (Part 52) 2003	BDL[DL=0.01]	mg/L
4.	Chloramines	APHA 24th Ed. 4500 Cl G	BDL[DL=0.05]	mg/L
5.	Total Chromium as Cr	IS 3025 (Part 52) :2003	BDL[DL=0.02]	mg/L
6.	Residual Free Chlorine	IS 3025 (Part 26)1986	BDL[DL=0.1]	mg/L
7.	Arsenic As as	APHA 23rdEd. 3114 C:2017	BDL[DL=0.003]	mg/L
BACTERIOLOGICAL PARAMETERS:				
8.	*Total Coliform*	IS 1622 : 1981	BDL[DL=2]	MPN/100 ml
9.	*E.Coli*	IS 1622 : 1981	Absent	Absent
10.	*F.Coli*	IS 1622 : 1981	BDL[DL=2]	MPN/100 ml

DL – Detection Limit **BDL – Below Detection Limit**

Opinions / Interpretations: *NIL*

Note:
1. Samples was collected using laboratory's SOP (UT/LQMS/SOP/W01A) based on CPCB's Guide Manual: Water & Wastewater Analysis, APHA 23rd Edition and IS3025 (Part 1).
2. This test report refers only to the sample tested.
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4. Any correction invalidates this test report.
5. Parameters tested above are not covered under NABL scope.
6. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4766/06-2023 Dated 29/06/2023for final conclusion.

– END OF REPORT –

ULTRA-TECH Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For ULTRA-TECH
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

ULTRA TECH (TM)
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QCI-NABET Accredited EIA Consulting Organization
STP/ETP/WTP Project Management Consultants

ULR -TC560023000003530F
TC-5600
ISO 9001 : 2015
ISO 45001 : 2018

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Tele : +91 22 2547 49 07 / +91 22 2547 62 17 Email : lab@ultratech.in Visit us at : www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4768/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS
Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/W01A
Sample Registration Date : 19/06/2023
Date & Time of Sampling : 17/06/2023 at 16:00 Hrs
Analysis Starting Date : 19/06/2023
Analysis Completion Date : 23/06/2023
Sample Collected By : ULTRA TECH
Sample Lab Code : UT/ELS/413/06-2023

WATER SAMPLE ANALYSIS
Sample Type : Ground Water
Sample Location : Virar Railway Station Near platform 3A
Sample Quantity & Packing Details : 5 L in Plastic Container

Sr. No.	Test Parameter	Test Method	Test Result	Unit
PHYSICAL PARAMETERS:-				
1.	Colour	APHA 23rd Ed. 2120 C	BDL[DL=1]	Hazen
2.	Turbidity	IS 3025 (Part 10) 1984	BDL[DL=0.1]	NTU
CHEMICAL PARAMETERS:-				
3.	pH	IS 3025 (Part 11) 2022	7.3	-
4.	Total Dissolved Solids	IS 3025 (Part 16) 1984	421	mg/L
5.	Total Hardness as $CaCO_3$	IS 3025 (Part 21) 2009	191	mg/L
6.	Total Alkalinity as $CaCO_3$	APHA 23rd Ed. 2320 B: 2017	242	mg/L
7.	Cyanide as CN^-	IS 3025 (Part 27) 1986	BDL[DL=0.02]	mg/L
8.	Sulphate as SO_4^{2-}	APHA 23rd Ed. 4500- SO_4^{2-} E	32	mg/L
9.	Chlorides as Cl^-	IS 3025 (Part 32) 1988	51	mg/L
10.	Nitrates as NO_3^--N	IS 3025 (Part 34) 1988	0.8	mg/L
11.	Oil & Grease	IS 3025 (Part 39) 2021	BDL[DL=2]	mg/L
12.	Calcium as Ca	IS 3025 (Part 40) 1991	41	mg/L
13.	Magnesium as Mg	IS 3025 (Part 46) 1994	22	mg/L
14.	Boron as B	IS 3025 (Part 57) 2021	BDL[DL=0.1]	mg/L
15.	Lead as Pb	IS 3025 (Part 47) 1994	BDL [DL=0.6]	mg/L
16.	Iron as Fe	IS 3025 (Part 53) 2003	BDL [DL=0.06]	mg/L
17.	Mercury as Hg	APHA 23rd Ed. 3112 B	BDL[DL=0.0006]	mg/L
18.	Selenium as Se	APHA 23rd Ed. 3114 C	BDL[DL=0.003]	mg/L
19.	Zinc as Zn	IS 3025 (Part 49) 1994	BDL[DL=0.02]	mg/L
20.	Cadmium as Cd	IS 3025 (Part 41) 1992	BDL[DL=0.015]	mg/L
21.	Fluoride as F^-	APHA 23rd Ed. 4500- F- B,D: 2017	BDL[DL=0.2]	mg/L
22.	Anionic Surfactant as MBAS	APHA 23rd Ed. 5540 BC	BDL[DL=0.08]	mg/L
23.	Phenolic Compound as C_6H_5OH	UT/LQMS/SOP/W31	BDL[DL=0.001]	mg/L
24.	Aluminium as Al	IS 3025 (Part 55) :2003	BDL[DL=0.5]	mg/L
25.	Sulphide as S^{2-}	IS 3025 (Part 29) 1986	BDL[DL=0.05]	mg/L
26.	Barium as Ba	APHA 23rd Ed. 3111 D:	BDL[DL=0.5]	mg/L
27.	Copper as Cu	IS 3025 (Part 42) :1992	BDL[DL=0.03]	mg/L
28.	Manganese as Mn	APHA 23rd Ed. 3111 B	BDL[DL=0.03]	mg/L
29.	Molybdenum as Mo	APHA 23rd Ed. 3111 D	BDL[DL=0.9]	mg/L
30.	Nickel as Ni	IS 3025 (Part 54) 2003	BDL[DL=0.6]	mg/L
31.	Silver as Ag	APHA 23rd Ed. 3111 B	BDL[DL=0.05]	mg/L

DL – Detection Limit **BDL – Below Detection Limit**

Opinions / Interpretations: *NIL*

Note:
1. Samples was collected using laboratory's SOP (UT/LQMS/SOP/W01A) based on CPCB's Guide Manual: Water & Wastewater Analysis, APHA 23rd Edition and IS3025 (Part 1).
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3. This test report may not be reproduced in part, without the permission of this laboratory.
4. Any correction invalidates this test report.
5. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4769/06-2023 Dated 29/06/2023 for final conclusion.

– END OF REPORT –

ULTRA TECH Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For ULTRA TECH
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 Fax : +91-22-2542 96 50 Email : sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in Kochi : +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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Lab. Accredited by NABL - ISO/IEC 17025:2017 [TC-5600,Valid until 03.08.2024 in the field of Testing]
QCI-NABET Accredited EIA Consulting Organization
STP/ETP/WTP Project Management Consultants
ISO 9001 : 2015
ISO 45001 : 2018

Lab : Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4769/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

Sampling Plan Ref. No.	UG02-06/2023	**Sample Type**	Ground Water
Sampling Procedure	UT/LQMS/SOP/W01A	**Sample Location**	Virar Railway Station Near platform 3A
Sample Registration Date	19/06/2023		
Date & Time of Sampling	17/06/2023 at 16:00 Hrs		
Analysis Starting Date	19/06/2023		
Analysis Completion Date	23/06/2023	**Sample Quantity & Packing Details**	5 L in Plastic Container and 100ml in Sterile Corning Bottle.
Sample Collected By	ULTRA TECH		
Sample Lab Code	UT/ELS/413/06-2023		

WATER SAMPLE ANALYSIS

Sr. No.	Test Parameter	Test Method	Test Result	Unit
CHEMICAL PARAMETERS:-				
1.	Odor	IS 3025 Part 5	Agreeable	--
2.	Taste	IS 3025 Part 7 & 8	Agreeable	--
3.	Hexavalent Chromium	IS 3025 (Part 52) 2003	BDL[DL=0.01]	mg/L
4.	Chloramines	APHA 24th Ed. 4500 Cl G	BDL[DL=0.05]	mg/L
5.	Total Chromium as Cr	IS 3025 (Part 52) :2003	BDL[DL=0.02]	mg/L
6.	Residual Free Chlorine	IS 3025 (Part 26)1986	BDL[DL=0.1]	mg/L
7.	Arsenic As as	APHA 23rdEd. 3114 C:2017	BDL[DL=0.003]	mg/L
BACTERIOLOGICAL PARAMETERS:				
8.	*Total Coliform*	IS 1622 : 1981	BDL[DL=2]	MPN/100 ml
9.	*E.Coli*	IS 1622 : 1981	Absent	Absent
10.	*F.Coli*	IS 1622 : 1981	BDL[DL=2]	MPN/100 ml

DL – Detection Limit **BDL – Below Detection Limit**

Opinions / Interpretations: *NIL*

Note:
1. Samples was collected using laboratory's SOP (UT/LQMS/SOP/W01A) based on CPCB's Guide Manual: Water & Wastewater Analysis, APHA 23rd Edition and IS3025 (Part 1).
2. This test report refers only to the sample tested.
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5. Parameters tested above are not covered under NABL scope.
6. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4768/06-2023 Dated 29/06/2023for final conclusion.

– END OF REPORT –

ULTRA-TECH * Gazetted by MoEF Govt. of India * THANE (W) INDIA PIN-400 601 * ENVIRONMENTAL CONSULTANCY & LABORATORY *

For **ULTRA-TECH**

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
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STP/ETP/WTP Project Management Consultants

ULR -TC560023000003533F
TC-5600
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 Email : lab@ultratech.in Visit us at : www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4774/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/W01A
Sample Registration Date : 08/06/2023
Date & Time of Sampling : 08/06/2023at 11:10Hrs
Analysis Starting Date : 08/06/2023
Analysis Completion Date : 16/06/2023
Sample Collected By : ULTRA TECH
Sample Lab Code : UT/ELS/170/06-2023

WATER SAMPLE ANALYSIS

Sample Type : Drinking Water
Sample Location : Drinking water Badlapur Station Platform No-03 Tap .
Sample Quantity & Packing Details : 5L in Plastic Container

Sr. No.	Test Parameter	Test Method	Test Result	Unit	Standard Limits [IS 10500 : 2012]
1.	Colour	APHA 23rdEd. 2120 C	BDL[DL=1]	Hazen	5
2.	Turbidity	IS 3025 (Part 10) 1984	BDL[DL=0.1]	NTU	1
3.	pH	IS 3025 (Part 11) 2022	7.8	-	6.5 – 8.5
4.	Total Dissolved Solids	IS 3025 (Part 16) 1984	67	mg/L	500
5.	Total Hardness as $CaCO_3$	IS 3025 (Part 21) 2009	33	mg/L	200
6.	Total Alkalinity as $CaCO_3$	IS 3025 (Part 23) 1986	30	mg/L	200
7.	Cyanide as CN	IS 3025 (Part 27/ Sec1) : 2021	BDL[DL=0.02]	mg/L	0.05
8.	Anionic Surfactants as MBAS	APHA 23rd Ed. 5540 B,C	BDL[DL=0.08]	mg/L	0.2
9.	Sulphide as S^{2-}	IS 3025 (Part 29) 1986	BDL[DL=0.05]	mg/L	0.05
10.	Barium as Ba	APHA 23rdEd. 3111 D:	BDL[DL=0.5]	mg/L	0.7
11.	Copper as Cu	IS 3025 (Part 42) :1992	BDL[DL=0.03]	mg/L	0.05
12.	Manganese as Mn	APHA 23rdEd. 3111 B	BDL[DL=0.03]	mg/L	0.1
13.	Sulphate as SO_4^{2-}	APHA 23rdEd. 4500- SO_4^{2-} E	6	mg/L	200
14.	Chlorides as Cl^-	IS 3025 (Part 32) 1988	7	mg/L	250
15.	Nitrates as NO_3^--N	IS 3025 (Part 34) 1988	0.8	mg/L	45
16.	Calcium as Ca	IS 3025 (Part 40) 1991	9	mg/L	75
17.	Magnesium as Mg	IS 3025 (Part 46) 1994	3	mg/L	30
18.	Iron as Fe	IS 3025 (Part 53) 2003	0.12	mg/L	0.3
19.	Fluoride as F^-	APHA 23rdEd. 4500-F-B, D	BDL[DL=0.2]	mg/L	1.0
20.	Phenols	UT/LQMS/SOP/W31	BDL[DL=0.001]	mg/L	0.001
21.	Boron as B	IS 3025 (Part 57) 2021	BDL[DL=0.1]	mg/L	0.5
22.	Selenium as Se	APHA 23rdEd. 3114 C	BDL[DL=0.003]	mg/L	0.01
23.	Zinc as Zn	IS 3025 (Part 49) 1994	1.19	mg/L	5
24.	Silver as Ag	APHA 23rdEd. 3111 B	BDL[DL=0.05]	mg/L	0.1

DL – Detection Limit **BDL – Below Detection Limit**

Remark/ Statement of Conformity *Nil*

Note:
1. Samples was collected using laboratory's SOP (UT/LQMS/SOP/W01A) based on CPCB's Guide Manual: Water & Wastewater Analysis, APHA 23rd Edition and IS3025 (Part 1).
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5. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4775/06-2023 Dated 30/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH ENVIRONMENTAL CONSULTANCY & LABORATORY Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601

For ULTRA TECH
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 Fax : +91-22-2542 96 50 Email : sales@ultratech.in
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Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor,Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4775/06-2023
ISSUE DATE : 30/06/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE : 22/05/2023

SAMPLE PARTICULARS :

Sampling Plan Ref. No. : UG02-06/2023
Sampling Procedure : UT/LQMS/SOP/W01A
Sample Registration Date : 08/06/2023
Date & Time of Sampling : 08/06/2023at 11:10Hrs
Analysis Starting Date : 08/06/2023
Analysis Completion Date : 16/06/2023
Sample Collected By : ULTRA TECH
Sample Lab Code : UT/ELS/170/06-2023

WATER SAMPLE ANALYSIS

Sample Type : Drinking Water
Sample Location : Drinking water Badlapur Station Platform No-03 Tap .
Sample Quantity & Packing Details : 5L in Plastic Container and 100ml in Sterile Corning Bottle.

Sr. No.	Test Parameter	Test Method	Test Result	Unit	Standard Limits [IS 10500 : 2012]
1.	Odour	--	Agreeable	-	Agreeable
2.	Taste	IS 3025 (Part 7 &8)	Agreeable	--	Agreeable
3.	Chloramines	APHA 24th Ed. 4500 Cl G	BDL[DL=0.05]	mg/L	4.0
4.	Total Chromium as Cr	IS 3025 (Part 52) :2003	BDL[DL=0.02]	mg/L	0.05
5.	Molybdenum as Mo	APHA 23rdEd. 3111 D	BDL[DL=0.9]	mg/L	0.07
6.	Nickel as Ni	IS 3025 (Part 54) 2003	BDL[DL=0.6]	mg/L	0.02
7.	Aluminium as Al	APHA 23rd Ed. 3500- Al B: 2017	BDL[DL=0.04]	mg/L	0.03
8.	Residual Chlorine	IS: 3025 (Part 26) – 1986	BDL[DL=0.1]	mg/L	0.2
9.	Mercury as Hg	IS 3025 (Part 65) 2022	BDL[DL=0.006]	mg/L	0.001
10.	Oil & Grease	IS 3025 (Part 39): 2021	BDL[DL=2]	mg/L	0.5
11.	Cadmium as Cd	IS 3025 (Part 65) 2022	BDL[DL=0.015]	mg/L	0.003
12.	Lead as Pb	IS 3025 (Part 47) 1994	BDL [DL=0.6]	mg/L	0.01
13.	Hexavalent Chromium	IS 3025 (Part 52) : 2003	BDL[DL=0.01]	mg/L	--
14.	*Total Coliform*	IS 1622 : 1981	BDL[DL=2]	MPN/100 ml	0
15.	*E. Coli*	IS 1622 : 1981	Absent	-	Absent
16.	*F.Coli*	IS 1622 : 1981	BDL[DL=2]	MPN/100 ml	Absent

DL – Detection Limit **BDL – Below Detection Limit**

Remark/ Statement of Conformity *Nil*

Note:
1. Samples was collected using laboratory's SOP (UT/LQMS/SOP/W01A) based on CPCB's Guide Manual: Water & Wastewater Analysis, APHA 23rd Edition and IS3025 (Part 1).
2. This test report refers only to the sample tested.
3. This test report may not be reproduced in part, without the permission of this laboratory.
4. Any correction invalidates this test report.
5. Parameter/s tested is/are not covered under NABL scope.
6. *Parameters outsourced to competent laboratory.
6. This test report shall be referred along with Test Report No. UT/ELS/REPORT/4774/06-2023 Dated 30/06/2023 for final conclusion.

– END OF REPORT –

ULTRA-TECH Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

For **ULTRA TECH**
Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

ULTRA TECH (TM)
Environmental Consultancy & Laboratory
Lab.Gazetted by MoEF&CC-Govt. of India
Lab. Accredited by NABL - ISO/IEC 17025:2017 [TC-5600,Valid until 03.08.2024 in the field of Testing]
QCI-NABET Accredited EIA Consulting Organization
STP/ETP/WTP Project Management Consultants
ISO 9001 : 2015
ISO 45001 : 2018

Lab :Survey No. 93/A, Conformity Hissa No.2 G.V.Brothers Bldg., Bata Compound, Khopat, Near Flower Valley, Thane (West) - 400 601, Maharashtra, India.
Tele : +91 22 2547 49 07 / +91 22 2547 62 17 **Email :** lab@ultratech.in **Visit us at :** www.ultratech.in

TEST REPORT

ISSUED TO: AECOM INDIA PVT. LTD.
Unit No 2, 8th Floor, Times Square, Wing A, Opp Mittal Eastate
Andheri-Kurla Road, Marol, Andheri-E, Mumbai, India
Project site: Central Railway and Western Railway [Project No. 60666755], Mumbai, Maharashtra.

REPORT NO. : UT/ELS/REPORT/4885/07-2023
ISSUE DATE. : 05/07/2023
YOUR REF. : Sub-Consultancy Agreement
REF. DATE. : 22/05/2023

SAMPLE PARTICULARS : **VIBRATIONS DUE TO PASSING TRAIN**

Sampling Plan Ref. No. : UG02-06/2023
Date of Monitoring : 30/06/2023
Sample Lab Code : UT/ELS/717/06-2023
Survey Done By : ULTRA TECH

SR NO.	Location	Time (Hrs)	Vibration Reading in mm/sec
1.	Ambernath Railway Station Platform No.01	10:00	1.8
2.	Ambernath Railway Station Platform No.02	10:10	2.3
3.	Ambernath Railway Station Platform No.03	10:15	1.8

Remark/ Statement of Conformity: *Nil*

Sampling Equipment Details	Instrument Used	Make & Model	Calibration Status
	Vibration Level Meter	Make – BASETECH; Model – 2050, Sr. No. 0716-2480	Valid up to – 01/09/2023

Note:
1. This test report refers only to the monitoring conducted.
2. This test report may not be reproduced in part, without the permission of this laboratory.
3. Any correction invalidates this test report.

– END OF REPORT –

For **ULTRA-TECH,**

ULTRA-TECH Gazetted by MoEF Govt. of India THANE (W) INDIA PIN-400 601 ENVIRONMENTAL CONSULTANCY & LABORATORY

Meghan Patil
(Authorized Signatory)

H.O.: Unit No. 224,225,206, Jai Commercial Complex, Eastern Express Highway, Opp. Cadbury Factory, Khopat, Thane (W) 400 601, Maharashtra, India.
Tel : +91-22+2538 01 98 / 2545 03 72 / 2544 62 51 **Fax :** +91-22-2542 96 50 **Email :** sales@ultratech.in
Pune : +91-20-29525517 - pune@ultratech.in **Kochi :** +91-048-44011173 / +91-9895200526 - kochi@ultratech.in
Kolkata: +033-40089145 / +91-9674488198 - kolkata@ultratech.in

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