

GURUGRAM METRO RAIL PROJECT

Sustainable Multimodal and Resilient Transport for Haryana



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

Metro Connectivity from Millennium City Centre to Cyber City

June 2026



Swift Safe and Sustainable

GURUGRAM METRO RAIL LIMITED

PREFACE

The present Environmental and Social Impact Assessment (ESIA) study has been undertaken by RITES on behalf of Haryana Mass Rapid Transport Corporation Limited (HMRTC) as a part of the comprehensive planning and decision-making process associated with the Gurugram Metro Rail Project (GMRP). The study aims to evaluate the potential environmental and social consequences - both beneficial and adverse - that may arise from the implementation and operations of the project, and to propose suitable mitigation measures for enhancing positive impacts and minimizing the negative impacts. In 2024, Gurugram Metro Rail Limited (GMRL) was established as the nodal agency responsible for the implementation of the GMRP.

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List of Abbreviations

AFC	Automatic Fare Collection	EHS	Environmental, Health and Safety
AIDS	Acquired Immune Deficiency Syndrome	EIA	Environmental Impact Assessment
AOI	Area of Influence	ERP	Emergency Response Plan
ARP	Aerodrome Reference Point	ESCP	Environmental and Social Commitment Plan
BIS	Bureau of Indian Standards	ESF	Environmental and Social Framework
BOCWA	Building and Other Construction Workers Act	ESIA	Environmental and Social Impact Assessment
CBTC	Communication-Based Train Control	ESMF	Environmental & Social Management Framework
CMP	Comprehensive Mobility Plan	ESMP	Environmental & Social Management Plan
CPCB	Central Pollution Control Board		
CPR	Common Property Resources		
DPR	Detailed Project Report		

ESIRT	Environmental and Social Incident Response Toolkit	NBC	National Building Code
ESS	Environmental and Social Standards	NDMA	National Disaster Management Authority
ESZ	Eco-Sensitive Zones	NGO	non-governmental organization
FGDs	Focus Group Discussions	NOC	No Objection Certificate
FI	Financial Intermediary	NOCAS	No Objection Certificate Application System
GBV	Gender Based Violence	PHPDT	Peak Hour Peak Direction Trip
GMDA	Gurugram Metropolitan Development Authority	PMC	Project Management Consultant
GoH	Government of Haryana	PPE	Personal Protection Equipment
Gol	Government of India	PWD	Public Works Department
GPN	Good Practice Note	R&R	Resettlement & Rehabilitation
HIV	Human Immunodeficiency Virus	RAP	Resettlement Action Plan
HMRTC	Haryana Mass Rapid Transport Corporation Limited	RDSO	Research Designs and Standards Organisation
HSVP	Haryana Shehari Vikas Pradhikaran	RESCO	Renewable Energy Service Company
HUDA	Haryana Urban Development Authority	RoW	Right of Way
HVPNL	Haryana Vidyut Prasaran Nigam Limited	RWA	Resident Welfare Association
IT	Information Technology	SEA	Sexual Exploitation and Abuse
LMP	Labour Management Procedure	SEP	Stakeholder Engagement Plan
MCG	Municipal Corporation of Gurugram	SH	Sexual Harassment
MoEF&CC	Ministry of Environment, Forest and Climate Change	SIA	Social Impact Assessment
MoHUA	Ministry of Housing and Urban Affairs	SPCB	State Pollution Control Board
MRTS	Mass Rapid Transit System	ToR	Terms of Reference
NAAQS	National Ambient Air Quality Standards	VEC	Valued Environmental Components
NABL	National Accreditation Board for Testing and Calibration Laboratories	VVVF	Variable Voltage Variable Frequency
		WPA	Wildlife Protection Act

Summary

1. Introduction

Gurugram is known as the "Millennium City" for its remarkable shift from an agricultural region to a major financial and industrial hub in India. This transformation has seen the rise of multinational corporations, IT firms, business centres, and towering skyscrapers, making Gurugram a significant driver of India's economy. The city's rapid growth can be attributed to extensive urbanisation and robust economic development, owing to its strategic location in the National Capital Region (NCR) near New Delhi and its airport.

Gurugram has been improving its transportation infrastructure, but as urban mobility needs evolve, there's a demand for an efficient Mass Rapid Transit System (MRTS). With a focus on enhancing urban public transport in Gurugram City, Gurugram Metro Rail Limited (GMRL) is implementing the Gurugram Metro Rail Project (GMRP), which will connect Millennium City Centre (MCC) station to Cyber City (CC) station. GMRP involves the construction of approximately 29.05 km of elevated metro line in Gurugram, with 27 metro stations, a depot, rolling stock, and electric, telecommunication, signalling and control systems.

The Environmental and Social Impact Assessment (ESIA) report has been prepared for the entire GMRP corridor from MCC to CC. The construction of 29.05 km along with a Metro Depot in Sector 33 will be carried out in three civil packages: AC01¹, AC03² and AC04³ based on the Detailed Project Report (DPR) for AC03 and the design finalised by the Detailed Design Consultant (DDC) for AC01 and AC04. The ESIA report complies with national regulations and the World Bank (WB) Environmental and Social Framework (ESF). It is agreed in the ESCP that the ESIA/ESMP will be updated according to the Detailed Design Drawings of AC03 and findings from other planned studies, such as the Integrated Biodiversity Assessment and Environmental & Social (E&S) Audit of AC01, AC04, and the Casting Yard. As of June 2026, AC01 is under construction using GMRL's own funds.

2. Applicable Regulatory and Guidance Framework

The applicable regulatory framework for the ESIA comprises the following:

- Applicable international, national, state and city level E&S policies, regulations and guidance's including environmental policy, EIA notification (in case of Buildings more than threshold area as per notification) and acts, Water and Air Acts, Noise Rules,

¹AC01: Metro corridor section from Millennium City Centre (MCC) to Sector 9 (Chainage: Ch. -593 to Ch. 12603) and Spur to Sector 101.

²AC03: Metro corridor section from Sector 9 to Cyber City (Chainage: Ch. 12604 to 26650/26637)

³AC04: Workshop/Metro Depot at Sector 33

regulations on various type of Wastes, Wetlands and Eco sensitive areas, biodiversity, The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations, The Sexual Harassment of Women at Workplace Act and others)

- Indian labour and related laws, including The Building and Other Construction Workers (Regulation of Employment and Conditions of Service Act, The Factories Act, Child Labour (Prohibition and Regulation) Act, Minimum Wages Act, Workmen's Compensation Act & Rules, The Street Vendors Act.
- WB ESF, World Bank Group (WBG) Environmental, Health, and Safety (EHS) general guidelines, and the Environmental and Social Standards (ESSs) have been thoroughly reviewed and incorporated into the applicable regulatory framework.

3. Project Description

The GMRP corridor is 29.05 km in length and has 27 elevated stations. The primary corridor, spanning 27.20 km, is from Millennium City Centre to Cyber City and includes 26 stations. A spur of 1.85 km is proposed to connect the Dwarka Expressway from Basai Village with a single station.

DPR of GMRP envisaged a small stabling depot at Sector 101 as it planned its operational integration with Rapid Metro. However, with the approval of GMRP as an independent system, a full-fledged depot was required to meet enhanced operational requirements. GMRL subsequently planned a full-fledged Depot-cum-Workshop at Sector 33, covering a total area of 19.23 ha, of which 18.37 ha is government land (HSVP-owned) and 0.86 ha is private land. The depot will be developed with all requisite repair facilities, stabling and inspection facilities and associated support infrastructure and facilities.

As per the approved cost estimate for GMRP covering civil, electrical, signalling and telecommunications works, rolling stock, etc., the estimated total cost including Taxes & Duties at Sept' 2021 price level is Rs. 4,808.02 Cr (Rs. 48,082.2 million). Other features of the project are:

- The GMRP corridor is fully elevated and planned on the median of the existing roads, thereby minimising the private land requirement.
- Gauge⁴The gauge adopted for the metro is Standard Gauge 1435 mm, which permits sharper curves and is favourable for metro alignment in urban scenarios, resulting in less property demolition and acquisition.

⁴ Gauge is the gap between the two rails on which the train runs.

- Formation: Ballast less track⁵ is proposed for elevated stretches and depot to optimise maintenance and reduce the risk to vehicles on the road. This will help in reducing fugitive dust emissions during operation.
- Rolling Stock⁶: The rolling stock proposed for the corridor aims to improve energy efficiency and resource utilization. Communication-Based Train Control (CBTC) is proposed, which is mainly used for MRTS networks. This system works on the moving or virtual block principle to reduce headways, increase transport capacity, provide an adequate safety level, and reduce demand on passenger evacuation systems.
- Traction System⁷: A 750 V DC third rail traction system is proposed for the metro corridor. The modern rolling stock with a 3-phase VVVF drive has been proposed, which is an electricity-driven mass rapid transit system. The cars are equipped with 3-phase AC traction motors with a regenerative braking system, by which the trains can 'generate' electricity when brakes are applied. The regenerative braking will be the main brake power of the train and will regain the maximum possible energy and pump it back to the system, and thus fully utilise the advantage of 3-phase technology.

The current status of the project is as follows.

➤ AC01:

1. Consisting of a 15.55 km viaduct structure and 14 stations are under construction and financed by GMRL's own funds. The construction started in September 2025.
2. The contractor of AC01 has given an undertaking to follow and implement all commitments required in accordance with the WB ESF and the E&S documents prepared for the Project.
3. An agency to audit AC01 civil work, AC04 and Casting Yard and prepare a Corrective Action Plan (CAP) has been engaged, for the work is in progress.
4. The contractor has submitted C-ESMP, Labour Management Plan (LMP), Safety, Health & Environment (SHE) Plan, Wastewater Management Plan (WWMP), Traffic Management Plan (TMP), and Emergency Preparedness and Response Plan (EPRP). GC has reviewed these plans, and their implementation on site is being monitored by GC.
5. 2,515 trees have been affected in AC01, Casting Yard and GMDA Section (Bakhtawar Chowk). Compensatory afforestation (CA) of 10 times the affected number of trees namely; 25,150 trees will be planted by GMRL. Of the 25,150 trees identified for CA, 18,000 trees are under CA through Haryana Forest Development Corporation (HFDC), with 7,300 trees planted as of 31.03.2026. The forest clearance proposal is under preparation and will be uploaded to the Parivesh Portal of the Ministry of Environment and Climate Change (MoEFCC).

⁵ A ballast less track, or slab track, is a railway track where the rails are fixed on a solid surface, like concrete or asphalt, instead of being laid on loose stones.

⁶ Rolling stock refers to all railway vehicles that move on a railway line, including both powered and unpowered units.

⁷ A traction system in metro operation is the electrical system that provides the power to propel metro trains.

6. HSVP has handed over encumbrance-free government land for Casting Yard (11 ha) to GMRL and is in the process of handing over encumbrance-free Depot land (18.37 ha) to GMRL.
 7. GMRL has planned to undertake an Integrated Biodiversity Assessment during the migratory season in the month of July 2026. The preparation for the test pile is in progress, and after the results, piling work is expected to start by the end of the month and will be completed within 3-4 months. Construction of the Station next to the KBA location, will start with the installation of the pillar, after 7-8 months, and Station construction will be done after 1-1.5 years. In the CESMP for this construction, the contractor will include mitigation measures as guided by the biodiversity assessment study.
- AC03:
1. The section of AC03 consists of a 13.50 km viaduct structure and main structures for 13 stations. This section is expected to be financed by the WB, and the civil work tender is under finalization to launch the bidding process.
 2. 2204 Trees will be affected in AC03, and tree-cutting permission will be applied for once the contractor is on board.
- AC04
1. The depot contract has been tendered.
 2. The depot land identified at Sector 33 had five pockets (Annexure 1) totalling 19.23 ha: Pocket No. 1 (14.62 ha), Pocket No. 2 (2.88 ha), Pocket No. 3 (0.85 ha), Pocket No. 4 (0.016 ha), Pocket No. 5 (0.86 ha). Out of 19.23 ha of land, 18.37 ha is government land and 0.86 ha is private land. Except for Pocket No. 4 & 5, all three pockets had court cases involving HSVP.
 3. The marble merchants have been rehabilitated at a newly planned site, which is approximately 200m from the existing site in Sector 33.
 4. HSVP is in the process of handing over encumbrance-free government land (18.37 ha) for the depot to GMRL.
 5. 576 trees will be affected in AC04, and tree-cutting permission will be applied for once the contractor is on board.
- Update on other E&S Aspects
1. For the acquisition of private land, the Government of Haryana has notified a Policy for Direct Purchase of Private Land or Property through Mutual Negotiation. The purchase of private land is in progress as per the policy. The process of compensation calculation for the affected persons is underway.
 2. GMRL has engaged an expert agency for Resettlement Action Plan (RAP) implementation support activities, and the work is in progress.
 3. GMRL management has approved the Entitlement Matrix detailing the compensation to be paid to NTH PAPs.
 4. An agency has been engaged to undertake E&S audit including OHS and CAP preparation for AC01, AC04 and Casting Yard as per the WB ESF requirement. The audit has been completed and CAP are under development. ESMP and RAP shall be updated based on the findings of Audit & CAP.
 5. For assessment of KBA/IBA site falling in the GMRP influence area, an agency has been engaged and field studies are supposed to start in mid of July, 2026.

6. GMRL is in the process to float tender for engaging an agency to carry out Independent Environmental and Social Monitoring during the construction and operation phase of GMRP.

4. Analysis of Alternatives

The Analysis of Alternatives is structured to follow a "narrowing approach" involving a series of logical steps. This process begins with high-level strategic alternatives and progresses to more detailed technological and location-specific options. Following this commonly adopted approach, alternatives are considered in the following sequence:

- **Strategy Alternative:** In accordance with the Conceptual Transport Alternatives outlined in the Comprehensive Mobility Management Plan (CMMP) for Gurugram, 2020 (developed by the School of Planning and Architecture, New Delhi), both rail-based and road-based mass transport systems were evaluated to address the public transport demand in Gurugram. Metro rail systems were identified as a more environmentally sustainable modal choice than the other modes, offering enhanced safety, higher transport speeds, and reduced long-term emissions in the National Capital Region (NCR), which faces severe air pollution challenges.
- **'Zero' or 'No Project' alternative:** Here, without a project scenario, i.e., continuing the existing situation, compared with the scenario where the proposed project is implemented.
- **Alternative for the Location of Metro Depot, for Location of MCC Station and Alternatives for Corridor from Sector 5 to Sector 3.**

GMRP will yield tangible and non-tangible savings due to an equivalent reduction in road traffic and certain other socio-economic benefits. The introduction of the MRTS will lead to a significant decline in the number of buses, intermediate public transport (IPT) vehicles, and private vehicles, resulting in lower air pollution and improved traffic flow. With fewer vehicles, road movement will become faster and more efficient, making city travel smoother and more sustainable. This will reduce fuel consumption, vehicular emissions, travel time, and accidents, contributing to a cleaner and safer urban environment. Additionally, modifications to the alignment have reduced the number of affected structures from 261 to 210.

5. Environmental and Social Baseline

Baseline data was collected for land, water, air environment, noise & vibration, biological environment, sensitive receptors, archaeological monuments and the socio-economic profile of the study area between November 2023 and October 2024.

Land Environment: The GMRP alignment begins near Millennium City Centre Station at 28°27'34.40"N, 77°4'36.86"E and ends near Cyber Hub at 28°30'1.29"N, 77°5'43.10"E, with an average elevation of 257 m above sea level. The study area is covered by vast alluvial and sandy tracts, remnants of the Aravali Mountain chain. Soil quality analysis revealed sandy clay loam with good fertility. Land use is predominantly built-up area (44.71%) and agricultural land (29.7%). According to the revised seismic zoning map of India (IS 1893), the GMRP falls under the High Damage Risk Zone (Zone IV), which is the second most severe seismic zone.

Water Environment: Surface water from the Yamuna River is supplied after treatment by Gurugram Water Supply (GWS) and the National Capital Region (NCR) Water Supply Channel serves as the primary water source for the city. Groundwater is a crucial water source for Gurugram, predominantly extracted by private entities such as housing societies and individual households. Groundwater is heavily exploited, with levels averaging 39.89 meters below ground level. Surface water samples indicated organic pollution, while groundwater samples showed some parameters exceeding acceptable limits but remaining within permissible ranges.

Bajghera, Chandu, Budhera and Daultabad villages in Gurugram Tehsil are identified as highly flood-prone; however, the GMRP alignment does not pass through/or in proximity to these villages. Critical areas prone to storm water stagnation near the GMRP alignment have been identified. These include major intersections and chowks such as: 1) Hero Honda Chowk and the area opposite TPS-1, 2) Subhash Chowk, 3) Bakhtawar Chowk, 4) Umang Bhardwaj Chowk to Himgiri Chowk, 5) Khandsa Chowk, 6) Basai Chowk and its associated flyover 7) near ESI Hospital towards Sector 9A, 8) Sector-4/7 Chowk and 9) Presidium School Flyover and Krishna Chowk in Palam Vihar.

Meteorology: Gurugram experiences a subtropical climate with four distinct seasons. January is the coldest month and May & June are the hottest months. The average annual rainfall in Gurugram district is 505.4 mm, mainly between July and September. Humidity is high during South-West Monsoon. Winds are predominantly from the west and north-west direction.

Air Environment: Monitoring was conducted at 12 locations near the GMRP alignment and depot for four weeks from November 2023 to January 2024. The air quality monitoring results indicate that PM10 & PM2.5 exceed the permissible limits for residential, Industrial and Sensitive areas at all locations, while parameters SO₂, NO₂ and CO were noted within permissible limits. As per the monitoring results, the AQI in the project area ranges from 199 to 322, indicating air quality categories from moderate to very poor.

Noise: A noise level survey was carried out at 20 locations near the GMRP alignment and depot. The results show that Leq for day and night at 10 locations exceeded the permissible limits for silence zones as per National Ambient Noise Standards. At the remaining locations, noise levels were within the permissible limits for residential zones. The main source of noise in the project area is traffic movement on the roads.

Vibration: Vibration monitoring was carried out at 10 locations for 24 hr at each location. Vibration levels vary from 54 to 79.9 VdB, and the vibration is predominantly due to the road traffic.

Biological Environment: The state has a forest cover of around 3.63% of its geographical area, mainly comprising tropical and mixed dry deciduous forest and tropical thorn forest. Forest areas are distributed along roads, drains, railway lines and flood protection bunds, forming strips on either side of roads. Sector 10 Metro Station and part of the alignment falls within an unclassified forest (i.e. areas of scrub and tree growth not officially classified or notified as protected forest areas) of area 3.25 ha (8.02 acres).

The project area includes floral species such as neem, babool, gulmohar, peepal and eucalyptus etc. Animals recorded in Gurugram district include common langur, golden jackal,

leopard, jungle cat, Indian grey mongoose, nilgai, monkey and sambar. Mammals also include squirrel and mouse; reptiles include common garden lizard and rat snake.

Sultanpur National Park and Najafgarh Jheel are located within a 10 km radius of the GMRP alignment. MoEF&CC has notified an area of 5 km from the boundary of Sultanpur National Park as an Eco-Sensitive Zone. The nearest point of the alignment is the end point of the Spur at Dwarka Expressway, which is approximately 8.2 km from the national park. Najafgarh Jheel, the largest surface water body in Delhi, is located about 4.7 km from the end point of the Spur at Dwarka Expressway.

Sector 101, Basai is a Key Biodiversity Area (KBA) identified and validated by the by KBA Secretariat co-hosted by International Union for Conservation of Nature (IUCN) and Bird Life International. It is also an Important Bird and Biodiversity Area (IBA) as per the Birdlife International. As per WB ESS 6, this area is a modified habitat. This area is predominantly covered with seasonal agricultural activities, water hyacinth and beds of Typha. Tree species of Kabuli Kikar are predominantly present in the vicinity of the water spread area. Avifauna visiting this area, along with their IUCN Status and Indian Wildlife Protection Act (IWPA), 1972 schedule, are detailed in the ESIA report. As per the 2004 assessment by Birdlife International available on the DataZone portal⁸, the primary water source for the site was a breached water channel carrying wastewater and partially treated sewage from the Gurgaon Water and Sewage Works; and the seasonal rains. During the site visits conducted by the ESIA Consultants (RITES) between August 2023 to October 2025, it was observed that the main source of water inflow originated from a damaged drain carrying treated wastewater from a nearby STP. However, the flow of water stopped after repair of the damaged drain, which was also confirmed through consultation with an NGO operating in this area.

The Sector 101 land comprises of both privately owned plots and land under the jurisdiction of the Basai Panchayat. Currently, the site is being used for agricultural purposes..

The Basai Village Metro Station is proposed near Basai Pond, and the GMRP alignment passes close to the pond (Ch. 11690 to Ch. 11789). Basai Pond is primarily used by local residents for cattle bathing. The pond's water quality has significantly deteriorated due to indiscriminate solid waste dumping. During the monsoon season, the water level rises close to the pond's outer boundary, while in other seasons it recedes to approximately 10 meters away. During the detailed design stage, careful measures were taken to ensure that pillar placements is restricted to the outer edge of the pond to minimize impacts on the water spread. Even though the impacts are minimal, key measures to minimise impacts have been outlined in the Environmental and Social Management Plan (ESMP) to address any construction related concerns.

Sensitive Receptors and Cultural Heritage: Sensitive receptors located within the right of way (RoW) include temples, schools and hospitals. One temple and one pond fall within the RoW,

⁸ <https://datazone.birdlife.org/site/factsheet/18172-basai-wetlands>

while 18 temples, 21 schools/colleges, 21 hospitals and 9 parks are located within 100 m of the GMRP alignment. The nearest archaeological monument is the Mosque of Ala Vardi Khan, 490m from the GMRP alignment. Centrally protected monuments of ASI are protected with a prohibited area of 100m around them and a further 200m regulated area as per the AMASR Act (2010). As the Mosque is 490m away from the alignment, no impact is anticipated due to the project. If any chance finds such as artifacts, fossils or human remains are discovered during GMRP construction, chance-find procedures given in the ESMP will be followed.

Socio-Economic Survey: The socio-economic survey covered 154 households, representing a total population of 852 members. The largest age group comprised 46.24% of the population, aged between 19-45 years, with a nearly balanced gender ratio of 52.58% males and 47.42% females. Most families (77.92%) were nuclear, with an average household size of 5.53 members. The religious composition of the surveyed population comprised 86.36% Hindu, 11.04% Muslim and 2.60% Sikh, while the social composition consisted of 40.91% Other Backward Classes (OBC), 33.77% general category and 25.32% Scheduled Castes (SC).

Educational attainment varied, with 32.16% of population being illiterate and 19.72% completing high school, while approximately 10% were graduates or had attained higher education. Approximately 25.82% of the population was working, mainly in business/trade (19.13%) with smaller numbers in labour and services. The rest were mostly students, homemakers or elderly. Vulnerable groups constituted about 9.62% of the population, including elderly, widows, differently-abled persons and women-headed households.

Housing conditions showed that 24.68% of households owned their homes, while 75.32% resided in rented accommodations. The majority of houses (79.22%) were pucca structures, with access to basic amenities like electricity (91.56%), piped water (81.82%) and separate toilets (78.57%). Average monthly incomes predominantly ranged from Rs. 10,001 to Rs. 20,000 (54.55%).

Community awareness of the project stood at nearly 49%, with positive expectations including reduced travel time and traffic congestion. However, concerns were raised about potential impacts such as loss of land, livelihood and structures.

During implementation phase, in case of any site related development in GMRP, micro-level surveys shall be conducted to identify the social risks, vulnerable groups and community impacts such as restrictions in access, livelihood disruption and presence of informal users. A site specific Social Management Plans (SMPs) shall be prepared for the identified risks, including consultation, mitigation measures, and deployment of a grievance mechanism.

6. Stakeholder Consultations

Between December 2023 and October 2024, a series of formal and informal consultations were conducted with a total of 194 stakeholders. These included 69 project-affected persons (PAPs) and vulnerable groups; 63 other interested parties including NGOs, 13 police officials (both male & female officers) and 49 women transport users. The discussions focused on project design, transparent & timely communication, livelihood impacts, traffic management, safety & security and gender inclusive facilities in metro design. Major concerns raised

included potential income loss, safety issues, traffic management, and the provision of gender-sensitive facilities at metro stations.

7. Assessment of Environmental and Social Risks and Impacts

The risks and impacts associated with the project have been thoroughly assessed in line with the WB ESSs. Each ESS outlines specific areas of concern, ensuring that all potential issues are identified, evaluated and addressed comprehensively in the ESIA report.

The project provides opportunities to improve resource use and planning and management to contribute to the overall improvement of the environment (including air quality), and to improve access to planned infrastructure, services, greenspace, safe and less polluting modes of transport, and better facilities in Gurugram. Environmental risk is rated “High” given the high-risk investments to be implemented in the complex and dense urban settings of Gurugram city in the NCR, some near sensitive environmental features. Possible environmental risks to the biophysical environment potentially include (a) land and surface and ground water pollution, and likely disturbances to habitats/landscapes (KBA/IBA in Sector 101, Basai, two drains, and designated forest patches in the city); (b) visual impacts related to the permanent change of the city’s skyline. Based on project site screening, there are no known environmental liabilities. In addition, during construction and operation stages, the project will result in air, water and land pollution impacts (due to dust, heat, light, noise, and wastes/wastewater), on communities and some impacts on local fauna and flora. The aspects during construction and operations include:

- Generation of substantial debris and muck during the demolition of existing structures, construction, and operations & maintenance (O&M), including shifting of utilities.
- Dust and emissions to air (resulting in pollution, health impacts and odour) due to demolition, excavation, cutting, backfilling, compaction operations and other construction activities, and O&M works.
- Noise and other disturbances to residents and businesses during material movement, demolitions, and laying of rising mains.
- Temporary flooding of excavated areas during monsoons.
- Land and water contamination due to construction waste and operation-phase waste and sludge handling, including from the depot.
- Spillage of chemicals, fuel, and oil.
- Safety hazards to labourers (Occupational Health and Safety (OHS)) and the public (Community Health and Safety (CHS)).
- Increased traffic inconvenience (emissions, congestion, longer travel times, blockage of access) during transport of project staff and materials to the site during construction.
- Biodiversity impacts, including tree cutting, disturbance to habitats/landscapes at KBA/IBA in Sector 101, Basai, and nuisance and menace of pigeons at metro stations pillars and tracks.

The Social Risk is rated “High” as the GMRP alignment and stations are sited in dense urban settings of Gurugram City and shall impact 23.71 ha. of land including: a) 1.54 ha of private land (residential and commercial); b) about 22.17 ha of government land for construction of station, viaduct and depot; c) about 210 structures, of which 30 are owned by title holders,

one managed by a trust, two informal settlers (encroachers), 75 informal occupiers (squatters), 44 street vendors structures (holding license from MCG), one vendor holding Excise & Taxation Department License and 57 other structures. Of 30 titleholder structures, 28 are fully affected, and two will be partially impacted; and d) total depot land is 19.23ha. Additionally, 21 ha of govt. land is needed on a temporary basis for construction yards.

GMRL has applied the mitigation hierarchy principle to minimize impacts on land and structures by ensuring that the alignment passes over the median of existing roads. A DDC has been appointed to refine the alignment, station locations and entry/exit points. Accordingly, the land requirement may change slightly.

There may also be a need for land acquisition for infrastructure required for first- and last-mile connectivity such as bike spaces and charging stations. In addition to land related issues, other social impacts may include: (i) land-use changes and densification of urban fabric; (ii) pedestrian-vehicular conflicts and other CHS issues including those due to dust, noise and vibration, (iii) OHS risks during construction and O&M stages (iv) potential aggravation of risks in case of disasters (such as earthquakes, fires, manmade disasters, etc.) with envisioned densification along the corridor, (v) labour influx and Social Exploitation and Abuse/ Sexual Harassment (SEA/SH) risks are associated with migrants workers. Further, civil work for at least 3-4 years is likely to result in impacts on livelihoods and disrupt access to communities. Another key aspect to understand and mitigate during operation relates to life and fire safety (L&FS) preparedness and response/users evacuation measures during emergencies, including provisions for elderly and disabled users.

Based on the relevance of each ESS and the national/ state Legal, regulatory and institutional framework, the ensuing sections summarise the E&S risks and impacts likely due to the proposed interventions, followed by the mitigation measures considered.

Assessment and Management of E&S Risk and Impact (ESS 1)

Given the nature of activities, eight of the ten ESSs are relevant; ESS7 and ESS9 are not relevant to the project. Considering a variety of investments, including retro rail, last-mile connectivity, and multi-modal integration, an ESIA has been finalised for GMRP with suitable mitigation instruments, ESMP and RAP.

Associated Facilities are limited to those facilities or activities that are:

- a. directly and significantly related to the project;
- b. carried out, or planned to be carried out, contemporaneously with the project; and
- c. necessary for the project to be viable and would not have been constructed, expanded or conducted if the project did not exist.

In accordance with the definition and criteria for Associated Facilities under the WB ESF, AC01 and AC04 of the GMRP are considered as an Associated Facilities because they are directly and significantly related to the Project, are planned and implemented contemporaneously with the Project, and would not have been constructed, expanded, or undertaken in the absence of the Project.

However, the proposed road widening by NHAI on the section between Hero Honda Chowk and Umang Bhardwaj Chowk is not considered as an Associated Facilities to the GMRP for the following reasons:

1. The road widening is being implemented by NHAI, an independent implementing agency, through separate institutional arrangements and financing mechanisms.
2. The road widening has not yet started, but the land acquisition decisions were made much earlier. Land acquisition has already been completed and compensation paid by NHAI in accordance with the applicable legal and policy framework governing the highway project.
3. The road widening section of NH was decided beforehand, and NH is going ahead with its implementation.
4. The road widening of NH is not required for GMRP as it was earlier planned on the median of the roads like majority of the GMRP alignment.
5. NHAI is a national body not reporting to any state agency. It has rejected the application of WB ESF, and it has independent project objectives not related to GMRP.

Labour and Working Conditions (ESS 2)

The project will involve direct workers (GMRL employees) and consultants undertaking core functions (design for the corridor, stations, feasibility studies for multimodal integration and first/last mile connectivity; land acquisition surveys, ESIA and mitigation plans, and other related studies). The project's civil works contracts will engage skilled, semi-skilled and unskilled workers who are expected to contribute a major proportion of contracted workers besides migrant labour. Primary supply workers are relevant because civil-works contractors will procure construction materials. Community workers are not envisaged at present. A Labour Management Procedure (LMP) covering all requirements of ESS2, including child labour, labour influx, labour disputes, discrimination & exclusion, gender-based violence (GBV)/SEA/SH, OHS, and noise etc., has been prepared by GMRL. Contractor's Management Plans shall reflect the requirements of the LMP as applicable to respective activities. OHS management Plan will be updated by contractors before site mobilisation. Training programs are planned for project staff, including two orientation sessions and eight ESMP training sessions. Contractor will arrange training for staff/employees on Environmental Management Systems, Hazard Awareness, Health & Safety, Drainage, Noise, Waste, and Wastewater Management, incident reporting, emergency response and Project Management.

Resource Efficiency and Pollution Prevention and Management (ESS 3)

The project will recycle waste and wastewater, aim at energy and water efficiency, and use raw materials consistent with ESS3 and relevant national policies. C&D waste will be recycled, and the recycled material will be used. Energy-efficient measures will be implemented. Materials will be sourced from authorised suppliers due to local mining bans. Pollution prevention measures, including improved storage, management of fuels, construction materials, and various types of wastes (such as solid, C&D, hazardous, e-wastes), will help to mitigate air, water, land and noise pollution in areas where the alignment and stations are located near water bodies. Water sprinkling on local roads and worker sites, along with wheel washing facilities and coverings for materials and trucks, will be implemented to control dust. Additionally, measures to prevent soil erosion will be put in place. The contractor will take

necessary steps to prevent the release of pollutants and implement mitigation measures to minimize air pollution.

No contaminated sites have been identified during the ESIA Study in the project area. However, if identified at a later date, contamination assessments and site-specific cleanup plans will be developed in accordance with applicable guidelines. An outline for the Site Clean-Up/Remediation Plan for Contaminated Sites is provided in **Annexure 7.1**. Risks of alien species and pesticide use will be avoided in landscaping. Visual and environmental impacts, including light, shadow, vibration, noise, and air pollution, are evaluated, and mitigation measures to be implemented are suggested. The ESIA includes noise and air quality modelling, greenhouse gas (GHG) emissions estimation, runoff risk assessment, and waste management plans.

Noise: Construction noise from internal combustion engines, earth-moving, and material-handling equipment will impact nearby residence/ landuse and workers, with noise levels ranging from 76-88 dB(A) at 15 m, and the noise levels decrease with distance. During construction, Noise barriers and personal protective equipment will mitigate impacts. During operation, metro train noise is primarily from wheel/rail roughness and propulsion equipment. Cumulative noise levels exceeding permissible limits at certain locations. Proposed noise barriers at various locations (sensitive areas like schools and hospitals), with a budgetary estimate of **Rs. 522.11 Lakh (USD 551616.48)**.

Vibration: The GMRP is located in seismic Zone IV, requiring structures to withstand significant seismic forces with high-quality materials and dynamic analysis. Vibration impacts during construction are expected to be minimal from vehicles/equipment, and piling as the bored cast-in-situ piling method will be used under GMRP. During operation, vibrations are primarily due to train axle loads and acceleration forces. Sensitive receptors (temples, schools, and hospitals) are identified along the GMRP, which are prone to vibration impact, and no vibration impact is anticipated on Heritage structures. Design solutions and mitigation measures include track and rolling stock design enhancements, use of resilient materials, metro rail grinding, and vibration monitoring at sensitive sites. During the construction stage, stakeholders will be informed to promptly report any damages. GMRP sections shall be designed to minimise vibration and regular maintenance⁹ shall be planned to reduce the impact.

GHG Emissions: These are estimated based on the reduction in road traffic and the corresponding decrease in CO₂ emissions, after accounting for emissions from grid electricity consumption and the benefits of the regenerative braking system. The net carbon credits eligible due to the project in Year 2041 are approximately 89 tCO₂e/day (equivalent to 32,530 tCO₂e/year).

⁹Regular monitoring and preventive maintenance of the project infrastructure will be conducted by GMRL to ensure its efficient and safe operation.

Management plans such as C-ESMP, SHE, and WWMP are proposed, which cover the following aspects: tree cutting, air, noise and vibration, water supply management, rainwater harvesting, wastewater treatment and disposal, oil pollution control, green belt development, chance finds, waste disposal and labour management.

Community Health and Safety (ESS 4)

The H&S of the communities are important during the construction stage, mainly as these will occur along/on/under main traffic corridors where the density of development and traffic will be higher. H&S risks and public inconvenience due to the shifting of utilities, material transport, storage, construction and maintenance activities, and modal interchanges are important, and EHS plans (incl. Traffic Management, GBV and SEA/SH, etc) will be prepared. The ESIA assessed the risks to communities (eg: inconvenience, noise, disturbance, and pollution), pedestrian-vehicular conflicts and disturbance during construction, other project activities; and operations and maintenance; vibration and safety of structures and all other H&S issues, including traffic-related safety and diseases during all stages. Construction and O&M will be planned, designed and implemented to comply with the WBG's EHS guidelines. Life and Fire Safety (L&FS) standards will be internalised besides universal access. The proposed project corridor is situated in seismic Zone IV of the seismic zoning map of India. Accordingly, the design of all structural components will have a suitable seismic coefficient in line with the provisions of IS 1893: 2016, (Criteria for Earthquake Resistant Design of structures) to ensure seismic resilience in metro structure.

Land Acquisition, Restrictions on Land Use and Involuntary Resettlement (ESS 5)

Even though design features such as elevated tracks over medians of existing roads and stations will help to minimise impacts, it is estimated that the project impacts 23.71 ha. of permanent land, including a) 1.54 ha of private land (residential and commercial); b) about 210 structures. It shall also involve physical and economic displacement of shops/street-side vendors (including vendors holding licenses issued by MCG)/sanitary shop owners, particularly at station locations; and c) Total Depot land is 19.23 ha, with approximately 18.37 ha being government land. Additionally, 21 ha of land (Govt.) is needed temporarily for construction yards. Land will be purchased in accordance with the GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations. A preliminary notification for the acquisition of 1.09 ha (10,883.37 sq. m.) of land for AC01 was published in newspapers and on the GMRL website on 27.03.2026.

As part of the ESIA, key gaps have been identified, including: (a) the recognition of non-titleholders (such as encroachers and squatters) as PAPs, (b) the establishment of cut-off dates for non-titleholders and c) the consideration of depreciation for affected structures. To address these gaps, a RAP has been prepared, incorporating appropriate mitigation measures. RAP shall be updated based on the findings of E&S Audit & CAP of AC01, ACO4 and Casting Yard.

Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS 6)

Tree Cutting: The project will affect approximately 5295 trees. It is proposed to plant 10 saplings in lieu of each tree to be removed. In total, 52,950 saplings are proposed for

compensatory afforestation at an estimated cost of **Rs. 1201.90 lakh (USD 12,69,837.78)**. Native and indigenous tree species are recommended for planting.

KBA/IBA in Sector 101, Basai: The spur to Dwarka passes near this site. The key likely impacts of the project on KBA are noise, dust emissions, material and waste disposal, potential soil and water contamination from leaks or spills from fuel storage, material storage, hunting of birds, light pollution at night, etc. To protect the KBA, mitigation measures proposed include restrictions on material storage, including fuel storage, & proper planning for usage of construction machinery, erosion control measures, prohibition on hunting, regular monitoring, sanitation facilities for workers, and proper waste & wastewater management practices. Implementing these measures will reduce the project's impact on KBA/IBA in Sector 101, Basai. Additionally, an Integrated Biodiversity Assessment (with Critical Habitat Assessment) shall be conducted to prepare a BMP and bird-friendly design guidelines for implementation.

Basai Pond: The alignment passes near the pond. Basai Pond is primarily used by residents for cattle bathing. To mitigate impacts, the pond area will be isolated through hard barricading and temporary cut off drains. Measures such as soil bund silt fence, as feasible, shall be provided to prevent soil erosion at the pond. The likely impacts of the construction activities on the pond are as follows and will be mitigated as per the ESMP.

- Temporary deterioration of water quality
- Increased turbidity and reduction in pond area
- Disruption of natural drainage patterns
- Temporary restriction of cattle access to one side of the pond
- Soil erosion due to excavation in close proximity, especially during the monsoon
- Potential fuel spills and disposal of construction materials and waste
- Utility bursts (e.g., sewer or drainage lines) near the alignment, causing accidental discharge into the pond

During the operation phase, measures should be implemented to prevent the disposal of effluent, treated wastewater, and solid waste into the pond.

Sultanpur National Park: Approximately 8.2 km from the alignment and outside the 5 km Eco-Sensitive Zone; no impact is anticipated on the national park due to the project.

Najafgarh Jheel is located approximately 4.7 km from the alignment, and no anticipated impact due to the project. Further, the Aravalli Range lies around 3 km from the alignment, and no impact is expected since the alignment does not pass through the range.

Significant height barriers such as Elevated Dwarka Exp, Rail Over Bridge, High Rise Buildings and High-Tension Line (HTL) already exist near the GMRP alignment near the KBA. Moreover, the Gurugram-Rewari Railway line is located near the area.

The GMRP will have a third-rail traction system rather than overhead catenary lines, which substantially reduces exposure of flying birds to live conductors and the associated risk of electrocution. Third-rail components are installed at track level and are shielded or fenced,

minimizing opportunities for perching or in-flight contact that could cause collisions. Thus, no impact is anticipated on the flying path of avifauna due to the GMRP corridor.

Pigeons in metro networks pose significant challenges and risks such as health hazards from droppings, safety dangers from falling eggs and debris, operational disruptions and increased maintenance burdens affecting hygiene and passenger safety. Mitigation measures proposed in the ESMP, like changes in structural design, netting & barriers, deterrents, regular cleaning, etc need to be implemented for handling pigeon menace at metro stations.

Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities (ESS7)

The GMRP is located in Gurugram District, which does not fall under the Schedule V area of the Indian Constitution. Furthermore, the affected population does not meet the four key characteristics required to trigger the provisions of ESS 7.

Cultural Heritage (ESS 8)

The presence of physical/cultural heritage in the project area cannot be ruled out, as the city has protected monuments, temples, and churches. The project will avoid impacts on protected monuments and will be in line with national regulations and ESF.

A temple will be impacted due to the GMRP, which necessitates its reconstruction with community involvement.

An archaeological site, namely “Mosque of Ala Vardi Khan”, 490 meters from the GMRP, is well beyond the prohibited and regulated zones delineated by the National Regulations. As per Indian National Trust for Art and Cultural Heritage (INTACH) specified spatial extent, the impact zone can range from a regulated 100m to 300m radius also aligning with the ASI guidelines, the archaeological sites beyond the regulated zone, and hence not affected. These and are expected to be safe from the indirect project effects as well considering the design and construction mechanisms employed. Measures including compensations, are outlined in the ESMP to mitigate and manage any unexpected impacts.

Chance finds of archaeological significance may occur during construction, managed under the Indian Treasure Trove Act, 1878, involving notification to the District Collector and potential government control of the area commensurate with the significance of the find. Procedures for handling chance finds are prepared as part of the ESIA. All impacts and mitigation measures aim to preserve cultural heritage and comply with national regulatory requirements.

Stakeholder Engagement and Information Disclosure (ESS 10)

The Project undertook a preliminary stakeholder analysis of potential stakeholders. These involve a) PAPs including landholders, non-titleholders, and street vendors, particularly at certain station locations, b) other interested parties, such as local communities, interest groups of Basai Pond and KBA/IBA in Sector 101, Basai and key institutional stakeholders with whom the project will interact in relation to land acquisition or during construction. These include agencies/departments such as Municipal corporations, national highways, religious entities, educational institutions that fall en-route, etc. and other agencies, stakeholders involved in support activities, and c) Disadvantaged and vulnerable groups such as those

physically challenged/differently able and other vulnerable groups/households who might be impacted in varying degrees.

Consultations have been carried out with PAPs, other interested parties, and disadvantaged & vulnerable groups, and their issues and suggestions are incorporated in the ESIA. Additional consultation with affected parties and interested groups of Basai KBA/IBA will be conducted as part of BDA.

Cumulative Impacts: The cumulative E&S impacts of the GMRP are expected to be short-term, localised, and largely reversible, primarily occurring during the construction phase. These include temporary increases in dust, noise, and traffic congestion, which can be effectively mitigated through the strict implementation of the ESMP, including dust suppression, noise barriers, traffic management, and environmental monitoring. Importantly, the project is expected to deliver substantial long-term benefits, including a reduction in GHG emissions by encouraging a shift from private vehicles to cleaner, energy-efficient metro services, which will subsequently have a positive impact on the air quality of NCR. It will also improve urban mobility, enhance accessibility across key city zones, and support the broader goals of sustainable and environmentally responsible urban development.

8. Environmental and Social Management Plan (ESMP)

ESMP for the design/ pre-construction, construction and operation stages of the project has been developed based on the assessment conducted. It presents the management of E&S impacts adopting mitigation hierarchy: (a) Anticipate and avoid risks and impacts; (b) Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels; (c) Once risks and impacts have been minimized or reduced, mitigate; and (d) Where significant residual impacts remain, compensate for or offset them, were technically and financially feasible. ESMP will be incorporated in the bid documents so that the contractor allocates the required resources and mechanisms to implement these measures. The ESMP for the GMRP is structured into four key phases:

Design Phase: The DDC focuses on minimising visual and environmental impacts through aesthetic design and avoidance of structures in important areas, flood control, green building practices, and inclusivity features for all user groups. Energy and water efficiency, natural disaster safety, traffic management, and stakeholder engagement are prioritised. The Indian Railway/MoHUA standard guideline regarding rakes manufacturing envisages the metro train with a regeneration of 30% electrical energy that not only replaces internal combustion road vehicles but also gives a much superior energy efficient public transport system. GMRL metro project has adopted 750DC traction obviating OHE Steel Structure etc, giving a much cleaner skyline.

Pre-Construction Phase: The contractor is responsible for developing and implementing various plans, including C-ESMP, EHSMP, WWMP, LMP, etc. Pre-construction tasks include detailed geotechnical investigations, compensatory afforestation for affected trees, and continuous monitoring. Engagement with affected communities and stakeholders is essential.

Construction Phase: Utility services must be safeguarded, and workers must be provided with appropriate safety gear. Mandatory training on GBV and SEA/SH risks will be conducted. The contractor is required to implement strict safety protocols, including dust control, noise

suppression, and efficient waste management. A traffic management plan, environmental monitoring, and emergency preparedness measures will be strictly enforced.

Operation Phase: Regular maintenance, effective noise and vibration control, and proper waste management practices are essential. Also, energy-efficient lighting, emergency response systems, and security measures will be implemented to enhance safety and sustainability. Environmental monitoring will be conducted at all stations and depots, with a focus on noise, vibration, and waste impacts. An Incident Management Plan, Emergency Response Plan for Construction and O&M and a grievance mechanism will ensure ongoing safety and compliance. GBV awareness and traffic management support will continue during the operation.

9. Environmental and Social Monitoring Plan

During the construction phase, E&S monitoring will be carried out to check the quality of the environment and the triggering of social impacts during ongoing construction activities. It will be carried out through a contractor, and GMRL will be responsible for the review of the implementation of monitoring. Monitoring will include assessment of Ambient air quality, water and treated wastewater quality, Ambient noise, groundwater quality, soil quality, vibration and ecology. This monitoring shall also include OHS aspects, community safety, workers' safety, labour and working conditions, livelihood impact, and consultations as part of Construction Supervision and Quality Control by the General Consultant (GC).

During the operation phase, environmental monitoring will be conducted to understand the impacts on environmental attributes due to project activities. It will be carried out through the contractor, and GMRL will be responsible for the review of implementation. Monitoring will include Ambient air quality, outlet treated water quality, Ambient noise, Ground & Surface water quality, Soil quality, Wastewater quality, Solid waste, vibration and ecology monitoring.

To ensure adherence to the ESMP, an independent E&S monitoring agency shall be appointed during the construction and operation phases. This agency shall concurrently monitor Health and Safety (OHS, CHS) aspects throughout the Project and ensure corrective actions at the earliest. Mid-term and End-term evaluations of the implementation of ESMP and RAP shall be carried out.

10. Capacity Building

Capacity building will be required at all stages, including planning, construction, and operation. It will include various workshops and seminars for GMRL project staff, contractors' staff, supervisors, consultants, E&S and OHS experts, labourers, stakeholders, etc. The topics for training will include Health and Safety, pollution management, Environmental management and ESMP implementation, regulatory requirements, Monitoring requirements, Gender equality, biodiversity awareness, and others.

11. Implementation Arrangements

The E&S implementation arrangement for GMRP includes the Environmental and Social Management Unit (ESMU), consisting of an Environmental Health & Safety Expert, a Gender

Expert, and a Social cum R&R Expert supported by a Patwari in GMRL. In addition, the General Consultant (GC) has onboarded an Environmental Expert, Social Safeguard Expert and Safety Expert supported by an OHS Expert.

The ESMU is responsible for overseeing the ESMP and the Environmental Monitoring Plan (EMoP). Contractors will submit monthly, quarterly, and annual environmental compliance reports to the GC, which reviews and forwards them to the GMRL. The contractor must also maintain photographic documentation of key construction activities.

Further, GMRL has also engaged an agency to conduct an audit of AC01, AC04, and Casting Yard. In addition, an agency will be appointed to conduct independent environmental and social monitoring for four years during the construction period and the first year of operation.

GMRP partners include GMRL, Municipal Corporation of Gurugram, and Gurugram Metropolitan Development Authority (GMDA), who jointly own the project. GMDA coordinates all infrastructure projects in Gurugram District and performs the role of Unified Metropolitan Transport Authority (UMTA).

Government of Haryana established a High-Power Committee to fast-track the GMRP. The Chief Secretary of Haryana holds quarterly meetings to review the GMRP progress. All concerned authorities attend these meetings and work together to resolve project bottlenecks.

GMRL officials actively collaborate with all involved agencies. They regularly hold meetings, document minutes of meetings (MoMs) and organise follow-ups to ensure successful project completion.

12. Grievance Mechanism (GM):

The types of grievances stakeholders may raise include, but are not limited to:

- Construction-related impacts: cracks, damage to structures; dust damaging crops/trees
- H&S risks.
- Negative impacts on the environment including water bodies, and biodiversity
- Negative impacts on communities, which may include, but are not limited to, financial loss, physical harm, and nuisance from construction or operational activities and GBV, SEA/SH.
- Gaps in regulatory compliance

The project-related grievances will be segregated from the main grievances through unique coding options so that they can be tracked and reported effectively. Separate modes of grievance registration at project sites will be designed, and awareness-building activities and appropriate signage will be promoted.

The GM will have two Grievance Committees for redressing E&S matters. Grievances can be submitted through various platforms, including a dedicated telephone line, email, letters, grievance or suggestion boxes, online form on the GMRL website. GMRL is in the process of developing dedicated grievance channels, which will be incorporated into the E&S

documentation upon finalisation. All complaints will be categorised under Land, Environmental Issues, Social Issues, Occupational Health and Safety Issues, Contractor Issues, and Project Execution. Each grievance will be acknowledged within two days and resolved within 30 working days following a thorough investigation by the Grievance Committee. When grievances (excluding those related to compensation) are brought to the Grievance Committee, they shall be resolved within 30 days of receipt. Grievances related to compensation may take more time; however, GMRL will strive to resolve them within three months of receipt. If complainants remain dissatisfied with the resolution at either level, they may seek legal recourse at any stage of the project.

13. Estimated Budget for Implementation and Supervision of ESMP

The total project cost will cover the design, construction, and operation of the ESIA. The budget includes compensatory afforestation, environmental monitoring, establishment of an environmental division, training, rainwater harvesting, Effluent Treatment Plant, Noise barriers, STP, etc. The total residual cost of ESMP implementation during design/ pre-construction (6 months to 1 year), construction (4 years) and operations stages (3 years) is **Rs. 4582.67 Lakh (USD 4857651.55).**

14. Aspects for inclusion in Environmental and Social Commitment Plan (ESCP)

The disclosure and consultation of this ESIA, inclusion of the ESMP, are part of the procurement documents for agreement from the contractor on E&S requirements, and updating of the ESIA and ESMP for the project after finalising the detailed design shall be included in ESCP.

Design should be responsive to the ESF, and measures shall be incorporated to meet the suggested standards. Bidding documents and contracts to include ESMP and Monitoring Plan to enable the contractor to allocate appropriate time, resources (manpower and budget) for implementing ESMP, update as required, get approvals, disclose and implement the ESMP for Proposed GMRP. For tenders that had been invited for AC01, i.e. construction of Viaduct and 14 Elevated Stations from Millennium City Centre to Sector 9 and Spur to Dwarka Expressway and ramp to Depot at Sector 33, funded by GMRL, corresponding mitigation measures will be taken if any gap has been identified in the ESMP for this contract.

A comprehensive assessment should be made to assess vibration effects during the operation phase and visual impacts; additionally, the biodiversity of the KBA/IBA in Sector 101, Basai, will also be re-examined during the rainy season in July 2026. These studies will incorporate resilient designs and infrastructure essential for the project. In addition, GMRL shall have adequate capacity to implement and monitor the project E&S requirements, ESMP, Monitoring Plan, Capacity Building requirements and ESCP.

Monitor all emissions/discharges/ disposal of wastes (including sludge, slurry) from project facilities during construction and operation stages and ensure that the discharges from project facilities into the environment are as per the latest limits suggested by MoEF&CC, HSPCB, WB EHS and National Green Tribunal, whichever is stringent for each parameter. Prepare Disaster Management Plan (DMP) including Standard Operating Procedures for natural disasters and project-specific emergencies (as part of DPR, ESIA). Operations should also follow the latest DMP for Haryana.

The ESIA Report for the GMRP covers AC01, AC03 and AC04, spanning the entire 29.05 km corridor with 27 stations and one Metro Depot. The first civil works packages for approximately 15.55 km of the corridor have been tendered by GMRL with their own funding. The final scope of financing from other sources, including Multilateral Development Banks (MDBs), is still under discussion. As such, the ESIA, the ESIA Summary and the ESCP may be updated, as needed, based on further assessment, including determination of associated facilities and E&S Risk management in line with ESS1. Likewise, a RAP has been prepared for the entire corridor and applies to all PAPs identified in the corridor and at station locations, including those affected by associated facilities. The RAP will be updated to cover any PAPs who might be identified during implementation.

15. Recommendations and the Way Forward

Stakeholder consultation is a dynamic process. Consultations have been carried out with various stakeholders, including PAPs, other interested parties and disadvantaged and vulnerable groups during the preparation of the ESIA for the project. Consultations will be carried out during the life cycle of the GMRP. Draft and Final ESIA, ESMPs (in English, with translated summary of ESIA in Hindi) will be disclosed on the website of the implementing agency, namely GMRL, and on the funding agency's website. Consultations will also be carried out after a month of disclosure of the ESIA and ESMP on the website of GMRL. The suggestions of the stakeholders will be incorporated, and the final version of the documents will be re-disclosed again on websites of GMRL and the World Bank.

Chapter 1: Introduction

1.1 Background

Gurugram is known as the "Millennium City" for its remarkable shift from an agricultural region to a major financial and industrial hub in India. This transformation has seen the rise of multinational corporations, IT firms, business centres, and towering skyscrapers, making Gurugram a significant driver of India's economy. The city's rapid growth can be attributed to extensive urbanisation and robust economic development owing to its strategic location proximal to New Delhi and its airport, in the National Capital Region.

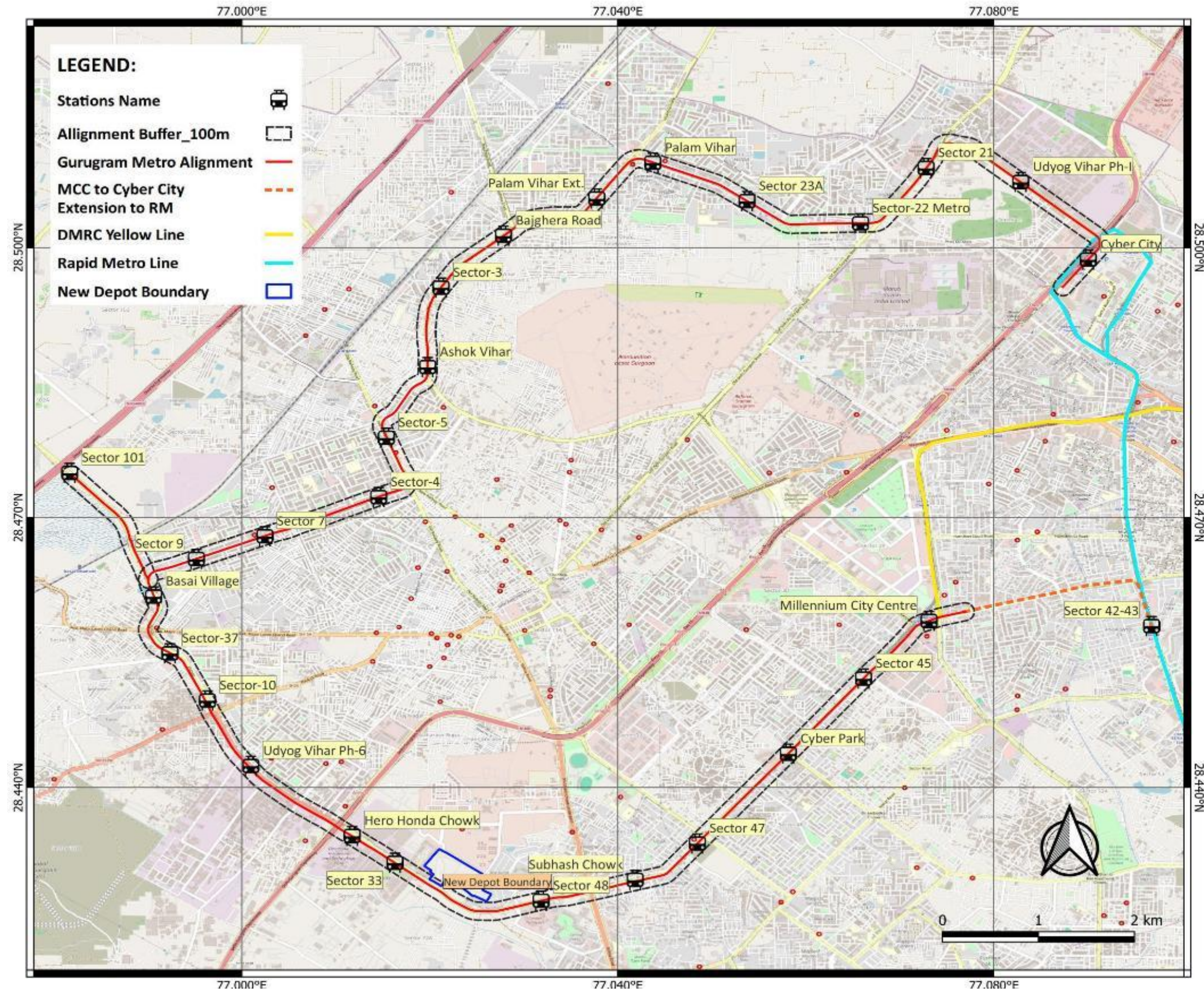
Gurugram has been improving its transportation infrastructure, but with urban mobility needs evolving, there's a demand for an efficient Mass Rapid Transit System (MRTS). GMRL intends to utilise financial support from the World Bank for the Sustainable Multimodal and Resilient Transport for Haryana (SMART-H, PHASE 1). The initial phase focuses on enhancing urban public transport in major cities, beginning with the GMRP, which will connect Millennium City Centre station to Cyber City station¹⁰.

1.2 Study Area

The study area for this ESIA is 100 meters on both sides of the GMRP alignment, which starts from Millennium City Centre and joins Rapid Metro at Cyber City. The alignment is shown in **Figure 1-1**.

¹⁰Before the GMRL was constituted, HMRTC prepared the Detailed Project Report (DPR) for GMRP. HMRTC entrusted RITES Limited with conducting the ESIA study for the Metro Connectivity from Millennium City Centre (formerly HUDA City Centre) to Cyber City, Gurugram, in August 2023. The ESIA report is prepared based on the design finalised by the Detailed Design Consultant for AC01 (from Ch. -593 to Ch. 12603, including Spur to Dwarka Expressway) and the DPR for AC03 (from Ch. 12604 to 26650/26637), covering the project alignment, station locations and entry/exits points, and AC04 (Metro Depot/Workshop). The ESIA report complies with national regulations and the WB ESF. The ESIA/ESMP is required to be updated based on the Detailed Design Drawings of AC03 and findings from other studies, i.e. Integrated Biodiversity Assessment and Environmental & Social (E&S) Audit of AC01, AC04 and Casting Yard.

Figure 1-1 Proposed Metro Corridor Alignment



1.3 Objective of the Study

The study envisages assessing the magnitude and sensitivity of direct, indirect and cumulative impact on the environment, cultural and socio-economic characteristics in the area of influence due to development of metro rail and its associated facilities, in accordance with pertinent policies and applicable legal and regulatory framework of the Government of India (GoI), Government of Haryana (GoH) and the WB's ESF. The specific objectives of the ESIA Study are:

- To identify and assess E&S risks and impacts, considering all relevant direct, indirect, and cumulative E&S risks and impacts of the subproject and its associated facilities.
- To assess the applicability and relevance of various legal and regulatory provisions in the construction of GMRP and the relevance of ESS as per ESF of the WB.
- To consult with and assess stakeholders' perceptions of a diverse set of stakeholders, particularly those impacted (including those disadvantaged and vulnerable) and others in the vicinity of the corridor and to elicit their concerns and suggestions for incorporation in the final design as necessary
- To assess current institutional arrangements for implementation, monitoring and grievance redressal and assess capacity constraints, if any and propose institutional responsibilities to implement the ESMP and Monitoring Plan and the budget required for the same
- To provide inputs to devise comprehensive and commensurate plans such as ESMP and RAP to address the identified risks and impacts.
- To identify risks related to GBV hotspots and SEA following WB's Good Practice Note (GPN) on SEA/SH.

Note: The Metro project does not fall under purview of the Environmental Impact Assessment (EIA) as per the EIA notification of the Ministry of Environment, Forest, and Climate Change (MoEF&CC); hence Environmental Clearance (EC) is not required for this Project. However, in case the area of the buildings exceeds 20,000 sqm. (if so for depots, station area development, etc), it shall require prior EC from the State Environment Impact Assessment Authority (SEIAA).

1.4 Approach of the Study

The ESIA study approach has focused on meeting the objectives within the agreed scope and timeframe while maintaining professional quality and meeting the client's expectations. The approach has been collaborative and coherent to complete the project within the time limit. RITES study team has maintained regular communications with all project stakeholders, including key stakeholders and other community groups. The general approach is based on:

- A clear understanding of the project's wider objectives and the scope of work;
- The study has been conducted in accordance with the policies, laws, government orders, and guidelines of the GoI and the GoH;
- Studying the WB ESF policy and ESSs;
- The WB GPN on SEA & SH and also the WB GPN on Assessing and Managing the Risks of Adverse Impacts on Communities from Project-Related Labour Influx;

- Formulation of an appropriate work plan based on understanding of the important issues and likely time requirements;
- Mobilisation of a suitable team of experts;
- Coordination with GMRL officials to ensure that matters are discussed openly and resolved quickly;
- Use of effective project management and coordination systems.

1.5 Methodology

Based on an understanding of the objectives and the detailed Terms of Reference (ToR) for the project, an appropriate methodology that addresses the specific requirements of the project has been proposed and followed.

1.5.1 Area of Influence (AOI)

Impacts were assessed both within the area of impact of 100 meters either side of the alignment and the project's area of influence up to 10 km. This area of influence encompasses project-associated facilities, construction camps, labour camps, access roads, material sourcing areas, etc.

A 100% census and socio-economic survey have been done for all affected structures & families residing within the Right of Way (RoW) of the corridor, and station building, entry/exit of stations. The RoW requirements are as follows:

- Alignment/Viaduct: 16 m (i.e., 8 m on either side from the centreline of the alignment/viaduct, including 3m for working space).
- Stations: 3m from the outer periphery of the stations.
- Entry/Exit Points: 3m from the outer periphery of the entry/exits.
- Depot: Up to the outer boundary of the depot area.

1.5.2 Tools and Methodology used for ESIA

The standard methodology for the data collection, impact assessment and formulation of mitigation plans has been adopted to carry out ESIA.

A. Literature Review

RITES team has collected and reviewed all existing policies, legislative frameworks, alignment drawings & station layout, reports, data, and documents from GMRL related to the project. The study team has also reviewed the ESF & all relevant GPN of WB.

B. Site Reconnaissance

The RITES survey team has conducted field visits for alignment, station, entry/exit locations of the proposed project and has identified the facilities/infrastructure that are categorised as associated facilities. During site visits, the team has verified the available project drawings on the ground and consulted with various stakeholders to create awareness about the project. Accordingly, all features falling along the alignment & station are identified for E&S assessment. The team has identified the baseline monitoring locations for air, water, soil, noise and vibration. The survey team has visited the potentially affected E&S sensitive receptors, property/community structures indicating their nature and types, viz. household

structure, commercial and social structure, religious structure, office and educational, hospital, infrastructure, agricultural farms, ponds, parks and trees, etc., during the field visit. The field visit has helped in identifying the AOI with due consideration of the E&S settings and helped to develop the survey & consultation questionnaires for the social survey.

C. Data Collection

E&S baseline data is collected from primary and secondary sources. Emphasis is given on the collection of the data from primary sources; however, secondary data is also collected wherever required. The secondary sources include the documents from various government and non-government organisations, DPR and other project documents/reports, etc. Baseline data for the following aspects is documented:

- ❖ Physical Environment: Land, Water, Meteorology, Air, Noise, Vibration, and Sensitive Receptors
- ❖ Biological Environment: Biodiversity (Flora/ Fauna including migratory species), Habitat Study, Forests, Protected Areas and other natural Habitats
- ❖ Socio-Cultural Environment: Demography, Socio-economic Status, and Cultural Aspects

Information on physiography, geological features and seismicity of the project area, physical and chemical characteristics of soil, water quality, ambient air quality, meteorological (temperature, relative humidity, wind rose, rainfall), noise and vibration data are collected. Primary data is collected for air, noise, vibration, water and soil quality of the area of influence during the non-monsoon season, and the monitoring results are compared with applicable standards.

Identification of the Valued Environmental Components (VECs) and social issues associated with the project, and environmentally important areas such as urban forest, water bodies, key biodiversity area, archaeological/ historical/ religious structures in and around the project area was carried out as part of ESIA.

Information on flora and fauna in the Project influence area, including critically endangered, threatened, near threatened, and vulnerable species, as well as sensitive habitats such as biodiversity areas, unclassified forests, and national parks, etc. has been studied through visual inspection and review of secondary data.

Socio-economic aspects in the project area were assessed using a range of indicators, including gender-disaggregated population data, social composition, educational levels, employment and income patterns, public health status and the use of common property resources.

The data was collected through a baseline survey comprising a household census and socio-economic survey of PAFs. Public consultations were also conducted to gain qualitative insights and understand community perspectives. Additionally, secondary data from official sources such as government publications and district statistical handbooks were reviewed.

D. Public Consultation

Stakeholder mapping was carried out to assess the relative influence of various individuals and groups on the project, as well as the project's impact on them. This process enabled the identification of stakeholder groups, the nature of their interests, and group-specific concerns and potential risks. The stakeholders consulted included affected parties (both titleholders and non-titleholders), other interested groups (such as RWA members, the public, street vendors, police officials, and women transport and metro users), and disadvantaged/vulnerable individuals or groups (including women, elderly people, and informal settlers).

Observations recorded during these consultations have been used as input for gap analysis in existing practices and contributed to the development of the ESIA, RAP, LMP and SEP. The SEP provides detailed information on stakeholder groups and outlines engagement strategies, specifying methods of engagement based on the type of stakeholders, including PAPs, vulnerable groups and other interested parties.

E. Impact Assessment

Based on the project particulars and the existing E&S conditions, all potential impacts arising from the GRMP have been identified and, wherever feasible, quantified. The assessment covered significant positive and negative impacts, including direct and indirect, immediate and long-term, cumulative, and unavoidable or irreversible impacts.

The magnitude of adverse impacts was also evaluated, and appropriate safeguard instruments were identified in accordance with the principles outlined in the WB's ESF, as well as applicable laws and regulations of the GoI and the GoH. Additionally, the key project benefits have been quantified in monetary terms, and a summary chart has been prepared to outline the positive and negative impacts associated with the project's location, design, and operational phases.

F. Analysis of Alternatives

The examination of project alternatives included a detailed assessment of site options, outlining the rationale for site selection and providing a comparative analysis of the alternatives considered, rejected, or selected based on merit. The evaluation considered site suitability with respect to E&S risks and impacts. Furthermore, both 'With Project' and 'Without Project' scenarios were analysed to understand the potential implications of project implementation versus non-implementation.

G. Mitigation Measures

A set of mitigation measures has been proposed following the mitigation hierarchy to avoid, reduce negative E&S risks and impacts through:

- Modifications in site selected, design, construction practices, maintenance, and operation to avoid or minimise adverse risks and impacts.
- Mitigation, management and monitoring to be adopted to protect and minimise impacts on the biophysical and social environment, as well as individuals directly affected by the project.

The nature, extent, and timing of these mitigation measures are aligned with the significance of the predicted impacts. Feasible and cost-effective mitigation strategies have been identified to reduce adverse effects to acceptable levels. The responsibilities of the implementing agency, along with the timelines for implementation, have been clearly outlined. .

1.5.3 Environmental and Social Management Plan (ESMP)

The ESMP for the project has been developed to address all identified risks & impacts and corresponding measures for the entire project lifecycle from design to operation.

This includes specific actions such as compensatory afforestation, provisions of infrastructure facilities in labour camps, waste management, measures for worker and community safety, etc. Cost estimates for each of the proposed mitigation measures have been incorporated in the report. Environmental monitoring during both construction and operational phases is essential, and the frequency of such monitoring has been specified along with the estimated costs and the required organisational structure for implementation. Additionally, the institutional arrangements have been identified for the effective implementation of the ESMPs.

A separate RAP has been prepared, which outlines: (a) the socio-economic profile of the affected settlements; (b) the type and extent of loss of assets including land and structures; (c) principles and legal framework applicable for mitigation of these losses; (d) the entitlement matrix; (e) income and livelihood restoration program; (f) relocation and resettlement budget; (g) the institutional framework for implementation of the plan, including monitoring and evaluation mechanisms.

A detailed list of individuals and organisations involved in the ESIA is provided in **Annexure 1.1**.

Chapter 2: Policy, Legal and Institutional Requirements

This chapter delineates the legal and regulatory requirements for E&S considerations. It outlines the permits and licenses required at various stages of the project, in accordance with applicable International, National and State-level laws and regulations. Additionally, it highlights the applicability and relevance of ESSs to the project.

2.1 Applicable Regulations at International, National and State Levels

Several key regulations are applicable to the GMRP to ensure compliance with environmental protection, social welfare and safety standards. These include the Environment (Protection) Act, 1986 (as amended in 1991), the Environment (Protection) Rules, 1986, Air and Water Acts, and the Forest (Conservation) Act, 1980.

Social aspects are governed by legislation such as the RFCTLARR Act, 2013, and the Building and Other Construction Workers Act (BOCWA), 1996.

Additionally, the guidelines for Noise and Vibrations issued by the Research Designs and Standards Organisation (RDSO), Ministry of Railways, in September 2015, are relevant for mitigating environmental impacts associated with the MRTS.

Furthermore, compliance with various standards and rules is essential to ensure environmental sustainability, workers' safety and social responsibility throughout the project lifecycle. These include regulations related to noise and vibration control, plastic waste, e-waste, battery waste, solid waste management, and labour laws.

The important acts, rules and notifications issued by the GoI, the GoH and relevant International Conventions applicable to E&S aspects of the project are presented in **Annexure 2.1**. The applicability of the WB ESS to the project is provided in **Annexure 2.2**.

2.2 Key Statutory Clearances

From the perspective of a metro project, several key clearances, authorisations, and permits are required to ensure legal compliance, environmental protection, and operational safety. These include approvals such as Tree Cutting Permission under the Forest (Conservation) Act, 1980, from the State Forest Department or Municipal Corporation, as well as Consent to Establish and Consent to Operate for facilities such as depots, workshops, and other infrastructure.

The project is also required to comply with regulations on environmental clearances were applicable, forest clearance, land use change, and the proper management and disposal of various waste types, including construction debris, hazardous waste, e-waste and plastic waste. Permits are required for the extraction of construction materials such as stone, aggregates, sand and earth from approved quarries, and the establishment of construction-related facilities like batching plants, casting yards and material storage areas.

Labour licenses and fire & electrical safety certifications, are equally critical to ensure smooth project execution and adherence to statutory requirements.

A comprehensive table outlining the required clearances and authorisations under applicable Acts, Rules and Notifications, along with the responsible authorities, applicable procedures, and their relevance to the project, is provided in **Annexure 2.3**.

2.3 Gap Analysis

To ensure compliance with the WB's ESF requirements, the project has adopted specific measures to address gaps between GoI legislation and the WB's ESS. The identified gaps, along with recommended corrective measures, are briefly outlined below and presented in **Annexure 2.5**.

Although metro projects are exempted from the requirement of Environmental Clearance (EC) under national law, the project has undertaken an ESIA and prepared an ESMP in line with ESS1. In addition, a Labour Management Procedure (LMP) has been developed to fill existing gaps in national and state frameworks. The LMP includes provisions for occupational health and safety (OHS), establishment of worker-specific grievance mechanisms (GM), prevention of gender-based violence (GBV), and implementation of a Code of Conduct (CoC) applicable to all categories of workers. Recognising the absence of a comprehensive national framework on resource efficiency, the project has also adopted international principles to promote the efficient use of water, energy, and other natural resources, as detailed in the ESMP.

The ESMP further outlines a set of community health and safety measures, including a Safety, Health and Environment (SHE), Traffic Management Plan (TMP), and Labour Management Plan, addressing critical issues not comprehensively covered by existing legislation. The RFCTLARR Act considers depreciation in the valuation of structures and does not recognise non-titleholders as PAPs. These gaps have been addressed by adopting provisions for compensation at full replacement cost excluding depreciation and by including non-titleholders in the project's entitlement matrix. Biodiversity impacts beyond protected areas are also addressed through specific actions included in the ESMP and a proposed detailed biodiversity assessment to support updation of ESMP to ensure environmental safeguards are upheld.

The provisions related to Indigenous Peoples are not applicable, as the project area does not fall under the Scheduled V area, and the affected population does not meet the relevant criteria. Additionally, a Chance Find Procedure has been integrated into the ESMP to manage any potential impacts on culturally significant, though unprotected, religious or social structures. Stakeholder Engagement Plan (SEP) has also been prepared, incorporating a dedicated GM and ensuring proactive disclosure of project-related information to promote transparency and meaningful stakeholder participation throughout the project lifecycle.

Chapter 3: Project Description

3.1 Metro Corridor

3.1.1 Alignment

The GMRP corridor is 29.05 km in length and has 27 elevated stations. The primary corridor, spanning 27.20 km, is from Millennium City Centre to Cyber City and includes 26 stations. A spur of 1.85 km is proposed to connect the Dwarka Expressway from Basai Village with a single station. The ESIA study has been carried out for the main corridor, the spur line and the depot. The alignment details are provided in the **Table 3-1**.

Table 3-1 Salient Features of the Corridor

S. No.	Route	Length in Kms	No. of Stations
1	Millennium City Centre to Cyber City	27.20	26
2	Spur from Basai Village to Dwarka Expressway	1.85	1
Total		29.05	27

3.1.2 Spur Line from Basai Village to Dwarka Expressway (Sector 101)

The purpose of the proposed spur is to connect GMRP with Dwarka Expressway. It begins just after the Basai Village station and terminates at Dwarka Expressway (Sector 101). The spur is fully elevated and has a total length of about 1.85 km.

3.1.3 Stations

The GMRP has been planned to serve major passenger catchment areas/destinations and to enable convenient integration with other modes of transport, including First and Last Mile connectivity, enabling all the modes to operate as an integrated transport system. There are 27 elevated stations proposed in GMRP. Stations vary in complexity along the route and have been located by an interactive process influenced by ridership forecasts, interchange requirements with other modes of transport, station spacing, alignment, utilities, road, pedestrian requirements, etc. The details of metro stations are provided in **Annexure 3.1**.

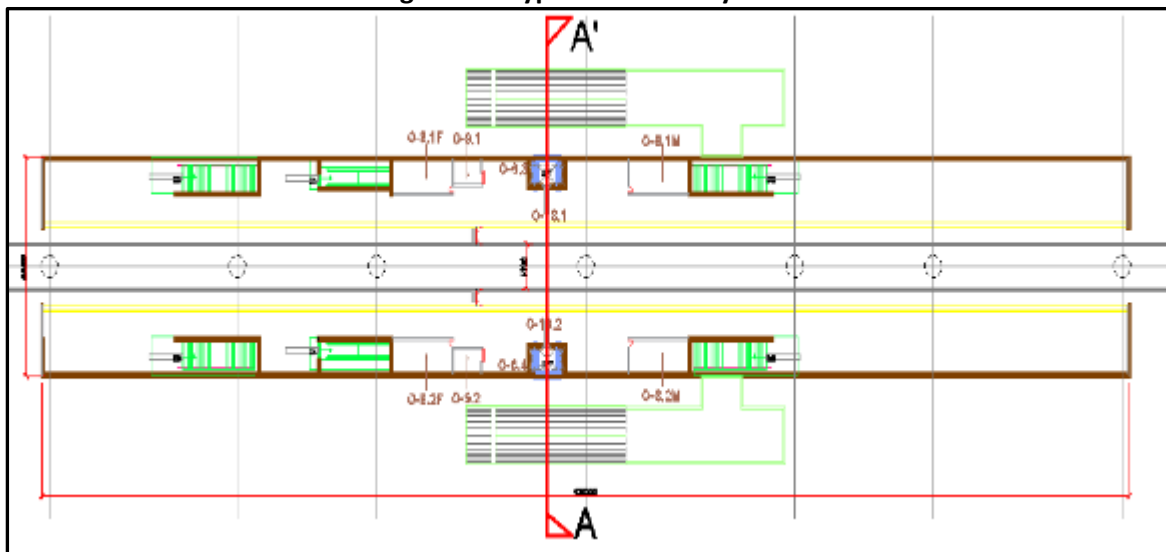
The station's design depends on the peak-hour traffic load for each station. As per the DPR, the horizon year for the study is taken as 2041, where a maximum Peak Hour Peak Direction Trip (PHPDT) is 34,309. The platform length is planned with a capacity of 6 cars/train. The total evacuation time for the movement of all passengers in an emergency from platform level to the landing at the next level is considered as 5.5 minutes (as per National Building Code (NBC), 2016), considering that the stations are open and the risk is less. Three typical designs of stations (**Table 3-2**), have been proposed and will serve as the foundation for all station development. The typical station layout is shown in **Figure 3-1**.

Table 3-2 Typical Designs

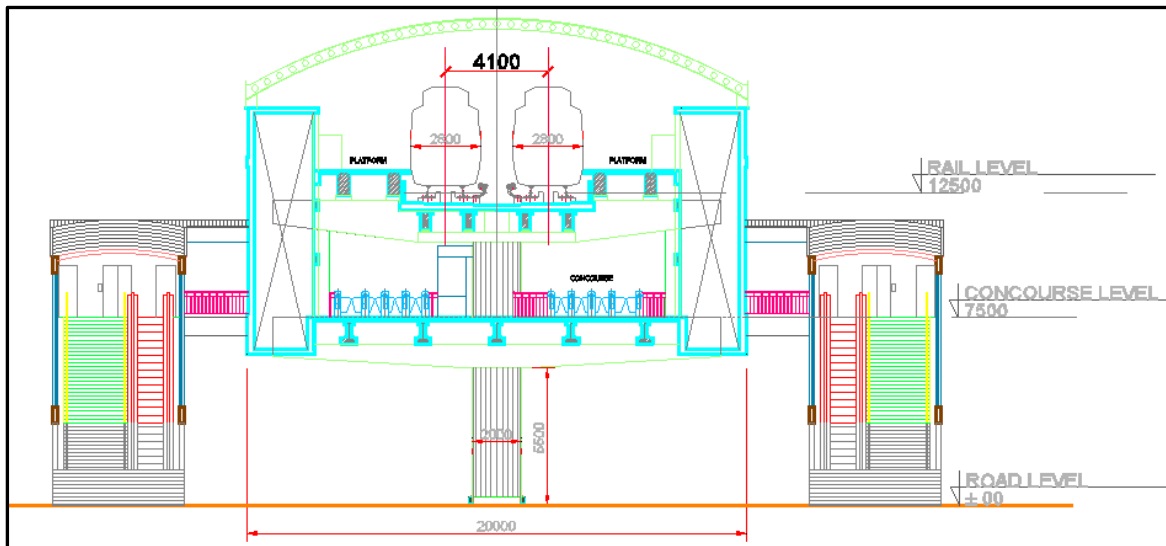
S. No.	Proposed Type	Dimensions
1	Type A (Typical Station)	130m x 20m
2	Type B (Cyber City)	130m x 28m
3	Type C (Millennium City Centre)	130m x 22m

Source: DPR, 2021

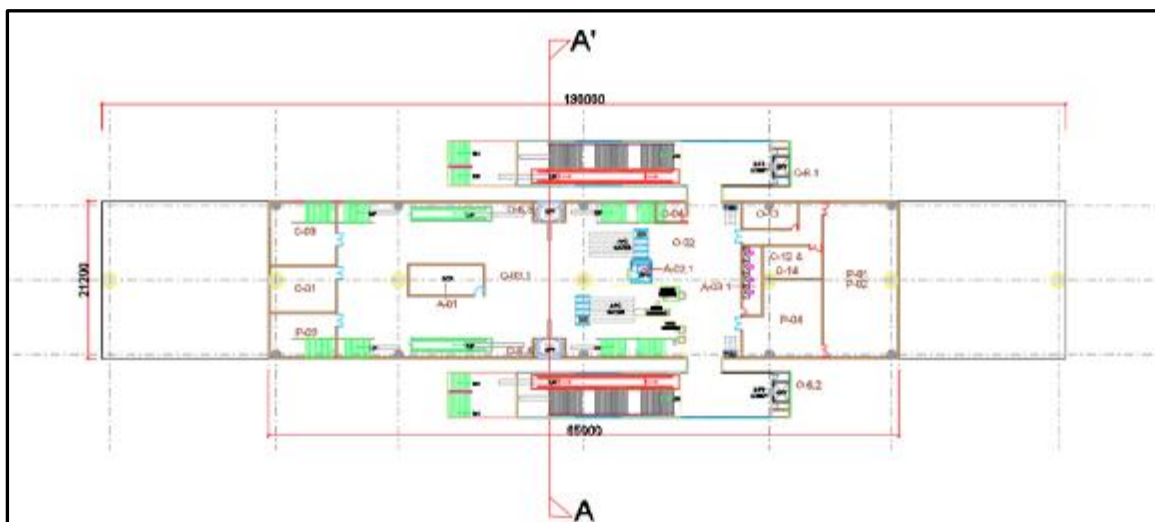
Figure 3-1 Typical Station Layout Plan



PLATFORM LEVEL PLAN



CROSS SECTION AA'



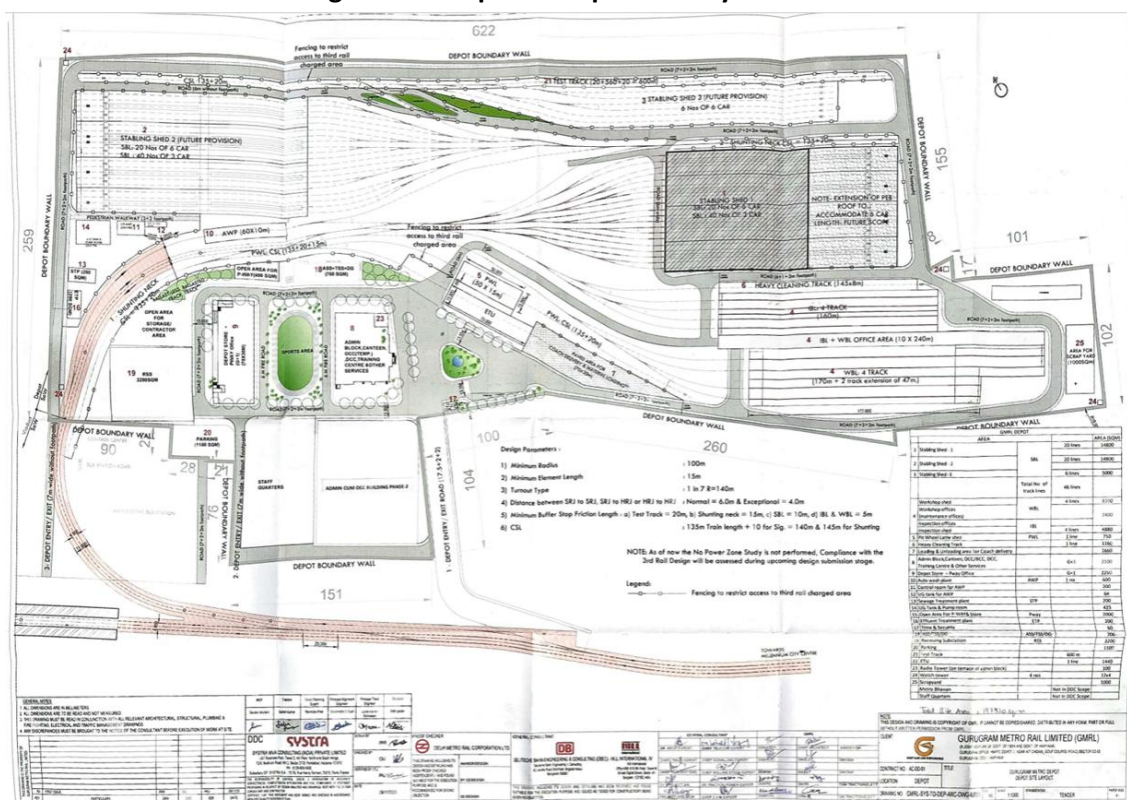
CONCOURSE LEVEL PLAN

Source: DPR, 2021

3.1.4 Depot

A small stabling depot was proposed at Sector 101 for GMRP in the DPR Study, as it envisaged its operational integration with Rapid Metro. However, with the approval of GMRP as an independent system, a full-fledged depot was required to meet enhanced operational requirements. GMRL subsequently planned a full-fledged Depot-cum-Workshop at Sector 33. The area of the proposed Depot is 19.23 ha (18.37 ha government land and 0.86 ha private land), and the layout plan is shown in **Figure 3-2**. This was also to avoid impacts on the Basai KBA.

Figure 3-2 Proposed Depot Site Layout Plan



Source: GMRL

3.1.5 Double Decker Fly-Over

In this project, the double-deck viaduct as an integrated structure was not originally envisaged but was subsequently adopted as the most rational option for efficient spatial utilisation and improved urban traffic performance at certain sections of GMRP. The construction of a double-decker structure includes a flyover on the lower tier to accommodate vehicular traffic and a metro viaduct on the upper tier.

The scope encompasses the design of temporary works; construction of all permanent civil, structural and associated systems; and fabrication/installation of rail and road viaducts, bearings, pier caps, piers, piles, pile caps/spread footings, crash barriers, reinforced earth (RE) walls and retaining walls. It also includes all associated enabling civil works, such as provisions for lighting. The design of the sections with such arrangements is under finalisation.

3.1.6 Permanent Way

Gauge: GMRP will adopt a standard gauge of 1435 mm, which permits sharper curves and is better suited for metro alignment in urban scenarios, resulting in less property demolition and acquisition.

Formation: A ballast-less track system is proposed for elevated stretches and depot areas to optimise maintenance requirements and minimise risks to road traffic. This will help in reducing fugitive dust emissions during operation.

3.1.7 Rolling Stock

The proposed rolling stock aims to improve energy efficiency and resource utilisation. The broad features of rolling stock are presented in **Table 3-3**.

Table 3-3 Broad Features of Rolling Stock

S. No.	Parameters	Rolling Stock
1.	Basic Unit	3 Car basic unit 2 DMC and 1 TC
2.	Coach Dimensions	19.9m x 2.8m
3.	Train Composition	3 Car: DMC+TC+DMC 6 Car: DMC-TC-MC-MC-TC-DMC
4.	Train Capacity	3 car train: 757 @6p/m ² , 978 @8p/m ² 6 car train: 1576 @6p/m ² , 2040 @8 p/m ²
5.	Coach construction	Aluminium body
6.	Axle load	≤16 T
7.	Braking System	Regenerative Braking
8.	Propulsion system	3 phase drive system with VVVF control
9.	Type of traction supply	750 V DC Third Rail

Source: DPR, 2021

3.1.8 Signalling & Train Control System

A Communication-Based Train Control (CBTC) system is proposed, which is mainly used for MRTS networks. This system works on the moving or virtual block principle to reduce headways, increase transport capacity, provide an adequate safety level and reduce demand on passenger evacuation systems.

3.1.9 Traction System

A 750 V DC third rail traction system is proposed for the GMRP corridor. Modern rolling stock with a 3-phase VVVF drive system has been proposed, which is the electricity-driven MRTS. The metro cars will be equipped with 3-phase AC traction motors with a regenerative braking system, by which the trains can 'generate' electricity when brakes are applied. Regenerative braking will be the main brake power of the train and will regain the maximum possible energy and pump it back to the system, thus fully utilising the advantage of 3-phase technology.

3.1.10 Power Requirements

The power requirements of a metro system are determined by peak-hour power demand for traction and auxiliary applications. The ultimate (design) power requirement for this corridor has been conceptualised considering various norms, directives, and guidelines. Accordingly, the estimated power demand for the GMRP corridor is provided in **Table 3-4**.

Table 3-4 Power Demand Estimation (MVA)

Year	2026	2031	2041
Traction	13.65	25.46	31.42
Auxiliary	8.87	10.27	11.67
Total	22.52	35.73	43.09

Source: DPR, 2021

3.1.11 Substation

Gurugram City has a 220kV and 66kV power transmission and distribution network that caters to various types of demand. As part of the GMRP, two Receiving Sub-Stations (RSS) are proposed to supply power for both traction and auxiliary services. These RSS will source power from the existing Grid Sub-Stations (GSS) of Haryana Vidyut Prasaran Nigam Limited (HVPNL). The GSS and RSS details are given in **Table 3-5**.

Table 3-5 Sources of Power Supply

Grid Sub-Station	RSS of Metro Authority	Approx. Dist. GSS to RSS
Sector 52 GSS (220/66 kV)	Sector-45 RSS (66/33 kV)	03 km
Daulatabad GSS (440/220/66 kV)	Krishna Chowk RSS (66/33 kV)	07 km

Source: DPR, 2021

3.1.12 Ventilation and Air-Conditioning System

The air conditioning and ventilation requirements at the elevated stations of the GMRP are mainly for ancillary spaces such as staff rooms, equipment rooms, etc. These systems are essential to ensure a comfortable working environment for operations and maintenance personnel, to prolong the life of equipment through proper control of temperature, pressure and humidity, and to mitigate the possible risk of gas accumulation.

3.1.13 Fare Collection System

An automatic fare collection system has been proposed, which enables ease of use/operation, issue of single/multiple journey tickets, amenability to quick fare changes and requires lesser manpower requirements and significantly improves passenger flow and egress at stations.

3.1.14 Transport Demand Forecast

The projected trips between adjacent stations of the GMRP have been estimated for the years 2026, 2031, 2041 and 2051. The maximum PHPDT for the GMRP are given in

Table 3-6.

Table 3-6 Maximum Peak Hour Section Loading on Study Corridor

Corridor Details	Maximum PHPDT			
	2026	2031	2041	2051
Millennium City Centre to Cyber City and Spur	19359	27263	34309	43878

Source: DPR, 2021

3.1.15 Ridership on Metro Corridor for Years 2026, 2031, 2041 & 2051

The estimated daily ridership on the study corridor is projected to be 5.34 lakh passenger trips in 2026, 7.26 lakh in 2031, 8.81 lakh in 2041, and 10.70 lakh in 2051. The corresponding daily passenger boardings and trips for these years are presented in **Table 3-7**.

Table 3-7 No. of Daily Ridership for the Study Corridor

Corridor Details	Details	Horizons Year			
		2026	2031	2041	2051
Millennium City Centre – Cyber City and Spur	Daily Boarding	563175	772925	940286	1150076
	Daily Trips	534294	726098	881563	1070315

Source: DPR, 2021

3.1.16 Land Requirement

Land will be required for various key components of the project, including the viaduct, station buildings along with entry/exit points, traffic integration facilities and depots. Additionally, land shall be needed for receiving and traction substations, as well as for temporary land for construction yards.

GMRP corridor is fully elevated and planned on the median of the existing roads, thereby minimising the private land requirement. The land requirements detail along with ownership information, are described in **Table 3-8**.

Table 3-8 Land Requirement

Purpose	Permanent Land (Ha)	Temporary Land (Ha)	Ownership
Station/Viaduct	3.80	-	Government
Maintenance Depot	18.37	-	
Construction Yards	-	21.00	
Station/Viaduct	0.68	-	Private
Maintenance Depot	0.86	-	
Total	23.71	21.00	

Source: GMRL

3.1.17 Solar Energy

A grid-connected solar photovoltaic (PV) power plant is proposed for the GMRP, utilising all feasible areas such as rooftops of stations, sheds, and other buildings. Based on the solar radiation intensity in the city, the peak solar power generation is expected to be about 50

kWp for the elevated stations and about 500 kWp for the stabling depot. The solar energy harnessing system is proposed to be implemented under the Renewable Energy Service Company (RESCO) model, as adopted in various metro projects. A fixed tariff, as per the power purchase agreement, shall be applicable for a duration of 20-25 years. This initiative is expected to result in significant energy cost savings and a reduction in CO₂ emissions using renewable solar energy.

3.1.18 Structural Safety

The structural safety of an elevated metro system is of paramount importance to ensure the safety of passengers, staff and the public. The structural design of the metro system has been undertaken by the DDC and incorporating several critical safety considerations into the design. These include vibration control, earthquake resistance, and other essential parameters that must be addressed during the design, construction, and maintenance phases of the elevated metro system.

3.2 Resource Requirements

3.2.1 Labour

The civil works for the GMRP are expected to be completed in a period of 4 years, during which manpower will be required for various construction-related activities. In the post-construction phase, additional personnel will be employed for the operation and maintenance of the metro system, thereby generating substantial direct employment opportunities.

In addition to direct employment, the project is also expected to create significant indirect employment in allied sectors, such as the supply of essential goods, construction materials, metro cars/coaches and rolling stock. The project workforce will comprise direct workers, contracted workers and primary supply workers.

3.2.2 Construction Material Requirement

Major construction materials such as reinforcing bars, cement, steel sections, shuttering materials, precast segments, solar panels, etc will be primarily sourced from local suppliers.

3.2.3 Source of Construction Material

Construction materials such as aggregate and earth shall be sourced exclusively from licensed quarries, in strict compliance with material sourcing regulations, including those specific to the Aravalli region, to minimise E&S risks and impacts. No mining, quarrying, or excavation activities are permitted in the Aravalli Hill areas notified under the MoEF&CC Notification dated 07.05.1992, unless prior Environmental Clearance (EC) has been obtained from the competent authority.

3.2.4 Use of Water

The water required for construction activities will be sourced from treated water. Drinking water and raw water requirements for the elevated stations will be met through municipal sources, in coordination with the relevant local agencies.

3.3 Cost Estimate

Cost estimate for GMRP has been prepared in DPR covering civil, electrical, signalling, and telecommunications works, rolling stock, etc. The estimated total cost, including Taxes & Duties at Sept' 2021 price level, is Rs. 4,808.02 Cr (Rs. 48,080.2 million).

3.4 Associated Facilities

Associated facilities refer to those facilities or activities that are not funded as part of the project but, in the judgement of the Bank, meet all of the following criteria:

- a. directly and significantly related to the project; and
- b. carried out, or planned to be carried out, contemporaneously with the project; and
- c. necessary for the project to be viable and would not have been constructed, expanded or conducted if the project did not exist.

The associated facility must meet all three criteria.

In accordance with the definition and criteria for Associated Facilities under the WB ESF, AC01 and AC04 of the GMRP are considered as an Associated Facilities because they are directly and significantly related to the Project, are planned and implemented contemporaneously with the Project, and would not have been constructed, expanded, or undertaken in the absence of the Project.

However, the proposed road widening by NHAI on the section between Hero Honda Chowk and Umang Bhardwaj Chowk is not considered as an Associated Facilities to the GMRP for the following reasons:

1. The road widening is being implemented by NHAI, an independent implementing agency, through separate institutional arrangements and financing mechanisms.
2. The road widening has not yet started, but the land acquisition decisions were made much earlier. Land acquisition has already been completed and compensation paid by NHAI in accordance with the applicable legal and policy framework governing the highway project.
3. The road widening section of NH was decided beforehand, and NH is going ahead with its implementation.
4. The road widening of NH is not required for GMRP as it was earlier planned on the median of the roads like majority of the GMRP alignment.
5. NHAI is a national body not reporting to any state agency. It has rejected the application of WB ESF, and it has independent project objectives not related to GMRP.

3.5 Current Project Status

The current project status is as follows:

➤ AC01:

1. The AC01 consists of a 15.55 km viaduct structure and main structures for 14 stations and is under construction and financed by GMRL's own funds. The construction started in September 2025.
2. The contractor submits Monthly Progress Reports and also submitted C-ESMP, LMP, SHE Plan, WWMP, TMP, EPRP and their implementation are being monitored by GC.
3. The Contractor has submitted an undertaking to follow and implement all commitments as per WB ESF. The undertaking is attached as **Annexure 3.2**.
4. An agency has been engaged to audit AC01, as per WB ESF and prepare a CAP. The work is in progress.
5. Tree: 2515 trees to be felled in AC01, Casting Yard and GMDA Section (Bakhtawar Chowk) due to the ongoing project works. Compensatory afforestation (CA) of 25,150 trees will be done by GMRL. Of 25,150 CA trees, 18,000 trees CA & maintenance contract was given to Haryana Forest Development Corporation (HFDC). As of 31.03.2026, 7300 trees have been planted as part of compensatory afforestation at the site identified near the Kundli-Manesar-Palwal (KMP) expressway. The remaining trees will be planted during the monsoon season. The forest clearance proposal is under preparation and will be uploaded by June mid.
6. The project requires 11 ha of land for the casting yard and 19.23 ha for the depot. Government land in Sector 33 for the casting yard has been made encumbrance-free available to GMRL by HSVP. The depot land has been cleared of encroachments by HSVP and is in the process of being handed over to GMRL.
7. The spur section is in proximity to the Basai KBA/IBA area, which is a modified habitat impacted by urbanisation, being surrounded by high-rise residential land uses, agricultural areas, ROB, Railway Tracks, Dwarka Expressway, wastewater channels, and C&D waste management facilities. To address any impact on this habitat, GMRL has planned to undertake BIA during the migratory season in July 2026, and BMP shall be prepared based on the findings, & relevant recommendations/mitigation measures will be incorporated in CESMP. The preparation for the test pile is in progress, and after the results, piling work is expected to start by the end of June and will be completed within 3-4 months. Station construction next to the KBA with the installation of a pillar will happen after 7-8 months, and Station construction will be done after 1-1.5 years. In the CESMP for this construction, the contractor will include mitigation measures as guided by the biodiversity assessment study.
8. For the acquisition of private land, the Government of Haryana has notified a Policy for Direct Purchase of Private Land or Property through Mutual Negotiation. Purchase of private land is in progress as per the policy, and a preliminary notification has been issued for the acquisition of 1.08 ha of private land. The process of compensation calculation for the affected persons is underway.
9. GMRL management has approved the Entitlement Matrix detailing the compensation to be paid to NTH PAPs.
10. GMRL has engaged an expert agency for Resettlement Action Plan (RAP) implementation support activities, and the work is in progress.

➤ AC03:

1. The section of AC03 consists of 13.5 km viaduct structure and main structures for 13 stations. This section is expected to be financed by WB and civil work tender is in process.

2. 2204 Trees have been identified in AC03 and tree cutting permission will be applied once the contractor is on board.
- AC04:
1. The depot contract has been tendered.
 2. The depot land identified at Sector 33 had five pockets (Annexure 1) totalling 19.23 ha: Pocket No. 1 (14.62 ha), Pocket No. 2 (2.88 ha), Pocket No. 3 (0.85 ha), Pocket No. 4 (0.016 ha), Pocket No. 5 (0.86 ha). Out of 19.23 ha of land, 18.37 ha is government land and 0.86 ha is private land. Except for Pocket No. 4 & 5, all three pockets had court cases involving HSVP.
 3. The marble merchants have been rehabilitated at a newly planned site which is approximately 200m from the existing site in Sector 33.
 4. HSVP is in the process of handing over encumbrance-free Depot land (18.37 ha) to GMRL.

Chapter 4: Analysis of Alternatives

This chapter presents an analysis of alternatives undertaken to identify the most suitable option among various transport modes. The alignment design was developed after evaluating a range of alternatives during the planning phase, with the relative E&S benefits of the selected option assessed based on the following mitigation hierarchy:

- Anticipate and avoid risks and impacts;
- Minimise or reduce risks and impacts to acceptable levels, where avoidance is not possible;
- Once risks and impacts have been minimised or reduced, mitigate; and
- Wherever significant residual impacts remain, compensate or offset them, where technically and financially feasible.

The key aspect which is considered while selecting the metro alignment are optimisation of the functionality, minimization of E&S risks & impacts, reduction in construction time, reduction in construction and operational costs and maximization of the overall economic return from the investment.

4.1 Assessment of Alternatives

While considering the best alternatives for the GMRP corridor, various parameters were considered, including:

- E&S Impacts due to the project
- Cost-benefit analysis
- Flexible and economic operation
- Land use and intermodal integration
- Meet the projected traffic demand
- Safe, fast and comfortable travel

4.1.1 Conceptual Transport Alternatives as per Comprehensive Mobility Plan (CMP)

To meet the public transport demand in Gurugram city, both rail-based and road-based mass transit systems have been considered, as detailed in **Table 4-1**.

Table 4-1 Different Types of Public Transport Modes

System		Normal Bus System	Bus Rapid Transit (BRT)	Metro-Neo	Metrolite	Medium Metro Rail System	Heavy Metro Rail System
Exterior of Vehicle							
Description		Bus operation characterized by use of shared rights-of-way along the general traffic flows.	Bus operation is characterised by the use of reserved rights-of-way (busways) that permit higher speeds and avoidance of delays from traffic flows.	Electric coaches are driven by electricity provided by overhead wires.	The transport system runs on elevated or at-grade track.	The most prevalent worldwide Mass Rail Transit System runs on elevated/at-grade/ underground	Heavy Metro is similar to Medium Metro but with higher carrying capacity and thus higher axle load.
Gauge		Not Applicable	Not Applicable	Not Applicable	Standard Gauge (1435mm)	Standard Gauge (1435mm)	Broad Gauge (1676mm)
Superstructure		Roads	Roads	Roads/Concrete Slab	Concrete slab	Concrete slab	Concrete slab
Axle load (max)		6.0 to 10.0T	6.0 to 10.0T	10.0 T	12.0 T	16.0 T	17.0 T
Rolling stock	Length (m)	12m	12m	18 m (Articulated) 25 m (Bi-articulated)	33 m	20.0 – 22.60 m	22.60 – 25.0 m
	Width (m)	2.5m to 2.6m	2.5m to 2.6m	2.5m to 2.6m	2.65 m	2.80 – 2.90 m	3.20 m
	Height (m)	3.25 to 3.5m	3.25 to 3.5m	3.25 to 3.5m	3.90 m	3.90 m	3.90 – 4.20 m
Traction System		None	None	None/ Catenary	Catenary or 3 rd Rail	Catenary or 3 rd Rail	Catenary or 3 rd Rail
Maximum Speed		80 Kmph	80 Kmph	70 Kmph	60 Kmph	90 Kmph	100 Kmph
Average speed		10 - 15 Kmph	20 - 25 Kmph	25 Kmph	30 Kmph	35 Kmph	35 Kmph
Minimum curve radius		12 m	12 m	15 m	25 m	120 m	220 m

System		Normal Bus System	Bus Rapid Transit (BRT)	Metro-Neo	Metrolite	Medium Metro Rail System	Heavy Metro Rail System
Maximum gradient		10%	10%	6%	6%	4%	4%
Capacity		100 per coach	100 per coach	140 for 18 m coach 225 for 25 m coach	300 per coach	250 per coach	350 per coach
Max. PHPDT		Upto 3000	Upto 4000	Upto 8000	Upto 15,000	Upto 60,000	Upto 90,000
Environment Effect		Higher level of pollution compared to other modes	More polluting than rail-based systems	This type of system is more eco-friendly due to its operation of the system on electricity.	This type of system is more eco-friendly due to its operation of the system on electricity.	This type of system is more eco-friendly due to its operation of the system on electricity.	This type of system is more eco-friendly due to its operation of the system on electricity.
Social Effect		The requirement for land is less compared to other systems.	Needs urban spaces for a dedicated corridor	Space is required for the dedicated corridor	The land requirement is huge for the maintenance depot	The land requirement is huge for the maintenance depot	Land acquisition is high for the corridor and depot
Surrounding & Harmony		Noise and Pollution Problems	Noise and Pollution Problems	Low noise as compared to a rail-based system	Noisy due to steel wheel arrangements.	Noisy due to steel wheel arrangements.	Noisy due to steel wheel arrangements.
Maintainability and cost	Track	Extensive maintenance of roads required.	Extensive maintenance of roads required.	Extensive maintenance of roads required.	Less maintenance of the track compared with the Metro rail transit system.	Requires extensive track maintenance work due to rail-wheel interaction.	Requires extensive track maintenance work due to rail-wheel interaction.
	Vehicle	Maintenance of the engine and rubber tyres is necessary.	Maintenance of the engine and rubber tyres is necessary.	Maintenance of the engine, rubber tyre, and battery charging is necessary.	Maintenance of rotary motors and turning of steel wheels necessary.	Maintenance of rotary motors and turning of steel wheels necessary.	Maintenance of rotary motors and turning of steel wheels necessary.
Capital cost per km (Cr/km)		Rs 10 Cr/km	Rs. 15-20 Cr/Km (At grade) Rs. 50-60 Cr/Km (Elevated)	Rs. 50 Cr/Km (At grade) Rs. 80-100 Cr/Km (Elevated)	Rs. 120 Cr/km (At Grade) Rs. 180 Cr/km (Elevated)	Rs. 200 - 250 Cr/km (Elevated) & Rs. 450 - 500 Cr/km (Underground Section)	Rs. 250 - 300 Cr/km (Elevated) & Rs. 500 - 600 Cr/km (Underground Section)

Source: DPR, 2021

4.1.2 Constraints considered during DPR stage

While finalizing the alternatives for the GMRP corridor, the following key requirements and constraints have been kept in view:

- To remain on the centre line of the existing road or within government-owned land, while minimizing the impact to the extent feasible.
- To utilize the existing road RoW to the maximum extent to minimise the land acquisition and minimize the length of required diversions.
- To avoid dismantling of existing structures, buildings and other permanent facilities.
- To avoid private built-up areas, villages, habitation zones, and religious structures, etc., to the extent possible.
- To provide adequate clearance from existing railway and highway structures.
- To satisfy the requirements of sound engineering principles and economic feasibility.
- To rationalise the location of proposed stations.

1. Alternatives for Millennium City Centre Station

Details of the alternatives considered for Millennium City Centre Station are given in **Table 4-2** and illustrated in **Figure 4-1**. After evaluating all relevant parameters and associated impacts, Alternative 1, i.e. positioned along the road median between the existing Millennium City Centre Metro Station and Sector 45, has been selected as the proposed station location.

Table 4-2 Comparison of Alternatives for Millennium City Centre Station

Planning Parameters	Alternative 1	Alternative 2	Alternative 3
Location	On the Dividing Road of Millennium City Centre Metro Station and Sector 45.	On Millennium City Centre's Parking and Substation.	On Millennium City Centre's Parking towards the underpass.
Connectivity	• Better integration with the existing Millennium City Centre Metro Station. • A direct connection to the platform of the existing Metro station can be planned. • Integration with Rapid Metro is possible.	• Direct connection to the platform of the existing metro station can be provided. • Construction of a station building close to the existing metro station would be very difficult.	The commuters will have to travel longer to interchange with the existing HCC Metro station.
Time	Less time is required for interchange.	Reduced time for interchange for passengers.	Travel time is long for interchange.
Environmental & Social Aspects	• No acquisition, as the station is proposed on the road. • Sufficient space is available for the movement of construction equipment. • 22 trees will be impacted because of the alignment.	• Land acquisition of existing Parking and Sub-station area. • Some portion of the viaduct will overhang private land (Appu Ghar Water Park), which may require the acquisition of land, and effectively	• Private Land acquisition for entry/exit of the station and for the curve portion of the alignment. • 40 trees will be impacted because of the alignment.

Planning Parameters	Alternative 1	Alternative 2	Alternative 3
		reduce the recreation area and create disturbances during construction. • 37 trees will be impacted because of the alignment.	

Source: DPR, 2021

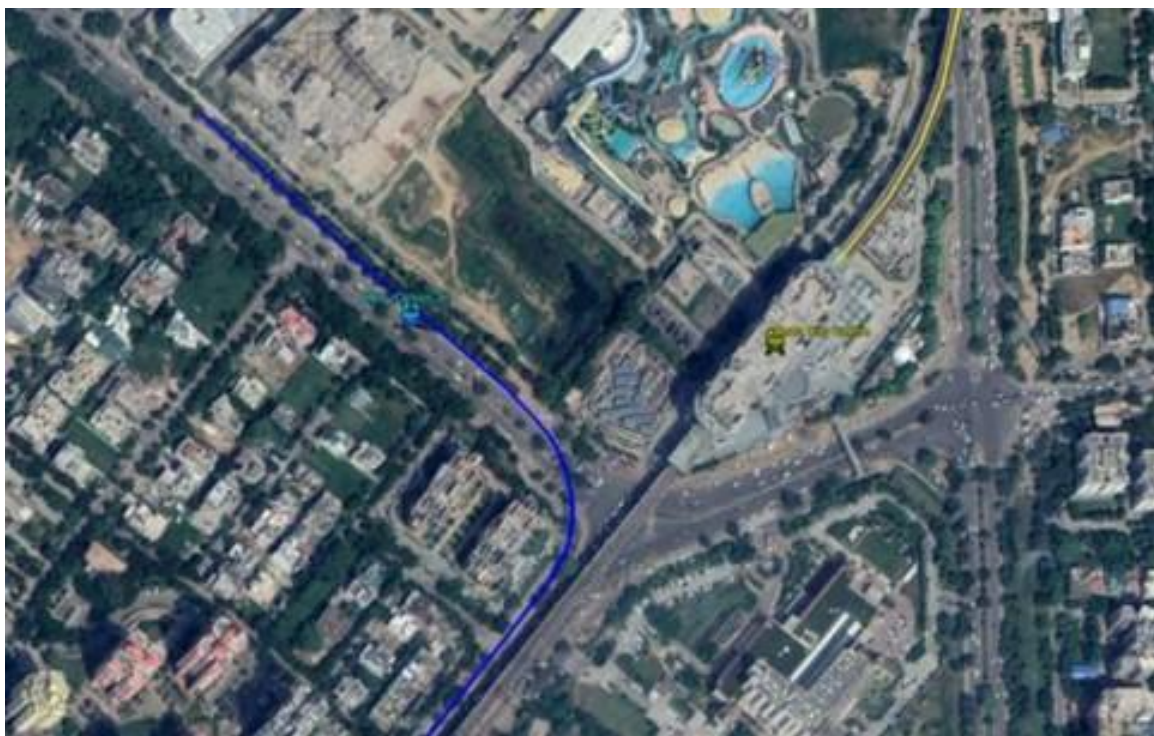
Figure 4-1 Location of Proposed Millennium City Centre Station



Alternative 1



Alternative 2

**Alternative 3**

Source: DPR, 2021

2. Alternatives for Corridor from Sector-5 to Sector-3

Details of the alternatives considered for the corridor from Sector-5 to Sector-3 are provided in **Table 4-3** and illustrated in **Figure 4-2**. Among the three alternatives proposed, Alternative 3, i.e. comprising a fully elevated continuous corridor from MCC to Sector-22, has been finalised.

Table 4-3 Alternatives for Corridor from Sector-5 to Sector-3

Planning Parameters	Alternative 1	Alternative 2	Alternative 3
Location	Continuous Corridor from MCC to Cyber City- Completely Elevated	Continuous Corridor from MCC to Cyber City is elevated, except for the Gurugram Railway Station section, which is Underground.	Continuous Corridor from MCC to Cyber City with a spur to Gurugram Railway station from Sector-5 Metro station - Completely Elevated
Alignment Description & Connectivity	The alignment will pass through the area adjacent to Gurugram Railway Station Platform No. 1.	The alignment section at Railway station proposed as underground.	A spur of a length of 1.2 km from Sector-5 considered to connect the Gurugram Railway station. A few trains will directly go to the Gurugram Railway station, and rest towards Cyber City.
Number of Stations	A greater number of stations can be established, expanding the catchment area, improving accessibility,	-	Additional stations could increase ridership, improve accessibility, and lead to a reduction in the use of private vehicles and

Planning Parameters	Alternative 1	Alternative 2	Alternative 3
	and reducing the reliance on private vehicles and Intermediate Public Transport (IPT).		Intermediate Public Transport (IPT).
Environmental & Social Effect	Acquisition of private properties at the junction of Neki Ram Marg and Railway Road, adjacent to Maruti Stock Yard, outdoor recreational space of GEMS International School, near Carter Puri Road.	Acquisition of land for ramps along Neki Ram Marg and Carterpuri Road. The alignment will have to pass below private properties, which may result in vibration impacts.	- Acquisition of private property at the junction of Neki Ram Marg and Railway Road. - Minimal property acquisition compared to other alternatives.
Cost Implication	The cost of the project is lower.	The cost of the entire project would increase by about Rs. 1200 Crore due to the underground length of about 4.7 kms and 3 underground stations.	The cost of the project will be lower than other options

Figure 4-2 Alternatives for Corridor from Sector-5 to Sector-3



Alternative 1- Completely Elevated



Alternative 2 – Railway Station as Underground



Alternative 3 – Completely Elevated with a Spur to Railway Station

Source: DPR, 2021

4.2 With or Without Project Scenario

The 'Without Project Scenario' represents current conditions, including existing and committed transport infrastructure developments expected to be implemented in the future.

A comparative analysis of the 'With Project' and 'Without Project' scenarios is provided in **Table 4-4**.

Table 4-4 With or Without Project Scenario

Quantitative Evaluation	With Project Scenario	Without Project Scenario
Travel Time	- Travel Time will be reduced due to the higher speed of the MRTS project. - Congestion reduction due to modal shift leads to fewer vehicles on roads. This also contributes to time savings for passengers travelling on other modes.	- With the increase in population, the traffic load will be higher, which will result in increased travel time. - Traffic congestion on the road due to inadequate capacity of public transport increases the travel time.
Vehicles Operating Cost	- A smaller number of vehicles on the road due to the modal shift of passengers on MRTS. - Smoother operations of passenger trips of other modes of vehicles owing to reduced congestion on roads.	More number of vehicles will lead to increased operating costs.
Accident	- Reduction in accidents due to fewer vehicles on roads. - Savings in damage costs to vehicles involved in accidents.	The accident rate is high due to the mismanagement of the traffic system.
Pollution	- Reduction in vehicular emissions due to the modal shift of passengers on MRTS. - Less conversion of land as MRTS is elevated over existing road infrastructure - Less pollution due to reduced congestion on roads. - Less tree felling as the alignment is planned on the median.	- Emission rates are high due to vehicular pollution. - Need to convert more land for future vehicle movement - Increased congestion - Expanding the road sideways could cause disruptions to local communities. - Trees retained on medians, contributing to reducing the urban heat island effect
Connectivity	The project connects Millennium City Centre to Cyber City with a spur to Dwaraka Expressway	Without a project, vehicles will be high, which leads to traffic jams, increased travel time, increased air pollution, etc.
Road Traffic	Reduction in daily vehicle trips due to the project in Year 2051 will be 78,17,591 (Car: 7,20,726; 2W: 32,96,184; Auto: 20,35,290; Bus: 17,65,391)	Vehicle trips (78,17,591 nos) will be increased in the year 2051
Fuel Consumption	The reduction in fuel consumption in the year 2051 will be as follows: - Diesel: 1.68 Lakh Litres per year - Petrol: 3.97 Lakh Litres per year	Fuel consumption will be more in Year 2051

Quantitative Evaluation	With Project Scenario	Without Project Scenario
	CNG: 1.79 Lakh Kg per Year	
Impact on Structures	The metro project shall impact 210 structures.	These structures will be saved without the metro project scenario.
Maintenance of road infrastructure	With fewer vehicles on the roads, expenditure on road maintenance is expected to go down.	With a greater number of vehicles on the road, the maintenance requirement is high.

4.2.1 Economic Analysis

The development of the two scenarios starts with the estimation of traffic demand and modal share for the proposed metro system. The total estimated travel demand is approximately 33.36 lakh trips per day in the year 2026, which is projected to increase to around 78.17 Lakh by 2051. In 2026, the rail-based transit system is expected to cater to about 3.74 Lakh daily trips, rising to an estimated 8.98 lakh trips per day by 2051. The estimated trips under the 'With Project' and 'Without Project' scenarios are illustrated in **Table 4-5**.

Table 4-5 Estimated Trips 'With' and 'Without' Scenario

Mode	Trips without Mass Transport System				Trips with Mass Transport System			
	Year				Year			
	2026	2031	2041	2051	2026	2031	2041	2051
Bus	753287	1238074	1478406	1765391	656639	1061196	1263567	1542474
Car	307532	505447	603564	720726	261223	425980	506994	618511
2 Wheelers	1406472	2311624	2760351	3296184	1257755	2014982	2400260	2931888
Auto	868452	1427355	1704430	2035290	786121	1254245	1494365	1825883
Metro	-	-	-	-	374006	726098	881563	898833
Total	3335744	5482500	6546750	7817590	3335744	5482500	6546750	7817590

Source: DPR 2011

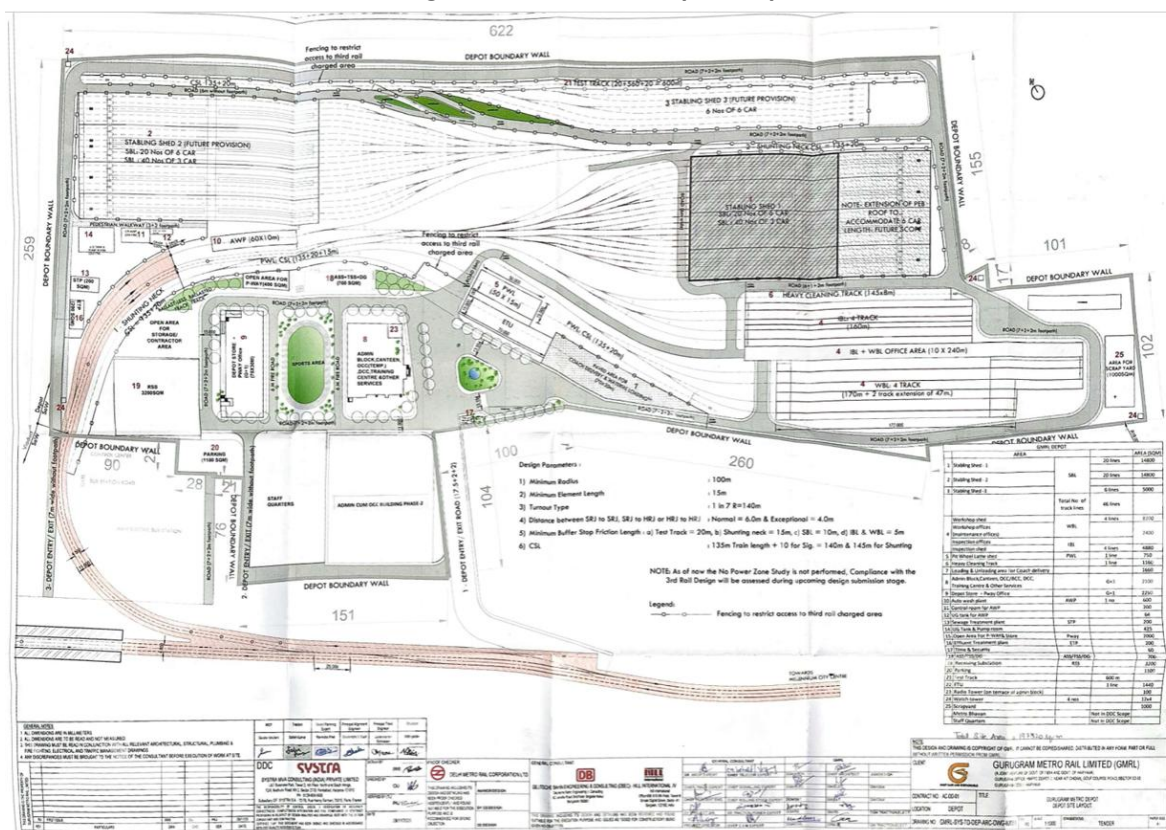
The GMRP is expected to generate both tangible and intangible benefits through a corresponding reduction in road traffic and various socio-economic benefits. The introduction of the MRTS will result in a reduction in the number of buses, IPT modes, usage of private vehicles, air pollution and an increase in the average speed of road-based vehicles. These changes will contribute to significant E&S benefits, including reduced fuel consumption, vehicular emissions, road accidents, land acquisition and tree cutting for road expansion. Additionally, there will be savings in vehicle operating costs and passenger travel time. The project will also help reduce future road construction, expansion, and maintenance costs, providing long-term benefits to society at large.

4.3 Alternative Analysis for Depot

A small stabling depot was proposed at Sector 101 for GMRP in the DPR Study, as it envisaged its operational integration with Rapid Metro. However, with the approval of GMRP as an independent system, a full-fledged depot was required to meet enhanced operational requirements. GMRL subsequently planned a full-fledged Depot-cum-Workshop at Sector 33,

covering a total area of 19.23 ha (18.37 ha of government land and 0.86 ha of private land) as illustrated in **Figure 4-3** and details represented in **Table 4-6**.

Figure 4-3 Location map of Depot



Source: GMRL

Table 4-6 Analysis for Depot Locations

S. No	Parameter	Stabling Depot at Sector 101	Depot at Sector 33
1.	Area of Depot	5.50 ha	19.23 ha
2.	Location	Sector 101	Sector 33
3.	Existing Land use	Proposed at KBA/IBA in Sector 101, Basai and low-lying area	Commercial and Open land
4.	Land use of the Project Site as per Master Plan 2031, Department of Town and Country Planning, Haryana	Sector 101: Public Utilities (Water Works, Disposal Works, Grid Substation)	Commercial and Open Spaces in Sector 33
5.	Waterbody	KBA/IBA in Sector 101, Basai	A waterbody is located next to the proposed depot site, within the golf course area of the Unitech Resort Villas complex. The waterbody is located outside the depot boundary; no impact is anticipated.

S. No	Parameter	Stabling Depot at Sector 101	Depot at Sector 33
6.	Major Environmental & Social Impacts	- The Basai waterbody is a KBA/IBA, and the construction and operation of the Depot will impact the Ecosystem. - Impact on Water Quality during construction - Flooding is expected at the project site, as KBA/IBA in Sector 101, Basai, is a low-lying area. - Shifting of HTL - Impacts during Construction activities - During operation: Disturbance and Pollution impacts on all parameters, and biodiversity	- R&R issues for relocation of about 52 marble shops at depot location. 0.86 ha of private land - Impacts during Construction activities - During operation: Noise Pollution and soil contamination - Trees to be affected: 576 - Relocation of Electric Substation

Chapter 5: Environmental and Social Baseline Condition

5.1 Methodology for Environmental Baseline Data Collection

5.1.1 Right of Way (RoW)

The alignment from Millennium City Centre to Cyber City passes mainly through existing roads, settlements, open land, etc. The RoW requirements are as follows:

- Alignment/Viaduct: 16 m (i.e., 8 m on either side from the centreline of the alignment/viaduct, including 3 m for working space)
- Stations: 3 m from the outer periphery of the stations
- Entry/Exit Points: 3 m from the outer periphery of the entry/exits
- Depot: Up to the outer boundary of the depot area

To comprehensively assess the potential E&S risks and impacts of the GMRP, the following spatial delineations have been adopted for impact assessment, taking into account urban density, existing land use, and expected propagation of impacts:

- **Physical and Social Impacts:** The GMRP viaduct alignment, spanning 16m in width, has been considered to assess land acquisition requirements and involuntary resettlement, displacement (if any), and impacts on physical infrastructure and utilities.
- **Noise and Vibration Impacts:** A 100 m buffer zone on either side of the alignment has been adopted to identify and assess potential noise and vibration impacts on sensitive receptors such as residential areas, educational institutions, hospitals and heritage structures.
- **Indirect and Cumulative Impacts:** A buffer of 10 km on either side of the GMRP corridor has been considered for the identification of NOCs/clearances, Land Use/Land Cover classification, etc.

The area of influence includes project-associated facilities, construction camps, labour camps, access roads, material sourcing areas, etc. and considers potential impacts on VEC. The area of influence for the proposed project is shown in **Figure 5-1**.

5.1.2 Baseline Conditions

The baseline study includes the collection and evaluation of both secondary and primary data to establish existing E&S conditions within the study area. Secondary data has been sourced from relevant databases, published reports, and other official records, while primary data has been collected through field surveys covering ambient air quality, noise, vibration, land and soil characteristics, water quality, ecology and biodiversity, and socio-economic aspects.

The E&S baseline provides a comprehensive understanding of existing conditions, forming the foundation for assessing the potential risks & impacts of GMRP. Baseline data has been compiled for the following components:

- Land Environment: Physiography and climate, geology and hydrogeology, soils, minerals, land use and land cover, and seismicity.

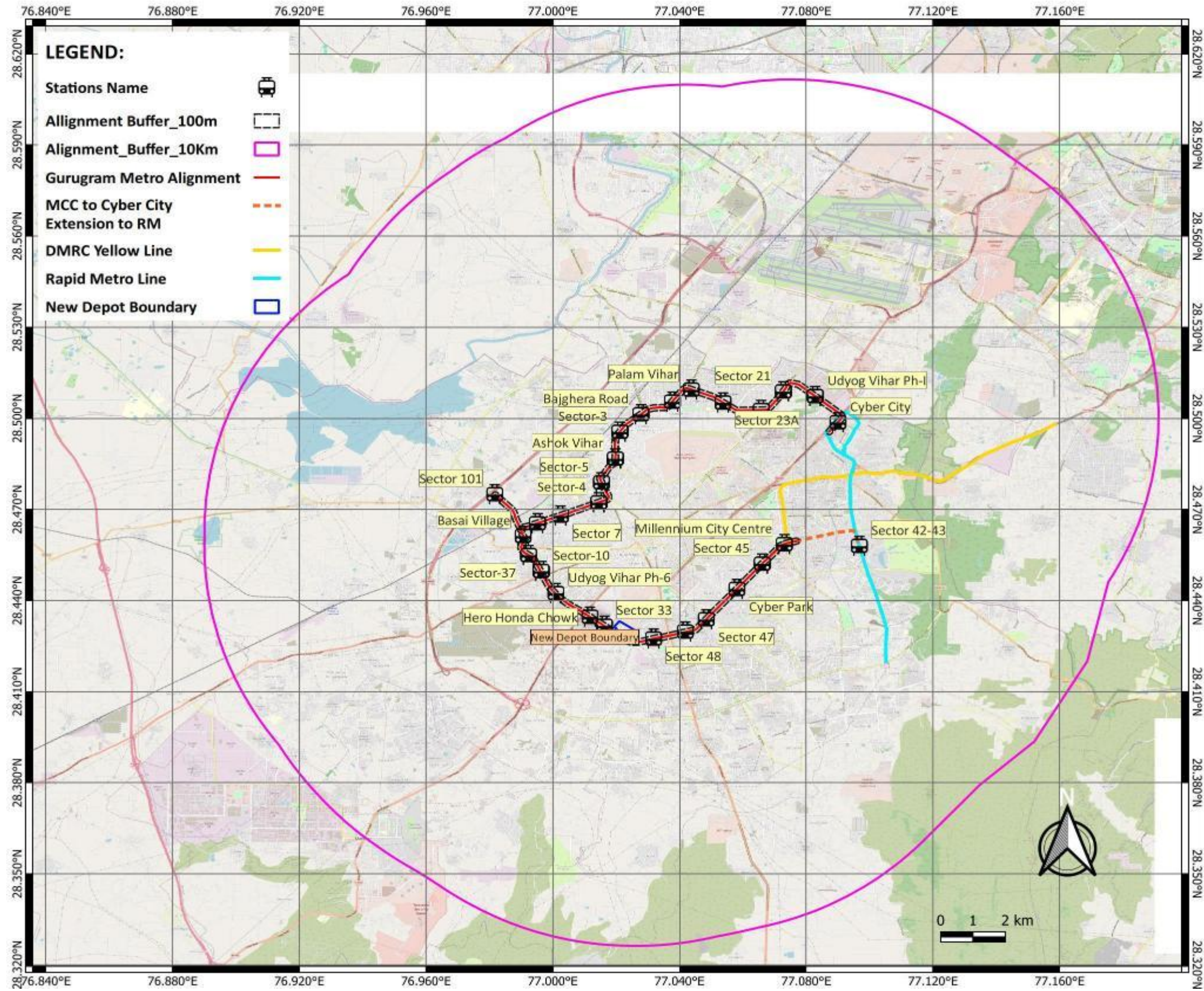
- Water Environment: Water resources, availability, access, quality, drainage patterns and flood risks.
- Air, Noise and Vibration
- Biological Environment: Biodiversity (flora and fauna), habitat studies, forests and protected areas.
- Socio-Economic Environment: Demographic characteristics, socio-economic conditions, cultural heritage, etc.

Data collection for the ESIA study was conducted between November 2023 and October 2024. A scoping matrix along with the frequency adopted for data collection of E&S attributes is summarised in **Table 5-1**.

Table 5-1 Environmental & Social Attributes and Frequency of Monitoring

S. No.	Attribute	Parameter	Frequency	Source
LAND ENVIRONMENT				
1.	Physiography	Elevation	-	Secondary Data
2.	Soils	Soil Characteristics	Once	Field studies
3.	Geology and hydrogeology	Geological Status & hydrogeology	-	Secondary Data
4.	Seismology	Seismic Hazard	-	Secondary Data
5.	Minerals	Minerals	-	Secondary Data
6.	Land Use and Land Cover	Land Use	-	Primary and secondary data
WATER ENVIRONMENT				
7.	Ground Water	Physical and Chemical	Once	Field Studies
8.	Surface Water	Physical, Chemical and Biological	Once	Field Studies
9.	Drainage	Drainage	-	Secondary data
10.	Floods	Floods	-	Secondary data
AMBIENT ENVIRONMENT				
11.	Meteorology	Temperature, Relative Humidity, Rainfall, Wind direction and speed	Monthly	Secondary data
12.	Ambient Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , and CO	2 working days in a week continuously for 4 weeks	Field Studies
13.	Noise	Noise levels in dB (A)	2 working days in a week	Field Studies
14.	Vibration	Peak Particle Velocity	24 hr continuous Monitoring	Field studies
BIOLOGICAL AND ECOLOGICAL ENVIRONMENT				
15.	Trees	Number/species	Once	Field Studies
SOCIO-ECONOMIC				
16.	Socio-economic aspects	Socio-economic profile	Once	Field Studies and Secondary Data

Figure 5-1 Area of Impact and Area of Influence



Source: RITES

5.1.3 Adaptive Management

During implementation phase, in case of any site related development in GMRP, micro-level surveys shall be conducted to identify the social risks, vulnerable groups and community impacts such as restrictions in access, livelihood disruption and presence of informal users. A site specific Social Management Plans (SMPs) shall be prepared for the identified risks, including consultation, mitigation measures, and deployment of a grievance mechanism.

5.2 Land Environment

5.2.1 Physiography

Gurugram district features a diverse topography, comprising hills, depressions and irregular terrain. The Delhi Ridge forms the eastern boundary, while the Firozpur Jhirka–Delhi Ridge marks the western boundary. The district's hills are part of the northern extension of the ancient Aravalli Range. The Aravalli Range contains some of the oldest rock formations in the country. Dunes are present in the north-western region, shaped by south-westerly winds. This combination of Aravalli hills and dunes contributes to the district's varied physiographic characteristics.

The metro alignment starts near MCC at coordinates 28°27'34.40" N & 77°4'36.86"E and terminates near the entrance of Cyberhub at coordinates 28°29'44.30"N 77° 5'14.39"E, with an average elevation of 257m above sea level. A topographical and contour map of the study area is provided in **Annexure 5.1**. As per the contour map, the alignment elevation range varies from 214m to 238m. Since the GMRP alignment is entirely elevated, no significant impact on the topography of the project area is anticipated.

5.2.2 Geology and Hydrogeology

Gurugram district is mainly covered by vast alluvial and sandy tracts, which are remnants of the Aravali Mountain chain. The area is geologically classified under the Delhi Supergroup, comprising the Alwar and Ajabgarh formations, with occurrences of various mineral intrusions. Groundwater within the quartzite ridge is primarily found in fractures and joints, while sandy layers at varying depths serve as major water-bearing horizons. Groundwater occurs in unconfined to semiconfined conditions, with the upper saturated zone consisting of fine sand with a varying amount of silt. In urban areas, the first aquifer depth ranges from 34m to 43m, with tube well yields varying between 129 and 606 litres per minute.

5.2.3 Soils

The soils in Gurugram district are classified into tropical and brown soils, primarily found in the northwestern, northern, and northeastern parts of the district, and waterlogged or salt-affected soils located in the southern regions. The average soil texture across the Gurugram blocks is medium-textured loamy sand.

Soil samples were collected from various locations such as open areas and vegetated areas along the GMRP corridor between November 2023 and January 2024. Details of the sampling locations are given in **Table 5-2** and the location map is shown in **Figure 5-2**. The results of the laboratory analysis are summarised in **Table 5-3**. During field investigations, signs of

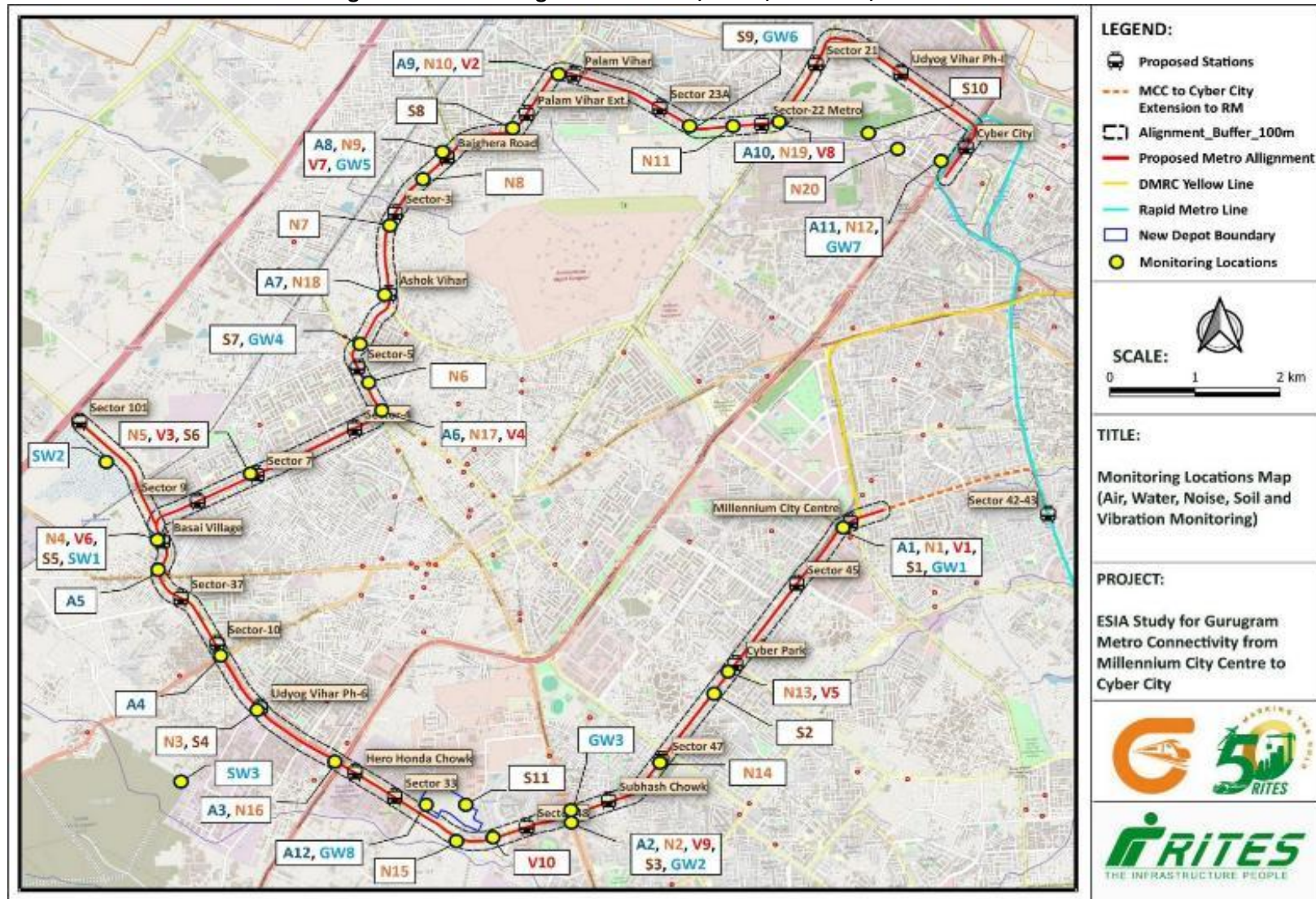
contamination, such as sewage discharge or waste dumping, at the proposed station sites and depot areas were not observed. However, it is acknowledged that during the detailed design and construction phases, changes in station locations or alignment may occur. In such cases, the assessments will be updated accordingly.

Table 5-2 Soil Sampling Locations

S. No	Location	Date of monitoring	Latitude	Longitude
S1	Millennium City Centre	30/11/2023	28.457135	77.073188
S2	Cyber Park	22/11/2023	28.440801	77.056182
S3	Subhash Chowk	22/11/2023	28.428008	77.03756
S4	Udyog Vihar	27/11/2023	28.436087	77.009277
S5	Basai Village	22/11/2023	28.46185	76.988835
S6	Sector-7	27/11/2023	28.468735	77.002448
S7	Sector-5	27/11/2023	28.480685	77.0153
S8	Palam Vihar Ext.	27/11/2023	28.503847	77.035454
S9	Sector-23A	27/11/2023	28.502977	77.057893
S10	Udyog Vihar Phase-V	02/12/2023	28.500758	77.079608
S11	Depot	04/01/2024	28.42951	77.02349

Source: RITES Field Study

Figure 5-2 Monitoring Locations – Air, Noise, Vibration, Soil and Water



Source: RITES

Table 5-3 Soil Quality Monitoring Results

S. No.	Parameter	Unit	Sampling Locations										Dutch Intervention Level (mg/kg)	
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	
1.	pH	-	8.05	7.88	7.96	7.66	7.82	7.42	7.26	7.90	8.12	7.68	7.52	-
2.	Electrical Conductivity (10% Solution)	µs/cm	428	488	338	563	510	620	429	642	415	436	454	-
3.	Organic matter	%	1.54	1.28	0.91	1.34	1.29	1.65	1.56	1.76	1.18	1.18	1.05	-
4.	Total Nitrogen (as N)	mg/Kg	240.3	172.0	92.8	232.3	98.9	205.3	200.0	249.8	220.5	192.0	188	-
5.	Total Phosphates (as PO ₄)	mg/Kg	32.7	28.9	14.3	29.2	26.5	38.7	32.4	39.2	21.5	28.3	24.2	-
6.	Potassium as K	mg/kg	422.0	503.5	232.0	463.0	356.7	442.0	423.7	527.0	410.0	415.0	388	-
7.	Available Calcium as Ca	mg/Kg	2815	2985	2765	3218	3008	3508	3185	3418	3008	2415	2269	-
8.	Zinc	mg/Kg	73.5	97.8	41.9	75.3	42.7	66.2	78.1	57.3	62.3	98.4	90.1	720
9.	Boron	mg/Kg	20.2	19.4	10.2	26.3	30.1	29.5	20.9	29.2	27.1	22.5	26.2	-
10.	Magnesium	mg/Kg	835.0	182.6	281.3	825.0	510.3	1008.0	355.0	1018.0	819.0	652.0	690	-
11.	Iron	mg/Kg	94.5	97.3	64.9	108.3	91.4	114.9	97.2	106.5	105.2	91.4	82.2	-
12.	Texture													
I.	Silty	%	13	14	16	13	21	12	11	11	12	14	17	-
II.	Sandy	%	56	54	54	52	48	63	54	53	56	58	56	-
III.	Clay	%	31	36	30	35	31	25	34	31	32	28	27	-
13.	Sodium (as Na)	mg/Kg	154	435.2	618.5	338	420.8	305	198	302	169	178	196	-
14.	Chloride (as Cl)	%	0.20	0.22	0.25	0.18	0.28	0.15	0.21	0.14	0.20	0.22	0.18	-
15.	Bicarbonates	%	13.5	8.5	11.8	9.2	9.1	12.8	13.9	17.2	13.8	18.2	22.4	-
16.	Sulphates	mg/kg	6.3	14.6	9.3	7.9	10.9	4.8	6.8	4.6	4.9	9.3	11.6	-
17.	Organic Carbon	%	0.86	0.94	0.56	0.90	0.84	0.96	0.82	0.82	0.75	0.78	0.84	-
18.	Organic Matter	%	1.54	1.28	0.91	1.34	1.29	1.65	1.56	1.76	1.18	1.18	1.05	-
19.	Carbonates	%	10.3	8.2	13.1	10.2	12.1	10.8	10.1	10.4	10.2	12.4	10.1	-
20.	Sulphur	mg/kg	22.4	31.6	12.4	19.4	16.7	21.7	23.4	21.6	13.5	26.3	29.4	-
21.	Total Cadmium (as Cd)	mg/kg	1.79	2.26	0.81	1.97	2.24	2.24	1.73	2.19	1.15	1.43	1.16	13
22.	Total Copper (as Cu)	mg/kg	31.2	32.7	21.6	29.5	24.8	33.5	30.4	33.2	33.9	33.8	46.8	190
23.	Total Lead (as Pb)	mg/kg	10.1	12.8	8.6	11.2	10.9	10.8	9.4	10.2	10.6	9.3	8.6	530
24.	Nickel as Ni	mg/kg	4.6	6.8	7.2	6.8	13.8	5.6	4.5	5.5	5.4	8.3	6.8	100
25.	Permeability	cm/hour	3.1	1.85	1.81	2.9	2.7	2.7	1.80	2.7	2.7	1.4	1.9	-
26.	Water Holding Capacity	%	26.5	23.7	27.2	25.3	22.9	29.5	26.5	25.1	29.2	29.3	29.8	-
27.	Porosity	%	27.3	27.5	36.6	29.8	39.5	25.1	23.2	26.2	26.2	22.4	25.9	-

Source: RITES Field Study

Based on the soil analysis results, the following observations were made:

- At all sampling locations, the percentage of silt, sand and clay ranged from 11-21%, 48-63% and 25-36%, respectively. Accordingly, the soil in the project area is classified as sandy clay loam.
- Sandy clay loam soil exhibits a balanced composition of sand, silt, and clay. It offers good drainage due to its sandy component, moderate fertility and reasonable water retention capacity.
- Arsenic (As), Mercury (Hg) and Molybdenum (Mo) were not detected in any of the soil samples, indicating no significant contamination risks from these elements.
- The concentrations of heavy metals were as follows: Zinc (Zn) ranged from 41.9 to 98.4 mg/kg, Cadmium (Cd) from 0.81 to 2.26 mg/kg, Copper (Cu) from 21.6 to 46.8 mg/kg, Lead (Pb) from 8.6 to 12.8 mg/kg, and Nickel (Ni) from 4.6 to 13.8 mg/kg across various sampling locations, reflecting variable levels of these elements in the soil.
- The soil quality data from locations S1–S11 were compared with the Dutch Intervention Levels as per the MoEF&CC Guidelines for Contaminated Sites (Volume II). Heavy metal concentrations, including Copper, Lead, Zinc, Cadmium, and Nickel, were found to be well within acceptable limits.
- Electrical conductivity across the study area ranged from 338 to 642 $\mu\text{S}/\text{cm}$, classifying the soils as non-saline (normal).
- Calcium concentrations were found in the range of 2415 to 3508 mg/kg, indicating a moderate to high presence of calcium. Its influence on overall soil characteristics depends on the intended use of the soil.
- Total Nitrogen (as N) ranged from 172 to 249 mg/kg, Total Phosphates (as P_2O_5) from 22 to 39 mg/kg, and Potassium (as K) from 410 to 527 mg/kg, indicating high soil fertility (excluding S3 and S5) and suitability for plant growth with improved resistance to environmental stressors.
- At sampling locations S3 and S5, nutrient levels were slightly lower but still indicative of good fertility: Total Nitrogen ranged from 92.8 to 98.9 mg/kg, Phosphates from 14.3 to 26.5 mg/kg, and Potassium from 232 to 356 mg/kg. These values signify adequate to high nutrient availability, providing favourable conditions for vegetation growth and development.

5.2.4 Land Use and Land Cover

Land use patterns are an important component of the ESIA as they help to identify various land utilisation types such as agriculture, settlements, forests, vegetation, etc. For the GMRP, the Land Use/Land Cover classification includes built-up land, agricultural land, forest, barren land, water bodies, roads, and other categories, and has been derived using the latest satellite imagery for the study area extending 10 km on either side of the proposed corridor centreline.

Satellite Imagery: High-resolution imagery (less than 1 meter) of the Indian Remote Sensing (IRS) Cartosat satellite was obtained from the National Remote Sensing Centre (NRSC). The data is referenced using the Universal Transverse Mercator (UTM) projection system with WGS84 datum, Zone 43.

Land Use Map: The land use map was developed through on-screen visual interpretation using ERDAS Imagine and ArcGIS software. The identified land use classes include built-up area, agricultural land, water bodies, grassland, barren/waste land, and forest. The

classification covers a 10 km buffer zone on either side of the proposed GMRP corridor centerline. The land use classification data is presented in **Table 5-4**, and the corresponding land use map is shown in **Figure 5-3**.

Table 5-4 Land Use Classification of Metro Corridor (10 km on either side of the corridor)

S. No.	Classes		Area in Ha.		%
1	Built Up	Urban	26364	31389	44.37
		Rural	2175		
		Airport	2072		
		Parks	740		
		Mining	38		
2	Agriculture	Crop	11452	21552	30.47
		Fallow	9920		
		Plantation	180		
3	Water Bodies	Ponds	1420	1710	2.42
		Reservoir/tanks and Najafgarh Drain	290		
4	Grass	Grass	4140	4140	5.85
5	Barren/ Waste Land	Barren	2620	11853	16.76
		Scrub	9233		
6	Forest	Forest	99	99	0.14
Total			70743	70743	100

- Agricultural land: Crop, fallow and plantation land together contribute to about 30.47% of the study area.
- Built-up Area: Including urban, rural, airport, parks and mining covers about 44.37% of the study area. The surrounding villages around the project site are well developed with roads, electricity and water connectivity.
- Grassland covers about 5.85% of the study area.
- Out of the total study area, 16.75% is barren land.
- Forest area covers about 0.14% of the total study area.
- The water bodies contribute about 2.42% of the total study area.
- Proposed GMRP alignment covers 0.18% of the urban area and covers 0.07% of the total area.

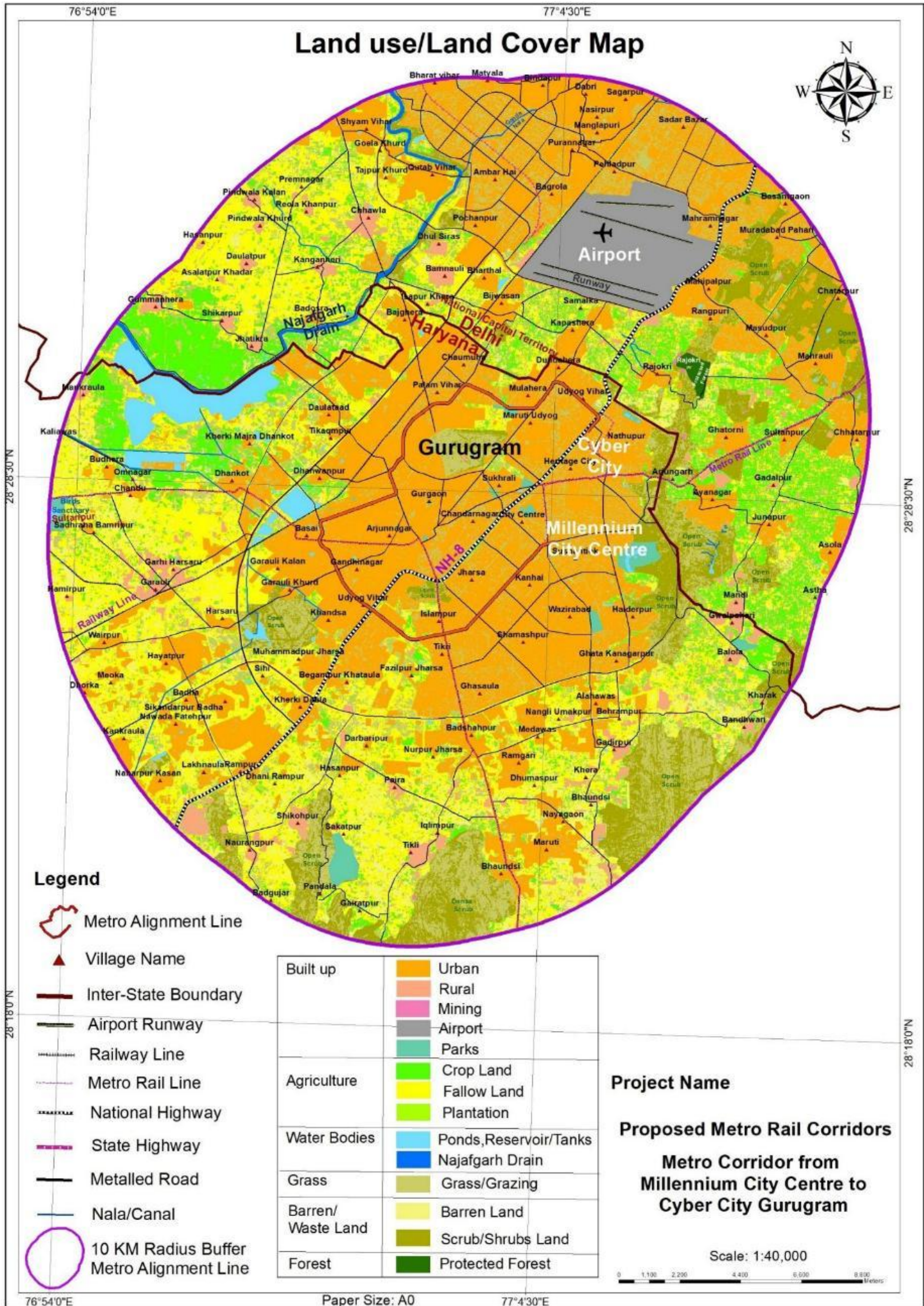
5.2.5 Minerals

The principal minerals available in Gurugram district include China clay, quartz/silica sand, quartzite and slate. However, the GMRP alignment passes through urban areas and does not pass through any designated mineral-bearing zones.

5.2.6 Seismicity

As per the revised seismic zoning map of India, different parts of Haryana fall under the Low Damage Risk Zone (Zone II), the Moderate Damage Risk Zone (Zone III) and the High Damage Risk Zone (Zone IV). As per IS 1893 standards, the GMRP corridor in Gurugram City falls in Seismic Zone IV, indicating a serious damage risk.

Figure 5-3 Land Use Classification – Buffer of 10 km on either side of GMRP



Source: RITES

5.3 Water Environment

The water environment consists of both the availability and quality of water resources. It is important to assess the sufficiency of water resources to meet the project's requirements at various stages and to assess the potential impact of the project on local water resources.

5.3.1 Water Resources of the District

Water resources data is crucial for the GMRP, as it informs water availability, seasonal variations and groundwater management requirements. A comprehensive assessment and strategic planning are essential to ensure smooth project implementation and operation, while mitigating environmental and construction-related issues. Gurugram's water demand is primarily met through surface water, with a smaller share contributed by groundwater and a minor portion from rainwater. Efforts are being made to diversify and optimise the use of available water sources for distribution.

Surface Water: Gurugram features the Najafgarh Jheel, an important component that supports both water storage and groundwater recharge. However, the lake is facing pollution and shrinkage due to waste and wastewater discharge. Additionally, many seasonal streams and ponds in the region have dried up as a result of rapid urbanisation and lack of maintenance. The city primarily relies on surface water drawn from the Yamuna River, supplied through the Gurugram Water Supply (GWS) system and National Capital Region (NCR) channels.

Ground Water: Groundwater serves as a significant water source in Gurugram, largely extracted by private users, including housing societies and individual households. It occurs under unconfined and semi-confined conditions, with tube wells generally installed at depths ranging from 45m to 90m, yielding between 129 and 606 L/min. The pre-monsoon groundwater level averages 39.89m below ground level (mbgl), while post-monsoon levels range from 37.37 to 38.12 mbgl. Despite moderate monsoon recharge effects, groundwater development across the district is categorised as "Overexploited", mainly due to excessive extraction for irrigation purposes.

As per the Haryana Water Resources Authority (HWRA) notification dated 23.12.2020, groundwater extraction for construction is prohibited in over-exploited zones unless treated sewage water is unavailable within a 10 km radius. For the GMRP corridor, treated sewage water is available within the specified distance; hence, groundwater extraction for the project is not permitted.

5.3.2 Water Quality of the Project Area

5.3.2.1 Surface Water Quality

Three surface water samples were collected along the GMRP corridor and its vicinity to assess the baseline surface water quality. The sample locations are shown in **Figure 5-2** and the details of the surface water quality monitoring locations are provided in **Table 5-5**.

Table 5-5 Location of Surface Water Samples

Location No	Particulars	Latitude	Longitude	Source
SW1	Basai Village	28.46185	76.988835	Pond

Location No	Particulars	Latitude	Longitude	Source
SW2	Sector-101	28.471235	76.98526	Pond
SW3	Sector-37	28.435008	76.99162	Drainage

The samples were analysed for various physical and chemical parameters and compared against the permissible limits for inland surface waters as specified in IS: 2296 – 1982. The analysis results are presented in **Table 5-6**.

Table 5-6: Analysis of Surface Water Samples in Project Area

S. No.	Parameter	Unit	SW1	SW2	SW3	Permissible unit		
						Class C	Class D	Class E
1.	Temperature	°C	18.4	16.2	16.6	-	-	-
2.	pH Value	-	7.28	7.35	7.31	6.0-9.0	6.5-8.5	6.0-8.5
3.	Salinity	PPT	<1	<1	<1	-	-	-
4.	Electrical Conductivity at 25 °C	µmho s/cm	615	852	882	-	1000	2250
5.	Dissolved Oxygen (DO)	mg/l	3.7	3.9	3.9	4	4	-
6.	BOD at 5 days at 20 °C	mg/l	13	15.6	17	3	-	-
7.	COD	mg/l	66	77	83	-	-	-
8.	Nitrate	mg/l	7.3	8.4	9.5	50	-	-
9.	Nitrite Nitrogen	mg/l	<0.1	<0.1	<0.1	-	-	-
10.	Turbidity	NTU	17.5	25.5	20	-	-	-
11.	Total Alkalinity (as CaCO ₃)	mg/l	116	155	187	-	-	-
12.	Chloride	mg/l	58	96	112	600	-	600
13.	Total Kjeldahl Nitrogen (as N)	mg/l	12	18	14.4	-	-	-
14.	Total Phosphorous (as P)	mg/l	0.66	0.57	0.63	-	-	-
15.	Ammonical Nitrogen (as N)	mg/l	8.3	12.4	9.6	-	1.2	-
16.	Total Hardness (as CaCO ₃)	mg/l	162	179	195	-	-	-
17.	Calcium (as Ca)	mg/l	28	40	48	-	-	-
18.	Sulphate as SO ₄	mg/l	38	54	63	400	-	1000
19.	Sodium (as Na)	mg/l	44	78	84	-	-	-
20.	TDS	mg/l	332	460	511	1500	-	2100
21.	Total Suspended Solids	mg/l	23	36	29	-	-	-
22.	Total Phosphate (as PO ₄)	mg/l	1.36	1.76	1.94	-	-	-
23.	Boron (as B)	mg/l	ND	ND	ND	-	-	2
24.	Magnesium (as Mg)	mg/l	22	19.1	18	-	-	-
25.	Potassium (as K)	mg/l	4.7	5.76	7.32	-	-	-
26.	Fluoride (as F)	mg/l	0.78	1.36	1.12	1.5	-	-
27.	Cadmium (as Cd)	mg/l	ND	ND	ND	0.01	-	-
28.	Total Arsenic (as As)	mg/l	ND	ND	ND	0.2	-	-
29.	Lead (as Pb)	mg/l	ND	ND	ND	0.1	-	-
30.	Hexavalent Chromium (as Cr ⁺⁶)	mg/l	ND	ND	ND	0.05	-	-

S. No.	Parameter	Unit	SW1	SW2	SW3	Permissible unit		
						Class C	Class D	Class E
31.	Nickel (as Ni)	mg/l	ND	ND	ND	-	-	-
32.	Mercury (as Hg)	mg/l	ND	ND	ND	-	-	-
33.	Iron (as Fe)	mg/l	0.26	0.32	0.21	-	-	-
34.	Aluminium (as Al)	mg/l	ND	ND	ND	-	-	-
35.	Barium (as Ba)	mg/l	ND	ND	ND	-	-	-
36.	Copper (as Cu)	mg/l	ND	ND	ND	-	-	-
37.	Residual Free Chlorine	mg/l	ND	ND	ND	-	-	-
38.	Manganese (as Mn)	mg/l	ND	ND	ND	-	-	-
39.	Phenolic Compound (as C ₆ H ₅ O ₆)	mg/l	ND	ND	ND	-	-	-
40.	Selenium (as Se)	mg/l	ND	ND	ND	-	-	-
41.	Silver (as Ag)	mg/l	ND	ND	ND	-	-	-
42.	Sulphide (as H ₂ S)	mg/l	ND	ND	ND	-	-	-
43.	Zinc (as Zn)	mg/l	0.14	0.15	0.08	-	-	-
44.	Cyanide (as CN)	mg/l	ND	ND	ND	-	-	-
45.	Total Chromium (as Cr)	mg/l	ND	ND	ND	-	-	-
46.	Vanadium (as V)	mg/l	ND	ND	ND	-	-	-
48.	Oil & Grease	mg/l	<0.1	<0.1	<0.1	-	-	-
49.	Total Nitrogen (as N)	mg/l	19.3	26.4	23.9	-	-	-
50.	Total Coliform	MPN/100ml	70	90	110	-	-	-

Source: RITES Field Study

The analysis of various parameters revealed the following findings:

- The parameters such as pH, nitrate, chloride (as Cl) and Sulphate (as SO₄) at all three locations were found within the prescribed limits.
- Parameters related to toxic substances, including Boron, Cadmium, Arsenic, Lead, Chromium, nickel, mercury, aluminium, barium, copper, phenolic compound, selenium, silver, and zinc, were not detected in any of the samples across the three locations.
- Fluoride concentrations in the surface water samples were within the permissible limit of 1.5 mg/L for Class C as per 2296 – 1982 for Inland Surface Waters subject to pollution. However, as the water is not proposed for drinking, no fluoride treatment is required, and no significant impact is anticipated on either metro operations or local fluoride levels.
- DO levels ranged from 3.7 to 3.9 mg/L, which is slightly lower than optimal levels for sustaining fish health.
- BOD values were observed in the range of 13 to 17 mg/L, which exceeds acceptable limits, indicating moderate organic pollution. This suggests a considerable presence of organic matter in the water, resulting in elevated microbial activity and oxygen consumption.
- Total coliform concentrations ranged from 70 to 110 MPN/100ml at all three locations, suggesting the presence of microbial contamination.

5.3.2.2 Ground Water Quality

As per CGWB data, ground water in the district is alkaline in nature and ranges from moderately to highly saline. Analysing ground water is essential to assess whether the construction and operation of the GMRP could potentially introduce contaminants or pollutants into the subsurface, thereby impacting ground water quality through the leaching process.

To establish the baseline ground water quality, eight samples were collected along the GMRP alignment or its vicinity. The sampling locations are shown in **Figure 5-2** and the descriptions of ground water quality monitoring locations are provided in **Table 5-7**.

Table 5-7 Location of Ground Water Samples

Location No	Particulars	Latitude	Longitude	Source
GW1	Millennium City Centre	28.45739	77.07347	Bore Well
GW2	Sector-10	28.447465	76.997526	Bore Well
GW3	Subhash Chowk	28.428566	77.058486	Bore Well
GW4	Sector-4	28.472975	77.017484	Bore Well
GW5	Bajghera Road	28.502247	77.028314	Bore Well
GW6	Sector-22	28.500839	77.059598	Bore Well
GW7	Rao Gajraj Singh Marg	28.300335	77.042368	Bore Well
GW8	Depot	28.43006	77.0211	Bore Well

Source: RITES Field Study

The groundwater samples were analyzed for various physical and chemical constituents to assess their suitability for domestic and irrigation use. The results of the water quality analysis were compared with the drinking water standards as specified in IS 10500:2012. The detailed results are presented in **Table 5-8**.

- The analysis indicates that parameters such as pH, Turbidity, Sulphate, Fluoride, Iron and Magnesium were within acceptable limits across all samples.
- Calcium, Alkalinity, Chloride, Total Hardness and Total Dissolved Solids exceeded the acceptable limits but remained within the permissible limits for drinking water standards.
- Chloride levels exceeded the acceptable limits in all samples but remained within permissible limits, except at Subhash Chowk (GW3), where the Chloride content was found within acceptable limits.
- Toxic substances including Total Arsenic (As), Lead (Pb), Hexavalent Chromium (Cr+6), Nickel (Ni), Mercury (Hg), Barium (Ba), Copper (Cu), Vanadium (V), and Phenolic Compound (C6H5OH) were not detected in any of the samples.
- Total Coliform and Faecal Coliform were also not detected in any of the ground water samples, indicating no microbiological contamination and serving as a positive indicator of good water quality in terms of microbiological safety.

Table 5-8 Analysis of Ground Water Samples

S. No.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	Acceptable Limit	Permissible Limit
1.	Temperature, °C		18.3	18.4	17.3	18.1	17.2	17.5	16.6	15.44	-	-
2.	pH Value	-	7.4	7.44	7.36	7.48	7.52	7.4	7.38	7.44	6.5-8.5	No relaxation
3.	Salinity	PPT	<1	<1	<1	<1	<1	<1	<1	<1	-	-
4.	Electrical Conductivity at 25 °C	µmhos/cm	1619	1762	1312	1402	1810	2016	2614	2511	-	-
5.	BOD at 5 days at 20 °C	mg/l	<2	<2	<2	<2	<2	<2	<2	<2	-	-
6.	COD	mg/l	7.4	8	<4	6.5	8.4	9.4	10.6	8	-	-
7.	Nitrate	mg/l	5.2	5.6	3.4	4.7	4.1	4.5	5.7	6.3	-	-
8.	Nitrite Nitrogen	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
9.	Turbidity	NTU	<1	<1	<1	<1	<1	<1	<1	<1	1 Max.	5 Max.
10.	Total Alkalinity (as CaCO ₃)	mg/l	319	354	284	331	318	372	562	532	200 Max.	600 Max.
11.	Chloride	mg/l	286	312	244	295	295	344	438	472	250 Max.	1000 Max.
12.	Total Kjeldahl Nitrogen (as N)	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	-	-
13.	Total Phosphorous (as P)	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
14.	Ammonical Nitrogen (as N)	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	-	-
15.	Total Hardness (as CaCO ₃)	mg/l	462	478	390	422	451	489	572	543	200 Max.	600 Max.
16.	Calcium (as Ca)	mg/l	105	112	88	95	104	120	136	128	75 Max.	200 Max.
17.	Sulphate as SO ₄	mg/l	109	117	90.6	98.5	98	128	192	180	200 Max.	400 Max.
18.	Sodium (as Na)	mg/l	79.6	86.4	54	66.5	79.8	95.6	98.7	92.6	-	-
19.	TDS	mg/l	917	952	766	852	977	1170	1411	1372	500 Max.	2000 Max.
20.	Total Suspended Solids	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	-	-
21.	Total Phosphate (as PO ₄)	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
22.	Boron (as B)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.5 Max.	2.4 Max.
23.	Magnesium (as Mg)	mg/l	48	48	41	44.6	46.2	45.7	56	52	-	-
24.	Potassium (as K)	mg/l	1.36	1.82	1.92	2.17	1.58	1.94	1.62	1.34	-	-
25.	Fluoride (as F)	mg/l	0.35	0.48	0.39	0.42	0.44	0.52	0.4	0.38	1 Max.	1.5 Max.
26.	Cadmium (as Cd)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.003 Max.	No relaxation
27.	Total Arsenic (as As)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.01 Max.	No relaxation
28.	Lead (as Pb)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.01 Max.	No relaxation
29.	Hexavalent Chromium (as Cr+6)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	-	-
30.	Nickel (as Ni)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.02 Max.	No relaxation
31.	Mercury (as Hg)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.001 Max.	No relaxation
32.	Iron (as Fe)	mg/l	0.24	0.2	0.18	0.13	0.28	0.22	0.29	0.31	1 Max.	No relaxation

S. No.	Parameter	Unit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	Acceptable Limit	Permissible Limit
33.	Aluminium (as Al)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.03 Max.	0.2 Max.
34.	Barium (as Ba)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.7 Max.	No relaxation
35.	Copper (as Cu)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.05 Max.	1.5 Max.
36.	Residual Free Chlorine	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.2 Min.	1 Min.
37.	Manganese (as Mn)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.1 Max.	0.3 Max.
38.	Phenolic Compound (as C6H5O6)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.001 Max.	0.002 Max.
39.	Selenium (as Se)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.01 Max.	No relaxation
40.	Silver (as Ag)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.1 Max.	No relaxation
41.	Sulphide (as H2S)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.05 Max.	No relaxation
42.	Zinc (as Zn)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	5 Max.	15 Max.
43.	Cyanide (as CN)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.05 Max.	No relaxation
44.	Total Chromium (as Cr)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.05 Max.	No relaxation
45.	Vanadium (as V)	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	-	-
46.	Oil & Grease	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
48.	Total Nitrogen (as N)	mg/l	5.2	5.6	3.4	4.7	4.1	4.5	5.7	6.3	-	-
49.	Total Coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	-	-
50.	Faecal Coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	-	-

Source: RITES Field Study

5.3.3 Drainage

The drainage system in the project area falls within the Yamuna Sub-Basin. The district is traversed by two seasonal rivers, Sahibi and Indrani and comprises large depressions and natural streams. The depressions in the district are Khalipur, Chandaini, Sangel-Ujjina, Kotla Dahar Jheels and Najafgarh Lake.

The drainage pattern within a 10 km radius of the project area is shown in **Figure 5-4**. The GMRP alignment primarily passes through the urban areas of Gurugram City and crosses small streams/nalas, the details of which are given in **Table 5-9**.

Table 5-9 Stream/Nala Crossings

S. No.	Section		Nearest Chainage	Nearest Metro Station
	From	Towards		
1.	Ashok Vihar	Sector-3	16859	Ashok Vihar
2.	Cyber city /Udyog Vihar Phase 1	Cyber city	25670	Cyber city

5.4 Floods

The main causes of flooding in the district are the heterogeneous topography, like hillocks and undulating terrain, and rapid urbanisation, which has placed significant pressure on the natural drainage systems, leading to instances of urban flooding. Flood-prone villages in Gurugram Tehsil are Bajghera, Chandu, Budhera, and Daultabad.

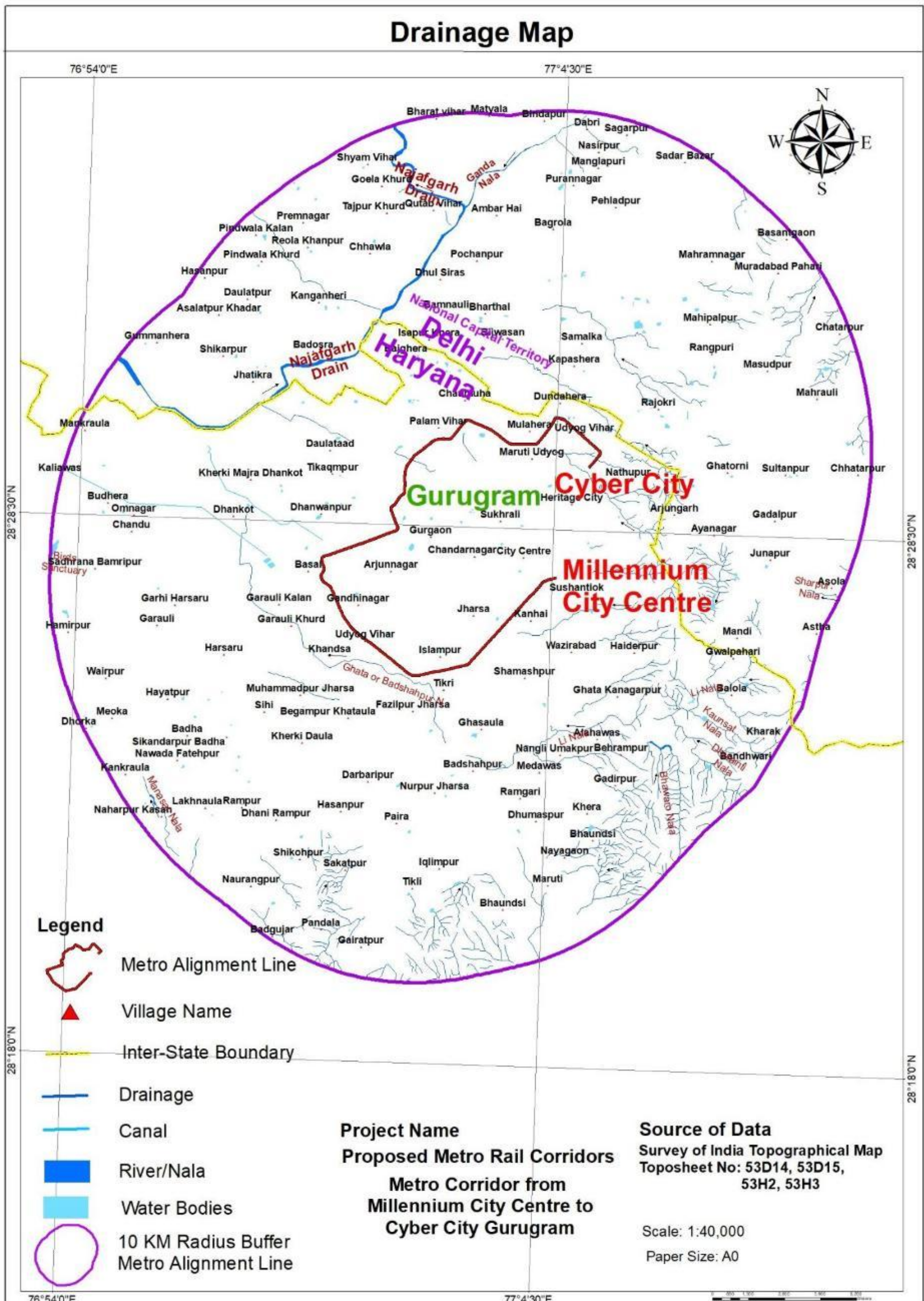
Critical areas prone to stormwater stagnation near the GMRP alignment are given in **Table 5-10**.

Table 5-10 Critical Areas prone to Stormwater Stagnation Near the Alignment

S. No.	Water Logging Points/Location
1.	Hero Honda Chowk & Opposite TPS-1
2.	Subhash Chowk
3.	Bakhtawar Chowk
4.	Umang Bharadwaj Chowk to Himgiri Chowk
5.	Khandsa Chowk
6.	Basai Chowk and Flyover
7.	Near ESI Hospital towards Sector 9A
8.	Sector-4/7 Chowk
9.	Presidium School Flyover Sector 2/3 & Krishna Chowk Palam Vihar

Source: Gurugram flood control order year 2023-24, Department of Revenue and Disaster Management, Government of Haryana

Figure 5-4 Drainage Map of the Project Area



Source: RITES

5.5 Meteorology

Air pollutant dispersion and concentration from both point and non-point sources are significantly influenced by meteorological and topographical conditions. Meteorological parameters such as temperature, wind speed and direction, humidity, and rainfall play a crucial role in regulating the transport and diffusion of pollutants in the atmosphere. Gurugram's climate is characterised by generally dry air (except during the monsoon season), hot summers, and cold winters. The region experiences four distinct seasons (i) Summer: March to end of June; (ii) Monsoon: July to mid-September (Southwest monsoon); (iii) Post Monsoon: Mid-September to end of November; (iv) Winter: December to early March.

Temperature: The district experiences considerable seasonal variation in temperature. January is the coldest month, with an average maximum temperature of 22.2°C and a minimum of 6.9°C. May and June are the hottest months, with June reaching an average daily maximum temperature of 40.8°C and occasionally exceeding 45°C.

Rainfall: Approximately 72% of the district's annual rainfall occurs between July and September, with July and September being the rainiest months. The average annual rainfall is approximately 505.4 mm.

Humidity: The air remains generally dry throughout the year, except during the monsoon. April and May are the driest months, with morning relative humidity around 30% and dropping below 20% in the afternoons. Humidity is highest during the southwest monsoon season.

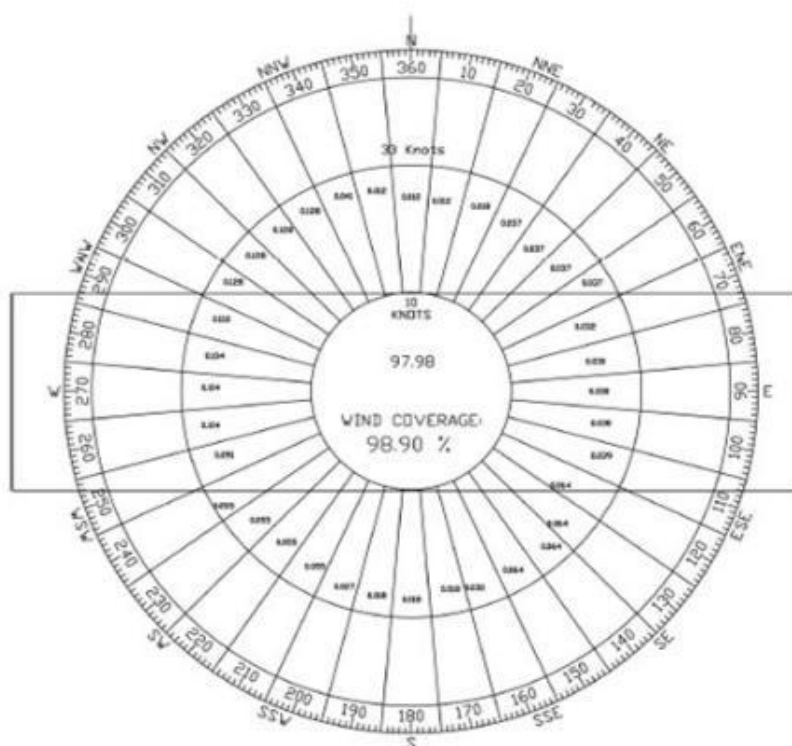
Cloudiness: Overcast or heavily clouded skies are typically observed during the monsoon and occasionally for short spells in winter. For the remainder of the year, skies remain mostly clear or lightly clouded.

Winds: Winds are generally light throughout the year but gain momentum during the summer and monsoon seasons. During the monsoon, winds mainly blow from the east or southeast, whereas during the rest of the year, they predominantly blow from the west or northwest, shifting to a northerly direction in the afternoon.

Special weather phenomena: Between April and June, the region experiences the highest frequency of dust storms and thunderstorms, some of which can be intense. While some thunderstorms are dry, others are accompanied by heavy showers and occasional hail. Thunderstorms may also occur in winter, associated with Western disturbances.

Wind Rose: The wind rose diagram for Gurugram is shown in **Figure 5-5**, indicates that winds predominantly blow from the west 17%, northwest 21%, with calm conditions recorded 26.5 % of the time. Combined, the east-west direction accounts for 22% of wind flow, while the northwest-southeast axis accounts for 31.5%. The wind rose also shows that 98.9% of the wind speeds fall below 10 knots in the east–west direction

Figure 5-5 Wind Rose Diagram for Gurugram



Source: IMD

5.6 Air Environment

The pollution levels in Gurugram city are determined by the existing Ambient Air Quality Index (AQI), which classifies air quality into six categories: Good, Satisfactory, Moderate, Poor, Very Poor and Severe. As per CPCB data, the ambient air quality in the district varies from moderate to very poor for most parts of the year.

The baseline air quality survey was undertaken to evaluate compliance with national air quality standards. Monitoring was carried out at 12 locations near the GMRP alignment and depot for four weeks from November 2023 to January 2024. Monitoring sites were strategically selected to represent areas at major road intersections, commercial areas and places with high population density or sensitive populations. The air quality monitoring locations are listed in **Table 5-11** and shown in **Figure 5-2**. The results of the air quality analysis are summarised **Table 5-12**.

Table 5-11 Description of Air Quality Monitoring Locations

Station. Id	Location /Metro Station	Distance from Alignment (m)	Latitude	Longitude
A1.	Millennium City Centre	150	28°27'26.02"N	77° 4'24.61"E
A2.	Subash Chowk	20	28°25'42.33"N	77° 2'18.07"E
A3.	Hero Honda Chowk	32	28°26'9.82"N	77° 0'33.88"E
A4.	Umang Baradwaj Chowk	10	28°26'49.86"N	76°59'52.09"E
A5.	Basai Chowk	5	28°27'30.12"N	76°59'24.91"E
A6.	Sector 4-7 Chowk	46	28°28'23.77"N	77° 1'4.31"E
A7.	Ashok Vihar	20	28°29'9.89"N	77° 1'11.75"E
A8.	Near Bajghera Road Station	36	28°30'7.96"N	77° 1'42.74"E

Station Id	Location /Metro Station	Distance from Alignment (m)	Latitude	Longitude
A9.	Rejang La Chowk	56	28°30'31.57"N	77° 2'38.83"E
A10.	Palam Mod	40	28°30'9.52"N	77° 4'4.43"E
A11.	Cyber City	20	28°29'50.50"N	77° 5'13.82"E
A12.	Depot	95	28°25'47.208"N	77°1'15.672"E

Source: RITES Field Study

Table 5-12 Analysis of Ambient Air Samples in Project Area

Station Id	Location	Day	PM _{2.5}	PM ₁₀	SO ₂	NO ₂	CO	O ₃	HC
Permissible Limit as per (NAAQS)			60*	100*	80*	80*	2**	100**	NS
Unit			µg/m ³	µg/m ³	µg/m ³	µg/m ³	mg/m ³	µg/m ³	µg/m ³
A1	Millennium City Center	1	112.8	220.5	10.5	24.8	0.9	26.1	ND
		2	119.4	239.1	12.7	26.1	0.9	27.2	ND
A2	Subash Chowk	1	119.5	232.4	11.3	19.7	1.2	24.5	ND
		2	140.2	256.8	13.5	18.5	1.2	25.8	ND
A3	Hero Honda Chowk	1	149.5	259.3	12.7	24.5	1.1	34.5	ND
		2	137.6	242.1	12.2	26.9	1.2	28.9	ND
A4	Umang Baradwaj Chowk	1	113.8	205.9	10.4	18.7	1	ND	ND
		2	92.7	189.3	12.3	19.2	0.9	ND	ND
A5	Basai Chowk	1	138.5	246.2	12.3	20.6	0.8	37.4	ND
		2	131.8	239.7	13.5	27.7	0.9	29.4	ND
A6	Sector 4-7 Chowk	1	118.9	242.5	10.5	19.8	1.1	24.2	ND
		2	114.3	236.9	12.7	20.5	0.9	29.3	ND
A7	Ashok Vihar	1	89.6	205.3	12.4	22.1	0.9	29.2	ND
		2	102.5	219.6	13.8	24.3	0.8	27.4	ND
A8	Near Bajghera Road Station	1	112.5	209.8	13.5	24.2	1	26.9	ND
		2	126.4	235.9	14.1	23.5	1	28.2	ND
A9	Rejang La Chowk	1	123.6	249.6	19.3	27.5	0.9	30.5	ND
		2	118.1	252.5	20.5	28.4	1.1	28.2	ND
A10	Palam Mod	1	110.8	245.2	17.5	24.5	0.9	26.8	ND
		2	119.5	240.8	16.1	23.8	0.9	25.3	ND
A11	Cyber City	1	114.5	243.8	18.3	37.4	1	32.2	ND
		2	116.9	237.5	18.9	38.9	1	29.5	ND
A12	Depot	1	121.7	228.9	13.5	24.2	1	ND	ND
		2	105.9	198.4	15.3	25.4	1.1	ND	ND

Source: RITES Field Study

Remarks: (*) 24 Hour Average; (**) Annual Average; ND=Not Detected

The findings of air quality monitoring are as follows:

- PM₁₀ & PM_{2.5} concentrations exceeded the permissible limits for residential, industrial and sensitive areas at all locations.
- SO_x, NO_x and CO levels were within the permissible limits for all land use categories across all monitoring locations.
- Ozone was detected at all locations except at A4, and the concentration levels at all locations were within permissible limits.
- Hydrocarbons were not detected at any of the monitoring locations.

- Based on the monitoring results, the AQI in the project area ranged from 199 to 322, categorising the air quality as moderate to very poor.

5.7 Noise

The construction and operation of a GMRP corridor generate noise, which may impact adjoining areas. Noise monitoring is essential to assess baseline conditions and implement appropriate mitigation measures.

To evaluate existing noise levels and anticipate potential project-related impacts, monitoring was conducted at 20 locations along the alignment and within the project area. Noise levels were recorded hourly over two consecutive days to evaluate both daytime and nighttime noise intensity

The noise monitoring locations are given in **Table 5-13** and shown in **Figure 5-2** and while the recorded noise levels are summarized in **Table 5-14**.

Table 5-13 Description of Noise Monitoring Locations

Station Id	Location	Distance from Alignment (m)	Latitude	Longitude	Category of Area/Zone
N1.	Fortis Hospital, near Millennium City Center	150	28°27'26.02"N	77° 4'24.61"E	Silence
N2.	Subash Chowk	20	28°25'42.33"N	77° 2'18.07"E	Residential
N3.	Udyog Vihar Phase 6 Metro station	70	28°26'35.19"N	76°59'57.90"E	Silence
N4.	Near Greenwood Public school (Basai Pond)	10	28°27'42.84"N	76°59'24.59"E	Silence
N5.	ESIC Hospital	22	28°28'3.40"N	77° 0'3.09"E	Silence
N6.	Near Jain Sant Phool Chand Ji Charitable Hospital	60	28°28'40.46"N	77° 0'59.35"E	Silence
N7.	Block C2, Near Blossoms Primary School, Sector 3	25	28°29'36.86"N	77° 1'11.04"E	Residential
N8.	Infront of G A V International School	25	28°29'55.02"N	77° 1'25.12"E	Residential
N9.	Near Krishna Chowk, Presidium School, Palam Vihar	36	28°30'7.96"N	77° 1'42.74"E	Commercial
N10.	Manipal Hospital, Palam Vihar	56	28°30'31.57"N	77° 2'38.83"E	Silence
N11.	Near Rotary Public School	20	28°30'8.89"N	77° 3'52.58"E	Silence
N12.	Cyber City	20	28°29'50.50"N	77° 5'13.82"E	Commercial
N13.	Near Unitech Cyber Park	20	28°26'32.72"N	77° 3'25.61"E	Commercial
N14.	Sector 47 Metro station	5	28°26'5.24"N	77° 2'57.84"E	Commercial

Station Id	Location	Distance from Alignment (m)	Latitude	Longitude	Category of Area/Zone
N15.	Sector 72/A Metro station	20	28°25'35.32"N	77° 1'28.75"E	Commercial
N16.	Hero Honda Chowk	15	28°26'9.43"N	28°26'9.43"N	Commercial
N17.	Sector 4-7 Chowk	10	28°28'23.77"N	77° 1'4.31"E	Commercial
N18.	Sector 5 Gol Chakkar	32	28°29'9.98"N	77° 1'12.23"E	Commercial
N19.	Sector 22 Metro station	40	28°30'9.52"N	77° 4'4.43"E	Commercial
N20.	Udyog Vihar Phase V Metro station	20	28°30'0.69"N	77° 4'49.60"E	Commercial

Source: RITES Field Study

Table 5-14 Noise Levels (in dB) in the Project Area

Station Id	Day	Lmin	L ₁₀	L ₅₀	L ₉₀	Leq	Lmax	Leq-day	Leq-night
N1.	1	41.8	64.0	57.5	47.4	62.5	72.5	63.9	48.5
	2	43.9	64.9	59.8	48.5	62.4	69.3	63.9	49.9
N2.	1	43.7	63.1	56.6	52.3	61.0	71.2	62.4	52.2
	2	42.5	64.5	58.2	50.9	62.9	71.9	64.4	51.8
N3.	1	36.4	52.5	47.6	43.3	52.4	62.3	53.9	44.1
	2	37.2	52.6	46.6	41.5	52.6	64.1	54.1	44.6
N4.	1	36.8	53.0	46.6	41.5	52.8	64.3	54.3	44.2
	2	37.3	53.3	46.9	41.7	53.4	65.3	54.9	44.8
N5.	1	37.9	67.0	50.9	42.8	52.8	68.1	53.7	44.8
	2	38.8	66.1	50.4	42.8	52.1	67.3	54.5	43.5
N6.	1	39.6	54.5	43.8	40.0	51.7	62.8	53.2	43.6
	2	38.6	54.8	44.7	40.5	52.5	63.9	54.0	43.7
N7.	1	42.3	67.3	56.8	44.0	53.1	70.8	53.8	44.5
	2	43.5	68.0	57.6	45.1	53.4	72.1	54.3	44.1
N8.	1	41.6	66.6	59.3	48.2	62.4	68.9	63.9	44.6
	2	40.8	67.7	59.8	43.2	63.1	68.1	64.7	45.7
N9.	1	38.7	64.4	60.2	47.5	61.2	66.8	62.6	48.3
	2	37.5	63.6	59.3	47.0	60.4	65.3	61.7	47.7
N10.	1	39.2	62.4	59.3	45.7	52.4	67.3	53.7	43.9
	2	40.9	64.4	59.5	47.4	52.9	66.2	54.1	44.4
N11.	1	38.4	50.0	43.6	40.4	53.3	66.3	54.8	44.4
	2	39.5	49.4	43.6	40.6	52.0	64.8	53.5	44.7
N12.	1	38.1	63.4	57.3	49.6	59.7	67.5	61.2	50.1
	2	37.3	63.8	55.8	48.5	59.1	66.3	60.5	49.4
N13.	1	42.9	66.4	60.6	43.9	63.2	68.5	64.5	49.7
	2	41.2	64.8	60.1	44.9	62.5	70.1	63.7	50.5
N14.	1	35.4	55.2	46.0	41.1	52.9	63.9	54.5	44.4
	2	36.6	55.4	46.3	40.1	52.4	62.8	53.9	43.8
N15.	1	40.7	56.0	45.2	41.8	53.3	65.9	54.8	44.9
	2	38.1	53.9	45.9	41.1	51.8	62.3	53.3	43.8
N16.	1	41.9	65.9	53.6	51.6	62.7	72.5	64.3	52.1
	2	42.8	66.6	55.3	51.8	64.3	73.1	66.0	52.9
N17.	1	37.5	65.5	60.2	49.4	52.3	65.3	53.9	44.1
	2	40.1	65.7	60.4	47.1	52.6	66.2	54.3	43.9
N18.	1	39.2	54.9	45.4	41.4	52.7	64.1	54.3	43.4

Station Id	Day	Lmin	L ₁₀	L ₅₀	L ₉₀	Leq	Lmax	Leq-day	Leq-night
N19.	2	38.6	54.6	45.3	40.0	53.3	65.3	54.8	44.2
	1	38.5	68.3	58.0	42.8	63.3	69.7	64.8	47.4
	2	37.9	67.9	59.1	42.4	63.1	68.9	64.6	47.3
N20.	1	41.9	65.2	57.6	44.6	52.8	67.3	53.7	44.6
	2	42.3	63.4	57.5	43.6	53.1	66.5	54.5	44.2

Source: RITES Field Study

The analysis of noise level monitoring reveals the following observations:

- Day time and night-time noise levels at locations N1, N3, N4, N5, N6, N10 and N11 exceeded the permissible limits for silence zones.
- At location N7, noise levels during both day-time and night-time were within the permissible limits for a residential zone. However, at location N2, both daytime and nighttime noise levels exceeded the permissible limits for residential areas. At location N8, noise levels exceeded the permissible limits during daytime on both sampling days and nighttime on one of the sampling days.
- Daytime and nighttime noise levels at locations N9, N12, N13, N14, N15, N17, N18, N19 and N20 were within the permissible limits for commercial zone. However, at the N16 location, noise levels exceeded the daytime limit for a commercial zone on one sampling day.
- Noise levels at locations N2, N6, N12, N13, N14, N15, N16, N17, N18 and N20 were found within the permissible limits for residential and commercial zones.
- Fortis Hospital near Millennium City Centre and the area around GAV International School, both classified as sensitive zones, were observed to have elevated noise levels.
- The variation in baseline noise levels between locations such as N3 and receptors N1, N8, and N13 reflects differences in local traffic movement, urban density, commercial activity, and surrounding land-use characteristics along the project corridor.
- Sensitive receptors such as hospitals (N1, N5, N10) and schools (N4, N8, N11) have been considered in the assessment based on their location, surrounding environment, and proximity to the corridor. Variations in exposure conditions, such as Greenwood School (N4) at 10 m and Fortis Hospital (N1) at 150 m, are inherently reflected in the monitored and predicted noise levels.

5.8 Vibration

Human response to vibration is subjective and can vary significantly among individuals. When vibrations are transmitted through floors and walls, they may become perceptible depending on their amplitude and frequency. Such vibrations can cause the rattling of windows, dishes and other objects, resulting in audible disturbances known as ground-borne noise. Ground-borne vibration is often caused by trains, buses on rough roads, construction activities such as pile-driving or the use of heavy equipment can be a significant concern for residents living near transit routes. Blasting activities are not required for GMRP. The existing sources of vibration in the project area are ongoing construction activities, vehicular traffic and train movement. Another factor that is significant in the propagation of ground-borne vibration is the soil and subsurface conditions.

To assess baseline vibration conditions, 24-hour vibration monitoring was carried out at 10 locations, as listed in **Table 5-15** and shown in **Figure 5-2** Using a vibration level meter. The vibration meter recorded vertical vibrations in VdB, and the summary of results is presented in **Table 5-16**.

Table 5-15 Description of Vibration Monitoring Locations

Station. Id	Location	Distance from Alignment (m)	Latitude	Longitude	Environmental Setting
V1.	Fortis Hospital	15	28°28'24"N	77°04'22"E	Sensitive
V2.	Manipal Hospital	70	28°30'33"N	77°02'28"E	Sensitive
V3.	ESIC	50	28°28'03"N	77°00'03"E	Sensitive
V4.	INOX Mall	45	28°28'24"N	77°01'02"E	Commercial
V5.	Unitech Cyber Park	52	28°26'35"N	77°03'25"E	Commercial
V6.	Greenwood School	50	28°27'44"N	76°59'26"E	Sensitive
V7.	Presidium School	10	28°30'10"N	77°01'46"E	Sensitive
V8.	Sector-22 Palam Vihar	60	28°30'10"N	77°03'59"E	Residential
V9.	Apartment Near Subhash Chowk	150	28°25'42"N	77°02'17"E	Residential
V10.	Infosys Ltd.	100	28°25'35"N	77°01'40"E	Commercial

Source: RITES Field Study

Table 5-16 Vibration Monitoring Results

S. No.	Location Name	Ambient Vibration at monitored location (Vdb)	Ambient Vibration at Receptor Location (Vdb)
V1	Fortis Hospital	69	51.5
V2	Manipal Hospital	56	56.0
V3	ESIC Hospital	61.8	47.8
V4	INOX Mall	60.1	36.6
V5	Unitech Cyber Park	66.2	53.8
V6	Greenwood School	79.9	69.4
V7	Presidium School	54	40.0
V8	Sector -22, Palam Vihar	66.8	51.2
V9	Apartment near Subash Chowk	69.9	46.4
V10	Infosys	63.5	47.0

Source: RITES Field Study

The monitoring results indicate that ambient vibration levels at all locations, except V6 (Greenwood School), are within the permissible limits prescribed by RDSO. Although the vibration level exceeded the permissible limit at location V6, natural attenuation reduced it to within permissible limits at the receptor location.

At Greenwood School, the ambient vibration level (79.9 VdB) and receptor vibration level (69.4 VdB) represent source and receptor conditions, respectively. The lower vibration level at the receptor location is consistent with expected attenuation and ground damping effects with increasing distance from the source.

The variation in vibration levels between receptors, such as INOX Mall (36.6 VdB) and Greenwood School (69.4 VdB), reflects normal site-specific influences including local activities, traffic conditions, ground characteristics, and receptor distance from the source.

Such variability is expected in urban environments and is adequately represented through the baseline monitoring data.

5.9 Biological Environment

This section presents the baseline status of the biological environment within the project area, based on primary data collected through field surveys and secondary data collated from relevant literature. The scope of the biological baseline includes assessments of flora, fauna, habitats and overall biodiversity in the region. The project area falls within the Semi-Arid biogeographical zone.

Tree inventory was carried out by identifying tree species with a girth greater than 30 cm at chest height. Species identification was conducted using taxonomic manuals, published literature, and verified sources such as the Botanical Survey of India (BSI) and the State/District Forest Department. Faunal species were documented through primary surveys and validated secondary sources. All identified faunal species were screened against the Schedules of the Wildlife (Protection) Act, 1972, and cross-verified with the International Union for Conservation of Nature (IUCN) Red List to determine their conservation status.

5.9.1 Forest Area

Haryana's landscape is primarily agricultural, with approximately 80% of its area under cultivation. Forestry activities are primarily concentrated in the rugged Shivalik Hills in the north and the Aravalli Hills in the south. Forests in Haryana are classified as Reserved, Protected and Unclassified under the Indian Forest Act, 1927 and the Punjab Land Preservation Act, 1900. The state's forest cover constitutes around 3.63% of its total geographical area. The area-wise distribution of forests by category is provided in **Table 5-17**.

Table 5-17 Categories of Forests in Gurugram District

S. No.	Type of forest	Area (in hectares)
1.	Reserved Forest/ Block Forest	214.89
2.	Protected Forest	144.68
3.	Unclassified Forest	22.66
4.	Areas closed under section 4/5 of PLPA 1900	6824.85
5.	Strip forests (Protected)	1443.59
6.	Areas closed under Section 38	247.37
Total		8898.04

Source: Divisional Forest Office, Gurugram

An unclassified forest area of 1.725 ha (4.26 acres) is located near the Sector 10 Metro Station and is classified as a terrestrial modified habitat. The entry/exit of the Sector 10 Metro Station falls within the unclassified forest, which is predominantly occupied by Vilayati Kikar (*Prosopis juliflora*), an invasive species commonly found along roadsides in India. This species is known for its rapid growth and aggressive spread, often displacing the growth of native vegetation. Approximately 3,598 sqm (equivalent to 0.3598 ha, i.e. 21% of the total forest area) will be required for the construction of the metro alignment and station infrastructure. The entire forest-designated area will not be impacted; only a limited portion is proposed to be utilised. The location of the forest area is depicted in **Figure 5-6**.

Figure 5-6 Location of Forest Area at Entry/Exit of Sector-10 Metro Station

5.9.2 Flora

The common tree species identified along the GMRP corridor during the field study are provided in **Table 5-18**.

Table 5-18 Tree Species Found along the GMRP Corridor

S. No.	Scientific Name	Common name	Native/Exotic/Invasive
1.	<i>Ailanthus excelsa</i>	Ullo Neem	Native
2.	<i>Albizia lebbbeck</i>	Siris	Native
3.	<i>Alstonia scholaris</i>	Saptaparni	Native
4.	<i>Azadirachta indica</i>	Neem	Native
5.	<i>Senegalia senagal</i>	Khairi	Native
6.	<i>Broussonetia papyrifera</i>	Paper mulberry	Native
7.	<i>Cassia fistula</i>	Amaltas	Native
8.	<i>Dalbergia sissoo</i>	Shisham	Native
9.	<i>Delonix regia</i>	Gulmohar	Exotic
10.	<i>Eucalyptus cameldulensis</i>	Safeda	Invasive
11.	<i>Ficus benghalensis</i>	Bargad	Native
12.	<i>Ficus religiosa</i>	Peepal	Native
13.	<i>Ficus glomerata</i>	Gular	Native
14.	<i>Leucaena leucocephala</i>	Subabul	Invasive
15.	<i>Melia azedarach</i>	Bakain	Native
16.	<i>Putranjiva roxburghii</i>	Putranjiva	Native
17.	<i>Polyalthia longifolia</i>	Ashok	Native
18.	<i>Pongamia pinnata</i>	Karanja	Native
19.	<i>Prosopis juliflora</i>	Vilayati Kikar	Invasive
20.	<i>Senegalia catechu</i>	Khair	Native
21.	<i>Terminalia arjuna</i>	Arjun	Native
22.	<i>Vachellia nilotica</i>	Babool	Native

Source: RITES Field Study

5.9.3 Fauna

Wildlife species found in Gurugram district include Common langur, Golden Jackal, Leopard, Jungle Cat, Indian Grey Mongoose, Nilgai, Monkey, Sambar, etc. Small mammals such as squirrels and mice are also present along with reptiles like the Common Garden Lizard and Rat Snake. The list of bird and animal species observed in the district, along with their IUCN conservation status and classification under the WPA, 1972, is provided in **Annexure 5.2**.

5.9.4 Habitat and Biodiversity in the region

For the ecological study, a buffer distance of 10 km on either side of the GMRP alignment has been considered. Sultanpur National Park (a designated Ramsar Site), KBA/IBA in Sector 101, Basai and Najafgarh Jheel are located within this 10 km radius from the GMRP alignment.

5.9.4.1 Sultanpur National Park

Sultanpur National Park is an intermittent freshwater wetland and has been designated as a Wetland of International Importance (Ramsar site) under the Ramsar Convention. The mosaic of habitats within the park supports a spectacular diversity of species.

It is located about 8.2 km from the nearest point of the proposed spur from Basai Village to Dwarka Expressway. The National Park covers an area of 143 ha. The location map of the park is represented in

Figure 5-7.

According to Rodgers and Panwar's (1987) classification, this Ramsar wetland falls within the semi-arid biogeographic zone and features habitats such as grasslands and marshes. Sultanpur National Park has been assigned IBA Site Code IN-HR-04. It was declared a National Park in July 1991 and recognised as a Ramsar site in 2021.

As per the MoEF&CC Notification dated 27.01.2010, a 5 km radius from the park boundary has been declared an Eco Sensitive Zone (ESZ). The endpoint of the spur is 3.2 km from the boundary of ESZ. The wetland forms the core area of the National Park, is primarily fed by overflow from nearby canals and agricultural fields and is also replenished by saline groundwater.

Flora: The vegetation of this park is tropical and dry deciduous, and the flora includes grasses, Khair (*Senegalia catechu*), Karanja (*Pongamia Pinnata*), Arjun (*Terminalia arjuna*), Bargad (*Ficus benghalensis*), Neem (*Azadirachta indica*), Babool (*Acacia nilotica*) and Israeli Babool (*Acacia tortilis*) etc.

Avifauna: The wetland supports a rich diversity of avifauna, with over 250 species of resident, winter migratory and local migratory waterbirds recorded at various critical stages of their life cycles. The site hosts several globally threatened species, including the Critically Endangered Sociable Lapwing (*Vanellus gregarius*), the endangered Egyptian vulture (*Neophron percnopterus*), the Saker falcon (*Falco cherrug*), Pallas's fish eagle (*Haliaeetus leucoryphus*) and the Black-bellied tern (*Sterna acuticauda*). The site regularly supports over 7% of the biogeographic population of the Bar-headed goose (*Anser indicus*) and more than

8% of the Greylag goose (*Anser anser*) populations, underscoring its international ecological significance. Other notable bird species observed in the park include:

Raptors: Crested sparrowhawk (*Accipiter trivirgatus*), Besra (*Accipiter virgatus*), Shikra (*Accipiter badius*), Eurasian sparrowhawk (*Accipiter nisus*),

Mynas: Common myna (*Acridotheres tristis*), Jungle myna (*Acridotheres fusca*), Bank myna (*Acridotheres ginginianus*),

Others: Indian great reed warbler (*Acrocephalus stentorus*), Common sandpiper (*Actitis hypoleucos*), Oriental skylark (*Alauda gulgula*), and Common kingfisher (*Alcedo atthis*) are also found in the park.

5.9.4.2 KBA/IBA in Sector 101, Basai

KBA/IBA in Sector 101, Basai, was historically characterised as a low-lying area and holds considerable ecological significance, particularly for its avian biodiversity. It was recognised by KBA as an IBA under site code IN-HR-01 and is also listed as a KBA due to its role in supporting a wide variety of migratory and resident bird species recorded over the years. The IBA assessment conducted in 2004 established that the site in Sector 101, Basai, met multiple IBA criteria, including: A1 - Presence of globally threatened species, A4i - Supporting at least 1% of the biogeographic population of certain bird species and A4iii - Hosting large congregations of birds.

KBA/IBA in Sector 101, Basai, is not notified as a wetland by GoI and GoH, and it is not listed in the Indian National Wetland Inventory. As per the Gurugram Master Plan 2031, Sector 101 is categorised as “Public Utilities” such as Water Works, Disposal Works and Grid Substation. The salient feature of the area is provided in **Table 5-19** and

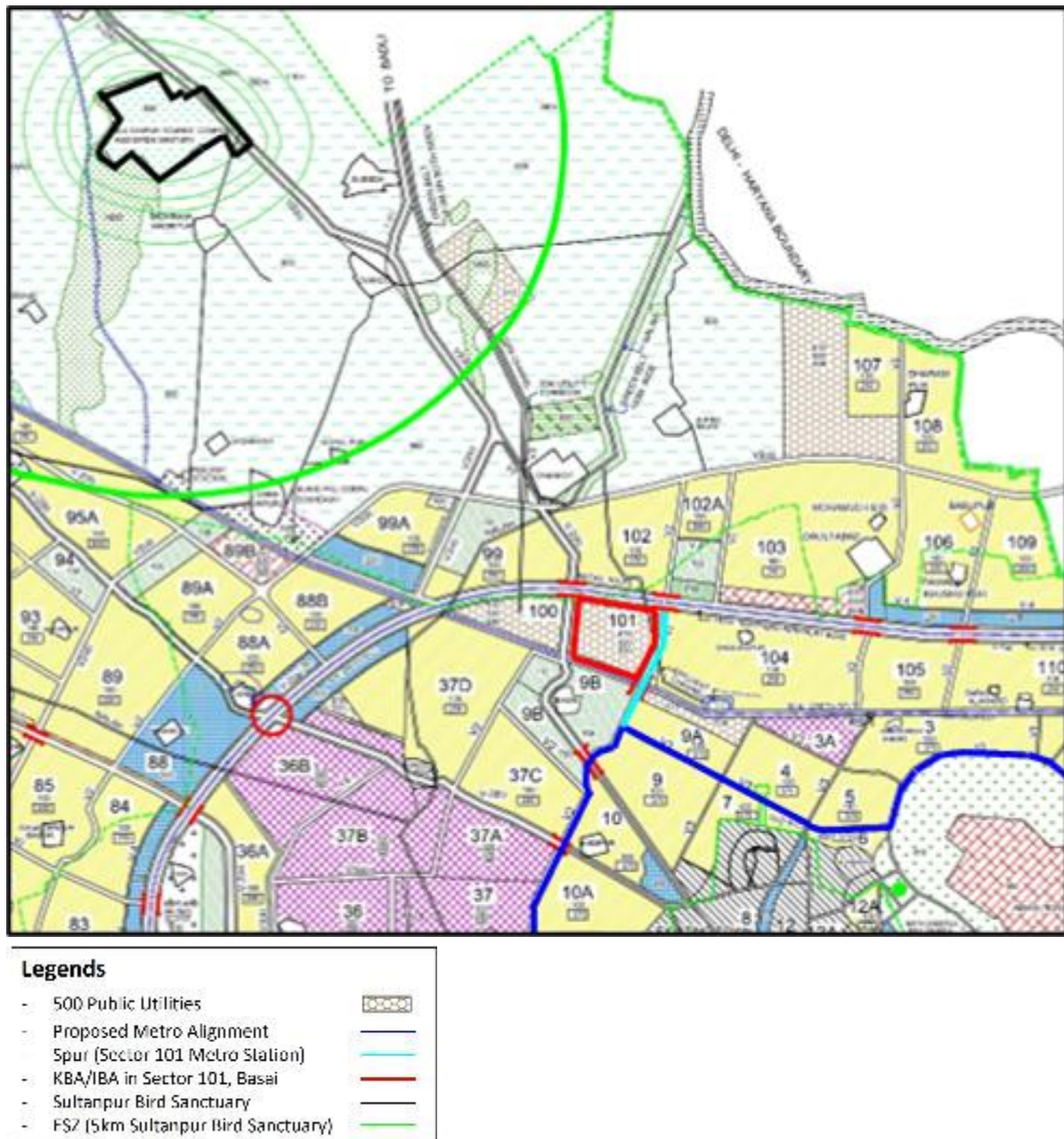
Figure 5-8 Illustrates the location of the KBA/IBA in Sector 101, Basai, as marked on the Gurugram Master Plan 2031.

Table 5-19 Salient Feature of KBA/IBA in Sector 101, Basai

S. No.	Parameters	Description
1.	Name	Basai Wetland as per IBA, 2004
2.	Location	Sector 101, Basai
3.	Coordinates	28.47° N, 76.98°E
4.	Biogeographic Zone	Semi-Arid

S. No.	Parameters	Description
5.	Area	Approx. 250 Acres
6.	Source of Water	The main source of water is overflow water from the broken drain, which carries Effluent from the nearby STP.
7.	Notification if any	Not notified as a wetland by the State and Central Government
8.	Land use as per the Master Plan, 2031 of Gurugram	Sector 101 is categorised as “Public Utilities” for Water Works, Disposal Works, and Grid Substation.
9.	Whether a Ramsar site?	No
10.	Whether a protected site?	No
11.	Listed in Important Bird Area (IBA)	Yes, as per the IBA assessment in the year 2004
12.	IBA Site Code	IN-HR-01
13.	IBA Criteria in the year 2004	A1: Threatened Species, A4i: (>=1% of biogeographical population) and A4iii: (Congregatory species).

Figure 5-8: KBA/IBA in Sector 101, Basai, marked on the Gurugram Master Plan 2031



Source: Master Plan 2031, Gurugram

The GMRP spur alignment passes along the edge of this area, making it an environmentally sensitive zone adjacent to the GMRP. A map showing KBA/IBA in Sector 101, Basai and the GMRP alignment is presented in

Figure 5-9.

Biodiversity and ecosystems are critical components to be considered in any infrastructure project. A preliminary biodiversity assessment was conducted in January 2024 to identify and

evaluate the potential risks and impacts of the spur alignment adjacent to the KBA/IBA in Sector 101, Basai and to propose appropriate mitigation measures.

Figure 5-9: KBA/IBA in Sector 101, Basai



Source: RITES

A. Preliminary Biodiversity Assessment of the KBA/IBA in Sector 101, Basai

The preliminary assessment is based on site visits, public consultation and a review of secondary data sourced from various national and international websites, research articles, etc.

A habitat refers to the place or environment where an organism or a biological population lives and sustains itself. As per WB ESS 6, this area falls under modified habitat.

The study approach utilises measurable and field-monitorable indicators to assess habitat conditions, particularly the status of the water spread area. The specific criteria and indicators adopted for the assessment are presented in **Table 5-20**. Photographic documentation from the January 2024 site visit is provided in **Figure 5-10**.

Table 5-20 Indicators for KBA/IBA in Sector 101, Basai

S. No.	Indicator	Explanation	Method of Assessment	Remarks
Criteria 1: Ecosystem Level				

S. No.	Indicator	Explanation	Method of Assessment	Remarks
1.	Surrounding land use	Adjacent land use has an influence on the overall water spread area. Agricultural practices, settlements, and encroachments negatively affect the water spread area.	Field observation and Satellite imagery (Google Earth)	The urban settlements surrounding KBA/IBA in Sector 101, Basai include real estate development, a flyover, roads, an expressway, a railway line, a sewage treatment plant, water treatment plant. As per the Gurugram Master Plan 2031, the land use in Sector 101 is categorised as “Public Utilities” for Water Works, Disposal Works, and Grid Substation.
2.	Shallow water zone (depth < 2 m)	The most productive zone of the water spread area indicates the good health of KBA/IBA in Sector 101, Basai.	Field observation	Migratory bird species, especially those using the Central Asian Flyway, frequently visit Sultanpur National Park. Due to the proximity of KBA/IBA at Sector 101, Basai, some of these birds are also observed to migrate to this area for resting.
3.	Impervious structures	Presence of impervious structures around KBA/IBA in Sector 101, Basai site, such as flyovers, expressway, buildings, railway tracks, embankments, etc., can reduce percolation and disturb water availability from the catchment.	Field observation, satellite imagery (Google Earth)	Permanent impervious structures in the vicinity of KBA/IBA in Sector 101, Basai include Dwarka Expressway, Gurugram-Rewari railway line, Rail overbridge/flyovers, residential complexes including high-rise building apartments, sewage treatment plant, and water treatment facility.
Criteria 2: Water Quality				
1.	Physico-Chemical properties	The physico-chemical properties of water, such as pH, BOD, and TSS, serve as key indicators of the ecological health of the water spread area.	Sampling and analysis were carried out as per the IS standards	Water quality status: • pH: 7.35 • BOD: 15.6 mg/l • COD: 77 mg/l • Turbidity: 25.5 NTU • TSS: 36 mg/l • D.O: 3.9 mg/l The primary source of water in KBA/IBA at Sector 101, Basai, is treated effluent from the STP. Water quality

S. No.	Indicator	Explanation	Method of Assessment	Remarks
				analysis indicates that the dissolved oxygen levels are slightly below the optimal range for sustaining fish health and reveal the presence of a considerable amount of organic matter.
2.	Algal Bloom /Water Hyacinth invasion	The dissolved oxygen level reflects the ecological functions and also indicates a high level of eutrophication due to the presence of sewage and fertilisers.	Field observation	Visual inspection revealed the presence of algal mats and water hyacinth on the water surface when inundation is high.
Criteria 3: Biotic Indicators				
1.	Free-floating invasive species	Floating invasive species form thick mats on the water surface, hindering light penetration and affecting native aquatic species.	Field observation	Invasive species such as Water Hyacinth (<i>Eichhornia crassipes</i>) are present on the water surface and are a primary factor contributing to the deterioration of water quality.
Criteria 4: Biotic Indicators (Fauna)				
1.	Native aquatic fauna	The presence of native fauna such as fish, crabs, shrimps, amphibians, snakes, etc.	Field Observation/ Literature review	Occasional sightings of a water snake species and an amphibian species have been reported in KBA/IBA in Sector 101, Basai.
2.	Birds	Presence of aquatic birds (Local and migratory)	Field Observation/ Consultation with NGO	Bird presence in the water spread area has been confirmed through field observations and consultation with local NGOs
3.	Resting Area	Presence of a resting area for birds in KBA/IBA in Sector 101, Basai	Field Observation/ Consultation with NGO	Field observation and consultation with the NGO have helped in identifying areas where migratory birds usually rest.
Criteria 5: Anthropogenic disturbances (Indicates severity of disturbances/pressure which results in KBA/IBA in Sector 101, Basai degradation and water pollution)				
1.	Water withdrawal from KBA/IBA in Sector 101, Basai	Water withdrawal from this area for any purpose reduces the water spread and depth, thereby impacting the local ecology	Field Observation	During field observation, it was found that no water is currently being withdrawn from the area for irrigation activities.
2.	Discharge of Sewage	Sewage discharge in this area may lead to	Field	No sewage discharge was observed near the KBA/IBA

S. No.	Indicator	Explanation	Method of Assessment	Remarks
		degradation of water quality and contribute to eutrophication, which affects the overall ecological health of the water spread area.	observation/ Consultation with NGO	at Sector 101, Basai. However, the primary source of water in the area is treated effluent from the nearby STP.
3.	Discharge of any industrial effluent	Industrial discharges can degrade water quality and adversely affect the ecological health of the area	Field observation	There is no industry found near KBA/IBA at Sector 101, Basai.

Figure 5-10 Photographs of KBA/IBA in Sector 101, Basai



Source: RITES Field Visit

Flora

KBA/IBA in Sector 101, Basai, is predominantly covered with invasive species such as Water Hyacinth and dense beds of Typha. Tree species like Kabuli Kikar are predominantly present in the vicinity of this area. The details of flora in KBA/IBA in Sector 101, Basai are provided in **Table 5-21**.

Table 5-21 Flora at KBA/IBA in Sector 101, Basai

S. No.	Type	Common Name	Scientific Name	Family	Description of Species
1.	Shrub	Elephant Grass	<i>Typha elephantina</i> Roxb.	Typhaceae	Shrub up to 1.5 - 2 m in height with erect leaves and stems.
2.	Shrub	Water Hyacinth	<i>Eichhornia crassipes</i>	Pontederiaceae	It is a floating aquatic plant characterised by clusters of leaves with spongy stalks, emerging from a base of dark purple, feathery roots
3.	Tree	Kabuli Kikar	<i>Acacia juliflora</i>	Mimosaceae	Branches are greyish with stipular spines up to 1 cm long. The pods are pale yellow, glabrous, constricted between the seeds, and contain multiple seeds.

Source: IBA, 2004

Fauna

According to the assessment conducted by the Bombay Natural History Society in 2004, species such as Nilgai, Indian Mongoose, and Jungle Cat are occasionally observed in the area. However, during the visual inspection, no faunal species were sighted in the vicinity of KBA/IBA in Sector 101, Basai. The details of the fauna reported through secondary sources are provided in **Table 5-22**.

Table 5-22 Fauna near the KBA/IBA in Sector 101, Basai

S. No.	Common name	Scientific name	Family	IUCN list	IWPA, 1972 Schedule
1.	Nilgai	<i>Boselaphus tragocamelus</i>	Bovidae	LC	II
2.	Indian Mongoose	<i>Herpestes edwardsii</i>	Herpestidae	LC	II
3.	Jungle Cat	<i>Felis chaus</i>	Felidae	LC	II
4.	Common Rat Snake	<i>Ptyas mucosa</i>	Colubridae	LC	II
5.	Checkered Keelback	<i>Xenochrophis piscator</i>	Colubridae	LC	II

Source: Bombay Natural History Society, 2004

Avifauna

As per the IBA assessment conducted in 2004, the avifaunal species visiting this area are listed in **Table 5-23**, along with their IUCN Status and the corresponding schedules of the IWPA, 1972.

For the present study, species of global or national conservation importance include those categorised as Least Concerned, Near Threatened, or Vulnerable under the IUCN Red List. As per the IWPA, 1972, avifaunal species falling under Schedules I, II and IV have been recorded at Sector 101, Basai.

Table 5-23 Avifauna recorded at KBA/IBA in Sector 101, Basai

S. No.	Common Name	Scientific Name	Family	IUCN List	WPA, 1972 Schedule
1.	Asian dowitcher	<i>Limnodromus semipalmatus</i>	Scolopacidae	NT	I
2.	Bar-headed Goose	<i>Anser indicus</i>	Anatidae	LC	I
3.	Black-headed ibis	<i>Threskiornis melanocephalus</i>	Threskiornithidae	NT	IV

S. No.	Common Name	Scientific Name	Family	IUCN List	WPA, 1972 Schedule
4.	Black-necked Stork	Ephippiorhynchus asiaticus	Ciconiidae	NT	I
5.	Black bittern	Dupetor flavicollis	Ardeidae	LC	II
6.	Cattle egret	Bubulcus ibis	Ardeidae	LC	IV
7.	Cinnamon bittern	Ixobrychus cinnamomeus	Ardeidae	LC	I
8.	Common redshank	Tringa totanus	Scolopacidae	LC	IV
9.	Common Shelduck	Tadorna tadorna	Anatidae	LC	II
10.	Eurasian curlew	Numenius arquata	Scolopacidae	NT	II
11.	Grey lag Goose	Anser anser	Anatidae	LC	II
12.	Great bittern	Botaurus stellaris	Ardeidae	LC	II
13.	Greater spotted eagle	Aquila clanga	Accipitridae	VU	I
14.	Imperial eagle	Aquila heliaca	Accipitridae	VU	I
15.	Glossy Ibis	Plegadis falcinellus	Threskiornithidae	LC	II
16.	Indian pond-heron	Ardeola grayii	Ardeidae	LC	IV
17.	Lesser kestrel	Falco naumanni	Falconidae	LC	II
18.	Marbled Teal Duck	Marmaronetta angustirostris	Anatidae	NT	I
19.	Oriented Darter	Anhinga melanogaster	Anhingidae	NT	IV
20.	Pallid Harrier	Circus macrourus	Accipitridae	NT	I
21.	Painted Stork	Mycteria leucocephala	Ciconiidae	NT	IV
22.	River tern	Sterna aurantia	Laridae	NT	I
23.	Red-crested pochard	Netta rufina	Anatidae	LC	II
24.	Sarus Crane	Grus antigone	Gruidae	VU	I
25.	Water Rail	Rallus aquaticus	Rallidae	LC	II
26.	Yellow bittern	Ixobrychus sinensis	Ardeidae	LC	II
27.	Yellow wagtail	Motacilla flava	Motacillidae	LC	II
28.	Citrine wagtail	Motacilla citreola	Motacillidae	LC	IV

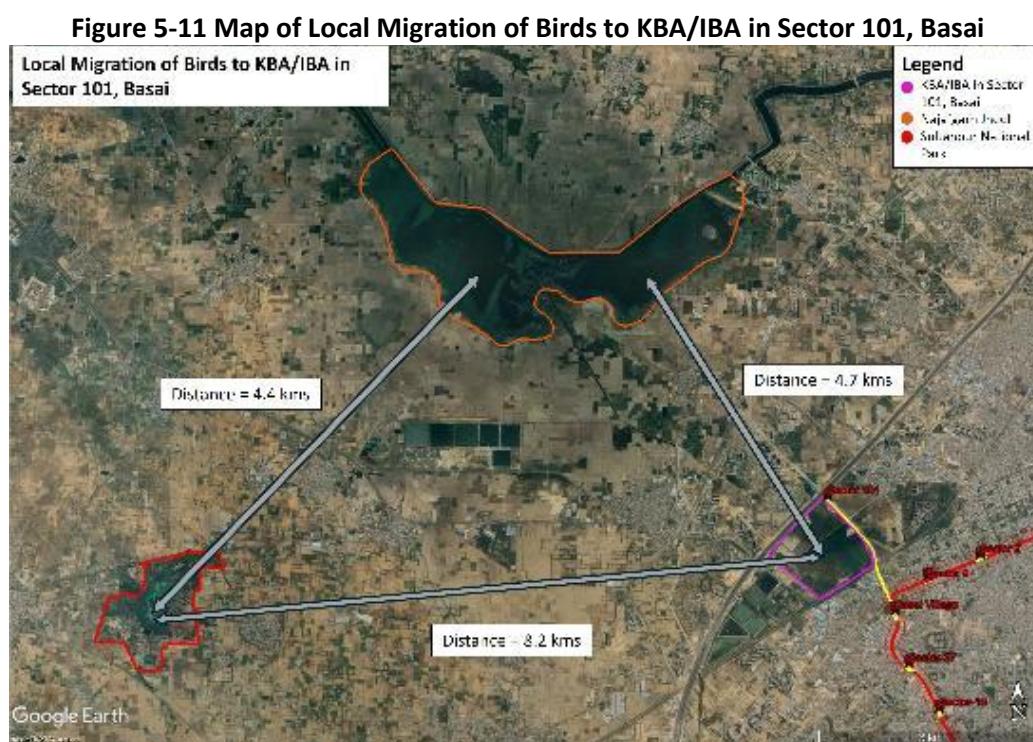
Source: IBA, 2004 LC – Least Concerned, VU – Vulnerable, NT – Near Threatened,

Migration of Birds to KBA/IBA in Sector 101, Basai

Sultanpur National Park lies along the Central Asian Migratory Flyway and hosts thousands of migratory waterbirds during the winter season, primarily from Central Asia and the Western Palearctic region. These migratory bird species reach the National Park after covering an extensive distance. Similarly, Najafgarh Jheel attracts many migratory birds, including waterbirds such as Ruffs and Bar-headed Geese, as well as raptors like the Steppe Eagle and Greater Spotted Eagle. The wetland further serves as a habitat for migratory land birds.

Since KBA/IBA in Sector 101, Basai is located at an aerial distance of 8.2 km from Sultanpur National Park and about 4.7 km from Najafgarh Jheel. Due to its proximity, birds are often observed making local movements to this area for resting. The map depicting local migration routes of birds from Sultanpur National Park and Najafgarh Jheel to KBA/IBA in Sector 101, Basai is presented in

Figure 5-11.



Source: RITES

Present Status

Field studies and consultation were conducted in October 2024 and in April 2025 to understand the present status of KBA/IBA in Sector 101, Basai. The key findings are summarised below:

The primary source of water sustaining the area was treated wastewater discharged from a damaged sewage drain connected to a nearby STP. This discharge led to water ponding, which supported avifaunal activity, particularly among local and migratory bird species. Following

the repair of the damaged drain, the discharge of treated effluent into the area has ceased. Subsequently, the site has been backfilled with soil and is currently being converted for agricultural use.

During a consultation held on October 15, 2024, participants who were residents confirmed that the land where ponding occurred comprises both privately owned plots and land under the jurisdiction of the Basai Panchayat. Photographs taken in April 2025 and May 2026 are presented in

Figure 5-12 and Google Earth images showing the site before and after the drainage repair are provided in

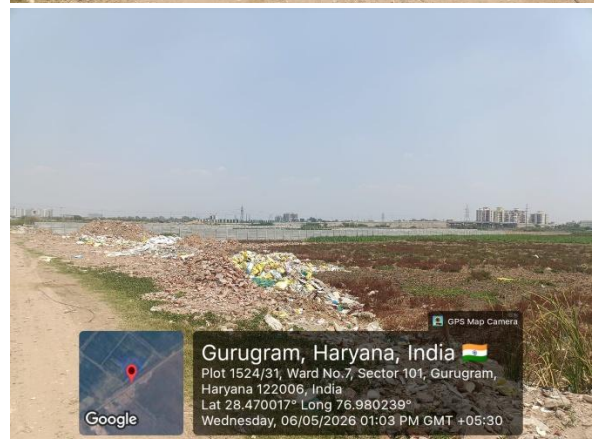
Figure 5-13.

Figure 5-12 Photographs of the Area





April 2025



May 2026

Figure 5-13 Google Earth Screenshot



Figure A: Google Earth Image of February 2024 - Before Drainage Repair



Figure B: Google Earth Image of May 2025 - Post Drainage Repair

In addition to this preliminary biodiversity assessment conducted as part of the ESIA, GMRL has planned to undertake an integrated biodiversity impact assessment during the migratory season in July 2026 to prepare the BMP. The study would provide a detailed understanding of the habitats & address any impact on this habitat and establish corresponding mitigation measures.

5.9.4.3 Najafgarh Jheel

Najafgarh Jheel is the largest surface water body in Delhi, located approximately 4.7 km from the GMRP alignment. In the past, it was fed by the Sahibi River and stormwater runoff from surrounding areas. However, its primary water sources now include wastewater from the Badshahpur Drain, Outfall Drain No. 8, and monsoonal rainwater.

The Jheel previously served as a recharge zone for surrounding aquifers and functioned as a natural catchment for surface runoff, thereby mitigating flood risks in the adjacent areas. As per the Hon'ble Supreme Court order dated 08.02.2017, the Jheel was directed to be notified under the Wetlands (Conservation and Management) Rules, 2017. However, as per the current status, it has not yet been notified as a wetland.

- **Flora:** The flora of Najafgarh Jheel includes a diverse mix of aquatic and terrestrial plant species such as Prickly chaff flower (*Achyranthes aspera*), Alligator weed (*Alternanthera sp.*), Water hyacinth (*Eichhornia crassipes*), Munj grass (*Sachharum munja*), Field bindweed (*Convolvulus arvensis*), Nut Sedge (*Cyperus rotundus*), Indian mallow (*Abutilon indicum*), Kanta chaulai (*Amaranthus spinosus*), Jungle chaulai (*Amaranthus viridis*), Krishn neel (*Anagallis arvensis*), Vajradanti (*Barleria prionitis*), Punarnava (*Boerhavia diffusa*), Milkweed (*Calotropis procera*), Ivy gourd (*Coccinia grandis*), Ground cherry (*Physalis minima*), Karanj (*Pongamia pinnata*), Flannel weed (*Sida cordifolia*), Malabar gulbel (*Tinospora sinensis*), Kantakari (*Solanum surattense*), Kans grass (*Sachharum spontaneum*), Patera (*Typha elephanta*), Giant Reed (*Arundo donax*), Neem (*Azadirachta indica*), Babool (*Acacia nilotica*) and Vilayati kikar (*Prosopis juliflora*).
- **Fauna:** The Jheel supports several terrestrial mammalian species, including the Jungle cat (*Felis chaus*), Golden jackal (*Canis aureus indicus*), fox (*Vulpes vulpes*), Indian hare (*Lepus nigricollis*), Nilgai (*Boselaphus tragocamelus*), etc.

- **Avifauna:** The Jheel is a significant habitat for avifauna, hosting approximately 281 bird species, comprising both resident and migratory birds, including land and water birds. A few of the species found at the Jheel include the Egyptian vulture (*Neophron percnopterus*), Sarus crane (*Antigone antigone*), Steppe eagle (*Aquila nipalensis*), Greater Spotted eagle (*Clanga clanga*), and Imperial Eagle (*Aquila heliaca*).

5.9.4.4 Aravali Range

The Aravalli Range, situated approximately 3 km from the GMRP, comprises semi-arid and dry deciduous forests interspersed with patches of thorn scrub and rocky outcrops. This ecologically significant landscape supports a diverse range of flora, fauna, and avifauna characteristic of the Northern Indian Aravalli ecosystem.

- **Flora:** The Aravalli Range in Gurugram comprises tropical dry deciduous and thorn scrub forest types, characterised by a rich diversity of native plant species. Prominent flora includes *Acacia senegal*, *Acacia leucophloea*, *Prosopis cineraria*, *Capparis zeylanica*, *Salvadora spp.*, *Grewia spp.*, *Gardenia spp.*, *Boswellia serrata*, *Anogeissus pendula*, *Butea monosperma*, *Mitragyna parvifolia*, *Commiphora wightii*, *Sterculia urens*, *Wrightia tinctoria*, *Albizia odoratissima*, *Mallotus philippensis*, along with various native shrubs and grasses.
- **Fauna:** The region supports a variety of terrestrial wildlife, including species such as *Panthera pardus*, *Hyaena hyaena*, *Canis aureus*, *Boselaphus tragocamelus*, *Sus scrofa*, *Macaca mulatta*, *Felis chaus*, *Herpestes edwardsii*, *Paradoxurus hermaphroditus*, *Hystrix indica*, *Lepus nigricollis*, and *Pavo cristatus*. Reptilian fauna includes *Varanus bengalensis*, *Calotes versicolor*, *Ptyas mucosa*, *Fowlea piscator*, and other species of water snakes.
- **Avifauna:** The Aravalli range in Gurugram includes areas such as Mangar Bani and the Aravalli Biodiversity Park, supports a diverse assemblage of avifauna. Notable bird species observed include *Pitta brachyura*, *Terpsiphone paradisi*, *Rhipidura aureola*, *Leiopicus mahrattensis*, *Ocyrceros birostris*, *Psittacula cyanocephala*, *Treron phoenicoptera*, *Pycnonotus cafer*, *Copsychus saularis*, *Argya striata*, *Prinia socialis*, *Anthus similis*, *Dicrurus macrocercus*, *Curruca curruca*, *Aquila nipalensis*, *Pycnonotus leucotis*, *Sarcogyps calvus*, *Neophron percnopterus*, along with other raptors and waterbirds.

5.9.4.5 Basai Pond

Basai Pond is a manmade waterbody located adjacent to the proposed Basai Village Metro Station, between Ch. 11690 and Ch. 11789. Rainwater is the only source of water for this pond. It is primarily used by residents for cattle bathing. Seasonal fluctuations in water levels are common, with the water rising near the outer edge of the pond during the monsoon season and retreating to about 10m away from the boundary during drier months.

The pond's water quality has significantly deteriorated due to solid waste dumping. Human activities have significantly degraded the pond, resulting in the absence of avifauna in the area. Also, during the field studies, no avifauna was observed at Basai Pond. The Municipal Corporation of Gurugram is planning to develop ramps around the pond to facilitate religious activities. The location of the pond and the GMRP are depicted in

Figure 5-14.

Figure 5-14: Basai Pond



Source: RITES

5.10 Sensitive Receptors

The sensitive receptors within the RoW and within 100m on either side of the centerline of the GMRP alignment have been identified and presented in **Table 5-24** and the details of these receptors are provided in **Annexure 5.3**.

Table 5-24: Details of Sensitive Receptors along the GMRP Alignment

	Within RoW			Within 100 m on either side of the CL of the GMRP alignment					
	Temple	Pond	Forest	Temple	School/ College	Hospital	Pond	Forest	Park
Start Point – Millennium City Centre	-	-	-	1	-	-	-	-	-
Millennium City Centre - Sector 45	-	-	-	1	-	1	-	-	-
Sector 45 - Cyber Park	-	-	-	-	-	1	-	-	-
Cyber Park - Sector 47	-	-	-	2	1	3	-	-	-
Sector 47 - Subash Chowk	-	-	-	-	-	-	-	-	-
Subash Chowk - Sector 48	-	-	-	-	1	-	-	-	1
Sector 48 - Sector 72A	-	-	-	-	2	-	-	-	-
Sector 72A - Hero Honda Chowk	-	-	-	-	1	-	-	-	-
Hero Honda Chowk- Udyog Vihar Ph-6	-	-	-	-	-	-	-	-	1
Udyog Vihar Ph-6 - Sector 10	-	-	-	4	-	1	-	-	-
Sector 10 - Sector 37	-	-	1	1	-	-	-	1	-
Sector 37 - Basai Village	-	-	-	-	-	3	-	-	-
Basai Village - Sector 9	1	1	-	-	1	2	1	-	-
Sector 9 - Sector 7	-	-	-	-	1	2	-	-	-
Sector 7 - Sector 4	-	-	-	1	2	-	-	-	4
Sector 4 - Sector 5	-	-	-	2	1	2	-	-	-
Sector 5 - Ashok Vihar	-	-	-	-	2	3	-	-	1
Ashok Vihar - Sector 3	-	-	-	3	2	2	-	-	2
Sector 3 - Bajghera Road	-	-	-	-	2	-	-	-	-
Bajghera Road - Palam Vihar Ext.	-	-	-	1	2	-	-	-	-
Palam Vihar Ext. - Palam Vihar	-	-	-	1	1	1	-	-	-
Sector 23A - Sector 22	-	-	-	1	2	-	-	-	-
Sector 22 – Cyber City (End Point)	-	-	-	-	-	-	-	-	-
Spur from Basai Village to Dwarka Expressway	-	-	-	-	-	-	-	-	-
Total	1	1	1	18	21	21	1	1	9

Source: RITES Field Study, 2023

5.11 Cultural Heritage

Tangible cultural heritage encompasses objects, sites, structures and landscapes of cultural, historical, or aesthetic significance, while intangible heritage includes the practices, expressions, and knowledge passed down and continuously adapted by communities. Both forms are integral to preserving cultural identity and legacy.

Tangible cultural heritage in the project area includes cultural assets, archaeological monuments, and structures listed by INTACH, which are described in the following sections. No intangible cultural heritage sites or practices have been identified within the project area.

One cultural heritage asset, a temple at Basai Village Metro Station (Ch. 11684) will be impacted by the GMRP. The impact on the temple is expected to be significant and is depicted in **Figure 5-15**.

Figure 5-15: Photograph of Religious Place within the ROW

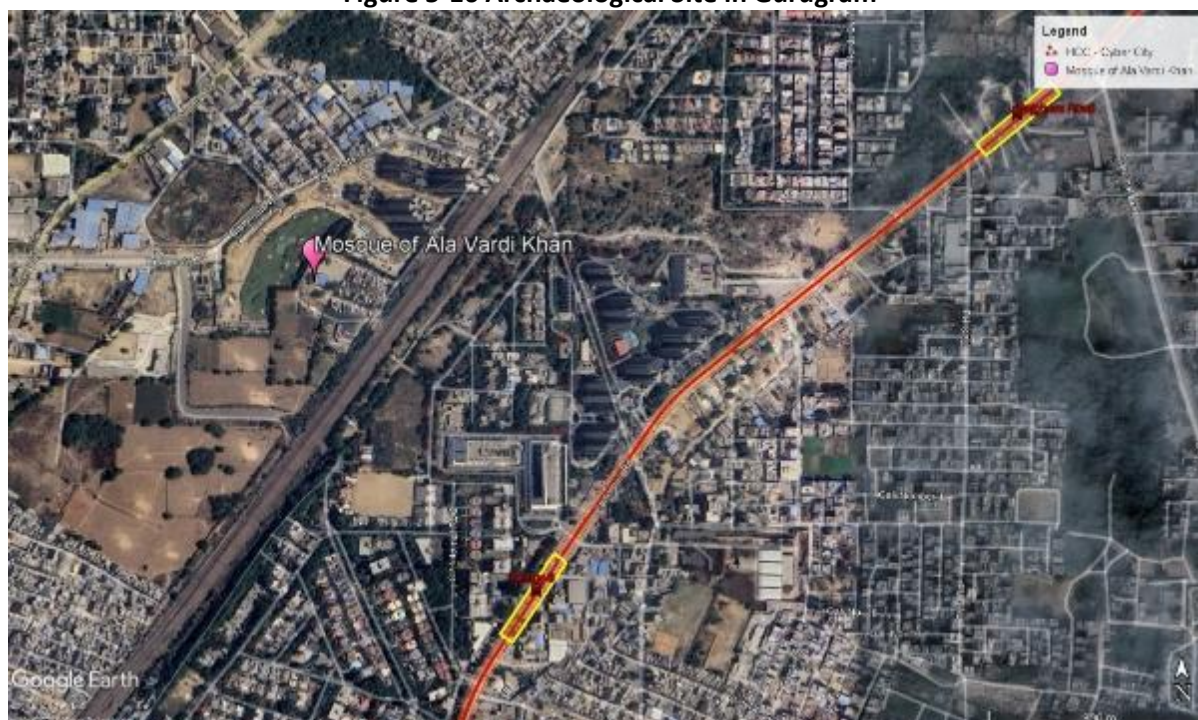


5.11.1 Archaeological Sites

The following archaeological monuments/sites are located in the Gurugram district:

1. Sheesh Mahal, Farukh Nagar, Gurugram
2. Lal Gumbad, Sohna, Gurugram
3. Qutub Khan ki Masjid, Sohna, Gurugram
4. Baoli Ghauss Ali Shah, Farukh Nagar, Gurugram
5. Mosque of Ala Vardi Khan, Gurugram

Among these, the Mosque of Ala Vardi Khan is a Centrally Protected Monument under the jurisdiction of the Archaeological Survey of India (ASI) and is located approximately 490m from the GMRP alignment, as shown in **Figure 5-16**. The remaining monuments are located beyond 10 km from the alignment. No impact is anticipated on the monuments due to the GMRP.

Figure 5-16 Archaeological Site in Gurugram

Source: RITES

5.11.2 Indian National Trust for Art and Cultural Heritage (INTACH) listed Structures

The INTACH-listed structures located within 10 km on either side of the GMRP alignment are as follows:

- Water Body: Bhim Kund
- Temples: Sita Ram Temple, Sheetla Mata Devi Temple, Dronacharya Temple and Eklavya Temple
- Mosques: Sarai Allawardi Mosque, Eidgah Mosque, Shahi Jama Mosque and Jama Masjid
- Church: Church of Epiphany

Among these, the Mosque of Ala Vardi Khan is a Centrally Protected Monument under the jurisdiction of the Archaeological Survey of India (ASI) and is located approximately 490m from the GMRP alignment. Therefore, no impact is anticipated on the monuments due to the GMRP.

5.12 Valued Environmental Components

Valued environmental components (VECs) refer to specific aspects of the natural and cultural environment that are important to maintain and protect their intrinsic value or their benefits to humans and other living organisms. These components are critical to environmental assessment and conservation planning. The VECs identified within the project area include water bodies, streams/nalas, temples, mosques, churches and heritage structures and are discussed below:

- **Waterbodies:** A total of 34 water bodies, including Najafgarh Jheel and KBA/IBA in Sector 101, Basai, have been identified within a 10 km buffer on either side of the alignment. Basai Pond is located within the RoW of the GMRP alignment.
- **Streams/nalas:** The GMRP alignment is crossing streams/nalas at two locations as detailed in Section 5.3.3.
- **Religious Places:** A total of 19 temples have been identified within 100m on either side of the GMRP alignment; out of which one temple falls directly within the RoW.
- Indian National Trust for Art and Cultural Heritage (INTACH) Listed Structures are detailed in 5.11.2.

5.13 Socio-Economic Profile

The objectives of the socio-economic survey are as follows:

- To generate a socio-economic profile of the PAPs and groups and to categorise them for appropriate entitlements and subsequently to monitor and evaluate their socio-economic status.
- To understand the impacts of the GMRP, including related concerns, and to capture the perceptions of PAPs and beneficiaries.
- To integrate these issues and impacts into the design and implementation of the project.
- To enhance the sustainability of the project.

The survey used both quantitative household questionnaires and qualitative Focus Group Discussions (FGDs) to gather comprehensive data. The survey was conducted among the identified project-affected households; however, some did not share socio-economic information. Additionally, FGDs with beneficiary communities, including women and vulnerable groups, were held to assess impacts and capture perceptions and aspirations regarding the GMRP.

The survey was conducted between December 2023 and February 2024 and covered 154 households and collected data on demographics, livelihoods, education, etc. The collected data was meticulously scrutinised, entered into a customised database and analysed. Qualitative information was coded and integrated. Findings are presented in the following sections.

Sample Selection: The purposive sampling technique was used for the survey. The project socio-economic survey was carried out with PAHs, and a structured questionnaire was administered during the data collection. In total, 154 households were covered under the study.

5.13.1 Demographic Profile of Households

5.13.1.1 Distribution by Age Group

The surveyed households were categorised into five age groups. The distribution shows that 65 members (7.63%) are below 5 years, 239 members (28.05%) are aged between 6-18 years, 394 members (46.24%) are aged between 19-45 years, 95 members (11.15%) are aged between 46-60 years, and 59 members (6.92%) are above 61 years. The majority of members belong to the 19-45 years age group. The distribution of age groups is depicted in **Table 5-25**.

Table 5-25 Age Group of Population

S. No.	Age Group	Nos.	%
1	Less than 5 Years	65	7.63
2	6 – 18 Years	239	28.05
3	19 – 45 Years	394	46.24
4	46 – 60 Years	95	11.15
5	61 and above	59	6.92
Total		852	100

5.13.1.2 Gender

Gender data is crucial for assessing male and female participation in society, which is a significant factor contributing to the human development index. Among the surveyed population, 52.58% are male and 47.42% are female. The detailed distribution of the sampled population is presented in **Table 5-26**.

Table 5-26 Gender Composition of Population

S. No.	Gender	Nos.	%
1	Male	448	52.58
2	Female	404	47.42
3	Third Gender	-	-
Total		852	100

5.13.1.3 Family Pattern and Size

The majority of households surveyed live in nuclear families (77.92%), followed by joint families (20.13%), and a small percentage live alone (1.95%). The average household size of the surveyed family is 5.53.

Household sizes vary, with 27.27% categorised as small (1-4 persons), 59.09% as medium (5-7 persons), and 13.64% as large (more than 8 persons). These patterns reflect varying degrees of sentimental attachment, social values, and economic structures among households. The details of family patterns and family sizes are presented in **Table 5-27**.

Table 5-27 Family Pattern and Size of HHs

S. No.	Particular	Nos	%
Family Pattern			
1	Joint	31	20.13
2	Nuclear	120	77.92
3	Individual	3	1.95
Total		154	100
Family Size			
1	1– 4 Member	42	27.27
2	5– 7 Member	91	59.09
3	8 and above Member	21	13.64
Total		154	100

5.13.1.4 Religious Composition

The study area reports three religious groups: Hindu, Muslim, and Sikh. The study results reveal that approximately 133 (86.36%) of the HHs are Hindu, 17 (11.04%) are Muslim, and the remaining Sikh (2.60%) are Sikh. A detailed religious composition is presented in **Table 5-28**.

Table 5-28 Religion Details of HHs

S. No.	Religious Group	Nos.	%
1	Hindu	133	86.36
2	Muslim	17	11.04
3	Sikh	4	2.60
Total		154	100

5.13.1.5 Social Composition

The survey reveals that 40.91% of households belong to the Other Backward Classes (OBC) category, 33.77% to the general category, and 25.32% to Scheduled Castes (SC). The social groups (SC/ST and OBC) receive preferential treatment in government schemes to address socio-economic backwardness. The details are given in **Table 5-29**.

Table 5-29 Caste Composition of HHs

S. No.	Social Group	Nos.	%
1	SC	39	25.32
2	OBC	63	40.91
3	General	52	33.77
Total		154	100

5.13.1.6 Educational Attainment

Education is a vital means for social vertical mobility, enabling individuals to participate in developmental opportunities. Despite its potential to exacerbate disparities, education is essential for socio-economic progress, serving as a fundamental indicator of regional development.

Education levels among the surveyed persons vary widely: 32.16% are illiterate, 24.30% have education up to primary level, 11.62% up to upper primary, 19.72% up to high school, 9.98% are graduates, 1.76% are postgraduates, and 0.47% have technical education. The details of educational attainment are presented in **Table 5-30**.

Table 5-30 Education Attainment of Surveyed Population

S. No.	Education Level	Nos.	%
1	Illiterate	274	32.16
2	Primary	207	24.30
3	Upper Primary	99	11.62
4	High School	168	19.72
5	Graduate	85	9.98
6	Postgraduate	15	1.76
7	Technical	4	0.47
Total		852	100

5.13.1.7 Work Status

Out of the total survey persons, 220 (25.82%) persons come under the working group, and 632 (74.18%) persons come under the non-working group. Details of work status are presented in **Table 5-31**.

Table 5-31 Working Status

S. No.	Working Status	Nos.	%
1	Working	220	25.82
2	Not Working	632	74.18
Total		852	100

5.13.1.8 Occupational Details

The survey records the occupational patterns of individuals to assess their skills for devising suitable income generation plans and identifying prevalent economic activities in the area. Approximately 25.82% of surveyed individuals are engaged in economic activities, including artisans (0.47%), labourers (2.70%), business/trade workers (19.13%), government employees (0.59%), private sector workers (1.41%), and maids (0.59%). Students, young children not of school-going age, the elderly, housewives, and individuals with disabilities are not considered part of the working group. The details of occupational status are presented in **Table 5-32** and the reasons for not working are tabulated in **Table 5-33**.

Table 5-32 Occupation Status of Surveyed Population

S. No.	Occupation Status	Nos.	%
1	Artisans	4	0.47
2	Labour	23	2.70
3	Business/Trade	163	19.13
4	Govt. Service	5	0.59
5	Private Service	12	1.41
6	Maid Servant	5	0.59
7	Unemployed	0	0.00
8	Retired	1	0.12
9	Others(specify)	7	0.82
10	Not Working	632	74.18
Total		852	100

Table 5-33 Reasons for Not Working

S. No.	Occupation Status	Nos.	%
1	No Work Available	19	3.01
2	Seasonal Inactivity	2	0.32
3	Household Family Duties	172	27.22
4	Old/young	118	18.67
5	Differently Abled	3	0.47
6	Students	312	49.37
7	Others	6	0.95
Total		632	100

5.13.1.9 Vulnerability among the Surveyed Population

Out of the total surveyed population of 852, 82 individuals fall into the category of vulnerable persons. This includes four (4.88%) who are differently abled, 56 (68.29%) who are elderly, 17 (20.73%) who are widowed, four (4.88%) who are Women Headed Household, and one (1.22%) who is below the poverty line (BPL). The details of vulnerability among the surveyed population are presented in **Table 5-34**.

Table 5-34 Vulnerability among the Surveyed Population

S. No.	Vulnerable Population	Nos.	%
1	Differently Abled	4	3.31
2	Persons above 60 Years of Age	56	46.28
3	Widow	17	14.05
4	Women Headed Household	4	3.31
5	BPL	1	0.83
6	SC	39	32.23
Total		82	100

5.13.1.10 Housing Pattern

Out of the total surveyed population, 24.68% of households reside in owned properties, while 75.32% live in rented accommodations. Regarding housing structure, 79.22% of households reside in pucca structures, 16.23% in kutcha structures, and 4.55% in semi-pucca houses. The details of ownership and the typology of the housing structure are presented in **Table 5-35 & Table 5-36**.

Table 5-35 Ownership of House

S. No.	Ownership	Nos.	%
1	Owned	38	24.68
2	Rented	116	75.32
Total		154	100

Table 5-36 Type of House Structure

S. No	Typology	Nos.	%
1	Kutcha	25	16.23
2	Semi-Pucca	7	4.55
3	Pucca	122	79.22
Total		154	100

5.13.1.11 Access to Facilities

According to the surveyed households, 78.57% have separate bathroom and toilet facilities, 81.82% have a piped water supply, and 79.22% have separate kitchen facilities within their premises. The details are given in **Table 5-37**.

Table 5-37 Access to Facilities

S. No.	Basic Facilities	Availability			
		Total	Yes	No	%
1	Separate Bathroom, Toilet	154	121	33	78.57
2	Electricity	154	141	13	91.56

S. No.	Basic Facilities	Availability			
		Total	Yes	No	%
3	Piped Water Supply	154	126	28	81.82
4	Separate Kitchen	154	122	32	79.22

5.13.1.12 Income

Income and asset ownership serve as indicators of household living standards. The survey shows that 0.65% of households have an average monthly income of less than Rs. 5000, 12.99% earn between Rs. 5001 and Rs. 10000, 54.55% earn between Rs. 10001 and Rs. 20000, and 14.94% earn between Rs. 20001 and Rs. 30000 monthly. The details of the average monthly income are presented in **Table 5-38**.

Table 5-38 Average Monthly Income

S. No.	Monthly Income Categories	Nos.	%
1	Below 5000	1	0.65
2	Above 5001 and up to 10000	20	12.99
3	Above 10001 and Below 20000	84	54.55
4	Above 20001 and up to 30000	23	14.94
5	Above 30001 and up to 50000	14	9.09
6	50001 and above	12	7.79
Total		154	100

5.13.1.13 Household Assets Details

Possession of household assets offers insights into the socio-economic status and comfort level of surveyed households. Most own mobile phones (90.26%), televisions (47.40%), two-wheelers (30.52%), food processors/mixers/grinders (27.27%), air coolers (26.62%), refrigerators (24.03%), washing machines (14.94%), etc. The details of the assets owned are presented in **Table 5-39**.

Table 5-39 Assets Owned

S. No.	Assets	Nos.	%
1	Telephone/ Mob. Phone	139	90.26
2	Television	73	47.40
3	Two-Wheeler	47	30.52
4	Food Processor/Mixer/Grinder	42	27.27
5	Air Cooler	41	26.62
6	Refrigerator	37	24.03
7	Washing Machine	23	14.94
8	Air Conditioner	16	10.39
9	Microwave Oven	17	11.04
10	Computer/Laptop	17	11.04
11	Four-Wheeler	16	10.39
			N = 154

5.13.1.14 SHG Membership

It is observed from table only 5.84% of sampled households' members are members of Self Help Groups (SHG). Out of the total HH sample, 5.19% have one member in SHGs, and 0.65%

of HHs have three members in SHGs. The details of SHG membership and members are presented in **Table 5-40** and **Table 5-41**.

Table 5-40 SHG Membership

S. No.	SHG Membership	Nos.	%
1	SHG Member	9	5.84
2	No	145	94.16
Total		154	100

Table 5-41 No. of Family Members who have SHG Membership

S. No.	No. of Family Members	Nos.	%
1	No Membership	145	94.16
2	1	8	5.19
3	2	-	-
4	3	1	0.65
Total		154	100

5.13.1.15 Participation, Perception and Information Participation

The survey found that 48.70% of households were aware of the project. Efforts were made to inform affected individuals about project details through consultations and outreach, promoting transparency and trust. This approach encourages stakeholder engagement, gathers feedback, and addresses concerns promptly, fostering community participation and accountability in decision-making processes. The details about the awareness of the project are given in **Table 5-42** and **Table 5-43**.

Table 5-42 Awareness about the Project

S. No.	Awareness about the Project	Nos.	%
1	Aware	75	48.70
2	Not Aware	79	51.30
Total		154	100

The households reported that they learned about the project through various channels, with the following distribution:

- Print media: 7.14% of households.
- Electronic media: 4.55% of households.
- Internet: 1.30% of households.
- Word of mouth: 35.71% of households.

Table 5-43 Source of Information about the Project

S. No.	Awareness about the Project	Nos.	%
1	Print Media	11	7.14
2	Electronic Media	7	4.55
3	Internet	2	1.30
4	Word of Mouth (Family, Friends, and Public Interaction)	55	35.71
6	Not Aware	79	51.30
Total		154	100

Perception

Perceived Positive Impacts

- Generation of Employment Opportunities: 8.15% of respondents anticipate that the project will generate increased employment opportunities.
- Development of City: 10.37% of respondents believe the project will improve city infrastructure.
- Traffic Reduction: 24.44% of respondents believe that the proposed metro corridor will reduce traffic congestion in the city.
- Reduction in Travel Time and Convenient Mode: 32.59% of respondents believe the proposed project will reduce travel time and offer convenient transportation options.
- Reduction in Accidents: 9.63% of respondents believe the upcoming project will decrease road accidents.
- Sense of Safety and Security: 14.81% of respondents believe this mode of transportation will enhance safety and security for users.

The perceived positive impacts listed below and presented in **Table 5-44**.

Table 5-44 Perception of HH – Positive impacts due to the project

S. No.	Positive Impacts	Nos.	%
1	Generation of Employment Opportunities	11	8.15
2	Development of the City	14	10.37
3	Traffic Reduction	33	24.44
4	Reduction in Travel Time and a convenient mode	44	32.59
5	Reduction in Accidents	13	9.63
6	Safety and Security	20	14.81
Total		135	100

Perceived Negative Impacts

Any development project will also have some negative impacts. It's essential to mitigate negative impacts through planning, stakeholder engagement, and environmental and social management plans. Continuous monitoring and evaluation ensure benefits are maximised and adverse effects minimised, adapting strategies as needed. The perceived negative impacts listed below and presented in **Table 5-45**.

- Loss of Land: 20% of respondents expressed concerns regarding land loss due to the project, which can disrupt livelihoods, causing displacement and property rights loss.
- Loss of Structures: 26.67% of respondents are worried about possible structure loss due to the project.
- Loss of Livelihood: 40.00% of respondents foresee livelihood loss from the project.
- Pollution and Traffic Jams: 13.33% of respondents are concerned about pollution and traffic congestion during the project's construction phase.

Table 5-45 Perception of HH – Negative Impacts due to Project

S. No.	Negative Impacts	Nos.	%
1	Loss of Land	3	20.00

S. No.	Negative Impacts	Nos.	%
2	Loss of Structures	4	26.67
3	Loss of Livelihood	6	40.00
4	Pollution during construction	1	6.67
5	Traffic jams during construction	1	6.67
Total		15	100

Participation

Out of 154 samples, 23.38% expressed their willingness to work during the construction phase of the project, and the rest 85.71 percent were unwilling to work. The details of willingness to work are presented in **Table 5-46**.

Table 5-46 Willingness to Work

S. No.	Willingness to Work	Nos.	%
1	Willing to Work	36	23.38
2	No	118	76.62
Total		154	100

Suggestions

Respondents' suggestions for mitigating negative project impacts are vital for addressing people's concerns and optimising project benefits while minimising adverse effects. Here's a summary of the suggestions provided by respondents:

- Location of Staircase: 5.19% of respondents think staircases at metro stations should be placed carefully to ensure smooth accessibility and minimise disruptions to local businesses.
- Provision of Employment: 9.09% of respondents suggested for employing affected families.
- Proper Compensation for Affected Structures and Households: 9.09% of respondents emphasised giving fair compensation for affected properties.
- Provision of Shops for Businesses and Livelihoods: 34.42% of respondents emphasised the need to provide shops and jobs to those affected by the project.
- Affordable Ticket Prices and Free Metro Cards: 5.19% of respondents suggested reducing ticket prices for all commuters and providing free metro cards to Below Poverty Line (BPL) cardholders.
- No Suggestions Provided: 37.01% of respondents did not provide any specific suggestions to mitigate the project's negative impacts.

The details of suggestions for better implementation are presented in the **Table 5-47**.

Table 5-47 Suggestions for Better Implementation

S. No.	Suggestions for Better Implementation	Nos.	%
1	Consideration of the location of the staircase to avoid obstruction	8	5.19
2	Provision of employment to the affected households	14	9.09
3	Provision of Proper Compensation	14	9.09
4	Provision of a Shop for Business and Livelihood	53	34.42
5	Ticket cost should be cheaper/ free metro card for BPL Card holders	8	5.19
6	Did not suggest	57	37.01
Total		154	100

5.13.1.16 Gender Norms and Issues in Haryana

The Society in Haryana is traditionally a Patriarchal society with the majority of women involved in household work.

- Gender Norms and Attitudes in the Society of Haryana State:
 - a. Restrictions on women's mobility and employment opportunities.
 - b. Limited participation in decision-making, especially in mobility, career and marriage.
 - c. Female foeticide due to son preference
 - d. Sex ratio is 879 per 1000 males, child sex ratio 834 females per 1000 males.
 - e. Female literacy rate is 65.94, male literacy rate is 84.06
 - f. High school dropout and early marriage.
- Underreporting of GBV is common (NCRB/NFHS) due to:
 - a. Social stigma
 - b. Fear of retaliation
 - c. Institutional distrust
- Public space harassment is often normalised, particularly in:
 - a. Crowded and limited transport modes.
 - b. Poorly lit or unregulated/ secluded areas.
 - c. Absence and limited access to public transport at late hours.

GBV cases reported in Gurugram district from 2022 include rape, sexual harassment and domestic violence. The police record shows an increasing trend over these years. In 2022, Gurugram Police recorded 302 cases. This number slightly dropped to around 280 cases in 2023 but then rose significantly to 355 cases by November 2024. This rise in 2024 suggests that more people are becoming aware of these crimes and are reporting them, or that such crimes are becoming more common in the area. The following groups are identified as more vulnerable to GBV/SEA/SH risks:

- a. Female-headed households with limited support systems.
- b. Women from SC communities residing in informal settlements.
- c. Migrant women workers (e.g. domestic workers, housekeeping staff, construction labour) with limited access to formal grievance systems.
- d. Adolescent girls and young women commuting in public/private transport for education/employment
- e. Women in informal sector employment such as street vendors and service workers.
- f. PwDs, particularly women with mobility or sensory limitations.
- g. Low-income households dependent on shared or informal transport modes.
- h. NCRB 2023 of the State of Haryana data further highlights child and youth vulnerability: 18 cases of kidnapping and abduction of women over 18 years; 41 for girls under 18 years and 25 child sexual assault cases.

5.13.1.17 Prevalence of Child Labour

The data indicates that the number of registered child labour cases in Gurugram district has remained relatively steady over recent years, with 12 cases in 2021, 15 in 2022, 12 in 2023 and 10 cases till November 2024.

Child labour is mostly employed in informal sectors such as roadside eateries, domestic work, construction, small retail shops, workshops, hotels and auto repair garages. In 2023, Haryana Police under 'Operation Smile' rescued and rehabilitated 1,308 missing children, including child beggars and labourers, with Gurugram being among the leading districts in child rescues, and reunited 27 children and 20 adults with their families.

Chapter 6: Stakeholder Consultations

6.1 Objectives of Public Consultation

The objectives of the stakeholder consultations for the project and the ESIA study are as follows:

- **Inform and Disclose the Proposed Project:** It aims to ensure transparency and clarity by informing stakeholders, including affected communities and local authorities, about the proposed project's details, objectives, scope, and potential impacts.
- **Assess Stakeholder Interest and Involvement:** It assesses stakeholder interest, involvement, concerns, priorities, and expectations regarding the project, informing decision-making by understanding diverse perspectives and needs.
- **Enable Stakeholders to Provide Views and Options:** Stakeholders are provided a platform to express their views, concerns, and preferences about the project, and are encouraged to offer feedback and suggestions to improve project design, implementation, and mitigation measures.
- **Disclose Environmental and Social Risks and Impacts:** It ensures stakeholders receive timely, clear, and accessible information about environmental and social risks associated with the project, promoting informed decision-making and transparency.
- **Provide Effective and Inclusive Engagement:** It ensures active and inclusive engagement with project-affected parties, involving them in discussions and decision-making to effectively address their perspectives and concerns.

Overall, the objectives of the public consultations for the project and ESIA aim to foster meaningful stakeholder engagement, transparency, and accountability. This contributes to sustainable and responsible project development, respecting the interests and rights of all stakeholders involved.

6.2 Consultations during the field work of ESIA

As part of the ESIA Study, stakeholder consultations (about 30% of PAF) were carried out from December 2023 to October 2024 during the field visits. These involved both formal and informal interviews and consultations with likely affected people and interested groups at the project level. The objective was to disseminate project information and ascertain stakeholders' views on probable environmental and social (E&S) risks associated with the GMRP. Based on the suggestions received, mitigation plans to avoid or minimise the impacts of the project are proposed in the report.

Consultations have been carried out with various stakeholders, including affected residents, vulnerable groups, shop owners, police officials, women as metro and transport users (at existing metro stations and bus stops), Auto drivers (both formal and informal), etc. A total of 194 persons (127 male and 67 female) participated in the consultation, including 69 PAPs (63 male and 6 female), vulnerable groups, 63 other interested parties, 13 police officials (1 male and 12 female), and 49 women as transport users. At the depot location, consultation was carried out with the president and other members of the Marble Market Association.

The stakeholder categories and No. of Participants in consultations are given in **Table 6-1**. Detailed information on stakeholder consultations and interviews is provided in **Table 6-2**, while issues are raised, discussed, and mitigation measures are provided in **Table 6-3**. The detailed summaries of the consultations and interviews are provided in **Annexure 6.1**, and the pictures of these consultations are presented in **Annexure 6.2**.

Biodiversity Assessment consultant shall conduct consultations with key stakeholders and other interested groups, including NGO, as part of preparing the BMP. The ESMP shall be updated accordingly based on the findings of the biodiversity assessment.

Table 6-1 Stakeholder Categories and No. of Participants

S. No.	Type of Stakeholder		Male	Female	Total	%
1	PAPs		55	3	58	29.90
2	Project Affected Vulnerable Groups	Elderly	3	1	4	2.06
3		Banjaras	5	2	7	3.61
4	Other Interested Groups	General Public	19	-	19	9.79
5		RWA Members	7	-	7	3.61
6		Street & Fruit Vendors	16	-	16	8.25
7		Auto Drivers	13	-	13	6.70
8		E-Rickshaw	5	-	5	2.58
9		NGO	3	-	3	1.55
10		Police Officials	1	12	13	6.70
11		Women as Transport Users	-	49	49	25.26
Total			127	67	194	100

Table 6-2 Details of Stakeholder Consultations and Interviews

S. No.	Date	Location	Type of Stakeholder	Male	Female	Total
Consultations and discussions with Affected Persons, including Vulnerable Groups						
1	21.12.2023	Sector 4, Gurugram	Affected Vulnerable Group (Elderly)	3	1	4
2	21.12.2023	Sector 4 & 5	Affected Persons (Fruit Vendors)	8	-	8
3	22.12.2023	Rezangla Chowk	Affected Vulnerable Group (Banjaras)	5	2	7
4	29.12.2023	Ashok Vihar	Affected Persons (including Vulnerable Group: Elderly and WHH)	9	1	10
5	08.01.2024	RITES Office, Gurugram	Affected Persons	4	-	4
6	10.01.2024	Ashok Vihar	Affected Persons	17	2	19
7	25.01.2024	Rao Gajraj Singh Chowk	Affected Persons	5	-	5
8	29.01.2024	Rao Gajraj Singh Chowk	Affected Persons	5	-	5
9	30.01.2024	Rao Gajraj Singh Chowk	Affected Persons	3	-	3
10	05.02.2024	Sector 33, Depot	Affected Persons	4	-	4

S. No.	Date	Location	Type of Stakeholder	Male	Female	Total
Consultations and Discussions with Other Interested Groups						
1	21.12.2023	Sector 10A	RWA Members	7	-	7
2	21.12.2023	Sector 10	Fruit Vendors	8	-	8
3	21.12.2023	ESIC Hospital, Sector 7	Auto Drivers	8	-	8
4	21.12.2023	Sector 7	General Public	5	-	5
5	21.12.2023	Sector 48	Street Vendors	8	-	8
6	27.12.2023	RITES Office, Gurugram	General Public	4	-	4
7	25.01.2024	Jwala Mill, Phase 4	E-rickshaw Driver	5	-	5
8	25.01.2024	Rao Gajraj Singh Chowk	General Public	6	-	6
9	29.01.2024	Udyog Vihar Phase 4	General Public	4	-	4
10	30.01.2024	Palam Vihar Mor	Auto Drivers	5	-	5
11	15.10.2024	KBA/IBA in Sector 101, Basai	NGO	3	-	3
GBV Consultation and Discussions with Police Officials						
1	21.12.2023	Palam Vihar	Police Officials	-	5	5
2	22.12.2023	Sector 51	Police Officials	-	5	5
3	29.12.2023	Palam Vihar	Police Officials	-	2	2
4	29.12.2023	Jhadsa, Sector 39	Police Officials	1	-	1
GBV Consultation and Discussions with Women as Transport Users						
5	29.12.2023	Gurugram	Women as Transport Users	-	49	49

Women participants reported encountering physical threats and eve-teasing while using various forms of public transport, including buses, autos, and shared autos, as well as during their travels on the metro. Despite these challenges, they indicated that metro travel is currently the safest transportation option. They highlighted safety features such as police presence, CCTV surveillance, dedicated women's coaches, and clearly visible helpline numbers as key factors contributing to their sense of security.

6.3 Issues raised and discussed during Consultation

The issues raised & discussed, and mitigation measures during consultations are presented in **Table 6-3** and details are given in the Stakeholder Engagement Plan (SEP).

Table 6-3 Issues Raised & Discussed and Mitigation Measures

Stakeholder Groups	Issues Raised and Discussed	Responses Provided
Project Affected Persons	a. Requested to review the alignment and station plan to avoid impact on their structure. b. Requested to share the timelines of construction and land acquisition.	The Detailed Design Team will review the alignment, and if possible, the alignment shall be modified. The findings will be communicated to the participants.

Stakeholder Groups	Issues Raised and Discussed	Responses Provided
	c. Requested to share how their loss will be compensated and what will happen to the remaining land. d. Suggested that the station entry and exit need to be reconsidered and proposed along the station extension rather than on the left and right sides of the station. e. The locations where ramp/stairs for entry & exit points is proposed to be constructed may be expected to block the roads, which are the only entry-exit points for residents residing in said lane. f. Proposed metro facilities shall close front of the shops, which shall be covered by the wall of the metro project. It will lead to huge financial losses for shopkeepers and may also lead them to vagrancy. g. Fruit Vendors have concerns that the metro project would have negative impacts in terms of loss of income and customers during the construction period. h. Suggested that traffic management is very necessary during construction as the area is very congested. i. Marble merchants in Sector 33 (Depot location) filed a petition alleging that the authority (HSVP, earlier known as HUDA) has not adopted fair and appropriate criteria/methods for the newly allotted site. The marble market area falls in the proposed depot location got stay order by the Hon'ble Court for the operations of the Marble Market. They have stated that they will not participate in the census and socio-economic survey until the Hon'ble Court orders them to vacate the location.	• The construction work will likely start at the end of 2024. • The land shall be acquired through Mutual Negotiation; in case of failure in negotiation, it shall be acquired through the RFCTLARR Act, 2013¹¹. • They were informed that the remaining land will be acquired by GMRL if the remaining land is unviable. • Compensation will be paid as per the RFCTLARR Act, 2013, for their losses. • The participants were informed that the entry/exit will not be blocked during construction. • The participants were informed that traffic during construction will be managed with the support of the traffic police. • The marble merchants were informed that the census and socio-economic survey will be conducted after the Hon'ble Court issues its verdict on the matter.
Other Interested Groups	a. Proper and designated space for autos and e-rickshaws to avoid chaos at metro stations. b. Street vendors near the metro station would increase the chances of traffic jams.	• The participants were informed that the issue will be discussed with GMRL and based on the applicability it shall be incorporated into the design.

¹¹Private land will be purchased in accordance with the GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations.

Stakeholder Groups	Issues Raised and Discussed	Responses Provided
	c. A parking space would be beneficial for metro users. d. Provisions for dust pollution reduction and management of service lanes during the construction phase. e. Seasonal street vendors will not have any impact due to the proposed project. f. Auto, e-rickshaw, taxi, and feeder services would be beneficial for metro users for last-mile connectivity. g. Traffic management plan for temporary interruptions to vehicular and pedestrian traffic to avoid jams. h. The project will have negative impacts in terms of loss of income as road traffic is diverted to the metro. i. Auto fare would be reduced during the construction phase. j. Requested to pay compensation if their shops are closed or affected during the construction phase of the metro. k. Provisions for CCTV at major GBV hotspots. l. Provisions for cameras at stations and nearby locations should be proposed. m. Screening of GBV-related major crimes and their punishment to be displayed at the metro stations to make commuters aware. n. Only those auto and taxi drivers shall be allowed at metro stations whose police verification is being done regularly. o. Suggested photographs of those auto and taxi drivers with criminal records should be displayed at metro stations. p. Concerned police stations should be consulted at the time of construction to identify grey areas and hotspots for regular police patrolling and CCTV installation.	• The compensation will be paid as per the RFCTLARR Act, 2013¹². • Participants were informed that first aid kits are already incorporated in the design, and their concerns of dedicated auto and taxi parking will be discussed with the GMRL and Detailed Design Team.

¹²The Entitlement Matrix (EM) has been developed in accordance with the RFCTLARR Act and ESS5. The Entitlement Matric outlines the provisions to address impacts occurring during the construction phase and compensated accordingly

Stakeholder Groups	Issues Raised and Discussed	Responses Provided
	q. Separate and dedicated space for autos and taxis. r. Police booth with a residential facility at the station location for 24x7 police officials' deployment. s. Provisions for the deployment of police officials, both men and women, at the entry or exit of metro stations to restrict bad elements at and near metro premises. t. Metro premises must have Sanitary Pad Vending Machines, Transparent Elevators, Gender Neutral Toilets, Dedicated Women Coaches and Apps for Online Complaints. u. Emergence helpline numbers must be displayed at and near metro premises and require immediate response from them. v. Provisions for Platform Screen Door (PSD) to prevent accidents, objects falling on track, and trespassing	
Vulnerable and Disadvantage Group (including Elderly People, Banjaras, etc.)	a. Requested to share the timelines of construction and land acquisition. b. Requested to share how their loss will be compensated and what will happen to the remaining land. c. Vendors have concerns that the metro project would have negative impacts in terms of loss of income and customers during the construction period. d. They do not want compensation in monetary form; instead, a license from a local body is to be provided to all affected vendors against their losses. e. Requested to avoid the impact, and if their structures get affected, compensation shall be paid or provide space nearby.	• The construction work will likely start at the end of 2024. • The land shall be acquired through Mutual Negotiation; in case of failure in negotiation, it shall be acquired through the RFCTLARR Act, 2013. • They were informed that the remaining land will be acquired by GMRL if the remaining land is unviable. • Compensation will be paid as per the RFCTLARR Act, 2013, for their losses.

6.4 Consultations and Disclosures

The draft ESIA study report shall be made available to stakeholders. Executive summaries of the ESIA and other E&S documents shall also be translated into Hindi and disclosed on the GMRL website for feedback and comments. Stakeholders' feedback will be incorporated into the SEP and LMP, and ESIA and RAP as appropriate. The revised reports will be disclosed in accordance with the WB's disclosure requirements on the GMRL website and the Bank's external website.

Chapter 7: Assessment of Environmental and Social Risks and Impacts

7.1 Impact Assessment Methodology

E&S risks and impacts can be positive or negative, direct or indirect, and may occur at the local, regional, or global scale. These impacts may be reversible or irreversible. This chapter focuses on the potential negative risks and impacts arising from the GMRP activities. The assessment is based on the Project Description (Chapter 3) and the E&S Baseline Data (Chapter 5).

7.2 ESS 1: Assessment and Management of E&S Risks and Impacts

The E&S risks and impacts of the project, in accordance with ESS1, are set out in the following section.

7.2.1 Change of Land Use

The development of the GMRP requires land acquisition for station buildings, platform structures, a depot, office complexes, and other associated facilities. Government land will be transferred, and private land will be acquired for the project. The required land is located in existing commercial areas or along road verges characterised by mixed land use. Land acquisition will be limited to small parcels, and hence large-scale land conversion is not anticipated along the alignment.

The spur line passes through an open space designated 'Public Utilities' under the Gurugram Master Plan 2031, after crossing the railway track in Sector 101. This land is currently used by villagers for agricultural activities. With proper planning, there will be no access restrictions for the local community during both the construction and operation phases of GMRP. The alignment runs near residential and sensitive areas, including forests, temples, and waterbodies, which will be reclassified as 'Transport and Communication' land use. The design shall ensure uninterrupted pedestrian movement by providing footpaths and parking spaces.

The depot is planned for an area of 19.23 ha. According to the Department of Town and Country Planning, Haryana's Master Plan 2031, the existing land use of the proposed depot site is categorised as commercial and open space. The development of the depot will result in the permanent conversion of the current land use.

7.2.2 Utilities

Numerous utility services, including sewer lines, water mains, electrical lines, telecom cables, gas supply pipelines, traffic signal systems, and other infrastructure, run along the GMRP alignment. The construction of the Spur Line from Basai Village to Dwarka Expressway (Sector 101) is expected to restrict the use of the area designated as 'Public Utilities' in the Sector, as per the Gurugram Master Plan 2031. Shifting, maintenance, and potential impacts on construction activities must be addressed through well-planned temporary or permanent diversions. Proactive planning and timely action will be required to manage these challenges.

effectively. The organisations and departments responsible for the relevant utility services are listed in Table 7-1.

Table 7-1 Organizations Responsible for Utilities and Services

S. No.	Organization/ Department	Utility/Services ¹³
1.	Gurugram Municipal Corporation	Sewerage and drainage lines. Water mains and their service lines, including hydrants and fountains, water treatment plants, pumping stations, roads, surface water drains, nallahs, sewer lines, streetlights, high mast lights, etc.
2.	Public Works Department	Roads, foot over bridges, large surface water drains, nallahs, etc.
3.	National Highway Authority of India (NHAI)	Roads
4.	Haryana Vidyut Prasaran Nigam Limited and Dakshin Haryana Bijli Vitran Nigam Limited	Substations, power cables and their appurtenances, pole-mounted transformers, and high-tension line
5.	Bharat Sanchar Nigam Limited (BSNL), Vodafone, Bharti Airtel, Reliance Jio, Cable TV operators, etc.	Telecommunication cables, junction boxes, telephone posts, overhead lines, etc.
6.	Office of the Commissioner of Police, Gurugram	Traffic signal posts, junctions, and cable connections, etc.
7.	Haryana City Gas Distribution Ltd.	Gas Pipelines

Mitigation Measures

The following measures are recommended to ensure effective planning and execution of utility service diversions:

- **Uninterrupted Services:** Utility services must remain operational throughout the construction phase and after project completion to ensure continuous service.
- **Coordination and Timing:** The contractor shall coordinate closely with the relevant utility providers to schedule utility-shifting activities, preferably during dry weather, to minimise disruption. The utility providers shall also ensure that appropriate alternative arrangements are in place and that the public is adequately informed through timely communication and awareness initiatives.
- **Minimal Disruption:** Elevated viaduct construction generally results in minimal disruption to existing utilities. Where utilities are located within or near pier locations, they shall be diverted away from the pile cap zones to avoid conflict with construction activities.

¹³There may be additional utilities not listed in the table above. The contractor should coordinate with the relevant utility providers to plan and execute the utility shifting accordingly.

- **Design Flexibility:** When major utilities cannot be readily relocated, the viaduct alignment and pile foundation layout shall be adjusted to avoid such crossings. Alternatively, utilities may be safely encased within the pile foundations, if technically feasible.
- **Risks of Service Disruptions:** There is a possibility of disruptions to utility services, such as water supply, electricity, telephone, and internet, during construction.
- **Minimise Interruptions:** Disruptions should be minimised through careful planning, scheduling activities, and effective coordination among relevant departments. The implementation of temporary access roads and traffic diversion plans will also be necessary.
- **Stakeholder Engagement:** Continuous stakeholder engagement and transparent disclosure of information on utility shifting must be maintained to ensure constructive relationships throughout the project implementation.
- **Work Scheduling and Communication:** The construction schedule shall be shared in advance with line departments (such as water supply, electricity, road & transport, etc.) to enable them to prepare for any necessary adjustments and ensure service continuity.
- **Regulatory Compliance:** The contractor must comply with the terms and conditions specified by the respective utility authorities for all utility shifting activities.
- **Sewage Management and Safety:** During the relocation of sewage lines and manholes, appropriate precautions must be taken to address potential hazards, including gas accumulation and burst risks. Manual entry into manholes is strictly prohibited; all sewage-related work must be carried out using mechanical equipment to ensure worker safety.

7.2.3 Traffic Diversion/ Management

During the construction period, partial or complete traffic diversions will be required, as most construction activities will take place along the road median. Additionally, the proposed entry and exit points of the metro stations may conflict with both pedestrian and vehicular traffic.

Mitigation Measures:

Any reduction in road space during metro construction is likely to constrain traffic flow. To address this, the DDC team shall incorporate footpath widening and provide designated bays for the safe pick-up and drop-off of metro passengers in the design. To maintain acceptable traffic flow during construction, appropriate traffic management and engineering interventions need to be implemented. These may include road widening, traffic segregation, one-way traffic arrangements, diversions to adjacent roads, use of service lanes, etc. Various construction methodologies shall be adopted to minimise traffic disruptions and ensure efficient vehicular movement.

The implementation of traffic management and diversion plans will be essential to ensure smooth and safe traffic operations throughout the construction period. The DDC shall propose appropriate conceptual traffic diversion plans for construction zones, prioritising the safety of both construction workers and road users.

Traffic Management Guidelines: The primary objective of the following guidelines is to set out procedures for the contractor to adopt to ensure the safe and efficient movement of traffic and the safety of workers at construction sites.

- A Traffic Management Plan shall be prepared, incorporating safety measures with particular attention to sensitive areas such as schools, hospitals, and residential areas. The plan must be developed in consultation with the traffic police, municipal authorities, and other relevant stakeholders.
- High-visibility jackets with reflective tape shall be provided to all construction workers. Enhanced visibility is essential to protect workers from high-speed vehicular traffic, particularly at night or in low-visibility conditions.
- The safety of road users in the affected areas shall be prioritised.
- Traffic diversion plans must be clearly communicated to road users.
- Safe, clearly marked lanes and diversion routes shall be provided, along with well-lit signage positioned ahead of diversion points to guide road users.
- Provide safe, clearly marked, and barricaded buffer zones (with lighting and reflectors) and work zones.
- Provide adequate measures to control driver behaviour in and around construction zones.
- Within work zones, primary traffic control devices shall be deployed to maintain order and safety. These include signage, delineators, hard barricades, cones, pylons, pavement markings, flashing lights, reflectors, and adequate day and night lighting. Large information boards shall be installed at least 200 m before the work zone on both sides to alert and guide approaching drivers.
- The contractor shall ensure that all pits and excavations within the work zone are promptly backfilled and closed upon completion of work. Where temporary closures are required, barricades should be robust, equipped with reflective tape and proper lighting, and designed to remain upright to prevent hazards to vehicles and pedestrians.
- Traffic marshals shall be deployed as required by the traffic police department to manage movement and ensure public safety.
- A qualified traffic consultant shall be engaged by the contractor to conduct a traffic survey, suggest alternative routes, and support the development of an effective traffic management strategy. A traffic safety audit shall be conducted periodically, including an assessment of city traffic. Corrective measures identified during the audit shall be implemented within defined timeframes.
- Where applicable, utility shifting activities shall be integrated into the TMP.

7.2.4 Associated Facilities

The associated facilities identified for the GMRP are discussed in **Section 3.4**. This section provides an overview of the potential impacts of these facilities and presents the corresponding mitigation measures, as detailed in **Table 7-2**.

Table 7-2 Associated Facilities – Potential Impacts and Proposed Mitigation Measures

Impacts	Mitigation Measures
• Land Acquisition and R&R issues if any • Impact on sensitive receptors. • Accidents due to improper signages. • Emissions from various construction activity • Loss of avenue trees. • Impact on utilities and common property resources. • Impact on natural drainage pattern. • Health impact on workers. • Impacts due to un-scientific dumping of demolition and construction waste. Disruption to public services due to utility shifting. • Risk of damage to infrastructure	• R&R compensation as per the RFCTLARR Act 2013 and other acts. • Noise barriers should be provided at sensitive receptors if unavoidable. • Road infrastructure shall be provided to avoid accidents. • Plantation of native species. • Suitable scientific measures, such as water sprinkling and regular vehicle maintenance, will be adopted to minimise emissions during construction activities. • Compensatory plantation for tree felling. • All utility services should be kept operational during the construction and operational phases. • The flow of natural drainage should not be affected, and proper cross-drainage structures should be constructed. • Health and safety of workers and communities should be ensured. • Waste generated from construction sites will be disposed of at pre-identified landfill sites. • Mitigation measures as presented in the EHS manual should be implemented. • Detailed utility mapping to develop a comprehensive utility relocation plan. • Preference for trenchless technology to shift underground utilities without extensive digging, reducing the need for road cuts (with OHS/CHS plans). No manual scavenging or related activities (such as cleaning manholes during shifting). • Management of all types of solid and liquid waste or effluents during drain works • Plan for Disposal of spoils, sludges during utility shifting or drain reconstruction • Implement TMP in coordination with Traffic Police & Department of Roads. • Critical controls for high energy hazards in place during construction and operations phase. • Impacts on open areas & public activity areas • Detailed utility mapping and preference for trenchless technology to shift underground utilities with minimal disruption.

All such future facility-related activities will be screened, and their E&S risks and impacts will be assessed in accordance with the WB's ESF principles. GMRL will update the ESIA at a later stage to incorporate the findings of these assessments.

Mitigation Measures:

Any reduction in road space during metro construction is likely to constrain traffic flow. To address this, the DDC team shall incorporate footpath widening and provide designated bays

for the safe pick-up and drop-off of metro passengers in the design. To maintain acceptable traffic flow during construction, appropriate traffic management and engineering interventions need to be implemented. These may include road widening, traffic segregation, one-way traffic arrangements, diversions to adjacent roads, use of service lanes, etc. Various construction methodologies shall be adopted to minimise traffic disruptions and ensure efficient vehicular movement.

7.2.5 Defence Ammunition Depot

In Sector 17, Gurugram, a defence ammunition depot is situated as shown in

Figure 7-1. From the project alignment Ch. 16400 to Ch. 22300; the defence ammunition depot is located at a distance of 820–900 meters. A background study was conducted about restriction on power supply and construction around the defence ammunition depot.

According to the available related codes, such as the International Ammunition Technical Guidelines (IATG 05.40 - Safety standards for electrical installations, 2021), “The distance between an explosive building and an overhead power line operating at 11KV or above should be the public traffic route distance, subject to a minimum of 60m”.

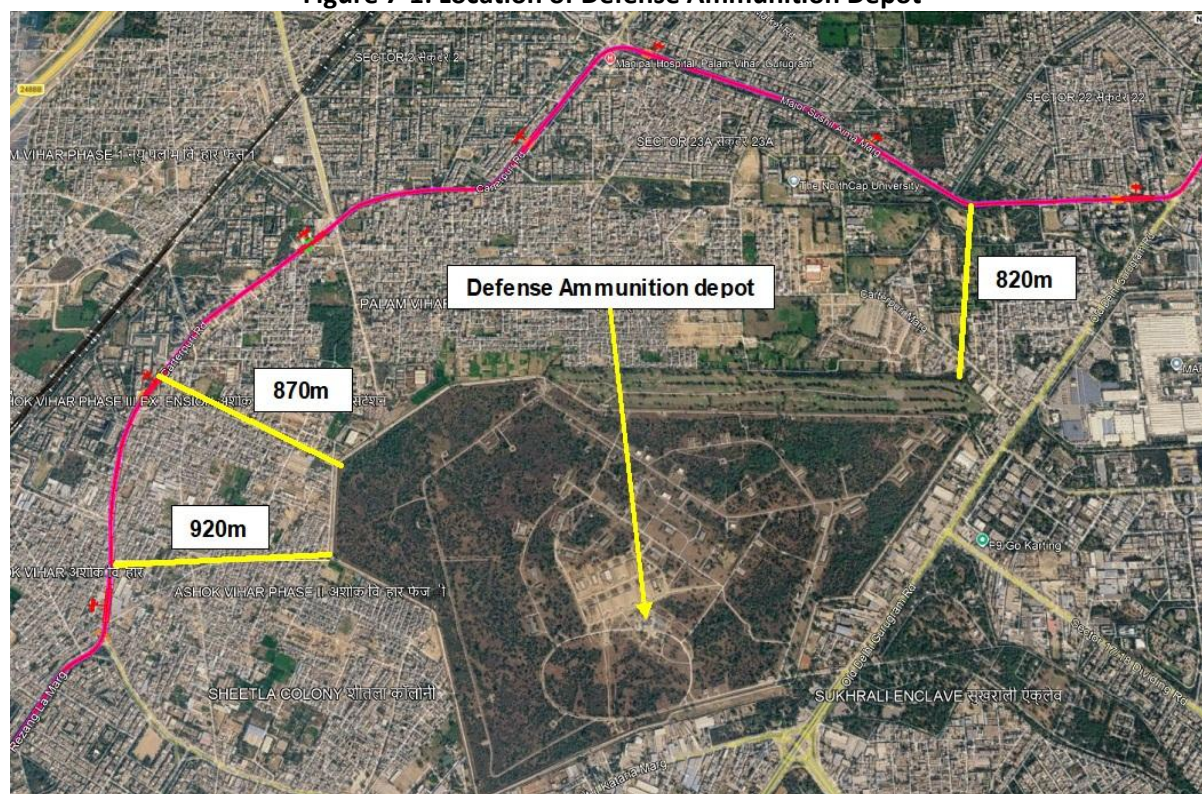
As per Clause 29 of the Ministry of Defence R&D Organisation STEC pamphlet - 7 Safety for Electrical installations and apparatus for buildings and areas containing military explosives, 2025, the distance between an explosives’ building and a public supply overhead power line operating at 3.3 kV or above should be the public traffic route distance, subject to a minimum of 60 metres.

In GMRP, the metro operations utilise a design voltage of 750 V, well below the limits set by the two standards above. In addition, there is no overhead electrification system in GMRP. In the elevated sections, power is transmitted via a third rail laid adjacent to the tracks within the viaduct, eliminating risks associated with overhead power supply restrictions.

Major electrical transmission requirements for the GMRP will be at the Metro Depot (5.29 km), TSS (5.4 km), and GSS (6.70 km) from the Defence Ammunition Depot. At stations, the power supply is delivered via 33 kV cables mounted on viaduct brackets and fed to the stations through dry-type transformers, which are placed inside a room in the Station Building. Moreover, in this connection, a meeting was held with the Sub-Divisional Officer (SDO), DHBVN, on 05.05.2026, and it was informed that the restriction concerns providing new electrical connections near the Ammunition Depot within the restricted 900 m zone. The GMRL team informed that the metro project shall receive electrical power supply through GSS and TSS, and therefore no new electrical connection would be required within the restricted 900 m zone. Further, all electrical installations required for the GMRP need

authorisation by the Electrical Inspector of Government (EIG) prior to commissioning, and this authorisation shall be obtained for all electrical installations before energisation.

Figure 7-1: Location of Defense Ammunition Depot



In view of the above, there will be no impact on the power supply to GMRP within the restricted 900 m zone of the Ammunition Depot.

7.2.6 Establishment of Casting Yard

The land for the Casting Yard is provided to the project on a temporary basis to facilitate construction. Establishing casting yards is a critical activity for fabricating precast structural elements such as U-girders, pier caps, and other components required for elevated corridor construction. These facilities are typically set up at strategically selected locations along or near the project alignment to optimise logistics, reduce transport time, and ensure continuity of construction activities. For the AC01 Project, the Casting Yard is established at Hero-Honda Chowk, Sector 33, Gurugram. For AC03, the Casting Yard location is under finalisation.

The casting yard will include the installation of a concrete batching plant, which will be the primary source of ready-mix concrete. The batching plant will include material storage areas

(cement silos, aggregate stockpiles), mixing units, water supply systems, and quality control laboratories.

The casting yard will also include a plant and machinery workshop to support the maintenance and repair of construction equipment, including cranes, gantry systems, batching plant machinery, and transport vehicles. This workshop is essential for minimising downtime and ensuring uninterrupted production cycles.

Additional infrastructure within the casting yard typically includes:

- Storage areas for raw materials and finished precast components
- Internal roads and circulation paths for heavy vehicles and trailers
- Handling systems, including gantry cranes and lifting equipment
- Administrative and labour facilities, including site offices, worker accommodation, sanitation, and safety provisions

From an E&S perspective, the establishment of casting yards may lead to temporary land-use change, increased traffic, noise generation, and localised air pollution. These impacts are generally site-specific and can be mitigated through proper planning, including selecting sites away from sensitive receptors, implementing pollution control measures, and adhering to occupational health and safety standards.

Overall, the casting yard serves as a centralised production hub, enabling efficient, standardised, and large-scale fabrication of structural components required for timely project execution.

The casting yard shall be established with the employer's prior approval, and the following measures shall be taken to mitigate risks and impacts:

- Barricading with tall hard-sheet to control noise and air emissions
- Vehicle movement areas are paved with concrete/GSB and watered regularly to suppress dust
- Wheel-washing facility at the site exit
- Vehicle maintenance carried out in a designated workshop with impervious flooring
- Store chemicals in a designated area with spill-prevention and control measures
- Batching plant operation after obtaining consent from the SPCB
- Dust-control measures at the batching plant and raw material storage
- Reuse and disposal of wastewater from the batching plant and transit mixers via a sedimentation tank
- Authorised vendors for disposal of construction-demolition waste and domestic solid waste
- The site shall be restored to its original condition or as agreed upon after demobilisation

- Permits/consents shall be obtained from Pollution Control Board & consent conditions and monitoring reporting requirements will be followed

7.2.7 Double-Deck Metro Structures

In urban areas, land is always scarce; therefore, a double-deck configuration for two transport modes is preferred to optimise land use. Under GMRP, a double-decker configuration is being explored where the alignment intersects with a flyover/underpass under planning by GMDA.

This eliminates the need for separate alignments for road and metro systems, resulting in a reduced physical footprint. This would lead to positive environmental and social outcomes, such as lower land requirements, fewer tree removals, and minimised displacement of people. Additionally, eliminating traffic junctions will facilitate smoother traffic flow and less congestion, ultimately improving fuel efficiency, reducing travel time, and lowering air and noise emissions. In addition, the double deck helps reduce ground-level traffic congestion, thereby lowering honking and overall ambient noise levels.

The construction and operation phase risks and impacts due to double decker structure possess mostly the similar risks associated with elevated structure of GMRP. The likely risks and impacts with mitigation measures are detailed in this chapter. Though due to increased height of double decker structure, size of pier, and ramps can cause the following additional risks and impacts during construction and operation phase.

Construction phase:

Risks & Impacts:

- Working at significant heights on upper deck
- Falling objects from upper working platforms
- Heavy lifting using cranes
- Construction of large sized piers and entry/exit ramps may reduce the carriageway width

Mitigation Measures

- Certified scaffolding, fall arrest systems, safety nets, work permits, rescue plans, height pass test for workers.
- Toe boards, debris nets, exclusion zones, tool lanyards, covered pedestrian pathways
- Lift plans, certified operators, exclusion zones, weather monitoring.

Operation phase impacts:

Few impacts are also anticipated, during the operation phase as described further. The larger vertical structure can appear visually bulky and may create a “tunnel effect”. It can also cause localized restriction of natural ventilation beneath the viaduct, which may contribute to

temporary accumulation of vehicular emissions under low-wind conditions. Train movement may generate structure-borne noise, rumbling, and reverberation beneath the deck. The larger piers may marginally influence road geometry, sight distance, and vehicle movement. There is also a low-probability risk of falling objects during maintenance activities. In the event of a train breakdown, passenger can get stranded over the viaduct.

Mitigation Measures:

- Apply architectural treatments, such as uniform colour schemes, streamlined forms, and façade elements, and appropriate lighting to reduce perceived bulk.
- Optimise pier placement by clustering supports and aligning them within existing road corridors to avoid unnecessary widening.
- Introduce landscaping and human-scale design elements, such as under-deck public spaces and cycle tracks, where safe and feasible.
- Shadowing and the tunnel effect shall be minimised through an optimised structural design, adequate spacing between structural elements, maintenance of open carriageway sides to facilitate natural light and ventilation.
- The vehicular emissions beneath the viaduct shall be minimised through the viaduct configuration, maintaining unobstructed airflow, and keeping both sides of the carriageway open.
- Structure-borne noise, rumbling, and reverberation will be mitigated through the adoption of continuously welded rails (eliminating rail joints), provision of elastomeric pads or equivalent resilient elements between the track and the U-girder, installation of resilient rail fastenings, adoption of ballastless track systems, installation of noise barriers at identified sensitive locations, and implementation of regular track and rolling stock maintenance.
- Impacts on vehicular movement on road shall be minimised by providing adequate carriageway widths, appropriate traffic signage and road markings, sufficient illumination, crash barriers where required, and well-maintained road medians to ensure safe and efficient traffic flow.
- The risk of falling objects will be minimised through the provision of crash barriers along the viaduct edges, the inherent containment offered by the U-girder configuration, and the use of safe maintenance platforms and appropriate maintenance practices.
- The risk of passengers becoming stranded on the viaduct will be addressed through comprehensive emergency preparedness and response measures.

Structural and Geotechnical Risks

Double-deck structures are subjected to complex loading conditions, including simultaneous metro and vehicular loads and thermal effects. These conditions increase demands on structural components such as piers, bearings, and foundations. Additionally, rail-structure interaction (RSI) can induce higher stresses, particularly in continuous deck systems.

Mitigation Measures:

- Consider the combined and dynamic effects of the load in the design. The rail, road and foundation designs shall be based on the applicable IRS CBC and IRC codes.
- Conduct detailed structural and dynamic analyses during the design stage, incorporating appropriate bearing systems and expansion joints.
- Adopt robust foundation solutions (e.g., pile or raft foundations) and phased construction methodologies.
- Maintain stringent quality control during construction, including monitoring of welding, concreting and prestressing activities.

7.3 ESS2: Labour and Working Conditions

GMRL will engage agencies or contractors for civil works, core functional support, material and equipment supply, and implementation support, in line with its procurement plan. Construction works will require a labour force and associated goods and services. A standalone LMP has been prepared to guide labour management throughout project implementation.

7.3.1 Types of Workers involved in the Project

Direct workers: Under the GMRP, direct workers are individuals employed directly by GMRL. These employees are responsible for overseeing the overall implementation of the project, including the supervision of construction activities carried out by contractors. The number of direct workers is expected to vary across the phases of the project, from preparation through to completion. The estimated number of direct workers is approximately 40.

Contracted Workers: As GMRL may not possess the full range of technical expertise required to manage the entire project independently, GMRL will require support from consultants in specific technical areas, including project management and coordination, financial management, procurement, construction, environmental and social expertise, and monitoring and evaluation. To implement various components of the project, GMRL will engage contractors, General Consultants (GC), Detailed Design Consultant (DDC), Independent Monitoring Consultants, and other relevant entities.

The estimated number of contracted workers will likely be 1310 (1200 construction labour/workers and consultants, 110 GC, DDC, audit, quality and safety audit, and independent monitoring consultants). The different categories of anticipated contracted workers are presented below.

- **Skilled permanent staff of contractors:** The contractor's permanent technical staff will be engaged in GMRP, including key personnel such as project managers, project

engineers, environmental engineers, construction foremen, medical officers, administrative officers, finance officers and other team members.

- **Skilled workers engaged by contractors:** A contractor may engage subcontractors for technical work, like heavy machine operations, if required.
- **Unskilled community members engaged by the contractor:** The project aims to maximise employment by engaging community members as unskilled workers. The contractor may prioritise host communities and vulnerable groups, including females and persons with disabilities, in close coordination with the GMRL.
- **GC, DDC, etc:** A GC (national or international organisation) will be engaged by GMRL to provide day-to-day construction oversight for civil works. The GC team will consist of both national and international experts, including specialists in Planning & Coordination, Structural Design, Quality Assurance, Quality Control, Construction Safety, Signal Train, Telecom, Traction and Power Supply, Track, Rolling Stock, Geospatial Technology, Quantity and Cost Estimation, Community Liaison /Public Relations, Environmental, Social, Environment, Health and Safety (EHS), etc. The procurement process for the consultant team will start during the project preparation phase, with the consultants expected to be on board in the early stages of project implementation. The GC will support GMRL throughout the implementation period, until the completion of civil works. Also, a DDC will be engaged to prepare the designs for elevated stations and viaduct superstructures.
- **Independent Monitoring Consultants:** An Independent Monitoring Consultant for E&S issues to ensure compliance with approved plans. They will be engaged at the start of implementation and will review all resettlement/ environmental activities for satisfactory completion.

Primary Supply Workers: The GMRL will procure essential goods, including metro cars and rolling stock for the development of the GMRP. These materials will be sourced directly from primary suppliers on an ongoing basis. Workers engaged by these suppliers are classified as "primary supply workers," as defined in ESS2. The estimated number of primary supply workers is 200.

Community workers: The project will not have community workers as defined under ESS2.

7.3.2 Expected Negative Risks and Impacts

Key Labour Risks:

The most significant OHS hazards associated with the construction of metro facilities occur during the construction phase and include activities with high risk for workers if not managed properly. These are applicable to workers/labours engaged in the implementation of the project. The risks associated with construction are provided below:

1. **Child Labour Risks:** Child labour shall be strictly prohibited at the construction site of the proposed project. To ensure adherence to this mandate, all workers will be required to provide legally recognised documents as proof of age, such as Aadhaar Card, Birth Certificate, Voter ID Card, or 10th Grade Marksheet/Certificate. Age regulations for project labour will be included in the contractor's bidding documents to monitor E&S compliance during project implementation.

2. **Risks due to Labour influx:** Migrant workers may be required for the construction activities, although a large influx is not anticipated due to local labour availability. Cultural differences can cause tensions between local and migrant workers at construction sites and camps. Furthermore, male migrant workers may pose risks of GBV and SH.
3. **Risks of Labour Disputes:** Labour disputes on metro construction sites may arise from various factors such as limited job opportunities, wage rates, delays in payment, working conditions, contractual issues, union activities, and health and safety concerns. Employers, including contractors and subcontractors, might retaliate against workers who seek improvements or voice grievances, potentially escalating into labour unrest.
4. **Discrimination and exclusion of vulnerable/disadvantaged groups:** Vulnerable and disadvantaged groups, such as women and persons with disabilities, may face higher risks of being excluded from job opportunities.
5. **GBV:** Construction workers, who are mostly males, often work far from home, isolated from their families and usual social controls. This situation can contribute to inappropriate and criminal behaviours such as SH of women and girls, exploitative or illicit sexual relationships, including with minors from the local community.
6. **Noise:** Construction activities are expected to produce noise levels in the range of 76-88 dB(A) at 15 m distance. Due to the high noise levels of some construction machinery, the personnel operating near the machines and the workers stationed close to the machines are prone to exposure to high levels of noise.
7. **Occupational Health and Safety Risks**
 - **Health Risks:** Health risks may rise from working in a polluted environment with high dust concentrations generated by construction activities such as site clearance, soil excavation, levelling, machine operation and material transportation.
 - **Collapse of nearby structures:** Excavation and demolition activities can damage the foundations of nearby existing structures, potentially leading to structural collapse and causing serious injuries to workers.
 - **Risks of Falling from High Levels:** Workers may fall from heights due to improperly installed scaffolding, unsecured ladders and unprotected steel bars during the construction of metro facilities, which may lead to labour accidents.
 - **Risks of Falling Objects:** Workers working below under construction metro facilities may be injured by hard objects including massive concrete structures falling from heights.
 - During metro operations, several risks may arise, including fire and explosion hazards, accidents, power substation failures, stampedes at platforms or station entry and /exit points.
 - **Risks due to Heavy Machinery:** The construction of metro facilities requires the use of heavy machinery; however, its movement poses a risk of injury to nearby workers if they are struck or hit.
 - **Risks due to Fatigue:** During both the construction and operational phases of the metro project, workers may be required to work irregular or extended hours, potentially leading to fatigue. Such fatigue can impair concentration, reduce alertness, and negatively affect performance in safety-critical tasks. This poses a significant safety risk not only to the workforce but also to the public.
 - **Risks due to Signalling, Telecommunication and Electrical Systems:** Installation, testing, operation and maintenance of signalling, telecommunication and electrical

systems may expose workers to electrical hazards such as electric shock, arc flash, electrocution and burns. Equipment malfunction or system failure may also disrupt train operations, increasing the risk of operational incidents. These hazards may pose significant health and safety risks to workers, passengers and the public if not properly managed.

- **Risks due to Maintenance of Rolling Stock:** These hazards include physical risks from moving equipment and machinery, chemical exposure to hazardous substances such as asbestos, PCBs, and VOCs, risks of fire or explosion during hot work, biological exposure from sewage systems, and confined space entry risks during the maintenance of tanks and compartments. These factors may pose significant health and safety risks to maintenance personnel if not properly managed.
- **Risks due to derails of metro trains:** Metro train derailments pose significant risks to both passengers and staff, including physical injuries and fatalities.
- **Risks due to birds:** Bird presence at metro lines and maintenance depots can lead to safety hazards, equipment damage, electrical issues, health hazards, and increased maintenance costs due to collisions, droppings, and nesting activities.
- **High Energy Hazards:**
 - a. **Risks of Fire and Explosion:** During construction, welding activities can generate sparks that may ignite nearby flammable materials, such as fuels and gases, leading to fires or explosions with potentially serious consequences for both workers and surrounding communities. During the operational stage, the risk of fires at stations and depot locations is also anticipated, which could impact employees, passengers and nearby communities.
 - b. **Electrical Hazards:** During construction, workers may be exposed to live electricity while testing TLs, substations or using electrical power for soldering, which can result in serious injuries or fatalities due to electric shock. During metro operation, electrical accidents may happen due to the following reasons:
 - Live mains: LT or HT,
 - Overhead power lines,
 - Parts which have become live due to leakage either because of low insulation resistance of the electrical windings, high earth resistance or discontinuity of the earthing leads.
 - Areas that develop a high potential gradient, such as near an earth electrode where fault currents flow, are insufficient to trip circuit breakers or blow fuses.

The impact associated with electricity includes electric shocks or burns, whether minor, major or fatal, affecting both metro personnel and others.
 - c. **Possible risks due to depot:** Depot operations involve various potential risks, such as handling heavy parts, the possibility of collisions, tripping or falling into maintenance pits, electrical hazards, and slipping on oily floors. Additionally, improper waste handling can lead to safety risks, environmental pollution, and operational inefficiencies.
 - d. **Risks due to storage of Gas/LPG:** During the construction period, workers may face significant risks of serious injury due to the storage of GAS/LPG cylinders, particularly from potential explosions caused by gas leaks or damage to cylinders.

- e. **Risks Associated with Iron Cutting and Soldering:** Workers engaged in cutting iron and soldering without proper personal protective equipment (PPE), such as face shields, hand protection, safety glasses, and high-top boots, may be at significant risk of serious injuries. The absence of high-top boots increases the risk of electric shock, while the lack of gloves can cause injuries to the wrists and forearms from heat, sparks, molten metal, and radiation.
- **Other Occupational Risks:**
 - Risks due to lack of full-height fences, barriers, or barricades around the construction site.
 - Obstructions caused by vehicles parked in no-parking zones.
 - Use of vehicles, machinery and other equipment without valid fitness certificates.
 - Safety issues, including injuries or fatalities, due to lack of PPE and inadequate safety measures.
 - Exposure to mental or physical harassment, including SEA/SH.
 - Health risks related to HIV/AIDS and other sexually transmitted diseases among labourers.
 - Risk of contamination during infectious disease outbreaks if proper and frequent hygiene practices are not maintained.

7.3.3 Management Strategies

1. **Child labour:** Minimum age for project workers is 18 years; no one under 18 years will be permitted. Contractors must adhere to these age requirements, with penalties for non-compliance. They must also maintain a labour registry that verifies workers' ages.
2. **Labour influx:** GMRL will require contractors to prioritise recruiting unskilled labour from local communities for basic tasks. All workers must sign and adhere to a code of conduct addressing the risk of GBV. Training will be organised with a focus on expected behaviour, local norms, and raising awareness about GBV/SH.
3. **Labour Disputes over Terms and Conditions of Employment:** To prevent labour disputes, fair terms and conditions will be enforced for all project workers. Grievance mechanisms will be established to promptly address workplace issues for both direct and contracted workers. Additionally, the project will respect workers' rights to join labour unions and freedom of association.
4. **Discrimination and Exclusion of vulnerable/disadvantaged Groups:** Employment under the project will uphold equal opportunity and fair treatment, without discrimination. Contractors are required to include vulnerable groups such as women, SC/ST groups, and persons with disabilities in their unskilled workforce. To mitigate the risk of these groups being excluded from job opportunities, the project will require the contractor to employ them as part of its workforce. Compliance with national legislation on gender equality, including provisions for maternity leave, nursing breaks, and separate toilet facilities for men and women, is mandatory.
5. **GBV:** Approximately 80-85% of contract workers are expected to be men, while women's participation is likely to be around 15-20% and will primarily involve unskilled and semi-skilled positions. Contractors will enforce the Code of Conduct (CoC) for all workers, subcontractors, and suppliers. CoC will include sanctions for non-compliance, including gender-based violence policies, etc. Contractor will ensure that the CoC is

written in plain language, understandable to local and migrant workers and signed by each worker to indicate that they have:

- Received a copy of the CoC as part of their contract.
- CoC has been explained to them as part of the induction process.
- Acknowledged that adherence to CoC is a mandatory condition of employment.
- Understood that violations of the CoC can result in serious consequences, up to and including dismissal or referral to legal authorities.

6. Noise: Use of personal protective equipment will help in reducing the noise impact on personnel. All construction activities will have to comply with the Noise Pollution (Regulation and Control) Rules, 2000, & amendments and the World Bank Environmental and Social Standards. This could be achieved by:

- Job rotation to the extent possible
- Automation
- Construction of permanent and temporary noise barriers, including greenery
- Re-route and regulate the traffic, a main source of noise.
- Use electric equipment instead of diesel-powered equipment
- Use hydraulic tools instead of pneumatic tools
- Acoustic enclosures should be provided for individual noise-generating construction equipment
- Scheduling of truck loading, unloading and hauling operations
- Proper operation and maintenance of the construction vehicles and equipment would keep them within the noise limit
- Schedule work to avoid simultaneous activities
- Anti-drumming floor and noise absorption material
- Low-speed compressor, blower and air conditioner
- Mounting of under-frame equipment on an anti-vibration pad

The workers employed in high noise level areas could be employed in low noise level areas and vice versa from time to time. Special acoustic enclosures should be provided for individual noise-generating equipment, wherever possible. Noise level from loading and unloading of construction materials can be reduced by using various types of cranes and placing materials on sand or sandy bag beds.

7. OHS: The construction activities have their own challenges and contribute significantly to OHS concerns. OHS concerns can increase due to various factors, including site conditions, awareness of OHS preventive and protective measures, contract provisions, and inadequate supervision, monitoring, and enforcement by the implementing agency.

- **Mitigation for health risks:** The contractor shall take measures to minimise fugitive dust emissions during construction activities. Dust emissions should not be visible beyond the source's boundary for extended periods, and equipment should be used to control air pollution and provide respiratory protection for workers in high-dust areas.
- **Mitigation for risks of accidents:** Erection, excavation, dismantling of structures, temporary work, shoring, or any other tasks must be performed by trained workers under competent supervision.
- **Mitigation measure for risks of falling from high levels:** Contractor shall ensure that work at height is properly planned for emergencies and rescue, adequately

supervised, and conducted in a manner that is reasonably safe. Safety nets and harnesses must be used for work over 2 meters to prevent falls and injuries.

- **Mitigation measure for risks of falling objects:** Contractor shall take measures to prevent injuries from falling materials, including prohibiting throwing or tipping from heights, and ensuring proper barricading, safety nets, and fall arrest systems are in place in high-risk areas.
- **Mitigation measures for risks of electrical shock:** Contractor shall ensure safe power usage and electrical equipment practices, including the use of protection devices. Cables should be selected based on the exposure conditions and the project's specific requirements. Regular inspections should be conducted to detect any cuts or cracks in the cables.
- **Risks of fire and explosion:** Contractor shall provide the workplace with fire extinguishing equipment that is regularly recharged and maintained to meet Indian National Standards. Additionally, combustible scrap and debris must be disposed of regularly.
- **Mitigation measures for risks due to use of heavy machinery:** All workplace equipment must be in sound mechanical condition and certified by a competent authority. Vehicles should have audible reverse alarms and be well-maintained. Reversing shall be done with adequate rear-view visibility or under the banksman's direction.
- **Mitigation measures for Heat Stress:** Provide shaded rest areas and hydration for workers. Allow for regular breaks to prevent heat-related illnesses. Monitor workers for signs of heat exhaustion.
- **Mitigation measures for Traffic Hazards:** Designate safe walking paths and vehicle routes. Use signage and barriers to separate pedestrian and vehicle areas.
- **Mitigation measures for Lockout/Tagout Failures:** Follow lockout/tagout procedures during maintenance. Train workers on safe handling of rolling stock components. Use machine guards and safety interlocks on equipment.
- **Mitigation measure for other occupational risks:**
 - Maintain all stairways, passageways, gangways, and emergency exits clear and unobstructed.
 - Erect full-height fences, barricades, and barriers around the construction site to contain excavated soil and rubbish.
 - Prohibit parking of vehicles on roads to prevent traffic obstruction.
 - Enforce a zero-tolerance policy for employees entering the work area under the influence of alcohol or drugs.
 - Ensure all vehicles, machinery, and equipment have valid fitness certificates.
 - Mandate the use of PPE for all workers at the construction site.
 - Provide essential facilities such as first aid boxes, clean drinking water, separate latrine facilities, temporary living accommodations, and childcare rooms as per regulatory standards, etc., for labourers at labour camps/construction sites.
 - Contractor shall ensure that the EHS supervisor is engaged during the conduct of work.
 - A first-aid box is provided and maintained at the labour camp and construction site as specified in BOCWA.
 - Contractor shall ensure that an adequate canteen on a 'no profit, no loss' basis is provided where 250 workers are employed.

- In the case of works like track laying, the zone of work is constantly moving at an elevated level or at ground level. In such cases, mobile urinals with proper facilities for draining sullage shall be provided at a reasonably accessible distance.
- In every workplace where more than 50 female workers are ordinarily employed, a well-maintained suitable room is provided for the use of children in accordance with Section 35 of BOCWA.
- Contractor shall organise awareness camps for GBV and STDs (HIV/AIDS)
- Contractor shall organise regular HIV/AIDS check-ups and medical health camps.

7.3.4 Training

The training for engineers and managers will be imparted by GMRL on a regular basis to monitor the implementation of ESMP during the construction and operation phases. The details of the training programs are given at

Table 7-3.

Table 7-3 Details of Proposed Training Programs

Training Program	Objectives	Participants	Number of Trainings
T1. Orientation/Sensitisation Training Programs – 1 Day	• To orient/ sensitize the project staff at the project launch towards the environmental and social issues of the project. • To orient the project staff about the ESMF and its importance, provisions and implications.	• EHS and Social Experts and other Staff, GMRL • GC • NGO	• 2 (during first year of project)
T2. Training on the ESMP, and RAP, – 2 Days	• To equip with knowledge and skills necessary for use of ESMF, undertaking environmental and social screening and appraisal as per the requirements of the ESMF, conduct ESIA and preparation of management/ mitigation plans • To prepare for undertaking periodic supervision of the implementation of environmental and social management/ mitigation plans and performance monitoring of sub-projects	• EHS and Social Experts of GMRL • E&S Experts, GC • NGO Staff	• 8 (During project Implementation). • A minimum of 2 trainings per year
T3. Training on World Bank's ESF	• WB's ESF Training will address potential E&S risks	EHS and Social Experts	• 1 Training

Training Program	Objectives	Participants	Number of Trainings
	during project implementation, such as aspects related to working conditions, employment, OHS and safety, CHS, GM, GBV (SEA/SH), security management plan, etc.	or other Staffs, GMRL	
T4. Training on OHS and EHS	To enhance competency of the project staff of EHS and OHS risks during construction and operation, including Biodiversity Management Plan.	EHS and Social Experts or other Staffs, GMRL	A minimum of 2 trainings per year.

About 10 to 20 trainees would participate in each of the training programs. It is intended that these trained persons will, in turn, provide onsite training to NGOs, resource persons, etc., onsite. The estimated total training budget for the proposed corridor is Rs. 49.00 Lakh. The contractor will arrange training for staff/ employees on Environmental Management Systems, Hazard Awareness, Environmental and Drainage Management, and Project Management.

7.4 ESS 3: Resource Efficiency and Pollution Prevention and Management

To promote the sustainable use of resources, the following measures shall be implemented to ensure the efficient consumption of energy, water, and raw materials.

7.4.1 Resource Efficiency

Resource efficiency in metro projects involves the optimal use of materials, energy, and other resources throughout the project lifecycle to minimise environmental impacts, reduce costs, and improve sustainability. It offers an opportunity to implement practices such as recycling and reusing waste and wastewater, improving energy and water use efficiency (considering demand-supply dynamics), and optimising the use of raw materials in line with applicable national and state policies and guidelines. Although the National Resource Efficiency Policy (NREP), 2019 remains in draft form and is not applicable to this project, alignment with ESS3 is maintained through the application of relevant national regulations and the adoption of established good practices.

7.4.1.1 During the Detailed Design Stage

1. Green Buildings

All stations and depot buildings shall be designed as green buildings as per IGBC rating system. This system serves as a framework for integrating green concepts into MRTS and addresses the green features under the following categories:

- Site Selection and Planning
- Water Efficiency
- Energy Efficiency
- Material Conservation/ Building Materials and Resources

- Indoor Environment and Comfort
- Innovation in Design and Construction

The IGBC rating system integrates circularity principles in metro projects by encouraging the reuse of construction and demolition (C&D) wastes, thereby reducing resource consumption and minimising the impact on landfills. It awards credits for the use of recycled materials, adoption of sustainable construction practices, and implementation of effective waste management strategies that support a closed-loop system.

Haryana has five, and Delhi has two, C&D waste recycling facilities. Recycled Materials from these recycling units will preferably be used for construction works, including pavement construction, subject to testing and confirmation of their structural soundness.

2. Energy Efficiency

- **Maximisation of Natural and Renewable Energy Use:** Natural lighting and alternative energy sources, particularly solar power, shall be harnessed to the maximum extent feasible.
- **Integration of Energy-Efficient Systems:** Energy-efficient technologies shall be incorporated in trains, stations and supporting infrastructure. This includes an LED lighting system, an energy-efficient HVAC (heating, ventilation, and air conditioning) and advanced signalling systems.
- **Solar Energy Development and End-of-Life Management:** Renewable energy sources, such as solar panels with anti-reflective coatings, shall be integrated at station buildings and depots. Upon reaching the end of their operational life, solar panels installed under the GMRP shall be disposed of or recycled in accordance with the E-Waste (Management) Rules, 2022, and relevant guidelines issued by the Central Pollution Control Board (CPCB).
- **Regenerative Braking System:** The proposed metro system shall be equipped with regenerative braking technology to recover and reuse energy during train operations.
- **Variable Voltage Variable Frequency (VVVF) Technology:** All escalators and elevators shall be equipped with VVVF technology to enhance energy efficiency.
- **Occupancy Sensors:** Occupancy sensors shall be installed in public toilets to minimise energy wastage.
- **Energy Efficient Office Equipment:** All office equipment, including computers, printers, fax machines, etc., shall be certified with Energy Star or equivalent energy efficiency labelling.
- **Environmentally Safe Fire Suppression Systems:** Fire suppression systems used in stations shall be free from halons and ozone-depleting substances.
- **Eco-Friendly Refrigerants:** Refrigerants used in the station systems shall have low or no Ozone Depleting Potential (ODP) and Global Warming Potential (GWP). Proper recycling and end-of-life management of refrigerants shall be mandated in procurement documents.
- **Adoption of Good International Practices:** Contractors shall implement measures specified in the WB's EHSs to optimise the use of energy, water and raw materials, to the extent that it is technically and financially feasible.

3. Water Use

- **Installation of High-Efficiency Water Fixtures:** Water-efficient fixtures shall be installed at stations and maintenance facilities, including low-flow toilets, dual flush systems, sensor-based electronic taps, foam taps, waterless urinals, toilets, faucets, showers, dishwashers, etc., to significantly reduce water consumption.
- **Rainwater Harvesting:** Provision of rainwater harvesting systems at stations, along the alignment, and at the depot to aid in groundwater recharge.
- **Water-Efficient Landscaping:** Landscaping at stations and depots (wherever feasible) shall be designed using native or adaptive plant species.
- **Permeable Pavements:** Wherever feasible, permeable pavement shall be used for access roads to stations, depots and service areas to promote water infiltration and reduce surface runoff.
- **Water Reuse:** Treated wastewater shall be reused for non-potable applications such as landscape irrigation and toilet flushing, thereby minimising freshwater use.

7.4.1.2 During Construction & Operation Phase

- **Water Use**

During the construction phase, water requirements will be met through treated effluent from nearby STP and municipal water supply sources. In the operation phase, water for air conditioning, cleaning and use of staff and passengers at stations will be sourced from the municipal supply. This will be supplemented by the reuse of treated wastewater generated on-site, particularly for non-potable applications such as toilet flushing, landscaping, etc. To facilitate this, a double plumbing system will be incorporated into the design, included in procurement specifications and implemented accordingly. Water supply for depots will similarly be sourced from municipal supply and supplemented by on-site reuse of treated wastewater and harvested rainwater, wherever feasible. All sludge generated from wastewater treatment facilities will be managed and treated in line with prevailing guidelines and regulatory standards.

- **Raw Material Use-Sustainable Building Materials**

Wherever feasible and available, construction materials recommended by the BIS, such as fly ash and other approved waste-derived materials, shall be utilised, provided they exhibit properties comparable to conventional building materials. To promote circular economy principles, the project may utilise recycled materials available at several C&D waste recycling facilities in Delhi. As per the Construction and Demolition Waste Management Rules, 2016, it is mandatory for municipal and government contracts to procure 10–20% of construction materials from C&D waste sources, subject to strict quality control standards. The use of such recycled materials significantly reduces dependence on virgin resources in the building structure, thereby enhancing environmental sustainability in infrastructure development.

7.4.2 Dust from construction/demolition activity

Impact: During the construction phase of the metro, activities such as excavation, material transportation and operation of heavy machinery generate a significant quantity of dust particles. These emissions can adversely affect both human health and the environment.

Mitigation Measures:

- Regularly spray water or use dust suppressants at work sites to minimize airborne dust.

- Cover all construction materials with green nets to prevent wind-blown dust.
- Ensure material and waste storage areas, as well as transport vehicles, are adequately covered to prevent dispersion due to wind, rain, or flooding. A full green net enclosure shall be provided around construction zones, supplemented by hard barricading equipped with lighting and reflectors for safety.
- Schedule construction activities in a manner that avoids operations during high wind speeds or extremely dry conditions. Additionally, comply with the Graded Response Action Plan (GRAP) guidelines to address air pollution in the National Capital Region.
- Conduct frequent water sprinkling on local roads and worksites to control dust emissions. The Contractor shall mobilise an adequate number of water sprinkling trucks.
- Install wheel washing facilities at the exit points of all construction sites.

7.4.3 Supply of Construction Material

Construction materials such as aggregate and earth will be sourced from approved quarries to ensure minimal environmental impact and efficient utilisation of natural resources.

Mitigation Measures:

- Procedures for the storage, handling, transportation and reuse of construction materials shall be outlined in the GMRL EHS Manual. This manual will be prepared in line with WB EHS guidelines and applicable national regulations.
- Designated facilities for processing and disposal of C&D waste are available in Gurugram. In the event that these are unavailable or have limited capacity, the waste shall be transported to alternate authorised facilities, including those in Delhi.
- The construction materials to be used include coarse aggregates, cement, coarse sand, reinforcement steel, structural steel, water supply components, drainage and sanitary fittings, etc. Loading and unloading of these materials shall be carried out by labour engaged by the contractor.
- The procurement source of the construction materials will be decided by the contractor; however, all materials must be procured from licensed and approved suppliers.
- The contractor shall be responsible for the management of all construction materials during the entire construction phase. Sufficient quantities of all materials must be available before the commencement of each construction activity.
- All construction materials shall be tested in government labs or labs approved by the government to ensure quality compliance prior to use. This responsibility shall be clearly mentioned in the contractor's agreement.
- The contractor's responsibilities will also include supervision and monitoring of all aspects related to the storage, loading and transportation of construction materials and equipment.
- The construction material storage area shall be regularly inspected to ensure there is no uncontrolled waste, and appropriate measures shall be taken to prevent silt runoff and pollution due to improper storage or handling.
- Close coordination with the designated GMRL officer and the head of the construction team shall be required to promptly address environmental concerns and to implement necessary mitigation measures.

- Scheduling of material procurement and transportation shall be linked with the overall project construction schedule.
- All stairways and passageways shall be kept free from obstructions. Emergency exits, passageways, fire doors, alarm points, fire-fighting equipment, first aid stations, and other emergency stations must be kept clean, unobstructed and in good working condition at all times.
- Empty cement bags and other packaging material shall be properly stacked and removed.

7.4.4 Impact due to Pre-casting yards and Material stockpiling

A construction yard is a storage yard or assembly yard for building materials and equipment directly related to a specific construction project and subject to removal at completion of construction. Activities such as casting structural concrete elements and material stockpiling at these sites can potentially lead to air and water pollution, increased noise levels, diversion of open spaces such as parks, and temporary displacement.

Mitigation Measures:

- Site selection criteria for a construction yard are as under:
 - Away from the right-of-way of a highway/ or any road
 - Away from the footpath
 - Away from habitation and settlements
 - Away from the flood plains, water bodies
 - Away from the notified areas- reserved forests, wetlands, nature protection, wildlife sanctuary, eco-sensitive zones, historical monuments, places of tourist interest, etc.
- Proper and safe stacking of materials at construction yards and storage areas is of paramount importance. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner without affecting the movement of people, the health & safety of workers or communities, & environment.

7.4.5 Risk of Soil and Water pollution due to construction works

Impact: Metro construction activities such as foundation laying and structural development can lead to soil erosion, which may contribute to sedimentation in nearby water bodies. Additionally, construction-related pollutants, including sediments, debris, waste, and chemical runoff, pose a risk of contaminating water sources, degrading aquatic habitats and impacting the quality of essential water reservoirs.

No contaminated sites have been identified during the ESIA Study in the project area. However, if required, contamination assessments and site-specific cleanup plans will be developed in accordance with applicable guidelines. An outline for the Site Clean-Up/Remediation Plan for Contaminated Sites is provided in Annexure 7.1.

Mitigation Measures:

- Construction materials shall be stored at a safe distance from water bodies to prevent contamination, especially during heavy rainfall or flooding.
- Properly treat and manage stormwater runoff to prevent pollutants from entering water bodies.

- Fuel and oil would be stored in cement-lined, elevated storage yards equipped with cut-off drains to prevent leakage or spillage and subsequent soil or water contamination.
- All fuels and chemicals must be stored in contained, designated facilities. Preventive measures should be implemented to avoid spillage or leakage.
- In case of accidental spills, contaminants must be contained immediately. Oil spills shall be cleaned using spill kits, and standard operating procedures (SOPs) shall be prepared and strictly followed for spill response and cleanup.
- Improper site management and spills from construction equipment may cause soil contamination; therefore, appropriate housekeeping and spill prevention practices must be in place.
- Sedimentation control measures, such as sedimentation tanks, shall be installed at batching plants to minimise runoff-related pollution
- Contractors shall adopt water conservation practices, including the use of energy-efficient water fixtures at sites and project offices.
- Water leakages through pipes and valves must be prevented through regular inspection and maintenance.
- Reuse of water used for curing and other construction uses shall be planned and implemented to reduce overall water consumption.

7.4.6 Air Pollution during Construction

Air pollution may result from activities such as excavation, loading and unloading construction materials, and emissions from vehicles, construction equipment and DG sets. Additional sources include muck disposal sites, debris disposal locations and pre-casting yards.

DG sets will be used to provide a power backup supply during construction. For estimation purposes, a DG set of 50 KVA capacity has been considered. The predicted maximum incremental load on applicable averaging hour 24 hours for criteria pollutants SO_2 , NO_x , $\text{PM}_{2.5}$, PM_{10} and 8 hour for CO due to the operation of DG set during daytime construction activity between 0800 IST and 1800 IST are predicted to be about $0.70 \mu\text{g}/\text{m}^3$, $7.0 \mu\text{g}/\text{m}^3$, $0.07 \mu\text{g}/\text{m}^3$, $0.14 \mu\text{g}/\text{m}^3$ and $7.40 \mu\text{g}/\text{m}^3$ respectively and occurs within 100 m from the DG set location.

While the impact on ambient air quality during the construction phase is expected to be minimal and temporary, the implementation of a comprehensive EMP is essential to mitigate potential adverse effects.

Mitigation Measures:

The following mitigation measures shall be adopted to minimise air pollution during the construction period, particularly focusing on PM, gaseous emissions, and fugitive dust:

- The contractor shall take all necessary precautions to minimize fugitive dust emissions during excavation, grading, land clearing, and waste disposal. Dust emissions from material handling, storage, and transport activities must not be visible beyond the property boundary for any extended period without prior notification to the Employer.

- All vehicles and construction equipment used by the contractor shall comply with the latest emission standards prescribed by the GoI and the GoH. Periodic emission checks shall be conducted, and necessary corrective actions, including equipment replacement, shall be taken to ensure compliance
- Loose materials such as soil and debris being transported shall be covered adequately. Trucks must be loaded with sufficient freeboard and secured to prevent spillage through tailboards or sideboards.
- Barricades or enclosures shall be installed around open construction sites prior to the commencement of work.
- Temporary storage areas must be barricaded, well-lit, and maintained with appropriate pollution prevention measures. Excavated material shall be reused for backfilling or managed as directed by the Employer. Dust suppression measures must continue even during work stoppage or public holidays
- Materials shall be placed in a manner that minimizes dust generation. Regular wetting of materials shall be conducted, particularly during dry or windy weather conditions.
- Water sprinkling shall be undertaken at construction sites during excavation, demolition, or debris handling. Adequate water sprinkling equipment must be available at all times. Dust screens should be used in areas close to sensitive receptors when additional dust control is required.
- Wheel washing or vehicle cleaning facilities equipped with high-pressure water jets shall be installed at site exits, including batching plants and construction depots, to prevent off-site dirt transfer.
- In compliance with the GRAP, the use of DG sets from Stage II onward shall be regulated in all NCR sectors as per CAQM Directions No. 76 and 83.
- The contractor shall install sealed construction enclosures near air intake points of hospitals to block entry of pollutants.
- Water sprinkling shall be intensified near schools during school hours to minimize dust exposure to children.
- Dust-generating activities shall be scheduled during non-peak hours to reduce exposure risks for sensitive receptors.

7.4.7 Noise Pollution

7.4.7.1 Construction Phase

Noise generated during the construction phase may become a nuisance to nearby residents and passersby. Construction workers are also at risk of exposure to elevated noise levels while working on-site. The most prevalent noise source at the project construction sites would be internal combustion engines used to power various types of equipment. Earth-moving equipment, material-handling equipment, and stationary machines are all engine-powered and typically generate continuous noise. Activities involving the handling of heavy precast panels and the casting of pillars are also expected to contribute significantly to construction noise levels. While mobile equipment operates in a cyclical manner, stationary equipment tends to emit noise at a constant level over time. Additionally, trucks transporting materials to and from the site could impact a wider range of receptors, as their movement is not confined to the project site alone. Other noise sources would include equipment and tools such as pile drivers.

Construction noise will be intermittent and localised, varying with the type and intensity of construction activities. These activities are expected to occur seasonally and at different locations across the project area.

An analysis of construction-related noise has been conducted based on typical activities and equipment associated with demolition, excavation, and erection phases. For prediction purposes, no ground attenuation has been considered, assuming that the ground is undisturbed, consolidated and hard in nature. The estimation of noise levels during the construction phase has been carried out in accordance with guidelines specified in the “Transit Noise and Vibration Impact Assessment, May 2006 published by the Federal Transit Administration (FTA). Noise Levels for all equipment have been modelled accordingly and are provided in **Table 7-4**.

Table 7-4: Construction Equipment Noise

Equipment	Noise level (in Leq dB(A) at 50 ft)	Equipment Noise (Leq) in dB (A) at various distances				
		50m	100m	200m	300m	400m
Auger drill	84	72	64	57	53	50
Generator	81	69	61	54	50	47
Chiseling	88	76	68	61	57	54
Crane	88	76	68	61	57	54
Concrete Pump truck	81	69	61	54	50	47
Dumper	76	64	56	49	45	42
Dozer	85	73	65	58	54	51
Compactor	82	70	62	55	51	48
Grader	85	73	65	58	54	51
Concrete Mixer	85	73	65	58	54	51
Truck	88	76	68	61	57	54

Construction activities are expected to generate noise levels in the range of 76-88 dB(A) at a distance of 15 m, with sound levels decreasing as the distance from the source increases. As noted from the table, noise levels without any shielding attenuate to within the permissible daytime limits for residential areas at approximately 400 m. However, with the provision of source-level shielding, compliance with the standard is achieved at a reduced distance of approximately 140 m. Further reduction in noise levels can be achieved through the implementation of mitigation measures outlined under S. No. 6 of Section 7.3.3. Overall, the noise impact during the construction phase is anticipated to be short-term and manageable with appropriate control measures.

To minimize disturbance to nearby communities, noise barriers shall be installed along the construction boundaries in proximity to sensitive receptors, as identified in Section 5.10. Environmental Health & Safety Expert of ESMU shall monitor the noise levels at these sensitive receptors during construction. If noise levels are found to exceed permissible limits, implementation of the mitigation measures will be undertaken to ensure compliance.

7.4.7.2 Noise during Operation

Noise generated during metro operations primarily originates from train movements, auxiliary systems, and activities within the depot. Key contributors include train acceleration and braking, ventilation systems, use of power tools, and machinery employed for train

maintenance. Among these, the most significant source of noise is the operation of running metro trains. The primary sources of wayside airborne noise during metro operations include:

- i. Wheel/ Rail Noise: Due to wheel/rail roughness
- ii. Propulsion Equipment: Traction motors, cooling fans for TM, reduction gears, etc.
- iii. Auxiliary Equipment: Compressors, motor generators, brakes, ventilation systems, other car-mounted equipment
- iv. Elevated Structure Noise
 - At low speed (<15 km/h), auxiliary equipment may predominate
 - At speeds up to approx. 50 km/h, W/R noise predominate
 - At speeds greater than 50 km/h, the propulsion equipment noise predominates
 - For light weight steel elevated structures, the structure noise can predominate at all speeds above 15 km/h

The information related to metro operations, which has been considered for predicting noise levels, is sourced from the DPR and is also provided in **Table 7-5**.

Table 7-5: Data Considered for Noise Level Predictions

Corridor	Train Speed (Kmph)	No. of Cars	Corridor	Trains per day in both directions					
				Year 2026		Year 2031		Year 2041	
				Day	Night	Day	Night	Day	Night
Millennium City Centre to Cyber City	80	3/6	Viaduct	137	14	278	28	285	28

Note: Day: 06:00-22:00 hrs and Night 22:00-06:00 hrs

Source: DPR, October 2021

Predicted noise levels at all metro stations were modelled based on the guidelines outlined in the “Transit Noise and Vibration Impact Assessment, May 2006 by the Federal Transit Administration (FTA)”. The parameters used for the modelling are as follows:

- SELref: 82 dB (A) for fixed guideway rail cars operating at @ 50mph, measured at a distance of 50 feet,
- Ground Factor (G) for ground attenuation is considered as zero,
- Attenuation due to shielding between source and receptor is considered zero,
- Adjustment Factor of +4 is considered for aerial structure with slab track,
- Performance Parameters considered for the project as per DPR are:
 - Max Acceleration 1.0 m/s²
 - Max Deceleration 1.1 m/s²

The maximum acceleration and deceleration values were used to determine the distance between stations where the metro train attains the maximum operating speed of 80 kmph. It is assumed that the metro enters and leaves station at a speed of 20 kmph. Accordingly, the predicted noise levels at a distance 15 m are given in **Table 7-6**. Additionally, Leq noise contours are generated along the GMRP corridor for the year 2026 and presented in **Figure 7-2**.

Table 7-6: Predicted Noise Levels due to Metro Operations

Year	Predicted Noise Levels in dB (A) at 15 m distance			
	20 KMPH		80 KMPH	
	Leqd	Leqn	Leqd	Leqn
Corridor: Millennium City Centre to Cyber City				
2026	52.41	49.77	64.45	61.81
2031	55.48	52.78	67.52	64.82
2041	56.59	53.75	68.63	65.79

The assumptions of zero ground attenuation and zero shielding represent a conservative worst-case modelling approach. In actual urban conditions of Gurugram, existing buildings, barriers, and surface characteristics are expected to provide additional attenuation, indicating that the predicted impacts are conservatively estimated and remain manageable under realistic conditions.

The predicted noise levels estimated due to metro operations for the years 2026, 2031, and 2041 reveals the following:

Speed 20 KMPH

- The Leqd noise levels generated will be within the CPCB permissible limits prescribed for Residential areas at a distance of 11 m for year 2026, 16 m for year 2031; and 18 m for year 2041.
- The Leqn noise levels generated will be within the CPCB permissible limits prescribed for Residential areas at a distance of 26 m for year 2026, 37 m for year 2031; and 41 m for year 2041.

Speed 80 KMPH

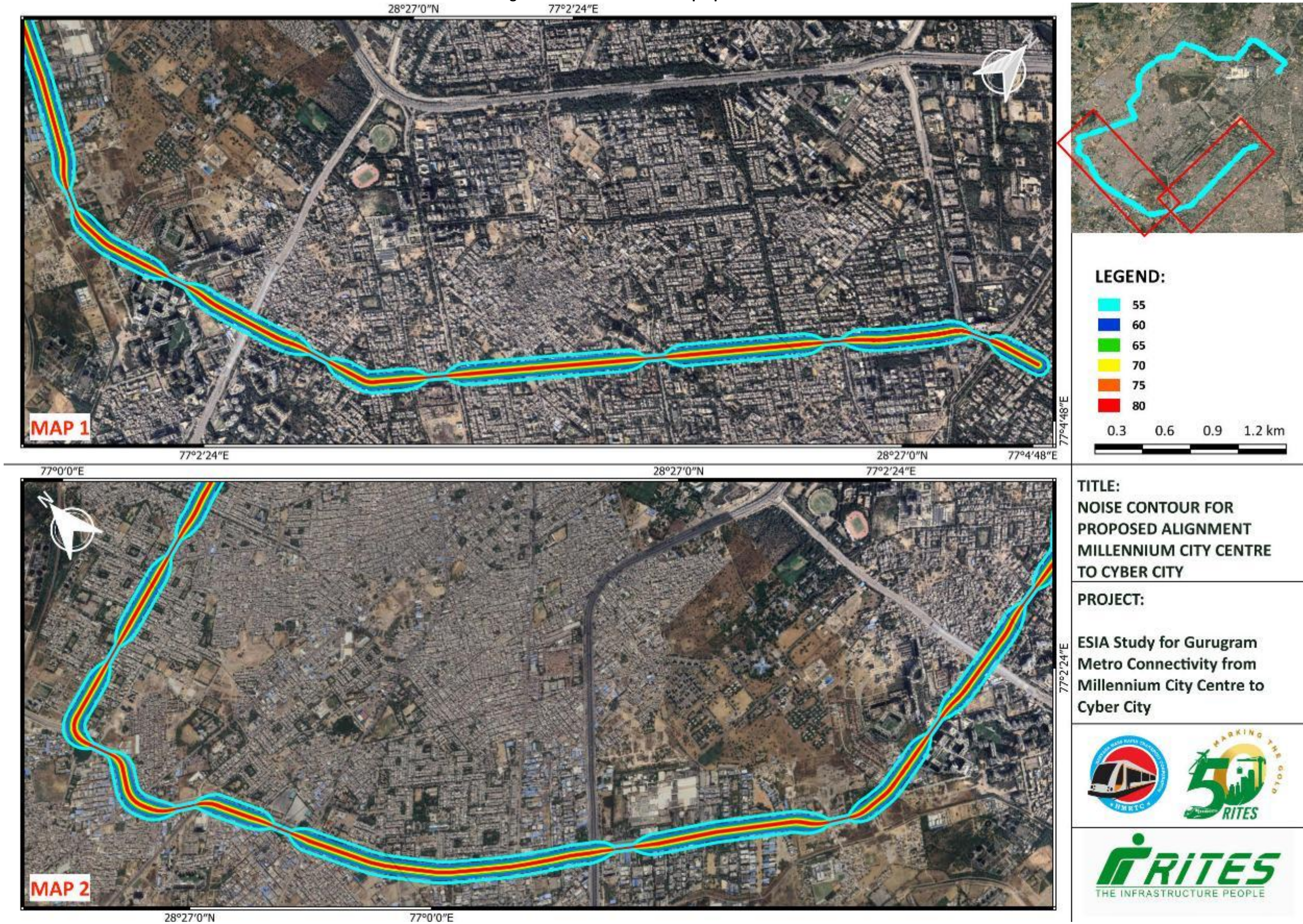
- The Leqd noise levels generated will be within the CPCB permissible limits prescribed for Residential areas at a distance of 45 m for year 2026, 63 m for year 2031; and 72 m for year 2041.
- The Leqn noise levels generated will be within the CPCB permissible limits prescribed for Residential areas at a distance of 104 m for year 2026, 147 m for year 2031; and 164 m for year 2041.

Cumulative noise levels in the project area have been modelled based on existing measured sound levels and predicted noise levels due to future daily metro rail operations. Cumulative noise levels at each noise monitoring location are given in **Table 7-7** and summarized below:

- Silence Zone (N1, N3, N4, N5, N6, N10, N11) Locations: Cumulative day and night noise levels for all years exceeding the permissible levels for Silence Zones prescribed by CPCB
- Residential Zone (N2, N7, N8) Locations: Cumulative day and night noise levels for all years exceeding the permissible levels for Residential Zones
- Commercial Zone (N9) location: Cumulative night noise levels for all years exceeding the permissible levels for Commercial Zones
- Commercial Zone (N16 and N17) locations: Cumulative day and night noise levels for all years exceeding the permissible levels for Commercial Zones
- Commercial Zone (N12, N13, N14, N15, N18, N19, N20) Locations: Cumulative day and night noise levels for all years within the permissible levels for Commercial Zones.

- The cumulative noise exceedances are primarily influenced by the already elevated existing urban baseline conditions, while the predicted metro noise contribution remains comparatively low. The assessment indicates that existing traffic and urban activity are the dominant contributors to overall cumulative noise levels.
- Residual noise conditions are inherently reflected within the cumulative operational noise assessment, which considers the integrated effect of proposed mitigation measures and operational controls under the modelled scenario.

Figure 7-2: Noise Contours for proposed Corridor



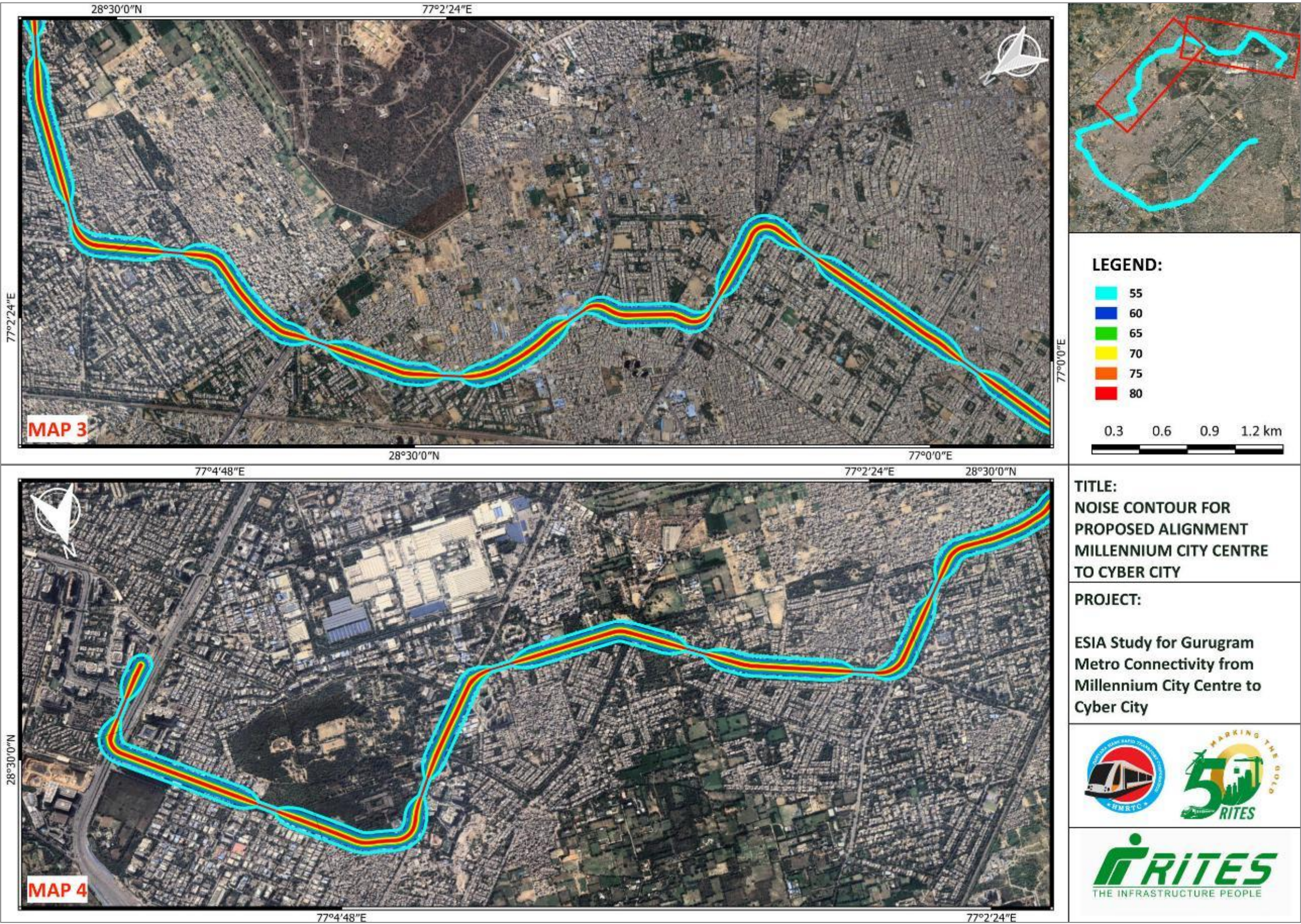


Table 7-7: Noise Levels at Monitoring Locations due to Metro Train Operations

S. No.	Monitoring Locations	Distance from Metro Centreline in m	Ambient Noise Levels in dB(A)		Predicted Noise Levels in dB(A) at Monitoring Locations						Cumulative Noise Levels in dB(A) at Monitoring Locations					
					2026		2031		2041		2026		2031		2041	
			Lday (6:00 AM- 10:00 PM)	Lnight (10:00 PM - 6:00 AM)	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight
Corridor: Millennium City Centre to Cyber City																
N1	Millennium City Center	150	63.9	49.9	32.4	29.8	35.5	32.8	36.6	33.7	63.9	49.9	63.9	50.0	63.9	50.0
N2	Subash Chowk	20	64.4	52.2	61.9	59.3	65.0	62.3	66.1	63.3	66.4	60.1	67.7	62.7	68.4	63.6
N3	Udyog Vihar Phase 6 Metro station	70	54.1	44.6	39.0	36.4	42.1	39.4	43.2	40.4	54.2	45.2	54.4	45.7	54.4	46.0
N4	Near Greenwood Public school (Basai Pond)	10	54.9	44.8	55.9	53.3	59.0	56.3	60.1	57.3	58.5	53.9	60.4	56.6	61.3	57.5
N5	ESIC Hospital	22	54.5	44.8	49.1	46.4	52.2	49.5	53.3	50.4	55.6	48.7	56.5	50.7	56.9	51.5
N6	Near Jain Sant Phool Chand Ji Charitable Hospital	60	54	43.7	52.4	49.8	55.5	52.8	56.6	53.7	56.3	50.7	57.8	53.3	58.5	54.2
N7	Blossoms Primary School	25	54.3	44.5	48.0	45.3	51.0	48.3	52.2	49.3	55.2	47.9	56.0	49.8	56.4	50.6
N8	G A V International School	25	64.7	45.7	60.0	57.4	63.1	60.4	64.2	61.4	66.0	57.7	67.0	60.5	67.5	61.5
N9	Presidium School, Palam Vihar	36	62.6	48.3	56.8	54.2	59.9	57.2	61.0	58.2	63.6	55.2	64.5	57.7	64.9	58.6
N10	Manipal Hospital, Palam Vihar	56	54.1	44.4	53.0	50.4	56.1	53.4	57.2	54.3	56.6	51.3	58.2	53.9	58.9	54.8
N11	Near Rotary Public School	20	54.8	44.7	61.9	59.3	65.0	62.3	66.1	63.3	62.7	59.5	65.4	62.4	66.4	63.4

S. No.	Monitoring Locations	Distance from Metro Centreline in m	Ambient Noise Levels in dB(A)		Predicted Noise Levels in dB(A) at Monitoring Locations						Cumulative Noise Levels in dB(A) at Monitoring Locations					
					2026		2031		2041		2026		2031		2041	
			Lday (6:00 AM-10:00 PM)	Lnight (10:00 PM - 6:00 AM)	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight	Lday	Lnight
N12	Cyber City	20	61.2	50.1	49.9	47.3	53.0	50.3	54.1	51.3	61.5	51.9	61.8	53.2	62.0	53.7
N13	Near Unittech Cyber Park	20	64.5	50.5	49.9	47.3	53.0	50.3	54.1	51.3	64.6	52.2	64.8	53.4	64.9	53.9
N14	Sector 47 Metro station	5	54.5	44.4	61.9	59.3	65.0	62.3	66.1	63.3	62.7	59.4	65.4	62.4	66.4	63.3
N15	Sector 72/A Metro station	20	54.8	44.9	49.9	47.3	53.0	50.3	54.1	51.3	56.0	49.3	57.0	51.4	57.5	52.2
N16	HeroHonda Chowk	15	66	52.9	64.4	61.8	67.5	64.8	68.6	65.8	68.3	62.3	69.8	65.1	70.5	66.0
N17	Sector 4-7 Chowk	10	54.3	44.1	68.0	65.3	71.0	68.3	72.2	69.3	68.2	65.4	71.1	68.4	72.2	69.3
N18	Sector 5 gol chakkar	32	54.8	44.2	45.8	43.2	48.9	46.2	50.0	47.2	55.3	46.7	55.8	48.3	56.0	48.9
N19	Sector 22 Metro station	40	64.8	47.4	43.9	41.3	47.0	44.3	48.1	45.2	64.8	48.3	64.9	49.1	64.9	49.5
N20	Udyog Vihar Phase V Metro station	20	54.5	44.6	49.9	47.3	53.0	50.3	54.1	51.3	55.8	49.1	56.8	51.3	57.3	52.1

Source: RITES Field Study

The predicted increase in cumulative noise levels at receptors such as N2 and GAV School (N8) is relatively marginal in comparison to the prevailing urban baseline environment. The observed incremental increase of approximately 2–4 dB primarily reflects the combined influence of existing traffic and urban activity, with the project contribution remaining moderate within the overall Noise environment. Such variations are consistent with typical urban infrastructure scenarios and represent localized perceptibility rather than substantial adverse Noise change at sensitive receptors.

The noise impact on sensitive receptors located along the GMRP corridor has been modelled and presented in **Annexure 7.2**. Background noise levels at each receptor have been considered from the nearest baseline noise monitoring location. Key observations from the analysis are as follows:

- Cumulative noise levels at all these receptors are exceeding the permissible limits prescribed by the CPCB and WBG EHS except at few locations during night-time.
- Noise barriers need to be provided wherever noise impact criteria are severe at all the receptors, which occurs when the project results in a substantial increase in noise levels over existing conditions (typically more than 15 dB(A)), and the resulting absolute noise level meets or exceeds the threshold defined by the FTA's noise impact criteria for transit projects.
- The elevated baseline noise levels observed at sensitive receptors such as Fortis Hospital (N1), GAV School (N8), and N13 are primarily associated with existing urban traffic movement, commercial activities, and surrounding anthropogenic sources along the project corridor. These prevailing ambient conditions have been considered in the impact assessment while evaluating the incremental contribution from the proposed metro operation. The assessment indicates that the predicted project-related noise contribution remains comparatively marginal with respect to the existing urban noise environment, and the cumulative acoustic conditions are predominantly influenced by existing background activity patterns within the study area.

Mitigation Measures:

- Use of ballast-less track with elastic and absorbent fittings is a standard provision for noise control.
- At depot location; development of a green belt with dense vegetation helps reduce noise; where site layout permits, barrier blocks of less-vulnerable buildings can be used.
- Screening of noise shall be ensured by providing parabolic noise barriers on each side of the track along the curved portion of the viaduct and at sensitive receptors during operation.
- Providing tree buffers with a multilayered approach to enhance sound attenuation, consisting of deciduous and evergreen trees, to provide year-round noise control wherever possible.
- Use of sound-absorbing materials in maintenance areas, such as acoustic panels and insulation, to reduce noise emissions from maintenance activities.
- Use of low-noise machinery and tools wherever feasible to reduce noise generated during maintenance activities at the depot.

Detailed quantification of individual mitigation effectiveness has not been presented separately, as the assessment considers the combined integrated performance of multiple mitigation measures within the overall operational noise modelling scenario.

Even though the predicted noise levels from metro operations are generally lower than the existing ambient noise levels at most locations, noise barriers are proposed at sharp curves and sensitive receptor locations such as educational institutions and hospitals, where noise impact criteria are exceeded or considered severe. The proposed location for noise barriers along the GMRP alignment is presented in **Table 7-8** and the estimated cost for the implementation of these barriers is **Rs. 522.105 Lakh (USD 551616.48)**. The project proponent needs to monitor the noise environment at these locations before erecting the noise barriers during operation. By implementing these noise mitigation measures, the project is expected to remain compliant with applicable Indian Standards and WB EHS Guidelines.

Table 7-8: Location of Noise Barrier

S. No.	Chainage in m		Length (m)		Total Length (m)	Cost in Rs. Lakh
	From	To	LHS	RHS		
1	117.613	145.137	27.3	29	56.3	8.445
2	4118.495	4174.614	26.2	27.4	53.6	8.04
3	6210.59	6258.395	49.3	47.5	96.8	14.52
4	10649.91	10687.1	35.7	39.3	75	11.25
5	10958.48	11015.28	58.5	54.1	112.6	16.89
6	11153.65	11245.02	96.2	89.3	185.5	27.825
7	11445.42	11520.51	71.9	79.2	151.1	22.665
8	11812.87	11987.54	182	167	349	52.35
9	12008.2	12038.7	-	30.5	30.5	4.575
10	14744.65	14914.81	163	179	342	51.3
11	15575.59	15715.93	150	136	286	42.9
12	15795.93	15827.91	31.5	34.2	65.7	9.855
13	16161	16213.77	54	51.7	105.7	15.855
14	16314.41	16394.16	76.4	83	159.4	23.91
15	18667.38	18704.17	38.4	35.3	73.7	11.055
16	19266.25	19357.61	88	95.6	183.6	27.54
17	20135.37	20287.13	157	147	304	45.6
18	21985.77	22020.66	34.2	36.6	70.8	10.62
19	22917.84	22992.75	71.8	78.4	150.2	22.53
20	24071.42	24200.1	134	123	257	38.55
21	24405.02	24451.34	47.9	45.3	93.2	13.98
22	26149.13	26288.75	146	133	279	41.85
Total					3480.7	522.105

Source: RITES Field Study

7.4.8 Impacts due to Vibration

A. Pre-Construction

Vibration due to earthquakes: The proposed project corridor is situated in seismic Zone IV of the seismic zoning map of India. Accordingly, the design of all structural components should have a suitable seismic coefficient in line with the provisions of IS 1893, Part 1, to ensure seismic resilience. High-quality, durable materials shall be used to ensure structures can withstand long-term weathering, stress, and seismic loads. The elevated structures must be designed to be earthquake-resistant and possess adequate load-bearing capacity to support the weight of trains, passengers, and additional loads such as wind and seismic activity.

During the DDC, dynamic analysis should be carried out to assess and mitigate the effects of dynamic forces generated by train movement, wind, and other external factors. If significant vibration impacts are expected, appropriate vibration mitigation measures shall be implemented. The detailed technical note on vibration impacts on nearby buildings from construction activities is provided in **Annexure 7.3**.

B. During Construction

The Transportation and Construction Vibration Guidance Manual (Caltrans, September 2013) specified threshold vibration criteria for various types of structures, which are presented in **Table 7-9**. These criteria for monuments are more stringent than those prescribed in UK, Germany, Switzerland and Japan. Vibration source levels for typical construction equipment used in the project are provided in **Table 7-10**.

Table 7-9 Guideline Vibration Damage Threshold Criteria

Structure and condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous / frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Source: Transportation and Construction Vibration Guidance Manual, Caltrans, September 2013

Table 7-10 Vibration Source levels for Construction Equipment

Equipment		PPV at 25 ft (in/sec)	Approximate Lv# at 25 ft
Pile Driver (impact)	upper range	1.518	112
	Typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	Typical	0.170	93

Equipment		PPV at 25 ft (in/sec)	Approximate Lv# at 25 ft
Calm shove drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	85
Jackhammer		0.0345	79
Small bulldozer		0.003	58
# RMS velocity in decibels (VdB) re 1 µinch/sec			

Source: Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

i. Vibration impact due to Piling Work

The piling works for the project are carried out using bored cast in-situ methodology with hydraulic piling rigs. This minimizes the vibration impacts on nearby structures and utilities. Unlike driven piling systems, this method employs rotary drilling to form the borehole, followed by the installation of reinforcement cages and concreting, thereby eliminating dynamic loading and substantially reducing ground-borne vibrations during construction.

Mitigation Measures:

Although ground-borne vibration is not as common as an environmental issue as airborne noise, it can significantly impact sensitive structures and must be addressed through proactive planning and site-specific mitigation. The current vibration impact assessment is based on a worst-case scenario. Geotechnical investigations shall be carried out during construction. The following measures are recommended during construction of metro:

- Conduct a detailed geotechnical investigation before initiating construction activities.
- Information dissemination about the construction method, potential vibration effects, and associated safety and quality control measures.
- Notify residents, particularly those in buildings near the alignment, about expected vibrations and mitigation strategies.

i. Vibration due to Blasting

Blasting activities are not anticipated for the GMRP. However, if blasting becomes necessary due to the presence of hard rock formations, only controlled blasting shall be carried out in accordance with all relevant safety procedures and regulatory requirements. Before initiating any blasting operations, the necessary licenses and NOC must be obtained from the District Magistrate and/or the DGMS, as applicable, for the possession, transportation, and use of explosives. All prescribed safety protocols related to the transportation, handling, storage, inventory, and use of explosives must be followed. This includes measures to prevent fire, accidents, theft, and pilferage, and to ensure safe disposal or destruction of unused or expired explosives in compliance with legal and safety standards.

C. During Operation

Impacts: Ground-borne vibrations from metro operations are generated by two prime excitation mechanisms.

- The quasi-static displacement caused by the axle load as the wheel moves along the track,
- The inertia forces due to the acceleration of the unsprung mass of the train as it rolls over the irregular profile of the railhead.

According to the U.S. Department of Transportation (1998), the human perception threshold for peak particle velocity is about 0.04 mm/s (65VdB with reference 1e-6 inch/sec). For individuals inside residences, the annoyance threshold is 72 VdB as per FTA, 2006 guidelines. Prolonged exposure to vibrations above permissible limits can have adverse effects on human health, including fatigue, increased pulse & respiration rates, dizziness & loss of balance, anger and irritation.

As per Research Designs and Standards Organisation (RDSO) Guidelines on Noise & Vibrations, an LRT system operating at 80 kmph generates a vibration level of 72 VdB (threshold for residential land uses and buildings) at a distance of 18.3 m from the track centreline. The same system generates 75 VdB (threshold for Institutional land use with daytime use) at 12.2 m from the track centreline.

A vibration impact assessment for the GMRP has been carried out using the FTA guidelines, and the predicted vibration levels are presented in **Table 7-11**.

Table 7-11: Predicted Vibration Level due to Rapid Transit Rail

S No.	Location	Distance (D) from Metro alignment (m)	Receptor Vibration Level (VdB)	Predicted Vibration Level (VdB)	Resultant Vibration Level (VdB)	Permissible Limits* in (VdB)
1.	Fortis Hospital	15	51.5	58.8	59.6	65
2.	Manipal Hospital	70	56.0	53.3	57.9	65
3.	ESIC Hospital	50	47.8	54.5	55.3	65
4.	INOX Mall	45	36.6	54.9	54.9	75
5.	Unitech Cyber Park	52	53.8	54.3	57.1	75
6.	Greenwood School	50	69.4	54.5	69.6	75
7.	Presidium School	10	40.0	60.3	60.3	72
8.	Sector-22, Palam Vihar	60	51.2	53.8	55.7	72
9.	Apartment near Subhash Chowk	150	46.4	50.5	51.9	75
10.	Infosys Ltd	100	47.0	52.0	53.2	75

Note: Permissible Limits as per FTA guidelines

The recorded vibration level of 69.4 VdB at Greenwood School is slightly above the typical perception threshold; however, it represents a localized near-source condition at 50 m. As stated in the ESIA, vibration levels are expected to reduce with increasing distance due to natural attenuation, geometric spreading, and ground damping effects. Overall, the observed

values remain consistent with expected vibration propagation behaviour, and significant impacts are not anticipated.

The close similarity between baseline and predicted vibration levels indicates that operational vibration contribution from the project is minimal relative to the existing ambient vibration environment. This reflects the combined effect of source control, attenuation with distance, and damping characteristics of the local ground conditions.

The predicted vibration levels, in the absence of control measures, indicate that all receptor locations fall within permissible limits. However, based on the vibration levels predicted at sensitive receptors (**Annexure 7.4**), it is observed that two sensitive receptors (both hospitals) may be impacted during the operation phase due to vibrations, as detailed in **Table 7-12**.

Table 7-12 List of Sensitive Receptors impacted due to Vibration

S. No.	Sensitive Receptors (SR)	Chainage of SR (in m)	Distance (D) from Metro alignment (m)	Predicted Vibration Level (VdB)	Permissible Limits* in (VdB)
Hospitals					
1.	Jannat Hospital	16810	15	65.07	65
2.	Balaji Life Care Hospital and Maternity Centre Hospital	16939	15	65.07	65

Note: Permissible Limits as per FTA guidelines

Mitigation Measures: Vibration can be reduced through proper design, regular monitoring and preventive maintenance of the project infrastructure, which will be conducted by GMRL to ensure its efficient and safe operation. In the case of ballast-less tracks, the following vibration damping measures shall be adopted: Installation of resilient soft base plates between rail and track slab; Use of resilient rubber pads between the base plate and track slab; Adoption of soft elastic fastening systems.

To further reduce vibrations, bogies with bolster-less designs equipped with secondary air springs shall be used. In addition, regular vibration monitoring shall be carried out at these sensitive receptors during the operation phase. Wherever feasible, tree buffers with a multilayered foliage approach comprising both deciduous and evergreen species should be planted to aid in year-round vibration attenuation and environmental screening.

In the double-deck system mentioned in Section 7.2.7, the following measures shall be additionally ensured.

- Vibration dampening systems shall be installed on the metro deck.
- Elastomeric bearing shall be installed in both levels, Rail & Road, to minimise vibration effects by isolating dynamic loads and reducing transmission between structural components.

7.4.9 Multi-Modal Integration Infrastructure (MMI) & First and Last Mile Connectivity (FLM)

MMI and FLM connectivity form critical components of sustainable urban transport systems. Together, they transform isolated metro services into seamless, door-to-door transit networks. This integration not only ensures seamless journey for passengers but also increases daily ridership, reduces private vehicle dependency, decreases urban congestion and significantly lowers carbon emissions.

By bridging the gap between homes, stations, and offices, these two components create formal and informal jobs across technology, green energy, local retail sectors, etc.

With the implementation of the metro, the role of all the transport modes operating now along GMRP will change to feeder mode, as such, no impact on employment associated with the existing modes is anticipated.

With the government focus on green mobility, electric mobility is being promoted in first and last mile connectivity for metro systems. This requires not only the electric vehicles but also the infrastructure to support the ecosystem.

Risks:

- a. Installation of electrical infrastructure for future charging facilities may generate electronic waste, used batteries. Improper handling or disposal of these materials may result in environmental pollution and potential health risks.
- b. Improper storage, handling, or disposal of batteries, electrical components, lubricants, and other hazardous materials during installation and maintenance activities may lead to soil and groundwater contamination.
- c. Installation, testing, operation, and maintenance of electrical systems and charging infrastructure may expose workers to electrical hazards, arc flash, work at height, lifting operations, and manual handling injuries, which may result in serious injuries or fatalities if not adequately controlled.

Mitigation Measures

- a. Electrical Safety Management Procedures shall be implemented, including Permit-to-Work (PTW), Lock-Out/Tag-Out (LOTO), energy isolation procedures, use of insulated tools, appropriate personal protective equipment (PPE), certified lifting equipment, fall protection systems, competency-based training, and emergency preparedness measures.
- b. Adoption of Electrical safety protocols, including lockout/tagout systems during installation of charging infrastructure.

- c. Compliance with Extended Producer Responsibility (EPR) requirements for Battery waste
- d. Waste segregation, storage and disposal of batteries and e-waste through authorised recyclers
- e. Periodic audits of waste handling and disposal systems.

7.4.10 Generation of Solid Waste

Impact: Solid waste generated during the construction and operation of the metro corridor includes both biodegradable and non-biodegradable municipal waste. During construction, waste primarily originates from labour camps, workspace canteens, and rest areas. In the operational phase, solid waste will be generated at metro stations and the depot, including sludge from the ETP and STP at the depot and support facilities. During construction, municipal solid waste generated from labour camps is estimated to be 360 kg per day, while during operation, waste generation from all metro stations is expected to be around 5,064 kg per day.

MCG is divided into 35 wards and four zones. Gurugram's estimated per capita waste generation is approximately 560 gm/day, accounting for residential, commercial and institutional waste. Currently, approximately 1,100 tons of municipal waste is generated and managed within the MCG jurisdiction, comprising:

- Wet waste: 576 metric tons,
- Dry waste: 448 metric tons
- Composition: 50-52% biodegradable, 12-15% recyclable dry waste, and 30-35% inert components.

MCG is also addressing legacy waste through a biomining and bioremediation project handling 6,000 tons/day, using 15 trommels and 3 high-capacity waste processing machines.

During both construction and operation, solid waste generated at the depot and stations will be temporarily stored in a segregated manner in line with SWM Rules 2026. Collection and transportation of wet and dry waste, treatment and disposal will be ensured in line with the rules. Other wastes such as e-waste, biomedical wastes, battery waste, hazardous wastes, C&D wastes etc will be segregated and stored, and collected, transported, treated and disposed in line with applicable national regulations.

Mitigation Measures:

- Install clearly labelled bins for biodegradable, non-biodegradable, hazardous, e-waste, and biomedical waste using a color-coded system for easy identification. Storage containers should not exceed 50 litres and should be equipped with side handles for easy handling.
- Establish a regular collection schedule for stations in line with applicable regulations. Mechanisms shall be ensured for deposit of waste in a segregated manner. Handling techniques shall prevent contamination.
- Ensure all waste transportation containers are sealed and leak-proof, particularly for wet waste (biodegradable), hazardous and biomedical waste.

- Provision dedicated spaces for segregation and collection of recyclable wastes such as paper, plastic, metal and organic waste (e.g., food, landscape waste) during both construction and operation.
- Non-biodegradable waste shall be recycled through authorized recyclers. Hazardous waste shall be labelled, stored and transported (following manifest system) as in the Rules; and disposed in SPCB approved Hazardous waste Transfer Storage Disposal Facilities. Collaborate with certified e-waste recyclers for the disposal of electronic waste.
- Prevent waste spillage along roads during transportation.
- Wash garbage containers frequently to avoid odour and the accumulation of fly-supporting materials.
- Ensure that storage and transfer points are specially floored and designed, covered and cleaned daily to prevent nuisances and maintain hygienic conditions.
- Strictly prohibit burning, burying, or open dumping of waste in public areas or streets.

The solid waste shall be managed in accordance with Solid Waste Management, Rules 2026 and its amendments.

7.4.11 Generation of Construction & Demolition Waste

Construction Phase: During the construction phase of the metro project, significant quantities of Construction and Demolition (C&D) waste are generated. This includes excavation materials such as soil and rocks, concrete and masonry debris, metal and steel scraps, wood, gravel, silt, bitumen, muck, and waste arising from utility shifting, pile cap construction, excavation works, demolition activities, and excess construction materials. Improper disposal of C&D waste can lead to land, air, water, and noise pollution, impacting both the environment and public health. Additionally, C&D waste dumped on streets and footpaths obstructs vehicular and pedestrian movement, contributing to traffic congestion and posing accident risks.

C&D waste is also a valuable resource when appropriately processed and reused in future construction projects. However, unmanaged C&D waste becomes a primary source of fugitive dust emissions, further deteriorating urban air quality. Percentage composition during construction phase is represented in **Table 7-13**.

Table 7-13: Waste Composition - during Construction Phase

S. No	Constituents	% Composition
1.	Soil, Sand and Gravel	34.99
2.	Brick and Masonry	29.95
3.	Concrete	24.98
4.	Metal	4.97
5.	Bitumen	2.04
6.	Wood	2.04
7.	Other	1.02
Total		100

Source: TIFAC Report "Utilization of Waste from Construction Industry,"

As per the CPCB guidelines on Environmental Management of Construction & Demolition (C&D) Waste, new construction projects generate approximately 40-60 kg of C&D waste per square meter. For the entire construction period of the project, the estimated generation of

C&D waste is approximately 17,650 tonnes (approx. 12 t/day). The construction waste shall be managed as per the Construction and Demolition Waste Management Rules, 2016 and its subsequent amendments. The C&D waste generated will be reused to the extent possible, and the remaining quantity will be disposed of in a manner that does not affect human health or the environment. As per the Rules, if C&D waste generation exceeds 20 tonnes per day or 300 tonnes in a month per project, the waste generator shall:

- Segregate waste into five streams: concrete, soil, metal, wood, plastic, bricks and masonry.
- Submit a waste management plan and obtain prior approval from the local authority before starting construction, demolition or remodelling activities.
- Pay applicable charges for collection, transportation, processing and disposal as notified by the local authority.

C&D waste can be used for backfilling, elevation enhancement, or as a top layer in construction works. Materials with high reuse potential, such as wood frames, unbroken bricks and ceramic items, can be used for temporary or even permanent structures with appropriate treatment. Additionally, C&D waste can serve minor construction applications such as filler material in roofing, wall decorative chips, etc.

Currently, one C&D waste processing facility is operational at Sector 101, Gurugram, with a capacity of 300 TPD, managed by M/s Indo Enviro Integrated Solutions Limited. The waste generator is responsible for transporting and dumping the waste at this facility. This processed waste is converted into aggregate, M-sand, silt, interlocking tiles and bricks. In Delhi, five C&D waste processing facilities are operational at (i) Jahangirpuri, Burari (2000 TPD) (ii) Rani Khara (1000 TPD) (iii) Shastri Park (1000 TPD) (iv) Bakkarwala (1000 TPD) and (v) Mundka (150 TPD).

Mitigation Measures:

- C&D waste should not be mixed with other types of waste and must be disposed of separately.
- All generated C&D waste shall be collected at designated locations and segregated into categories such as soil, inert material (e.g., concrete, bricks, mortar), and recyclables (e.g., plastic, steel etc.)
- Inorganic construction waste such as waste concrete, mortar, leftover aggregate, debris, etc. shall be recycled and used in base layers of paved areas, such as parking zones or road construction or for filling low-lying areas.
- Recycled coarse aggregate may be used in concrete for bulk fill, embankment protection, base or fill for drainage structures, pavements, sidewalks, kerbs, gutters, etc.
- Up to 30% of natural crushed coarse aggregate may be replaced by recycled concrete aggregate.
- The soil will be stacked and used for landscaping; recyclable materials will be sold to authorised recyclers; remaining C&D waste shall be handed over to authorised facilities.
- C&D waste generated from metro construction has high reuse potential once appropriately processed, graded and recycled. It shall be handled and disposed of at the Sector 101 processing facility or as directed by the MCG.

7.4.12 Generation of Plastic Waste

Plastic waste generation during both the construction and O&M phases includes a variety of plastic materials and packaging. During construction, plastic is commonly used in pipework, insulation, wall coverings, flooring, interior fittings, window frames, scaffolding boards and kerbstones. The common sources of plastic waste include construction packaging waste, over-ordering and disposal of offcuts and unused materials, over-specified project designs, improper storage and handling, and packaging from food consumed by construction workers. During the operation phase, waste collection facilities will be set up near the metro line to manage plastic waste. The recyclable plastic waste will be collected and sent to authorized recyclers or EPR agencies, in accordance with the Plastic Waste Management Rules, 2016 and its subsequent amendments. In most municipal corporations, door-to-door collection and segregation of waste is being done through private agencies. All MCs have been directed to setup MRF as required and to manage plastic waste in accordance with the SWM Rules, 2016 and the Plastic Waste Management Rules, 2016. The State is also exploring the possibility of RDF as an energy source. Currently, plastic waste is being used in co- processing in cement plants.

In FY 2022–23, Gurugram generated approximately 25,500 tonnes of plastic waste, all of which was collected and channelized for recycling through approved recyclers.

Mitigation Measures:

- Plastics are categorised into seven types based on their recyclability, properties, and applications. Source segregation must be implemented accordingly to facilitate effective recycling.
- Plastic waste management shall be done in accordance with the Plastic Waste Management Rules 2016 and its amendments.

7.4.13 Generation of E-Waste

The waste generated during the construction and operation of the GMRP includes electrical and electronic equipment listed under Schedule-I of the E-Waste Management Rules, 2022 and its subsequent amendments. This includes information technology and telecommunication equipment, consumer electrical and electronics items, photovoltaic panels and solar modules, refrigerants from air-conditioners and cooling systems, computers, laptops and peripherals, digital displays, announcement systems, wiring and other associated components. In addition, waste batteries and plastic packaging material fall under the purview of the Batteries Waste Management Rules, 2022, and the Plastic Waste Management Rules, 2016, respectively.

Mitigation Measures:

- E-waste shall be transported in compliance with the manifest system.
- All e-waste, including solar panels, shall be sent to recyclers or facilities authorised by the Haryana SPCB.
- An inventory of solar photovoltaic modules, panels, and cells shall be put in place.
- E-waste may be stored for a maximum period of 180 days. Records of e-waste transfer and storage shall be maintained. If required for the development of a recycling or

reuse process, the storage period may be extended up to 365 days with approval from the CPCB.

- E-waste shall not be mixed with municipal solid waste. It must be properly segregated, collected and channelised to registered recyclers or refurbishers.
- All e-waste management practices shall be undertaken in accordance with the E-Waste Management Rules, 2022 and any subsequent amendments.

7.4.14 Generation of Hazardous Waste

Hazardous waste is expected to be generated mainly from the maintenance of equipment and vehicles. This may include used engine oils, hydraulic fluids, waste fuel, spent mineral oils, cleaning fluids, scrap batteries or spent acid/alkali, spent solvents, and potential hazardous materials such as asbestos and silica. Additionally, small quantities of hazardous waste will also be generated from vehicle maintenance activities including liquid fuels and lubricants, hydraulic oils, antifreeze chemicals, spillage control materials (used to absorb oil and chemical spills); machine/engine filter cartridges; oily rags, spent filters, contaminated soil, etc. Improper disposal of such wastes may lead to significant human health risks and environmental impacts.

Asbestos Handling: Asbestos is commonly found in old buildings and structures. During the field study, it was observed that no such structures likely to be demolished as part of the project contain asbestos materials. The Draft Haryana Occupational Safety, Health and Working Conditions Rules, 2021 propose Standard Operating Procedures (SOPs) for the handling and processing of asbestos. However, since these rules are still in the draft stage, they are currently not applicable to this project. In the event that asbestos-containing material is encountered during demolition activities, it will be handled and disposed of in accordance with the Asbestos Management Plan (**Annexure 7.5**) and the provisions of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, and subsequent amendments.

Mitigation Measures:

- The contractor shall develop a comprehensive Waste Management Plan that includes provisions for the safe handling, use, storage, transportation, and disposal of hazardous materials and wastes.
- Adequate containers of appropriate size and number shall be placed at worksites for segregated collection of different waste streams (e.g., metals, rubber, used fuels, batteries). These shall be transported regularly to a centralised storage facility. Only authorized recyclers and treatment/disposal facilities shall be engaged for handling hazardous waste, under prior intimation to the GMRL.
- The contractor shall ensure that all workers handling hazardous materials receive adequate training and information to ensure safe operations.
- Hazardous and other wastes must be clearly labelled, recorded, and stored in impermeable containers for a period not exceeding 90 days, in accordance with applicable handling, storage, and transport guidelines.
- A detailed record of sale, transfer, and storage of hazardous wastes shall be maintained and made available for inspection by relevant authorities.

- Hazardous and other wastes generated shall be either sent to or sold to an authorised user or disposed of at an authorised facility in compliance with the Hazardous and Other Wastes (Management, Handling & Transboundary movement) Rules 2016 and its amendments.
- In the event of any accident at the contractor's facility involving hazardous or other wastes, the contractor shall immediately intimate the State Pollution Control Board via telephone and email, followed by a detailed report in Form 11.

7.4.15 Generation of Batteries Waste

During the construction phase, battery waste shall mainly be generated from battery-powered machinery. In the operation phase, such waste may be generated from UPS systems, inverters and similar equipment.

Mitigation Measures:

- Waste batteries shall be safely stored separately from other waste streams, particularly from domestic or mixed wastes, and away from fire-prone or hazardous areas.
- It shall be ensured that waste batteries are disposed of in an environmentally responsible manner. Disposal shall be carried out through authorized recyclers, either via refurbishment, recycling, or a buyback method, in compliance with the Batteries Waste Management Rules, 2022.

7.4.16 Water supply

A. Construction Phase

The estimated water requirement during the construction phase is approximately 400 KLD. This demand will be met through municipal water supply or recycled treated water from STPs. Groundwater extraction is not permitted for the proposed project, as treated sewage water is readily available within a 10 km radius.

Labour Camps: The establishment of labour camps will begin with obtaining permits from the relevant local authorities for the proposed location. A detailed site plan must be prepared and submitted for approval by the designated engineer or competent authority. Construction of the camps can commence only after obtaining this approval.

In addition, separate permissions for sanitation, wastewater discharge, and overall camp infrastructure must be obtained in accordance with national environmental and health regulations. The employment of labourers must comply with applicable labour laws, including the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996; the Contract Labour (Regulation and Abolition) Act, 1970; the Employees' State Insurance Act, 1948; the Inter-State Migrant Workmen Act, 1979; and the Factories Act, 1948. Registration under the BOCW Act is mandatory to ensure the safety, welfare, and legal protection of workers. Approximately 1,200 workers are expected to be engaged during the construction phase. Accordingly, two labour camps (one for each package) shall be established at appropriate locations, with a capacity of 600 persons per camp. The water requirement across all labour camps is estimated at 162 KLD, with wastewater generation of approximately 130 KLD.

Contractor should provide facilities like uncontaminated water for drinking, cooking and washing, health care, latrines and urinals, system for conveyance, treatment and disposal of sewage and solid waste, adequate and clean washing and bathing places at labour camps. The water requirement will be met from the municipal supply. Wastewater generated at the labour camp shall be disposed of through the municipal sewer with prior permission, through an approved vendor or treated in an STP. Solid waste generated at the camps will be collected and transported to local municipal bins for onward disposal to the treatment site by the municipal corporation.

B. Operation Phase at Stations

Provision of adequate public health facilities, including water supply, sanitation, and toilet facilities, is essential at all metro stations to ensure public hygiene and environmental health. Water supplied for station use shall be treated to meet Indian Drinking Water Standards before consumption. The collection and safe disposal of human waste is a key requirement for good environmental health. Accordingly, safe and efficient sewage disposal systems would be provided at all station locations.

The total estimated water requirement across all stations for the year 2041 is projected to be 760 KLD, which includes both domestic and flushing demands. The water supply will be sourced from the MCG.

Based on standard norms, the daily sewage flow is estimated to be approximately 80% of the total water demand i.e. 608 KLD. At the station buildings, it is proposed to construct a Sewage Treatment Plant (STP) with an MBBR (Moving Bed Biofilm Reactor) system to treat the domestic sewage. At present, this provision is captured in the BOQ of upcoming tender documents of ARC 01 (Architectural work for AC 01 project) and AC 03 packages. The treated sewage from the STP will be utilized for irrigation. Technical details of the STP including the treatment units that will be provided and disposal mechanism of sludge is yet to be finalized. Once the details are finalized, any additional environmental impacts identified and corresponding mitigation measures proposed shall be incorporated in the ESMP. The estimated cost of the STP is provided in **Table 7-14**.

Table 7-14: Cost of installation of STP

S. N.	Description of STP	Cost of one STP	No. of STP	Total Cost
1	STP with a capacity of 10-12 KLD	33,57,401	27	9,06,49,827

Sewage Treatment Plant

The Moving Bed Biofilm Reactor (MBBR) based STP is a compact and efficient system designed to treat domestic wastewater using attached growth biological processes. It utilizes specially designed bio-media suspended in an aeration tank, where microorganisms form a biofilm and degrade organic pollutants in the presence of oxygen.

The treatment process includes screening, equalization, biological treatment in the MBBR tank, secondary clarification, and filtration. Aeration keeps the media in motion and maintains

optimal conditions for microbial activity. The system ensures effective reduction of BOD, COD, and suspended solids, with minimal sludge generation and low maintenance requirements.

Treated water from the STP flows into a storage tank, from which it will be pumped and reused for flushing, gardening and other similar activities. Before reuse, the treated water will pass through simple filters to eliminate odours and any residual suspended particles. The anticipated influent and effluent wastewater quality parameters from the STP, from various peer-reviewed studies, are presented in **Table 7-15**. The effluent characteristics comply with the CPCB discharge standards for irrigation.

Table 7-15: Wastewater Quality Parameters (Influent & Effluent)

S. No.	Parameter	Unit	Influent	Effluent
1.	pH	–	7.0 - 9	6.5 – 8.5
2.	Turbidity	Turbidity	Turbidity	Turbidity
3.	Total Suspended Solids (TSS)	mg/L	90 - 120	≤ 10
4.	Total Dissolved Solids (TDS)	Mg/L	350 - 450	100-300
5.	BOD (3 days @ 27°C)	mg/L	70 - 120	≤ 10
6.	COD	mg/L	250 - 300	≤ 50
7.	Fecal Coliform	MPN/100 mL		≤ 0-12

Source: DRDO Website

7.4.17 Impacts due to Depot

One depot has been proposed at Sector 33 for the GMRP. The depot will have the following facilities:

- Washing Lines,
- Operation and Maintenance Lines,
- Workshop, and
- Offices

The depot area will be levelled through the cut and fill method within the depot. Impacts anticipated at depot sites are:

i. Water Supply

Water supply will be required for different purposes in the depot. Water quantity considered in the depot for train wash is 300 litres per car every 3 days. 80% of water requirement for car wash should be recycled and reused. For different uses about 31.34 KLD of water will be required for Depot. Other water requirements for cleaning the depot, horticulture, flushing urinals and closets will be met from recycled water (which shall conform to the standards expected for such use). The water requirement will be met from the supply water by the Municipal Corporation.

ii. Treatment Plants

ETP: About 19.47 KLD of wastewater will be generated at the Depot, which will be treated through ETP of capacity 30 KLD. The treated wastewater shall be recycled and reused for Car Washing (and other uses above).

STP: The proposed Sewage Treatment Plant (STP) to be constructed at the depot location is designed with a treatment capacity of approximately 21 KLD to handle domestic

wastewater generated from facility operations, employing a biological treatment process based on MBBR/SBR-type technology to ensure efficient pollutant removal and compliance with discharge/reuse standards. The treatment scheme comprises preliminary screening through a bar screen chamber, followed by an equalization tank to homogenize flow and load variations, and an aeration/SBR tank where biological degradation of organic matter occurs under controlled conditions. Subsequent clarification and decanting enable separation of treated effluent, which is further polished through tertiary treatment units including pressure sand filtration, activated carbon filtration, and chlorination for disinfection, ensuring the treated water meets prescribed standards for reuse such as landscaping or non-potable applications. Sludge generated during the process is stabilized in a sludge holding tank and dewatered using a filter press for safe disposal. The system is supported by automated controls (PLC-based operation), ensuring efficient, reliable, and continuous performance with minimal manual intervention.

A lump sum amount of Rs. 200 Lakh has been kept for ETP & STP.

iii. Oil Pollution

Oil spillage during the change of lubricants, cleaning, and repair processes for the maintenance of rolling stock is very common. The spilled oil should be trapped in oil and grease trap. The collected oil would be stored appropriately and disposed of to authorised collectors, to avoid any underground/ surface water and soil contamination. The sludge will be dewatered and transported to the designated landfill sites of the Gurugram Municipal Corporation.

iv. Noise Pollution

The main source of noise from the depot is the operation of the workshop. The roughness of the contact surfaces of rail and wheel, and train speed are the factors which influence the magnitude of rail - wheel noise. Use of ballast-less track with elastic and absorbent fittings is a standard provision for noise control. Use of the green belt of thick foliage helps to reduce noise impact at the depot.

v. Surface Drainage

The surface drainage pattern may change due to levelling of the Depot Site. Suitable drainage measures will be adopted to drain off the area suitably into the nearby water body or drains.

vi. Rainwater Harvesting

To augment the storage of groundwater, it is proposed to construct a rooftop rainwater harvesting structure of suitable capacity in the depots. The annual rainwater harvesting potential of the depot will be 14.31 thousand cum. A lump sum amount of Rs. 40.00 lakh has been kept for rainwater harvesting structures consisting of Gutters, Downpipes, filtration units, storage tanks, piping, pumps, and recharge structures at the depot.

vii. Solid Waste Generation

The solid waste generation at the depot location is estimated to be 30 kg/day. The waste generated from the Depot shall be collected and kept in the designated bins for biodegradable and non-biodegradable waste for onward disposal. Non-biodegradable waste shall be recycled and shall be disposed of through authorised recyclers.

viii. Loss of Trees and Green Belt Development

About 576 trees are to be removed at the proposed Depot. It is proposed to plant ten saplings for each tree to be cut. Compensatory afforestation cost at the depot area is included in **Section 7.7.1**.

The greenbelt development/plantation in the depot area harmonises the depot with the surrounding environment and acts as pollution sink/noise barrier. The estimated cost for green belt development at Depot shall be about **Rs. 11.85 Lakh**.

7.4.18 Carbon Credits for Gurugram Metro Rail Project

The measures used to calculate Carbon Credit for the projects are classified into the following categories:

- A. Emissions due to Energy requirement
- B. Emissions due to reduction in Modal Shift

A. Emissions due to Energy requirement

The GMRP is designed to operate low-GHG-emitting rolling stock, equipped with a regenerative braking system. This system enables the recovery of electrical energy during braking, which is then fed back into the traction system, thereby reducing the net energy demand from the grid. This reduction in grid electricity usage results in energy conservation and contributes to GHG emission reduction.

The gross annual energy requirement for traction and auxiliary power for GMRP is presented in **Table 7-16**. The proposed rolling stock will feature regenerative braking, and it is estimated that 20% of the total traction energy will be recovered through regeneration. Based on this, the projected regenerated energy is 68,530 MWh in the year 2026 and 1,55,510 MWh in the year 2041.

Table 7-16 Energy Requirement

S. No	Item	Unit	MCC to Cybercity		
			Yr: 2026	Yr: 2031	Yr: 2041
1.	Total Energy required per Year (Traction +Auxiliary) (A)	MWh	81,783	1,50,939	1,86,016
2.	Regeneration Energy (20% of total Traction Energy) per Year (B)	MWh	13,253	24,719	30,506
Net Annual Energy consumption (A-B)		MWh	68,530	1,26,220	1,55,510

Source: DPR

CO₂ emissions due to energy consumption (including both traction and auxiliary power) and the reduction through regenerative energy have been estimated using the CO₂ emission intensity of grid electricity as provided in the CMP Toolkit, 2014. The results of the estimation are presented in **Table 7-17**.

Table 7-17 CO₂ Emissions from Energy Requirement (Ton/Year)

Item	Yr: 2026	Yr: 2031	Yr: 2041
CO ₂ emissions due to Total Energy Consumption (Traction & Auxiliary) of Metro Operations	40,074	51,319	35,343

Reduction in CO ₂ Emissions due to Regeneration Energy (20% of total Traction Energy)	6,494	8,404	5,796

B. Reduce Emission per unit Transported Modal Shift from Two, Three and Four wheelers

The daily reduction in vehicle km travelled on road due to the implementation of GMRP is presented in

Table 7-18.

Table 7-18 Daily Reduced Vehicle KM

Mode	Yr: 2026	Yr: 2031	Yr: 2041
Car+Taxi	2,87,564	4,07,127	5,24,586
2W	2,96,509	4,19,625	5,46,585
Auto Rickshaw	3,07,753	4,29,850	5,43,043
Bus	72,276	95,197	1,09,531

The implementation of GMRP is expected to result in a reduction in road traffic, which in turn leads to a reduction in CO₂ emissions. The estimated reduction in CO₂ emissions is presented in **Table 7-19**. These estimates are based on emission factors outlined in the MoUD Policy, 2017.

Table 7-19 Reduction in CO₂ Emissions (Ton/Year)

Mode	Yr: 2026	Yr: 2031	Yr: 2041
Car+Taxi	14,644	20,733	26,714
2W	3,093	4,377	5,702
Auto Rickshaw	8,749	12,221	15,439
Bus	20,781	27,371	31,492
Total	47,267	64,702	79,347

Details of the carbon credits accruing from modal shift, gross energy consumption and regenerative braking system for the year 2031 are summarised in **Table 7-20**.

Table 7-20 Carbon Credits due to Metro Operations

S. No	Item	Carbon Credits (tCO ₂ e/Year)		
		Yr: 2026	Yr: 2031	Yr: 2041
a)	Reduction in CO ₂ emissions due to Modal Shift	47,267	49,910	62,077
b)	Reduction in CO ₂ Emissions due to Regeneration Energy (30% of total Traction Energy)	6,494	8,404	5,796
c)	CO ₂ emissions due to Gross Energy Consumption (Traction & Auxiliary) of Metro Operations	40,074	51,319	35,343
Carbon Credits tCO ₂ e/year: (a)+(b)-(c)		13,687	21,787	49,800

Source: RITES Study

7.4.19 Soil Erosion

Construction activities pose a heightened risk of soil erosion, especially in areas involving extensive excavation and earthmoving operations. For this project, the primary areas of impact are road verges, with minimal disturbance to virgin land.

Mitigation Measures:

Prior to the start of construction, the contractor shall submit schedules to GMRL outlining both temporary and permanent erosion and sedimentation control measures. These measures will apply to activities such as clearing and grubbing, roadway and drainage excavation, and embankment/subgrade construction, especially in open and low-lying areas, near or across water bodies, areas prone to flooding, and sloping terrain. The Contractor shall also submit an erosion and sedimentation control plan, including strategies for the disposal of waste materials.

Visual monitoring shall be carried out during construction, which will include photographic records and site description records. The contractor shall conduct daily inspections, in consultation with GC, to ensure compliance. No construction work shall commence until the erosion/sedimentation control schedules and methods of operations for the relevant construction sections are approved by GMRL. Topsoil from construction areas shall be stripped and stockpiled separately for reuse in landscaping and site restoration. All roads and work areas must be kept clean and free of soil, sand, tools, materials and equipment during and after construction activities.

The Contractor shall be responsible for the integration of all approved permanent and temporary erosion and sedimentation control measures throughout the construction period.

7.4.20 Impact on Waterbodies

The major water bodies that fall within a 10 km radius of the alignment are:

- Sultanpur National Park (Wetland) (Distance from alignment - 8.2 km)
- Najafgarh Jheel (Distance from alignment - 4.7 km)
- Basai Pond (adjacent to alignment & Basai village metro station)
- KBA/IBA in Sector 101, Basai (Spur is at the edge of this area)

No significant impact on water quality is anticipated for Sultanpur National Park and Najafgarh Jheel, as both are located at a considerable distance from the proposed GMRP corridor. Furthermore, a high-density urban buffer, including multiple high-rise buildings, exists between these water bodies and the metro alignment, significantly reducing any potential direct or indirect impact.

The Basai pond is located adjacent to the Basai Village Metro Station. The Basai Village Metro Station is proposed near Basai Pond and the GMRP alignment passing near the pond (Ch. 11690 to Ch. 11789). The total area of Basai Pond is approximately 14,500 sqm. A permanent area of approximately 9.4 sqm may be required within the pond for the installation of three piers, each with a 2-metre diameter.

Construction activities near Basai Pond and KBA/IBA in Sector 101, Basai, may result in:

- Temporary deterioration of water quality
- Increased turbidity and reduction in pond area
- Disruption of natural drainage patterns
- Temporary restriction of cattle access to one side of the pond
- Soil erosion due to excavation, especially during the monsoon

- Potential fuel spills and disposal of construction waste
- Utility bursts (e.g., sewer or drainage lines) near the alignment, causing accidental discharge into the pond

Gurugram experiences four distinct seasons, as outlined in the meteorology section. During the monsoon and winter, sunlight is generally limited, and even in the remaining months. The viaduct is located on the eastern side of the Basai Pond, and as the sun rises in the east, its shadow falls on the pond only during early morning hours, typically for 3–4 hours per day, depending on seasonal sun movement. Given that the width of the viaduct is only 10m, the shadow impact of the viaduct on the pond is negligible.

Mitigation Measures.

- During the detailed design stage, GMRL shall explore the possibility of avoiding pillar placement within the pond. If unavoidable, pillars shall be placed only along the outer edge to minimise any impact on water spread.
- Pond area will be isolated through hard barricading. Measures such as soil bund and silt fence, as feasible, shall be provided to prevent erosion of soil to the pond.
- A temporary on-site drainage system will be constructed prior to the commencement of construction, particularly planned during the lean season when the pond's water level is minimal.
- The construction site shall be isolated using protective sheeting, earth bunds, or sandbag barriers to prevent sediment runoff into the pond.
- Regular water quality monitoring shall be carried out during the construction phase.
- Geo-textile sediment fences shall be used to control the entry of sediment into the waterbody.
- The contractor shall strictly prohibit the disposal of solid or construction waste into the pond.
- Site grading shall be designed so that runoff water flows away from the pond.
- The contractor shall coordinate with utility agencies, maintain quick response teams, and pre-identification of sensitive areas to manage emergencies effectively.

7.4.21 Rainwater Harvesting

To augment groundwater storage, it is proposed to construct rainwater harvesting structures of suitable capacity at all stations and along the alignment. Each pillar can have inbuilt downpipes to collect rainwater runoff from the viaduct, which will be directed into underground storage tanks. The collected rainwater will percolate into the subsoil through filtration layers consisting of sand and gravel, promoting effective groundwater recharge.

Rainwater harvesting assessment has been done for a corridor length of 29.05 km and 27 elevated stations, for which the design has been finalized. Gurugram receives an average annual rainfall of 505.4 mm. Based on a runoff coefficient of 0.85, the estimated annual rainwater harvesting potential from elevated stations and viaduct sections is approximately 1,36,135 cubic meters per year. The estimated capital cost for implementing a rainwater harvesting system is **Rs. 479.90 lakh (USD 507025.88)** for the GMRP corridor. In addition, a lump sum amount of **Rs. 40.00 lakh (USD 42260.96)** has been allocated for rainwater harvesting infrastructure at the depot, which will include gutters, downpipes, filtration units,

storage tanks, piping, pumps, and recharge structures. If monitoring at any stage indicates a potential risk of chemical leaching, especially toward the end of the lifecycle of structural panels, additional measures, such as filtration systems or first-flush diverters, shall be integrated into the rainwater harvesting infrastructure at elevated stations to eliminate any traces of toxic substances.

7.4.22 Light and Shadow

Light and shadow are integral elements in the design of elevated metro stations, influencing safety, wayfinding, aesthetics, user comfort and sustainability. The impact of an elevated metro system in terms of light and shadow depends on various factors such as design, location and the surrounding urban context.

Positive Impacts:

- The elevated metro system can create dynamic and visually appealing shadow patterns, enhancing the aesthetic appeal of urban areas.
- Well-designed artificial lighting systems can improve nighttime visibility, enhance ambience and make stations and adjacent areas feel safer and more inviting.

Negative Impacts:

- The large structures of the metro system can cast long shadows that might reduce natural light in adjacent areas such as roads, curves, public spaces and nearby buildings.
- Reduced sunlight exposure can limit passive solar heating, especially during winter, thereby increasing reliance on artificial heating in adjacent buildings.
- Lower surface temperatures in shaded areas may create cold spots, leading to discomfort for pedestrians and reducing the usability of public spaces.
- Excessive or poorly designed lighting may contribute to light pollution, which can have environmental, health and safety impacts.
- Most riders, particularly two-wheeler users, tend to prefer riding under metro viaducts during sunny or rainy weather, leading to localised congestion in these lanes.

To address and minimize the potential negative effects of light and shadow, the following measures need to be incorporated during the DDC stage:

- **Optimise Structure Height:** Design an elevated metro structure to minimise the height required for safe clearance. Lower structures cast shorter shadows, reducing the impact.
- **Architectural Integration:** Ensure the metro infrastructure is visually integrated with the surrounding built environment to reduce discord.
- **Landscape Design:** Incorporate greenery, trees, and landscaping features around stations to soften visual impact, improve microclimate, and enhance aesthetic appeal.
- **Use of transparent or translucent materials:** Integrate glass, polycarbonate, or other light-permeable materials in roofing or side panels to allow natural light penetration and reduce harsh shadows. Emphasize maximum use of natural daylight in station and viaduct design. Where feasible to avoid design in poorly lit or heavily shaded area to prevent a reduction in ambient light

- **Smart Lighting Systems:** Install intelligent lighting solutions that adjust brightness based on time of day, weather conditions, and occupancy, thereby optimizing energy consumption and enhancing visual comfort.

7.4.23 Impacts due to Solar Panel

Reflectance from solar photovoltaic panels can produce glare, may affect local fauna and cause temporary visual discomfort for nearby residents.

To address solar glare from photovoltaic panels in the GMRP, several effective measures can be implemented, including optimizing panel orientation and tilt to reduce glare angles, applying anti-reflective coatings to glass surfaces and installing physical barriers to obstruct reflected light paths

7.4.24 Impacts due to the construction and operation of Temporary Office and QA/QC lab

Temporary office and QA/QC lab are necessary for construction work. During construction and operation of temporary site offices, buildings and QA/QC laboratories will be provided by the contractor. These may result in localized and short-term E&S risks and impacts. The likely risks and impacts are as follows:

- Minor land disturbance
- Generation of construction and domestic waste
- Risks of soil and water contamination from improper handling of concrete slurry and wastewater.

QA/QC lab activities may generate concrete waste and tested samples, while curing tanks can create conditions for mosquito breeding if not properly maintained. Additionally, there are occupational health and safety risks associated with handling laboratory equipment, and electrical systems, along with potential fire hazards. However, these impacts are temporary, site-specific, and manageable through the implementation of standard environmental management practices, proper waste handling, good housekeeping, and adherence to safety protocols outlined in the ESMP.

7.5 ESS 4: Community Health and Safety

The proposed metro project may have potential health, safety, and security risks, particularly for vulnerable populations residing near the construction sites.

Community health and safety concerns are crucial during the construction phase, as the project corridor runs along high-traffic corridors. Increased risks may arise due to utility shifting, material transport and storage, and heavy construction activities. It is essential to carefully manage safety hazards and inconvenience during this phase of the project.

Construction activities will primarily occur on existing roads, which may lead to traffic congestion and temporary diversions, affecting nearby settlements and daily mobility patterns. The project includes various activities such as labour engagement, use of heavy machinery use, civil construction, and material transportation. These activities may directly or indirectly impact the surrounding communities, particularly in high-density urban and residential areas. While the project will prioritize local employment, the requirement for

specialized skills and technologies may necessitate the deployment of migrant labour during the construction phase. It is estimated that approximately 1,200 construction workers will be employed for a period of 4 years, with about 50% accommodated in labour camps and the rest residing in nearby settlements. The influx of workers can lead to the following risks: an increase in the risk of crimes such as theft and robbery, and risks of GBV/SH. Poor waste management within labour camps may pollute the nearby areas, resulting in health issues. Additionally, the spread of communicable diseases, as migrant workers may introduce infectious diseases, poses a threat to both labour camps and adjacent settlements.

The civil construction phase and associated project activities are expected to contribute to environmental pollution, including air emissions, noise generation, oil and fuel spills, alteration in surface drainage, improper solid waste disposal, and water pollution. These factors may have a direct impact on community health and safety, particularly in densely populated or environmentally sensitive areas.

The project area is located within Zone IV, classified as a high-risk seismic zone under India's seismic zoning classification. All metro structures will be designed using appropriate design technology to withstand seismic forces in accordance with relevant Indian Standards. To avoid hindrance for take-off and landing and to ensure Aviation Safety, certain areas of the local airspace are regarded as integral parts of the aerodrome environment. Obtaining NOC for height clearance is a statutory requirement as per Government of India's Gazette Notification G.S.R 751 (E) and its amendments. All project structures' height is within the permissible top elevation as prescribed by the No Objection Certificate Application System (NOCAS). Hence, permission from the Airports Authority of India is not required for the project.

a. Safety Hazards Due to Increased Traffic and Mitigation Measures

Safety Hazards

Construction activities may pose safety risks to residents, particularly children and the elderly, due to the increased movement of heavy vehicles and construction equipment. This may lead to pedestrian-vehicular conflicts, especially along congested sections such as Hero Honda Chowk to the Start Point of Basai Flyover, Sector 4 & 7 Chowk to Prakash Puri Chowk, Sector 5 Chowk to Ashok Vihar Phase 2 Petrol Pump, Jawala Mill Chowk to the End of Rao Gajraj Singh at NH 48, and Krishna Chowk at Palam Vihar.

Mitigation measures to address traffic-related safety hazards are discussed in Section 7.2.3.

b. Community Exposure to Work Hazards and Communicable Diseases

Communities residing near the project site may be exposed to various construction-related hazards due to the movement of vehicles transporting materials and equipment, the operation of heavy machinery, the use of chemicals, and other associated construction activities. In addition, settlements located along the project corridor are particularly susceptible to heavy waterlogging and urban flooding during periods of rainfall.

Risks

1. Pedestrian safety risks during both construction and operational phases, especially near metro stations and during utility shifting.
2. Increased risk of traffic hazards and incidents.

3. Injuries and accidents resulting from unauthorized access or trespassing at construction sites.
4. Injuries, accidents, and property damage caused by waterlogging and urban flooding.
5. Increased risk of respiratory illnesses due to dust and air pollution.
6. Health hazards from poor sanitation and inadequate drainage in labour camps.
7. Risk of spreading or increasing incidence of communicable and vector-borne diseases such as COVID-19, Tuberculosis, Hepatitis C, Dengue, Malaria, and Chikungunya.
8. Personal safety and well-being impacts associated with worker influx.
9. Noise and vibration risks and impacts caused by vehicular movement, construction works, machinery, generators and operational activities.
10. Risk of chemical and sludge spills during transport through or near residential areas.
11. Safety risks associated with poor housekeeping, such as improper storage of materials, tools, and equipment at construction sites.
12. Influx of predominantly male workers heightens SEA/SH risks to women and children near construction sites.
13. Potential for project workers to establish exploitative or transactional relationships with economically vulnerable community members, especially with women and children.
14. Heightened SEA/SH risks create unsafe environments for women and girls near project sites, particularly during early morning and late evening hours when visibility is low.

Mitigation Measures

1. Barricade and fence the work areas using sturdy materials to restrict unauthorized community access to the construction sites.
2. Ensure safe and uninterrupted access to residential and commercial establishments. Where technically and financially feasible, universal access provisions shall be made.
3. Install adequate signage and deploy flagmen to guide the community away from construction zones.
4. Implement a traffic management plan to ensure smooth vehicular and pedestrian movement.
5. Install adequate lighting across work areas, pathways and common facilities to enhance visibility and deter incidents.
6. Conduct awareness programs on community health and safety, including safe road usage protocols.
7. Organise regular medical check-up camps near settlements.
8. Establish tie-ups with nearby hospitals for routine checkups and emergency services.
9. Integrated Pest Management, including regular monitoring of pest and vector populations, use of non-chemical control methods (biological and cultural practices), and minimal use of chemical treatments. Additionally, measures include eliminating breeding sites, safe insecticide use, and community awareness programs.
10. Conduct awareness camps on the prevention and control of STIs, communicable diseases, and vector-borne diseases.
11. Undertake regular cleaning of drains, especially in areas prone to urban flooding and waterlogging.
12. Use of dewatering pumps to effectively remove stagnant water from the affected area.

13. Raise community awareness about preventive measures such as keeping doors and windows closed during construction-related dust emissions.
14. Implement alternative working hours (e.g. early morning or staggered shifts) to minimize disruption during sensitive times like school hours, prayer times, or community events.
15. Restrict construction activities near residential areas during nighttime hours (10:00 PM and 6:00 AM). If noise levels exceed permissible limits, mitigation measures outlined under S. No. 6 of Section 7.3.3 Will be implemented.
16. Surface the roads used for transporting materials to the site and implement dust suppression measures, such as regular water spraying or the use of non-toxic dust suppressants, to minimize dust emissions from vehicle movement.
17. Establish mechanisms to receive, acknowledge, and address community grievances and feedback effectively.
18. Implement mandatory CoC for all workers with SEA/SH clauses and penalties.
19. Prohibit transactional relationships via contract clauses and community sensitization.
20. Install adequate lighting, CCTV and security personnel at sites, camps and access routes. Enforce no-access zones during low-visibility hours.
21. Strict action against the offender as per CoC signed by the workers.
22. Include SEA/SH GM into the overall project-level GM

With the implementation of the above mitigation measures, the residual impacts on the community are expected to be minimal.

c. Risks & Impacts of Labour Influx and Mitigation Measures

Risks

It is estimated that about 1,200 construction workers will be engaged in project-related construction activities. The influx of labour can potentially lead to a variety of social risks and impacts. The common risks associated with labour influx are as follows:

1. Risk of conflict between workers and communities
2. Increased risk of illicit behaviour and crime
3. Increased burden on and competition for public service.
4. Increased risk of communicable diseases and burden on local health services
5. Risk of GBV/SH
6. Increased pressure on accommodations and rents

Mitigation Measures:

1. Prior to the commencement of construction activities, the contractor will prepare a LMP for approval by GMRL.
2. A CoC has been developed to regulate the worker behaviour on site, in labour camps, and within the surrounding communities. Also, CoC is included in the Tender Document.
3. Information on the CoC will be provided in the local languages to ensure accessibility and understanding.
4. SEA/SH risk mitigation plan includes a program to raise awareness among construction workers about respecting local communities.
5. Cultural sensitization training will be conducted to guide workers in appropriate engagement with local communities.

6. Establish designated leisure areas within workers' camps to discourage workers from visiting community leisure spots.
7. Strict disciplinary actions (e.g., dismissal) will be enforced for workers found engaging in criminal activities.
8. Enforcement of laws against drug abuse and human trafficking.
9. Awareness sessions will be organized for workers and local communities on issues such as illicit behaviour, substance abuse, prostitution, and GBV.
10. Adequate services and facilities will be provided within the labor camps to minimize reliance on local community infrastructure.
11. Awareness programs shall be conducted for both workers and the local community to prevent disease transmission.
12. Provide separate, well-maintained toilets and changing facilities for male and female workers to ensure privacy and safety.
13. Ensure adequate lighting at labour camps.
14. Implement mandatory CoC for all workers with SEA/SH clauses and penalties. Conduct pre-employment GBV sensitization training and regular awareness campaigns.
15. Include SEA/SH GM in the overall project-level GM.

With the implementation of the above mitigation measures, the residual impacts associated with labour influx are assessed to be minimal.

d. Risk of Gender-Based Violence and Proactive & Preventive Measures

Risks

The construction workers, predominantly composed of young males, often operate away from their families and outside their usual social environments. Such circumstances may increase the risk of GBV/SH, particularly in interactions between workers and the local community, including female residents. During the operational phase, GBV-related risks may include harassment or abuse on trains, within station premises, or in nearby areas, potentially affecting both passengers and GMRL Staff.

Proactive & Preventive Measures

1. Ensure GM to address SEA/SH complaints, with confidential reporting channels, trained focal points, and timely resolution protocols for women working at the construction sites.
2. Mandatory training and awareness programs for all construction workers on GBV and SEA/SH issues
3. Integration of a clearly defined CoC into all employment contracts.
4. Collaboration with local law enforcement agencies to ensure effective response mechanisms.
5. Special safeguards for vulnerable groups, particularly women and children, to be implemented throughout the project lifecycle.
6. Incorporation of gender-sensitive design features during the planning and design stages of the metro infrastructure.
7. Community sensitization campaigns, especially targeting women and girls, to raise awareness of safety measures and reporting mechanisms.
8. Installation of CCTV surveillance systems across metro stations and trains.

9. Provision of well-lit station platforms, entrances, and surrounding areas.
10. Deployment of trained security personnel, including female staff, to ensure a safe and secure transit environment.
11. GBV service provider mapping will be conducted to link the GMs, and an accountability framework will be developed for the project.
12. GMRL ICC shall address SEA/SH cases at both GMRL and project levels.

7.5.1 Visual Intrusion

The proposed metro's alignment and stations are elevated, which may result in some degree of visual intrusion. However, the use of sleek and modern structural elements in the elevated metro design can contribute to an aesthetically appealing urban landscape. During the DD stage, the viaduct and station structures will be carefully designed to minimize visual intrusion.

7.5.2 Flood Protection

At the detailed design stage, the flood risk assessment considerations have been incorporated into the project design. The design is being done based on the HFL data collected from the local body for the last 25 years in the project area. Station boxes, entry/exit points and related infrastructure comply with Clause 12.1 of the National Building Code (NBC), which mandates that "the height of the plinth shall be not less than 450 mm above the surrounding ground level". Sub-structure & foundation designs follow IRS Code of Practice for Design of Sub-Structures and foundations of bridges & IRC:78 Sub-structure & foundation."

Construction activities may disrupt the natural drainage system, resulting in localized flooding or the submergence of low-lying areas. Run-off during both construction and operation phases may become contaminated, impacting the surrounding environment. Measures need to be implemented to integrate the natural drainage features into the project's design.

Addressing storm water stagnation at critical points near the GMRP alignment during both construction and operation phases is crucial to prevent flooding, structural damage, and to ensure public safety.

Mitigation Measures:

- A. During Design Phase:
 - Rainwater harvesting structures to be designed for alignment, stations and depot.
 - All structures shall be constructed above the high flood level. Adequate flood protection measures shall be provided for all key installations, including electrical systems, labour camps, and storage facilities for materials, chemicals, and fuels.
 - Ensure permeable pavements.
- B. During Construction Phase:
 - Temporary drainage systems, such as cut-off storm drains, are to be installed to divert stormwater away from construction sites.
 - Adequate grading and sloping shall be ensured to facilitate proper stormwater flow.
 - Erosion control measures such as silt fences, sedimentation basins, and erosion control blankets shall be implemented to prevent sedimentation in drainage channels.

- Exposed soil surfaces shall be stabilized using vegetation or suitable synthetic covers.
 - Portable pumps shall be used to remove stagnant water from low-lying or flood-prone areas during heavy rains.
 - Temporary flood protection measures, such as sandbags or water-filled barriers, shall be installed to protect construction zones.
 - The contractor shall prepare and implement a stormwater management plan that includes a silt basin, sediment collection mechanisms, and proper disposal systems for construction yards and labor camps.
 - Regular inspections and maintenance of temporary drainage systems and erosion control measures.
- C. During Operation Phase:
- Trees and vegetation shall be planted to increase absorption and reduce surface runoff at the depot location.
 - A regular schedule for maintenance and cleaning of the drainage network shall be established to prevent clogging and ensure effective stormwater flow.
 - Promptly inspect and repair any damage to drainage infrastructure.
 - Coordination with ULB and relevant water management authorities shall be maintained to ensure stormwater management and compliance with regulations.
 - Participate in regional stormwater management initiatives.

7.5.3 MMI Infrastructure & FLM Connectivity

MMI focuses on integrating different modes to facilitate seamless travel for commuters. It can generate some risks as well. The probable risks associated with MMI have been identified and their mitigation measures are as under:

Risks:

- a. Crowding on FOBs, skywalk entries, AFC Gates
- b. Fire risks from electrical systems.
- c. Increased slip and fall incidents on wet or uneven surfaces
- d. Noise pollution due to honking
- e. Traffic congestion, vehicular and pedestrian conflict
- f. Waterlogging around the facility during the monsoon season
- g. Overcrowding because of haphazard parking by IPT modes

Mitigation Measures:

- a. Implementation of effective access and dispersal plans for commuters.
- b. Deployment of traffic marshals during peak hours and heavy rainfall events.
- c. Adequate lighting along all access routes, including during low-visibility conditions.
- d. Installation of weatherproof and waterproof electrical systems, including EV charging points.
- e. Designated all-weather IPT bays and parking areas.
- f. Incorporation of rain shelters and covered walkways for pedestrian comfort.

- g. Display of proper signage, including prohibitory signage on honking/no-smoking/loud music, public announcements, etc
- h. Facilities for PWD including ramps, access, wheelchairs, etc.
- i. Dedicated pathways for access and dispersal of passengers.

7.5.4 Impact on disadvantaged and vulnerable persons

A census & socio-economic survey have been conducted among the project-affected families for the GMRP. Vulnerable persons identified for this project include families or households headed by women, people with disabilities, families living below the poverty line (extremely poor), widows, and persons above the age of 60 years, irrespective of their title status (ownership). The social survey findings reveal that approximately 82 vulnerable persons are likely to be affected. This includes four (3.31%) individuals who are differently abled, 56 (46.28%) elderly people, 17 (14.05%) widows, 39 (32.23%) SC, four (3.31%) women-headed households (WHH), and one (0.83%) person living below the poverty line (BPL). Mitigation measures and interventions for impacted vulnerable households are incorporated in the RAP.

Also, vulnerable passengers who will travel by metro may face issues during their journey. To address this, the DDC shall incorporate the following design features into the project to provide support:

- Gently sloped ramps with gradients ranging from 1:15 to 1:17 for wheelchair users.
- Lifts and escalators for persons with disabilities and elderly people.
- Tactile paving to guide visually impaired individuals.
- Women's security staff and women's helpline number for female passengers.
- Sign language training for frontline staff (Customer Relations Assistants) to assist hearing-impaired and mute (deaf and dumb) passengers.
- A public address system and CCTV for all users, with a particular focus on aiding the visually impaired.
- Toilets for the physically challenged at all stations and the depot
- Provision of Stretchers at Stations to assist those who are sick/unwell/got injured.

7.5.5 Dark Spots

Safety Concerns

- **Crime and Security:** Poorly lit or unmonitored areas can become hotspots for criminal activities such as theft, vandalism, and assault.
- **Tripping Hazards:** Inadequate lighting at stations and platforms increases the risk of trips, slips, falls, and collisions, particularly during nighttime or low-visibility conditions.
- **User Experience:** Dark and poorly lit areas can create a perception of insecurity and discomfort, affecting passenger confidence and ridership experience.
- **Accessibility:** Inadequate lighting can affect the accessibility of metro facilities for passengers with visual impairments.

Operational Challenges

- **Maintenance Issues:** Dark spots may hide maintenance issues, structural damage, or safety hazards, making it difficult for maintenance teams to identify and address problems promptly.
- **Emergency Response:** In the event of an emergency such as a fire, health incidents, or security threats, dark spots can impede rapid response and safe evacuation.

Following measures shall be implemented to reduce and mitigate the impacts due to dark spots:

- Ensure a uniform and adequate smart lighting system throughout metro stations, platforms, access points, and surrounding areas to eliminate dark spots, especially during evening and night hours.
- Utilize energy-efficient lighting fixtures with occupancy sensors, timers, and daylight-responsive controls to optimize lighting levels while conserving energy and ensuring safety.
- Incorporate backup lighting systems, illuminated signage and uninterrupted power supplies to support safe evacuation and emergency response operations.
- Install and maintain security cameras, emergency call boxes, and alarm systems to deter crime, monitor passenger safety, and facilitate rapid response to incidents.
- Implement regular security patrols, provide training for security personnel, and community engagement initiatives to enhance the perception of safety and vigilance among metro users.

7.5.6 Seismicity

If seismic risks are not adequately addressed during the design and subsequent operations of the metro project corridor in Gurugram City (Zone IV), the potential impacts could be severe. Failure to incorporate seismic considerations can increase the vulnerability of infrastructure to earthquake-induced damage, compromising structural integrity and endangering public safety. Additionally, there is potential for soil liquefaction and landslides during seismic events, which may further impact construction and operations. The key potential impacts are:

1. **Structural Failure:** Increased risk of collapse or severe damage to metro structures during earthquakes, endangering the safety of passengers and staff.
2. **Injury and Loss of Life:** Higher likelihood of fatalities and injuries due to insufficient seismic resilience.
3. **Service Disruption:** Prolonged interruptions in metro operations, leading to increased traffic congestion and reliance on alternative transportation modes.
4. **Economic Consequences:** Significant financial losses resulting from repairs, compensation claims, and decreased ridership in the aftermath of seismic events.

These risks highlight the critical need for incorporating robust seismic engineering practices to ensure the safety, reliability, and continued community confidence in the metro system.

Mitigation Measures:

- **Seismic Design Standards:** DDC, GC and Contractor shall implement robust seismic design standards in compliance with IS 1893 to enhance structural resilience.

- Regular Inspections: GMRL should conduct regular inspections and maintenance of infrastructure to identify and rectify vulnerabilities.
- Emergency Preparedness: Contractor shall develop and implement comprehensive emergency response plans to ensure swift action during seismic events.
- Design layouts should also integrate designated open spaces or refuge areas for safe evacuation.
- Retrofitting Strategies: GMRL should plan for future retrofitting of existing structures.

7.6 ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement

The project will require the acquisition and transfer of land (permanent and temporary) for the construction of the proposed corridor, stations, and depot. The cut-off date for legal title holders will be the date of Notification under GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations. For non- titleholders, the cut-off date has been set as the completion date, i.e., 14.02.2024, of the survey, which was done from December 2023 to February 2024. Cut-off date details of the survey have been provided in the Resettlement Action Plan (RAP). This was communicated to the affected people during the survey and consultation process. People moving into the project area after the cut-off date will not be entitled to any assistance. A total of 121 NTH are likely to be affected by the project, of which 22 NTH were not available during the survey despite multiple attempts to cover them. However, some flexibility will be considered during implementation to take into account any non-titled-holders who were identified but unavailable during the survey and owned assets within the project footprint prior to the cut-off date.

A. Land Requirement

The proposed metro project requires 44.71 ha of land, which includes 23.71 ha of permanent land and 21 ha of temporary land (required for casting yards). Permanent land includes 22.17 ha government land and 1.54 ha of private land. The details of the land requirement are provided in **Table 7-21**.

Table 7-21 Details of Land Requirement (in ha)

Ownership	Station & Viaduct	Maintenance Depot	Casting Yards	Total
Government	3.80	18.37	21.00 ¹⁴	43.17
Private	0.68	0.86	0	1.54
Total	4.48	19.23	21.00	44.71

Wherever land or permanent structures are required to be purchased or acquired for metro construction, land or property will be purchased through the provisions of the GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations. A preliminary

¹⁴ The temporary casting yard land is recently handed over to GMRL, therefore ESIA Study is not carried out for the said land. However, GMRL has appointed an independent agency to audit (including tracer study) civil work packages i.e. AC01, AC04 and the Casting Yard at Sector 33, Gurugram, as per the World Bank ESF. ESMP and RAP will be updated accordingly, incorporating required mitigation measures as per the approved entitlement matrix and the audit findings.

notification for the acquisition of 1.09 ha (10,883.37 sq. m.) of land for AC01 and AC04 (Metro Depot) was published in newspapers and on the GMRL website on 27.03.2026. The entitlement provisions under the RFCTLARR Act, 2013, in lined with ESS5 are outlined in the RAP.

Although the number of affected titleholders is low, there remains a significant risk of grievances being raised, which could potentially cause delays in the project's construction schedule. Therefore, the impact of land and property acquisition during the construction phase is considered major.

B. Impact on Structures

The findings of the census and socio-economic survey revealed that 210 structures are likely to be affected in the project corridor. Among these structures, there are 14 title-holder structures, two informal settlers' structures, 91 informal occupiers' structures, 44 with licenses issued by MCG, one holding an Excise & Taxation Department License for a wine shop, one trust structure, 52 government structures, one religious structure, and four community structures. The affected structures are mostly small in size, and the extent of impact has been assessed based on the percentage of the area affected. Accordingly, where the impact exceeds 10%, the structures are deemed no longer viable for use and are therefore considered fully affected. A detailed representation of the typology of the affected structure and extent of the impact is presented in **Table 7-22**.

Table 7-22 Details of Affected Structures

Affected Properties	Typology of Impacted Structure			Extent of Impact*						No. of Impacted Properties
	K	P	S-P	<1 0 %	11 - 20%	21 - 40%	41 - 60%	61 - 70%	>71%	
Title Holders (TH)	0	13	1	2	1	3	3	1	4	14
Informal Settlers	1	-	1	1	-	-	-	-	1	2
Informal Occupiers	73	15	3	-	2	3	8	-	78	91
License issued by MCG	43	-	1	-	-	-	-	-	44	44
License issued by Excise & Taxation Department, Haryana	-	-	1	-	-	1	-	-	-	1
Trust	-	1	-	1	-	-	-	-	-	1
Government	10	17	25	2	-	1	-	-	49	52
Religious	-	1	-	-	-	-	-	1	-	1
Community	-	3	-	1*	-	-	-	-	3	4
Total										210

Source: RITES Field Studies

(K: Kutch, P: Pucca, & SP: Semi-Pucca)

*Basai pond is not considered in the typology of affected structures

Among the 210 affected structures, 20 are residential, comprising five houses belonging to TH, three houses, and 12 huts resided by NTH. There are 126 commercial structures, including 24 shops (06 TH and 18 NTH), one TH office (political party office), one wine shop license

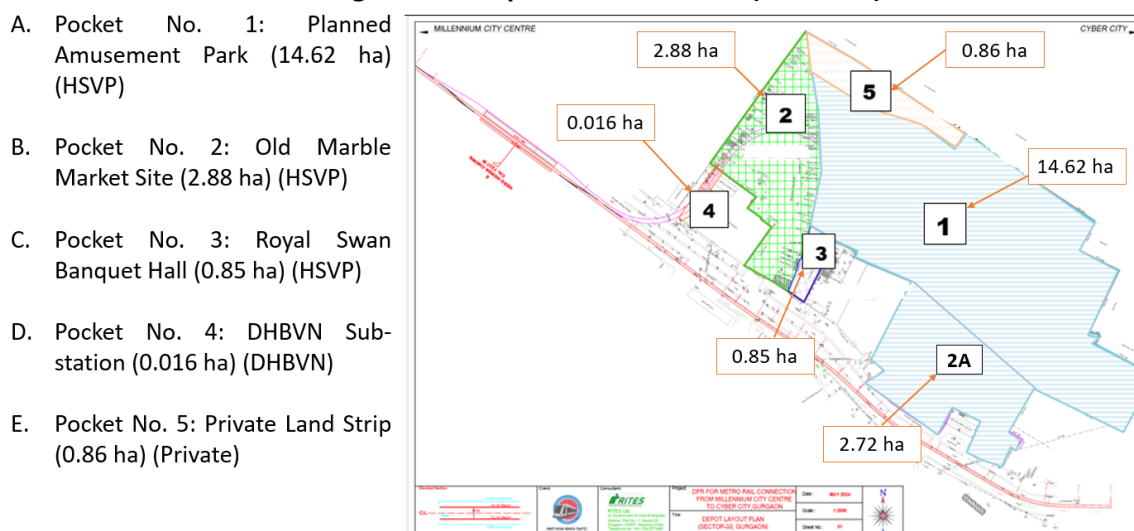
issued by the Excise & Taxation Department, Haryana, and 101 kiosks operated by NTH, which consist of one informal settler (encroacher), 56 informal occupiers (squatters), and 44 licensed from MCG. Additionally, four NTH structures serve both residential and commercial purposes and three other structures (two are boundary walls and one under construction). The list of affected private structures is placed at **Annexure 7.6**.

Furthermore, 57 other structures comprising government, community, and religious will also be impacted by the project. Of these, 52 are government structures, including 32 bus stops, eight boundary walls, and 12 other structures. In addition, one religious structure (temple) and four community properties (one pond and three water tanks/ATMs) are likely to be affected. The list of government, religious and community structure is placed at **Annexure 7.7**.

C. Details of Land Identified for Metro Depot (Sector 33)

1. DPR of GMRP envisaged a small stabling depot at Sector 101 as it planned its operational integration with Rapid Metro. However, with the approval of GMRP as an independent system, a full-fledged depot was required to meet enhanced operational requirements. GMRL subsequently planned a full-fledged Depot-cum-Workshop at Sector 33, covering a total area of 19.23 ha of which 18.37 ha is government land (HSVP owned) and 0.86 ha is (private land).
2. The depot land identified at Sector 33 have five land pockets. **Figure 7-3** shows the details of land pockets required for metro depot.

Figure 7-3: Required Land Pockets (Sector 33)

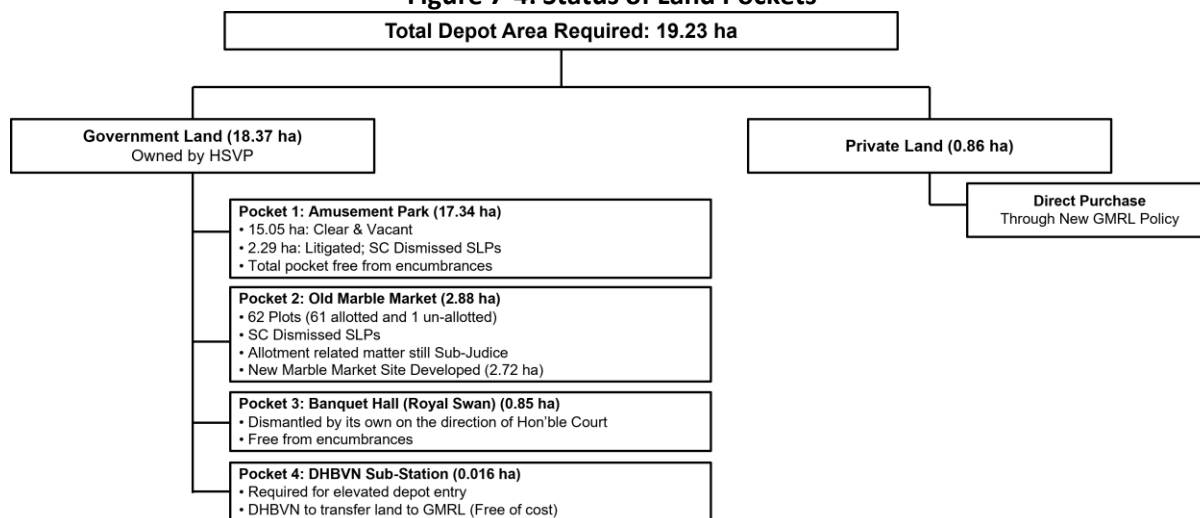


3. A total of 19.23 ha of land is required for the development of metro facilities. Except for Pocket 4, where DHBVN ESS is located, all land pockets are required in full. In pocket 4, the land requirements are only for the placement of pillars for depot entry.
4. In the past, the land parcels in Pockets 1, 2, 3, and 4 were acquired by HSVP by paying due compensation for land, structures, and other assets to the respective owners for the development of Sector 33.

Present Status of Land Pockets (Sector 33)

The current status of the land pockets is presented in the following section, with detailed information are provided in **Annexure 7.8**. A summary is shown in **Figure 7-4**.

Figure 7-4: Status of Land Pockets



➤ **Pocket No. 1: Planned Amusement Park (Total: 17.34 ha and 2.29 ha - Under litigation)**

- Case No.: CWP No. 23543 of 2015 titled Vinod Kumar & Ors. Vs State of Haryana, and CWP No. 28056 of 2017 titled Bhagwan Singh & Ors. Vs State of Haryana.
- HSVP acquired the land for an amusement park from landowners by paying them due compensation. Compensation was paid directly to 33 landowners and for 223 landowners amount was kept in LAC Account.
- The petitioners challenged the acquisition of their land, seeking de-notification or release on the grounds that the acquisition proceedings had lapsed under Section 24 (2) of the RFCTLARR Act, 2013.
- Hon'ble High Court, in its judgments dated 13.02.2025 and 26.03.2025, dismissed the above writ petitions and upheld the land acquisition as valid and acquired for public purpose.
- The Special Leave Petitions filed before the Hon'ble Supreme Court of India against judgments dated 13.02.2025 and 26.03.2025 have also been dismissed on 07.05.2026 and 01.04.2026, respectively. Thereafter, HSVP got the 2.29 ha land vacated.

➤ **Pocket No. 2: (Marble Market: 2.88 ha - under litigation)**

- Case No.: CWP No. 10317 of 2004 titled Narender Mohan Kapoor Vs State of Haryana.
- The marble merchants were earlier located at Sikandarpur Ghosi and Sheetla Mata Mandir Road, which were not recognized locations. HSVP invited the applications through public advertisement dated 03.11.2003 and corrigendum dated 19.11.2003 for shifting them to a recognized and planned area in Sector 33-34, Gurugram.
- A total of 152 plots/shops were allotted in the Marble Market in Sector 33 & 34, of which 86 shops were allotted with a plot size of 206.25 sqm, and 66 shops were allotted with a plot size of 600 sqm. Marble Market in Sector 33 had 62 shops of 206.25 sqm size only, and the remaining plots/shops are in Sector 34. Out of 62 plots, 61 plots were allotted and 1 remained unallotted. The construction on the allotted plots was the responsibility of the respective allottee.

- d. Out of 61 allotted plots, 1 omitted /cancelled, 51 land plots had structures, while 09 land plots remained vacant.
- e. Most of the marble traders retained their shops in Sheetla Mata Mandir Road, and Sikhandarpur Ghosi got a new plot allotted in Sector 33 & 34. They continued their operation from all three locations.
- f. The allotment has been under challenge since 2004 in the Hon'ble Court by non-successful applicants for the subject matter on the grounds of arbitrariness and mala fides on the part of the scrutiny committee in the allotment process. The allotment-related matters in Pocket 2, however, remain sub judice
- g. At the time of allotment, the cost of the plot of 206.25 sqm area was Rs. 14,90,841/- (@ Rs.7,228.32 per sqm). Most of the allottees have paid 25% of the cost of the plots, while balance amount still remains outstanding since the allotment in 2004.
- h. The market had 51 structures, 25 had one or two rooms, 11 had rooms with tin sheds, 13 had only tin sheds, and 3 had permanent construction. The Constructions raised by the shop owners are not recognized as the same, as they were raised without paying the full cost of the plot, getting any building plan passed, or obtaining occupation certificates from the authority.
- i. Notice for vacating the area was issued to marble traders on 26.12.2025. A copy of the notification is also attached in Appendix 1. Also, Notices were pasted on individual shops, and announcements were made through the AV System in the area.
- j. After giving due notice to the traders, HSVP carried out demolition of shops from 29.12.2025 to 08.01.2026, ensuring no damage to the material stored in the shops.
- k. Despite the above issues, HSVP has developed an alternate site approximately 200 mts from the old site at the cost of Rs. 7.50 Crores to accommodate the existing Sector 33 Marble Market allottees/shop plots with all basic amenities like parking, pavements, roads, water supply, sewerage, etc. The allottees have not been charged for the alternate site at Sector 33.
- l. Shops of the same size and the same site number were given, and possession was handed over simultaneously to the affected marble traders. HSVP also published the tender in December 2025 to develop the market area with all basic amenities like parking, pavements, roads, water supply, sewerage, etc.
- m. The SLPs (Civil) No. 2953/2026 and 3403 of 2026, filed in relation to resistance to shifting have been dismissed by Hon'ble Supreme Court of India dismissed dated 27.01.2026.
- n. As of 01.06.2026, 28 allottees have constructed shops and shifted to new marble market and started operations.

Conclusion on Marble Market

- a. Earlier, the ESIA study carried out for the GMRP considered Marble Traders as PAP, but due to non-cooperation from them on the plea of the marble market case being sub-judice, the socio-economic impact assessment could not be completed.
- b. The old marble market was vacated during the period from 29.12.2025 to 08.01.2026, while the process for development and allotment of the alternate marble market site was being finalized simultaneously.
- c. During the period, only the constructed structures were dismantled, and no damage was caused to the marble and tiles stored in the shops. Subsequently, the plots in the new marble market were handed over within 15 days. As of 12.05.2026, 21 allottees have shifted and started their business operation from the new site, and the remaining are

- either operating from their other shops at Sheetla Mata Mandir Road/ Sikandarpur Ghosi/ Sector 34 or from Sector 33 despite eviction by HSVP from the old site.
- d. The remaining 40 allottees are constructing shops on the new allotted site/ or in the process of shifting to the new marble market site.
 - e. This is pertinent to mention here that the marble traders have not paid the full amount towards the land parcels allotted to them and have been in possession of the said land since 2004 without payment of the total cost of the land.
 - f. Despite outstanding dues, HSVP developed the alternate site at their own cost of approximately **Rs. 7.50 crores** to facilitate the shifting of the marble traders. Further, no charges have been levied upon the marble traders for relocation to the new site.
 - g. The Marble Market traders have been treated as non-title holders because they have not yet paid the full cost of the plots allotted to them in 2004. The relocation of Marble Market traders from their original site to the alternate site has resulted in the following impacts:
 - Loss of livelihood during the period when their establishments remained non-operational.
 - Damage to the shop structure during demolition drive.
 - h. In accordance with World Bank ESS5 and GMRL's approved Entitlement Matrix for non-title holder PAFs, the traders are economically affected and are eligible for:
 - Compensation for damaged shops/structures based on the PWD's scheduled rates;
 - R&R assistance as specified in GMRL's Entitlement Matrix for non-title holder PAFs.
 - i. As the Marble Market falls under the jurisdiction of HSVP and there is ongoing litigation between HSVP and the traders, HSVP will establish an escrow account with the initial deposit of Rs. 3 Crore for payment of R&R assistance and compensation to affected NTHs. The deposited amount will be adjusted for inflation by indexing it to the CPI prevailing in the month and year of actual payment prior to disbursement. Disbursement from the escrow account will be made following direction of the Hon'ble court.
 - j. This payment through escrow arrangement and disbursement under court direction safeguards the timely compensation and R&R assistance to affected NTHs.
 - k. The new marble market site photos are provided in Figure 7-5

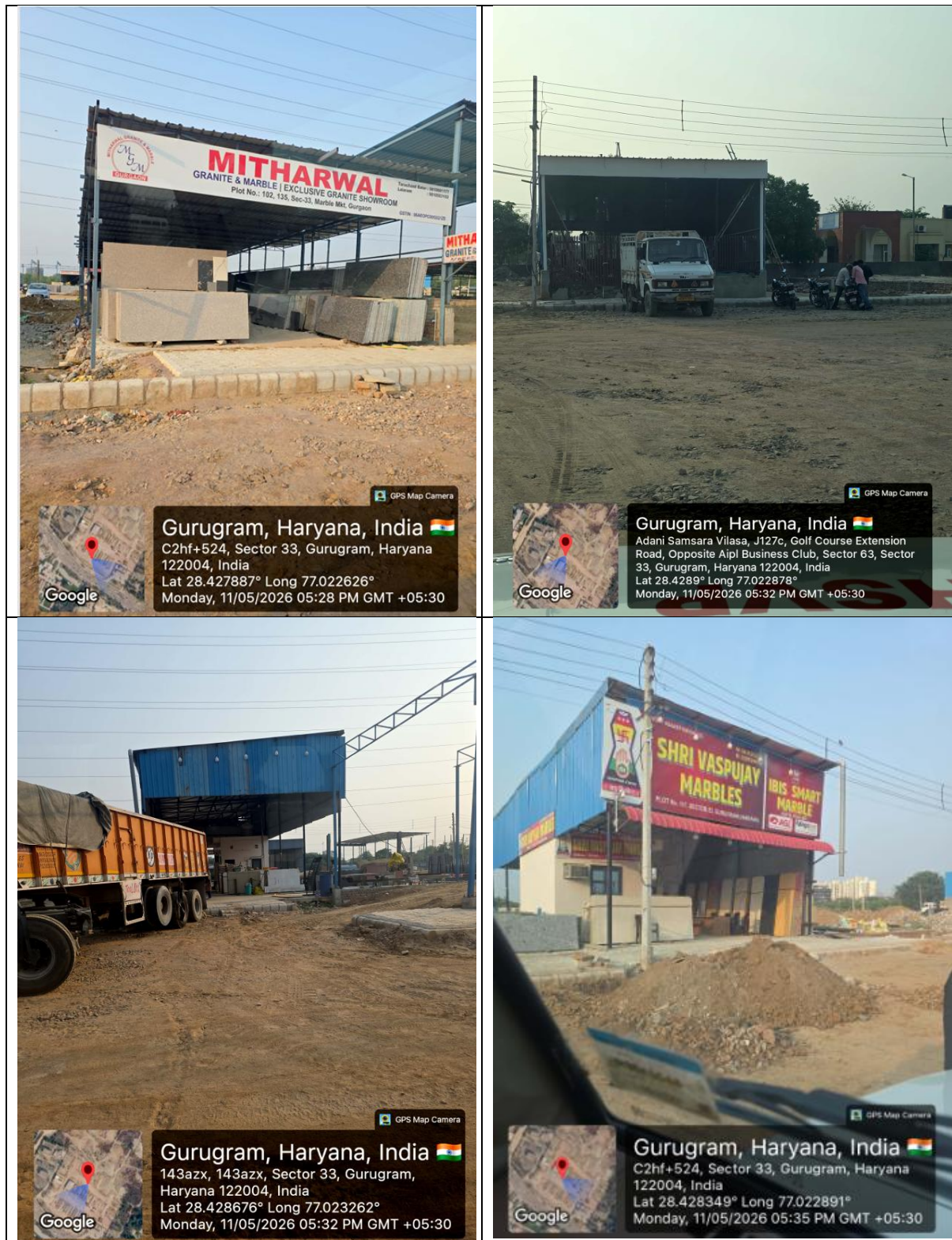
➤ **Pocket No. 3: Royal Swan Banquet Hall (0.85 ha was under litigation)**

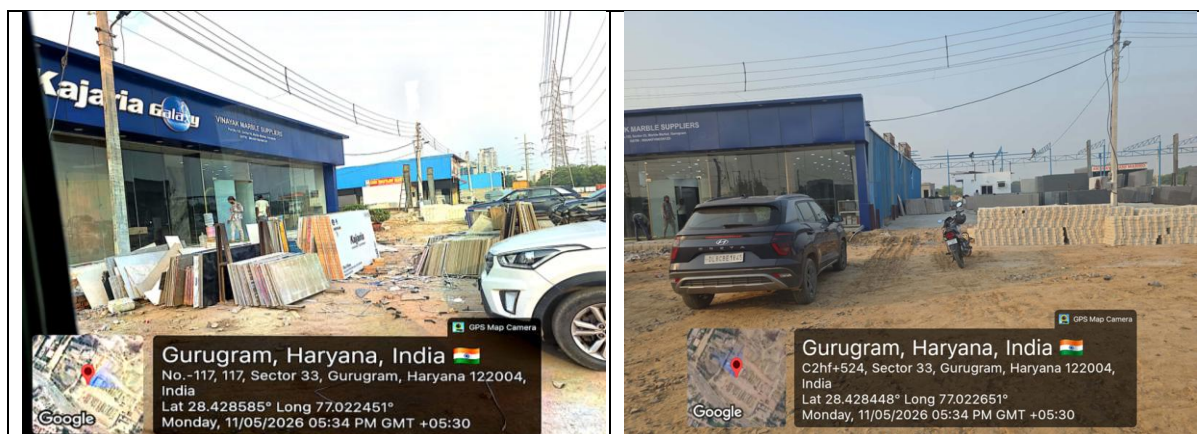
- a. Case No.: CWP No. 12998 of 2006 titled Mukesh & Ors. Vs State of Haryana
- b. The plot of land was acquired by HSVP for the purpose of the development of Sector 33 by paying compensation for the land dated 27.11.2006 as per the LA Act, 1894.
- c. The HSVP could not take possession of the acquired land as the Hon'ble High Court gave a status quo order dated 26.09.2006 on the acquired land.
- d. The land was lying vacant and an encroacher constructed a banquet hall (Royal Swan) in violation of Hon'ble High Court Status quo order without any permission and despite pending litigation.
- e. HSVP filed applications in CWP No. 12998 of 2006, the Hon'ble High Court took cognizance of the same and asked the litigant itself to vacate the same and HSVP to take the possession.
- f. The encroacher requested the hon'ble court in the interest of its customer who made booking and paid advance payment and to carry out the commercial activities on land the in question till 01.04.2026.

- g. The hon'ble court in their order dated 06.03.2206 granted permission till 01.04.2026 to handover the land in question to HSVP.
 - h. The encroacher vacated the banquet hall and HSVP took over the position of the land on 05.04.2026.
 - i. Earlier this small plot of land was not part of the depot land as it was under litigation even though owned by HSVP. After the court verdict in favour of HSVP, they proposed this land to GMRL for its OCC.
- **Pocket No. 4: 0.016 ha land is earmarked as Electric Sub Station (ESS) land.**
 - a. HSVP acquired this land and handed it over to DHBVN. The ESS is operational at the site. GMRL has taken up the matter with DHBVN. It has already been agreed that the land shall be transferred from DHBVN to GMRL free of cost. The cost of utility shifting shall be borne by GMRL.
 - **Pocket No. 5: 0.86 ha this pocket has private land owned by 52 owners.**
 - a. The acquisition is being done under GMRL Policy for Direct Purchase of Private Land or Property through Mutual Negotiation. The process of land acquisition is being carried out under the Chairmanship of the Deputy Commissioner, Gurugram.

Figure 7-5: New Marble Market Site (Sector 33)







D. Casting Yard, Sector 33 (Transport Nagar)

1. The land was owned by Gram Panchayat Narharpur Rupa and was acquired by HSVP in the year 1992 for the planned development of Transport Nagar after payment of due compensation for the land to Gram Panchayat.
2. The said land was allotted by the Gram Panchayat to 14 parties, who subsequently constructed dwelling units/structures thereon. Compensation for the said structures was paid to all 14 parties by HSVP in the year 2013.
3. Out of 14 parties, two parties sought enhanced compensation. Their claims were examined and approved by the competent authority, and the enhanced compensation was paid to them in 2025.
4. Subsequently, these two parties constructed unauthorized structures on HSVP land even after receiving enhanced compensation.
5. The encroachers filed CWP No. 24745 of 2025 titled Shiv Kumar & Anr. vs State of Haryana & Ors in which Hon'ble High Court had stayed the dispossession of 26.08.2025.
6. The Hon'ble High Court, while dismissing the CWP No. 24745 of 2025, gave the order to vacate the land via interim order on 23.12.2025.
7. The said land was vacated by HSVP on the directions of the Hon'ble Court.
8. A tracer study is currently underway and will generate the socio-economic profile of these encroachers.

E. Mitigation Measures

A Resettlement Action Plan (RAP) is prepared to address and mitigate the impacts on the affected households. The RAP shall be disclosed on the GMRL Website for all stakeholders. The objective of the plan is to improve or at least restore the income and livelihood conditions of the people to at least the pre-project level. The households affected will not only receive cash compensation for land and other assets at prevailing rates for full replacement cost, but also additional assistance will be given for relocation and livelihood restoration. Overall, the RAP presents (a) the socio-economic profile of the affected settlements; (b) the type and extent of loss of assets; including land, structures, and trees; (c) principles and legal framework applicable for mitigation of these losses; (d) the entitlement matrix; (e) income and livelihood restoration program; (f) relocation and resettlement budget; (g) the institutional framework for the implementation of the plan, including monitoring and evaluation.

The gap-filling measures between GoI policies and WB ESS5 are outlined below:

- **Replacement Cost of Affected Structures:** The RFCTLARR Act calculates compensation for structures based on the market value of the building and other immovable properties or assets attached, along with a 100% solatium on the final award amount. In contrast, ESS 5 mandates replacement compensation for structures without accounting for depreciation.
- **Recognition of Non-Titleholders:** The Act does not recognize informal settlers (encroachers) and informal occupiers (squatters) as affected persons. In contrast, the ESS5 recognizes informal settlers and informal occupiers as affected families.

These gaps have been addressed by aligning with the requirements of ESS5 to ensure affected persons receive compensation at full replacement value and by including non-titleholders in the project's entitlement matrix.

F. Avoidance of Displacement through Alternative Design Solutions

WB's ESF mitigation hierarchy was adopted to minimize adverse impacts through careful project design, guided by the findings of the social study conducted as part of the ESIA. In line with the avoidance principle under this hierarchy, the initial identification of 261 properties likely to be affected by the development of the viaduct, station, and entry/exit locations was reviewed. As a result of design modifications, 79 properties were saved, although a few additional properties were identified due to further refinement of the project design. The details of the saved properties are provided below **Table 7-23**:

Table 7-23 Impact avoided through alternative design solution

S. No.	Chainage	No. of Structures Saved	Remarks
1	6+000 to 7+000	1	Change in alignment
2	7+000 to 8+000	1	
3	8+000 to 9+000	3	
4	9+000 to 10+000	19	
5	10+000 to 11+000	3	
6	16+000 to 17+000	11	Change in entry/exit points
7	18+000 to 19+000	1	Change in alignment
8	22+000 to 23+000	3	Change in entry/exit points
9	23+000 to 24+000	16	Change in alignment
10	24+000 to 25+000	6	
11	25+000 to 26+000	14	

G. Approaches to Cover Absent PAPs (Titleholder)

The measures to be taken to identify the missing PAPs are detailed in the RAP.

7.7 ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

7.7.1 Loss of Trees

The proposed GMRP corridor passes through an urban area of Gurugram City. An inventory of trees under the project was carried out, and approximately 5,295 trees are likely to be affected, as presented in **Table 7-24**, with detailed information provided in **Annexure 7.9**. Most of the trees likely to be affected are located along the median of the road, on either side of the road at metro stations, and within the depot boundary.

Table 7-24 Number of Trees affected under GMRP

S. No.	Description	Number of Trees
1	AC01	1937
2	AC03	2204
3	AC04 (Metro Depot)	576
4	Casting Yard 1	122
5	GMDA Section (Bakhtawar Chowk)	456
Total		5295

Past studies indicate that survival rates of transplanted trees are generally low. Forest Department, Gurugram, has given permission for the felling of the trees with the condition of compensatory afforestation of ten trees against each tree to be cut. Accordingly, compensatory afforestation has been adopted over transplantation in the GMRP. However, in the event that tree transplantation is required in the future, appropriate mitigation measures outlined in the ESMP will be followed.

“It is proposed to plant ten saplings for each tree to be cut. Hence, a total of 52,950 samples need to be planted. The cost of afforestation is estimated at Rs.7,50,000/- per ha. Accordingly, the compensatory afforestation cost is estimated to be about **Rs. 1201.90 Lakh (USD 12,69,837.78)**. Native and miscellaneous indigenous tree species are recommended for afforestation.”

The list of proposed tree species for plantation is provided in **Table 7-25**.

Table 7-25 List of Trees for Plantation

S. No	Botanical Name	Common Name
1.	<i>Alstonia scholaris</i>	Alstonia
2.	<i>Azadirachta indica</i>	Neem
3.	<i>Ficus virens</i>	Pakad
4.	<i>Acacia nilotica</i>	Babul
5.	<i>Cassia fistula</i>	Amaltas
6.	<i>Alianthus excelsa</i>	Aadu
7.	<i>Holoptelea integrifolia</i>	Papdi
8.	<i>Dalbergia sisoo</i>	Shisham
9.	<i>Delonix regia</i>	Gulmohar
10.	<i>Albizia lebeck</i>	Siris

S. No	Botanical Name	Common Name
11.	<i>Albiziaamara</i>	Krishna siris
12.	<i>Kigeliapinnata</i>	Balamkheera
13.	<i>Ficusbengalensis</i>	Bargad
14.	<i>Ziziphusmauritiana</i>	Beri
15.	<i>Ficusracemosa</i>	Gular
16.	<i>Morus alba</i>	Shahtoot
17.	<i>Ficus religious</i>	Pipal
18.	<i>Terminaliaarjuna</i>	Arjuna
19.	<i>Caseariagraveolens</i>	Chila
20.	<i>Meliaazedarach</i>	Bakan

Source: Working Plan Gurgaon Forest Division 2009-10 to 2023-24.

The location for afforestation will be decided by GMRL in consultation with the MCG and the Department of Forests.

7.7.2 Aravalli Range

The Aravalli Range is located about 3 km away from the GMRP alignment. A dense urban settlement exists between the alignment and the Aravalli Range, which acts as a buffer. Therefore, no impact is anticipated on the Aravalli Range

7.7.3 Impact on Avifauna

Considering the ecological aspects, the waterbodies lying within 10 km radius of the proposed alignment are:

- KBA/IBA in Sector 101, Basai
- Sultanpur National Park
- Najafgarh Jheel
- Basai Pond

7.7.3.1 KBA/IBA in Sector 101, Basai

KBA/IBA in Sector 101, Basai was identified as an Important Bird Area as per the Birdlife International assessment conducted in the year 2004. As per this assessment, the primary water source for the site was a breached water channel carrying wastewater and partially treated sewage from the Gurgaon Water and Sewage Works. Historically, it served as a wintering site for local migratory bird species. The area is currently surrounded by urban infrastructure, including the Dwarka Expressway (with an elevation of 9–10m) located approximately 300m to the northwest, an operational railway line nearby, a railway overbridge (8–9m high) and several high-rise residential buildings are in the vicinity of this area. The proposed metro alignment will have a similar elevation, approximately 10m. A pictorial representation of the area, existing infrastructure, and the proposed metro alignment is shown in

Figure 7-6. It is anticipated that existing elevated structures/height barriers, such as Elevated Dwarka Exp, Rail Over Bridge, and High-

Rise Buildings, have been in place for a considerable duration. Additionally, the Gurugram-Rewari Railway line is located near the area and has not disrupted the flying path of avifaunal species in the past. Over time, local and migratory bird species have adapted their flight paths to accommodate these existing structures.

The proposed GMRP corridor will adopt the third rail traction system, which is ground-based. This system maintains open airspace, reduces the risk of electrocution and bird collisions, and helps preserve natural flight paths. Therefore, no adverse impacts are anticipated on the flying paths of avifauna species due to the GMRP. Considering the operation of an electric metro system, no significant noise or vibration impacts on avifauna are expected during the operational phase.

As per the baseline study conducted in the area, the primary source of water was treated wastewater discharged from a nearby STP, which led to ponding and consequently supported avifaunal activity, particularly among local and migratory bird species. Recently, the unintentional effluent discharge was halted due to the repair of a damaged drain. Subsequently, local residents have filled the land with soil and resumed agricultural activities.

The general impact due to construction activities is noise generation, dust emissions, material storage, affecting water quality and aquatic habitats, unauthorized activities by workers, such as hunting of birds or disturbing wildlife, habitat degradation, and light pollution at night.

Although the site holds historical ecological sensitivity as documented through bird sightings, any future seasonal ponding in the area may be impacted by metro construction and operations activities. Subsequently, GMRL has planned to undertake an integrated biodiversity impact assessment during the migratory season in July 2026 and get the BMP prepared. The study would provide a detailed understanding of any impact on this habitat and establish corresponding mitigation measures.

Material storage areas will be sited away from the KBA/IBA in Sector 101, Basai with proper containment systems to prevent runoff. Strict guidelines shall be enforced to prohibit hunting or disturbance of wildlife by workers, supported by regular monitoring and awareness programs. Fly camps and site facilities shall be managed with controlled waste disposal systems, adequate sanitation, and minimal footprint designs. Buffer zones shall be

maintained between construction activities and the waterbody to preserve ecological integrity.

Figure 7-6 KBA/IBA in Sector 101, Basai



Source: RITES Study

7.7.3.2 Sultanpur National Park

The Sultanpur National Park is located approximately 8.2 km away from the GMRP and the ESZ notified for Sultanpur National Park is 5 km from its boundary. There is an existing railway line (Gurugram-Farukhnagar), located about 200- 300 m from the National Park's boundary, that operates regularly without reported impacts on the avifauna frequenting the park.

Therefore, no adverse impact on Sultanpur National Park is anticipated due to the proposed metro project.

7.7.3.3 Najafgarh Jheel

Najafgarh Jheel is located approximately 4.7 km from the proposed metro corridor. Given this distance, it is anticipated that noise, vibration, and other operational disturbances generated during the construction and operation phases of the GMRP are not expected to propagate to the Jheel. and will have no impact on Najafgarh Jheel and its avifauna. Therefore, no adverse impact on Najafgarh Jheel and its avifaunal population is expected.

7.7.3.4 Basai pond

No avifauna was observed at Basai Pond during the baseline study; therefore, no impact on avifaunal species is anticipated.

7.7.4 Impact due to Pigeons

Pigeons pose significant challenges within metro networks, including issues related to excreta and nesting in inaccessible areas such as the undersides and crevices of overhead tracks. Eggs laid in such locations often fall onto roads, creating hazards for both vehicular traffic and pedestrians. The accumulation of droppings and nesting materials can disrupt metro operations and compromise hygiene and safety, necessitating effective management to mitigate their impact on the transportation system. Combating/Controlling the nuisance and menace caused by Blue Rock Pigeon (*Columba livia*) at metro stations can be challenging; however, several effective and sustainable measures can be implemented to mitigate their impact:

Structural Design Implementation/Application: Blue Rock Pigeons, commonly known as *Kabootar*, tend to perch and nest on flat surfaces. They are prolific breeders and often remain at the same breeding sites for generations, thereby creating a persistent nuisance. Their presence contributes to environmental contamination through the spread of viruses and bacteria, which can lead to serious respiratory illnesses such as *Hypersensitive pneumonitis* (a form of Interstitial Lung Disease - ILD). A single pigeon produces about 12 kg of excreta annually, which is acidic in nature and may contribute to material corrosion. Additionally, pigeon droppings are known to carry salmonella and other pathogens, posing significant health risks. Continuous exposure to such contaminated environments can endanger the health of metro commuters and staff.

The following measures shall be adopted to manage pigeon-related concerns at stations:

1. Incorporation into Detailed Design: Structural design interventions shall be integrated during the detailed design phase to deter pigeons from perching and establishing breeding colonies. Some of the suggestion for structural design for protection from pigeon nuisance is given in **Figure 7-7**.

Figure 7-7 Suggested Structural Design for Protection from Pigeon Nuisance



2. **Netting and Barriers:** Install physical barriers such as pigeon spikes or wire mesh nets to prevent pigeons from roosting and nesting in areas such as under eaves, ledges, and rafters. These measures help reduce pigeon colonization and minimize nuisance to the metro commuters.
3. **Deterrents:** Use of visual deterrents such as twisted metal ribbons or highly reflective coloured surface, which are effective in scaring birds away. This method has been widely used in agriculture and can be adapted for GMRP. Additionally, install bird repellent discs and incorporate natural deterrents like marigold, basil, and lavender plants around metro stations. These not only discourage pigeons from nesting and roosting but also enhance the station's aesthetic. Regular pest control at identified hotspots shall also be carried out.
4. **Regular Cleaning:** Keep the station and surrounding areas clean by promptly removing any food waste, spills, and garbage. Eliminating these food sources reduces the station's attractiveness to pigeons.
5. **Habitat Modification:** Modify the station environment to make it less conducive for pigeons nesting and roosting. This includes sealing off entry points to buildings, removal of stagnant water, and installing nets in specific areas to block access to potential nesting sites at stations.
6. **Public Awareness and Education:** Conduct awareness campaigns to discourage the public from feeding pigeons near metro premises. Artificial feeding grounds lead to overpopulation and increased nuisance. Educating commuters about the impacts of overfeeding can significantly reduce pigeon congregation in and around stations.
7. **Slanted Surfaces:** Introduce sloped sheathing and slanted surfaces on window panes, ledges, and structural beams of metro stations to discourage pigeons from perching.

By adopting this integrated approach, metro stations can effectively manage pigeon-related issues, thereby ensuring a cleaner, safer, and more commuter-friendly environment.

7.8 ESS 7: Indigenous People

The GMRP is located in Gurugram District, which does not fall under the Schedule V area of the Indian Constitution. Furthermore, the affected population does not meet the four key

characteristics required to trigger the provisions of ESS 7¹⁵. Therefore, the specific requirements safeguards mandated under ESS 7 pertaining to indigenous peoples, their rights, cultural heritage, and traditional knowledge are not applicable to this project.

7.9 ESS 8: Cultural Heritage

Tangible cultural heritage includes objects, sites, structures, and landscapes that hold cultural, historical, or aesthetic significance, while intangible heritage includes the practices, expressions, and knowledge passed down and continuously adapted by communities. Both forms are integral to cultural identity and legacy.

Tangible cultural heritage within the project area includes cultural assets, archaeological monuments, and structures listed by INTACH, small temples, ponds/water bodies of cultural or religious significance which are detailed in the subsequent sections. No intangible cultural heritage sites or practices have been identified within the project influence area.

7.9.1 Impact on Cultural Assets

Impact: One cultural heritage asset (temple) will be impacted by the GMRP. The extent of impact is full on the temple (**Figure 5-15**). Basai Pond is used for cultural activities, including Chhath Puja (sun worship).

Mitigation: GMRL shall reconstruct the affected temple with complete coordination and participation of the affected community and in a culturally and socially acceptable manner. Mitigation measures for Basai Pond are provided in ESMP.

7.9.2 Impact on Archaeological Monuments

One archaeological site is falling within a 10 km radius of the GMRP corridor, i.e., the Mosque of Ala Vardi Khan. The mosque is located approximately 490m from the GMRP alignment, near the Bajghera Road metro station. As per the Ancient Monuments and Archaeological Sites and Remains (Amendment) Act, 2010, public and other works are prohibited within 100m and regulated within 200m (totaling 300 m) from any protected monument. Since the GMRP alignment lies outside the regulated zone, at a distance of approximately 490m from the monument, no adverse impact is anticipated on the site due to the project.

7.9.3 Indian National Trust for Art and Cultural Heritage (INTACH) listed Structures

The INTACH-listed structures located within 10 km on either side of the GMRP alignment are as follows:

¹⁵ (a) Self-identification as members of a distinct indigenous social and cultural group and recognition of this identity by others; and (b) Collective attachment to geographically distinct habitats, ancestral territories, or areas of seasonal use or occupation, as well as to the natural resources in these areas; and (c) Customary cultural, economic, social, or political institutions that are distinct or separate from those of the mainstream society or culture; and (d) A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.

- Water Body: Bhim Kund
- Temples: Sita Ram Temple, Sheetla Mata Devi Temple, Dronacharya Temple, and Eklavya Temple
- Mosques: Sarai Allawardi Mosque, Eidgah Mosque, Shahi Jama Mosque and Jama Masjid
- Church: Church of Epiphany

All these structures are located outside 100m but within a 10 km on either side of the alignment. These structures are at a distance more than the tolerance distance of 12.2 m from the center of alignment; no mitigation measures are required, and no adverse impact is anticipated on these structures.

7.9.4 Chance finds

There is a possibility that chance finds may occur during the construction phase of the metro project. These findings may include the discovery of a single artifact, an artifact indicating the presence of a buried archaeological site, human remains, fossilized plant or animal remains, or animal tracks, or natural features that appear to indicate the presence of archaeological material.

In such instances, the contractor will follow the chance-finds procedures to ensure proper handling and compliance with applicable laws. Any chance finds discovered during excavation are to be dealt with in accordance with the Indian Treasure Trove Act, 1878. The key steps involved in dealing with chance finds are as follows:

- a. Notice by finder of treasure to Collector.
- b. Notification by Collector requiring claimants to appear.
- c. When treasure may be declared ownerless, such treasure shall either be delivered to the finder or be divided between him and the owner of the place in which it has been found. When no other person claims to be the owner of the place, the treasure is to be given to the finder.
- d. The Collector may, at any time before delivering or dividing the treasure, declare his intention to acquire on behalf of the Government the treasure or any specified portion thereof, by payment to the persons entitled thereto, and thereupon such treasure or portion shall be deemed the property of the Government.
- e. The Collector's decision in such matters shall be considered final.

Chapter 8: Sexual Exploitation & Abuse (SEA) and Sexual Harassment (SH) Action Plan

8.1 Proposed SEA/SH Action Plan

Gurugram's rapid urbanization and metro infrastructure expansion have led to increased interaction among diverse populations, including a substantial influx of labor and a growing daily movement of women as transport users. These dynamics elevate the risks of Gender-Based Violence (GBV) and Sexual Exploitation and Abuse (SEA) affecting women both as commuters and residents impacted by construction activities.

Gurugram district and Haryana state continue to experience significant challenges related to Gender-Based Violence (GBV) predominantly affecting women and girls. According to 2024 NCRB data, Gurugram recorded 1,727 cases of crimes against women, including 722 cases of domestic violence and 235 cases of sexual harassment. Women traveling in public and last-mile transport hubs such as Sikandarpur, MG Road and IFFCO Chowk stations often face heightened vulnerability to harassment due to inadequate safety measures, poor lighting, overcrowding and lack of dedicated women's security personnel. During stakeholder consultations conducted as part of the ESIA study with women police officials, it was revealed that the police department has identified five key hotspots for such incidents: Gurugram Bus Stand, Devi Lal Park (falling along the GMRP alignment), Sector-14, Choma Gaon Park, and IFFCO Chowk.

The influx of construction labourers during metro construction work further increases SEA/SH risks, especially for women living near or working at construction sites. The presence of large, predominantly male workforces without adequate oversight can lead to increased incidents of harassment, exploitation, and vulnerabilities to GBV for community women, children, and female laborers.

Risk mitigation must therefore prioritize the safety of women transport users by improving lighting, CCTV coverage, and the presence of security personnel at metro stations and transit routes. Construction sites must enforce strict codes of conduct, deliver sensitization training for laborers, and maintain grievance redressal mechanisms accessible to nearby communities. Multi-stakeholder coordination with police, local governance and civil society is vital to create safer spaces and reduce GBV risks related to Gurugram's metro development.

8.2 Legal Frameworks

1. Protection of Women from Domestic Violence Act, 2005
 - Provides civil remedies and protection to women from all forms of domestic violence, including physical, sexual, verbal, emotional, and economic abuse.
2. Dowry Prohibition Act, 1961
 - Criminalizes giving or taking of dowry before, during or after marriage.

3. Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act)
 - Mandates proactive steps and Internal Committees in workplaces to prevent and redress sexual harassment.
4. Indian Penal Code (as amended by the Criminal Law (Amendment) Acts, 2013, 2018; also updated as Bharatiya Nyaya Sanhita 2023):
 - Section 354: Assault or criminal force to a woman with intent to outrage her modesty
 - Section 354A: Sexual harassment
 - Section 376: Rape
 - Section 498A: Cruelty by husband or relatives
 - Section 509: Word, gesture, or act intended to insult the modesty of a woman

These sections criminalize various forms of violence, abuse, and harassment.
5. Protection of Children from Sexual Offences (POCSO) Act, 2012
 - Special law for child protection from sexual abuse and exploitation.
6. Haryana State Amendments and Schemes
 - Haryana Victim Compensation Scheme for Women Victims/Survivors of Sexual Assault/other Crimes, 2020: Provides financial aid and rehabilitation for GBV survivors.
 - Haryana State Commission for Women Act, 2012: Constitutes a dedicated commission for women's rights, protection, and policy advocacy in Haryana.
 - Rules on Night Shift and Workplace Safety for Women (2025 Amendment): Mandates consent, enhanced CCTV/security, safe transport, and PoSH Act compliance for women working night shifts in shops, establishments, or industry.
 - Women Safety Cell and Standard Operating Procedures by Haryana Police: Includes Women Helpline, special investigators, and field protocols for GBV.

These legal provisions and guidelines provide the mandatory legal framework and best practice standards required to address SEA/SH in India.

8.3 Project's SEA/SH Risk Prevention and Response Action Plan

The SEA/SH Risk Prevention and Response Action Plan is developed and outlined in **Table 8-1**. Gender Expert at GMRL will oversee all GBV-related matters for the GMRP, including SEA/SH prevention, monitoring, and response coordination. This role encompasses:

- Oversee SEA/SH risk screening, monitoring, and compliance across project activities
- Coordinate with GBV service provider mapping and GRM linkages.
- Enforcement of behavioral standards/CoC for project workers, contractors and staff.
- Capacity building on GBV sensitization for GMRL, contractors and GM focal points.
- Regular compliance audits, incident tracking and liaison with survivor support services.

Table 8-1: SEA/SH Risk Prevention and Response Action Plan

Key Risks	Actions to Address SEA/SH Risks	Indicators	Timing for Action	Responsibilities
Increased SEA/SH risks due to the influx of workers and contractors at the construction site	• Conduct risk assessment and mapping of hotspots at sites. • Develop & disseminate SEA/SH code of conduct for all workers and contractors • Conduct mandatory SEA/SH awareness and sensitization training for workers and supervisors	• Risk assessment/mapping done • Codes of conduct signed by all workers • % of workers trained on SEA/SH	Before and During construction	1. Gender Expert, GMRL 2. Social Safeguard Expert, GC 3. Contractors
SEA/SH risks associated with construction activities and project	• SEAH/SH training for GMRL staff and specialists • Designate SEAH/SH focal point • Awareness for technical teams	• Training of GMRL Officials on SEA/SH	Before and During construction	1. Gender Expert, GMRL
Lack of safe, accessible and confidential grievance redressal mechanisms at project sites	• Establish confidential grievance redressal mechanisms (GRM) • Publicize grievance channels with signage and awareness	• Number of grievances received and timely addressed • Grievance mechanism awareness among workers and the community	Throughout construction and implementation	1. PRO, GMRL
Limited survivor support services (medical, psychosocial, legal) in vicinity of project sites	• Develop referral pathways and MOUs with local hospitals, counseling and legal aid providers • Provide information to workers and communities on support services	• Referral agreements signed • Number of survivors assisted through referral pathways	Before construction and throughout implementation	1. PRO, GMRL
Risks of SEA/SH during metro operation	• Include safety measures in design and operation (lighting, CCTV, security personnel) • Conduct public awareness campaigns on zero tolerance for SEA/SH	• Safety audits findings • Public awareness campaign reach • Number of safe transport options available	Construction and Operation	1. PRO, GMRL during Operations, 2. Security Team

	• Ensure safe transport options for workers and women users			
Retaliation or stigma against SEA/SH survivors or complainants	• Ensure confidentiality protocols • Provide training to staff on victim-sensitive handling • Monitor for retaliation cases and act promptly	• Confidentiality breaches reported • Training sessions held • Retaliation cases recorded and resolved	Throughout project lifecycle	1. PRO, GMRL during Operations,
Female staff and commuters face harassment risks in metro stations, trains, and maintenance depots	• Establish GMRL policy based on POSH Act • CCTV coverage • Safety signage • Designated complaints system	• No. of complaints received/resolved • % stations with safety features	Continuous during operation	1. GMRL Operation Team, POSH Committee
Lack of awareness among metro staff	• SEA/SH trainings/ workshops on prevention, response and survivor-centered handling	• No. of trainings/workshop held • % staff trained/attended	Annual	2. POSH Committee

8.4 Budget for SEA/SH Risk Prevention and Response Action Plan

The Budget for SEA/SH Risk Prevention and Response Action Plan is **Table 8-2**.

Table 8-2: Budget for SEA/SH Risk Prevention and Response Action Plan

S. No.	Items	Frequency	Estimated Amount (In Rs.)
1	GBV Risk Mitigation Training	Twice a Year x 5 Year	10,00,000/-
2	IEC Materials (posters, leaflets, banners)	LS	3,00,000/-
3	GBV Awareness Campaigns including signages	Twice a Year x 5 Year	10,00,000/-
4	GBV Focal Point Capacity Building	Once a Year x 5 Year	5,00,000/-
5	Miscellaneous	-	2,00,000/-
	Total	-	30,00,000/-

Chapter 9: Environmental and Social Management Plan (ESMP)

9.1 Proposed ESMP

The negative environmental impacts stemming from the proposed project can be mitigated with a simple set of measures, with careful planning and designing of the metro alignment and structures. Adequate provision of environmental clauses in work contracts and efficient contract management will eliminate or significantly reduce all possible impacts. A common problem encountered during the implementation of environmental management plans of such projects is a lack of environmental awareness among engineers and managers concerned with day-to-day construction activities, which can be solved through regular environmental training programs. ESMP is presented in **Table 9-1**, which defines actions to be undertaken during the design, pre-construction, construction, and operation stages of the project. The effectiveness of environmental considerations will, however, depend on appropriate inclusion of these in the work contracts, commitment to implement, and implementation, supervision, and reporting well. These are very important for the Project, and by adopting this ESIA, there is expected to be full commitment and adherence to the mitigation and management measures herein. Contractors also have to ensure updating of the ESMP based on finalized 'as-built' plans and implement the revised plan to ensure compliance.

The major concern during the construction stage is that the contractors, due to a lack of enforcement, do not practice good environmental sanitation (housekeeping), safety standards, and may intend to get unauthorized use of the easily available natural resources and other available infrastructure like roads and water resources. This would result in degradation of ambient air quality, water resources, and the land environment around the construction sites and labor camp. Improper management of earthwork activities would disrupt the natural drainage and increase soil erosion. Additionally, the implementation of the mitigation actions requires that the project implementation unit record an end-of-construction mitigation checklist before releasing the final payment of any work contract.

In addition to that, GMRL shall develop and establish SHE Policy and Procedures, and that should become an integral part of the contract document.

Operational phase mitigation would involve good environmental sanitation (housekeeping) practice at metro establishments, including effective solid waste collection and disposal, wastewater disposal, and upkeep of the plantations and green areas. During the operation period, the metro operating unit will be required to confirm receipt of the construction period mitigation report through the GMRL and prepare and follow a timetable of corrective actions, including for any incidents.

Table 9-1 ESMP

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
Design Phase				
1.	Visual intrusion	a. Design aesthetic structures of viaduct and stations to minimize visual intrusion.	DDC	GMRL
2.	Flood Protection	a. Rainwater harvesting structures to be provided along the alignment, at station locations and within the depot area. b. The DDC has analyzed HFL data from the last 25 years and designed station boxes and entry/exit points above the maximum HFL. c. Design shall comply with clause 12.1 of the NBC to address flood and waterlogging risks around the station and its entry/exit points.	DDC	GMRL
3.	Disadvantaged and Vulnerable Person	a. The DDC should consider universal accessibility features in design, including gently sloped ramps with a gradient of 1:12 for wheelchair users, provisions of lifts and escalators for PWD, tactile paving to guide visually impaired individuals, and a public address system to assist all users, particularly the visually impaired.	DDC	GMRL
4.	Light and Shadow	a. Key design measures to be considered during the DDC stage include optimization of structural heights, architectural integration, landscape design, etc., in consultation with concerned public authorities, including fire and town planning departments. b. During the DDC stage, appropriate setback distances are to be integrated into the design to ensure adequate natural lighting and ventilation, minimize noise intrusion, facilitate access for fire and emergency vehicles, and enhance overall safety. c. Shadow and wind analysis will be conducted during the DDC stage to evaluate shadow impacts, optimize the use of natural light, and ensure proper ventilation and airflow.	DDC	GMRL
5.	Traffic Management	a. The DDC will propose appropriate conceptual traffic diversion plans within construction zones to ensure smooth traffic operations and the safety of both construction workers and road users. b. During the DDC stage, widening of footpaths at metro stations and the provision of designated pedestrian zones shall be proposed to minimize conflicts with passersby. Separate vehicle bays shall be planned to ensure safe drop-off and pick-up, thereby preventing pedestrian-vehicle conflicts. The design shall ensure no disturbance to pedestrian movement through footpaths and parking.	DDC	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
6.	Green Buildings	c. All stations and depot buildings will be designed as green buildings as per IGBC rating system.	DDC	GMRL
7.	Energy & Water Efficiency	a. During the DDC stage, the integration of energy and water-efficient systems will be planned. b. Wherever feasible, permeable pavement shall be incorporated into the design for access roads leading to stations, depots and service areas to facilitate water infiltration. c. Wherever feasible, incorporation of renewable energy sources such as solar panels with anti-reflective coatings at stations and the depot.	DDC	GMRL
8.	Impact on residential and commercial establishments	a. During the DDC stage, the alignments are/will be refined to mitigate or minimize social impacts associated with the viaduct and station locations.	DDC	GMRL
9.	Noise and Vibration	a. During DDC stage, the alignment will be refined to mitigate or minimize E&S impacts associated with the viaduct and station locations. b. Dynamic analysis should be carried out by DDC to assess and mitigate the effects of dynamic forces generated by moving trains, wind, and other external factors. c. Lower vibration levels will be achieved by incorporating bolster-less bogies equipped with secondary air springs. d. To prevent the development of surface irregularities on the rails, a heavy rail section of 60 kg/m (90 UTS) supported at 60 cms intervals is to be incorporated into the design.	DDC	GMRL
10.	Loss of trees and water bodies	a. Alignment will be refined to avoid or minimize impacts on trees and water bodies. b. The design of the temporary on-site drainage system will be undertaken during the DDC stage prior to the commencement of construction. c. During the detailed design stage, GMRL shall explore the possibility of avoiding pillar placement within the pond. If unavoidable, pillars shall be placed only along the outer edge to minimize any impact on water spread. d. To mitigate impacts on the pond, a ramp will be constructed prior to pillar and viaduct works in the pond area, serving as a barricade against project activities. e. The depot should be designed to minimize tree removal and preserve existing trees to the extent possible.	DDC	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		f. A temporary on-site drainage system will be constructed prior to the commencement of construction, particularly planned during the lean season when the pond's water level is minimal		
11.	Management of Pigeons	a. DDC should design in consultation with a qualified ecological expert. b. Potential pigeon nesting locations will be closed or covered. c. To deter pigeons at station areas, structural design modifications such as slanted surfaces on windowpanes and other beam structures of the metro station can be incorporated. d. Identification and planning of netting areas at the metro station. e. Planning for deterrents like anti-bird spikes.	DDC	GMRL
12.	Safety of Structures	a. Design provisions to ensure structural safety against earthquakes, fire, etc. will be done in accordance with IS codes & other standards.	DDC	GMRL
13.	Cultural Heritage	a. There is one temple which is located within the RoW. During the DDC stage, the alignment will be refined to avoid any impact on this temple. b. If avoidance is not feasible, the temple will be reconstructed in a culturally and socially acceptable manner with the coordination and participation of the local communities and other concerned stakeholders.	DDC	GMRL
14.	Access points to Establishments	a. DDC will assess the feasibility of station entry/exit locations and other project facilities. b. Permanent structures planned for the project must be designed to ensure that they do not obstruct access to residential, commercial, and community establishments. c. Platform Screen Door (PSD) to be considered in the design phase.	DDC	GMRL
15.	Parking Space	a. GMRL will assess and plan the parking requirements based on projected demand and land availability for the development of the designated parking area.	DDC	GMRL
16.	Last-mile connectivity	a. GMRL will plan to allocate designated spaces for autos, taxis, e-rickshaws and other modes of transport to facilitate efficient last-mile connectivity.	DDC	GMRL
17.	Risk of exclusion of Households in design phase	a. Undertake consultations in accordance with the SEP. b. Special attention to ensuring the inclusion of vulnerable groups in project benefits, with continuous stakeholder engagement to promote and sustain such inclusion.	DDC	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
18.	Accident, breakdown or failure of Metro	c. Alarm systems should be integrated into the design of metro coaches and stations for emergency preparedness.	DDC	GMRL
19.	Gender-Based Violence	a. Gender-sensitive design features such as well-lit stations, information booths, police presence, safe and accessible feeder transportation, etc. should be incorporated at the design stage to proactively address and minimize risks related to SEA/SH. b. Additional provisions may include Sanitary Pad Vending Machines, Transparent Elevators, Gender Neutral Toilets, Dedicated Women Coaches and an App for Online Complaints.	DDC	GMRL
20.	Double Decker Structure	a. Optimize design to ensure minimum footprint within existing RoW, avoiding additional land take. b. Design the road, rail, and foundation systems based on IRS CBC, IRC codes. c. Use advanced rolling stock, such as bolster-less bogies with secondary air suspension systems. d. Use noise-reducing road surfaces. e. Minimise shadowing and the tunnel effect by adopting an optimised structural configuration, ensuring adequate spacing between piers and superstructure elements, and maintaining unobstructed carriageway edges on both sides to enhance natural lighting and air circulation. f. Minimise impacts on vehicular movement by ensuring adequate road width, preserving traffic capacity, and incorporating appropriate traffic management measures where required. g. Mitigate structure-borne noise, rumbling, and reverberation by adopting continuously welded rails (eliminating rail joints), providing elastomeric pads or equivalent resilient elements between the track and the U-girder, installing resilient rail fastenings, adopting ballastless track systems, and installing noise barriers at identified sensitive receptors, where required. h. Provide adequate illumination beneath the viaduct to ensure safe visibility, improve user comfort, and enhance security for motorists, pedestrians, and cyclists. i.	DDC	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
Pre-Construction Phase				
1.	ESMP Implementation	The Contractor will prepare the Environment, Health & Safety Manual covering following site-specific management plans: a. Contractor Environmental and Social Management Plan (C-ESMP) including Muck Disposal Site Management Plan (MDSMP) b. Contractor Labour Management Plan (C-LMP) including GBV CoC, Labour Influx Management, Labour Camp Management c. Safety, Health and Environment (SHE) d. Waste and Wastewater Management Plan (WWMP) (with locations of waste disposal sites and details of authorized vendors & adequacy of their disposal mechanisms, maximizing recycling efforts.) It will include SOPs/ Plan for segregation of waste at source, segregated storage, collection, transportation, treatment & disposal of wastes, slurry, sludge of different types for Construction & O&M stages e. Traffic Management Plan f. Training Plan for ESHS risks including HIV/AIDS, GBV and SEA/SH g. Grievance Mechanism for Workers h. Demobilization Plan (to be implemented upon completion of works) i. Emergency Preparedness and Response Plan GC/GMRL shall ensure that the Contractor prepares and implements all relevant plans at the appropriate stages of the project.	Contractor	GMRL
2.	Mobilization of ESHS staff	a. Qualified and experienced ESHS specialists should be deployed at the site throughout the construction period. b. Implementation of ESMP, including OHSMP, by the ESHS Staff. c. Daily monitoring and preparation of monthly reports.	Contractor	GMRL
3.	Consents/ Permits/ Approvals/ Compliances	a. The Contractor must obtain permissions for all construction activities such as establishing and operating batching/ hot-mix plants/ labour camps, PUCs, labor licenses, tree-cutting permissions, and all other permits and clearances as applicable.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		b. Forest clearance will be obtained from the forest department for the urban forest located at Sector-10 Metro Station.	GMRL	GMRL
4.	Flood Protection	a. The Contractor will develop a comprehensive stormwater management plan, integrating it with the overall construction schedule.	Contractor	GMRL
5.	Vibration	a. A detailed geotechnical investigation should be carried out prior to construction.	Contractor	GMRL
6.	Loss of Land, Structures, livelihood	a. Land will be purchased in accordance with the GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations. b. Compensation will be paid for the loss of land, structures, livelihood, and other assets. GMRL will ensure that compensation is paid in full prior to taking possession of the land. c. RAP is prepared in line with the RFCTLARR Act, 2013, and WB ESS5 and will be implemented by the RAP Support Agency. d. RAP is addressing issues associated with physical and economic displacement, loss of community infrastructure and other assets. e. A GM will be established by GMRL to allow affected persons to raise concerns related to displacement and other impacts. f. Information related to all project activities will be disclosed to affected communities in a transparent and timely manner. g. RAP implementation will be monitored until a point where it can be demonstrated that the standard of living and livelihoods of displaced households have been at least restored, if not improved. Where required, corrective actions will be taken to achieve this outcome.	GMRL/ RAP Implementing Agency	GMRL
7.	Engagement and information disclosure	a. Project affected persons, other interested parties, and vulnerable groups will be engaged, informed about the project, and their views, suggestions, and grievances will be recorded and addressed. Consultations will be conducted to solicit suggestions on planning and implementing measures to manage risks and impacts associated with project activities during both the construction and operation phases.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
8.	Loss of trees	a. A Compensatory Afforestation Plan will be prepared, including establishing nurseries, identifying locations for green belt development, a plan for care and maintenance of planted saplings, etc. b. Approximately 5,295 trees are likely to be affected, including 576 trees in the depot area. c. Monitoring Frequency: Four times in a year for the entire construction period.	Forest Department	GMRL
9.	Site Selection & Set up of Storage Yard, Labour Camps	a. Identification of suitable land for setting up a storage yard and labor camp. b. It should be ensured that the selected sites for the labor camp and storage yard are located at a safe distance from residential areas, water bodies, wetlands, forests, schools, hospitals, commercial establishments, heritage sites, etc.	GMRL/ Contractor	GMRL
10.	Site measures	a. Prepare an Environment, Health and Safety (EHS) Manual and ensure its implementation arrangements.	Contractor	GMRL
11.	Environmental Management and Monitoring	a. Set up of the Environment and Social Monitoring unit	GMRL	GMRL
12.	MMI and FLM (Charging Point and other infrastructure)	a. Incorporate segregated pedestrian pathways in the design. b. Design dedicated IPT bays & parking zones. c. Provision/Design of Elevated pathways in flood-prone areas. d. Provision for designated space for safe installation of EV charging systems	DDC	GMRL
13.	Cultural heritage	e. Cultural Heritage Management Plan (CHMP) shall be developed as per national & state regulations and implemented.	Contractor	GMRL
14.	GRM	a. GMRL setup an Internal Complaints Committee (ICC) for addressing any SEA/SH-related complaints at the workplace. b. Project GRM will also address grievances related to GBV/SEA/SH. c. Incidents of GBV/SEA/SH will be reported to the GM setup by GMRL, while maintaining confidentiality of victim/survivor details. d. Any cases of SEA/SH brought through the GM will be documented but remain closed/sealed to maintain the confidentiality of the survivor. GM will refer complainants to the relevant departments/authorities and record the resolution of the complaint.	GMRL Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		e. GMRL will notify the WB of any SEA/SH complaints WITH THE CONSENT OF THE SURVIVOR. f. Contractors are also required to set-up ICC in accordance with the POSH requirements. g. For the implementation of the SEA/SH Action Plan, a detailed operating plan is under preparation.		
Construction Phase				
1.	Soil Erosion	a. Implementation of suitable construction methods as per the EHS Manual. b. Prior to the commencement of construction activities, the Contractor will submit schedules to GMRL for carrying out temporary and permanent erosion/sedimentation control works, as applicable to clearing and grubbing, roadway and drainage excavation, embankment/sub-grade construction, pavement courses and shoulder works. c. The Contractor will submit the proposed methodology for erosion and sedimentation control and a plan for the disposal of waste soil. d. Careful planning, timing of cut and fill operations, use of geotextiles or other suitable measures, and re-vegetation practices will be adopted to reduce soil erosion and dust generation. e. The Contractor will be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time, as outlined in the accepted schedule, to minimize reliance on temporary control measures. f. Daily visual inspections should be conducted by the contractor in coordination with and in the presence of the GC. g. Temporary erosion, sedimentation and pollution resulting from the Contractor's negligence, carelessness, or failure to implement control measures will be rectified at the Contractor's own expense, as part of the work as scheduled or ordered by the GMRL. h. Topsoil, if present, will be stripped from constructional areas and stockpiled for reuse in landscaping and restoration activities.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		i. All roads and working areas will be kept clean during & after works, free from soil, sand, aggregates, tools, materials, and equipment. j. Batching plants will be located away from the construction site and human settlements. k. Contractor should submit the details to GMRL in accordance with Annexure 9.9 of this document.		
2.	Flood Protection	a. Installation of a temporary drainage system to divert stormwater away from construction sites. b. Sediment barriers will be installed at stockpile locations to prevent erosion and runoff of excavated material. c. An adequate drainage system will be provided to prevent flooding in excavated areas. d. Proper grading and sloping will be ensured to facilitate proper water flow and minimize waterlogging. e. A Stormwater Management Plan will be prepared for construction yards and labour camps. f. Portable pumps for removal of stagnant water from critical areas during heavy rainfall. g. Temporary flood protection measures such as sandbags or water-filled barriers will be employed to protect construction sites. h. Regular inspections and maintenance of temporary drainage systems and erosion control measures. i. Drainage systems will be regularly maintained to prevent blockages and ensure efficient water discharge flow. j. In the event of submerged areas or access paths, appropriate measures will be taken to ensure safe movement of pedestrians, avoiding the need to walk through muddy or flooded areas.	Contractor	GMRL
3.	Waterbodies	a. KBA/IBA in Sector 101: Conduct an Integrated Biodiversity Assessment (with critical habitat assessment) to prepare a biodiversity management plan and bird-friendly design guidelines for implementation. This will be implemented during construction & O&M stages. ESMP will be updated when mitigation measures are arrived at	GMRL Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		b. Basai Pond: The construction site shall be isolated using protective sheeting, earth bunds, or sandbag barriers to prevent sediment runoff into the pond. c. Regular water quality monitoring shall be carried out during the construction phase. d. Geo-textile sediment fences shall be used to control the entry of sediment into the waterbody. e. The contractor shall strictly prohibit the disposal of solid or construction waste into the pond. f. Site grading shall be designed so that runoff water flows away from the pond. g. The contractor shall coordinate with utility agencies, maintain quick response teams, and pre-identify sensitive areas to manage emergencies effectively. h. Runoff water from the construction site should be prevented from entering nearby waterbodies by preparing appropriate site slopes and diversion channels directed away from these sensitive areas. i. The Contractor will take adequate protective measures to ensure that excavation activities do not affect or damage any waterbodies. j. Stockpiles will not be provided near waterbodies. In cases where stockpiling near waterbodies is unavoidable, silt fencing and diversion channels will be provided around the stockpiles to direct runoff and sediments away from the sensitive areas. k. Construction materials containing fine particles will be stored within enclosed areas to prevent sediment-laden water from draining into nearby watercourses. l. Regular monitoring of waterbodies will be carried out, and all applicable discharge standards under the Environmental Protection Act, 1986, and its amendments or any other rules, acts or directions (including those issued by courts or NGT) will be strictly followed by the Contractor. m. All solid and liquid waste generated from the construction site will be disposed of in an acceptable manner. The above mitigation measures will be implemented till Biodiversity Assessment Study completes. Based on the findings of Biodiversity Assessment, any additional mitigation measures proposed shall be implemented. Till then, activities shall be planned in way that construction impacts are minimal.		

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
4.	Utility Shifting	a. The contractor shall identify all underground and above-ground utilities, prepare a diversion plan, and submit it to GMRL. b. GMRL shall submit the details of affected utilities and their diversion plans to the utility-owning agency for its approval. c. The contractor shall carry out the shifting of utilities under the supervision of the utility-owning agency, adhering to their safety standards. The special utilities, such as the gas pipeline, shall be shifted by the utility-owning agency in coordination with GMRL. d. The Contractor will ensure that all utility services remain operational throughout the construction period and after the project is completed. e. The contractor will plan any required utility shifting in coordination with the respective utility providers and users, preferably during dry weather conditions. Alternate arrangements and information dissemination to users will be ensured by the utility provider. f. In case of major changes in design, ESMP shall be updated. g. Due care will be taken during the construction phase to ensure that no utilities are damaged by project activities. Any accidental damage will be rectified immediately. Temporary access routes will be provided to the establishments where access is obstructed due to construction. h. Utilities that may be affected by construction activities will be properly cordoned off to prevent any potential damage. i. Proper barricading and informative signboards will be installed around these utilities during construction activities. j. The construction work schedule will be shared in advance with concerned line departments (e.g., water supply, electricity, roads, transport) and affected communities to ensure continuity of essential services. k. For any utility shifting, the Contractor will comply with the terms and conditions stipulated by the respective utility authorities. l. All excavation works will be safely closed immediately after the completion of activities or upon the departure of workers from the site. Excavated areas will be	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		secured with hard barricading to prevent the entry of pedestrians or vehicles and to avoid accidents. m. All necessary utility provisions shall be made, and necessary NOCs will be obtained from the respective utility authorities. The Contractor will provide necessary assistance to these authorities for effective utility management.		
5.	Traffic Diversion/Management	a. A Traffic Diversion and Management Plan will be developed and implemented to minimize congestion. This will include measures such as proposing diversions, creating alternate routes, avoiding school peak hours, enforcing speed limits, and hiring licensed drivers. The plan will focus on ensuring safe access to residential areas and minimizing risks near schools, housing and construction zones. It should be prepared in consultation with the Traffic Police Department, Municipal Authorities, and other relevant stakeholders. b. Necessary traffic management measures such as road widening, traffic segregation, one-way movements, traffic diversions and acquisition of service lanes will be implemented as required. c. Surrounding roads will be widened to ensure smooth commuter access and traffic flow. d. Within work zones, the use of primary traffic control devices will be essential for ensuring safety and effective traffic direction. These devices will include road signage, delineators, hard barricades, cones, pylons, pavement markings, flashing lights, reflectors, and full day/night lighting. Large information boards will be placed at least 200m on both sides of work zones to provide advance guidance to approaching vehicles. e. Common assembly points will be earmarked at construction sites, labour camps, temporary offices, etc. f. Safety and movement of all workers and local communities will be ensured throughout the construction period. All pits within work zones will be promptly closed upon the completion of related works. Where temporary closures are necessary, strong and stable barricades will be installed to prevent collapse and ensure safety for both pedestrians and vehicles. g. Traffic marshals will be deployed as required by the traffic department.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		h. A transportation consultant will be engaged to conduct traffic surveys and recommend alternative routes to ensure smooth traffic flow during construction. i. All construction workers will be provided with high-visibility jackets with reflective tapes. Additionally, all work areas shall be adequately illuminated at all times, both during the day and at night, to ensure visibility and safety j. Necessary permissions from the traffic department, Gurugram, must be obtained. Detailed information regarding barricade locations, enclosed area dimensions, and estimated work durations will be submitted to secure the required approvals. k. Drivers engaged in project activities will undergo defensive driving training, hold valid driving licenses, and be trained in handling construction work-related traffic operations. Drivers will not be permitted to operate vehicles under the influence of intoxicants and will be provided with adequate rest periods to ensure safe driving practices.		
6.	Dark Spots	a. To avoid any safety hazards, adequate lighting will be provided at construction sites. All barricades will be fitted with continuous reflectors that remain clearly visible at all times, both day and night. b. No pit or work area will be left unlit or poorly illuminated under any circumstances.	Contractor	GMRL
7.	Child Labour	a. Workers under the age of 18 years will not be permitted to engage in any project-related activities. b. Contractual provisions will include clauses to ensure compliance with the minimum age requirement along with penalties for any non-compliance. c. A labour registry of all contracted workers will be maintained with page verification documentation.	Contractor	GMRL
8.	Labour Influx	a. Unskilled labor will be recruited from local communities for basic tasks such as excavation, leveling, cleaning, loading/unloading materials, site watering, etc. b. All workers will be required to sign and adhere to the safety protocols and a code of conduct addressing the risk of GBV/SH. c. Training sessions will be conducted with a focus on expected behavior, local norms, and raising awareness about GBV/SH. d. The LMP, including an accessible Grievance Mechanism, will be implemented in full.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
9.	Labour camps	a. Essential facilities will be provided to workers, including liveable accommodation that remains safe and secure in all conditions, including during inclement weather. Proper water supply and sanitation arrangements will be ensured so that neither workers' nor nearby communities' health is impacted. Additional provisions will include first-aid boxes, shoe racks, clean drinking water, separate latrine/bathing/washing facilities for male and female workers with water available at all times, proper drainage systems to prevent stagnation, temporary living accommodations, and childcare rooms, all in line with applicable regulatory standards. b. Labor camps will be constructed only after receiving approval of the proposed layout and arrangements from the Authority Engineer/GMRL. c. A common kitchen or canteen facility will be provided to eliminate the need for individual room cooking. d. LPG cylinders will be supplied at labor camps, along with firefighting equipment and safety measures. e. The contractor will ensure that all workers sign CoC. Daily toolbox talks will be conducted each morning, including reminders of dos and don'ts as outlined in the CoC. f. Regular site inspection, health check-ups, and sensitization sessions will be organised for workers g. Regular awareness camps and workshops on GBV, STDs (HIV/AIDS), and GM will be conducted. h. Regulated movement of the workers to and from the work site. i. Fire extinguishers, first-aid kits, and emergency contact numbers will be installed at strategic locations within the camp areas. j. Legal register for the project will be formulated and implemented. k. Regular anti-dengue and anti-malaria spraying and fogging will be carried out at the worksite and nearby settlements. Also, mosquito nets are to be provided to all laborers. l. Written permissions for construction-related activities will be obtained from all relevant regulatory and statutory authorities.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		m. There will be no water, waste, or wastewater stagnation at or around the camps. Hygienic conditions will be ensured and consistently maintained until project completion or camp closure. n. SOP will be developed for various activities, including training, PPE usage, permission request templates, incident recording and reporting, etc. o. IEC materials will be prominently displayed at construction sites to raise awareness. p. Labor management plan, Incident management plan, Emergency preparedness plan, Waste management plan, Hazardous management plan) q. BOCWA guidelines and WB EHS will be followed for labour camps. r. Separate toilets will be provided for female workers and any support staff such as cooks, if hired. In cases where female workers are accommodated outside the labour camps (e.g., in nearby villages), GBV awareness posters will be displayed, and engagement meetings with the local communities will be conducted. s. A dedicated housekeeping to be provided at labour camps.		
10.	Occupational Health & Safety	a. Comply with OHS aspects of various labor-related acts of India, WB EHS, and OHS Guidelines. All high-energy hazards will be identified, and critical control measures will be implemented to prevent serious injuries and fatalities. The OHS management plan will form part of the EMP. b. A work permit mechanism will be implemented for specialized tasks. c. Measures will be adopted to minimize fugitive dust emissions during construction activities such as excavation, grading, waste disposal and land clearing. d. An EHS supervisor will be engaged during conducting activities. e. An EHS Plan will be prepared and implemented, with approval from GMRL. The plan will include measures such as: f. Restricting public/unauthorized access to worksites; g. Ensuring that all workers are provided with and use PPE (reflectorized vests, footwear, gloves, goggles, and masks); h. Providing (H&S) training for construction personnel; i. Documenting standard procedures for all site activities; j. Maintaining records of accidents and incidents.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		k. Work at height will be properly planned, supervised and carried out with adequate provisions for emergencies and rescue. Safety nets and harnesses will be mandatory for all work conducted at height over 2m. l. SOP will be developed and followed for all construction related activities. m. Training sessions will be organized for workers on prevention and treatment of scorpion and snake bites. Anti-venom supplies will be kept onsite or at the nearest healthcare facility. n. All workers will be required to wear PPE while on duty. o. Steel scaffolding will be tagged and inspected weekly by a qualified engineer. Working platforms for height work will be a minimum of 400 mm wide. p. Electrical distribution boards will be installed within closed sheds to prevent exposure to dust and water. CO₂ fire extinguishers will be placed outside these sheds for use in electrical emergencies. q. Lifelines will be provided at slab edges, and worker will be required to wear safety harnesses while working at heights. r. Ladders of appropriate length will be provided to ensure safe access to elevated work areas. s. Safety posters must be prominently displayed across the site to promote a safety culture. t. Labour camps will undergo regular cleaning, inspection, and sensitization drives. u. Emergency contact details (police, fire, ambulance, hospital, security, and forest department) will be displayed at multiple prominent locations in languages understood by all workers. Workers will be trained to use these resources when necessary. v. Electrical wiring will be regularly inspected. Smaller switches with rain protection covers will be installed to reduce the risk of electrical short circuits. w. Housekeeping practices will be maintained, with materials neatly stacked, labelled and records of housekeeping activities kept up to date. x. There should be no accumulation of solid, construction, or hazardous waste at the site. A comprehensive waste management plan will be implemented for collection, treatment, and disposal in line with local regulations and SPCB guidelines.		

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		y. Rest areas with shade, clean drinking water, and sanitation facilities will be provided. z. Medical emergency facilities will be arranged, including paramedical staff, first aid, isolation centers (for COVID-19 or other contagious illnesses), ambulance services, and tie-ups with nearby government or private hospitals for emergency care. - aa. The contractor will tie up with nearby hospitals and submit the list to GMRL. - bb. An Internal Complaints Committee (ICC) will be formed by the contractor in accordance with statutory norms. - cc. The contractor will maintain registers for attendance, wage payments, overtime, penalties, incidents, and accidents to ensure transparency, compliance with labour laws and to maintain transparency and accountability in site safety and labour management. - dd. The Contractor will submit the required data and documentation as per Annexure-9.4 & 9.5. - ee. SOP will be developed for various activities, including training, PPE usage, permission request templates, and recording and reporting, etc. - ff. Chief Safety Manager shall ensure health safety compliance such as PPE and other safety measures mandatory for construction site on daily basis. - gg. Review of Health and Safety Performance: Contractor shall review health and safety performance of the project on monthly basis through monthly audit rating score (MARS) system and submit Monthly Report on the same to GC. - hh. GC will conduct verification audit on regular basis.		
11.	Dust from Construction/Demolition	a. Implementation of suitable construction methods will be carried out in accordance with the EHS Manual. b. Water sprays or dust suppressants will be used to minimize dust levels. c. Construction materials will be covered with green nets to prevent dust from blowing away. d. Material and waste storage areas, as well as transport vehicles, will be covered to prevent waste from getting eroded/carried away by air, rain, flood, etc. e. Dust accumulation along service lanes will be minimized through toe dust cleaning, regular water sprinkling, and enforcement of vehicle speed restriction.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		f. Awareness will be raised among nearby communities to adopt safe practices, such as keeping windows and doors closed during high dust emissions. g. The contractor will submit the details to the GMRL as per Annexure 9.9 of this document. h. Contractor to provide anti-smog gun, mechanical broomer, etc and fulfill the requirements of GRAP regulations implemented from time to time by the state government. i. Aggregate and m-sand stored at the batching plant premises shall be kept covered to control dust emission or water sprinkler arrangement shall be installed for dust suppression. j. Cement/fly ash feeding to the silos shall be done in a controlled manner – fine cement/ fly ash emission from the silo top should be avoided.		
12.	Muck disposal	a. Implementation of suitable construction methods will be carried out in accordance with the EHS Manual. b. Muck generated during the construction of the project shall be utilized for the activities that require muck within the GMRP, such as depot area leveling and development of ramps. c. Any additional muck, the contractor will dispose of the muck/dry soil generated at construction sites at an approved location mutually agreed upon by GMRL. d. Reconciliation of the disposed soil will be carried out by the contractor, and the quantity will be submitted to GMRL on a quarterly basis. e. Dry wheel wash facilities will be installed at the exit gates from where soil disposal takes place. f. Sufficient staff will be deployed at the site for effective muck/soil disposal, including a supervisor, labours for wheel cleaning, brooms, and a concrete pad with proper drainage for wheel washing. g. Dumpers transporting muck/dry soil must be covered while moving on roads to the designated disposal locations. h. The contractor will ensure that muck generated during piling activities is not contaminated with any hazardous substances.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		i. On-site muck will be monitored quarterly at random locations during piling works. If any contaminated muck is identified, it will be handled and disposed of in accordance with the Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016, and subsequent amendments. j. The contractor will submit all relevant details to the GMRL as per Annexure 8.2 of this document.		
13.	Supply and Storage of Construction Material	a. Procedures for the storage, handling, transport, and reuse of construction materials will be outlined in the EHS Guidelines. b. The SHE Policy should be prepared in line with WB ESS guidelines and National regulations. c. The contractor will monitor all aspects of construction activities, commencing with the storage and loading of construction materials and equipment. d. The scheduling of material procurement and transport will be linked with the overall construction schedule of the project. e. The construction materials should be tested in the Government labs or Government-approved labs to ensure their quality prior to use. f. Construction materials will be stored away from waterbodies to prevent contamination, including during flooding or heavy rainfall events, etc. g. Stormwater runoff will be properly managed and treated to prevent pollutants from entering nearby water bodies. h. Wheel-washing facilities will be installed at the exit points of all construction sites and batching plants to prevent soil and debris from being transported outside the site. i. The Contractor will be responsible for the management of construction materials throughout the project lifecycle and will ensure sufficient material quantities and quality are tested in approved labs before their usage.	Contractor	GMRL
14.	Pre-casting yards and Material stockpiling	a. The construction yard will be away from any settlements and notified areas such as national parks, reserved forests, etc. b. Proper and safe stacking of materials will be a priority at all construction yards, storage areas and related facilities. The storage area will be systematically planned	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		with adequate access routes, and all materials will be stored or stacked in an organized and secure manner to ensure safety and ease of use.		
15.	Air Pollution	a. All vehicles and machinery used for construction works will be regularly maintained to comply with emission standards. Periodic inspections will be conducted, and all necessary permits will be renewed as required.	Contractor	GMRL
		b. All materials that generate dust during transportation will be adequately covered. Trucks will maintain sufficient freeboard to prevent material spills during transit. c. Barriers will be installed around construction sites prior to the commencement of any work. d. All vehicles deployed for works will possess valid PUC certificates and will undergo regular checks to ensure compliance with applicable local regulations. e. Dust control measures such as water sprinklers, dust screens, etc. will be implemented and continue even during work stoppages or public holidays. f. Wash pit or wheel washing or vehicle cleaning facilities will be established at all construction yards, depots and batching plants. g. Temporary storage areas will be maintained by the contractor within well-barricaded and illuminated areas. Adequate pollution prevention measures will be implemented until the excavated material is re-utilized for backfilling wherever necessary or as directed by GMRL. h. The contractor will submit relevant details to the GMRL as per Annexure 9.1, 9.3, 9.6, and 9.10 of this document. i. Diesel generators shall be provided with exhaust stack height fulfilling CPCB norms. j. Regular maintenance of bag house filters at the batching plant shall be ensured. k. Air Quality Monitoring: 24 hourly monitoring for 2 days, twice a month at six locations for each package (2 packages for the entire corridor)	Contractor	GMRL
16.	Noise Pollution	a. Periodic check of machinery and vehicles will be performed. Physical barriers will be installed at bulk loading and unloading areas. Machinery will be equipped with noise mufflers, and workers will be provided with PPE.	Contractor	GMRL
		b. Temporary walls will be erected around elevated station sites and other construction zones, as necessary.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		c. Noise barriers will be installed along construction boundaries, especially near sensitive receptors such as bird nesting or ecological areas, schools, hospitals, religious places, etc. d. Truck drivers and equipment operators will minimize the use of horns. e. All construction equipment and vehicles will be fitted with appropriate noise suppression devices, consistent with applicable national and local regulations. f. Noise from loading and unloading construction materials will be minimized by using cranes and placing materials on sand beds or sandbags to absorb impact. g. The Contractor should ensure that the work scheduling will be done in such a way that the work with heavy noise will be carried out during daytime and with low noise at nighttime. h. Ballast-less tracks with elastic and absorbent fittings will be used to reduce rail related noise. i. The contractor will submit the relevant details to the GMRL as per Annexure 9.1, 9.3, 9.6 and 9.10 of this documents. j. Noise Monitoring: 24 hourly monitoring for 2 days, twice in a month at six locations for each package (2 packages for entire corridor)		
17.	Vibration	a. Adopt construction methodologies and equipment producing no or less vibration. b. The contractor will submit the relevant details to the GMRL as per Annexure 9.7 of this document. c. Vibration Monitoring: 24 Hours, once in every month at 10 locations for 1 year	Contractor	GMRL
18.	Management of Solid Waste	a. The contractor will prepare a waste management plan and submit it to the project authority for concurrence. b. Biodegradable waste generated at labour camps and construction sites will be segregated at the source and handed over to the ULB for appropriate treatment and disposal. c. Non-biodegradable waste will be handed over to authorized recyclers. d. No spillage of waste will be permitted during transportation. e. Garbage will be covered in containers, which will be cleaned daily to prevent unhygienic conditions.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		f. The contractor will dispose-off non-hazardous solid waste, non-hazardous liquid waste and biomedical waste in accordance with national regulations. g. Solid Waste will be managed and disposed of in compliance with the Solid Waste Rules, 2016 and its subsequent amendments.		
19.	Management of Construction & Demolition Waste	a. C&D Waste will be managed in accordance with the provisions of C&D Waste Management Rules, 2016 and its subsequent amendments. b. C&D waste will not be mixed with other types of waste and will be disposed of separately. c. All generated C&D waste will be collected at a designated location and stored in a segregated manner based on its potential for reuse or recycling. d. The waste will be transported and disposed of at an authorised C&D waste processing facility. e. The contractor will submit relevant details to the GMRL as per Annexure 9.9 of this document.	Contractor	GMRL
20.	Management of Plastic Waste	a. The contractor will prepare a waste management plan and submit it to the project authority for concurrence. b. Source segregation of plastic waste will be carried out based on its recyclability. c. Plastic waste generated at the site will be handed over to authorized vendors in compliance with the Plastic Waste Management Rules, 2016 and its subsequent amendments. d. The contractor will submit the relevant details to the GMRL as per Annexure 9.9 of this document. ,	Contractor	GMRL
21.	Generation of Hazardous Waste	a. The Contractor will develop a plan for the management of hazardous waste. b. If asbestos is encountered during utility shifting or demolition activities, it will be handled in accordance with a SOP prepared and approved by the GMRL/AE. c. The contractor will engage only authorized recyclers for the treatment and disposal of Hazardous Waste, under intimation to the GMRL. d. Hazardous waste will be disposed of in accordance with the provisions of the Hazardous and Other Wastes (Management and Trans Boundary Movement) Rules, 2016 and its subsequent amendments.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		e. The contractor will ensure that hazardous and other wastes are properly labelled, recorded, and stored in impermeable containment for a period not exceeding 90 days, and in a manner suitable for safe handling, storage and transportation. f. A record of sale, transfer manifests, and storage of such waste will be maintained and made available for inspection upon request. g. In the event of any accident occurring at the contractor's facility involving hazardous or other wastes, the contractor will take immediate measures to safeguard personnel and property and promptly notify the State Pollution Control Board via telephone and email and subsequently submit a report in Form 11.		
22.	Water Supply and Sanitation	a. Arrangements for water supply will be made in accordance with national regulations and the ESF/EHS Manual. b. The water requirement for the project will be met through treated water from STPs and municipal supply. c. The Contractor will provide essential facilities at labour camps, including access to uncontaminated water for drinking, cooking, washing, latrines and urinals; clean and sufficient bathing and washing areas; and a proper system for the conveyance, treatment, and disposal of sewage and solid waste.	Contractor	GMRL
23.	Community Health and Safety	a. The contractor will develop and implement a traffic management plan, including traffic diversions, avoiding peak hours (e.g., school times, market activities, and religious activities), adherence to speed limits, and the deployment of licensed drivers, etc. The plan will ensure access to residential areas and enhance safety near schools, residential areas and construction zones b. Road signage will be installed at appropriate locations to minimize safety hazards associated with project-related traffic. c. Work areas will be barricaded and fenced with sturdy materials to restrict unauthorized community access. d. Safety barriers will be provided near trenches, and trenches will be covered with planks during non-working hours. e. All drivers deployed to project duties will receive defensive driving training. f. Adequate signage, barriers and flag persons will be deployed for effective traffic control.	Contractor GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		g. Cautionary signage and work timings will be displayed prominently at work sites. h. Sufficient signboards and flagmen will be placed to direct the public away from construction areas. i. Awareness programs on CHS will be conducted, including safe road use procedures. j. Regular medical check-up camps will be organized near settlements. k. Regular vector-borne spraying and fogging (e.g., anti-dengue and anti-malaria) will be carried out regularly in settlements near construction areas. l. Awareness camps will be conducted on the prevention and control of STIs, communicable and vector-borne diseases. m. Community awareness will be undertaken to promote safe practices among residents, including keeping windows and doors closed during dust-generating construction activities to minimize exposure. n. Water sprinkling will be carried out on access roads and construction sites for dust suppression. o. Grievance registers will be maintained at site gates, and contractors and GMRL staff will be trained in effective grievance redressal procedures. p. Prior to the commencement of construction works, the contractor will develop a labour management plan that includes provisions for preventing GBV/SEA/SH. q. Awareness campaigns will be organized to inform communities, especially women and girls, about the risks of GBV/SH and reporting mechanisms for project-related incidents. r. Disseminate information on how to use the GM to report SEA/SH cases, CoC violations, and support services for GBV/SH victims. s. Construction activities in congested or high-traffic areas will be prioritized for early completion to minimize public inconvenience. t. Contractors must use multi-gas analyzers and detectors to identify volatile materials and prevent safety hazards. u. The contractor will develop and enforce a CoC to regulate worker behavior at the construction sites, camps, and within local communities. v. CoC will include an awareness program for workers on respecting the local community and its customs.		

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		w. CoC-related information will be provided in local languages for better understanding. x. Cultural sensitization training for workers to ensure respectful interaction with local residents. y. Leisure areas will be established within workers' camps to discourage visits to community leisure spots. z. Sanctions, including dismissal, will be enforced against workers involved in criminal activities. - aa. Enforcement of laws against drug abuse and human trafficking. - bb. Sensitization camps on illegal behaviors such as prostitution, substance abuse, and GBV will be held for both workers and local communities. - cc. Adequate services and amenities will be provided in workers' camps to avoid dependency on community facilities. - dd. Concerned police stations will be consulted during construction to identify high-risk areas/hotspots for regular patrolling and CCTV surveillance. - ee. Contact details of designated or focal persons will be displayed at prominent locations along the project corridor, including on barricades. - ff. Integrated Pest Management and vector management will be implemented including pest monitoring, eco-friendly control methods and minimal use of chemicals to safeguard public health and the environment.		
24.	Tree protection/ Cutting and Disposal	a. Contractor will prepare an action plan for the management of 5,295 trees to be affected by the project. About 52,950 saplings will be planted as per compensatory afforestation norms b. The tree species proposed for plantation in the project area include Gulmohar, Siris, Neem, Ashoka, Jamun, Desi Badam, Karanj, Amalatash, etc. c. No individual or entity, other than the contractor, will be permitted to cut trees identified within the RoW. d. The contractor shall conduct the survey of trees that will be affected as part of project work, including marking of the alignment in the vicinity of the trees, identification of the tree species with details of the girth and height of the trees.	GMRL for Compensatory Afforestation; and Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		e. Terms and conditions mentioned in the permission for tree cutting will be followed by the contractor f. Biomass will not be stored at the construction site for more than 15 days. g. Monitoring Frequency: Four times in a Year for the entire construction period		
25.	Cultural Heritage	a. Chance finds: In the event of any chance finds during construction, GMRL and the contractors will apply measures in accordance with the Indian Treasure Trove Act, 1878. The concerned authorities will be informed at the earliest.	Contractor	GMRL
26.	Water logging	a. Temporary waterlogging due to construction activities, uneven dumping of construction waste, etc. will be avoided by ensuring that materials are not stored or waste is not dumped near stormwater runoff channels. b. It will be ensured that metro construction activities do not lead to waterlogging in the area. c. Regular cleaning of drains at waterlogging and urban flooding hotspots. d. Dewatering pumps will be used to remove water from affected areas and prevent waterlogging.	Contractor	GMRL
27.	Water Pollution	a. Measures such as sedimentation tanks and silt traps will be implemented at batching plants and along site runoff channels to control sedimentation. b. Contractor will make efforts to reduce water consumption by using energy-efficient water fixtures at construction sites and project offices. c. Water leakage through pipes and valves will be strictly avoided. d. Reuse of water, especially water used for curing and other uses will be planned and implemented. e. Contractor will submit relevant details to the GMRL as per Annexure 9.2, 9.3, 9.10 of this document. f. Monitoring Frequency: Four times in a Year at 10 locations for the entire construction period.	Contractor	GMRL
28.	Soil Pollution	a. Implement measures to prevent the ingress of toxic substances, heavy metals, or chemicals. A designated and secured storage area for such materials will be prepared, and necessary equipment will be made available for safe handling and emergency response.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		b. Contractor will take all necessary precautions to ensure that construction materials, diesel, grease, waste oil, chemicals, etc. do not spill onto the ground. c. Periodic inspection shall be carried out to ensure hazardous and C&D waste are not disposed of at the dumping site. d. Contractor will submit the required details to the GMRL as per Annexure 9.3 & 9.7 of this document. e. Fuel and oil will be stored in cement-lined storage yards on elevated platforms that are not prone to waterlogging or flooding. These materials will be handled with care to prevent soil contamination due to leakage or spillage. f. All fuels and chemicals will be stored in contained facilities, and appropriate measures will be taken to prevent any spillage. In case of an emergency spill, suitable containment mechanisms and pollution mitigation measures will be implemented with support from experts. g. Monitoring Frequency: Four times a Year at 10 locations for the entire construction period		
29.	Incident Management	a. An Incident Reports Management Plan will be prepared, incorporating reporting formats and aligned with the WB's Environmental and Social Incident Response Toolkit (ESIRT). b. The contractor will promptly notify the GMRL of any incident or accident related to the project that has, or is likely to have, a significant adverse impact on the environment, affected communities, the public, or workers, including, inter alia, cases of SEA/SH, and accidents resulting in death, serious injury, or multiple injuries. c. GMRL shall immediately inform the Bank and instruct the GC, Supervising Engineer and the contractors to: d. Prepare a Preliminary Incident Report in line with WB ESIRT e. Conduct a detailed incident investigation and reporting f. Prepare a corrective action plan and g. Implement the corrective measures at the earliest. h. In all such cases, the contractor will suspend the ongoing work at the affected site until the identified hazardous conditions have been rectified and it is safe to resume activities.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		i. Sufficient details must be provided regarding the scope, severity and potential causes of the incident or accident along with the immediate and planned remedial measures taken or proposed to address it, as appropriate. j. Part of the EHS manual, the contractor will submit the incident-related details as per Annexure 9.5.		
30.	Environmental Monitoring	a. Contractor will prepare and implement an environmental monitoring plan for air, noise, soil, water, vibration, and ecology. b. Monitoring Frequency c. Air: 24 hourly monitoring for 2 days, twice a month for the entire construction d. Noise: 24-hour monitoring for 2 days, twice in a month for the entire construction e. Soil: Four times a year for the entire construction f. Water: Four times a year for the entire construction g. Vibration: 24 Hours, once every month for 1 year h. Ecology: Four times in a year for the entire construction.	Contractor	GMRL
31.	Availability of institutional capacity	a. Contractor will implement training programs and establish an environmental unit comprising Environmental Engineers, OHS Experts, and Social Experts (refer to the EHS manual for details) b. Training will be conducted for officials and staff of GMRL, GC, contractors, etc., as per the Training Schedule.	GMRL	GMRL
32.	Energy Management /Conservation	a. The contractor will use and maintain lighting, tools and equipment that meet appropriate specifications to ensure energy conservation, in accordance with EHS guidelines.	Contractor	GMRL
33.	Construction Material Management and House Keeping	a. Full height, continuous safe fences, barriers, and barricades with reflectors, adequately lit at all times for clear visibility, will be erected around the construction sites b. All stairways, passageways, and gangways will always be maintained free from any blockages or obstructions. c. All surplus earth and debris will be removed or disposed of in line with C&D Waste Management Rules, 2016. Recycled materials from C&D waste recycling facilities may be used wherever feasible.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
34.	Access points to Establishments	a. Contractor will ensure that safe entry and exit are provided to residents during construction. b. Construction activities should not block access points to any residential or commercial establishments. If unavoidable, an alternate access point will be provided in discussion with the concerned property owners.	Contractor	GMRL
35.	Chance Find Procedure	c. Excavation for project-related activities may lead to chance finds. d. Contractor will prepare and implement a Chance Find Procedure and create awareness among workers, supervisors, and engineers regarding chance finds during excavation. In case of any suspected find, work will be stopped immediately to allow further investigation, and the procedure will be followed. e. The contractor will protect the site and report the findings to the Engineer/GMRL. f. The State Archaeological Department will be informed immediately if a find is suspected, and any required action for removal or protection in situ will be taken as per their instructions. g. All discovered artifacts will be handed over to the museum or cultural management agency based on State Archaeological Department recommendations. h. A review will be undertaken to determine whether excavation activities can continue.	Contractor	GMRL
36.	Restoration of Construction Sites	a. For site restoration, the contractor will submit the required information to the GMRL as per Annexure 9.8.	Contractor	GMRL
37.	Engagement and information disclosure	a. Consultations will be carried out to solicit suggestions and plan appropriate measures for managing risks and impacts arising from the proposed project activities during the construction phase.	GMRL	GMRL
38.	MMI and FLM (Charging Point and other infrastructure)	a. Implementation of C-OHS Plan b. Provision of Safety training & supervision c. Display of proper signage including prohibitory honking signs d. Isolation of the construction site with proper barricading including display of relevant safety signages. e. E-waste storage & disposal through authorized recyclers	Contractor	GMRL
39.	Tree Transplantation (TTP)	a. A detailed TTP with methodology shall be prepared, including the procedure followed, survival rates, etc.	Contractor/ GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		b. Only healthy, non-hazardous trees with appropriate girth and species characteristics will be selected for transplantation. c. Transplantation shall be carried out during appropriate seasons (preferably monsoon/pre-monsoon) to enhance survival rates. d. Pre-transplant root pruning and canopy trimming shall be undertaken by a qualified person to reduce transplant shock. e. Adequate soil ball preparation, wrapping, and moisture retention measures shall be ensured during lifting and transport. f. Mechanical equipment (cranes, hydras) used for transplantation shall be certified and operated by trained personnel only. g. Safe traffic management measures (barricading, signage, flagmen) shall be implemented during roadside transplantation works. h. Workers shall use appropriate PPE (helmets, gloves, safety shoes, reflective jackets) at all times. i. Manual handling risks shall be minimized through mechanization and proper lifting techniques. j. Transplanted trees shall be supported with staking, guying, and protective guards to prevent toppling. k. Immediate and regular watering, mulching, and nutrient application shall be ensured at receptor sites. l. A post-transplant monitoring program (minimum 1 year) shall be implemented to track survival and health. m. Biomass and pruning waste shall be properly disposed or reused.		
40.	Establishment and Operation of temporary QA/QC Lab	a. QA/QC laboratories shall be established with proper ventilation, lighting, and access control. b. Concrete waste (slurry, leftover mix) shall not be discharged onto soil or drains; it shall be allowed to dry/harden and disposed of as construction debris at approved locations. c. Tested concrete cubes/cylinders shall be reused where feasible or disposed of through authorized C&D waste streams.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		d. Curing tanks shall be regularly (once in a fortnight) emptied, cleaned and treated to prevent mosquito breeding. e. Appropriate PPE (gloves, goggles, lab coats, masks, safety shoes) shall be mandatory for all lab personnel. f. Mechanical equipment (compression testing machines, ovens, sieves, mixers) shall be operated only by trained personnel; regular inspection and calibration shall be carried out. g. Electrical safety shall be ensured through proper earthing, insulated wiring, and use of circuit breakers; no exposed wiring shall be permitted. h. Fire safety measures, including fire extinguishers (ABC/CO₂ type), sand buckets, and emergency exits, shall be provided and maintained i. Adequate first-aid kits and emergency contact details shall be available within the laboratory. j. Spill management kits shall be provided, and procedures established for immediate containment and cleanup of chemical spills. k. Noise and dust from lab activities (e.g., crushing, sieving) shall be minimized through enclosure or localized control measures l. Upon demobilization, the lab area shall be dismantled, cleared of wastes and restored to its original condition.		
41.	Temporary Office/ Site Facilities	a. Temporary offices shall be established within designated construction areas, avoiding ecologically sensitive zones, drainage paths, and public obstruction. b. Use of prefabricated/modular structures shall be preferred to reduce construction waste and land disturbance. c. Adequate sanitation facilities (toilets, septic tanks/portable units) shall be provided and maintained hygienically. d. Potable water supply shall be ensured. e. A proper solid waste management system shall be implemented, including segregation (biodegradable/non-biodegradable) and authorized disposal. f. Wastewater and sewage shall be managed through septic systems or connection to approved disposal systems or municipal sewer with prior permission; no direct discharge to open areas.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		g. Energy-efficient practices (LED lighting, controlled generator use) shall be adopted; DG sets shall comply with emission and noise norms. h. Adequate drainage arrangements shall be provided to prevent waterlogging and soil erosion within the office premises. i. Fire safety measures, including extinguishers, sand buckets, and emergency exits, shall be installed and clearly marked. j. Offices shall be equipped with first-aid kits and emergency contact information. k. Proper ventilation, lighting, and ergonomic conditions shall be ensured inside office spaces. l. Upon completion, the site shall be fully dismantled and restored to its original or better condition or as per the approved plan.		
42.	Removal of graves and other obstructions	a. In the event of the presence of any graves, burial sites, and other such obstructions, they shall not be removed without the consent of GC. The Contractor shall draw the GC's attention and shall make necessary arrangements and authorizations for such removal.	Contractor	GMRL
43.	Establishment of casting yard	a. Casting yard shall be located on non-sensitive land, away from environmentally sensitive areas. b. Topsoil shall be stripped, stored separately, and reused for site restoration/landscaping. c. Barricading with a tall hard-sheet to control noise and air emissions. d. Wheel-washing facility at the site exit. e. Equipment maintenance in a dedicated workshop area with impervious flooring. f. Necessary consent shall be obtained from the SPCB for the establishment and operation of the batching plant. g. Concrete batching plant shall be equipped with dust control systems (bag filters, water sprinkling). h. Aggregate storage areas shall be covered or regularly sprinkled to control fugitive dust emissions. i. Diesel Generator sets shall be fitted with acoustic enclosures and operated during permissible hours.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		j. Wastewater from batching and casting operations shall be routed to settling tanks/pits, treated, and reused; no discharge of untreated water into open land or drains shall be permitted. k. Concrete waste and rejected precast elements shall be reused or disposed of through authorized C&D waste facilities. l. Fuel, oil, and chemical storage shall be in bunded, impervious areas with spill prevention and response measures. m. Vehicle movement areas paved with concrete/GSB and watered regularly to suppress dust. n. Transportation of materials and precast elements shall be planned to minimize disruption; vehicles shall be covered and comply with emission norms. o. Solid waste management shall be implemented, including segregation, collection, and disposal through authorized agencies. p. Worker health and safety shall be ensured through PPE (helmets, gloves, safety shoes, harnesses), training, and supervision. q. Lifting operations using cranes/gantries shall follow certified procedures; only trained operators shall be engaged. r. Fire safety measures, including extinguishers, sand buckets, and emergency response plans, shall be in place. s. First-aid facilities and emergency preparedness shall be ensured at the site. t. Community safety measures (barricading, signage, restricted access) shall be implemented to prevent unauthorized entry. u. Regular environmental monitoring (air, noise, water) shall be conducted to ensure compliance. v. Casting yard land is temporary land given for construction purposes; as such, the site shall be restored to its original condition or as agreed upon after demobilization.		
44.	Gender Mainstreaming	a. Contractor shall promote gender mainstreaming and enhance the representation of female employees in the workplace by engaging female employees in non-construction roles such as administration (both executive and non-executive), QA/QC laboratory work, housekeeping, documentation, and related support functions.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
45.	Double Decker Structure	The mitigation measures associated with the double decker structure are mostly similar to that of elevated structure of GMRP. Additional mitigation measures are as follows: - Certified scaffolding, fall arrest systems, safety nets, work permits, rescue plans, height pass test for workers to address the risks of working on significant heights on upper deck. - For mitigation risks of falling of objects toe boards, debris nets, exclusion zones, tool lanyards, covered pedestrian pathways shall be used. - Lift plans, certified operators, exclusion zones, weather monitoring. - For mitigating risks of reduction in carriageway following measures will be adopted: - Phased wise construction planning - Schedule critical activities during nighttime or off-peak hours where feasible. - TMP including diversions, signage, and barricading. - Site safety protocols, including fall protection, equipment safety etc. - Utility shifting and coordination with service providers.	Contractor	GMRL
46.	Loading, transport and placement of large precast members	- Identification of designated loading areas with stable, prepared surfaces. Avoid unnecessary disturbance outside work zones. - No persons to be allowed below suspended load. - Restrict public access at lifting area using barricading and security personnel. Installation of warning signage in lifting area. - To avoid oil or hydraulic fuel spillage daily inspection of cranes and lifting equipment to be ensured. Spill kits shall be available. Immediate cleanup and disposal of contaminated materials in case to be done. - Traffic Management Plan approved by authorities to be available. Schedule transport during off-peak hours where feasible. Coordinate with traffic police to avoid traffic congestion - Conduct route survey before transport to Verify bridge capacity (if any) and other overhead clearances. - Escort vehicles/Impact protection Vehicle for oversized loads to be available, Install reflective markings, warning lights, and flags. Comply with legal axle load and speed limits to avoid road safety risk and damage to public infrastructure.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		h. Approved lifting plan. Certified cranes, lifting gears, and operators. Pre-lift inspection. Exclusion zone established, Competent lifting supervisor to be present while erection i. Emergency response plan available. Drivers trained in emergency procedures. Communication maintained throughout transport.		
47.	Signalling, telecom and electrical Contractor's work.	a. Establish a comprehensive work system for electrical work, testing and commissioning, confined space entry, work at height, lifting operations, hot work, and maintenance activities. b. Establish a standard interface management program to safely coordinated simultaneous operations involving multiple contrcators c. Implement Lock-Out/Tag-Out (LOTO) and energy isolation procedures before inspection, maintenance, repair, or modification of electrical, mechanical, signalling, telecom, and rolling stock systems. d. Ensure all testing and commissioning activities are performed in accordance with approved procedures under the supervision of competent and authorized personnel. e. Allow only trained, qualified, certified, and authorized personnel to install, operate, inspect, test, commission, and maintain rail systems. f. Conduct Job Hazard Analysis (JHA) or Task Risk Assessment (TRA) before all high-risk activities. g. Ensure cranes, forklifts, lifting appliances, rail-mounted maintenance vehicles, and rolling stock maintenance equipment are inspected, tested, certified, and maintained in accordance with statutory requirements. h. Establish exclusion zones around lifting operations, energized equipment, testing areas, and moving trains or maintenance vehicles. i. Coordinate train operations and maintenance activities through approved track possession, worksite protection, and centralized control procedures. j. Install physical barriers, warning signs, emergency stop devices, and adequate lighting in work areas.	Contractor	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		k. Use insulated tools, calibrated testing instruments, arc-rated PPE, insulated gloves, dielectric footwear, face shields, fall protection equipment, and other task-specific PPE. l. Maintain safe approach distances from energized electrical systems and moving rolling stock. m. Implement preventive and predictive maintenance programmes for rolling stock, signalling, telecom, electrical systems, depot machinery, and maintenance vehicles. n. Ensure safe housekeeping and cable management to prevent slips, trips, and falls. o. Provide adequate ventilation for electrical rooms, workshops, and confined spaces. p. Develop emergency response procedures for electrical shock, arc flash, fire, explosion, train collisions, derailments, confined space rescue, lifting incidents, and hazardous material releases. q. Conduct regular competency training, emergency drills, inspections, audits, and health surveillance for personnel involved in rail systems installation, operation, and maintenance.		
48.	Community outreach to manage labour influx/ GBV/ community health and safety risks	r. Organize site level monitoring s. Periodic site-level participatory monitoring including structured engagement with local communities, including women and vulnerable groups, to assess the performance and accessibility of measures related to labour influx, SEA/SH, and community safety. t. Feedback will be documented, acted upon, and reported as part of ESMP monitoring. u. Corrective actions will be tracked and disclosed at site level.	Contractor	GMRL
Operation Phase				
1.	Flood Protection	a. Regular maintenance and cleaning of drainage systems will be ensured to prevent blockages and maintain ensure efficient water flow. b. Drainage infrastructure will be regular inspected, and any damages will be repaired promptly. c. Rainwater harvesting structures will be installed along alignment, at stations and in the depot area.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		d. Coordination will be maintained with local municipalities and water management authorities to ensure integrated stormwater management and regulatory compliance. e. Participation in regional stormwater management initiatives will be undertaken, and nature-based solutions will be used wherever feasible.		
2.	Waterbodies	a. Monitoring of treated wastewater generated from metro stations during the operation phase will be carried out to ensure that it does not contain any harmful pollutants.	GMRL	GMRL
3.	Dark Spots	b. Adequate lighting levels will be provided throughout metro stations, platforms, access points and surrounding areas to minimize dark spots, especially during evening and nighttime hours. c. Energy-efficient lighting fixtures, sensors, timers and lighting controls will be used to optimize illumination based on occupancy, time of day and natural light conditions, while maintaining visibility and safety. d. Emergency lighting systems, backup power sources, and clearly visible signage for evacuation routes and emergency response will be incorporated. e. Safe and security, including CCTV cameras, emergency call boxes, and alarm systems, will be installed and maintained to deter crime, monitor passenger safety, and enable rapid incident response. f. Security patrols, personnel training and community engagement initiatives will be implemented to enhance the perception of safety and promote vigilance among metro users.	GMRL	GMRL
4.	Vulnerable and disadvantaged person	a. Regular maintenance of ramps, lifts, escalators, tactile paving, etc. will be ensured throughout the metro operations. b. The following provisions will be incorporated into the design to enhance accessibility for PwDs: ▪ Extra-wide automatic flap gates at stations for wheelchair access ▪ Provision of wheelchairs at stations ▪ Reserved spaces for wheelchairs on trains. ▪ Tactile paths for the visually impaired ▪ Ramps to address changes in level	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		▪ Handrails alongside staircases ▪ Separate and accessible toilets. ▪ Lifts equipped with wide access doors, audio-visual indications, telephone buttons, and braille-labeled call buttons. ▪ Signage at prominent locations for easy navigation. ▪ Reserved seating for differently abled passengers in trains ▪ Audio and visual indication during train door operations for safety and awareness.		
5.	Noise Pollution	a. A green belt will be maintained within the depot boundary to enhance environmental aesthetics and mitigate air and noise pollution. b. Noise barriers will be installed at sharp curves, near structures located within 20m of the alignment and at identified sensitive receptors. c. Screening of noise will be ensured by installing parabolic noise barriers on both sides of the track along curved sections of the viaduct and near sensitive locations during the operation phase. d. These noise mitigation measures are proposed in accordance with the Noise Pollution (Regulation and Control) Rules, 2000 & its amendment and WB's ESS3. e. Noise barriers are proposed for a total length of 3213 m. f. Monitoring Frequency: Once (24 hourly monitoring for 2 days continuously) in three months, Four times in a year for 3 years at each station and Depot.	GMRL	GMRL
6.	Vibration	Vibration can be minimized through the following measures: a. Regular maintenance of tracks and rolling stock. b. Installation of resilient soft base plates and resilient rubber pads between the rail and track slab. c. Periodic rail grinding using a rail grinding machine and lubrication of rails using vehicle-mounted lubricators will be undertaken. d. Rails will be continuously welded and laid to fine tolerances to reduce noise and vibration caused by track geometry. e. Regular vibration monitoring will be carried out at identified sensitive receptors during the operation phase.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		f. Monitoring Frequency: 24-hour monitoring, four times a year for 3 years at 10 locations.		
7.	Ecology	a. Maintenance of trees at afforestation sites and within the depot area. b. The GMRL will implement the biodiversity management plan for the KBA/ IBA in Sector 101, Basai and Basai Pond effectively during the construction and operational phase.	GMRL	GMRL
8.	Management of Solid Waste	a. A waste management plan will be developed, which will be effectively implemented during the operation phase. b. During operation, solid waste generated from metro stations and the depot will be collected in designated bins and handed over to the ULB for disposal. c. Non-biodegradable waste will be handed over to authorized recyclers for proper processing. d. Garbage storage and transfer points will be covered and cleaned every day to prevent nuisance, vector breeding and unhygienic conditions. e. Solid waste will be managed in compliance with the Solid Waste Management Rules, 2016 and its subsequent amendments.	GMRL	GMRL
9.	Management of Plastic Waste	a. Source segregation will be carried out based on the recyclability of the plastic waste. b. The waste will be handed over to authorised vendors for recycling and co-processing.	GMRL	GMRL
10.	Management of E-Waste	a. E-waste generated will be handed over to Haryana SPCB-approved e-waste recyclers or authorized management facilities, in accordance with the E-Waste Management Rules, 2022 and its subsequent amendments.	GMRL	GMRL
11.	Management of Hazardous & Battery Waste	a. The hazardous and battery waste generated will be disposed of in accordance with the Hazardous Waste Management Rules, 2016 & its subsequent amendments, and the Batteries Waste Management Rules, 2022, respectively.	GMRL	GMRL
12.	Water Supply and Sanitation	a. Water will be treated prior to use in accordance with Indian drinking water standards. b. Sewage will be treated using STP. c. Measures such as wastewater treatment and reuse, along with rainwater harvesting, will be implemented to augment groundwater levels.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		d. Organic waste will be segregated and treated using an on-site bio-composting technique. Monitoring Frequency: Wastewater: Once in three months, four times in a year for 3 years at each station and Depot Solid Waste: Once every three months, four times in a year for 3 years at each station and Depot.		
13.	Sewage Treatment Plant (STP)	a. Sewage shall be treated through an STP (10–12 KLD capacity) designed to meet applicable CPCB/State discharge standards. b. The STP shall include screening, equalization, MBBR aeration, secondary clarification, and disinfection units for effective treatment. c. Treated wastewater shall be reused for flushing, landscaping, and other non-potable purposes, reducing freshwater consumption. d. Sludge generated shall be periodically removed, dewatered, and disposed of through authorized vendors or reused as manure where permissible. e. Adequate odor control measures (covered tanks, ventilation, dosing if required) shall be implemented to prevent nuisance. f. Regular operation and maintenance (O&M) shall be ensured by trained personnel to maintain treatment efficiency. g. Standby power backup (DG/alternate supply) shall be provided to ensure uninterrupted operation. h. Treated water quality shall be monitored regularly to ensure compliance with applicable standards Monitoring Frequency: Wastewater: Once in three months, Four times in a year for 3 years at each station and Depot Solid Waste: Once in three months, Four times in a year for 3 years at each station and Depot.	GMRL	GMRL
14.	Solar Panel	a. Solar panels will be cleaned biannually as a standard practice. During periods of high dust or pollution, quarterly cleaning will be conducted to maintain optimal efficiency.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		b. Measures such as adjusting the panel orientation and tilt to minimize glare angles, applying anti-reflective coatings on the glass surface, installing physical barriers to block direct lines of sight, and optimizing indoor lighting placement will be implemented. c. At the end of their service life, solar panels used in the metro project will be disposed of or recycled as per E-Waste (Management) Rules, 2022 and CPCB guidelines.		
15.	Depot	a. The water requirement will be met through the municipal water supply. Additional requirement for horticulture and flushing of urinals/closets will be fulfilled using recycled water. b. Treated wastewater from the ETP will be recycled and reused for car washing, in compliance with consent conditions. c. Treated wastewater generated from the STP will be reused for horticulture and flushing purposes, in accordance with consent conditions. Proper records will be maintained at the site. d. Oil spillage during lubricant changes, cleaning and repair activities for rolling stock maintenance is common. Spilled oil will be captured using oil and grease traps, and the collected oil will be disposed of through authorized collectors to prevent contamination of soil, surface, and groundwater. e. For noise control, ballast-less tracks with elastic and absorbent fittings will be used. f. Thick green belt development will be undertaken to help reduce noise impact. g. Suitable drainage measures will be adopted, such as providing separate pipelines or channels for stormwater and wastewater, with appropriate slope and alignment to prevent cross-contamination and ensure that stormwater and site wastewater remain separate. h. A stormwater drainage system with silt and oil traps will be installed to ensure that the city's common surface drains do not carry contaminants from the depot. i. Spill kits, bunded areas, and containment barriers will be installed to address accidental chemical or fuel spills effectively. j. Well-defined emergency response procedures will be established, including personnel training for spill management and flood scenarios.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
16.	Management of Pigeons	a. Deterrents such as bird spikes, reflective materials, and similar measures will be installed to prevent bird nesting and related nuisances.	GMRL	GMRL
17.	Air Pollution	a. Air quality monitoring needs to be carried out at each station and depot b. Monitoring Frequency: Once (24-hour monitoring for 2 days continuously) in three months, four times in a year for 3 years at each station and depot.	GMRL	GMRL
18.	Soil Quality Monitoring	a. Soil quality monitoring to be checked at baseline monitoring locations b. Monitoring Frequency: Once in three months, four times in a year at 10 baseline monitoring locations for 3 years	GMRL	GMRL
19.	Incident Management	a. An Incident Management Plan will be implemented in accordance with the ESIRT provisions outlined in the EHS Manual	GMRL	GMRL
20.	Monitoring and Grievances	a. A mechanism will be implemented to monitor the progress of ESMP/EMoP measures and evaluate the results achieved. b. A project-level grievance mechanism will be implemented to address concerns.	GMRL	GMRL
21.	Gender Based Violence	a. Workshops will be organised on GBV/SEAH and POSH act, 2013 for all GMRL Staff. b. A clause on GBV/SEAH behavioral obligations will be included in the employment contracts of all employees to strengthen measures aimed at preventing and addressing SEAH in the workplace. c. Female security personnel will be deployed at stations and onboard trains (for random checks) to enhance the safety and comfort of female commuters. d. Information such as women's helpline numbers, gender specific messaging (audio & video), emergency buttons and intercom systems will be provided in all coaches and at stations. e. To address GBV-related incidents, an SOP should be developed.	GMRL	GMRL
22.	Screening of major Crimes	a. Display of information on major GBV-related offenses and corresponding punishments will be ensured at the metro stations to raise awareness among commuters.	GMRL	GMRL
23.	Provisions of CCTV	a. Installation of CCTVs at metro stations and nearby locations. b. Installation of CCTVs at identified GBV hotspots in the vicinity of metro stations.	GMRL	GMRL
24.	Facilities for Women Commuters	a. Installation of Sanitary Pad Vending Machines, b. Transparent Elevators,	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		c. Gender Neutral Toilets, d. Dedicated Women Coaches e. Apps for Online Complaint.		
25.	Street vendors near metro station	a. To avoid traffic congestion near metro stations caused by street vendors, traffic wardens should be deployed to manage and regulate vehicular movement.	GMRL	GMRL
26.	Proper and designated space for autos and e-rickshaws to avoid chaos at metro stations.	a. GMRL will ensure that designated spaces are provided for auto-rickshaws and e-rickshaws. b. Traffic Police and traffic wardens should be deployed to manage and regulate traffic movement effectively.	GMRL	GMRL
27.	Accident, breakdown or failure of Metro	a. Regular inspections of alarm systems in metro coaches and at metro stations will be conducted to promptly detect emergencies, accidents, breakdowns, or power failures. b. First aid facilities will be provided at all stations	GMRL	GMRL
28.	Pedestrian road safety during operation at major metro stations.	a. Traffic should be managed at and around the metro stations with the assistance of the Police Department.	GMRL	GMRL
29.	Engagement and information disclosure	a. Consultations will be carried out to solicit suggestions for planning and addressing measures to manage risks and impacts arising from the proposed project activities during the operation phase.	GMRL	GMRL
30.	MMI and FLM (Charging Point and other infrastructure)	a. Enforcement of No-Parking zones and designated parking to reduce encroachment on walkways. b. To avoid pedestrian-vehicle conflict, a traffic management plan shall be implemented including dedicated pedestrian pathways. c. Periodic inspection of charging systems. d. Use of insulated tools and PPE. e. Display of proper signage including prohibitory signage on honking/no-smoking/loud music, public announcements, etc. f. Safe and designated area for battery storage for management of used batteries. g. Designated storage and disposal of E-waste through authorized vendors.	GMRL	GMRL

S. No.	Environment & Social Aspect	Mitigation Measures	Implementing Entity	Responsible Entity
		h. Implement an Electrical Safety Management Plan, including PTW, LOTO, energy isolation, insulated tools, appropriate PPE, certified equipment, fall protection, worker competency training, and emergency response procedures		
31.	Double Decker Structure	a. Apply architectural treatments, such as uniform colour schemes, streamlined forms, and façade elements, and appropriate lighting to reduce perceived bulk. b. Optimise pier placement by clustering supports and aligning them within existing road corridors to avoid unnecessary widening. c. Introduce landscaping and human-scale design elements, such as under-deck public spaces and cycle tracks, where safe and feasible. d. Shadowing and the tunnel effect shall be minimised through an optimised structural design, adequate spacing between structural elements, maintenance of open carriageway sides to facilitate natural light and ventilation. e. The vehicular emissions beneath the viaduct shall be minimised through the viaduct configuration, maintaining unobstructed airflow, and keeping both sides of the carriageway open. f. Structure-borne noise, rumbling, and reverberation will be mitigated through the adoption of continuously welded rails (eliminating rail joints), provision of elastomeric pads or equivalent resilient elements between the track and the U-girder, installation of resilient rail fastenings, adoption of ballast-less track systems, installation of noise barriers at identified sensitive locations, and implementation of regular track and rolling stock maintenance. g. Impacts on vehicular movement on road shall be minimised by providing adequate carriageway widths, appropriate traffic signage and road markings, sufficient illumination, crash barriers where required, and well-maintained road medians to ensure safe and efficient traffic flow. h. The risk of falling objects will be minimised through the provision of crash barriers along the viaduct edges, the inherent containment offered by the U-girder configuration, and the use of safe maintenance platforms and appropriate maintenance practices. i. The risk of passengers becoming stranded on the viaduct will be addressed through comprehensive emergency preparedness and response measures.	GMRL	GMRL

9.2 Penalty for non-compliance of ESMP

The contractor is required to implement ESMP for all the construction activities. In the event of non-compliance, penalties shall be imposed based on the severity of the unsafe act and/or condition. The proposed penalties for ESMP non-compliance by the contractor are outlined in **Table 9-2**.

Table 9-2 Proposed Penalties for Non-Compliance with ESMP

S. No.	Conditions	Penalty in Rs.
1.	Delay in submission of monthly Progress Reports on ESMP	Rs.50,000 per month.
2.	Reports not updated as per the instructions of the GC/GMRL	
3.	Failure to observe important days related to environmental and social awareness among workers.	Rs.10,000 per violation
4.	Posters, as directed by GC/GMRL, are not printed and displayed at designated locations.	Rs.10,000 per violation
5.	Non-compliance with measures as proposed in the ESMP	Rs.1,00,000 per violation
6.	Non-Compliance of Traffic Management	Rs.25,000 per violation
7.	Non-Compliance with Emergency Preparedness Plan	Rs.1,00,000 per month
8.	Non-Compliance with Labour Welfare Measures	Rs.50,000 per month
9.	Environmental Pollution Failure to prevent or contain air, noise, water and soil pollution. Protection of trees Failure in carrying out environmental monitoring	Rs.50,000 per violation
10.	Housekeeping • Unhygienic conditions around drinking water tanks/taps. • Poor maintenance and cleanliness of site offices, stores, toilets and urinals • Non-provision or improper maintenance of garbage bins at required locations. • Blocked stairways, gangways, or passageways. • Lumber with protruding nails left unattended. • Unprotected openings at the worksite. • Excavated earth not removed within a reasonable time. • Truck carrying excavated earth not covered and vehicle tyres not cleaned before exit. • Vehicles and equipment not parked at designated place after completion of work. • Surplus cables, steel scrap, wooden scrap and empty wooden drums left scattered. • Water stagnation at the site.	Rs.50,000 per violation
11.	Non-compliance of management measures at batching plant and casting yard	Rs.10,000 per violation

9.3 Emergency/ Disaster Management Plan

A disaster is an unexpected event, natural or manmade, that may result from sudden failure, external threats, internal disturbances, earthquakes, fire, or accidents. According to the Disaster Management Act, 2005 a "disaster" is defined as a catastrophe, mishap, calamity or

grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence, which results in substantial loss of life or human suffering, damage to or destruction of property, or degradation of environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

The Disaster Management Act, 2005, enacted by the Government of India, provides a framework for the effective management of disasters. It establishes national, state, and district-level authorities responsible for formulating and implementing disaster management policies and plans. The Act emphasizes a holistic approach to disaster management, including prevention, mitigation, preparedness, response, and recovery. It mandates the preparation of disaster management plans, capacity-building initiatives, and the establishment of an early warning system. Additionally, the Act promotes community participation and coordination among various agencies aiming to minimize the impact of disasters through a systematic and structured approach.

9.3.1 Need for Disaster Management Measures

The effect of any disaster spread within the operational area of the GMRP is likely to be substantial, as GMRL handles thousands of passengers daily at its viaducts and stations. Disaster can cause sudden and immense misery, disrupting normal life and established socio-economic patterns. Additionally, they may result in damage to critical infrastructure, buildings, and communication systems within the metro network. Therefore, an efficient disaster management plan is essential for the proposed project.

The first step in disaster preparedness is the identification of potential causes that may pose unexpected risks to the structural integrity during construction and operation. These include excessive load, cracks, failure, and malfunctioning of sensing instruments, accident, etc. These factors must be thoroughly investigated and monitored with due care.

The primary objectives of the Disaster Management Plan are as follows:

- Provide timely assistance to stranded passengers and ensure their prompt evacuation.
- Provide accurate information to maintain a sense of security.
- Protect GMRL property from damage.
- Expedite the restoration of train operations following a disruption.

To achieve these objectives, clearly defined staff roles and responsibilities during disaster situations must be outlined to ensure a coordinated and effective response. Training and capacity building of officials and workers should be emphasized to prevent confusion and enable prompt response, fostering alertness and efficiency in fulfilling their duties.

9.3.2 Provisions under Disaster Management Plan

GMRL shall prepare a DMP covering all components of the metro project, including the corridor, stations, Depot, and other facilities. The DMP should include the following provisions.

A. Preventive Action

Once there is any indication or suspicion of a potential disaster, immediate preventive measures must be initiated to avoid failure or escalation. Engineers responsible for preventive action should be fully aware of the availability and readiness of repair equipment, materials, trained manpower, and technical expertise required during emergencies.

B. Reporting Procedures

Clear criteria should be defined to determine the level at which a situation is classified as a disaster. This should also specify the stage at which surveillance and monitoring need to be intensified both in terms of frequency and detail. The Engineer-in-Chief shall notify designated officers with the following critical information:

- Identified outdoor assembly points and emergency exit points for evacuation.
- Details of nearest medical facilities for emergency response.

C. Communication System

An efficient and robust communication system is essential for the success of any disaster response operation. The communication framework should be developed in consultation with local authorities. More often, the communication systems are disrupted during disasters; it is essential to clearly identify damage-prone areas, establish a temporary and foolproof communication system for those areas, and ensure redundancy and reliability in all communication channels.

D. Emergency Action Committee

To ensure a coordinated and timely response, an Emergency Action Committee should be constituted. The MD, GMRL, shall serve as the Chairman of this committee. The committee may comprise:

- Head of operations
- Head of technical services
- Head of security
- Representatives from fire services
- Representatives from local police
- Representatives from NGOs and civil society organisations

Emergency Action Committee will be responsible for preparing the evacuation plan and related procedures, based on local needs and available infrastructure. The evacuation plan should include:

- Demarcation of evacuation zones with prioritization based on risk levels.
- Identification of safe routes and assessment of transport adequacy and traffic control measures.
- Identification of safe shelters and relief areas.
- Security arrangements for protecting property left behind.
- Defined roles and responsibilities for all members of the evacuation and response teams.
- Establishment of a Joint Control Room for coordinated operations.

All personnel involved in the Emergency Action Plan should be thoroughly familiar with all elements of the plan and their roles and responsibilities. Regular training sessions and mock drills must be conducted to ensure readiness and eliminate confusion during actual emergencies. Site staff should be trained to detect early warning signs, assess the severity of the situation, and take immediate and effective remedial measures. Specific responsibilities must be assigned to individuals for each segment of the emergency plan.

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

It is essential to communicate with whom and how the declared emergency will be terminated. The termination of an emergency must be clearly communicated to the public through officials' de-alert signals. The notification should be clear so that the evacuees know precisely what to do when re-entering or approaching the affected areas.

9.3.3 Emergency Measures under Disaster Management Plan

Emergency measures are essential to prevent system failures in critical areas such as lighting, fire protection, escape routes, ventilation shafts, etc. The objective of the Emergency Action Plan is to identify vulnerable areas, structures, and population groups that may be affected during a catastrophic event or accident. The EAP should include provisions for preventive actions, notification and warning systems, and effective coordination among various emergency and relief authorities. These are discussed in the following sections.

A. Emergency Action Committee

Emergency lighting systems powered by batteries should be installed at all metro stations. The battery backup system should be capable of supplying power to at least 25% of the

lighting systems in stations, platforms, and viaducts for a minimum duration of 2 hours during a power outage or emergency.

B. Fire Protection

All materials and construction practices should comply with appropriate fire resistance standards. For surface or elevated structures, the minimum fire resistance period should be two hours. The use of wood should be strictly avoided, except for artificial or treated wood products that are flame-resistant and meet fire safety standards. The materials that have zero surface burning characteristics need to be used. The electrical systems should be equipped with automatic circuit breakers that are triggered by both current surges and overloads. The design of a station will include the following provisions:

- Fire prevention measures
- Fire control mechanisms
- Fire detection systems
- Clearly marked means of escape
- Firefighter access routes
- Adequate firefighting equipment

Accumulation of flammable waste materials such as paper and plastic cartons must be strictly prohibited. Smoking strictly prohibited at all designated non-smoking locations. Fire safety planning and implementation shall be undertaken in close coordination with the local fire authority. Smoke control will be achieved by the following means.

- Down stand bulkheads with a minimum depth of 600 mm will be installed around escalator and lift openings to help contain smoke.
- A minimum 30-minute water supply should be assured during fire emergencies. Pumps and overhead tanks should have the capacity to discharge water at 1,100 liters per minute at a head of 21m at the nozzle mouth.
- Water storage in tanks (underground or overhead) shall be divided into dead storage and running storage.
- Firefighting systems should be provided with a diesel pump as a standby in case of power failure.
- In case of fire of electrical origin, water cannot be used until the electric system has been made dead and earthed. For electrical fires, fire extinguishers with non-aqueous agents such as dry chemical powder or CO₂ gas should be installed generously at all static facilities and inside rolling stock
- As smoke inhalation often results in more casualties than direct burns, effective smoke management is critical. This includes ventilation systems that supply fresh air while extracting smoke and combustion gases from the site of the fire.
- All openings, including ducts and passages between the GMRP property and any adjoining structures that could allow uncontrolled access, must be protected using fire

doors, fire shutters, fire dampers, or other appropriate systems. Advanced fire detection and alarm systems shall be installed in accordance with the latest technological standards.

i. Fire Prevention and Safety Measures

Fire prevention measures will be carefully planned and implemented to minimize the risk of fire outbreaks. This will be achieved through the appropriate selection, location, and installation of materials and equipment. GMRL shall obtain approval for the firefighting scheme, ensuring compliance with the following statutory requirements:

- The National Building Code of India
- The Disaster Management Act, 2005 (53 of 2005)
- The Factories Act, 1948 (act 63 of 1948)
- The Punjab Factory Rules, 1952

A No Objection Certificate (NOC) shall be obtained in the prescribed format, and consultation with the fire safety department will be undertaken to incorporate their inputs regarding procedures and permits. In station planning, potential sources of fire can be reduced by:

➤ Fire Prevention

- Use of non-combustible or smoke-retardant materials where feasible.
- Use of fire-retardant materials in rolling stock, including low-smoke, zero-halogen-type electric cables.
- Design layouts that allow ease of equipment maintenance and cleaning of the station premises.
- Provision of dedicated storage spaces for combustible materials (e.g. paint, oil).
- Strict prohibition of smoking in fire-prone areas.
- Ensuring good housekeeping practices at all times.

➤ Safety

- Automatic sprinkler and detection system where the floor area exceeds 750 sqm.
- One wet riser-cum-downcomer per 1,000 sqm of floor area, supported by a static underground tank, overhead tanks and pumps of suitable capacity. System components include hydrants, first-aid hose reels, etc.
- Provision of portable non-aqueous fire extinguishers (CO₂, dry chemical powder) at suitable places.
- Installation of automatic smoke venting systems.
- At least two separate exits where more than 10 persons work, and area exceeds 1,400 sqm.
- Installation of fire-resistant doors along escape routes to prevent fire and smoke spread.

- Travel distance to escape routes should not exceed 20m, and may be extended up to 40 m where multiple escape options are available.

ii. Fire Alarm and Detection System

A comprehensive fire alarm and detection system will be installed across all stations and ancillary buildings, including entrance passages and subways, in compliance with Gurugram Fire Services standards. Key features include:

- Operation via 24V DC power source.
- Manual call points at every hydrant, hose reel point, station head wall, tail wall and other identified locations.
- Installation of alarm bells at both platform and concourse levels, and alarms must be clearly audible throughout the area.
- Heat detectors at roof level, ceilings and floor cavities.
- Smoke probe units in compartments and enclosed spaces.
- Automatic activation of the fire pump upon detection of alarm signals.
- A station fire control and indicating panel in the station controller's room to control, monitor and indicate the status of the fire detection and suppression systems.
- Integration with the fire service zone system for compatibility with Gurugram Fire Services.

iii. Fire Control Measures

Fire and smoke containment will be achieved through:

- Compartmentalization of fire risk areas (excluding public spaces in stations due to operational constraints).
- Provision for smoke extraction and smoke containment systems.
- Openings between compartments must be capable of automatic sealing in the event of a fire.
- Each fire compartment (except public areas) shall not exceed 1,500 sqm
- The fire resistance rating of separated compartments should be at least 3 hours

iv. Access for Fireman

Provision for secondary access, separate from public evacuation routes, shall be made to facilitate firefighter entry in emergencies. Key requirements:

- The secondary entry point should be directly and easily accessible from the road.
- Firefighter access shall be provided to all station levels.
- Minimum stairway width should be 1.0m and maximum riser height should not exceed 60cm.

C. Emergency Door

The rolling stock should be equipped with emergency doors at both ends of the cab to ensure the direct evacuation of passengers in the event of any emergency, including a fire on board the train.

9.3.4 Reporting to the World Bank

GMRL shall notify the Bank at the earliest possible time, and in any case no later than 48 hours after becoming aware of the incident or accident, and shall provide all available details upon request. Furthermore, GMRL shall submit an investigation report or root cause analysis along with a corrective action plan to the Bank no later than 10 days from the time of the initial notice unless a different timeframe is agreed to in writing by the Bank.

Chapter 10: Environmental and Social Monitoring Plan

10.1 Pre-Construction Phase

The environmental and social monitoring program serves as an early warning system to identify potential issues arising from the proposed project activities and enables timely implementation of corrective measures. As part of the ESIA, pre-construction phase monitoring was carried out for air, water, noise, soil, and vibration quality. The results of this monitoring are documented in Chapter 4 of this report.

10.2 Construction Phase

The environmental monitoring schedule for the entire construction period (4 Years) is summarized in **Table 10-1**. Environmental monitoring during the construction phase will be conducted at the same locations where baseline monitoring was previously carried out or at any other location deemed important during implementation by the GMRL, Contractor or Others. The number and selection of monitoring locations could be modified based on emerging requirements once construction activities begin. Monitoring activities should be undertaken by a NABL Accredited/MoEF&CC recognized agency, whether private or government-affiliated. The contractor will be responsible for carrying out the monitoring during the construction phase under the supervision of the GMRL.

Table 10-1 Construction Stage Monitoring Plan

Parameter	Locations	Frequency	Reference/ Standard	Implementation by/Approved by
Air Quality	- Construction Yard - Millennium City Center - Depot - Remaining locations will be variable based on construction activity.	24-hour monitoring for 2 days, twice a month at six locations for each package (2 packages for the entire corridor) for 4 years	- Guidelines for Ambient Air Quality Monitoring, CPCB, 2003 - National Ambient Air Quality Standards 2009	Contractor/ GMRL
Noise Quality	- Millennium City Centre - Udyog Vihar Phase 6 Metro station - Near Greenwood Public School (Basai Pond) - ESIC Hospital	24-hour monitoring for 2 days, twice a month at six locations for each package (2 packages for the entire corridor) for 4 years	Protocol for Ambient Level Noise Monitoring, CPCB, May 2015	Contractor/ GMRL

Parameter	Locations	Frequency	Reference/ Standard	Implementation by/Approved by
	• Near Blossoms Primary School • In front of GAV International School • Near Presidium School, Palam Vihar • Manipal Hospital, Palam Vihar • Near Rotary Public School • The remaining locations can be selected from sensitive areas near vulnerable receptors and ongoing construction sites.			
Water (Ground and surface water)	• Basai Village • Sector-101 • Sector-37 • Depot • The remaining locations can be selected at deep excavation sites, stockpile areas and storage yards.	Four times in a year for 4 years at 10 locations	• Guide Manual – Water and wastewater analysis, CPCB • Drinking water – Specifications IS 10500: 2012 and CPHEEO manual 2012	Contractor/ GMRL
Soil	• Basai Village • Sector-23A • Udyog Vihar Phase-V • The remaining locations can be selected at excavation sites, stockpile areas, storage yards, and labour camps.	Four times in a year for 4 years at 10 locations	US EPA test protocols	Contractor/ GMRL

Parameter	Locations	Frequency	Reference/ Standard	Implementation by/Approved by
Vibration	• Fortis Hospital • Manipal Hospital • INOX Mall • Greenwood School • Presidium School • Additional locations for vibration monitoring can be selected in areas where other heavy construction activities are occurring, as they may contribute to the vibrations from metro construction.	24 Hours, once every month at 10 locations for 1 year	ISO/ TC 108 vibration	Contractor/ GMRL
Ecology	• KBA/IBA in Sector-101, Basai. • Basai pond • Other locations can be selected from Green Areas (Parks and Gardens), Tree Felling, and Replantation Zones	Four times in a year for 4 years (at afforestation locations)	As per the Forest authorities & MCG	Contractor/ GMRL, MCG/GMDA & Forest Department

Workers' Health and Safety: Epidemiological studies will be conducted at construction sites to monitor the potential spread of diseases among workers. Regular health inspections and medical check-ups should be carried out to ensure effective monitoring of workers' health and safety. Any recurrence of health incidents should be recorded, and appropriate mitigation measures should be implemented promptly. The contractor will be responsible for ensuring the health and safety of workers throughout the construction phase. The project proponent will be responsible for reviewing and auditing the health and safety plans and measures implemented by the contractor.

The estimated environmental and social monitoring cost during the construction phase of the GMRP is **Rs. 132.32 Lakh (USD 139799.26)**. This cost shall be included as part of the civil construction contract.

10.3 Operation Phase

The monitoring schedule for the operation phase is detailed in **Table 10-2**. During this phase, the Environmental and Social Management Unit (ESMU) shall be responsible for submitting biannual monitoring reports. These reports will cover: air quality, noise levels, water quality, wastewater management, solid waste disposal, soil quality, vibrations, and ecological indicators.

Table 10-2 Operation Stage Monitoring Schedule Plan

Parameter	Locations and Frequency	Reference/Standard	Implementation by/Approved by
Air Quality	Once (24-hour monitoring for 2 days continuously) in three months, four times in a year for 3 years at each station and Depot.	- Guidelines for Ambient Air Quality Monitoring, CPCB, 2003 - National Ambient Air Quality Standards 2009	GMRL
Noise Quality	Once (24-hour monitoring for 2 days continuously) in three months, four times in a year for 3 years at each station and Depot. Monitoring before erecting Noise Barriers: Once (24 hourly monitoring for 2 days continuously) in a week; for Four weeks	Protocol for Ambient Level Noise Monitoring, CPCB, May 2015	GMRL
Water (Ground and surface water)	Once in three months, Four times in a year at 10 baseline monitoring locations for 3 years	- Guide Manual – Water and wastewater analysis, CPCB - Drinking water – Specifications IS 10500: 2012 and CPHEEO manual 2012	GMRL
Waste Water	Once in three months, four times in a year for 3 years at each station and Depot.	Guide Manual – Water and wastewater analysis, CPCB	GMRL
Solid Waste	Once in three months, four times in a year for 3 years at each station and Depot.	Solid Waste Management Rules, 2016 and its amendments	GMRL
Soil	Once in three months, four times in a year at 10 baseline monitoring locations for 3 years	US EPA test protocols	GMRL
Vibration	24-hour monitoring, four times a year for 3 years	ISO/ TC 108 vibration	GMRL

Parameter	Locations and Frequency	Reference/Standard	Implementation by/Approved by
Ecology	Four times in a year for 3 years at Depot, Afforestation Sites	As per the Forest authorities & MCG	GMRL, MCG/GMDA & Forest Department

The environmental and social monitoring cost during the operation phase of GMRP is **Rs 102.94 Lakh (USD 123,266.67)**. The estimated cost of environmental and social monitoring during operation will be the responsibility of GMRL.

Chapter 11: Institutional Arrangement

11.1 Proposed Institutional Arrangement

Supervision involves periodic checking to ensure that project activities are being carried out in accordance with the approved plans. It provides critical feedback to the project management team, enabling timely interventions to keep the project on schedule. During the construction phase, the supervision and reporting process related to the implementation of mitigation measures shall commence at the contractor level. The contractor will report to the GMRL through the GC.

During the construction phase, the implementation of the ESMP will comprise the following key activities:

- Timely implementation of various mitigation and enhancement measures as recommended in the ESMP.
- Overseeing the implementation of these measures and making necessary refinements or recommending additional measures based on evolving site conditions.
- Project-level monitoring of key performance indicators at specified intervals to evaluate ESMP implementation.
- Periodic reporting on the status of ESMP implementation, monitoring results and key performance indicators.
- Continuous assessment of the effectiveness of ESMP measures using monitoring data and reports and providing necessary directions or corrective actions.

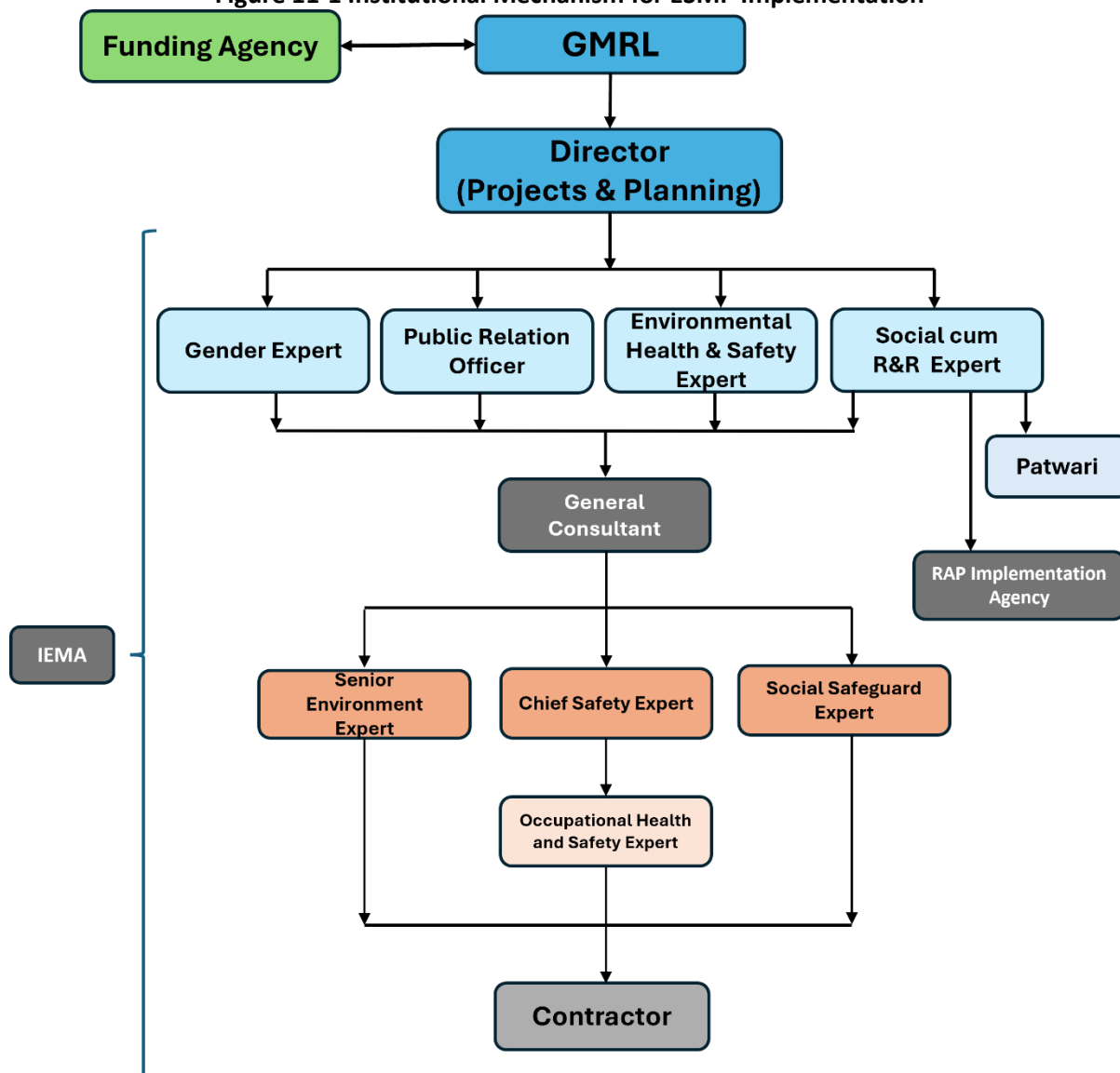
These activities are to be carried out by various agencies that will be involved in the implementation of the metro project. These activities will be conducted either concurrently or at regular intervals across different locations and durations. Therefore, it is essential that all participating agencies function within a well-defined and coordinated framework. The proposed coordination model for the construction and operational phases is presented in **Figure 11-1** and the roles and responsibilities of identified agencies are detailed in the subsequent section.

GMRL: GMRL will be responsible for the overall planning and implementation of the project. It will be supported by its Directors, officials, consultants, subject-matter experts, and contractual staff to ensure effective coordination and successful project execution. GMRL will also ensure that all project interventions align with the strategies and commitments outlined in the ESCP.

Director/Project: The Director/Project holds overall responsibility for planning, execution, monitoring, and evaluation of the project. He will oversee the implementation of the ESMP and coordinate with safeguard specialists for issue resolution. The Director will also conduct periodic reviews, monitor safeguard implementation, recommend improvements as needed,

and liaise with relevant institutions and government departments for necessary support. The Social cum R&R Expert, Gender Expert, and Environmental Health & Safety Expert shall work under the Director/Project and are responsible for implementing social, gender, environmental, and safety mitigation measures. Their key functions include supervising and monitoring construction activities, facilitating the relocation of affected persons, coordinating with utility departments for service relocation, and ensuring overall implementation of the ESMP.

Figure 11-1 Institutional Mechanism for ESMP Implementation



*IEMA: Independent External Monitoring Agency

Environmental Health & Safety Expert: The Environmental Health & Safety Expert at the GMRL will look after environmental, health, and safety aspects. The expert will guide the project team on these aspects and support in building safeguard parameters. He/she will also guide the GC and contractors and monitor their work with regard to ESMP implementation

from time to time. In case of requirement, he/ she will prepare a detailed EMP for different activities to be executed by the project.

Social-cum-R&R Expert: The Social-cum-R&R expert will be responsible for guiding the overall process related to social and resettlement-related aspects of the project. The implementing agencies will monitor social/R&R activities in consultation with the expert. He/ she will be associated in the screening of project activities that may require eviction of encroachers or squatters. He/ she will monitor the implementation of planned activities to ensure compliance with established social safeguards and inclusion parameters. The expert will be supported by the Patwari for land-related issues.

Gender Expert: The gender Expert will be responsible for guiding the overall process related to gender aspects. He/she will oversee SEA/SH risk screening, monitoring, and compliance across project activities. He/she will coordinate with the GBV service provider and GRM linkages. He/she will conduct capacity-building for project staff, contractors, and stakeholders. Enforcement of behavioral standards/CoC for project workers, contractors, and staff. Also facilitate reporting, survivor support referrals and periodic audits.

Public Relations Officer (PRO): The PRO will be responsible for managing all communication activities related to the metro project. This includes preparing press releases, organizing media events, and running public awareness campaigns to keep stakeholders and the public informed about project progress, important milestones, and benefits. PRO also monitors news and social media coverage, responds to public questions and ensures regular updates about the GMRP construction and operations activities.

General Consultant: GMRL has engaged a consulting firm as the General Consultant (GC) to provide technical support and facilitate project implementation. GC will ensure that the project ESIA, ESMP, and E&S Monitoring Plan are effectively followed during project implementation.

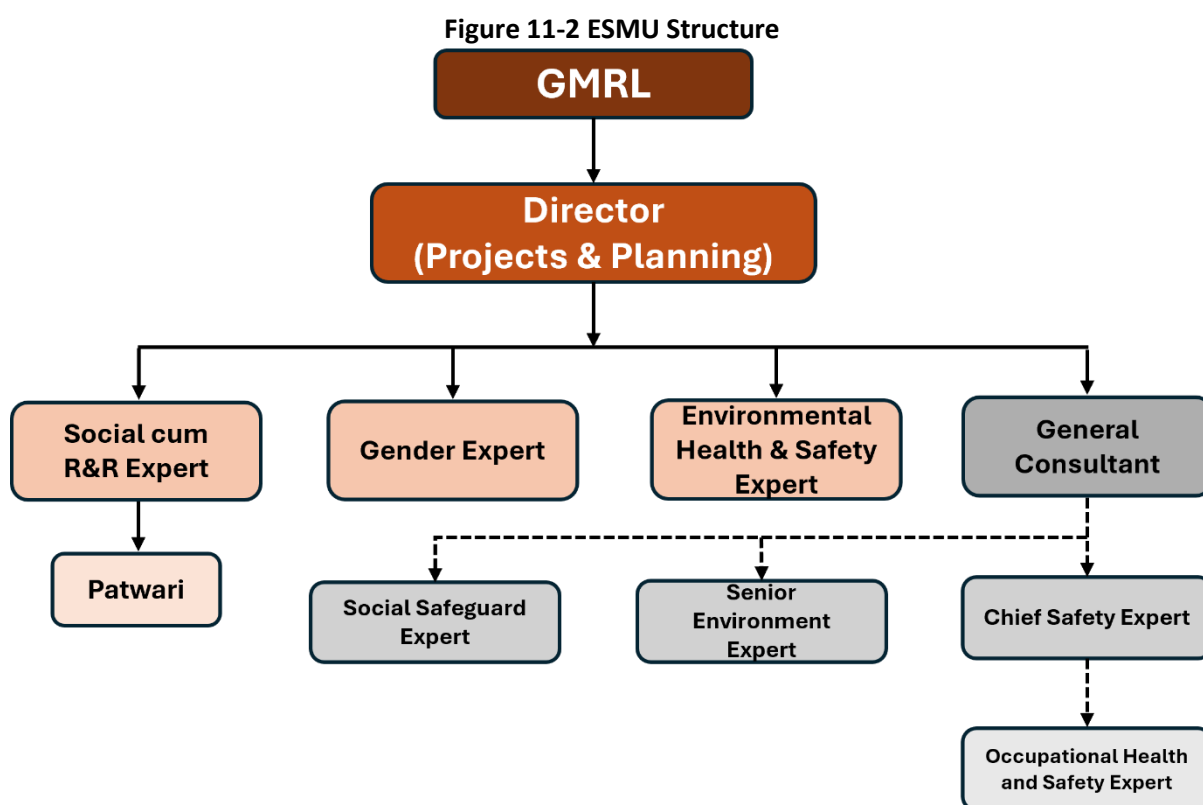
The GC will deploy a team comprising a Senior Environment Expert, a Social Safeguard Expert, and a Chief Safety Expert, supported by an Occupational Health and Safety Expert. These experts will assist the GMRL in updating or modifying the ESIA and ESMP, if required. They will work in close coordination with GMRL's E&S experts, facilitating agencies, and relevant line departments. They will ensure that project interventions align with the ESMP and the E&S Monitoring Plan and will support the effective implementation and monitoring of mitigation measures.

Independent External Monitoring Agency (IEMA): An IEMA agency will be engaged to monitor and evaluate the project implementation. IEMA agency will assess the implementation of the ESMP, RAP, SEP, and LMP along with other related monitoring activities. The agency will also be responsible for conducting mid-term and end-term evaluations of ESMP implementation.

RAP Implementation Support Agency: A RAP Implementation Support Agency has been appointed to facilitate the implementation of the RAP. The agency engaged by GMRL will act as a facilitator and serve as a link between GMRL and the affected persons and communities, ensuring smooth and effective execution of RAP-related activities.

Contractor: The project contractor will implement the ESMP measures, enhancement measures, and measures as directed by GMRL and GC. The responsibility to implement the ESMP measures will be built into the contractual agreement.

The Environmental and Social Management Unit (ESMU) needs to be set up by GMRL for the implementation of the ESMP and the EMoP. The organizational structure of ESMU is provided in **Figure 11-2**¹⁶. The roles and responsibilities of ESMU officials are described in the above section.



11.2 Reporting Structure

The contractor should submit monthly, quarterly, and yearly reports on the compliance of environmental mitigation measures, including environmental monitoring, to the GMRL.

¹⁶ Social Safeguard Expert, Chief Safety Expert and Senior Environment Expert indicated by dashed lines in the figure are part of General Consultant

- GMRL, with support from the GC, shall review the monthly compliance reports submitted by the contractor and provide necessary feedback and recommendations for their finalization and approval. GMRL shall submit quarterly E&S compliance reports to the Bank.
- Photographic monitoring records shall be maintained by the contractor. All key locations, including material source points, disposal sites, plant and camp locations, etc., should be properly documented through photographs.
- A full record of construction activities shall be maintained as part of the standard contract monitoring system across various stages of construction.
- The GMRL will prepare an online ESMP management tool to enable real-time updates from all work sites directly.
- The reporting format for various activities during construction is given at **Annexure 9.1 to 9.10 and Annexure 11.1.**

11.3 Record Keeping

Monitoring forms shall be developed and utilized to focus attention on key environmental issues and to provide feedback for continuous improvement. All mitigation and enhancement measures adopted in the final design will be explicitly included in the Bill of Quantities (BOQ), so that performance and completion are readily documented. Project diaries will be maintained to record environmental issues (such as soil erosion, air quality, water quality, noise level, etc.) as well as safety incidents. These records will form part of the accepted environmental management system. GMRL will submit quarterly E&S performance reports to the WB throughout the project implementation period.

An Excel or Google Form-based system will be implemented for managing safeguard information and reporting safety incidents. In addition, the contractor will be required to maintain database/registers for the following:

- Local and migrant labour workforce
- Attendance and wage payment records
- Overtime details
- PPE issuance
- Accident and incident records
- Health check-up and fitness certification
- Safety and induction training sessions.

11.4 Grievance Mechanism

a) Project GM

GMRL will establish a GM to respond to queries, clarifications, and complaints related to the project. The GM aims to address concerns, grievances, and complaints from the PAPs/PAHs and other stakeholders in a timely, transparent, and effective manner. It will focus on

corrective actions that can be implemented quickly at no cost to the complainant and without fear of retribution.

The GM will address grievances arising from construction-related activities, including issues such as loss of access, damage to private or common property, vibration, noise, dust due to excavation, inadequate traffic diversions, traffic mismanagement, community safety concerns, and related issues. PAPs/PAHs may also raise grievances during the construction phase.

The GM will function independently in line with mandates and functions established under GMRL. Public Relations Officer (PRO) has been appointed by GMRL and will also serve as the communication expert. The details of GM, including institutional arrangements, procedures for lodging complaints, and timelines for grievance redressal, are outlined in the SEP developed for the GMRP. The contact details of the nominated PRO are under:

Table 11-1: Contact Information of PRO

S. No.	Name	Role of PRO in GRC	Official Mobile No.	Email Id
1	Mr. Mukesh Rawat	Member Secretary & Nodal Officer	+91 93551 11303	grievances@gmrl.org.in

b) Contractor GM

Each contractor appointed under the GMRP will be required to establish a GM to address labor-related grievances. The GM shall have due representation of GC, Contractor, Workers, and at least one woman representative (from GC/contractor/workers). The GM will function under the supervision of the GMRL. The mandate for GM, Institutional arrangements, procedure for receiving complaints, time limits for redressal of complaints, and escalation level for unresolved cases and resolution thereof will be finalized during the approval of C-ESMP by GMRL. GMRL will have oversight of this labor GM. The GM will be established during the firm's mobilization phase. The minimum requirement for GM will include:

- Complaint/suggestion boxes and grievance registers at work and camp sites.
- Local grievance committee with GMRL and worker (including female) representation.
- Helpline number of GMRL representative for grievance reporting, including anonymous submissions.
- Awareness programs on grievance redressal rights.
- Assurance of non-retribution and timely closure of complaints.

Information about the GM, including its structure, procedures, and assurance of non-retribution, will be regularly shared with all workers through the following channels:

- Induction training, toolbox meetings and tailgate sessions.
- Pictorial illustrations and posters in the local language.
- Awareness campaigns focused on workplace safety and Emergency Response Plans
- Briefings on community safety and responsible behaviour while working in or nearby communities.

Chapter 12: Environmental and Social Costs

12.1 Environmental and Social Costs

The estimated environmental and social costs for the implementation of ESMP and EMoP during the pre-construction, construction, and operation phases of the proposed project amount to **Rs. 4582.67Lakh (US\$ 4857651.55)**, as detailed in **Table 12-1**.

Table 12-1 Environmental and Social Cost

S. No.	Item	Cost in Indian Rs. Lakh	Cost in US\$	Responsibility
1.	Compensatory Afforestation			
	AC01	439.68	464528.00	GMRL
	AC03	500.28	528559.48	GMRL
	AC04 (Metro Depot)	130.75	138135.33	GMRL
	Casting Yard 1	27.69	29257.83	GMRL
	GMDA Section (Bakhtawar Chowk)	103.51	109357.13	GMRL
2.	Environment Monitoring			
	During Construction	132.32	139799.26	Contractor
	During Operation	102.94	123266.67	GMRL
3.	Environmental & Social Management Unit	489.54	517210.78	GMRL
4.	E&S Training & Capacity Building	49.00	51769.68	GMRL
5.	SEA/SH Risk Prevention and Response Action Plan Implementation	30.00	31695.72	GMRL
6.	Rainwater Harvesting	479.9	507025.88	Contractor
7.	Noise Barrier	522.105	551616.48	GMRL
8.	Sewage Treatment Plant (STP) at stations	906.5	957739.04	GMRL
9.	Depot			
	Effluent Treatment Plant (ETP) and Sewage Treatment Plant (STP) at stations	200	211304.81	GMRL
	Rainwater Harvesting	40	42260.96	GMRL
	Green Belt	11.85	12519.81	GMRL
Sub-Total		4166.065	4416046.86	
10.	Miscellaneous (10% of Sub-Total)	416.61	441604.69	
Grand Total		4582.67	4857651.55	
			4.86 million	

¹⁷Note: 1 US\$ = 94.65 as on 30.03.2026

¹⁷ In addition to the above environmental cost, the expenditure to implement ESMP measures during design phase, construction phase and operation phase as mentioned in the Table 9-1 will be the responsibility of DDC, Contractor and GMRL respectively

Chapter 13: Way Forward

This ESIA report comprehensively addresses all key aspects of the GMRP, including the project background, description, study area, and analysis of alternatives. It thoroughly examines applicable E&S regulations at the international, national, and state levels and presents detailed baseline information covering VECs.

The ESIA has identified impacts that have been evaluated in line with the applicable WB ESS. The stakeholder views are also considered and incorporated into the report.

All identified mitigation measures are included in the ESMP and RAP, which also details an Environmental Monitoring Plan, which needs to be implemented during the pre-construction, construction, and operation phases. Additionally, the ESMP includes associated environmental costs to ensure effective implementation of the proposed measures.

Furthermore, **Table 13-1** Outlines the additional technical studies and activities, which will be undertaken as part of continued project development.

Table 13-1: Additional Studies and Activities

S. No.	Additional Studies and Activities	Responsible Party	Supporting Party	Timeline
1	Traffic Diversion and Management Plans	GMRL	Contractor through GC	Before the commencement of construction work at particular section/ location
2	Environmental & social audits and monitoring related to the environment, social, and occupational health & safety	GMRL	Consultant	During Construction
3	Update or preparation of ESIA & RAP to reflect finalized designs and newly identified impacts	GMRL	GC	During Construction
4	Integrated Biodiversity Assessment and Preparation of BMP	GMRL	Biodiversity Consultant	During the monsoon/ migratory season (July 2026)
5	Incorporation of stakeholder suggestions during design development, including: • Provision of parking at metro stations where ever feasible • Refinement of alignment and station access points to minimize social impacts • Allocation of space for autos, e-autos, and taxis	GMRL	DDC	During the project pre-construction / construction

Annexure 1.1**List of Individuals and Organizations Involved in the ESIA**

S. No.	Name of Individual / Organization	Role / Contribution
1	M/s Arihant Analytical Laboratory Pvt. Ltd	Environmental Monitoring (Air, Noise, Water, Soil)
2	N-Dimensional GIS Solution	GIS Studies
3	M/s IADEPT Marketing	Vibration Monitoring
4	M/s Bernard Gruppe	Census and Socio-Economic Study

Annexure 2.1

Key Applicable Legislations

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
1.	Environment (Protection) Act, 1986 and amended in 1991; Environment (Protection) Rules, 1986	To protect and improve the natural environment, including forests, lakes, rivers, and wildlife, and to have compassion for living creatures. Section 5 of Chapter-II: Power to issue directions. (a) the closure, prohibition or regulation of any industry, operation, or process; or (b) Stoppage or regulation of the supply of electricity or water or any other service. Section 7 of Chapter III: Not to allow emission or discharge of environmental pollutants in excess of the standards. Section 8 of Chapter-III: Handling hazardous substances to comply with procedural safeguards.	The various environmental quality standards notified under this act are applicable to this project. • Compliance to general standards for the discharge of environmental pollutants • Overall Environmental Protection	Applicable
2.	EIA Notification, 2006, and subsequent amendments	Environment Clearance is required for new, modernization, and expansion projects listed under 39 categories of the Schedule of the notification.	Metro rail projects are not listed in the prescribed categories. However, construction of a building for commercial purposes (shopping complex, offices, etc) having a built area equal to or more than 20,000 sqm shall require prior EC from SEIAA.	Applicable if the stations are planned for commercial development or if the depots are more than area threshold
3.	Metro Rail Transit System, Guidelines for Noise and Vibrations, RDSO, Ministry of	To minimize the impacts of noise and vibration during the construction and operation of the metro corridor.	Recommended norms and precautionary measures for noise and vibrations for metro corridor in India.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
	Railways, September 2015			
4.	Forest (Conservation) Act 1980 amended in 2023; Forest (Conservation) Rules 2003	To protect and manage forests, to check deforestation by restricting the conversion of forest areas into non-forest areas. Section 2, Restriction on the use of forest land for non-forest purposes.	Entry/exit of Sector-10 metro station falls in a forest area, which is an unclassified Forest area. During field visits, the flora observed in the area is only Kikar, and the surrounding area is a fully developed residential area.	Applicable
5.	Haryana Forest Policy, 2006	To conserve and protect forest ecosystems, including biodiversity, wildlife habitats, and fragile ecosystems, from degradation and destruction.		Applicable
6.	The Wildlife (Protection) Act (WPA), 1972, amended in 2022	Protection of animals and specified plants. Section 27 - Restriction on entry in sanctuary; Section 28 - Grant of permit; Section 33 - Control of sanctuaries.	Sultanpur National Park is located within 10 km of the proposed project. The notified Eco Sensitive Zone (ESZ) of the National Park is up to 5 kms from the boundary of the protected area of the park. The proposed metro corridor does not pass through the boundary of the National Park and its notified ESZ. Therefore, the wildlife clearance is not required for this project.	Not Applicable
7.	The Biological Diversity Act, 2002 and its Rules, 2004	For conservation and sustainable use of Biodiversity. As per the provisions of the Act, certain areas which are rich in biodiversity and encompass unique and representative ecosystems are identified and designated as biosphere reserves to facilitate their conservation.	The water bodies that lie in 10 km on either side of the alignment are: • Sultanpur National Park: 8.2 km • Najafgarh Jheel: 4.7 km • KBA/IBA in Sector 101, Basai: 50 m • Basai Pond: adjacent to metro alignment. Out of the above, Sultanpur National Park is notified, and the proposed metro corridor does not pass through the	Not Applicable
8.	Wetland (Conservation and Management Rules), 2017	To conserve, manage, and maintain the ecological character of the wetlands without restricting wise use. Section 3 clause (a): wetlands categorized as 'wetlands of international importance' under the Ramsar Convention.		Not Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
		Section 4, clause (2): Activities shall be prohibited within the wetlands. Sub clause (i): Conversion for non-wetland uses, including encroachment of any kind. Sub clause (vi): Any construction of a permanent nature except for boat jetties within fifty meters from the mean high flood level observed in the past ten years, calculated from the date of commencement of these rules.	boundary of the National Park and its notified ESZ. Najafgarh Jheel and KBA/IBA in Sector 101, Basai are not notified to date by the Central/State Government. The alignment crossing streams/nalas as detailed in Table 5-9.	
9.	The Ancient Monuments and Archaeological Sites and Remains Act, 2010	Preservation of ancient and historical monuments, archaeological sites, and remains of national importance. To regulate the archaeological excavations and protection of sculptures, carvings, etc.	One archaeological site falls within a 10 km radius of the proposed metro corridor, i.e., the Mosque of Ala Vardi Khan. The location of the mosque is 490 m away from the alignment (near the Bajghera Road metro station). No impact is anticipated due to the proposed metro project.	Not Applicable
10.	The Treasure Trove Act, 1878	To regulate the ownership and disposition of treasure troves discovered in India. A treasure trove typically refers to any valuable items such as coins, bullion, jewellery, or artifacts that are found hidden or concealed in the ground or in structures, with no known owner.	Applicable to the project if during construction or excavation for metro projects, any valuable historical artifacts or objects of archaeological significance are discovered.	Applicable if any chance find occurs.
11.	The Antiquities and Art Treasures Act, 1972 and its rules	To regulate the export, import, and ownership of antiquities and art treasures in the country and to prevent the illegal trafficking of cultural heritage items, protect national treasures, and promote their preservation for future generations.	Protection and preservation of cultural heritage could apply if archaeological artifacts are discovered during construction activities of the project.	Applicable if any archaeological artifacts are discovered.

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
12.	Aircraft Act 1934 with Aircraft (Amendment) Act, 2007 (44 of 2007) & Ministry of Civil Aviation (Height Restrictions for Safeguarding of Aircraft Operations) Rules, 2015 and its amendment	Sub Rule 3 of Height restrictions for safeguarding of aircraft rules: No structure higher than the height specified within the 20 km of the Aerodrome Reference Point of the civil and defense aerodromes Rule 4: No structure shall be constructed or erected, or any tree planted or grown on any land.	Indira Gandhi International Airport, Delhi, is situated within 10 km on either side of the proposed alignment. The height of all proposed structures of the metro project is lower than the permissible height. So, Sub rule 3 is not applicable.	Not Applicable
13.	Water (Prevention and Control of Pollution) Act, 1974 amended in 1988; Water (Prevention and Control of Pollution) Rules, 1975 amended in 2011 The Water (Prevention and Control of Pollution) Cess Act, 1977 amended in 2003	To manage water quality standards (Link at Annexure 2.4) and effluent standards (Link at Annexure 2.4), as well as monitoring water quality (Link at Annexure 2.4), prosecuting offenders, and issuing licenses for the construction and operation of certain facilities. Cess Act 1977 is for the levy and collection of a cess on water consumed by persons operating and carrying on certain types of industrial activities. This cess is collected with a view to augmenting the resources of the Central Board and the State Board for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. - Section-19 3(a): alters any water pollution prevention and control area, whether by way of extension or reduction. - Section-19 3(b): define a new water pollution, prevention and control area in which one or more water pollution, prevention and control areas may be merged, or any part or parts thereof. - Section 24: Prohibition on use of stream or well for disposal of polluting matter.	Applicability to proposed metro corridor and proposed stations for - Stormwater Management - Wastewater Discharge - Protection of Water Bodies Consent to establish and operate to be obtained for operation of Depot.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
		Section 25 & 26: Require consent to establish or operate any industry from the board.		
14.	Air (Prevention and Control of Pollution) Act, 1981 amended in 1987; Air (Prevention and Control of Pollution) Rules, 1982.	To control the air-polluting activities and when the emissions of any air pollutants into the air exceed the standards set by the Central and State boards. - Section-16 2(b): plan and cause to be executed a nationwide program for the prevention, control or abatement of air pollution. - Section 17(a) to plan a comprehensive program for the prevention, control or abatement of air pollution and to secure the execution thereof. - Section 21: Restriction on use of certain industrial plant requires consent to establish or operate any plant from the board. - Section 22: Persons carrying on industry, etc not to allow emission of air pollutants in excess of the standards laid down by the board under Section 17(1)(19).	The project activities emit air pollutants during the construction and operation phases. Consent to establish and operate is to be obtained by the contractor for the operation of DG sets and the ready-mix plant, etc. Consent to establish and operate is to be obtained for the operation of the depot.	Applicable
15.	National Ambient Air Quality Standard - CPCB order Dated 18 th November, 2009	The regulation sets limits for air quality parameters for Residential, Commercial, and ecologically sensitive areas (Link at Annexure 2.4). Industry is not to allow the emission of air pollutants in excess of the standards laid down under section 17(1)(19) of the Air Act.	The project generates pollutants during the construction and operation phases.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
16.	Graded Response Action Plan (GRAP)	GRAP is a framework to combat air pollution in Delhi and surrounding areas. It defines different stages of air quality (Poor, Very Poor, Severe, Severe+) based on the Air Quality Index (AQI) and outlines corresponding actions to be taken by authorities and citizens to reduce pollution. The GRAP for the NCR under 4 stages: Stage - I 'Poor'(AQI 201 - 300), Stage - II 'Very Poor (AOI 301-400), Stage - III 'Severe' (AOI 401-450) Stage - IV 'Severe +' (AQI >450)	Under GRAP, Construction activities are permitted for metro projects up to stage III (AQI < 450). The activities are not permitted during stage – IV (AQI > 450).	Applicable
17.	Noise Pollution (Regulation and Control) Rules, 2000	To enforce noise pollution control measures - According to the provisions of the rules, a person could make a complaint to the designated authority if the actual noise levels exceed the ambient noise standards by 10 dB (A) or more as compared to the standards prescribed. The equipment used during the construction should have acoustic enclosure. Rule 3: Ambient air quality standards link is given at Annexure 2.4. The rules specify maximum permissible noise levels for different times of the day (daytime and nighttime) in each category of area. - Sub rule 5 A of Rule 5: Restriction on the use of horns, sound emitting construction equipment's during nighttime in the residential area and silence zones.	Noise generated during construction and operation phase of the project. The noise levels shall be controlled to avoid disturbances to nearby sensitive receptors.	Applicable
18.	Solid Waste Management Rules, 2016 amended in 2020	Management (Collection, Handling, Storage, Treatment and Disposal) of solid waste. Section 4: Segregate and store the waste generated in three separate streams namely bio-degradable, non-	Applicable at all stages throughout the project.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
		biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time.		
19.	Hazardous and Other Wastes (Management and Transboundary Movement) 2016 and its amendments	To ensure the protection of the environment and human health from the adverse effects of hazardous and other wastes. To control the import and export of hazardous and other wastes to prevent illegal trafficking.	Applicable at all stages throughout the project.	Applicable
20.	Plastic Waste Management Rules 2016 and its amendments	Management of Plastic waste. Rule 8, Responsibility of the waste generators. Storage of waste at source and handover of the segregated waste to urban local bodies, Extended Producer Responsibility (EPR) agencies, aggregators, and recyclers.	Applicable at all stages throughout the project.	Applicable
21.	E-waste (Management) Rules 2022 and its amendments	Management of e-waste, including solar panels, cells, batteries, etc. Rule 8, Responsibility of consumer or Bulk Consumer.	Applicable at all stages throughout the project.	Applicable
22.	Battery Waste Management Rules 2022	To ensure environmentally sound management of batteries. The rules cover all types of batteries, viz. Electric Vehicle batteries, portable batteries, automotive batteries and industrial batteries. The rules function based on the concept of Extended Producer Responsibility (EPR), where the producers (including importers) of batteries are responsible for the collection and recycling/ refurbishment of waste batteries and the use of recovered materials from waste into new batteries.	Portable batteries and EVs can have roles in supporting metro systems indirectly, such as emergency power, service vehicles, and station mobility.	Applicable
23.	Construction and Demolition Waste	Management of waste resulting from construction, remodelling, repair, and demolition of any civil structure.	The project will generate C&D waste during the construction phase.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
	Management Rules, 2016	Section 4, Clause 3 and 5: Duties of the waste generator. Waste generators who generate more than 20 tons or more in one day or 300 tons per project in a month shall have to segregate the waste and submit a waste management plan.		
24.	Categorization of industries - CPCB Order Dated 7th March 2016	The purpose is to categorize industries based on their potential to cause pollution. (Red, Orange, Green, and White - with Red being the most polluting and White being non-polluting)	The project requires a Ready Mix Concrete (RMC) plant during the construction phase, which is categorized as Green Category.	Applicable
25.	National Building Code, 2016	Provides guidelines for regulating the building construction activities across the country.	Stations and depot structures need to be designed as per the code provisions and fire codes.	Applicable
26.	Town and Country Planning Notification, Government of Haryana, Sep 2012	Land use definition and allocation for various purposes.	Change in Land Use	Applicable
27.	Central Motor Vehicle Act, 1988 and Central Motor Vehicle Rules, 1989	To check vehicular air and noise pollution. Chapter V: Construction Equipment and Maintenance of Motor Vehicles.	Construction Equipment & vehicles during construction.	Applicable
28.	Energy Conservation Act, 2001	To conserve natural resources and enhance energy security by minimizing energy wastage.	By integrating energy-efficient design, technologies, and management practices, we can minimize energy consumption and reduce operational costs.	Applicable
29.	Disaster Management Act, 2005	To establish institutional mechanisms at the national, state, and district levels for disaster management.	The project areas fall under the seismic (earthquake-prone) zone IV, and hence any construction activities/ interventions will be under the purview of this act.	Applicable
30.	The Haryana State Disaster Management Rules, 2010	To enhance the state's preparedness to effectively manage and respond to disasters of all kinds, including natural and man-made disasters.		

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
31.	The Ozone Depleting Substances (Regulation and Control) Rules, 2000 and its amendment	To control and manage the production, import, export, and use of substances known to deplete the ozone layer.	The instruments, equipment, etc, which are free from Ozone Depleting Substances (ODS) may be used in the project.	Applicable
32.	The Manufacture, Storage and Import of Hazardous Chemical Rules 1989 and its amendments	To ensure the safe handling, storage, transportation, and disposal of hazardous chemicals.	Applicable for hazardous chemicals that shall be used in the project as per the list in the schedule of rules.	Applicable
33.	Haryana Water Resources (Conservation, Regulation and Management) Authority Act, 2020 and its amendment 2022 and Haryana Water Resources Authority (HWRA), Notification dated 23.12.2020	For conservation, management, and regulation of water resources, i.e., groundwater and surface water, within the State of Haryana, for ensuring the judicious, equitable, and sustainable utilization, management, and regulation.	For groundwater extraction in over-exploited assessment units, NOC for infrastructure projects needs to be obtained from HWRA, subject to the non-availability of treated sewage within a 10 km radius.	Applicable
34.	Private Security Agencies (Regulation) Act, 2005	The act regulates private security agencies and their personnel. It mandates that private security agencies must obtain a license and comply with certain training and operational standards.	If the project employs private security agencies to protect the site, the personnel, and the assets, these agencies must comply with the PSARA requirements. This includes obtaining a PSARA license and adhering to the guidelines.	Applicable
35.	The Insecticides Act, 1968 and Insecticides Rules, 1971 and as amended	These provide for regulating the manufacture, sale, transport, distribution, export, import, and use of pesticides to prevent risk to human beings or animals, and for matters connected therewith. No one should import or manufacture, sell, stock or exhibit for sale; distribute, transport, use: (i) any misbranded insecticides, (ii) any	The insecticide usage may arise in landscape development works and compensatory afforestation work.	

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
		insecticide the sale, distribution or use of which is for the time being prohibited under the Act; and (iii) any insecticide except in accordance with the condition on which it was registered under the Act.		
Social Regulations				
1.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013	The act provides for a transparent process and fair compensation in land acquisition for public purpose and provides for rehabilitation and resettlement of landowners and those affected by land acquisition. It comprises four schedules that provide the minimum applicable norms for compensation based on market value, multiplier and solatium; Resettlement and Rehabilitation (R&R) entitlements to landowners and livelihood losers; and facilities at resettlement sites for displaced persons, besides providing flexibility to states and implementing agencies to provide higher norms for compensation and R&R. This act is applicable for supporting the continuous business activities during the works or livelihood restoration.	This act has several provisions that are highly relevant for the development of the metro corridor, as it affects the acquisition of land for infrastructure projects like metro rail systems. The relevance of this act for the development of the metro corridor is: 1. Fair compensation 2. Consent of affected families 3. Rehabilitation and Resettlement 4. Social Impact Assessment (SIA) 5. Transparency and Public Consultation	Applicable to this project when private land to be acquired on an involuntary basis.
2.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Haryana Amendment) Act, 2017	The Haryana-specific amendment allows the state government to de-notify land acquired under the Land Acquisition Act, 1894 if the public purpose becomes unviable or unnecessary. Section 101(A) empowers this, ensuring compensation, including alternative land and damages for landowners, if the acquired land has been utilized or constraints created.	The project requires the acquisition of private land. The act is applicable to all sub- projects when private land is required to be acquired on an involuntary basis for Haryana State.	Applicable when private land to be acquired on an involuntary basis.
3.	GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations	This policy facilitates the purchase of land or property through mutual negotiation or direct purchase.	This policy shall apply in cases where private land must be acquired for the project.	Applicable when private land to be acquired on

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
				a voluntary basis.
4.	Street Vendor Act, 2014	The Act mandates town vending committees (TVC) to survey all local street vendors at least once in every five years. A TVC must accommodate all surveyed vendors subject to the holding capacity of the vending zones. Until a survey is complete, no street vendor is to be evicted. The state is to specify the manner of conducting the survey in the scheme.	Relocation of squatters, kiosks, etc., during the project implementation.	Applicable
Other Relevant Acts and Policies				
1.	Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013	It aims to set out effective measures to avoid & to eliminate & if necessary, to impose punishment for any sexual harassment in the workplace.	It places responsibilities on employers and the management of metro construction projects to take measures to prevent and address sexual harassment.	Applicable
2.	Bonded Labour System (Abolition) Act, 1976 along with Rules, 1976	To prevent the economic and physical exploitation of the weaker sections of the people and for matters connected therewith or incidental thereto.	To protect the rights and well-being of the labor .	Applicable
3.	The Child Labour (Prohibition and Regulation) Act, 1986 and 2016 amendment	The act lays out: • Complete Ban on Child Labor • Adolescent labour regulations • Safety and Welfare Measures • Education and Awareness • Prohibition on Bonded Labor	It is crucial for metro development authorities, contractors, and relevant government agencies to be aware of and adhere to these provisions to ensure the protection and well-being of children and adolescents and to comply with the law.	Applicable
4.	Contract Labour (Regulation and Abolition) Act 1970 and rules	To prevent the exploitation of contract labor and to introduce better conditions of work.	As there will be labor involved in construction, this act ensures that labor contractors comply with the legal provisions and obligations. The contractors are required to obtain licenses for employing contract labor.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
5.	Employees Provident Funds and Miscellaneous Provisions Acts 1952 along with EPF Scheme Rules and Forms	It is a beneficent piece of social welfare legislation aimed at promoting and securing the well-being of the employees. It ensures that workers receive provident fund benefits, which can provide financial security and retirement savings, and it places obligations on employers to make contributions and maintain records.	This legislation is vital in safeguarding the interests of employees in the construction industry, including those involved in metro corridor construction.	Applicable
6.	Employees State Insurance Act 1948 along with Rules and Regulations	Protect the interests of workers in contingencies such as sickness, maternity, temporary or permanent physical disablement, death due to employment injury resulting in loss of wages or earning capacity. Act also guarantees reasonably good medical care.	During the Construction and Operation phases, employees have access to healthcare and various benefits in case of sickness, injury, or other contingencies while working in the construction industry.	Applicable
7.	Equal Remuneration Act, 1976 along with allied Rules	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.	Relevant as it addresses the issue of pay equity and non-discrimination in remuneration based on gender. This includes the following: 1. Equal Pay for Equal Work 2. Non-Discrimination 3. Provisions for Maternity Benefits 4. Registration and Filing of Returns etc.	Applicable
8.	Inter State Migrant Workmen (Regulation of Employment and Conditions Service) Act, 1979	To protect workers whose services are requisitioned outside their native states in India. Whenever an employer faces a shortage of skills among the locally available workers, the act creates a provision to employ better-skilled workers available outside the state. It is designed to protect the rights and welfare of inter-state migrant workmen by regulating their employment, working conditions, and ensuring their proper accommodation and transportation.	This legislation is essential in safeguarding the interests and well-being of laborers who migrate from one state to another to work on construction projects like the metro corridor.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
9.	Minimum Wages Act 1948 along with Central Rules 1950	To ensure that workman gets at least minimum wages as fixed by Govt. Minimum wages sets the lowest limit below which wages cannot be allowed to sink. The Minimum Wages Act empowers appropriate governments (both central and state governments) to fix and revise minimum rates of wages for different scheduled employments.	To ensure that workers receive fair wages is crucial in the construction industry, where labor can be physically demanding and may involve hazardous conditions.	Applicable
10.	Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participations) Act, 1995 along with Rules, 1996 and National Trust for Welfare of Persons with Disabilities Act, 1999 with rules 2000	It gives effect to the proclamation on the full participation and equality of persons with disabilities in the Asian & Pacific Region and provides for their education, employment, creation of barrier-free environments, social security, etc.	To ensure that infrastructure is accessible, that the rights of persons with disabilities are protected, and that opportunities for their participation in the workforce and society are promoted within the construction industry and public transportation systems.	Applicable
11.	The Rights of Persons with Disabilities Act, 2016	To ensure equality, non-discrimination, and full participation of PWDs in society by providing them with legal safeguards, entitlements, and opportunities for empowerment.	Applicable for PWD are present and affected in the project.	Applicable
12.	Guidelines and space Standards for Barrier Free Built Environment for Disabled and Elderly persons, 1998	To ensure accessibility and inclusivity in architectural design and urban planning for disabled and elderly persons.	Adherence to guidelines is crucial for ensuring equitable access to public transportation, which will promote independence and mobility for individuals with disabilities and the elderly. All metro stations are planned in compliance to these guidelines.	Applicable
13.	Workmen's Compensation Act, 1923 & its rules and amendments	It provides compensation to employees or their dependents in case of injuries or death arising out of and in the course of employment. The Act is aimed at ensuring	In the case of metro corridor construction, the employers (employer, contractors, construction companies, etc.) are responsible for providing compensation to	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
		financial protection for workers and their families in the event of accidents or injuries at the workplace.	the affected workers or their dependents in case of accidents or injuries at the workplace.	
14.	Right to Information Act, 2005	Empower the citizens, promote transparency and accountability in the workings of public authority.	To promote transparency, accountability, and citizen engagement in government projects, including the construction of the metro corridor. It empowers citizens to access critical information, participate in decision-making processes, and hold public authorities responsible for their actions, contributing to good governance and public interest.	Applicable
15.	The Building and Other construction Workers (Regulation of Employment and conditions of Services) Act, 1996	To regulate the employment and conditions of service of building and other construction workers and to provide for their safety, health, and welfare measures. Chapter VI: Hours of Work, Welfare Measures and other Conditions of Service of Building Workers. Chapter VII: Safety and Health Measures.	All construction-related activities, including incidents, the deployment of OHS personnel, workers' camp, construction camp, etc.	Applicable
16.	The Building and Other Construction Workers Welfare Cess Act, 1996	Provides for the levy and collection of a cess on the cost of construction incurred by employers to augment the resources of the Building and Other Construction Workers' Welfare Board constituted under the Building and Other Construction Workers (Regulation of Employment and conditions of service) Act, 1996	Provides for their safety, health and welfare measures and other matters connected therewith or incidental thereto	Applicable
17.	The Payment of Wages Act, 1936	Lays down the date by which wages are to be paid, when they will be paid, and what deductions, if any, will be made from the wages of the workers.	Intended to protect employees from unlawful employer deductions and/or unjustifiable salary delays	Applicable
18.	The Payment of Gratuity Act, 1972	Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation, if an employee has completed 5 years of service with the employer.	Provides payment of gratuity at the rate of 15 days' wages for each completed year of service, subject to a maximum of Rs. ten lakhs.	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
19.	The Maternity Benefit Act, 1961	Protects the employment of women during the time of her maternity and entitles her to a 'maternity benefit' - i.e., full paid absence from work - to take care of her child. The act is applicable to all establishments employing 10 or more persons.	Act regulates the employment of women in certain establishments for a certain period before and after childbirth and provides for maternity and other benefits.	Applicable
20.	Haryana Maternity Benefit Rules, 1967	To provide maternity benefits to women employees working in various establishments in the state of Haryana.	Applicable to the project for women employees for provisions related to maternity leave, payment of maternity benefits, and other related matters to ensure the welfare of women employees during pregnancy and childbirth.	Applicable
21.	The Payment of Bonus Act, 1965	Provides for payments of an annual bonus subject to a minimum of 8.33% of wages and a maximum of 20% of wages.	Provides for a minimum bonus of 8.33 percent of wages	Applicable
22.	The Trade Union Act, 1926	Lays down the procedure for the registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities for civil and criminal liabilities.	Provide opportunities to constitute unions.	Applicable
Labor Codes				
1.	The Code on Wages, 2019	Code on Wages, 2019, serves as a comprehensive legal framework that addresses various aspects of wage regulation and workers' rights, with the ultimate goal of promoting fairness and justice in employment relationships while simplifying compliance for employers.	It is essential for employers, contractors, and relevant authorities to ensure that all labour laws and regulations are followed to safeguard the rights and well-being of workers, including their wages and working conditions.	Details are given at end of table.
2.	The Occupational Safety, Health and Working Conditions Code, 2020	To promote the safety, health, and well-being of workers and regulate working conditions in India.	This code is designed to ensure the safety and well-being of workers and regulate working conditions, making it crucial for construction projects, including metro corridor development.	

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
3.	The Code of Social Security, 2020	It is a comprehensive piece of legislation with the overarching goal of extending social security benefits to a wider range of workers and promoting their welfare and economic security. It provides a legal framework to ensure that workers receive the social security benefits during various life stages and challenging situations.	The act mandates the imposition of a cess for the welfare and social security of building workers involved in metro corridor construction. The cess rate should range from one to two percent of the construction cost incurred by the employer, as determined by government notifications.	
4.	The Industrial Relations Code, 2020	The Industrial Relations Code, 2020 is part of a broader labour law reform agenda in India and is aimed at balancing the interests of employers and employees while fostering a more conducive environment for industrial growth.	It is part of the broader labour law framework in India and can indirectly impact labour practices and employment conditions in various sectors, including the construction industry. Employers and employees should be aware of the code's provisions and ensure compliance with relevant labour laws to maintain healthy labour relations and minimize labour-related disputes on construction sites.	
International Conventions				
1.	Forced Labour Convention, 1930 (No. 29)	Prohibits all forms of forced or compulsory labor, which is defined as “all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.” The convention also requires that the illegal extraction of forced or compulsory labor is punishable as a penal offense and that ratifying states ensure that the relevant penalties imposed by law are adequate and strictly enforced.	In the construction of any infrastructure project, the Forced Labor Convention (No. 29) is highly relevant because it addresses issues related to labor rights, fair employment practices, and the prevention of exploitation.	Applicable
2.	Abolition of Forced Labour Convention, 1957 (No. 105)	Prohibits forced or compulsory labour as a means of political coercion or education or as a punishment for holding or expressing political views or views ideologically opposed to the established political, social, or economic	Construction of a metro corridor or any infrastructure project, the Abolition of Forced Labour Convention (No. 105) is relevant for the same reasons as	Applicable

S. No	Legislation	Purpose	Relevant to Development of Metro Corridor	Applicability
		system; as a method of mobilizing and using labour for economic development; as a means of labour discipline; as a punishment for having participated in strikes; and as a means of racial, social, national, or religious discrimination	Convention No. 29. Both conventions are aimed at eradicating forced labour, and they share many key provisions.	
3.	Equal Remuneration Convention, 1951 (No. 100)	Lays out the principles for equal remuneration for work of equal value and addresses gender discrimination. This convention aims to promote and ensure equal remuneration for men and women workers for work of equal value.	It is relevant to the construction industry and infrastructure projects for several reasons: 1. Gender Equality 2. Work of equal value 3. Non-Discrimination 4. Promoting women in the construction industry 5. Legal framework	Applicable
4.	Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	Prohibits all discrimination and exclusion on any basis, including race or color, sex, religion, political opinion, national or social origin, in employment and repeals legislation that is not based on equal opportunities.	It is relevant, as it addresses the issue of discrimination in employment and occupation, ensuring that workers are treated fairly and without discrimination in all aspects of employment.	Applicable
5.	Minimum Age Convention, 1973 (No. 138)	To ensure the effective abolition of child labour and to rise progressively the minimum age for admission to employment or work. India has ratified this convention with minimum age at 14 years	The convention sets guidelines for the minimum age at which individuals can be employed and the types of work that are prohibited for individuals under a certain age.	Applicable
6.	Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour, 1999 (No. 182)	Prohibition and elimination of the worst forms of child labour, including slavery, forced labour and trafficking in human beings. It prohibits the use of children in armed conflicts, prostitution and pornography, illegal activities such as drug trafficking and dangerous work.	It is relevant as it is applicable to all types of construction projects.	Applicable

Note: Labour Codes Applicability: The rules prepared by States (including Haryana) and Union Territories, in accordance with the four labour codes established by the Central Government, aimed at consolidating 29 central labour laws covering wages, industrial relations, social security, occupational safety, welfare,

and working conditions, have not been enforced yet. These codes will come into effect from a date to be notified by the Central Government, except for provisions already enforced. For instance, certain sections under the Code on Wages, 2019, related to the Central Advisory Board, and provisions under the Code on Social Security, 2020, relating to establishing employees' and their family members' or dependents' identities through respective Aadhaar numbers, have already been enforced.

Annexure 2.2

Applicability of World Bank ESS

ESS Standards	ESS Objectives	Applicability	Remarks
ESS-1 Assessment & Management of Environmental and Social Risks and Impacts	Identify, assess, evaluate, and manage environmental and social risks and impacts in a manner consistent with the Environment. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities.	The Project activities will have environmental and social impacts during the project life cycle. Therefore, ESS 1 is applicable to the Project.	• Development of environmental and social action plans as appropriate. • Identification of project impacts. • Suggest environmental and social management plans appropriate to project impact. • Strengthening of organizational capacity. • Suggest training for security and safety workers. • Prepare emergency preparedness and response, Stakeholder engagement, and grievance redressal plans. • Identify monitoring and reporting requirements for the Project.
ESS-2 Labor and Working Conditions	The ESS 2 applies to workers (construction and operation) directly engaged by the borrower (direct workers), workers engaged through third parties (contracted workers), and workers engaged by the client's primary suppliers & Contractor (supply chain workers). ESS 2 promotes safety and health at work. Promote the fair treatment, non-discrimination, and equal opportunity of project workers. Protect project workers, with particular emphasis on vulnerable	The Project will involve employment of direct and contractual workers during construction and operation phases. The labour hired during the Project life cycle need to be managed based on the requirement of WB ESS-2 of the Environmental and Social Framework.	• Identification of labour related impacts and occupational hazards. • Suggest mitigations and prepare Labour Management Plan (LMP) and project Grievance Redressal Mechanism (GRM).

ESS Standards	ESS Objectives	Applicability	Remarks
	workers. Prevent the use of all forms of forced labor and child labour. Support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law. Provide project workers with accessible means to raise workplace concerns.		
ESS-3 Resource Efficiency and Pollution Prevention and Management	ESS-3 promotes the sustainable use of resources, including energy, water, and raw materials. Avoid or minimize adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimize project-related emissions of short and long-lived climate pollutants. Avoid or minimize the generation of hazardous and non-hazardous waste. Minimize and manage the risks and impacts associated with pesticide use.	Environmental impacts due to air and noise emissions generated from DG sets, site preparation work, material handling, and transportation are anticipated. The Project activities will need to comply with the pollution prevention measures of WB ESS-3 of the Environmental and Social Framework.	• Conduct primary surveys to gather information of baseline data on environmental parameters of the Project study area. • Identify project impacts on the environmental parameters. • Suggest mitigation, management, and monitoring plans.
ESS-4: Community Health and Safety	Anticipate or avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from routine and non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. Have in place effective measures to address emergency events. Ensure that safeguarding of personnel and	This Standard is applicable to projects which entail potential risks and impacts to the health and safety of the host communities from project activities. The major community health and safety risks associated with the Project are mainly limited to the construction phase only. The major safety and risk involved in the Project are foreseen during excavation works and elevated structures. The other risks may include during movement of heavy machinery and vehicles carrying	• Conduct community interactions and discussion. • Identify risk involved on community due to construction and implementation of the Project. • Suggest mitigation, management plans. • Sensitisation of the community with respect to project benefit, impacts and grievance mechanism.

ESS Standards	ESS Objectives	Applicability	Remarks
	property is carried out in a manner that avoids or minimizes risks to the Project-affected communities.	construction equipment on public access road.	
ESS 5: Land Acquisition, Restrictions on Land-use, and Involuntary Resettlement	Avoid or minimize involuntary resettlement by exploring project design alternatives. Avoid forced eviction. Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting affected persons in their efforts to improve, or at least restore, livelihoods and living standards to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher. Improve the living conditions of poor or vulnerable persons who are physically displaced through the provision of adequate housing, access to services and facilities, and security of tenure. Conceive and execute resettlement activities as sustainable development programs.	The corridor is passing through areas of settlements in Gurugram City. Land for the Project will be required for elevated station, entry and exit, depot, casting yard etc.	• Identification of the requirements of final alignment with Land Acquisition for both station and proposed route, as well as all other facilities. • Conduct a detailed social survey for the collection of information on the affected population, properties/structures, likely impact on land, type of ownership, and social groups, etc. • Enumeration of Community Property Resources (CPRs) • Prepare Resettlement Action Plan (RAP) to assess the feasibility and effectiveness of income restoration strategies.
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Protect and conserve biodiversity and habitats. Apply the mitigation hierarchy and the precautionary approach in the design and implementation of projects that could have an impact on biodiversity. To promote the sustainable management of living natural resources.	The proposed project alignment is planned within the RoW of existing roads. However, there will be a number of trees planted on either side of the roads to be either cut or transplanted, for which necessary permission will be required from the Forest Department. The roadside plantations in the State have been notified as Protected Forests.	• Conduct primary ecology and wildlife surveys to gather information on the ecology of the Project study area. • Identify project impacts on the ecology. • Suggest specific mitigation, management, and monitoring plans.

ESS Standards	ESS Objectives	Applicability	Remarks
ESS 7: Indigenous People/ Sub Saharan African Historically Underserved Traditional Local Communities	Ensure that the development process fosters full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. Promote sustainable development benefits and opportunities in a manner that is accessible, culturally appropriate, and inclusive. Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect, and preserve the culture, knowledge, and practices of Indigenous Peoples, and provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.	Not applicable for this Project	Not applicable for this Project
ESS-8 Cultural Heritage	Protect cultural heritage from the adverse impacts of project activities and support its preservation. Address cultural heritage as an integral aspect of sustainable development. Promote meaningful consultation with stakeholders regarding cultural heritage. Promote the equitable sharing of benefits from the use of cultural heritage.	The alignment of the project road has ancient monuments and/or archaeological site(s), protected, and few religious structures/shrines of local importance that are expected to be partially impacted by the proposed project	• Conduct primary surveys for identification of existing Private and Community Property Resources (CPRs) on both sides of the proposed Project alignment. • Identify any potential conflicts and impacts on cultural and religious structures due to the Project. • Suggest mitigation measures.

ESS Standards	ESS Objectives	Applicability	Remarks
ESS-9 Financial Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the sub-projects it finances. Promote good environmental and social management practices in the sub-projects' finance (FI). Promote good environmental and sound human resources management within the FI.	GMRL is not a Financial Intermediary (FI); thus, WB ESS-9 is not applicable to the Project.	Not applicable
ESS-10 Stakeholder Engagement and Information Disclosure	Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship with them. Assess stakeholder interest and support for the Project and enable stakeholders' views to be considered in project design. Promote and provide means for effective and inclusive engagement with project-affected parties throughout the Project life cycle. Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, accessible, and appropriate manner.	Relevant as the Project will involve a wide variety of stakeholders throughout the Project cycle.	• Public Consultation and Focus Group Discussions and In-depth Interviews with stakeholders. • Identification of key stakeholders and preparation of Stakeholder Engagement Plan (SEP).

Annexure 2.3

Clearances/Permissions required for the Proposed Project

S. No.	Clearance/Authorization	Act/ Rules/ Notifications	Competent Authority	Responsibility ¹⁸
1.	Tree Cutting Permission	Forest Conservation Act, 1980	State Forest Department/ Municipal Corporation	GMRL
2.	Location/ layout of workers' camp, equipment, and storage yards	Environment Protection Act, 1986 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	Haryana State Pollution Control Board (HSPCB)/ Municipal Corporation	Contractor
3.	Discharges from Labour Camp	Water (Prevention and Control of Pollution) Act, 1974 The Air (Prevention and Control of Pollution) Act, 1981	HPSCB	Contractor
4.	Permission for mining minerals (stones, aggregates, sand, earth, etc.) from quarries	Environment Protection Act, 1986	Mines and Geology Department	Contractor through authorised vendors/dealers
5.	Pollution Under Control certificate for vehicles	Central Motor Vehicle Act, 1988	Transport Department	GMRL & Contractor
6.	Employing Labour/ Workers	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Labour Department	Contractor
7.	Fire Safety Clearance	National Building Code State Fire Prevention and Fire Safety Act/Rules Public Safety Standards of India	State Fire Department	Contractor
8.	Electrical Safety	Indian Electricity Act, 1910 re- enacted in 2003.	Chief Electrical Inspector Department	GMRL/HMRYC Contractor

¹⁸ The details provided in the above table are indicative. All subcontractors, GMRL, and other relevant parties must obtain all necessary permits and comply with all applicable regulations for their respective subprojects.

S. No.	Clearance/Authorization	Act/ Rules/ Notifications	Competent Authority	Responsibility ¹⁸
		Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010		
9.	Environmental Clearance	EIA Notification 2006 & further amendments for Metro/ Railway	Not Required	-
10.		Construction of a building for commercial purposes (Shopping Complex, offices, etc) having a built-up area equal to or more than 20,000 sqm shall require Environmental Clearance from SEIAA as per the EIA notification 2006. The GMRL holds the responsibility to engage NABET-accredited environmental consultants to prepare Environmental Impact Assessment (EIA) reports and manage the clearance.	Required if the stations are proposed for commercial purposes.	GMRL
11.	Forest Clearance	Forest (Conservation) Act 1980	MoEF&CC	GMRL
12.	NOC for using Existing utility provision (Land Use Change)	Haryana Municipal Corporation Act, 1994 and Section 203 E of Haryana Municipal Act, 1973	GMDA	GMRL
13.	Consent to Establish (CTE) and Consent to Operate (CTO) for Depots, hot mix plant, crushers, and batching plant.	Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981	HSPCB	GMRL Contractor
14.	Factory License / Registration	The Factories Act, 1948	Directorate of Industrial Safety & Health (DISH), Haryana	
15.	Permission for the disposal of Construction and Demolition Waste	Construction and Demolition Waste Management Rules, 2016	HSPCB/ Municipal Corporation	GMRL Contractor
16.	Authorization for Disposal of Hazardous Waste	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	HSPCB/ Municipal Corporation	GMRL Contractor
17.	Municipal Solid Waste Authorization	Solid Waste Management Rules, 2016	HSPCB/ Municipal Corporation	GMRL Contractor
18.	Consent for disposal of sewage from labour camps	Consent from SPCB	HSPCB/ Municipal Corporation	Contractor

S. No.	Clearance/Authorization	Act/ Rules/ Notifications	Competent Authority	Responsibility ¹⁸
19.	Permission for Muck disposal	Environment (Protection) Act, 1986	HSPCB/ Municipal Corporation	GMRL Contractor
20.	Chance Finds, if any	- The Treasure Trove Act, 1878 - The Ancient Monuments and Archaeological Sites and Remains Act, 2010 The Antiquities and Art Treasures Act, 1972, and its rules	Art & Cultural Affairs Department	GMRL
21.	Pollution under control certificate for project vehicles	Central Motor and Vehicle Act, 1988	Department of Transport, Govt. of Haryana authorised testing centers	Contractor
22.	Employing Labour/ workers and labour related license and insurance	The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 The Contract labour (Regulation and Abolition) Act, 1970 and Rules. Employees' State Insurance Act, 1948. Interstate Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979, Factories Act, 1948	District Labour Commissioner	GMRL Contractor
23.	Authorization for Disposal of E-waste Waste	E- Waste Management Rules, 2022	HSPCB	GMRL Contractor
24.	Authorization for Disposal of Plastic Waste	Plastic Waste Management Rules, 2016	HSPCB	GMRL Contractor
25.	Railway Department (permission as per section 16 of the act if required)	Railway Act, 1989 and amendment (Construction near Railway tracks)	Northern Railway zone, North Western Railway zone, and North Central Railway zone	GMRL

S. No.	Clearance/Authorization	Act/ Rules/ Notifications	Competent Authority	Responsibility ¹⁸
26.	Safety Certification and Technical Clearance of Metro Systems	Amendment to Metro Railway (Operation and Maintenance) Act, 2009	Research Designs & Standards Organisation (RDSO), Ministry of Railways	GMRL
27.	Approval for Traffic Diversion	The Motor Vehicle Act, 1988	Concerned Traffic Department	Contractor

Annexure 2.4

The table below provides links to the relevant standards issued by the Central Pollution Control Board (CPCB), IFC, and WHO. These standards outline the permissible limits and regulatory requirements for a range of environmental parameters that must be adhered to during both the construction and operational phases of a project.

S. No.	Parameters	Link for the standards
1.	Drinking Water Quality Standards (IS 10500:2012)	https://cpcb.nic.in/wqm/BIS_Drinking_Water_Specification.pdf
2.	Effluent Discharge Standards (Inland Surface Water)	https://cpcb.nic.in/displaypdf.php?id=R2VuZXJhbFN0YW5kYXJkcy5wZGY= https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-wastewater-and-ambient-water-quality-en.pdf
3.	Tolerance Limits for Inland Surface Water Quality	Designated_Best_Use_Water_Quality_Criteria.pdf
4.	National Ambient Air Quality Standards	https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf https://www.who.int/tools/air-quality-standards
5.	National Ambient Noise Standards	https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-noise-en.pdf

Annexure 2.5

Comparison of ESF and National Regulation – Gaps and Remedies

World Bank Standards	Government of India Regulations	Gaps and Action
ESS1: Assessment and Management of Environmental and Social Risks and Impacts	- EIA notification 2006 and Its Amendments - RFTCLARR Act, 2013, Water (Prevention and Control of Pollution) Rules, 1975 amended in 2011, Air (Prevention and Control of Pollution) Act, 1981 amended in 1987	Gap Exists. As per the EIA notification, metro projects do not require Environmental Clearance (EC). However, as per EIA notification S.O.1533(E) dated 14.09.2006, construction of a building for commercial purposes (Shopping Complex, offices, etc) having a built area equal to or more than 20,000 sqm falls under category B, thus shall require prior EC from the State Level Environment Impact Assessment Authority (SEIAA). As per ESS1, considering the construction activities, impacts on Environmental and Social components, and pollution discharge expected, the proposed project requires ESIA as per World Bank ESF. Accordingly, ESIA and other reports are prepared in accordance with the World Bank ESF. For a railway depot having a discharge of less than 100 KLD, it falls under the orange category and shall require an STP & ETP. A railway depot with discharge of more than 100 KLD falls under the red category and shall require an STP & ETP.
ESS 2: Labour and Working Conditions	- The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 - The Workmen's Compensation Act, 1923 & its rules and amendments - The Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979 - The Equal Remuneration Act, 1976 along with allied Rules - The Child Labour (Prohibition &	Gaps exist in respect of i) need for labour GRM and ii) provision of some form of contract/MOU to informal workers. The national and state legal provisions meet the ESS2 requirements.

World Bank Standards	Government of India Regulations	Gaps and Action
	Regulation) Act, 1986 and 2016 amendment • The Building and Other Construction Workers Welfare Cess Act, 1996 • The Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act) • The Contract Labour (Regulation & Abolition) Act 1970 and rules • The Payment of Wages Act, 1936 • The Minimum Wages Act 1948 and its Rules • The Payment of Gratuity Act, 1972 • The Payment of Gratuity Rules Haryana 1972 • The Employees Provident Fund and Miscellaneous Provisions Act, 1952 and its rules • The Maternity Benefit Act, 1961 • Haryana Maternity benefit Rules 1967 • The Payment of Bonus Act, 1965 and its rules • The Bonded Labour (Abolition) Act, 1976 and its rules • Employees State Insurance Act, 1948 • The Trade Union Act, 1926	

World Bank Standards	Government of India Regulations	Gaps and Action
	The New Labour Codes¹⁹ of India • Code on Social Security, 2020 • Code on Wages, 2019 • Industrial Relations Code, 2020 • Occupational Safety, Health, and Working Conditions Code, 2020	
ESS3: Resource Efficiency and Pollution Prevention and Management	• In India, there are several statutes (Acts and Rules) that are enforced with respect to pollution abatement. These include: • The Environment (Protection) Act, 1986 and its rules and amendments • The EIA Notification, 2006, and subsequent amendments • The Metro Rail Transit System, Guidelines for Noise and Vibrations, RDSO, Ministry of Railways, September 2015 • The Forest (Conservation) Act 1980 and its rules and amendments • The Biological Diversity Act, 2002 and its Rules, 2004	The majority of ESS3 requirements are addressed directly by existing regulations and indirectly for resource efficiency, pollution prevention, and management aspects

¹⁹ Labour Codes Applicability: The rules prepared by States (including Haryana) and Union Territories, in accordance with the four labour codes established by the Central Government, aimed at consolidating 29 central labour laws covering wages, industrial relations, social security, occupational safety, welfare, and working conditions, have not been enforced yet. These codes will come into effect from a date to be notified by the Central Government, except for provisions already enforced. For instance, certain sections under the Code on Wages, 2019, related to the Central Advisory Board, and provisions under the Code on Social Security, 2020, relating to establishing employees' and their family members' or dependents' identities through respective Aadhaar numbers, have already been enforced.

World Bank Standards	Government of India Regulations	Gaps and Action
	• The Air (Prevention and Control of Pollution) Act, 1981, and its rules and amendments • National Building Code, 2016 • Town and Country Planning Notification, Government of Haryana, Sep 2012 • The Water (Prevention and Control of Pollution) Act, 1974, and its rules and amendments • The Motor Vehicle Act, 1988 • The Central Motor Vehicles Rules, 1989 • The Energy Conservation Act, 2001 • The Ozone Depleting Substances (Regulation and Control) Rules, 2000 and its amendment. • National Resource Efficiency Policy, 2019 (Draft) • The Manufacture, Storage and Import of Hazardous Chemical Rules 1989 and its amendments.	
ESS 4: Community Health and Safety	• The Environmental Protection Act, 1986, and its rules and amendments • The Disaster Management Act, 2005 • The Haryana State Disaster Management Rules, 2010 • The Rights of Persons with Disabilities Act, 2016 • The Air (Prevention and Control of Pollution) Act, 1981, and its rules and amendments	No Gap Exists. These existing laws and rules fulfil the community health and safety requirements.

World Bank Standards	Government of India Regulations	Gaps and Action
	• The Water (Prevention and Control of Pollution) Act, 1974, and its rules and amendments • The Manufacture, Storage & imports of Hazardous Chemicals (MSIHC) Rules, 1989 and its amendment • The Motor Vehicle Act, 1988 • The Central Motor Vehicle Rules, 1989 • Bureau of Indian Standards (BIS) • National Building Codes	
ESS 5: LA, Restrictions on Land Use and Involuntary Resettlement	• The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 • The Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement (Haryana Amendment) Act, 2017 • GMRL Policy for Direct Purchase of Private Land/ Property Through Mutual Negotiations.²⁰	A gap exists between the RFCTLARR Act, 2013, and ESS5. Gap exists specifically related to a) aspects such as the identification of non-titleholders (encroachers and squatters) as PAPs and cut-off dates for non-titleholders; b) Act considers depreciation in assets, whereas Bank ESS 5 requires that assets be valued without depreciation. The gaps are addressed with suitable provisions in EM. GMRL Policy: The compensation will be paid to all parties post-negotiation and will include 100% solatium on the cost of land and structures, along with an additional 25% above the estimated value after applying the 100% solatium and shall be inclusive of R&R entitlements in accordance with the Second Schedule of the RFCTLARR Act, 2013.
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	There are a number of acts and Rules enforced with respect to biodiversity and Habitat. These are as follows: • The Biological Diversity Act, 2002	No specific Gaps to be addressed as policy/regulations support biodiversity conservation, and livelihoods based on these exist in case of recognised sensitive features. However. Non-designated wetlands, ponds and other features are not protected directly by regulations (even though various Pollution

²⁰ Land will be purchased in accordance with the GMRL Policy For Direct Purchase of Private Land/Property through Mutual Negotiations.

World Bank Standards	Government of India Regulations	Gaps and Action
	- The Forest (Conservation) Act, 1980 and its rules and amendments - The Wildlife (Protection) Act, 1972, and its amendments - The Wetlands (Conservation and Management) Rules, 2017 - Haryana Forest Policy, 2006	prevention regulations indirectly address upkeep of these). Hence, assessment of biodiversity of non-designated habitats that may be impacted by the proposed development shall be conducted as part of this ESIA, and measures incorporated to avoid, mitigate, and manage impacts and risks on these
ESS 7: Indigenous Peoples/Sub Saharan African Historically Underserved Traditional Local Communities	Special Provisions for Scheduled Tribes - Fifth Schedule - Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 1989 - Panchayats (Extension to the Scheduled Areas) Act, 1996 (PESA)	Not applicable to the project. The project area does not fall under Schedule V of the Indian Constitution, and the affected population of the project area does not meet the characteristics outlined in ESS 7. As a result, the specific requirements and safeguards mandated by ESS 7 regarding indigenous peoples and their rights, cultural heritage, and traditional knowledge are not applicable to this project.
ESS8: Cultural Heritage	- The Treasure Trove Act, 1878 - The Ancient Monuments and Archaeological Sites and Remains Act, 1958, was amended in 2010 - The Antiquities and Art Treasures Act, 1972 and its rules - The Ancient Monuments Preservation Act, 1904	Gap Exists. Legislation exists for protected monuments; however, no legislation exists for religious structures or cultural properties, or activities having social and cultural value. These shall be taken care of as per ESS 8.
ESS 9: Financial Intermediaries	Not Applicable for the project	Not applicable to the project
ESS10: Stakeholder Engagement and Information Disclosure	- EIA Notification 14th Sep 2006 and amendments. - The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 - The Right to Information Act, 2005 - Haryana Lokayukta's Citizen's Charter.	Gap Exists. The Indian legislation partly meets the ESS requirements. As per the act, the information shall be provided when it is requested and asked for. Almost all government agencies have GM and Citizen Charters detailing the redressal services. ESS 10 has the provision for the borrower to respond to grievances of project-affected parties related to the environmental and social performance of the project in a timely manner, as well as to proactively disclose publicly about project-related information.

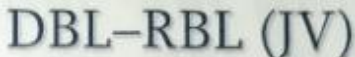
World Bank Standards	Government of India Regulations	Gaps and Action
		In addition to the above, Haryana Lokayukta's Citizens' Charter outlines its mandate to address public grievances against state public servants, with the objective of promoting transparency, accountability, and integrity in governance.

Annexure 3.1**Details of Proposed Stations along the Corridor**

S. No.	Station Name	Chainage (in meters)	Inter-Station Distance (in meters)
1	Millennium City Center	0	0
2	Sector 45	1000	1000
3	Cyber Park	2200	1200
4	District Shopping Center Sector 47	3665	1465
5	Subhash Chowk	4515	850
6	Sector 48	5500	985
7	Sector 72A	6360	860
8	Hero Honda Chowk	7789	553
9	Udyog Vihar Phase 6	9168	1379
10	Sector 10	10133	965
11	Sector 37	10808	675
12	Basai Village	11620	812
13	Sector 9	12445	825
14	Sector 7	13222	777
15	Sector 4	14487	1265
16	Sector 5	15466	979
17	Ashok Vihar	16514	1048
18	Sector 3	17514	1000
19	Bajghera Road	18439	925
20	Palam Vihar Ex.	19595	1156
21	Palam Vihar	20404	809
22	Sector 23 A	21495	1091
23	Sector 22	22781	1286
24	Sector 21	23785	1004
25	Udyog Vihar Phase 1	24830	1045
26	Cyber City	26450	1620
27	Sector 101 (Spur from Basai Village to Dwarka Expressway)	13426	1784

Annexure 3.2

Contractor's undertaking for ESIA Compliance


Ref No.: DBL-RBL JV/GEC/GMRL/CC-01/2025-26/337 **Date:** 29.01.2026

(without prejudice)

To,
The Project Director (GC)
 DB E&C and Hill International,
 2nd Floor, Mousari Avenue Road, DLF Phase III
 Gurugram-122001, Haryana, India

Sub: Construction of Viaduct and 14 Elevated Stations from Millennium City Centre to Sector 9 (inclusive) from chainage (-)381 m to 12603 m, Spur to Dwarka Expressway (1.85 km) and ramp to Depot at Sector 33, underpass at Bhaktawar Chowk excluding PEB and Architectural finishing works of Gurugram Metro Corridor – **Compliance of ESIA documents prepared as per World Bank Framework (ESF) – reg.**

Ref:

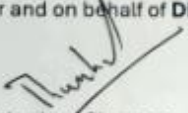
- i) Contract Agreement dated **08.09.2025** between Gurugram Metro Rail Ltd. and JV of Dilip Buildcon Ltd. and Ranjit Buildcon Ltd.
- ii) General Conditions of Contract and Special Conditions of Contract under Tender Document for Contract No. GMRL/PROJ/2025/CC-01/04

Dear Sir,

The Contractor hereby undertakes that all provisions related to Contractor's responsibilities, as detailed in the ESIA documents prepared in accordance with the World Bank Environment and Social Framework (ESF), shall be fully and strictly adhered to.

However, the Contractor wishes to highlight that any financial implications arising out of or in relation with such compliances shall be treated in accordance with the provisions of Clause 12 of GCC and other relevant provisions of the Contract Agreement.

For and on behalf of **DBL-RBL (JV)**



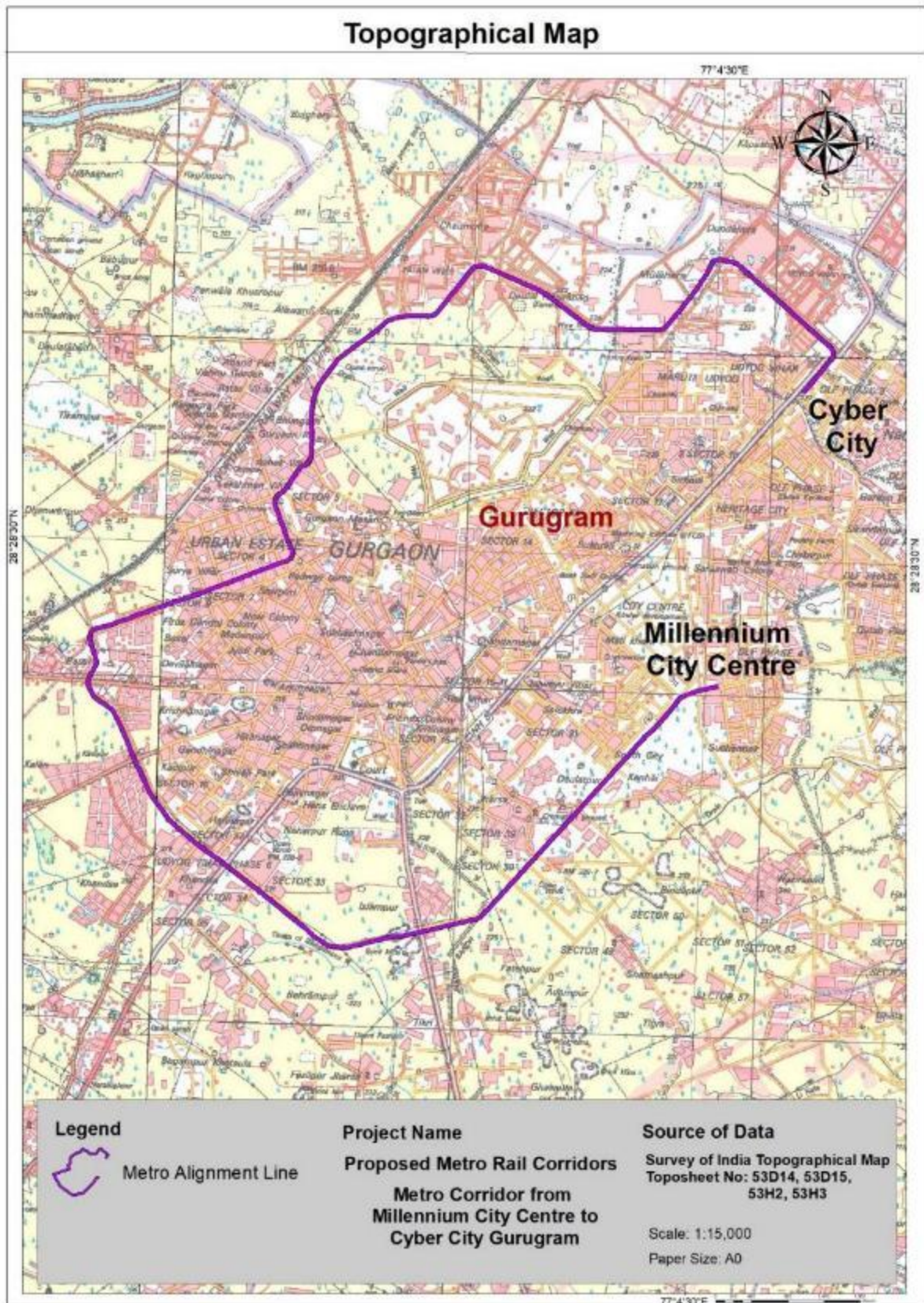

Authorized Signatory

Copy to:

1. The Director Project (GMRL) for your kind information
2. The CPM (GMRL) for your kind information

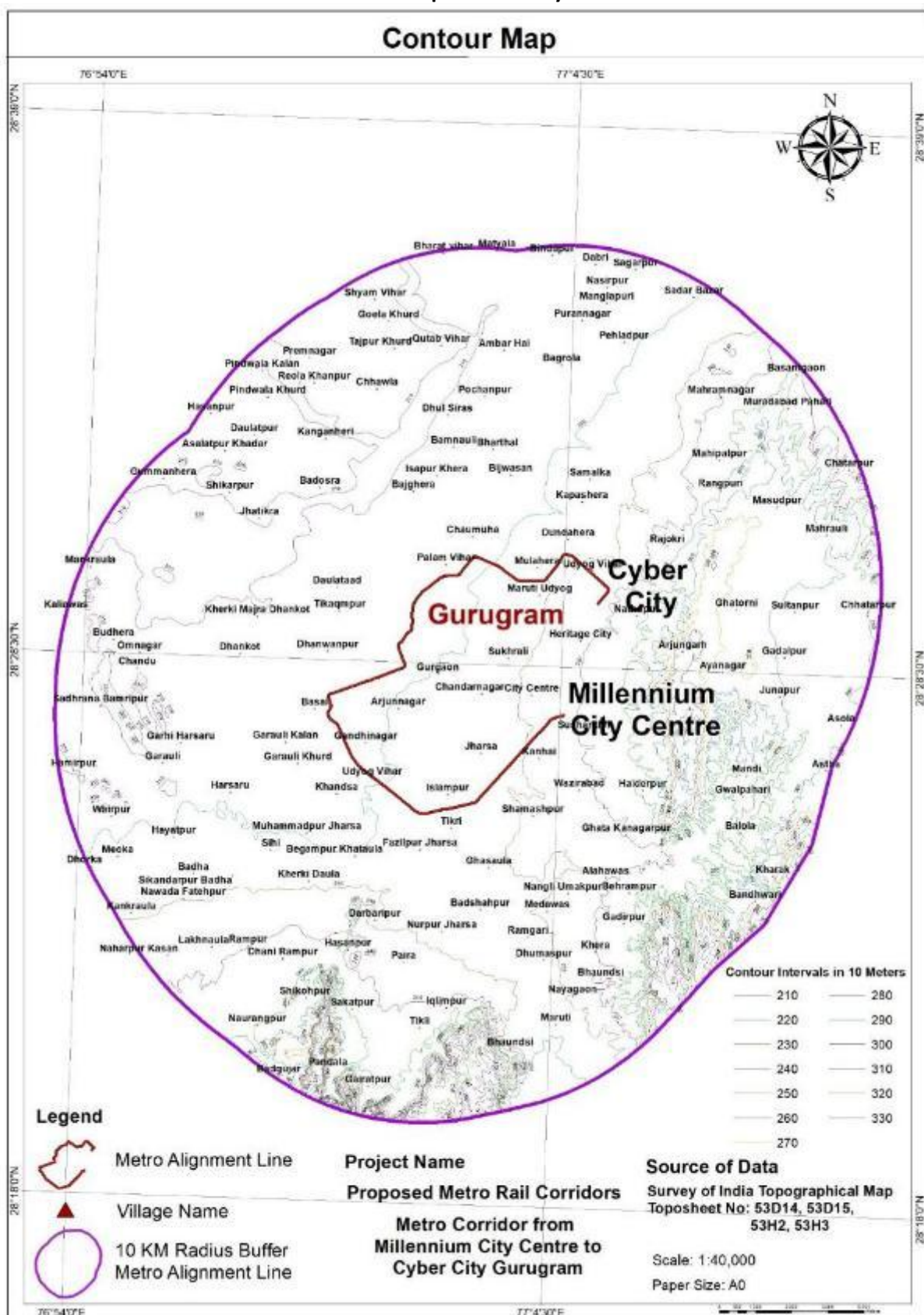
"DBL-RBL (JV)"
Office Address: - Plot No.- 5, Inside Govind Narayan Singh Gate, Chuna Bhatti, Kolar Road, Bhopal-462016 (M. P.)
Ph.: - 0755- 4029999, **Fax:** 0755- 4029998
E-Mail: - db@dilipbuildcon.co.in

Topographical Map of the Study Area



Source- Rites Study

Contour Map of the Study Area



Source- Rites Study

Annexure 5.2

Animals in Gurugram District

S. No.	Common name	Scientific name	IUCN status	WPA, 1972 Schedule
1	Common langur	<i>Semnopithecus entellus</i>	LC	II
2	Golden Jackal	<i>Canis aureus indicus</i>	LC	II
3	Leopard	<i>Panthera pardus</i>	VU	I
4	Jungle Cat	<i>Felis chaus</i>	LC	II
5	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	LC	II
6	Nilgai	<i>Boselaphus tragocamelus</i>	LC	III
7	Monkey	<i>Macaca mulatta</i>	LC	II
8	Sambar	<i>Rusa unicolor</i>	VU	III
9	Indian Hare	<i>Lepus nigricollis</i>	LC	IV
Mammals				
10	Three-striped palm squirrel	<i>Funambulus palmarum</i>	LC	IV
11	Mouse	<i>Mus musculus</i>	LC	V
Reptiles				
12	Common garden lizard	<i>Calotesvescicolor</i>	LC	IV
13	Rat snake	<i>Ptyas mucosa</i>	LC	II

LC – Least Concerned, VU – Vulnerable

List of Birds in Gurugram District

S. No.	Common name	Scientific name	IUCN Status	WPA, 1972 Schedule
1.	Asian Dowitcher	<i>Limnodromus semipalmatus</i>	NT	IV
2.	Bank myna	<i>Acridotheres ginginianus</i>	LC	IV
3.	Barn swallow	<i>Hirundo rustica</i>	LC	IV
4.	Bar-headed goose	<i>Anser indicus</i>	LC	II
5.	Baya weaver	<i>Ploceus philippinus</i>	LC	IV
6.	Besra	<i>Accipiter virgatus</i>	LC	I
7.	Black drongo	<i>Dicrurus macrocercus</i>	LC	IV
8.	Black kite	<i>Milvus migrans</i>	LC	I
9.	Black bittern	<i>Ixobrychus flavicollis</i>	LC	IV
10.	Black-headed ibis	<i>Threskiornis melanocephalus</i>	NT	IV
11.	Black-winged kite	<i>Elanus caeruleus</i>	LC	I
12.	Black-winged stilt	<i>Himantopus himantopus</i>	LC	IV
13.	Black-bellied tern	<i>Sterna acuticauda</i>	EN	IV
14.	Brown-headed barbet	<i>Psilopogon zeylanicus</i>	LC	IV
15.	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	NT	IV
16.	Cattle egret	<i>Bubulcus ibis</i>	LC	IV
17.	Cinnamon bittern	<i>Ixobrychus cinnamomeus</i>	LC	IV
18.	Collared dove	<i>Streptopelia decaocto</i>	LC	IV
19.	Common coot	<i>Fulica atra</i>	LC	IV
20.	Common kestrel	<i>Falco tinnunculus</i>	LC	IV
21.	Common kingfisher	<i>Alcedo atthis</i>	LC	IV
22.	Common myna	<i>Acridotheres tristis</i>	LC	IV

S. No.	Common name	Scientific name	IUCN Status	WPA, 1972 Schedule
23.	Common moorhen	<i>Gallinula chloropus</i>	LC	IV
24.	Common pigeon	<i>Columba livia</i>	LC	IV
25.	Common quail	<i>Coturnix coturnix</i>	LC	IV
26.	Common redshank	<i>Tringa totanus</i>	LC	IV
27.	Common tailorbird	<i>Orthotomus sutorius</i>	LC	IV
28.	Common sandpiper	<i>Actitis hypoleucos</i>	LC	IV
29.	Eurasian sparrowhawk	<i>Accipiter nisus</i>	LC	I
30.	Ferruginous duck	<i>Aythya nyroca</i>	NT	IV
31.	Gadwall	<i>Mareca strepera</i>	LC	IV
32.	Glossy ibis	<i>Plegadis falcinellus</i>	LC	IV
33.	Great bittern	<i>Botaurus stellaris</i>	LC	IV
34.	Great thick-knee	<i>Esacus recurvirostris</i>	NT	IV
35.	Greater coucal	<i>Centropus sinensis</i>	LC	IV
36.	Green sandpiper	<i>Tringa ochropus</i>	LC	IV
37.	Grey francolin	<i>Ortygornis pondicerianus</i>	LC	IV
38.	Greylag goose	<i>Anser anser</i>	LC	II
39.	Greater Spotted Eagle	<i>Clanga clanga</i>	VU	I
40.	Imperial Eagle	<i>Aquila heliaca</i>	VU	I
41.	Indian great reed warbler	<i>Acrocephalus stentorus</i>	LC	IV
42.	Indian peafowl	<i>Pavo cristatus</i>	LC	I
43.	Indian pond-heron	<i>Ardeola grayii</i>	LC	IV
44.	Indian robin	<i>Copsychus fulicatus</i>	LC	IV
45.	Indian roller	<i>Coracias benghalensis</i>	LC	IV
46.	Indian spot-billed duck	<i>Anas poecilorhyncha</i>	LC	IV
47.	Jungle Myna	<i>Acridotheres fusca</i>	LC	IV
48.	Jungle babbler	<i>Argya striata</i>	LC	IV
49.	Lesser whistling duck	<i>Dendrocygna javanica</i>	LC	IV
50.	Lesser kestrel	<i>Falco naumanni</i>	LC	IV
51.	Little cormorant	<i>Microcarbo niger</i>	LC	IV
52.	Little egret	<i>Egretta garzetta</i>	LC	IV
53.	Little grebe	<i>Tachybaptus ruficollis</i>	LC	IV
54.	Long-tailed shrike	<i>Lanius schach</i>	LC	IV
55.	Mallard	<i>Anas platyrhynchos</i>	LC	IV
56.	Marbled teal	<i>Marmaronetta angustirostris</i>	NE	IV
57.	Northern shoveler	<i>Spatula clypeata</i>	LC	IV
58.	Egyptian Vulture	<i>Neophron percnopterus</i>	EN	I
59.	Oriental Darter	<i>Anhinga melanogaster</i>	NT	IV
60.	Oriental magpie-robin	<i>Copsychus saularis</i>	LC	IV
61.	Oriental skylark	<i>Alauda gulgula</i>	LC	IV
62.	Plain prinia	<i>Prinia inornate</i>	LC	IV
63.	Pallas's fish eagle	<i>Haliaeetus leucoryphus</i>	EN	I

S. No.	Common name	Scientific name	IUCN Status	WPA, 1972 Schedule
64.	Painted Stork	<i>Mycteria leucocephala</i>	NT	IV
65.	Pallid harrier	<i>Circus macrourus</i>	NT	I
66.	Water rail	<i>Rallus aquaticus</i>	LC	IV
67.	Red-headed vulture	<i>Sarcogyps calvus</i>	CE	IV
68.	Red-naped ibis	<i>Pseudibis papillosa</i>	LC	IV
69.	Red-vented bulbul	<i>Pycnonotus cafer</i>	LC	IV
70.	Red-wattled lapwing	<i>Vanellus indicus</i>	LC	IV
71.	Rose-ringed parakeet	<i>Psittacula krameri</i>	LC	IV
72.	Rufous treepie	<i>Dendrocitta vagabunda</i>	LC	IV
73.	Saker falcon	<i>Falco cherrug</i>	VU	I
74.	Sarus crane	<i>Grus Antigone</i>	VU	IV
75.	Shikra	<i>Accipiter badius</i>	LC	I
76.	Spotted dove	<i>Spilopelia chinensis</i>	LC	IV
77.	Spotted owlet	<i>Athene brama</i>	LC	IV
78.	Sociable Lapwing	<i>Vanellus gregarius</i>	CR	I
79.	Crested Sparrow hawk	<i>Accipiter trivirgatus</i>	LC	IV
80.	White-throated kingfisher	<i>Halcyon smyrnensis</i>	LC	IV
81.	White-breasted waterhen	<i>Amaurornis phoenicurus</i>	LC	IV
82.	White-rumped vulture	<i>Gyps bengalensis</i>	CE	I
83.	White-browed wagtail	<i>Motacilla maderaspatensis</i>	LC	IV
84.	Yellow bittern	<i>Ixobrychus sinensis</i>	LC	IV
85.	Yellow-footed green-pigeon	<i>Treron phoenicopterus</i>	LC	IV

CR-Critically Endangered, EN-Endangered, LC – Least Concerned, VU – Vulnerable, NT – Near Threatened, NE – Not Evaluated

Annexure 5.3

Details of Sensitive Receptors

Section	Name	Type of Sensitive Receptors	Distance from Center Line (in m)	Chainage (in m)	Nearest Noise Monitoring Location
Start Point-Millennium City Centre	Shri Jaganath Temple	Temple	28.2	-171.5	N1
Millennium City Centre-Sector 45	Fortis Memorial Research Institute	Hospital	48.24	85.61	N1
	Radha Krishna Temple	Temple	70.5	704	N1
Sector 45-Cyber Park	Life Aid Medical Center	Hospital	81.1	2104.5	N13
Cyber Park-Sector 47	Safe Hands Hospital	Hospital	44.67	2753	N13
	Durga Mata Mandir	Temple	40.9	2775	N13
	Sai Siddhi Urology and Multispecialty Hospital	Hospital	40.86	2888	N13
	Kirpa Ram Hanuman Mandir	Temple	30.2	3131	N14
	Vishwas Vidyalaya	School	43.2	3143	N14
	Sukhmani Hospital	Hospital	38.6	3625	N14
Sector 47-Subash Chowk	Ram Sharnam Ashram	Temple	48.6	4128	N14
Subash Chowk-Sector 48	Vedanya International School	School	32	5309	N2
Sector 48-Sector 72 A	Yaduvanshi Shiksha Neketan	School	43	5788	N15
	Kangaroo Kids International Pre-School	School	40.7	5824	N15
Sector 72 A - Hero Honda Chowk	IBMR Business School	College	67	6974.8	N15
Udyog Vihar Ph-6-Sector 10	Shani Mandir	Temple	60	9350	N3
	Temple	Temple	60	9875	N3
	Vedic Hospital	Hospital	78	9895	N3
	Temple	Temple	60.17	9949.1	N3
	Temple Median	Temple	27.23	9985.3	N3
Sector 10-Sector 37	Devi Mandir	Temple	22.08	10565.7	N4
Sector 37-Basai Village	Helix Hospital	Hospital	85.37	10864	N4
	Shri Balaji Multispecialty Hospital	Hospital	97	11225	N4
	Sagar Hospital	Hospital	25	11150.45	N4
	Shiv Temple near Basai Pond	Temple	4.6	11684	N4

Section	Name	Type of Sensitive Receptors	Distance from Center Line (in m)	Chainage (in m)	Nearest Noise Monitoring Location
Basai Village-Sector 9	Greenwood Public School	School	34	11717	N4
	Vidya Medical Centre	Hospital	23	11829	N4
	Yashroop Hospital Maternity & Multispecialty Hospital	Hospital	31.58	12080	N4
Sector 9-Sector 7	Dr Shivangi Infertility Gynae Consultant	Hospital	19.5	12824	N5
	Shri Shiv Nararyan Sidheswar Senior Secondary Public School	School	78	12678	N5
	ESIC Hospital	Hospital	43.64	13063	N5
Sector 7-Sector 4	Guru Goraknath Temple	Temple	48.65	13457	N5
	Jiwan Jyoti Senior Secondary Public School	School	48.2	13742	N5
	Arya Public School	School	48.92	13995	N5
Sector 4-Sector 5	Blue Bells Preparatory School	School	26	14954	N17
	Prachin Shiv Hanuman Mandir	Temple	90	15000	N17
	Jain Sant Phool Chand Ji Charitable Hospital	Hospital	17	15244	N6
	Sarvodaya Hospital	Hospital	17.1	15252	N6
	Maa Chintapuri Mandir	Temple	17	15262	N6
Sector 5-Ashok Vihar	Xion International Convent School	School	64	15752.9	N6
	Aastha Medicare Maternity Centre	Hospital	13	15945	N18
	Vardhman Hospital	Hospital	28	16066.2	N18
	Eurokids Pre School & Day Care	School	68	16213	N18
	Mittal Ortho & fracture clinic	Hospital	34.8	16264	N18
Ashok Vihar-Sector 3	New Light Public School	School	42	16502	N18
	Jannat Hospital	Hospital	10	16829	N18
	Shri Dataram Mandir	Temple	17	16888	N7
	Balaji Life Care Hospital and Maternity Centre	Hospital	10.74	16953	N7
	Shiv Mandir	Temple	54	17040	N7

Section	Name	Type of Sensitive Receptors	Distance from Center Line (in m)	Chainage (in m)	Nearest Noise Monitoring Location
	Blossom Primary School	School	25	17333	N7
	Hanuman Mandir	Temple	14.9	17506	N7
	GAV International School	School	23	17989	N8
	Narayan e-Techno School	School	75	17984	N8
	SCR Global School	School	76	18577	N9
	Presidium School	School	17	18711	N9
	Krishnal Chowk Palam Vihar DB Baba	Temple	18.4	18565	N9
	DPSG Palam Vihar	School	19.55	20095	N10
	Manipal Hospital	Hospital	26.6	20140	N10
	Hanuman Mandir	Temple	30	20269	N10
	Hanuman Mandir	Temple	17.4	22212	N11
	Rotary Public School	School	30.66	22422	N11
	Nest Play School and Day Care	School	8.21	22702	N19

Detailed Summary of Consultations and Interviews

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
Consultation with the Project Affected Population			
1	Consultation with Project Affected Resident of Sector-4, Gurugram Haryana, Date: 21.12.2023 No. of Participants: 04	The participants requested to review the alignment again to avoid impact on their residential structure. The participants have also been requested to share the timelines for construction and land acquisition. They have also requested to share how their loss will be compensated and what will happen to the remaining land. It was requested to share the copy of the RFCTLARR Act and the alignment CAD Drawing of Sector 4.	The participants were informed that alignment is designed to avoid and minimize the impact as much as possible on their residential structure. The structure will be affected due to the sharp curve in the alignment. The construction work will likely start at the end of 2024. The land acquisition as per the RFCTLARR Act, 2013. They were informed that GMRL will first try to purchase the affected land through the Mutual Negotiation/Direct Purchase Method. In case of failure of negotiation, delay, resistance, or refusal of the land or property owner, it shall be acquired through the RFCTLARR Act, 2013²¹. They were informed that the remaining land will be acquired by the GMRL if the balanced land is unviable.

²¹ Land shall be purchased through GMRL Policy for Direct Purchase of Private Land/Property through Mutual Negotiations

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
			A copy of the RFCTLARR Act, 2013 and the alignment CAD drawing of Sector 4 are shared with the participant.
2	Consultation with affected fruits vendor Near Chintpurni Mata Mandir, Sector 4 & 5 Date: 22.12.2023 No. of Participants: 8	Participants have concerns that the metro project would have negative impacts in terms of loss of income and customers during the construction period. Also, the proposal will not serve the last-mile connectivity. However, the metro project will have the following benefits: • Increase in accessibility to facilities, employment, property value, customers, educational levels etc. • Improvement in the transportation system and decrease in accidents.	The participants were informed that the compensation will be paid as per RFCTLARR Act, 2013
3	Consultation Affected Persons (Banjaras Vulnerable Group) at Rezangla Chowk Date: 22.12.2023 No. of Participants: 7 (Male 5 and Female 2)	Participants were not aware of the project. Suggestion: • Requested to avoid the impact, and if their huts get impacted, then compensation shall be paid, or provide space near Rezangla Chowk.	The participants were informed that alignment is designed to avoid and minimize the impact as much as possible. The compensation will be paid as per the RFCTLARR Act, 2013, for residual impacts.
4	Consultation with Shop Owners at Ashok Vihar (Proposed Station), Gurugram, Haryana 29.12.2023 No. of Particioants:10	• The participants requested to review the proposed metro station plan to avoid impacting commercial establishments. One of them has suggested shifting the station around 300 meters, where wider space and land are available to plan the station. The chainage of the suggested station is 16833.577, which is near the Hindustan Petrol Pump (Ashok Vihar Phase II, Gurugram). • Participants have suggested that the station entry and exit need to be reconsidered and proposed along the station extension rather than on the left and right sides of the	The participants were informed about the project design and expected impact on their commercial establishments. The project alignment, station, and entry/exits will likely impact two shops permanently on the right side. But nine shops on the left side will likely be affected, as they are coming under 3 meters of working space considered for the construction stage. They were informed that the impact on these nine shops will be temporary during the construction

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		station. The alternative would be beneficial for the commercial establishment as it would not impact their source of income during the construction phase. They also raised concern regarding the project compensation of employees, as most of them used to pay salaries in cash, but they have maintained a register or logbook.	period. After completion of metro construction, they can operate as usual as they are presently operating. Participants were informed that suggestions to shift the alignment and change the entry/exit location will be discussed with the GMRL and the Detailed Design Team. The Detailed Design Team will review the viability of the suggested station plan and entry/exit location. The findings will be communicated to the participants.
5	Consultation with Shop Owners of Ashok Vihar, Gurugram, Haryana 08.01.2024 No. of Participants: 4	- The participants requested that the proposed metro station at Ashok Vihar's entry/exit plan be reviewed to minimize any potential effects on commercial establishments. The roads leading to homes will be blocked by the proposed project. proposed entry/exit location will block the ways to residences. - These are the only roads that provide connectivity to the local population. These roads would be blocked during the construction and operation of the metro project. - They suggested shifting to the Ashok Vihar metro station at Sector 5 Gol Chakkar.	Participants were informed about the project design and expected impact on their commercial establishments. The project entry/exits will temporarily affect nine shops on the left side, as they are coming under 3 meters of working space considered for the construction stage. Participants were informed that suggestions to shift the station and change of entry/exit location will be discussed with the GMRL Detailed Design Team. The Detailed Design Team will review the viability of the suggested station plan and entry/exit location. The findings will be communicated to the participants.
6	Consultation with Shop Owners of Ashok Vihar, Gurugram, Haryana 10.01.2024 No. of Participants: 19 (Male 17 and Female 02)	- The proposed metro project will have lifts, stairs, entry-exit points, ramps, etc. starting from OKAYA Electric Scotty Shop and is proposed to end at Shri Syam Rasoi. - Apart from the same, a Wall is also proposed to be constructed which shall cover the said facilities. - The proposed facilities will have the following difficulties and problems forever throughout our lives:	Affected persons were informed that suggestion to shift the station and change of entry/exit location will be discussed with the GMRL and Detailed Design Team. The Detailed Design Team will review the viability of the suggested station plan and entry/exit location. The findings will be communicated to the participants. If potential income reduction occurs during the construction phase due to restriction of access to their

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		• There is a road measuring approximately 20 feet from the spot where the lift is proposed to be installed. This road is the only access route for approximately 100 families residing in the area that this road leads to. • If the lift is installed at the proposed spot, it will severely hinder traffic flow on that road, which is mainly used by residents in the area. • Likewise, the spot where the proposed ramp/stairs for entry & exit points are to be constructed will block a road measuring approximately 18 feet, which is the only entry-exit point for residents in the said lane, and a plot measuring 800 sq. yds., which will again lead to significant restrictions on movement and entry/exit for residents & their vehicles. • The proposed wall shall close the front of all the shops, which will be covered by the said wall. Undoubtedly, if this happens, it will lead to huge financial losses for shopkeepers and may also lead them to vagrancy. • The space that will be left after construction of the wall, ramps, lift, stairs, etc., will be very limited near the shops, which will again lead to congestion & chaos in the sub-lanes. Otherwise, all the passengers using the metro shall alight on the main road, which will definitely lead to huge traffic jams, chaos, etc. Needless to point out, the road on which the Metro Station is proposed to be constructed otherwise witnesses heavy traffic movement and jams almost during the entire day. • Likewise, the spot where the proposed ramp/stairs for entry & exit points are to be constructed opposite to the lift shall block a road measuring approximately 18 feet, which	shops. They were informed that the issue would be discussed with GMRL. Also, they were further advised to maintain up-to-date records of their ITR and GST filings to facilitate income assessment. So that, compensation will be provided for loss of income due to obstruction in accessing their establishments during the construction period. In the event of potential income reduction during the construction phase due to restricted access to shops, affected individuals were informed that the matter would be discussed with GMRL. They were also advised to maintain up-to-date records of their Income Tax Returns (ITR) and Goods and Services Tax (GST) filings to facilitate accurate income assessment. This will support the provision of appropriate compensation for any loss of income resulting from limited access to their establishments during the construction period.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		is the only entry-exit point for residents residing in the said lane opposite the aforesaid spot, which will again lead to big restrictions for movements and entry/exit of residents & their vehicles..	
7	Consultation with Affected Persons at Rao Gajraj Singh Chowk, Gurugram Date: 25.01.2024, No. of Participants: 5	- Participants have concerns that the metro project would have negative impacts in terms of loss of income, customers, structures, and decrease in property value. - The proposed project will not serve the last mile connectivity, decrease the migration, increase the property value, etc. - However, the metro project will increase accessibility to facilities, decrease accidents, improve the transportation system, and provide a safe means of transportation. Suggestion: - Participants suggested that traffic management is very necessary during construction as the area is very congested.	The participants were informed that traffic during construction will be managed with the assistance of the traffic police.
8	Consultation with Affected Persons at Pardeshi Dhaba near Rao Gajraj Singh Chowk, Gurugram Date: 29.01.2024 No. of Participants: 5	Participants have concerns that the metro project would have negative impacts in terms of loss of income and customers during the construction period. Also, the proposal will not serve the last-mile connectivity. However, the metro project will have the following benefits: - Increase in accessibility to facilities, employment, property value, customers, educational levels, etc. - Improvement in the transportation system and decrease in accidents. Suggestion: - The participants requested to avoid the impact on their shops, and if it impacted, compensation would be paid.	The participants were informed that alignment is designed to avoid and minimize the impact as much as possible. The compensation will be paid as per the RFCTLARR Act, 2013.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
9	Consultation with manager and employee of The Theka, Wine Shop near Rao Gajraj Singh Chowk, Gurugram Date: 30.01.2024 No. of Participants: 3	Metro project will have the following impacts: - Provide safe and affordable transport, increase income, customers, employment, property value, accessibility to facilities, educational levels, and decrease accidents & migration, and enhance or improve the transportation system. Suggestion: - The participants requested that compensation be paid to the owner and employees if their shops are closed or affected during the construction phase of the metro.	Compensation would be provided if their shops were affected during the construction period, in accordance with the RFCTLARR Act, similar to that offered to other PAPs.
10	Consultation with Shop Owners at Sector 33 (Depot Location), Gurugram, Haryana 29.12.2023 No. of Participants: 4	- The shop owners at Marble Market were shifted to Sector 33 Site from Sikandarpur on Mehrauli-Gurugram Road in 2004 by HSVP (HUDA). - The shop owners have filed a petition alleging that the authority has not adopted fair and appropriate criteria/method for the newly allotted site. The marble market area falls in the proposed depot location and has received a stay order by the Hon'ble Court for operations of the Marble Market (a copy of the same provided by the marble market association is attached for reference). - The proposed project will have a direct and indirect impact (40 shops are likely to be affected). - The shop owners will not participate in the census and socio-economic survey until the Hon'ble Court gives them the order to vacate the said location. Suggestion: - The shop owners will not participate in the census and socio-economic survey until the Hon'ble Court gives them the order to vacate the said location.	The shop owners were informed that a census and socio-economic survey will be conducted after the Hon'ble Court issues its verdict on the matter.
Consultations and Discussions with Other Interested Groups			

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
1	Consultation with RWA Members at Ambedkar Chowk, Sector-10A Gurugram, Date: 21.12.2023 No of Participants: 07	Participants believe that the metro project would be beneficial for the local population and have the following benefits: Increase in income, employment, property value, customers, accessibility to facilities, educational levels, etc. Improvement in the transportation system and a decrease in accidents. Suggestion: Proper and designated space for autos and e-rickshaws to avoid chaos at metro stations. A parking space would be beneficial for metro users. Metro feeder services would be beneficial for metro users for last-mile connectivity. Provisions for dust pollution reduction and management of service lanes during the construction phase. Metro construction work should start as soon as possible.	The participants were informed that the issue will be discussed with GMRL, and based on the applicability, it shall be incorporated into the design.
2	Consultation with Street Vendors (Fruits and Vegetables), Udyog Vihar Phase-6, Sector 10 Date: 21.12.2023, 16:00 No. of Participants: 08	Participants believed that the proposed project would have multiple benefits in terms of better connectivity to the Industrial Area of Sector 10, reduction in dust pollution between Hero Honda Chowk and Umang Bhardwaj Chowk, and an increase in their income. Suggestion: The participants suggested that auto, e-rickshaw, taxi, and feeder services would be beneficial for metro users for last-mile connectivity where such locations are not connected to metro stations	The participants were informed that necessary action would be taken to improve the last-mile connectivity.
3	Consultation with Auto Drivers, Near ESIC Hospital, Sector-7,	Participants believe that the metro project would be beneficial for the local population and have the following benefits:	The participants were informed that designated auto stands would be proposed considering the land availability, and necessary action would be taken to improve the last-mile connectivity.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
	Date: 21.12.2023, 13:17 hrs (No. of Participants: 8)	Increase in income, employment, property value, accessibility to facilities, educational levels, etc and improvement in the existing transportation system. Participants have concerns that the metro project would have negative impacts in terms of loss of income, customers, and an increase in accidents. Suggestion: Proper and designated space for autos at metro stations. Street vendors near the metro station would increase the chances of traffic jams. Auto rickshaw would provide last-mile connectivity to metro users.	
4	Consultation with General Public Near Sector 7 Metro Station, Gurugram Date: 21.12.2023 No. of Participants: 5	Metro project will have the following benefits: Increase in income, employment, property value, customers, accessibility to facilities, educational levels etc. Improvement in the transportation system and a decrease in accidents. Suggestion: Metro feeder services from the metro station to Bhandwari village would be beneficial for the local population for last-mile connectivity. Traffic management plan for temporary interruptions to vehicular and pedestrian traffic to avoid jams during the construction stage.	The participants were informed that necessary action would be taken to improve the feeder buses and last-mile connectivity.
5	Consultation with Street Vendor at Sector 48, Gurugram Date: 21.12.2023 No of Participants: 5	Participants are not aware of the perceived positive and negative impacts of the project. Suggestion Participants mentioned that they have a seasonal business; therefore, there will be no impact due to the proposed metro.	

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
6	Shop Owners of Ashok Vihar (General Public), Date 27.12.2023 No of Participants: 04 (Male)	The participants were requesting to shift the alignment and station locations towards the right side, from Ashok Vihar to Carterpuri Chowk. The participants were saying that the land in this section has already been acquired by the government authority, and compensation has been paid to the landowners. Some of them have not collected their cheques from the treasury. The participants raised the issue of loss or reduction of income during the construction stage. Presently, they have sufficient space in front of their shops, but during construction, GMRL will barricade the project site to avoid any safety-related incidents. After barricading, they will left with 1 or 1.5 meter of space. Now, they are expecting that their sales will reduce during construction.	The Detailed Design Team will review the viability of the alignment and station design between Ashok Vihar and Carterpuri Chowk towards the right-side suggested station plan and entry/exit location. The findings will be communicated to the participants. The participants were informed that the loss or reduction of income will only be temporary during the construction period. After completion of metro construction, they can operate as usual as they are presently operating. They were also informed that the issue of loss or reduction of income will be discussed with the GMRL officials. They will be informed about the outcome of the discussion.
7	Consultation with e-Rickshaw Driver near Jwala mill Auto Stand, Phase IV, Gurugram Date: 25.01.2024 No. of Participants: 5	Metro project will have the following benefits: Increase in income, employment, property value, customers, accessibility to facilities, educational levels etc. Improvement in the transportation system and a decrease in accidents. Also, the proposed project will not serve last-mile connectivity to metro users. Suggestion: The metro project will have negative impacts in terms of loss of income as traffic from Salarpur, Kapashera Border and Mullahera would get diverted.	The participants were informed that necessary action would be taken to provide an alternate route for better connectivity during the construction phase.
8	Consultation with Shopkeepers near Rao Gajraj Singh Chowk, Gurugram	Metro project will have the following impacts: Provide safe means of transportation, increase in customers, property value, accessibility to facilities, educational levels, decrease in accidents etc.	The participants were informed that compensation shall be provided as per the RFCTLARR Act for their losses.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
	Date: 25.01.2024 No. of Participants: 06	Participants believe that the proposed project will not enhance the existing transportation system or increase employment, income, or educational levels. Participants have concerns that the construction of the metro project would reduce the right of way and have negative impacts in terms of loss of income and customers. Suggestion: The participants requested that compensation be paid if their shops are closed or affected during the construction phase of the metro.	
9	Consultation with Metro Users at Udyog Vihar Phase-IV, Gurugram Date: 29.01.2024 No. of Participants: 04	Metro project will have the following benefits: Increase in income, employment, property value, customers, accessibility to facilities, educational levels etc. Improvement in the transportation system and a decrease in accidents. However, the proposed project will not serve last-mile connectivity to metro users. Suggestions: Traffic management plan for temporary interruptions to vehicular and pedestrian traffic to avoid jams during the construction stage.	The participants were informed that a traffic management plan shall be developed during the implementation of the project, and traffic shall be managed with the assistance of the traffic police in Gurugram.
10	Consultation with Auto Drivers near Auto Stand Palam Vihar Mor, Sector 22, Gurugram Date: 30.01.2024 No. of Participants: 5	Metro project will have the following benefits: Increase in accessibility to facilities, employment, property value, educational level etc. Provide safe and affordable public transport, an improved transportation system, and a decrease in accidents. The proposed project will not serve last-mile connectivity to metro users.	The participants were informed that necessary action would be taken to improve the feeder buses and last mile connectivity.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		However, participants have concerns that during and after construction, the auto fare would be reduced from Gol Chakkar to Palam Vihar Mor and Palam Vihar Mor Vyapar Kendra Market.	
11	Consultation with NGO at KBA/IBA in Sector 101, Basai Date: 15.10.2024 No. of Participants: 3	Participants were aware of the project but didn't know the details. They believe the project will not affect the KBA/IBA in Sector 101, Basai. The water source to KBA/IBA in Sector 101, Basai is mainly from overflow water from the broken drain, which carries effluent from STP. Recent repairs carried out by the authorities have halted this outflow, causing the waterbody to dry up. Previously, the continuous flow had drawn bird watchers and photographers to the area, but since the repairs, bird activity has noticeably decreased. Metro project will have the following benefits: Property value will rise as the area becomes more accessible for residents and commuters, making the surrounding neighborhoods more appealing to homebuyers and businesses. Use of commercial Reduction in pollution due to decreasing the number of private vehicles on the road, leading to lower emissions, and by promoting the use of cleaner public transportation. Improvement in the transportation system by providing a fast, reliable, and efficient mode of travel, reducing congestion on roads, and making affordable public transit accessible to a larger population. There will be a reduction in traffic by encouraging commuters to opt for public transport. Suggestion:	Traffic diversion plans will be formulated and followed during the execution of project. Contractors will develop and execute a traffic management plan, including measures such as traffic diversion, avoiding school hours, market activities, religious activities, adhering to speed limits, and employing licensed drivers, etc. Frequent sprinkling of water on the local roads and worksites will be undertaken to control dust emissions. Use water sprays or dust suppressants to keep dust levels low. Cover construction materials with green nets to prevent dust from blowing away.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		Traffic management measures like diversions, adequate pedestrian facilities, and optimized signal timings can reduce congestion. These should be undertaken to ensure less noise and air pollution. Dust control measures during metro construction should be undertaken, including regular water spraying on construction sites and covering materials to prevent dust spread, along with using dust barriers and air filters to maintain air quality.	
GBV Discussion and Consultation with Police Station En route to the Corridor			
1	Women Police Station Palam Vihar, District Gurugram, Haryana. 21.12.2023 No of Participant: 05 Female Police Officials	SHO, along with the team, participated in the discussion. The police department has identified five hotspots for patrolling to stop the crime against women. The five hotspots are Bus Stand, Devi Lal Park, Sector-14, Choma Gaon Park and IFFCO Chowk. The women police officials are posted there in civil dress from 17:00 to 20:00 and 20:00 to 24:00. One FIR was registered against an unidentified person for harassment in the month of October, 2023. The police team has organized 13 awareness camps in schools to raise students' awareness of good and bad touch. The Principal of Sadar School has requested that the police team carry out regular patrols at the time of students leaving after school hours. The training was provided by women officials in uniform. For women's safety, a designated helpline number which is 112 called Durga Shakti, has been started by the department to report cases related to women's safety. Durga-Shakti Rapid Action Force vehicles patrol at hotspots.	The participants were informed that necessary steps shall be taken during implementation and operation of the project.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		Durga Shakti, a software application, is initiated by the Haryana Police, which offers a panic button facility for women in distress. Suggestion: The participant suggested that the provisions of CCTV at Devilal Park, Sector-22, Railway Station, and Sheetla Mandir. It was suggested that the screening of major crimes and their punishment should be displayed at the metro stations to make commuters aware.	
2	Women Police Station, Sector-51, Haryana, 22.12.2023 No of participants: 05 Women Police officials	The Women Police Station (Sector-51) is 1.25 km away from the proposed corridor. A dedicated Women Helpdesk with one female assistant sub-inspector and one female constable is assigned to the Helpdesk at the Station. The majority of cases registered at the station are dowry and domestic violence. For cases related to molestation, immediate action is taken by filing an FIR against the criminal. In the month of November No case has been registered for eve-teasing/harassment. One case was registered under the PCOSO Act. One rape case was registered. The women officials have organized 14 awareness camps in schools to raise awareness among the students and teachers. The topics of awareness camps were cybercrime (social media: Facebook and Instagram), good and bad touch, POCSO Act. The officials have also organized self-defence training programme. Durga-Shakti, a software application, is initiated by Haryana Police, which offers a panic button facility for women in distress.	The participants were informed that necessary steps shall be taken during implementation and operation of the project.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		The training was provided by women officials both in civil and uniform dress. For patrolling, Durga Shakti" PCR has been started by the government, which is meant for patrolling at the identified hotspot areas in three shifts: starting from 07:30-15:30,15:30-23:30, 23:30-07:30, to tackle the cases of eve teasing or any other offense related to women. Night patrolling at metro stations is carried out on a daily basis by officials to restrict prostitution activities. Suggestion: It was suggested by the officials that, for the safety of women and other passengers, provision for cameras at stations and nearby locations should be proposed. It was also suggested that only those auto and taxi drivers should be allowed at metro stations whose police verification has been done on a regular basis. It was also suggested that photographs of auto and taxi drivers with criminal records be displayed at metro stations. Concerned police stations should be consulted at the time of construction to identify grey areas and hotspots for regular police patrolling and CCTV installation.	
3	Women Police Station Palam Vihar, District Gurugram, Haryana. 29.12.2023 No of Participant: 02 Female Police Officials	Women Police Officials participated in the discussion. Eve-teasing and molestation cases are addressed directly. Rape cases and POCSO (Child cases) are addressed through the legal adviser. Accordingly, FIR is registered. Five hotspots (Bus Stand, Devi Lal Park, Sector-14, Choma Gaon Park, and IFFCO Chowk) have been identified by the department.	The participants were informed that necessary steps shall be taken during the implementation and operation of the project.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		For women's safety, a designated helpline number, which is 112, called Durga Shakti, has been started by the department to report cases related to women's safety. Also, cases reported by women on 100/1091 are transferred to the nearest Women Police Station. Most of the cases reported are related to domestic violence. In the last 6 months, 160 cases have been registered, 100 have been resolved, and 60 are pending. The police team has organized 30 awareness camps in schools, colleges, public and private organizations, and slum areas to raise awareness about good & bad touch and crime against women. Suggestion: Provisions of two dedicated women coaches, CCTV at metro premises, and a parking area.	
4	Consultation with Police Officials, Sector 39, Jhadsa, Gurugram, Haryana 29.12.2023 No of participants: 01	Police Officials participated in the discussion. No major complaints were reported in the last two months. Mostly, rental dispute-related complaints were reported between the owners and tenants. Officially, a woman police official is assigned to investigate gender-related crimes. Accordingly, actions have been taken as per the law. For women's safety, a designated helpline number, which is 1091, and 112, called Durga Shakti, has been started by the department to report cases related to women's safety. Also, cases reported by women on 100 are transferred to the nearest Women's Police Station. Suggestion: Provision for first aid and cameras at stations and nearby locations.	Participants were informed that a first aid kit is already provided, and their concerns about dedicated auto and taxi parking will be discussed with the GMRL and the Detailed Design Team.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		Separate and dedicated space for autos and taxis must be proposed in the project. A police booth with a residential facility is provided at the station location for 24/7 police officials' deployment.	
GBV Discussion and Consultation with Women as Transport Users:			
5	GBV discussion has been carried out with 27 Women as Transport Users 29.12.2023 No of participants: 49 Women	The participants were between the ages of 20 and 62 years. It was revealed by the five participants that they have faced physical threats or eve-teasing during travel on roads. One participant has physically retaliated against the action, one participant has called the police but did not receive any response, and three participants did nothing against the act. The participants revealed that the principal modes of transport used by women in the project area are Auto, Bicycle, Bike, Bus, Car, Ola/ Uber/Rapido, Scooty, etc. 20 participants believe that it is common for women to travel alone in auto/buses/tempo/sharing cabs. 23 participants believe that better Metro connectivity will help people travel from one place to another easily. 10 participants are daily users, six participants are weekly users, and five participants are monthly users of metro services. 17 participants feel safe while traveling in the metro, three participants do not feel safe in metro travel, and one participant does not feel safe while traveling in general metro coaches. It was revealed by the two participants that they have faced physical threats or eve-teasing while traveling in the metro, and one participant did nothing against the act, and one participant ignored the act due to less time. One participant was the victim of theft and was not aware of whom to contact, and made a complaint.	The participants were informed that necessary steps shall be taken during implementation and operation of the project.

S. No	Location of the Consultations, Date, No. of Participants	Stakeholder/ People's perceptions/ Suggestions	Mitigation Measures
		15 participants believe that the metro can be considered as a child-friendly mode of transport. Other participants believe that children can travel under the supervision of adults. Suggestion: For the safety of women and other passengers, provision for CCTV at stations (also near escalators and elevators) and nearby locations should be proposed. Provisions for Platform Screen Door (PSD) to prevent accidents, objects falling on track, and trespassing. Provisions for the deployment of police officials both men and women at the entry or exit of metro stations to restrict bad elements at and near metro premises. Metro premises must have Sanitary Pad Vending Machines, Transparent Elevators, Gender Neutral Toilets, Dedicated Women Coaches, and an App for Online Complaints. Emergence helpline numbers must be displayed at and near the metro premises and require immediate response from them.	

Annexure: 6.2

Photos of Consultations and Interview



Elderly Affected Resident, Sector 4,
Date 21.12.2023



Affected Shop Owners of Ashok Vihar,
Ashok Vihar Station, Date 29.12.2023



Affected Vulnerable Group (Banjaras),
Rezangla Chowk, Date 22.12.2023



Affected Persons (Fruit Vendors), Sector 4
& 5, Date 21.12.2023



Affected Shop Owners of Ashok Vihar,
RITES Office, Date 08.01.2024



KBA/IBA in Sector 101, Basai, Sangharsh
with Soul NGO, Date 15.10.2024



Affected Persons, Rao Gajraj Singh Chowk,
Date 25.01.2024



Affected Persons, Rao Gajraj Singh Chowk,
Date 29.01.2024



Affected Persons, Rao Gajraj Singh Chowk,
Date 30.01.2024



Affected Persons, Marble Market, Sector
33, Date 05.02.2024



RWA Members, Sector 10A, Date
21.12.2023



Fruit Vendors, Sector 10A,
Date 21.12.2023



Auto Drivers, ESIC Hospital, Sector 7
Date 21.12.2023



General Public, Sector 7, Date 21.12.2023



Street Vendors, Sector 48, Date 21.12.2023



General Public, RITES Office, Gurugram,
Date 27.12.2023



E-rickshaw Driver, Jwala Mill, Phase 4, Date
25.01.2024



General Public, Rao Gajraj Singh Chowk,
Date 25.01.2024



General Public, Udyog Vihar Phase 4, Date
29.01.2024



Auto Drivers, Palam Vihar Mor, Date
30.01.2024



Women Police Officials, Palam Vihar,
Date 21.12.2023



Women Police Officials, Sector 51,
Date 22.12.2023



Women Police Officials, Palam Vihar,
Date 29.12.2023



Police Official, Jhadsa, Sector 39,
Date 29.12.2023



Tau Devi Lal Park, Palm Vihar Extn,
Date 23.12.2023



Phase 2, Gurugram
Date 29.12.2023



Basai Chowk, Gurugram
Date 29.12.2023



Basai Village, Gurugram
Date 29.12.2023



Basai Village, Gurugram

Date 29.12.2023



Ashok Vihar, Gurugram

Date 29.12.2023

Surya Vihar, Gurugram

Date 29.12.2023



Sector-4, Gurugram

Date 29.12.2023

Annexure 7.1**Outline for Site Clean-Up/Remediation Plan for Contaminated Sites/Locations****1. Background and Context**

The site assessment undertaken as part of the present Environmental and Social Impact Assessment (ESIA) for the Metro Project indicates that no contaminated sites have been identified within the project's area of influence.

However, given the dense urban context of the project, the possibility of encountering previously unknown or legacy contamination (e.g., due to past industrial, fuel storage, or waste disposal activities) during excavation or construction cannot be excluded.

In line with good international practice and consistent with the requirements of the World Bank Environmental and Social Framework (ESS3: Resource Efficiency and Pollution Prevention and Management), a Framework for Contamination Assessment and Remediation has been developed.

This framework also complies with relevant Indian legislation, including:

- Environment (Protection) Act, 1986 and Rules;
- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (amended 2021);
- Solid Waste Management Rules, 2016;
- Construction and Demolition Waste Management Rules, 2016; and
- CPCB Guidelines for Investigation and Remediation of Contaminated Sites (2015).

2. Objective of the Framework

The main objectives of this Framework are to:

- Establish clear procedures for identifying, assessing, and remediating contamination encountered during construction or operation;
- Ensure compliance with national environmental laws and international financing institution (IFI) standards;
- Protect workers, nearby communities, and the environment from potential pollution risks; and
- Integrate contamination management into the Environmental and Social Management Plan (ESMP) and related implementation procedures.

3. Scope of Application

This Framework applies to all project components involving ground disturbance or excavation, including:

- Station and depot construction sites;

- Tunnels, cut-and-cover sections, and access shafts;
- Utility relocation and underground cable works;
- Temporary storage, stockpile, and laydown areas; and
- Disposal sites associated with the project.

4. Potential for Contamination

Although no contamination was identified during baseline investigations, potential sources could include:

- Historical industrial or commercial land uses;
- Leakage from fuel or chemical storage tanks;
- Improper disposal of waste materials or oils; and
- Accidental spills during construction activities.

5. Triggers for Assessment

Contamination assessment shall be initiated if any of the following signs are observed during construction:

- Discoloured, odorous, or oily soils;
- Buried waste, drums, or other foreign materials;
- Unusual colour or odour in groundwater;
- Evidence of prior industrial use or dumping activity; or
- Reports or complaints of contamination from workers or the community.

6. Mitigation and Management Measures

A. Immediate Response Procedures

- Notification: Upon discovery, the Contractor shall immediately inform the General Consultant and the GMRL Environmental Health & Safety Experts.
- Site Isolation: The affected area shall be cordoned off and access restricted to prevent disturbance or spread.
- Health and Safety Precautions: Workers shall wear appropriate Personal Protective Equipment (PPE) and avoid direct contact with contaminated materials.

B. Assessment and Investigation

If contamination is suspected:

- A rapid site inspection will be conducted to characterise the extent of contamination.
- If required, carry out detailed soil and/or groundwater sampling and laboratory analysis, in accordance with CPCB guidelines; and
- Contaminant concentrations will be compared with Indian and internationally accepted threshold values to assess risk levels.

C. Preparation of Site-Specific Remediation Plan (SSRP)

If contamination is confirmed, a Site-Specific Remediation Plan (SSRP) shall be developed by the GMRL, in consultation with relevant authorities (e.g., State Pollution Control Board (SPCB)). The SSRP shall include:

- Type, extent, and concentration of contamination;
- Cleanup targets and regulatory standards;
- Remediation strategy (e.g., excavation, containment, in-situ treatment, bioremediation);
- Health, Safety, and Environmental (HSE) protection measures;
- Waste handling, transport, and disposal plan (in accordance with the Hazardous Waste Rules, 2016);
- Monitoring and verification plan; and
- Roles and responsibilities of all implementing entities.
- The SSRP shall be approved by the SPCB before implementation.

7. Mitigation and Management Measures

- All contamination incidents shall be documented in a Contamination Incident Report (CIR), including photographs, sampling results, and mitigation actions taken.
- The GMRL will consolidate all CIRs and include a summary in quarterly Environmental and Social Monitoring Reports (ESMRs) submitted to the World Bank.
- Follow-up soil and groundwater monitoring shall be conducted post-remediation to confirm effectiveness and compliance with cleanup targets.
- All documentation shall be retained in the project's environmental records for audit purposes.

8. Institutional Responsibilities

Entity	Responsibilities
Contractor	Identify and report suspected contamination; implement site isolation and initial safety measures; cooperate with investigations.
Health & Safety Expert (GC)	Verify findings, direct initial containment actions, and ensure compliance with this Framework.
Environmental Health and Safety Expert (GMRL)	Coordinate assessments, engage qualified consultants, prepare SSRPs, and liaise with SPCB.
State Pollution Control Board (SPCB)	Review and approve SSRPs; oversee waste management and final clearance.
Independent Environmental and Social Monitoring Consultant	Provide external verification and report to the World Bank.

9. Integration with ESMP and Contractor Requirements

This Framework forms part of the Environmental and Social Management Plan (ESMP) and must be incorporated into:

- Contractor's Environmental and Social Management Plan (C-ESMP); and
- Emergency Response Plan (ERP).

Contract documents shall include provisions requiring the Contractor to follow these procedures and bear the costs associated with contamination response, investigation, and remediation.

10. Compliance with Indian and International Standards

All assessments and remediation works shall be conducted in compliance with:

- CPCB Guidelines for Remediation of Contaminated Sites (2015);
- MoEF&CC Environmental Standards for soil and groundwater;
- World Bank ESS3 – Resource Efficiency and Pollution Prevention and Management; and

Where discrepancies exist, the more stringent standard (between Indian regulations and World Bank Guidelines) shall apply.

Annexure-7.2

Cumulative Noise Levels at Sensitive Receptors due to Metro Operations

S. No	Receptor	Distance from Centre Line (in m)	Noise Baseline Data in dB(A) of nearest monitoring location			Cumulative Noise for Year 2021		Noise Criteria	
			Location	LeqD	LeqN	LeqD	LeqN	LeqD	LeqN
	Temple								
1.	Shri Jaganath Temple	28.2	N1	63.9	49.9	65.0	56.8	No Impact	No Impact
2.	Radha Krishna Temple	70.5	N1	63.9	49.9	64.1	52.2	No Impact	No Impact
3.	Durga Mata Mandir	40.9	N13	64.5	50.5	65.0	54.8	No Impact	No Impact
4.	Kirpa Ram Hanuman Mandir	30.2	N14	54.5	44.4	59.5	55.6	No Impact	No Impact
5.	Shani Mandir	31.3	N3	54.1	44.6	56.0	50.3	No Impact	No Impact
6.	Temple Rhs1	41.5	N3	54.1	44.6	57.8	53.3	No Impact	No Impact
7.	Temple Rhs2	41.1	N3	54.1	44.6	57.8	53.4	No Impact	No Impact
8.	Temple Median	24.2	N3	54.1	44.6	60.7	57.2	No Impact	No Impact
9.	Devi Mandir	45.5	N4	54.9	44.8	55.8	48.4	No Impact	No Impact
10.	Shiv Temple	11.0	N4	54.9	44.8	58.0	53.1	No Impact	No Impact
11.	Gur Goraknath Temple	35.3	N5	54.5	44.8	56.0	49.7	No Impact	No Impact
12.	Prachin Shiv Hanuman Mandir	89	N17	54.3	44.1	55.4	48.3	No Impact	No Impact
13.	Maa Chintpuri Mandir	18.9	N6	54.0	43.7	57.7	53.2	No Impact	No Impact
14.	Shri Dataram Mandir	49.2	N7	54.3	44.5	57.1	52.1	No Impact	No Impact
15.	Shiv Mandir	54	N7	54.3	44.5	56.8	51.5	No Impact	No Impact
16.	Hanuman Mandir	15.7	N7	54.3	44.5	58.6	54.4	No Impact	No Impact
17.	Krishna Chowk Palam Vihar By Db Baba	18.4	N9	62.6	48.3	63.4	54.2	No Impact	No Impact
18.	Hanuman Mandir	34.7	N10	54.1	44.4	55.8	49.7	No Impact	No Impact
19.	Hanuman Mandir	17.4	N11	54.8	44.7	62.7	59.4	Moderate	Moderate
	Educational Institute								

S. No	Receptor	Distance from Centre Line (in m)	Noise Baseline Data in dB(A) of nearest monitoring location			Cumulative Noise for Year 2021		Noise Criteria	
			Location	LeqD	LeqN	LeqD	LeqN	LeqD	LeqN
20.	Vishwas Vidyalaya	43.2	N14	54.5	44.4	57.8	53.0	No Impact	No Impact
21.	Vedanya International School	13	N2	64.4	52.2	65.2	56.8	No Impact	No Impact
22.	Yaduvanshi Shiksha Niketan Sec-School	43	N15	54.8	44.9	55.8	48.7	No Impact	No Impact
23.	Kangaroo Kids International Pre School	40.7	N15	54.8	44.9	58.2	53.5	No Impact	No Impact
24.	IBMR Business School	76.2	N15	54.8	44.9	56.1	49.5	No Impact	No Impact
25.	Greenwood Public School	64.5	N4	54.9	44.8	55.4	47.0	No Impact	No Impact
26.	Shri Shiv Narayan Sidheswar Senior Secondary School	70	N5	54.5	44.8	55.0	46.7	No Impact	No Impact
27.	Jiwan Jyoti Senior Secondary School	76.5	N5	54.5	44.8	55.9	49.4	No Impact	No Impact
28.	Arya Public School	75.6	N5	54.5	44.8	55.9	49.5	No Impact	No Impact
29.	Blue Bells Preparatory School	34.9	N17	54.3	44.1	58.7	54.5	No Impact	No Impact
30.	Xion International convent School	82.2	N6	54.0	43.7	54.4	45.5	No Impact	No Impact
31.	Euro Kids Pre-School & Day Care	88.4	N18	54.8	44.2	55.8	48.4	No Impact	No Impact
32.	New Light Public School	75.9	N18	54.8	44.2	55.2	46.1	No Impact	No Impact
33.	Blossoms Primary School	28.5	N7	54.3	44.5	56.4	50.9	No Impact	No Impact
34.	GAV International School	26.3	N8	64.7	45.7	65.7	56.7	No Impact	No Impact

S. No	Receptor	Distance from Centre Line (in m)	Noise Baseline Data in dB(A) of nearest monitoring location			Cumulative Noise for Year 2021		Noise Criteria	
			Location	LeqD	LeqN	LeqD	LeqN	LeqD	LeqN
35.	Narayan e-Techno School	58.6	N8	64.7	45.7	65.0	51.3	No Impact	No Impact
36.	SCR Global School	78	N9	62.6	48.3	62.7	49.1	No Impact	No Impact
37.	Presidium School	16.7	N9	62.6	48.3	63.5	54.7	No Impact	No Impact
38.	DPSG Palam Vihar	30.8	N10	54.1	44.4	59.3	55.5	No Impact	No Impact
39.	Rotary Public School	24.8	N11	54.8	44.7	60.7	57.0	No Impact	Moderate
40.	Nest Play School and Day Care	8.21	N19	64.8	47.4	66.0	57.5	Moderate	No Impact
Hospitals									
41.	Fortis Memorial Research Institute	57.6	N1	63.9	49.9	64.0	50.9	Moderate	No Impact
42.	Lifeaid Medical Centre	81.1	N13	64.5	50.5	64.5	51.0	Moderate	No Impact
43.	Safe Hands Hospital	33.8	N13	64.5	50.5	65.2	55.9	Moderate	Moderate
44.	Sai Siddhi Urology Multispeciality Hospital	56	N13	64.5	50.5	64.8	53.4	Moderate	No Impact
45.	Sukhmani Hospital	38.6	N14	54.5	44.4	55.8	49.1	No Impact	No Impact
46.	Vedic Hospital	99	N3	54.1	44.6	55.1	48.0	Moderate	No Impact
47.	Helix Hospital	60.3	N4	54.9	44.8	55.5	47.2	No Impact	No Impact
48.	Shri Balaji Multi speciality Hospital	93	N4	54.9	44.8	55.8	48.4	No Impact	No Impact
49.	Sagar Hospital	25	N4	54.9	44.8	60.7	57.0	Moderate	Moderate
50.	Vidya Medical Centre	15.3	N4	54.9	44.8	58.9	54.6	Moderate	Moderate
51.	Yashroop Hospital Maternity & Multi speciality Hospital	36	N4	54.9	44.8	58.8	54.4	Moderate	Moderate

S. No	Receptor	Distance from Centre Line (in m)	Noise Baseline Data in dB(A) of nearest monitoring location			Cumulative Noise for Year 2021		Noise Criteria	
			Location	LeqD	LeqN	LeqD	LeqN	LeqD	LeqN
52.	Dr. Shivangi Infertility and Gynae Consultant Hospital	19.5	N5	54.5	44.8	62.0	58.7	Severe	Severe
53.	ESIC Hospital	66.2	N5	54.5	44.8	55.0	46.9	No Impact	No Impact
54.	Jain Sant Phool Chand Ji Charitable Hospital	27	N6	54.0	43.7	56.4	51.0	Moderate	No Impact
55.	Sarvodya Hospital	17.1	N6	54.0	43.7	58.1	53.8	Moderate	Moderate
56.	Aastha Medicare Maternity Centre	33.2	N18	54.8	44.2	59.2	54.9	Moderate	Moderate
57.	Vardhman Hospital	36.4	N18	54.8	44.2	58.7	54.2	Moderate	Moderate
58.	Mittal Ortho & fracture Clinic	34.8	N18	54.8	44.2	58.9	54.6	Moderate	Moderate
59.	Jannat Hospital	14	N18	54.8	44.2	59.2	55.0	Moderate	Moderate
60.	Balaji Life Care Hospital	14	N7	54.3	44.5	63.8	60.7	Severe	Severe
61.	Manipal Hospital	26.6	N10	54.1	44.4	60.1	56.5	Moderate	Moderate

TECHNICAL NOTE ON BUILDING CONDITION SURVEY FOR VIBRATION IMPACTS

What is a Building Condition Survey (BCS)

A Building Condition Survey documents the pre-construction condition of existing structures near the construction zone by recording cracks, settlements, structural distress, tilts, and defects. The purpose is to establish a baseline against which any construction-induced damage can be assessed and liability determined.

Why Building Condition Surveys Differ Between Elevated and Underground Metro Construction

This is a technically sound and practically important question in metro rail project management. Here's a detailed justification:

Why BCS is Mandatory for Underground Metro Construction

1. **Direct Stress Transfer to Ground and Foundations:** Underground construction involves tunnelling through soil strata that directly support adjacent building foundations, involving activities like:
 - Shield tunnelling (TBM boring)
 - NATM excavation
 - Deep open-cut construction
 - Dewatering operations

Which causes ground loss, stress redistribution, and settlement that propagates upward to building foundations. Even a few millimetres of differential settlement can cause structural cracking.

2. **Vibration and Ground Movement Propagation:** TBM operations, blasting (where used), and heavy excavation equipment generate ground-borne vibrations that travel through soil and directly affect building foundations and superstructures within the influence zone on either side.
3. **Dewatering-Induced Consolidation Settlement:** Lowering the groundwater table during underground construction causes consolidation of compressible soils, leading to widespread settlement affecting buildings over a large area, sometimes several meters away.
4. **To know the extent of damages:** Without a pre-construction BCS, it is impossible to distinguish:
 - Pre-existing damage (old cracks, earlier settlement)
 - Construction-induced damage
 - BCS creates a proper baseline record for reference.

5. **Regulatory Requirement:** Most metro rail standards and international standards like BTS/ICE tunnelling codes mandate BCS for all structures within a defined influence zone before underground works commence.
6. **Instrumentation and Monitoring Baseline:** BCS guides in drafting the geotechnical instrumentation plan, settlement markers, tiltmeters, and crack gauges on buildings are installed and referenced against BCS findings to trigger alarm thresholds during construction.

Why BCS is Generally Not Required for Elevated Metro Construction (Typical Elevated Viaduct in Urban ROW)

1. **Defined and Narrow Zone of Influence (ROW/Median Works; No Undermining of Adjacent Foundations):** For an elevated corridor, the permanent works footprint is typically restricted to **pre-fixed pier / pile-cap locations** within the **public Right-of-Way (ROW)** (median/footpath) and does not involve excavation beneath third-party buildings. Accordingly, the potential mechanism that drives most BCS requirements, i.e. **subsurface stress relief, ground loss, and building-foundation interaction (soil–structure interaction, SSI)**, is generally absent. The ground disturbance is primarily **local, axisymmetric and vertical** around each bored cast-in-situ pile and pile cap, rather than a continuous, laterally propagating influence zone as in tunnelling or deep cut-and-cover.
2. **Piling-Induced Vibrations are Point-Source and Screen able (PPV/Frequency-Controlled):** Construction vibration for elevated viaducts is dominated by near-surface equipment excitation (rotary drilling, casing oscillation, chiselling, concreting, crane operations) rather than deep, continuous sources. Vibrations can be objectively managed using peak particle velocity (PPV) and dominant frequency criteria (commonly referenced in project ESIA/EMP frameworks and international practice). In addition, the typical foundation method for Indian metro viaducts is bored cast-in-situ piles (rotary drilling) rather than impact/vibro-driven piles; bored piles generally produce lower transmissible ground vibrations and do not generate repeated impact pulses that are most associated with cosmetic cracking claims.
 - It behaves as a point source with geometric and material damping, so PPV attenuates rapidly with distance in soil media.
 - The practical influence radius is typically limited to the immediate vicinity of the piling location.
 - Where piers are located within the RoW/median, adjacent private buildings are commonly outside the conservative vibration screening distance.
3. **No Regional Groundwater Drawdown / Consolidation Bowl (Unlike Deep Excavations):** Elevated viaduct foundations rarely require continuous deep excavation or large-scale dewatering. Any groundwater management is typically limited to local, short-duration pumping within individual pile bores/pile caps and does not create a regional drawdown cone or consolidation settlement bowl that could affect buildings at offset distances. This eliminates one of the principal damage mechanisms that makes BCS indispensable for underground works in compressible strata.
4. **Load Transfer is Predominantly Axial into Deep Foundations (Minimal Stress-Bulb Overlap):** In elevated viaducts, permanent loads are transferred via axial compression

through pile groups to deeper competent strata. The resulting stress distribution is concentrated below the pile group, and the stress bulbs are largely contained within the foundation footprint. Hence, there is negligible lateral stress redistribution, no sustained change in the effective stress regime of the surrounding soil mass, and minimal potential for interaction/overlap with the stress bulbs of adjacent building foundations.

5. **Transient Construction Vibration vs. Tunnelling/Deep Excavation Effects (Surface-Wave Dominated, Manageable by EMP):** For elevated works, vibrations are typically governed by surface-wave (Rayleigh wave) propagation from construction plant and are intermittent and short-duration at any given location (activity moves pier-to-pier). This is materially different from underground construction, where continuous ground loss/stress changes can accumulate over time.
 - Short exposure duration at any single receptor (activity is localised and progresses sequentially along chainage).
 - Lower propensity for deep transmission compared with sustained subsurface excavation sources; effects are primarily near-surface and attenuate with distance.
 - Readily controllable through method statements (rotary bored piling, controlled chiselling), equipment maintenance, working-hour windows, and real-time vibration monitoring with alarm thresholds.
 - This is qualitatively different from the sustained, deep, far-reaching vibration from TBM or NATM tunnelling.
6. **Risk-Based Condition Documentation is Sufficient (Targeted BCS Only for High-Risk Receptors):** For elevated corridors, good engineering practice is to adopt a screening and receptor-classification approach: (i) identify buildings/utility assets within a defined offset distance of each pier/station excavation, (ii) classify sensitivity (heritage/aged masonry, distressed structures, hospitals/labs, shallow foundations), and (iii) implement targeted condition documentation and/or instrumentation only for those receptors that exceed the screening thresholds. This approach is technically defensible and consistent with the fact that elevated works do not create a continuous ground influence zone comparable to tunnelling. Routine periodic visual checks with geo-tagged photographs, combined with the project's vibration monitoring locations and trigger/action protocol, are generally adequate for the remaining building stock.

Comparing the Exceptional Scenarios Requiring BCS for Elevated Metro with the Gurugram Metro Context

While there are a few unique cases where Building Condition Surveys (BCS) might be considered for elevated metro construction—such as when piers are extremely close to heritage or fragile structures- these situations are rare and typically manageable through targeted engineering solutions. The Gurugram metro corridor, in particular, is designed as an elevated viaduct with foundations constructed using bored cast-in-situ piles at discrete locations, not continuous underground excavation. This means the corridor avoids the sustained, deep ground influence associated with tunnelling that necessitates widespread BCS.

GMRP corridor passes through a highly urbanised environment characterised by recent, high-density development. The building typology in the influence zone is mainly dominated by

modern construction techniques that are inherently resilient to the minor vibratory impacts associated with elevated metro construction.

Typology Category	Structural Characteristics	Proximity & Risk Context
Grade-A Commercial & IT Parks	Steel-reinforced concrete (RCC) framed structures with deep pile foundations and glass-curtain walling.	These are set back significantly from the main carriageway, providing a natural buffer from piling activities.
High-Rise Residential (Group Housing)	Modern skyscrapers (20–40 floors) are designed for high seismic loads and structural redundancy.	Located in planned sectors with wide green belts separating the building footprints from the Metro Right-of-Way (RoW).
Modern Builder Floors	G+4 structures built within the last 10–15 years using RCC frames and infill masonry.	Situated along secondary sector roads, these modern structures lack the fragility of traditional load-bearing masonry.
Mixed-Use Retail Hubs	Large-scale malls and commercial complexes with integrated basement parking and robust structural skeletons.	These structures are engineered to handle high dead and live loads, making them insensitive to external construction-grade vibrations.

Risk, if any, to nearby buildings is limited to short-duration, surface-wave vibrations, which can be effectively monitored and mitigated using ESMP, vibration monitoring, and adherence to Indian standards such as RDSO guidelines.

Conclusion

The fundamental principle is that underground construction fundamentally alters the stress state of the soil mass that buildings depend upon for support, while elevated construction does not, making BCS indispensable for the former and unnecessary.

The Gurugram metro corridor is predominantly an elevated viaduct within an urban arterial ROW, with foundations executed as bored cast-in-situ piles at discrete pier locations (not continuous underground excavation). As vibrations from bored piling have minimal direct impact on adjacent piles, the residual risk to third-party buildings is nil.

Mitigation Measures

Further, as suggested, vibration monitoring will be conducted at the “vibration monitoring locations” specified in the ESIA report (Table 5-15) to ensure the vibration levels are within the prescribed standard.

In addition to this, any complaint regarding damage to adjoining buildings or properties shall be inspected and verified by the Project Team. The condition of the affected structure will be assessed in relation to the ongoing works in its vicinity to determine the extent and probable cause of the damage. The Contractor shall, at its own cost, make good and repair any damage attributable to the Works. Where compensation is deemed necessary, the same shall be assessed and provided accordingly. Such instances shall be covered under the Contractor's All Risk (CAR) insurance policy under the Third-Party Liability, ensuring that affected property owners are duly compensated. Complaints or grievances received in this regard shall be recorded in the project's GRM and redressed.

Annexure-7.4

Predicted Vibration Level at Sensitive Receptors

S. No	Sensitive Receptors	Chain age of SR	Distance from Centre Line (m)	Predicted Vibration due to Operation (VdB)	Permissible Limits* in (VdB)
Temples					
1	Shri Jaganath Temple	-171.5	28.2	62.54	75
2	Radha Krishna Temple	704	70.5	59.23	75
3	Durga Mata Mandir	2775	40.9	61.20	75
4	Kirpa Ram Hanuman Mandir	3019.5	30.2	62.29	75
5	Shani Mandir	9290.5	31.3	62.17	75
6	Temple Rhs1	9866.7	41.5	61.15	75
7	Temple Rhs2	9949.1	41.1	61.18	75
8	Temple Median	9945.3	1.6	72.90	75
9	Devi Mandir	10574.6	45.5	60.82	75
10	Shiv Temple	11657.5	4.6	69.09	75
11	Gur Goraknath Temple	13445	35.3	61.73	75
12	Prachin Shiv Hanuman Mandir	14997	89	58.39	75
13	Maa Chintpuri Mandir	15238	18.9	63.99	75
14	Shri Dataram Mandir	16884.1	49.2	60.53	75
15	Shiv Mandir	17012.7	54	60.20	75
16	Hanuman Mandir	17477.8	15.7	64.66	75
17	Krishna Chowk Palam Vihar By Db Baba	18521.9	18.4	64.08	75
18	Hanuman Mandir	20237	34.7	61.79	75
19	Hanuman Mandir	22160.5	17.4	64.28	75
Church					
	Nil				
Mosque					
	Nil				
Educational					
1	Vishwas Vidyalaya	3143	43.2	61.00	75
2	Vedanya International School	5270	13	65.34	75
3	Yaduvanshi Shiksha Niketan Sec-School	5774	43	61.02	75
4	Kangaroo Kids International Pre School	5831	40.7	61.22	75
5	IBMR Business School	6983.7	76.2	58.95	75
6	Greenwood Public School	11697.7	64.5	59.56	75

S. No	Sensitive Receptors	Chain age of SR	Distance from Centre Line (m)	Predicted Vibration due to Operation (VdB)	Permissible Limits* in (VdB)
7	Shri Shiv Narayan Sidheswar Senior Secondary School	12600	70	59.26	75
8	Jiwan Jyoti Senior Secondary School	13715	76.5	58.94	75
9	Arya Public School	13970.9	75.6	58.98	75
10	Blue Bells Preparatory School	14926.6	34.9	61.77	75
11	Xion International convent School	15728.9	82.2	58.68	75
12	Euro Kids Pre-School & Day Care	16200	88.4	58.42	75
13	New Light Public School	16473.4	75.9	58.97	75
14	Blossoms Primary School	17314	28.5	62.50	75
15	GAV International School	17967.8	26.3	62.79	75
16	Narayan e-Techno School	17977.1	58.6	59.90	75
17	SCR Global School	18520	78	58.87	75
18	Presidium School	18686.6	16.7	64.43	75
19	DPSG Palam Vihar	20061.2	30.8	62.22	75
20	Rotary Public School	22400	24.8	63.01	75
21	Nest Play School and Day Care	22647	8.21	66.99	75
Hospitals					
1	Fortis Memorial Research Institute	239	57.6	59.96	65
2	Lifeaid Medical Centre	2104.5	81.1	58.73	65
3	Safe Hands Hospital	2722.6	33.8	61.89	65
4	Sai Siddhi Urology Multispeciality Hospital	2903	56	60.07	65
5	Sukhmani Hospital	3625	38.6	61.41	65
6	Vedic Hospital	9902	99	58.01	65
7	Helix Hospital	10859.8	60.3	59.80	65
8	Shri Balaji Multispeciality Hospital	11197.5	93	58.23	65
9	Sagar Hospital	11149	25	62.98	65
10	Vidya Medical Centre	11808	15.3	64.75	65
11	Yashroop Hospital Maternity & Multispeciality Hospital	12053.7	36	61.66	65
12	Dr. Shivangi Infertility and Gynae Consultant Hospital	12800	19.5	63.87	65

S. No	Sensitive Receptors	Chain age of SR	Distance from Centre Line (m)	Predicted Vibration due to Operation (VdB)	Permissible Limits* in (VdB)
13	ESIC Hospital	13030	66.2	59.46	65
14	Jain Sant Phool Chand Ji Charitable Hospital	15226.3	27	62.70	65
15	Sarvodya Hospital	15221	17.1	64.35	65
16	Aastha Medicare Maternity Centre	15971.8	33.2	61.95	65
17	Vardhman Hospital	16066.2	36.4	61.62	65
18	Mittal Ortho & fracture Clinic Orthopedic Surgeion	16225.3	34.8	61.78	65
19	Jannat Hospital	16800	14	65.07	65
20	Balaji Life Care Hospital and Maternity Centre Hospital	16924.7	14	65.07	65
21	Manipal Hospital	20116.7	26.6	62.75	65

ASBESTOS MANAGEMENT PLAN

Applicable Regulations and Guidelines:

Asbestos fibres are classified as a hazardous airborne contaminant with known carcinogenic effects, primarily posing an inhalation risk. Therefore, any asbestos-containing material (ACM) must be handled and disposed of in accordance with the following regulations and guidelines:

1. **Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016** (including relevant amendments) for disposal of hazardous waste.
2. **Ministry of Environment, Forest and Climate Change (MoEF&CC)** guidelines and applicable **World Bank environmental safeguards**.

Removal, Repair, and Disposal Plan:

The contractor shall prepare and submit a comprehensive Asbestos Handling and Disposal Plan, subject to the approval of the Engineer. The plan must ensure minimal exposure to asbestos for both workers and the community and must include the following components:

1. Work Area Preparation:

- Restrict access to work zones.
- Ensure adequate lighting and clearly mark hazardous areas.
- Provide safe access routes for workers.

2. Interior Containment:

- Use negative pressure enclosures where applicable.
- Cover walls, floors, and surfaces with plastic sheeting.

3. Decontamination Facilities:

- Set up worker decontamination stations.
- Use appropriate Personal Protective Equipment (PPE): Hooded overalls, non-laced boots, respiratory protection.

4. Required Equipment for Dismantling:

- 500- and 1000-gauge polythene sheeting, duct tape.
- Warning signs, tape, and asbestos waste labels.
- Garden sprayer with wetting agent.
- Buckets of water, rags, asbestos waste containers.
- Bolt cutters, rope, webbing straps.
- Lockable skip for larger waste volumes.

Approved Asbestos Removal Procedures:

1. Use **wet methods** to prevent fibre release.
2. Immediately place removed ACM into sealed, impermeable containers.
3. **Do not break AC sheets**; handle them intact as far as possible.
4. Dampen fasteners and remove or cut bolts without disturbing AC.
5. Dismantle gutters, drainpipes, and ridge caps carefully, avoiding AC contact.
6. Lower large pieces carefully; **do not drop or slide sheets**.
7. Stack removed sheets safely; wrap large pieces in 1000-gauge polythene and seal with duct tape.
8. Label all packages with **asbestos hazard warnings**.
9. Place small debris and fasteners in designated asbestos containers.
10. **Avoid crushing** any AC waste on-site.

Cleaning and Final Disposal:

- Clean tools and area using **damp rags** (not dry brushing).
- Inspect bolt holes and other crevices for debris.
- Place used cleaning materials, polythene sheeting, webbing, and rope in asbestos waste containers.
- Securely **seal containers** and double-bag with clear polythene.

Waste Disposal Protocol:

As the Gurgaon Metro Project does not have its own hazardous waste disposal facility, all asbestos waste shall be sent to an authorised hazardous waste landfill site. The following steps must be observed:

- Disposal shall comply with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendments.
- Waste Authorisation must be obtained from the Haryana State Pollution Control Board (HSPCB).
- Waste must be **disposed of within 90 days** of generation; on-site storage beyond this period is not permitted.

Annexure 7.6

Affected Private Structures including NTHs

S. No	Chainage	Owner Id	Name	Status of Ownership	Type of Property	Use of Property	Impact
1	-168	DIL061228	Sarwan	Informal Occupiers	Commercial	Kiosk	Full
2	-168	COR10	Dev Karan Rawat	Informal Occupiers	Commercial	Kiosk	Full
3	3665	DIL191206	Ravindra Mahato	Hawkers holding MCG License	Commercial	Kiosk	Full
4	3665	DIL061230	Hira Lal	Hawkers holding MCG License	Commercial	Kiosk	Full
5	4480	N1	-	Informal Occupiers	Commercial	Kiosk	Full
6	4930	N2	-	Informal Occupiers	Commercial	Kiosk	Full
7	4930	N3	-	Informal Occupiers	Commercial	Kiosk	Full
8	4937	PUN071215	Shah Alam	Informal Occupiers	Commercial	Kiosk	Full
9	5045	DIL071225	Subhash Kumar	Informal Occupiers	Commercial	Kiosk	Full
10	5125	PUN071216	Deshraj	Informal Occupiers	Commercial	Kiosk	Full
11	6370	DIL071233	Bishwanath Coudhary	Informal Occupiers	Commercial	Kiosk	Full
12	6370	DHE071217	Biswanath Chowdhary	Hawkers holding MCG License	Commercial	Kiosk	Full
13	7420	DIL081239	-	Informal Occupiers	Commercial	Kiosk	Full
14	7430	VIK090101	Suresh Mandal	Informal Occupiers	Commercial	Kiosk	Full
15	8030	Squ/HHC/LFT/1	-	Informal Occupiers	Commercial	Kiosk	Full
16	8030	Squ/HHC/LFT/2	-	Informal Occupiers	Commercial	Kiosk	Full
17	8030	Squ/HHC/LFT/3	-	Informal Occupiers	Commercial	Kiosk	Full
18	8030	Squ/HHC/LFT/4	-	Informal Occupiers	Commercial	Kiosk	Full
19	8030	Squ/HHC/LFT/5	-	Informal Occupiers	Commercial	Kiosk	Full
20	8030	Squ/HHC/LFT/6	-	Informal Occupiers	Commercial	Kiosk	Full
21	8030	Squ/HHC/LFT/7	-	Informal Occupiers	Commercial	Kiosk	Full
22	8030	Squ/HHC/LFT/8	-	Informal Occupiers	Commercial	Kiosk	Full
23	8030	Squ/HHC/LFT/9	-	Informal Occupiers	Commercial	Shop	Full
24	8080	NEW 1	Na	Informal Occupiers	Commercial	Shop	Full
25	10655	N12	-	Informal Occupiers	Commercial	Kiosk	Full
26	10743	N13	-	Informal Occupiers	Commercial	Kiosk	Full

S. No	Chainage	Owner Id	Name	Status of Ownership	Type of Property	Use of Property	Impact
27	10770	RIT081205	Ram Naresh	Informal Occupiers	Commercial	Kiosk	Full
28	10800	DIL091235	Devi Rao	Informal Occupiers	Commercial	Kiosk	Full
29	10815	DIL091224	Firasat	Informal Occupiers	Commercial	Shop	Full
30	10815	COR09	Gouri Shankar	Title Holder	Other	Under Construction	Full
31	10815	DHE091219	Asraf	Title Holder	Commercial	Shop	Full
32	10815	Dhe081218	Surendra Kumar	Informal Occupiers	Commercial	Kiosk	Full
33	10865	DHE091210	Babita Devi	Informal Occupiers	Commercial	Kiosk	Full
34	11045	PUN091217	Did Not Share	Informal Occupiers	Commercial	Shop	Full
35	11080	Private House-3	Did Not Share	Informal Occupiers	Residential	House	Full
36	11085	Private House-4	Did Not Share	Informal Occupiers	Residential	House	Full
37	11092	Private House-5	Did Not Share	Informal Occupiers	Residential	House	Full
38	11096	DHE091209	Nisar	Informal Occupiers	Commercial	Shop	Full
39	11096	DHE091218	Nasir	Informal Occupiers	Commercial	Shop	Full
40	11096	NAR091001	Did Not Share	Informal Occupiers	Commercial	Shop	Full
41	11110	PUN091226	Vinay Yadav	Informal Occupiers	Commercial	Shop	Full
42	11115	N14	-	Informal Occupiers	Commercial	Shop	Full
43	11115	N15	-	Informal Occupiers	Commercial	Shop	Full
44	11120	PUN091227	Satbir Singh	Informal Occupiers	Commercial	Kiosk	Full
45	11120	DHE091221	Ramesh Barik	Informal Occupiers	Commercial	Kiosk	Full
46	11120	DIL091223	Shailesh Panday	Informal Occupiers	Commercial	Kiosk	Full
47	11450	NEW 2	Na	Informal Occupiers	Commercial	Shop	Full
48	11460	NEW 3	Na	Informal Occupiers	Commercial	Shop	Full
49	11470	NEW 4	Na	Informal Occupiers	Commercial	Shop	Full
50	11480	NEW 5	Na	Informal Occupiers	Commercial	Shop	Full
51	11789	N16	-	Trust	Other	Boundary Wall	Partial
52	11895	Private House-2	Did Not Share	Title Holder	Residential	House	Full
53	12518	NAR101201	Jyoti Prakash	Informal Occupiers	Commercial	Kiosk	Full

S. No	Chainage	Owner Id	Name	Status of Ownership	Type of Property	Use of Property	Impact
54	12548	DHE201239	Ram Snehi Chaurasia	Informal Occupiers	Commercial	Kiosk	Full
55	13000	Kiosk1303	Munni Devi	Informal Occupiers	Residential	Hut	Full
56	13020	COR32	Jeetendra	Informal Occupiers	Commercial	Kiosk	Full
57	13090	DIL211214	Rekha Devi	Hawkers holding MCG License	Commercial	Kiosk	Full
58	13175	COR 17	Pappu Kumar	Informal Occupiers	Commercial	Kiosk	Full
59	13215	COR37	Ajay Kumar Choudhary	Hawkers holding MCG License	Commercial	Kiosk	Full
60	13215	COR18	Chandragupt	Informal Occupiers	Commercial	Kiosk	Full
61	13215	COR17	Pappu Kumar	Informal Occupiers	Commercial	Kiosk	Full
62	13215	N20	-	Informal Occupiers	Commercial	Kiosk	Full
63	13430	DIL101244	Rijwan Ahamad	Hawkers holding MCG License	Commercial	Kiosk	Full
64	13430	VIK090103	Neha	Title Holder	Residential	House	Full
65	13450	DIL101216	Bharat Chouhan	Informal Occupiers	Mixed (R+C)	Res-cum-commercial	Full
66	13450	DHE101223	-	Informal Occupiers	Commercial	Kiosk	Full
67	13610	PUN111229	Sunil Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
68	13610	COR15	Vinod Choudhary	Hawkers holding MCG License	Commercial	Kiosk	Full
69	13610	RIT111209	Sharvan Chaurasiya	Hawkers holding MCG License	Commercial	Kiosk	Full
70	13630	DIL111209	Satyapal Singh	Hawkers holding MCG License	Commercial	Kiosk	Full
71	13630	COR42	Amar Singh	Hawkers holding MCG License	Commercial	Kiosk	Full
72	14480	COR36	Sanjay Chaudhary	Hawkers holding MCG License	Commercial	Kiosk	Full
73	13400	NEW 6	Na	Title Holder	Commercial	Shop	Full
74	14790	Private House-1	Closed	Title Holder	Residential	House	Full
75	14800	RIT111207	J S Katariya	Title Holder	Residential	House	Full
76	15050	PUN111230	Ram Dayal	Hawkers holding MCG License	Commercial	Kiosk	Full
77	15050	COR23	Rakesh Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
78	15050	COR40	Amit Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
79	15050	DIL111213	Shambhu Choudhary	Hawkers holding MCG License	Commercial	Kiosk	Full

S. No	Chainage	Owner Id	Name	Status of Ownership	Type of Property	Use of Property	Impact
80	15052	PUN111228	Rahul Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
81	15052	COR38	Ram Kumar Choudhary	Hawkers holding MCG License	Commercial	Kiosk	Full
82	15052	DIL111210	-	Hawkers holding MCG License	Commercial	Kiosk	Full
83	15465	COR 04	Murari Lala	Informal Occupiers	Mixed (R+C)	Res-cum-commercial	Full
84	15500	N28	-	Informal Occupiers	Commercial	Kiosk	Full
85	15510	VIK020103	Sumit Saroj	Informal Occupiers	Commercial	Shop	Full
86	15556	Private House-6	Did Not Share	Title Holder	Commercial	Shop	Full
87	15620	DIL221219	Lakhi Ram	Informal Occupiers	Commercial	Kiosk	Full
88	15633	DIL221201	Nanda	Informal Occupiers	Residential	Hut	Full
89	15633	DIL221202	Ranpal (Karu)	Informal Occupiers	Residential	Hut	Full
90	15633	COR05	Akash	Informal Occupiers	Residential	Hut	Full
91	15633	DHE221204	Hansh Raj	Informal Occupiers	Residential	Hut	Full
92	15633	DIL121215	Vijay Mnadal	Informal Occupiers	Commercial	Kiosk	Full
93	15633	DIL221226	Rahul	Informal Occupiers	Mixed (R+C)	Res-cum-commercial	Full
94	15633	BHO221201	Gajpat Singh	Informal Occupiers	Residential	Hut	Full
95	15633	DIL221203	Pooja	Informal Occupiers	Residential	Hut	Full
96	15633	COR 30	Ram Swarup	Informal Occupiers	Residential	Hut	Full
97	15633	DHE221202	Jeetu	Informal Occupiers	Residential	Hut	Full
98	15633	DHE221201	Vijay	Informal Occupiers	Residential	Hut	Full
99	15633	VIK080201	Dinesh	Informal Occupiers	Residential	Hut	Full
100	15633	COR04/DHE221205	Murari Lal	Informal Occupiers	Residential	Hut	Full
101	15633	COR25	Gyarsi Devi	Informal Occupiers	Mixed (R+C)	Res-cum-commercial	Full
102	16438	DIL101211	Jeetendra Kr Kushwaha	Hawkers holding MCG License	Commercial	Kiosk	Full
103	17510	RIT141218	-	Informal Settlers	Commercial	Kiosk	Full

S. No	Chainage	Owner Id	Name	Status of Ownership	Type of Property	Use of Property	Impact
104	18400	NAR141208	Raju	Informal Settlers	Commercial	Shop	Partial
105	18535	Private House-7	Mahesh Yadav	Informal Occupiers	Commercial	Shop	Full
106	18575	JIT141202	Vinod Singh	Informal Occupiers	Commercial	Kiosk	Full
107	19100	DHE141201	Bhoop Singh	Hawkers holding MCG License	Commercial	Kiosk	Full
108	19100	RIT141210	Gauri	Informal Occupiers	Commercial	Kiosk	Full
109	19120	NAR141207	Dayaram Namdev	Informal Occupiers	Commercial	Kiosk	Full
110	19130	DHE141236	Hans Raj	Informal Occupiers	Commercial	Kiosk	Full
111	19240	JIT141204	Khushi Lal	Informal Occupiers	Commercial	Kiosk	Full
112	19325	RIT141211	Chandra Dev Mandal	Informal Occupiers	Commercial	Kiosk	Full
113	19591	DHE141235	Ravinder Sharma	Informal Occupiers	Commercial	Kiosk	Full
114	19640	NAR141206	Arun Kumar	Informal Occupiers	Commercial	Kiosk	Full
115	19810	NAR141209	Rajesh Shresth	Informal Occupiers	Commercial	Kiosk	Full
116	19822	N33	-	Hawkers holding MCG License	Commercial	Kiosk	Full
117	19824	RIT141219	Radha Mohan Pandey	Informal Occupiers	Commercial	Kiosk	Full
118	19835	N34	-	Hawkers holding MCG License	Commercial	Kiosk	Full
119	19860	JIT141203	Santosh Shah	Informal Occupiers	Commercial	Kiosk	Full
120	20170	BHO030205	Braham Prakash Yadav	Excise & Taxation Department License for Wine Shop	Commercial	Shop	Full
121	20250	JIT141201	Ram Mishra	Informal Occupiers	Commercial	Kiosk	Full
122	20350	DHE151232	Saroj	Hawkers holding MCG License	Commercial	Kiosk	Full
123	20658	PUN151218	Lalan Kumari	Hawkers holding MCG License	Commercial	Kiosk	Full
124	21149	PUN151201	Shivani	Hawkers holding MCG License	Commercial	Kiosk	Full
125	22120	DHE161202	Satish	Informal Occupiers	Commercial	Kiosk	Full
126	22170	NAR151202	Rajnish Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
127	22340	RIT151212	Amar Kishore Podar	Informal Occupiers	Commercial	Kiosk	Full
128	22340	DIL151222	Vishwanath Jha	Hawkers holding MCG License	Commercial	Kiosk	Full
129	22345	RIT151214	Suraj Singh	Hawkers holding MCG License	Commercial	Kiosk	Full

S. No	Chainage	Owner Id	Name	Status of Ownership	Type of Property	Use of Property	Impact
130	22397	RIT151213	Mukesh Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
131	22450	NAR151205	Lakshmi Bibi	Hawkers holding MCG License	Commercial	Kiosk	Full
132	22450	RIT151215	Sujankant Pradan	Hawkers holding MCG License	Commercial	Kiosk	Full
133	22460	DIL151221	Vipin Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
134	22570	NAR151203	Kuldeep	Hawkers holding MCG License	Commercial	Kiosk	Full
135	22613	Dhe151231	Indradev Sahani	Hawkers holding MCG License	Commercial	Kiosk	Full
136	22620	PUN151223	Ahmad	Informal Occupiers	Commercial	Kiosk	Full
137	22660	PUN151231	Yogendra Singh	Hawkers holding MCG License	Commercial	Kiosk	Full
138	22673	DHE151233	Kamla Kumari Sharma	Hawkers holding MCG License	Commercial	Kiosk	Full
139	22685	RIT151217	Kamaish	Hawkers holding MCG License	Commercial	Kiosk	Full
140	22700	NAR151204	Dhan Singh	Hawkers holding MCG License	Commercial	Kiosk	Full
141	22760	COR41	Navin Kumar Thakur	Informal Occupiers	Commercial	Kiosk	Full
142	22773	DHE151237	Kumarpal	Hawkers holding MCG License	Commercial	Kiosk	Full
143	22773	DHE151238	Santosh	Hawkers holding MCG License	Commercial	Kiosk	Full
144	22773	DHE161206	Manu Kumar	Hawkers holding MCG License	Commercial	Kiosk	Full
145	22773	PUN161208	Trilochan Rout	Hawkers holding MCG License	Commercial	Kiosk	Full
146	22773	DLL161231	Satyam	Informal Occupiers	Commercial	Kiosk	Full
147	22773	RIT151216	Manoj Kumar Yadav	Hawkers holding MCG License	Commercial	Kiosk	Full
148	Spur	Spur	Did Not Share	Title Holder	Commercial	Shop (Mechanic)	Full
149	Spur	Spur	Did Not Share	Title Holder	Commercial	Shop	Full
150	Spur	Spur	Did Not Share	Title Holder	Commercial	Political Party Office	Full
151	Spur	Spur	Did Not Share	Title Holder	Commercial	Shop (Gym)	Full
152	Spur	Spur	Na	Title Holder	Residential	House (Abundant)	Partial
153	Spur	Spur	Na	Title Holder	Other	Boundary Wall	Partial

Annexure 7.7**Affected Government, Religious and Community Structures**

S. No	Chainage	Owner Id	Status of Ownership	Use of Property	Impact
1	-168	DIL191205	Government	Police Booth	Full
2	200	COR12	Government	Bus Stop	Full
3	260	PUN071220	Government	Generator Room	Full
4	650	BS-12	Government	Bus Stop	Full
5	2200	BS-13	Government	Bus Stop	Full
6	2200	BS-14	Government	Bus Stop	Full
7	3425	PUN071223	Government	Boundary Wall	Partial
8	3425	BW-2	Government	Boundary Wall	Partial
9	3490	PS-2	Government	Police Booth	Full
10	3540	PS-5	Government	Police Booth	Full
11	3665	BS-15	Government	Bus Stop	Full
12	5500	PUN071212	Government	Bus Stop	Full
13	5500	PUN071225	Government	Bus Stop	Full
14	5500	N4	Community	Water tank/ Water ATM	Full
15	7400	DIL071203	Government	Bus Stop	Full
16	10100	PUN0812WP	Community	Water tank/ Water ATM	Full
17	11190	Arp091201	Government	Police Booth	Full
18	11645	Pun091210	Religious	Temple	Full
19	11700	DIL091240	Community	Pond	Partial
20	12350	BS130304	Government	Bus Stop	Full
21	12438	N17	Government	Bus Stop	Full
22	12438	N18	Government	Bus Stop	Full
23	12670	BS130303	Government	Bus Stop	Full
24	13000	N19	Government	Bus Stop	Full
25	13115	DHE101207	Government	Bus Stop	Full
26	13215	ARP211201	Government	Others	Full
27	13215	N21	Government	Boundary Wall	Partial
28	13215	N22	Government	Boundary Wall	Partial
29	13380	DIL101218	Government	Bus Stop	Full
30	13815	BS-9	Government	Bus Stop	Full
31	13857	N23	Government	Bus Stop	Full
32	14465	MCG Staff-1	Government	Bus Stop	Full
33	14480	N25	Government	Boundary Wall	Partial
34	15465	DHE121229	Government	Boundary Wall	Partial
35	15465	DIL121245	Community	Water tank/ Water ATM	Full
36	15465	N27	Government	MCG Office	Full
37	15610	BS130302	Government	Bus Stop	Full
38	15610	N29	Government	Bus Stop	Full
39	15690	N30	Government	Police Booth	Full
40	15790	BS-11	Government	Bus Stop	Full
41	16200	BS-10	Government	Bus Stop	Full
42	16272	N31	Government	Bus Stop	Full
43	18671	BS-4	Government	Bus Stop	Full
44	19246	BS-3	Government	Bus Stop	Full
45	19760	N32	Government	Bus Stop	Full
46	20020	BS-7	Government	Bus Stop	Full
47	20200	RIT141209	Government	Police Booth	Full

S. No	Chainage	Owner Id	Status of Ownership	Use of Property	Impact
48	20266	N35	Government	Bus Stop	Full
49	20460	BS-2	Government	Bus Stop	Full
50	21491	BS-1	Government	Bus Stop	Full
51	22600	DIL161248	Government	Police Booth	Full
52	23710	C1	Government	Bus Stop	Full
53	24040	C2	Government	Bus Stop	Full
54	24070	C3	Government	Shed	Full
55	24160	C4	Government	Boundary Wall	Partial
56	24160	C5	Government	Police Booth	Full
57	24400	C6	Government	Boundary Wall (IDPL)	Partial

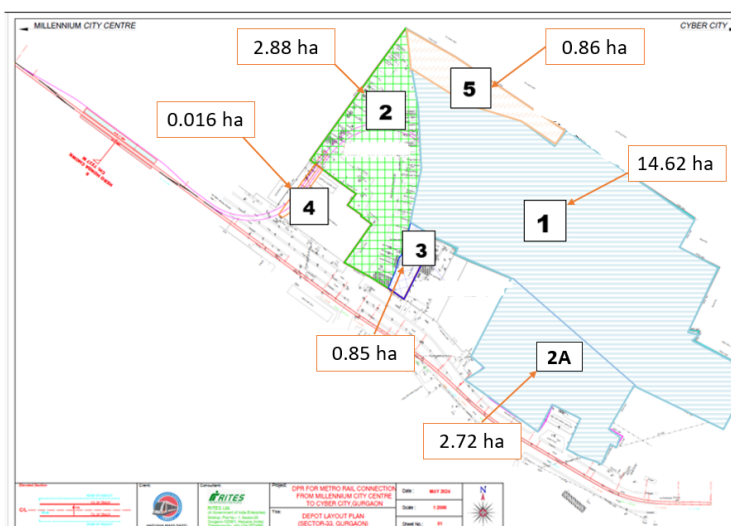
STATUS OF DEPOT LAND

A. DETAILS OF LAND IDENTIFIED FOR METRO DEPOT (SECTOR 33)

1. DPR of GMRP envisaged a small stabling depot at Sector 101 as it planned its operational integration with Rapid Metro. However, with the approval of GMRP as an independent system, a full-fledged depot was required to meet enhanced operational requirements. GMRL subsequently planned a full-fledged Depot-cum-Workshop at Sector 33, covering a total area of 19.23 ha, of which 18.37 ha is government land (HSVP-owned) and 0.86 ha is private land.
2. The anticipated award date for "Construction of Depot cum Workshop (including civil, architectural, and E&M works)" is mid-August 2026.
3. The depot land identified at Sector 33 has five land pockets. The details of land pockets are given in the figure below:

Figure: Land Pockets (Metro Depot, Sector 33)

- A. Pocket No. 1: Planned Amusement Park (14.62 ha) (HSVP)
- B. Pocket No. 2: Old Marble Market Site (2.88 ha) (HSVP)
- C. Pocket No. 3: Royal Swan Banquet Hall (0.85 ha) (HSVP)
- D. Pocket No. 4: DHBVN Sub-station (0.016 ha) (DHBVN)
- E. Pocket No. 5: Private Land Strip (0.86 ha) (Private)



Note: Land Pocket 2A is not part of Depot Land. It is a newly developed marble market site.

4. A total of 19.23 ha of land is required for the development of metro facilities. Except for Pocket 4, where DHBVN ESS is located, all land pockets are required in full. In pocket 4, the land requirements are only for the placement of pillars for depot entry.
5. In past, the land parcels in Pockets 1, 2, 3 and 4 were acquired by HSVP by paying due compensation for land, structures and other assets to the respective owners for the development of Sector 33.
6. The details of the land pockets are as under:
 - i. **Pocket No. 1:** This Parcel is earmarked as Amusement Park land, measuring approximately **17.34 ha**, out of which **15.05 ha** was clear and vacant at the site, while **2.29 ha** was under litigation (**CWP No. 23543 of 2015 titled Vinod Kumar & Ors. Vs**

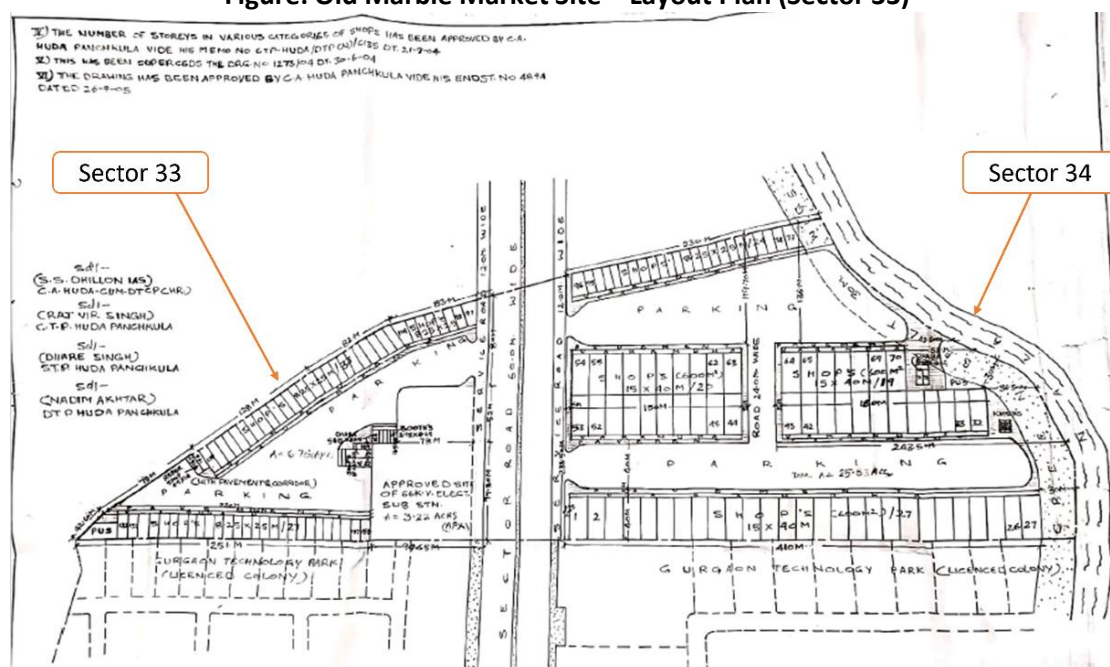
State of Haryana, and CWP No. 28056 of 2017 titled Bhagwan Singh & Ors. Vs State of Haryana).

ii. **Pocket No. 2: 2.88 ha** has a marble market with details as under:

- 62 land plots, of which 61 were allotted and 1 remained unallotted.
- Out of 61 allotted plots, 1 omitted /cancelled, 51 land plots had structures, while 09 land plots remained vacant.
- Among the 51 structures, 25 had one or two rooms, 11 had rooms with tin sheds, 12 had only tin sheds, and 3 had permanent construction.
- All plot sizes were 206.85 sqm.
- This land parcel is under litigation (**CWP No. 10317 of 2004 titled Narender Mohan Kapoor Vs State of Haryana**).

The layout plan of the old marble market at Sector 33 is shown in the figure below:

Figure: Old Marble Market Site – Layout Plan (Sector 33)



- iii. **Pocket No. 3: 0.85 ha of** land has the Royal Swan Banquet Hall. The land owned by HSVP was being used as a Banquet Hall (encroached and was under litigation in CWP No. 12998 of 2006 titled Mukesh & Ors. Vs State of Haryana).
- iv. **Pocket No. 4: 0.016 ha of** land is earmarked as Electric Substation (ESS) land. HSVP acquired this land and handed it over to DHBVN. The ESS is operational at the site. GMRL has taken up the matter with DHBVN. It has already been agreed that the land shall be transferred from DHBVN to GMRL free of cost. The cost of utility shifting shall be borne by GMRL.
- v. **Pocket No. 5: 0.86 ha.** This pocket has private land owned by 52 owners. The acquisition is being done under the GMRL Policy for Direct Purchase of Private Land or

Property through Mutual Negotiation. The process of land acquisition is being carried out under the Chairmanship of the Deputy Commissioner, Gurugram.

The details of the above court cases and their present status are provided in **Section C**.

B. CONSULTATION AND SURVEY AT MARBLE MARKET

1. Within the proposed metro depot boundary, approximately 20% (Pocket No. 2- 2.88 ha) of the land was under use by marble traders engaged in the sale and purchase of marbles and tiles. HSVP had allotted land plots measuring 206.25 sqm to these traders in 2004, on which they constructed structures/dwellings (Kutcha, Pucca and Semi-Pucca). All the Shopkeepers stored and displayed marble and tiles outside their shopfronts. Based on reconnaissance surveys and the presence of commercial activities, these marble merchants were identified as PAPs.
2. Before the census and socio-economic survey, information leaflets were distributed, and the survey team briefed the merchants about the project and proposed depot. While the merchants initially showed willingness to participate, they later declined during the actual survey, citing ongoing legal disputes between the Marble Merchants and HSVP. These court cases are old, having been going on since 2004, mainly related to the allotment of shops, and are not related to GMRL and the metro rail project.
3. The ESIA consultant has made three attempts on 01st, 3rd, and 5th February 2024 to cover Marble Traders in the social survey, whereas the E&S audit consultant made two attempts on 9th and 12th June 2026.
4. During consultations, representatives of the Marble Market Association stated that they would not participate in the social survey until the matter is resolved by the Hon'ble High Court.

C. COURT CASES AT METRO DEPOT SITE, SECTOR 33, GURUGRAM

Present Status of Litigation

- The litigation associated with land parcels 1, 2 and 3 is of two types, namely compensation-related and allotment-related matters.
- The Hon'ble Court has dismissed the compensation-related litigation in all three pockets. The allotment-related matters in Pocket 2, however, remain sub judice.

➤ Pocket No. 1 – Case History

Land Pocket Size: 17.34 ha

Under litigation: 2.29 ha

CWP No. 23543 of 2015 titled Vinod Kumar & Ors. Vs State of Haryana, and CWP No. 28056 of 2017 titled Bhagwan Singh & Ors. Vs State of Haryana.

1. The petitioners challenged the acquisition of their land, seeking de-notification or release because the acquisition proceedings had lapsed under Section 24 (2) of the RFCTLARR Act, 2013.
2. Hon'ble High Court, in its judgments dated 13.02.2025 and 26.03.2025, dismissed the above writ petitions and upheld the land acquisition as valid and acquired for public purpose. It also said that the land acquisition has not lapsed, and land has been lawfully taken as compensation has been partly accepted and the remaining deposited at the LAC and ADJ Court as per the Land Acquisition Act, 1894. The land owners who did not take the compensation can now claim by filing an appropriate application to LAO, Gurugram.
3. The Special Leave Petitions filed before the Hon'ble Supreme Court of India against judgments dated 13.02.2025 and 26.03.2025 have also been dismissed on 07.05.2026 and 01.04.2026, respectively. Thereafter, HSVP got the 2.29 ha of land vacated.
4. The above land parcel is free from all encumbrances and is in the possession of HSVP. The details of the compensation amount paid and unclaimed amount deposited at ADJ are as under:

S. N.	Particulars	Amount/ Status
1.	Total Compensation Awarded	Rs. 15,58,23,374/-
2.	Paid directly to landowners/interested persons (33)	Rs. 2,93,69,678/-
3.	Amount initially kept in the LAC Account and later deposited in ADJ Court, Gurugram on 01.12.2025(223 Landowners)	Rs. 12,64,53,696/-
4.	Amount deposited in the ADJ Court, Gurugram vide Demand Draft No. 966685 dated 01.12.2025 (in case of Vinod Kumar)	Rs. 1,31,14,884/-
5.	Reference petition under section 18 of the Land Acquisition Act, 1894 (in the case of Vinod Kumar)	Not filed
6.	Amount deposited in the ADJ Court, Gurugram vide Demand Draft No. 966685 dated 01.12.2025 (in case of Vinod Kumar)	Rs. 21,76,590/-
7.	Reference petition under section 18 of the Land Acquisition Act, 1894 (in the case of Bhagwan Singh)	Filed
8.	Enhanced Compensation deposited in the ADJ Court, Gurugram on 11.03.2015. The landowners in this case did not file an appeal before the Hon'ble High Court. State of Haryana had filed, which was dismissed on 10.03.2015	Rs 33,56,837/-

Source: HSVP (Legal Team)

➤ Pocket No. 2

Marble Market: **2.88 ha** is under litigation in **CWP No. 10317 of 2004 titled Narender Mohan Kapoor Vs State of Haryana.**

1. The marble merchants were earlier located at Sikandarpur Ghosi and Sheetla Mata Mandir Road, which were not recognised locations. HSVP invited the applications through

- public advertisement dated 03.11.2003 and corrigendum dated 19.11.2003 for shifting them to a recognised and planned area in Sector 33-34, Gurugram.
2. A total of 152 plots/shops were allotted in the Marble Market in Sector 33 & 34, of which 86 plots were allotted with the plot sizes 206.25 sqm and 66 plots were allotted with 600 sqm. Marble Market on Sector 33 had 62 plots of 206.25 sqm size only, and the remaining plots/shops are in Sector 34. Out of 62, 61 plots allotted and one unallotted, the construction on the allotted plots was the responsibility of the respective allottee.
 3. Out of 61 allotted plots, 1 omitted /cancelled, 51 land plots had structures, while 09 land plots remained vacant.
 4. The allotment has been under challenge since 2004 in the Hon'ble Court by non-successful applicants for the subject matter on the grounds of arbitrariness and mala fides on the part of the scrutiny committee in the allotment process.
 5. The plot sizes were later re-modulated to 334.75 sqm, 251.24 sqm and 209 sqm in 2014 pursuant to the Court's directions. The implementation of re-modulation was on the condition that all allottees provide an undertaking/consent for re-modulation. It could not be implemented as the bigger plot allottees did not give consent for re-modulation, and only 73 allottees, mostly belonging to the smaller plot category, submitted their undertakings in favour of re-modulation.
 6. The allotment-related matters in Pocket 2, however, remain sub judice
 7. At the time of allotment, the cost of the plot of 206.25 sqm area was **Rs. 14,90,841/- (@ Rs.7,228.32 per sqm)**. Out of the 61 allottees, 18 allottees deposited 25% of the plot cost, 20 allottees deposited between 26% and 35%, 17 allottees deposited between 36% and 50%, and 7 allottees deposited more than 50% of the plot cost, calculated based on the original plot size, while the **balance amount remains unpayable since the allotment in 2004.**
 8. Out of 61 plot allottees, 51 allottees had structures on allotted plots; 25 had one or two rooms, 11 had rooms with tin sheds, 12 had only tin sheds, and 3 had permanent construction. **The Constructions raised by the shop owners are not recognised as the same was raised without paying the full cost of the plot, getting any building plan passed or obtaining occupation certificates from the authority.**
 9. Notice for vacating the area was issued to marble traders on 26.12.2025. A copy of the notification is also attached in Appendix 1. Also, Notices were pasted on individual shops, and announcements were made through the AV System in the area.
 10. After giving due notice to the traders, HSVP carried out demolition of shops from 29.12.2025 to 08.01.2026, ensuring no damage to the material stored in the shops.
 11. Despite the above issues, HSVP has developed an alternate site approximately 200 mts from the old site to accommodate the existing Sector 33 Marble Market allottees/shop plots with all basic amenities at its own cost of **Rs 7.50 Crores.**
 12. Shops of the same size and same site number were given, and possession was handed over simultaneously to the affected marble traders. HSVP also published the tender in

December 2025 to develop the market area with all basic amenities like parking, pavements, roads, water supply, sewerage, etc.

13. The allottees have not been charged for the alternate site at Sector 33. The details of the new marble market site are provided in this section.
14. In SLP (Civil) No. 2953/2026, Suman Marbles & Another vs. State of Haryana, the Hon'ble Supreme Court dismissed the SLPs filed in relation to resistance to shifting.
15. In SLP (Civil) No. 3403 of 2026, Marble Market Dealers Association Vs State of Haryana & Ors, the Hon'ble Supreme Court of India dismissed the SLP on 27.01.2026, filed seeking their shifting to a new location.
16. The next date of hearing: CWP No. 10317 of 2004 is fixed for 08.07.2026, CWP No. 11 of 2206 is fixed for 13.08.2026, and CWP No. 44 of 2026 is fixed for 14.08.2026.

Current Status of New Marble Market Site (Sector 33)

- a. The marble merchants have been rehabilitated at a newly planned site, which is approximately 200 mtr from the old site in Sector 33.
- b. The total size of the land parcel is 2.72 ha, and each plot size is 206.85 sqm, the same as that in the old site.
- c. The new site is strategically located along the main road for better accessibility.
- d. The plot allottees of the old marble market site were intimated to shift to the new site through public notifications issued by the Estate Officer -II, HSVP, Gurugram
- e. Development work of the alternate site was allotted on 02.01.2026 based on the report submitted by the Engineering wing of HSVP.
- f. Additionally, HSVP has developed the following basic infrastructure facilities:

S. N.	Utilities	Status	
1	Water supply pipelines	Completed	100%
2	Sewer line	Connection is pending because a GAIL pipeline crosses the site; a tender has also been floated for the same.	90% work completed
3	Pavement	Completed	100%
4	Parking	Work completed up to the WMM layer. The finish layer of RMC is pending, for which a tender has been initiated	80% work completed
	Internal access roads	Completed	
5	Electric poles with an electricity supply	Completed	100%

- g. The new site has a concrete road, which is better given that heavy stone-laden trucks use the roads.

- h. HSVP has allotted shops to all 61 existing marble merchants who were previously allotted shops in the old market site. There is no last date for shifting to the new marble market. As of 1.06.2026, 28 allottees have constructed and shifted to this location.
- i. HSVP has provided only land to the allotted shop owners. Shop construction remains the responsibility of individual owners at their own cost.
- j. The Marble market in the city exists at Sector 33, Sector 34, Sheetla Mata Road, and Sikanderpur Ghosi. The details of shops/firms/agencies operating at multiple locations are as follows:

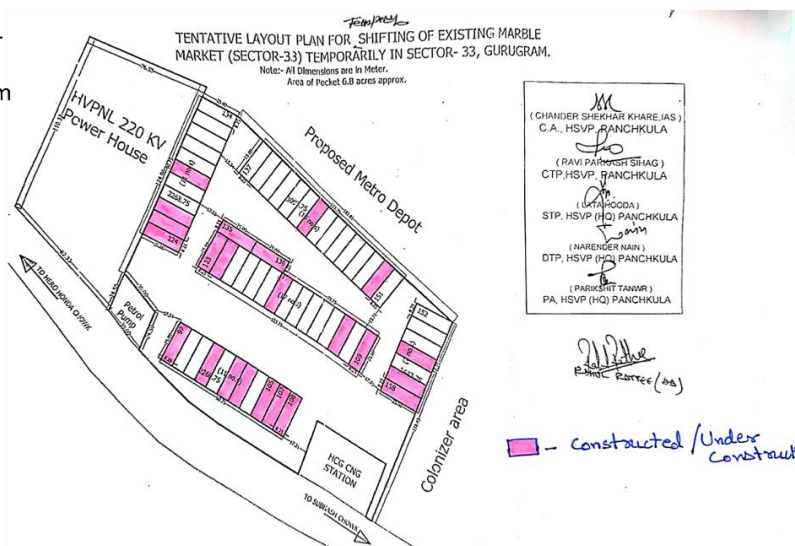
No. of Shops with the same name operating at multiple locations		
Sikandarpur Ghosi and Sector 33-34, Gurugram	Sheetla Mata Road and Sector 33-34, Gurugram	Sikandarpur Ghosi and Sheetla Mata Road and Sector 33, Gurugram
27	14	15

In view of the above, the livelihood impact on the shopkeepers is minimal, as most of the marble traders are operating shops at other places in the city during the period.

- k. It is pertinent to mention here that the cost of the plot of 206.25 sqm area was **Rs. 14,90,841/- (@ Rs. 7,228.32 per sqm)**. At present, the cost of the 206.25 sqm area plot is approximately **Rs. 7.25 crores (@ Rs. 3,51,515 per sqm)**. The allottees have been in occupation since 2004, while dues toward the land cost remain outstanding. As of 12.05.2026, the allottee/ shop owners of Sector 33 market owe HSVP **Rs. 45.77 Crores** as dues towards the remaining land cost and applicable interest. The new marble market site layout plan and photos are provided in the figure below:

Figure: New Marble Market Site – Layout Plan

- A. Total No. of Allotted Plots: 61
- B. Plot Dimension: 25m x 8.25 m
- C. Plot Sizes: 206.25 sqm
- D. Shop Constructed: 21 (Nos)



Conclusion on Marble Market

- a. Earlier, the ESIA study carried out for the GMRP considered Marble Traders as PAP, but due to non-cooperation from them on the plea of the marble market case being sub-judice, the socio-economic impact assessment could not be completed.

- b. The old marble market was vacated during the period from 29.12.2025 to 06.01.2026, while the process for development and allotment of the alternate marble market site was being finalised simultaneously.
- c. During the period, only the constructed structures were dismantled, and no damage was caused to the marble and tiles stored in the shops. Subsequently, the new marble market site was developed in January 2026 and handed over to the marble traders within 15 days. The traders started shifting to the alternate site after 06.01.2026. As of 1.06.2026, 28 allottees have constructed and shifted to this location. The remaining are presently in the process of constructing their shops and shifting their business operations to the alternate site.
- d. The facilities provided at the old site and at the new site are as follows:

S.N.	Facilities	Marble Market		Remarks
		Old	New	
1	Water supply pipelines	Yes	Yes	-
2	Sewer line	Yes	Yes	-
3	Electric poles with an electricity supply	Yes	Yes	-
	Parking	Yes	Yes	The old marble market has unpaved (kutcha) parking, whereas the new market has paved parking areas.
4	Pavement/ footpath	No	Yes	The new market has paved footpaths, whereas the old market lacks such facilities.
5	Internal access roads	No	Yes	The new market has paved internal roads.

- e. Most of the marble traders have multiple shops in Sheetla Mata Mandir Road, Sikhandarpur Ghosi and Sector 33 & 34, and they continued their operation despite eviction by HSVP from Sector 33. However, some of the traders are continuing their business operations without interruption from the old marble market shops.
- f. **This is pertinent to mention here that the marble traders have not paid the full amount towards the land parcels allotted to them and have had the said land since 2004 without payment of the total cost of the land.** Despite outstanding dues amounting to approximately **Rs. 45.77 crores**, HSVP developed the alternate site at their own cost of approximately **Rs. 7.50 crores** to facilitate the shifting of the marble traders. Further, no charges have been levied upon the marble traders for relocation to the new site.
- g. The Court cases involving HSVP and Marble Traders have been going on since 2004, before the metro project came into existence. As the matter is presently sub judice before the Hon'ble Court, any compensation payable to the marble traders shall be

determined and disbursed by HSVP strictly in accordance with the directions of the Hon'ble Court.

- h. Since the matter is sub judice and GMRL is not a party to the said case, it has no legal authority to make any payment, such as R&R assistance to the marble traders in relation to the subject matter of the dispute.

➤ **Pocket No. 3**

Under litigation in CWP No. 12998 of 2006 titled Mukesh & Ors. Vs State of Haryana

1. The plot of land was acquired by HSVP for the development of Sector 33 by paying compensation for land dated 27.11.2006 as per the LA Act, 1894.
2. The HSVP could not take possession of the acquired land as the Hon'ble High Court gave a status quo order dated 26.09.2006 on the acquired land.
3. The land was lying vacant, and an encroacher started construction of a banquet hall (Royal Swan) in 2018 and completed it in 2021 in violation of the Hon'ble High Court Status quo order without any permission and despite pending litigation.
4. HSVP filed applications in CWP No. 12998 of 2006 for impleadment dated 07.07.2025, vacation of status quo.
5. The Hon'ble High Court took cognisance of the same and asked the litigant itself to vacate the same and HSVP to take possession.
6. The litigant requested the Hon'ble Court to grant six weeks to relocate the premises on 18.02.2026. Hon'ble High Court directed petitioner to file affidavit to the effect that they shall vacate the land in question within six weeks from today and that during the said period, they shall also not use or permit to be used the premises in question for any commercial activity. The case was adjourned to 26.02.2026.
7. On 06.03.2026, the petitioners filed an affidavit in view of the order dated 18.02.2026, stating that they will hand over the vacant possession of the land in question on or before 01.04.2026. The Hon'ble High Court disposed of CWP No. 12998 of 2006 with the direction that the petitioners remain bound by their affidavit dated 06.03.2026.
8. Accordingly, the structure was dismantled by the encroacher himself after the expiry of the said period.
9. Earlier, this small plot of land was not part of the depot land as it was under litigation, even though owned by HSVP. After the court verdict in favour of HSVP, they proposed this land to GMRL for its OCC.

➤ **Pocket No. 4: NO LITIGATION**

➤ **Pocket No. 5: NO LITIGATION**

Appendix 1

PUBLIC NOTICE

(Issued without prejudice to rights and contentions of HSVP)

To Whomsoever It May Concern

1. Whereas, the allotment of certain shops in the Marble Market, Sector-33/34, Gurugram was made in the year 2004 by Haryana Shehri Vikas Pradhikaran (HSVP);
2. Whereas, the said allotments are presently under challenge before the Hon'ble High Court of Punjab & Haryana at Chandigarh in CWP No. 10317 of 2004, titled Narender Mohan Kapoor vs. State of Haryana & Ors., along with other connected matters, wherein the validity of the said allotments has been questioned;
3. Whereas, a substantial number of the said allottees have not deposited the full allotment price and, in most cases, payments have not exceeded 25% of the total consideration, despite long lapse of time;
4. Whereas, none of the occupants of the Marble Market, Sector-33, Gurugram has obtained a valid Occupation Certificate, and outstanding dues remain unpaid, in violation of the express and implied terms and conditions of the allotment letters and applicable statutory provisions;
5. Whereas, land measuring 9.26 acres in Sector-33, Gurugram is required by HSVP for implementation of a major public infrastructure project of national and international importance, forming part of an integrated urban mobility and infrastructure development initiative for the city of Gurugram and the National Capital Region, undertaken in larger public interest;
6. Whereas, the aforesaid land includes 61 shops allotted in the Marble Market, Sector-33, Gurugram;
7. Whereas, in view of the urgent public requirement of the land, HSVP has identified an alternate site within Sector-33, Gurugram itself for temporary relocation of the existing shops, and for this limited purpose HSVP has moved CM No. 2583 of 2025 in the aforesaid writ petition seeking permission from the Hon'ble High Court;
8. Whereas, the alternate site identified for temporary shifting is clear, vacant, and ready for handing over possession purely as an interim arrangement.

Therefore, in view of the position sketched above, all allottees of Marble Market Sector 33, Gurugram are called upon to immediately shift to alternate Site in Sector 33, Gurugram.

Allottees may contact office of Estate Office-II, HSVP, Gurugram regarding any clarification.

Estate Officer-II,
HSVP, Gurugram

Annexure 7.9**List of Affected Trees under GMRP**

S. No.	Description	Number of Trees	Status of Permission
1	AC01	1937	Received for 1800 Trees
2	AC03	2204	Yet to apply
3	AC04 (Metro Depot)	576	Yet to apply
4	Casting Yard 1	122	Received for 122 Trees
5	GMDA Section (Bakhtawar Chowk)	456	Received for 266 Trees
Total		5295	2188

Annexure 9.1

Details of Batching Plant (To be filled in by the contractor)

Name of Location:

Reporting Month:

Date of Submission:

1. Environment Features of the surrounding area

1.1	Name and location of Batching Plant	
1.2	Wind direction	
1.3	Name (s), distance, population and type of settlements in a 1.5 km radius of the site.	

2. Details of Batching Plant and Mitigation Measures taken

2.1	Installed Capacity	
2.2	Average Utilization	
2.5	Last maintenance date	

3. Explain Air Pollution Control Measures taken at the Batching Plant site

4. Explain Noise Pollution Control Measures taken at the Batching Plant site

Remark

Submitted	Checked	Approved
Signature	Signature	Signature
Name	Name	Name
Designation		
Contractor	Environmental Engineer of Construction Supervision Consultant	In-charge Officer (GMRL)

Annexure 9.2

**Details of Muck Dumping Operations
(To be filled by the contractor)**

Dumping site location:

Reporting Month:.....

Date of Submission:

1. Environment Features of the surrounding area

1.1	Location of the dumping site	
1.2	Capacity of the dumping site	
1.3	Safety measures taken at the dumping site (s)	
1.		
2.		
3.		
4.		
5.		

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer of
Construction Supervision
Consultant

Approved

Signature

Name

In-charge Officer (GMRL)

Annexure 9.3

**Details of Machinery during Construction
(To be filled monthly by the Contractor)**

Location Name:

Reporting Month:

Date of Submission:

1. Details of Machinery Operation

1.1	Total machinery in operation (Nos.)	
1.2	Number of pavers	
1.3	Number of rollers	
1.4	Number of excavators	
1.5	Number of graders	
1.6	Number of dumpers	
1.7	Number of Cranes	
1.8	No. of workshops with repair facility (furnish location and type of facility provided)	
1.9	Number of vehicles in repair at each location	
1.10	Details of waste disposal	
1.11	Others	

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer of
Construction Supervision
Consultant

Approved

Signature

Name

In-charge Officer (GMRL)

Annexure 9.4
**Safety Checklist
(To be filled by the contractor)**

1	Contract No.	
2	Name of Contractor	
3	Representation	
4	Name of Safety Officer	
5	Date of Inspection	

Location 1	Location 2			Location 3						
Adequate at the time of Inspection (A) Needs Improvement (B) Needs Immediate Attention (C)	Location 1			Location 2			Location 3			Remark
	A	B	C	A	B	C	A	B	C	
General										
House keeping										
Stacking of Material										
Passageway										
Lighting										
Ventilation										
Others										
Electrical										
Switches										
Wirings										
Fixed Installation										
Portable Lighting										
Portable Tool										
Welding Machine										
Others										
Fire Prevention										
Fire Fighting Appliance										
Dangerous Goods Store										
Gas Welding Cylinders										
Others										
Dust Control										
Noise Control										
First Aid Equipment										
Washing Facility										
Latrine										
Canteen										
Provision of Personal Protective Equipment										
Helmet										
Eye Protector										
Ear Protector										
Respirator										
Safety Shoes										
Safety Belts										
Others										
Remark										

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Signature

Name

Designation

Contractor

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Signature

Name

Environmental Engineer of
Construction Supervision Consultant

Approved

Signature

Name

In-charge Officer (GMRL)

Annexure 9.5

Accident Report
(To be completed on Occurrence of Injury by the Safety Officer)

Type of Accident

	Fall of a person from a height		Explosion
	Slip, trip or fall on the same level		Fire
	Struck against fixed objects		Contact with hot or corrosive substances
	Struck by flying or falling objects		Contact with poisonous gas or toxic substances
	Struck by moving objects		Contact with an electric current
	Struck / caught by cable		Hand tool accident
	Stepping on nail, etc.		Vehicle / Mobile plant accident
	Handling without machinery		Machinery operation accident
	Crushing/burying		Other (please specify)
	Drowning or asphyxiation		

Agent Involved in Accident

	Machinery		Excavation / underground working
	Portable power appliance		Floor, ground, stairs or any working surface
	Vehicle or associated equipment/ machinery		Ladder
	Material being handled, used or stored		Scaffolding/gondola
	Gas, vapour, dust, fume or oxygen		Construction formwork, shuttering and falsework
	Hand tools		Electricity supply cable, wiring, switchboard and associated equipment
	Floor edge		Nail, splinter or chipping
	Floor opening		Other (Please specify)
	Left shaft		
	Stair edge		

Unsafe Action Relevant to the Accident

	Operating without authority		Failure to use proper footwear
	Failure to secure objects		Failure to use eye protection
	Making safety devices inoperative		Failure to use a respirator
	Working on moving or dangerous equipment		Failure to use proper clothing
	Using unsafe equipment		Failure to warn others or give proper signals
	Adopting an unsafe position or posture		Horseplay
	Operating or working at an unsafe speed		No unsafe action

	Unsafe loading, placing, mixing, etc.		Others (please specify)
	Failure to use a helmet		
	No Protective gear		Unsafe layout of the job, traffic, etc.
	Defective protective gear		Unsafe process of job methods
	Improper dress/footwear		Poor housekeeping
	Improper guarding		Lack of a warming system
	Improper ventilation		Defective tool, machinery or materials
	Improper illumination		No unsafe condition
	Improper procedure		Others (please specify)

Personal Factor Relevant to the Accident

	Incorrect attitude/motive		Unsafe act by another person
	Lack of knowledge or skill		No unsafe personal factor
	Physical defects		Other (please specify)

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer.

Construction Supervision Consultant

Approved

Signature

Name

Designation

In-charge Officer (GMRL)

Annexure 9.6

Pollution Monitoring

Construction site location.....

Construction Stage: Report Date: Month: Year:

Mitigation measures suggested in the last report complied with or not: Yes/No

If not reasons there of:.....

S. No.	Chainage (km)	Details of locations	Duration of monitoring	Instrument used	Completion	Monitoring Parameters	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remark
1. Air Monitoring (As per National Ambient Air Quality Standards, CPCB (2009))												
		As per the decision of the Engineer in Charge					PM _{2.5}	60 µg/m3				
							PM ₁₀	100 µg/m3				
							SO ₂	80 µg/m3				
							CO	02 mg/m3				
							NOx	80 µg/m3				
2. Water Monitoring (As per Drinking Water Quality Standards, IS 10500, 2012)												
		As per the decision of the Engineer in Charge					pH	6.5-8.5				
							BOD	Nil				
							COD	Nil				
							TDS	500 mg/l				
							Chlorides	250 mg/l				
							Nitrates	45 mg/l				
							Sulphates	200 mg/l				
							Iron	0.3 mg/l				
							Calcium	75 mg/l				
Lead	0.01 mg/l											
3. Soil Monitoring												
		As per the decision of the Engineer in Charge					pH	<7.0 Acid 6.5–7.5 Neutral >7.5 Alkaline				
							Organic Matter	0.5 -0.75 %				
							Sodium	0-1 %				
							Potassium	2-6 %				

S. No.	Chainage (km)	Details of locations	Duration of monitoring	Instrument used	Completion			Monitoring Parameters	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remark
								Chloride	0-1 %					
								Available Nitrogen	280-560 kg/hac					
								Phosphorous	11.5 – 24.5 kg/hac					
								Arsenic	< 20 mg/kg					
								Cadmium	< 1 mg/kg					
								Mercury	< 1 mg/kg					
								Lead	< 35 mg/kg					
								Electric Conductivity	0.0-2.0 Non Saline 4.1-8.0 Saline 16.0 Strongly Saline					
4. Noise Monitoring (As per National Ambient Noise Standards, CPCB)														
		As per the decision of the Engineer in Charge						L _{day}	Residential-55 dB(A) Commercial-65 dB(A)					
								L _{night}	Residential-45 dB(A) Commercial-55 dB(A)					
Remark														

Submitted
Signature
Name
Designation
Contractor

Checked
Signature
Name
Environmental Engineer of
Construction Supervision Consultant

Approved
Signature
Name
In-charge Officer (GMRL)

Annexure 9.7

Format for Vibration Monitoring

Construction site location:

Construction Stage: Report Date: Month: Year:.....

Mitigation measures suggested in the last report complied with or not: Yes/No

If not reasons thereof.....

Format for Vibration Monitoring									
Sampling code	Location	Date	Start Time	Stop Time	Latitude	Longitude	Vibration level (PPV in mm/s)	Standard	Remarks
1								DGMS (Directorate General of Mines and Safety)	
2									
3									

Submitted
Signature

Name

Designation

Contractor

Checked
Signature

Name

Environmental Engineer of
Construction Supervision Consultant

Approved
Signature

Name

In-charge Officer (GMRL)

Annexure 9.8**Restoration of Construction Sites**

- **(To be filled by the Contractor)**

Construction site location:

Construction stage: Monthly Report Date: Month:.....Year:.....

Sl. No.	Contract Package	Labor Camp		Construction Camp		Plant Site		Top Soil	
		Yes	No	Yes	No	Yes	No	Preserved	Restored

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer of
Construction Supervision
Consultant

Approved

Signature

Name

Designation

In-charge Officer (GMRL)

Annexure 9.9**Format for keeping Records of consent obtained by the Contractor**

Construction site location:

Construction Stage: Report Date: Month:..... Year:.....

S. No.	Contractor's Name	Clearance	Applicable Acts	Agencies	Obtained on	Valid up to	Remarks
	Construction Site Location						

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer of
Construction Supervision
Consultant

Approved

Signature

Name

Designation

In-charge Officer (GMRL)

Annexure 9.10

**Checklist for Environment Inspection
(Points / Issues to be covered)**

Construction site location:.....

Date of Inspection:.....

S. No.	ESMP Measures
1	Provision of personnel accountable for the implementation of ESMP/Safety Measures with the Contractor
2	Consent of PCB to Establish Batching Plant
3	Consent of PCB to operate the Batching Plant
4	Compliance of PCB Conditions for Batching Plant installation and operation
5	Whether compliance is reported through the monthly Progress report to the In-Charge (GMRL)
6	PUC taken for all Construction vehicles
7	Concrete platform with trap under bitumen boiler, Fuel Tank for Batching Plant and generator set provided or not
8	Precautions to prevent contamination of soil by emulsion, oil and lubricant taken while storing
9	Providing cover to fine construction material & bituminous mix during transportation
10	Muck /debris disposal:
	a) Present status of land
	b) Closure and completion plan
11	Site-specific traffic Safety management Plan:
	a) The contractor installed the warning/regulatory Traffic signs at the construction site
	b) The arrangement is adequate
12	Safety equipment, i.e. helmet, gloves, gumboots, mask, earplugs, etc., is provided to workers
13	Health Facility at camp and work site, i.e. First Aid kit & suitable vehicle for conveyance in case of emergency/accident
14	Permit for Procuring River Sand
15	License from the Department of Mines for quarrying
16	Consent to establish/operation of crusher
17	Provision of a labour camp with sanitation & potable water
18	Fire precautions at the plant and the site Office
19	Air and noise monitoring at designated locations
20	Whether any cultural property is being impacted
21	Status of drainage provision in the camp area
22	General Housekeeping

Remarks:.....

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer of
Construction Supervision Consultant**Approved**

Signature

Name

Designation

In-charge Officer (GMRL)

Annexure 11.1**Summary Sheet**

(To be filled monthly by supervisory staff and submitted to GMRL)

Construction site location:

Month: Date:.....

S No.	Description	Remarks
1	No Objection Certificate	
A	Cement Batching Plant	
	Location 1	
	Location 2	
	Location 3	
2	Pollution Under Certificate	
	Vehicles	
	Machineries	
3	No Objection Certificate for Diesel Genset	
	Location 1	
	Location 2	
4	Labour Camps	
	No. of sites Identified	
	Approved	
	Opened	
	Conforms to conditions imposed at the time of opening of sites	
	Closed	
5	Workers	
	No of workers employed	
	No of male workers	
	No of female workers	
	No of day workers	
6	Quarry	
	No. of sites identified	
	Approved	
	Opened	
	Material available	
	Material obtained	
	No. of sites Rehabilitated	
7	Disposal Locations	
	No. of sites identified	

S No.	Description	Remarks
	Approved	
	Opened	
	Amount of Waste Disposed	
	Type of waste disposed of	
	No. of sites Rehabilitated	
8	Road Safety	
	Road Safety norms and approved Traffic plan	
9	Cleaning of Culvert/ drains	
	No. of culverts/ drains	
	No. Cleaned	
10	Trees	
	No of trees marked for cutting in the field	
	No of trees cut	
	No of trees to be planted	
	Trees Planted	
11	Haul Roads	
	Adequacy of maintenance of Haul Road Network	

Remarks:.....

Submitted

Signature
 Name
 Designation
 Contractor

Checked

Signature
 Name
 Designation
 Environmental engineer of
 Construction Supervision
 Consultant

Approved

Signature
 Name
 Designation
 In-charge Officer (GMRL)