GURUGRAM METRO RAIL LIMITED (GMRL)

# Metro Connectivity from Millennium City Centre to Cyber City

## EXECUTIVE SUMMARY

## Environmental and Social Impact Assessment (ESIA)

MAY 2025

# PREFACE

The present Environmental and Social Impact Assessment study has been undertaken by “Gurugram Metro Rail Limited” as a part of the comprehensive planning and decision-making process associated with the proposed project. This study aims to evaluate the potential environmental and social consequences - both beneficial and adverse - that may arise from the implementation of the project, and to propose suitable mitigation measures for minimizing the negative impacts. This study was conducted by RITES Limited as part of its consultancy assignment with Haryana Mass Rapid Transport Corporation Limited.

# EXECUTIVE SUMMARY

## Metro Connectivity from Millennium City Centre to Cyber City

### 1. Introduction

Gurugram city is known as the "Millennium City" due to 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 urbanization and robust economic development owing to its strategic location proximal to New Delhi and its airport, in the National Capital Region (NCR).

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). With the 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 station to Cyber City station. GMRP involves the construction of approximately 29.05 km of elevated metro line in Gurugram, with 27 metro stations, depots, rolling stocks, and electric, telecommunication, signalling and control systems.

A Detailed Project Report (DPR) was prepared for the project, based on which Environmental and Social Impact Assessment (ESIA) is conducted in accordance with the World Bank (WB) Environmental and Social Framework (ESF), as outlined in Term of References (ToR).

### 2. Applicable Regulatory and Guidance Framework

The applicable regulatory framework for the ESIA comprised of the following:

- Applicable international, national, state and city level environmental and social (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, 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, HSVP Land Acquisition Policy 2018, Scheduled Castes and Scheduled Tribes (Prevention of Atrocities) Act, 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 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, includes 26 stations. A spur of 1.85 km is proposed to connect Dwarka Expressway from Basai Village with a single station. A new link has also been proposed from Sector 5 to integrate city metro with Gurugram Railway Station.

The DPR of GMRP had adopted the same system as that of Rapid metro, existing metro of Gurugram from Sector 56 Gurugram to Cybercity. Accordingly, only a stabling depot spread over 5.5 Hectares was planned at Sector 101 as it envisaged the use of existing Rapid metro infrastructure. As per GoI approval, the GMRP corridor is independent corridor with no track integration with Rapid metro as such a full-fledged depot is required. The stabling depot planned earlier was located in Sector 101 near Basai. Sector 101 is a low-lying area mainly filled with wastewater and reeds; and this area is frequented by migratory birds. Considering these concerns and requirement of a full-fledged depot, the area alternatives for depot location along the corridor were analysed and a depot spread over 22.37 Hectares is now being planned in Sector 33, Gurugram. 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. 4808.02 Cr (Rs. 48082.2 million). Other features of the project are:

- The GMRP corridor is fully elevated and planned on the median of the existing roads, thereby minimizing the private land requirement.
- **Gauge:** 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.
- **Formation:** Ballast less track is proposed for elevated stretches and depot to optimize maintenance and risk to vehicles on the road. This will help in reducing fugitive dust emissions during operation.
- **Rolling Stock:** 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, provides adequate safety level, and reduces demand on passenger evacuation systems.
- **Traction System:** 750 V DC third rail traction system is proposed for the metro corridor. The modern rolling stock with 3-phase VVVF drive has been proposed, which is the electricity driven mass rapid transit system. The cars are equipped with 3 phase AC traction motors with 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 utilize the advantage of 3 phase technology.

## 4. Analysis of Alternatives

The Analysis of Alternatives is structured to follow a 'narrowing approach' involving a series of logical steps, starting with the high-level strategy alternatives followed by description of more detailed technology alternatives considered. Using this commonly adopted narrowing approach, the Analysis of Alternatives considers alternatives in the following sequence:

- Strategy Alternative: Based on Conceptual Transport Alternatives as per Comprehensive Mobility Plan (CMP), mass transport systems, comprising both rail-based and road-based systems have been considered to cater to public transport demand in Gurugram city. Metro rail systems are observed to be more environment friendly with lesser long-term pollution in the Delhi region reeling from air pollution, and more safety, and higher speeds of transport.
- 'Zero' or 'No Project' alternative: Here, without 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 Millennium City Centre Station and Alternatives for Corridor from Sector 5 to Sector 3.

GMRP will yield tangible and non-tangible savings due to 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), and private vehicles, resulting in lower air pollution and improved traffic flow. Additionally, the introduction of MRTS will enhance the speed and efficiency of road-based vehicles, making urban commuting smoother and more sustainable. It will lead to a reduction in fuel consumption, vehicular emissions, travel time, and accidents, contributing to a cleaner and safer urban environment. Additionally, modifications have been made in the alignment resulting in a reduction in the number of affected structures from 261 to 217.

## 5. Baseline Environmental and Social conditions

Baseline data was collected for Land, Water, Air Environment, Noise & Vibration, Biological Environment, Sensitive Receptors, Archaeological Monuments and 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 covered by vast alluvial and sandy tracts, remnants of the Aravali Mountain chain. Soil quality analysis revealing 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 High Damage Risk Zone (Zone IV), which is the second most severe seismic zone.

**Water Environment:** Surface water from Yamuna River is supplied by Gurugram Water Supply (GWS) and NCR Water Supply Channel serves as the primary water source for the city. Ground water is a crucial water source for Gurugram, predominantly extracted by private entities like housing societies and individual houses.

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 still 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 these villages. Critical Areas Prone to Storm Water Stagnation near to the GMRP alignment are 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. The winds are predominantly from 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 exceeding the permissible limits for residential, Industrial and Sensitive areas at all locations and Parameters SO2, NO2, and CO were noted within the permissible limits. As per the monitoring results, the AQI in the project area varies from 199 to 322, which indicates the air quality category as moderate to very poor.

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

**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 levels are predominantly due to the road traffic.

**Biological Environment:** The state has a forest cover of around 3.63% of its geographical area, mainly comprising of 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. The unclassified forest (i.e. areas possessing forest-like characteristics but not officially classified or notified as protected forest areas) of area 3.25 ha (8.02 acres) is located near Sector 10 Metro Station. Sector 10 Metro Station and part of the alignment falls in the unclassified forest.

The project area includes floral species like Neem, Babool, Gulmohar, Peepal and Eucalyptus etc. The animals found in Gurugram district are Common langur, Golden Jackal, Leopard, Jungle Cat, Indian Grey Mongoose, Nilgai, Monkey, Sambar. The mammals include squirrel and mouse; and reptiles include common garden lizard and rat snake.

Sultanpur National Park and Najafgarh Jheel are located within 10 km radius from the GMRP alignment. MoEFCC has notified an area of 5 km from the boundary of the Sultanpur National Park as 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 is the largest surface water body in Delhi located at about 4.7 km from the end point of the Spur at Dwarka Expressway.

Sector 101, Basai is a Key Biodiversity Area (KBA) as per Important Bird Area (IBA), 2004. The main source of water in this area was from damaged drain carrying treated wastewater from

nearby STP. During the site visit it was observed that the flow of water has stopped due to the repair of the damaged drain and the site is filled with soil and is being used for Agriculture purposes. , As per Master Plan 2031 of Gurugram, Sector 101 is categorised as “Public Utilities” like Water Works, Disposal Works and Grid Sub-Station. The Sector 101 land comprises both privately owned plots and land under the jurisdiction of the Basai Panchayat.

The Basai Village Metro Station is proposed near Basai Pond and the GMRP alignment passing near 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. However, during the Detailed Design Stage, careful measures have been taken to ensure that placement of pillars are restricted to the outer edge of the Pond to minimize impacts on the water spread. Even though the impacts are minimal, mitigation measures 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, 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 Monument of ASI are protected “with Prohibited area of 100m around it and further 200m regulated area around as per 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 discovered during the GMRP construction, then chance-find procedures as given in the ESMP will be followed.

Socio-Economic Survey: The socio-economic survey covered 154 households and focused on collecting both quantitative and qualitative data, with particular attention to women and vulnerable groups.

The survey captured key demographic, social, economic and perceptual aspects of the affected and beneficiary populations in relation to the GMRP.

## 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) including vulnerable groups, 63 other interested parties including NGOs, 13 police officials including 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 Risks and Impacts

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

The project provides opportunities to improve resource use, better planning and management to contribute to the overall improvement of the environment (including air quality), and access to planned infrastructure, services, greens, safe and less polluting modes of transport, and better facilities in Gurugram. Environmental Risk is “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, 2 drains and designated forest patches in the city); (b) potential encounter with contaminated land/environmental liabilities that may need remediation/clean up (no such sites currently in the Project Area); (c) visual impacts related to the permanent change of the city’s skyline. 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, back filling, compaction operations and other construction activities, and O&M works.
- Noise and vibration and other disturbances to residents and businesses during material movement, construction demolitions, and laying of rising main.
- 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 labours (Occupational Health and Safety (OHS)) and public (Community Health and Safety (CHS)).
- Increased traffic inconvenience (emissions, congestions, longer travel times, blockage of access), during transport of project staff and materials to the site, and during operations.
- Biodiversity impacts including tree cutting, disturbance to habitats/landscapes at KBA/IBA in Sector 101, Basai, and Nuisance and menace of pigeon at metro stations.

The Social Risk is “High” as the GMRP alignment and stations are sited in dense urban settings of Gurugram City and shall impact 24.76 ha. of land including a) 1.27 ha of private land (residential and commercial); b) about 23.49 ha of government land for construction of station, viaduct and depot; c) about 217 structures, of which 38 owned by title holders, one managed by a trust, two informal settlers (encroachers), 75 informal occupiers (squatters), 44 Street Vendors structures and 57 other structures. Of 38 titleholder structures 34 are fully affected and four will be partially impacted; and d) Total Depot land is 22.37 ha. Additionally, 5 ha of land (Govt.) is needed on a temporary basis for construction yards.

The National Highways Authority of India (NHAI) is undertaking the road widening from Hero Honda Chowk to Umang Bhardwaj Chowk as part of NH-352W (Gurugram–Pataudi–Rewari Road). GMRP Alignment from Ch. 8300 to Ch. 9910 is planned within NHAI land for placing of pillars between Hero Honda Chowk and Umang Bhardwaj Chowk. NHAI has widened the road in this section therefore this road widening section is considered as an associated facility. NHAI initiated compensation to the PAPs in this section, therefore, PAPs of this section are not considered under GMRP.

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

Besides, there might be need for land taking for infrastructure required for first and last mile connectivity such as bike spaces, charging stations, etc. 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 Community Health & Safety (CHS) issues, (iii) Occupational Health & Safety (OHS) risks during construction, O&M stages (iv) possible vibration impacts on existing buildings potentially involving some of cultural heritage value, (v) potential aggravation of risks in case of disasters (such as earthquakes, fires, manmade disasters, etc.) with envisioned densification along the corridor, (vi) labour influx and Social Exploitation and Abuse/ Sexual Harassment (SEA/SH) risks are likely from migrants to communities. Further, civil work for at least 3-4 years is likely to result in impacts on livelihoods, disrupt access to communities. Another key aspect to understand and mitigate during operation relates to Life and Fire Safety (L&FS) and preparedness and response / users evacuation measures during emergencies, including but not limited to elderly and disabled users.

Based on the relevance of each ESS, and national/ state Legal, Regulatory and Institutional Framework, ensuing sections summarize 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, 8 out of the 10 ESSs are relevant and ESS7 and ESS 9 are not relevant to the project. Considering a variety of investments including Metro Rail, last mile connectivity and multi-modal integration, an ESIA is finalized for GMRP with suitable mitigation instruments ESMP and RAP. Associated facilities (incl. power supply and distribution, Road widening along the corridor and Pedestrian Facilities, Multimodal Transport Facilities, Bus Interchanges etc) will be screened following ESS1 criteria and should be updated in ESIA by GMRL at later stage.

**Labour and Working Conditions (ESS 2)**

The project will involve direct workers (GMRL) employees and consultants for work related to its core functions (consultants preparing detailed design for the corridor, stations, feasibility for multimodal integration and first/last mile connectivity related studies; for undertaking surveys for Land acquisition, preparing ESIA and mitigation plans; other consultants undertaking various related studies). The project's civil works contracts will involve skilled, semi-skilled, and unskilled workers who are expected to contribute a major proportion of contracted workers' besides migrant labour. Primary supply workers will be relevant as the project through civil work contractors, will procure construction material for civil works. 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, GBV/SEA/SH, OHS etc shall be prepared and disclosed by the contractor. 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, Waste, and Waste water Management, incident reporting, emergency response and Project Management.

**Resource Efficiency and Pollution Prevention and Management (ESS 3)**

The project will recycle wastes and wastewater, aim at energy and water efficiency, and use raw materials consistent with ESS3, ESHSs, and relevant national policies. C&D waste will be recycled and recycled material will be used. Energy Efficient measures will be implemented. Materials will be sourced from authorized suppliers due to local mining bans. Pollution prevention measures including improved storage, management of fuels, contruction 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.

Contamination (currently no such site) assessments and cleanup plans will be developed if required. 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 modeling, 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 residences and workers, with noise levels ranging from 76-88 dB(A) at 15 m, and the noise levels decreases with distance. During construction, Noise barriers and personal protective equipment will mitigate impacts. During operation, metro train noise, 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 budgetary estimate of INR. 522.11 Lakh (USD 625,200.57).

Vibration: The GMRP is located in seismic Zone IV, requiring structures to withstand significant seismic forces with high-quality materials and dynamic analysis. During construction, vibration

impacts are from pile driving and construction equipment; which will be mitigated by implementing vibration reduction measures such as proper design & maintenance of Track & Rolling stock, Ballast less Track, resilient soft base plates between rail and track slab, resilient rubber between base plate and track slab etc. . 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 aniticipated on Heritage structures. 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 for any damages. GMRP sections shall be designed to minimize vibration and regular maintenance 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).

Management plans are proposed for water supply, rainwater harvesting, wastewater treatment, oil pollution control, green belt development and solid waste disposal at the Depot.

**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 CHS 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, 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. L&FS standards will be internalized besides universal access.

**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 minimize impacts, it is estimated that the project impacts 24.76 ha. of permanent land including: a) 1.27 ha of private land (residential and commercial); b) about 217 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 stations locations; and c) Total Depot land is 22.37 ha, with approximately 21.73 ha being government land. Of this, 17.38 ha of government land remains vacant at the depot. Additionally, 5 ha of land (Govt.) is needed on a temporary basis for construction yards. GMRL shall be acquiring the private land as per the provisions of the HSVP Land Acuisition Policy 2018.

As part of the ESIA, key gaps have been identified, including: (a) the recognition of non-titleholders (such as encroachers and squatters) as PAPs, and (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.

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

The project will affect approximately 2777 trees along the GMRP corridor and depot. It is proposed to plant 10 saplings for each tree to be removed. In total 27,770 saplings proposed for compensatory afforestation at an estimated cost of INR 189.34 lakh (USD 226,728.43). Native and indigenous tree species are recommended for planting.

KBA/IBA in Sector 101, Basai: Part of the spur alignment passes near this site. The main source of water was from damaged drain carrying treated wastewater from nearby STP. During the

site visit, it was observed that flow of water has stopped due to the repair of the damaged drain, and the site has been filled with soil and is being used for Agriculture. The likely impacts of the project on KBA are noise, vibration, dust emissions, waste disposal, potential soil and water contamination from leaks or spills from fuel storage, material storage, hunting of birds, light pollution during nights etc. The bird's resting area is 308 m away from the alignment as such no noise and vibration impact are anticipated. The proposed mitigation measures include restrictions on material storage including fuel storage & proper planning for usage on construction machinery, erosion control measures, prohibition on hunting, regular monitoring, sanitation facilities for workers, and proper waste & Waste Water management practices. The biodiversity of the KBA/IBA in Sector 101, Basai, will also be re-examined during rainy season.

Basai Pond: The alignment passes near the pond. No avifauna was observed during the baseline study. Basai Pond is primarily used by local residents for cattle bathing. Municipal Corporation of Gurugram is planning to develop ramps for religious activities. The impact of the construction activites on the pond will be mitigated as per the ESMP. 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 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. Futher, 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 HTL already exists near the GMRP alignment. Moreover, , Gurugram-Rewari Railway line is located near the area..

The GMRP will not impact the flying path of the birds as, the traction system proposed is third rail system, being ground-based, it maintains open airspace and helps preserve natural flight paths, reduces the risk of electrocution and collision. Thus, there will be no impact anticipated on flying path of avifauna due to GMRP corridor.

Pigeons pose significant challenges within metro networks. Mitigations measures proposed in ESMP like changes in structural design, netting & barriers, deterrents, regular cleaning etc need to be implemented for handling pigeons issues 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 Schedule V area of the Indian Constitution. Additionally, the affected population does not meet the four key criteria outlined in ESS 7.

### Cultural Heritage (ESS 8)

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

One temple will be impacted due to the GMRP; which necessitate its reconstruction with community involvement. One archaeological site namely "Mosque of Ala Vardi Khan", which is 490 meters from the GMRP is well beyond the prohibited and regulated zones of the monument. INTACH-listed structures, along the alignment include temples, mosques and a church, lie outside the critical impact zone of 100 meters and are safe from project effects. Chance finds of archaeological significance may occur during construction, managed under the Indian Treasure Trove Act, 1878, involving notification to the Collector and potential government acquisition. Procedures for handling chance finds is prepared as part of ESIA. All impacts and mitigation measures aim to preserve cultural heritage and comply with legal 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 with 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 for the 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 & vunerable groups and their issues and suggestions are incorporated in the ESIA.

**Cumulative Impacts:** The cumulative E&S impacts of the GMRP are expected to be short-term, localized, 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 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 Detailed Design Consultancy (DDC) focuses on minimizing 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 prioritized.

**Pre-Construction Phase:** The contractor is responsible for developing and implementing various plans, including Environment, Health & Safety (EHS), Occupational Health and Safety Management Plan (OHSMP), community health and waste management and Noise, vibration, dust reduction; environmental management of area near sensitive features. 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 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 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 operation.

## 9. Monitoring Plan

During the construction phase, E&S monitoring will be carried out to check the quality of the environment and triggering of social impacts during ongoing construction activities. It will be carried out through a contractor and PIU 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, Ground water quality, soil quality, vibration and ecology. This monitoring shall also include OHS aspects, community safety, and workers safety, labour and working conditions, livelihoods impact, 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 construction and operation phase. 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 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, concerned PIU, Contractors staff, supervisors, consultants, E&S and OHS experts, labourers, stakeholders, etc. The topics for training will include Health and Safety, Environmental management and ESMP implementation, regulatory requirements, Monitoring requirements, Gender equality, biodiversity and wildlife awareness, and others.

## 11. Grievance Mechanism (GM)

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

- Construction related impacts – cracks, damages to structures; dust damaging crops/ trees
- H&S risks.
- Negative impacts on the environment and biodiversity
- Negative impacts on communities, which may include, but not be limited to financial loss, physical harm, and nuisance from construction or operational activities and GBV, SEA/SH.

The project related grievances will be segregated from the main grievances, through unique coding options, so that it can be tracked and reported effectively. Separate modes of grievance registration at project sites will be designed and awareness building activities and appropriate signages 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 finalization. All complaints will be categorized under Land, Environmental Issues, Social Issues, Occupational Health and Safety Issues, Contractor Issues, 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.

## 12. Implementation Arrangements

The implementation arrangement for GMRL consists of the Project Implementation Unit (PIU), GC, Contractor, and the Environmental and Social Management Unit (ESMU) consist of Senior Environment Expert and Social cum R&R cum Gender Expert supported by Patwari in GMRL. In addition, GC will have a Senior Env. Social Safeguard Expert and Chief Safety Expert supported by 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 PIU. The contractor must also maintain photographic documentation of key construction activities.

## 13. Estimated Budget for Implementation and supervision of ESMP

The total project cost will cover design, construction, and operation of the ESIA. The budget includes compensatory afforestation, environmental monitoring, establishment of environmental division, training, rainwater harvesting, Effluent Treatment Plant, Noise barriers, bio-digesters, 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 INR 2418. 92 Lakh (INR 241.89 million, USD 2.89 million). Annual cost of INR 136.50 lakh (INR 13.65 million, USD 163,458) every year during operation phase.

## 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 procurement documents for agreement from the contractor on E&S requirements, and updation of ESIA and ESMP for the project after finalizing 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.

A comprehensive assessment should be made to assess flooding risks, vibration effects, and visual impacts, the biodiversity of the KBA/IBA in Sector 101, Basai, will also be re-examined during rainy season. If necessary. 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 MoEFCC, HPCB, 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 for GMRP has been prepared for the entire 29.05 km corridor. The first civil works packages for approximately 14 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 stations 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 were carried out for the preparation of the draft ESIA report. Consultations have been carried out with various stakeholders including PAPs, other interested parties and disadvantaged and vulnerable groups during the preparation of ESIA for 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 website. Consultations will also be carried out after a month of disclosure of 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 GMRL website and the World Bank