PUNJAB MASS TRANSIT AUTHORITY (PMA)
GOVERNMENT OF THE PUNJAB

FAISALABAD MASS TRANSIT SYSTEM

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

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Faisalabad Mass Transit Project

ENVIRONMENTAL IMPACT ASSESMENT STUDY

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LIST OF ABBREVIATONS

AOI	Area of Influence
BCP	Buildig Code of Pakistan
BOD	Biological Oxygen Demand
CC	Construction Contractor
CCMP	Construction Camp Management Plan
COVID-19	Coronavirus disease
CoI	Corridor of Impact
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessments
EMP	Environmental Management Plan
EMMM	Environmental Mitigation and Management Matrix
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
ESEs	Environmental and Social Experts
FGDs	Focused Group Discussions
FFD	Fire Fighting Department
GoP	Government of Pakistan
GoPb	Government of Punjab
HSE	Health Safety & Environment
IEE	Initial Environmental Examination
ILO	International Labour Organization
KPH	Kilometres Per Hour
LAA	Land Acquisition Act
LOS	Level of Service
MSDS	Material Safety Data Sheets
NESPAK	National Engineering Services Pakistan
NO	Nitrogen Oxide
NESPAK	National Engineering Services Pakistan
NL	Noise Level
NOC	No Objection Certificate
NPO	No Project Option
NPZ	Noise Perimeter Zones
NGO's	Non-Governmental Organizations
NCS	Pakistan National Conservation Strategy
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
O3	Ozone
PMA	Punjab Mass Transit Authority
PMD	Pakistan meteorological department
PGA	Peak Ground Acceleration
PHA	Parks & Horticulture Authority
PPE	Personnel Protective Equipment
PAPs	Project Affected Persons
PEPA	Punjab Environmental Protection Agency
PEQs	Punjab Environmental Quality Standards

PM	Particulate Matter
PRSP	Punjab Rural Support Program
QMP	Quarry Management Plan
RE	Resident Engineer
SBC	Seismic Building Code of Pakistan
SC	Supervision Consultant
STP	sewerage treatment plant
STDs	Sexually-Transmitted Disease
SSEMP	Site Specific EMP
SOP	Standard Operating Procedures
SO2	Sulfur Dioxide
SPM	Suspended Particulate Matter
SC	Supervisory Consultant
TA	Technical Assistance
VICS	Vehicle Inspection & Certification System
WASA	Water and Sanitation Agency

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Faisalabad, the third largest city of Pakistan and an important industrial hub of Punjab, has a population of over 3.7 million (2023 census) and continues to grow at an annual rate of around 2.4% (approx.). The city's significance as a textile and manufacturing center has contributed to continuous urban expansion and increased travel demand. However, the development of a structured public transport system has not kept pace with this growth. The result is a range of transport-related challenges including severe traffic congestion, increased road safety risks, unregulated public transport services, and environmental degradation due to rising vehicle emissions and inadequate traffic management.

To resolve public transport issues in Faisalabad and to provide safe, efficient, comfortable, and affordable transport to the public, Government of the Punjab (GoP) planning to introduce a Mass Transit system in Faisalabad. This document presents the findings of Environmental Assessment of the proposed Project.

ES-2 REGULATORY AND POLICY REVIEW

The EIA Study has been conducted for the subject project as a mandatory requirement of Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017). Section 12 (1) of the Act states that *"*No proponent of a Project shall commence construction or operation unless he has filed with the Provincial Agency an Environmental Impact Assessment or, where the Project is likely to cause an adverse environmental effect, an environmental impact assessment, and has obtained from the Provincial Agency approval in respect thereof." Other relevant laws have also been discussed briefly in Chapter-2.

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations 2022, the proposed project falls under Category 'D' of the Schedule-II. This category requires an EIA study to be conducted for urban development projects to initiate the process of environmental approval.

ES-3 DESCRIPTION OF PROJECT

The proposed Orange Line Mass Transit route will connect Tahir Pura (Airport Road) to Faisal Town near Makkuana Chowk. The Orange Line will operate using state of the art electric buses (Buses, Tram). The initiative aims to offer affordable and eco-friendly transport to the city's growing population. The proposed Orange Line will span a 20.3 kilometer stretch with 22 stations. Once operational, the project is expected to benefit nearly 90,918 passengers daily, easing congestion on major city routes and providing an efficient public transportation alternative. Tentative cost of the proposed Project is about PKR. 81,924.507 million.

ES-4 DESCRIPTION OF THE ENVIRONMENT

Physical Environment

The proposed Project falls under administrative jurisdiction of District Faisalabad. The area is underlain by thick alluvial deposits consisting of clay, silts and sand deposited by the River Chenab and River Ravi. The Project area has moderate to extreme climate conditions, with hot summers and cold winters.

As per Building Code of Pakistan (BCP), 2007 (Seismic Provisions), the proposed Project falls in the Zone-2A with Peak Ground Acceleration (PGA) from 0.08g to 0.16 g of the seismic zonation. Major sensitive receptors in the project area are health facilities, educational institutions, and religious places (mosques, shrines and graveyard) which has been recorded based on site survey and by using the GIS tool for the proposed Project.

Ecological Environment

The study area has a variety of trees. The major tree species in the Project Area are Eucalyptus (*Eucalyptus camalduolenis*), Shisham (*Dalbergia sissoo*), Bakin (*Melia azedarach*), Semal (*Bombax ceiba*), Mulbery (*Morus alba*), kachnar (*Bauhinia varigata*), Beri (*Ziziphus jujube*), Jaman (*Syzygium cumini*), Amaltas (*Cassia fistula*), Ailstonia (*Alstonia scholaris*), Ficus and variety of ornamental shrubs, palm trees, conocarpus and fruit plants.
.

Common mammals found in the area are dogs, cats, house rats and bats. House sparrow (*Passer domesticus*), House crow (*Corvussplendens*) and Mynah (*Acredotherestristis*), Mongoose (*Herpestes auropunctatus*) are the most common in the area. There are no wetlands in the Project Area. There is no game reserve, wild sanctuaries and National Park present in the Project Area.

Socio-Economic Environment:

At the time of the 2023 census, Faisalabad district had population of 9,075,819 of which 3,691,999 were in Faisalabad City. Faisalabad had a sex ratio of 108 males to 100 females and a literacy rate of 77.34% for males and 69.11% for females. 4,392,979 (48.40%) lived in urban areas. 2,200,114 (24.27%) were under 10 years of age. At the time of the 2023 census, 94.13% of the population spoke Punjabi, 4.49% Urdu, and 0.64% Pashto as their first language.

ES-5 STAKEHOLDER CONSULTATION

A series of public consultations were conducted to get the feedback/ concerns of the different category of stakeholders including provincial departments i.e. Environment Department, Wildlife Department, Parks & Horticulture Authority (PHA), Schools, hospitals etc., local community and other general public residing near the Study Area. Consultation process included focus group discussion, semi-structured interviews, one to one meeting and interviews with the government, private and civil society institutions. Basic concerns of

the stakeholders were related to construction phase impacts and implementation of mitigation measures.

ES-6 ANTICIPATED PROJECT IMPACTS AND MITIGATION MEASURES

Significant efforts were made to identify the main environmental issues related to the design, construction and operation of the proposed project. The significant adverse impacts and their mitigations during the design, construction and operation phases are here under:

- The noise and vibration will be produced due to the operation of construction machinery and equipment. Noise and vibration are perceived as one of the most undesirable consequences of construction activities. There are a variety of ways by which construction equipment and worksite noise can be controlled that includes use of quieter equipment, modification of existing old equipment, barrier protection, change in work activity schedule and maintenance of vehicle/equipment.
- Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as water channels. The wastewater generation is estimated to be 6,600 liters/day[1] for 200 construction workers; and sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.
- A total of about 120 kg of solid waste will be generated from construction camps on daily basis. All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system;
- Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;
- The project will involve clearing of vegetation during construction of the project. A tree plantation program has been formulated with the recommendations of planting of 10,000 trees for compensation and area enhancement at the available spaces in/around the Project area;
- Due to the construction camps, number of impacts may arise that include waste, soil pollution, groundwater pollution, dust, etc. The construction activities and vehicular movement at construction sites may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Institutions along the route may also suffer during construction period due to air, noise and road accidents. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Contractor will ensure the proper control on construction activities. Contractor will also take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

ES-7 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

[1] Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

The EMP of the proposed project mainly comprises institutional requirements; environmental mitigation and management; environmental monitoring plan; planning for EMP implementation; and EMP cost. PMA will be responsible for implementation of EMP of the proposed project during construction and operational phase. The total cost required to effectively implement the mitigation measures is approximately Rs. PKR 35.85 Million exclusive of Plantation Cost, which includes cost of environmental monitoring, tree plantation and Health and Safety and environmental management, etc. during construction and operational phases. The EMP will be part of the contract document with the Contractor(s).

ES-8 CONCLUSION AND RECOMMENDATIONS

Results of the EIA Study have shown that the impacts of the project activities on the physical environment will be low to moderate significant. However, there will be significant impacts on the ecological and social environment. These impacts could be reduced by proper and judicious compensation to the affectees and well planned meticulous design and by implementing an appropriate tree plantation.

The EIA Study concludes that there are no critical environmental impacts associated with the project. An Environmental Management Plan (EMP) for all the phases (pre-construction, construction and operation) has been developed as part of the report that covers impacts, mitigation measures roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the project. The EMP, its mitigation and monitoring programs, contained herewith will be included within the Bidding documents for project works for all Project components.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Faisalabad, the third largest city of Pakistan and a leading industrial and commercial hub of Punjab, has a population of over 3.7 million (2023 census) and continues to grow at an annual rate of around 2.4% (approx.). Often referred to as the “Manchester of Pakistan” due to its dominant textile industry, the city contributes significantly to the national economy through manufacturing, trade, and agriculture-based industries.

The city's significance as a textile and manufacturing center has contributed to continuous urban expansion and increased travel demand. With the growing number of motorized vehicles, including commercial freight trucks, public transport buses, motorcycles, and private cars, Faisalabad faces significant traffic management challenges such as congestion, parking shortages, road safety concerns and environmental degradation due to rising vehicle emissions and inadequate traffic management.

To address these challenges, the Government of Punjab, through the Punjab Mass Transit Authority (PMA), has been undertaking initiatives to introduce an efficient, reliable, and sustainable mass transit system in Faisalabad. The proposed network is envisaged to enhance mobility, improve accessibility to major activity centers, reduce travel times, and promote a mode shift from private vehicles to public transport.

The proposed project is a key component of Punjab’s broader transportation vision aimed at modernizing public transit, reducing urban traffic congestion, and offering safe, affordable, and efficient travel options for daily commuters. Once operational, the proposed project will significantly ease the travel burden for residents commuting on major roads of Faisalabad.

This document presents the findings of Environmental Impact Assessment (EIA) of Mass Transit Project, Faisalabad.

1.2 NEED FOR ENVIRONEMTNAL ASSESSMENT STUDY OF THE PROPOSED PROJECT

As per Punjab Environmental Protection Act (Amendment) 2017, under Section 12 (1) IEE/EIA is mandatory which states that:

“No proponent of a project of public and private sector shall commence construction or operation unless he has filed an Initial Environmental Examination / Environmental Impact Assessment with the Punjab Environmental Protection Agency, as the case may be, or, where the project is likely to cause adverse environmental effects; an environmental impact assessment, and has obtained from the Provincial Agency approval in respect thereof”.

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations 2022, the proposed project falls under Category "**D**" (*Transport)* of Schedule-II, which requires an EIA before commencement of construction.

1.3 NATURE, SIZE AND LOCATION OF THE PROJECT

GoP has launched the Mass Transit Project, a major public transport initiative aimed at easing urban traffic and enhancing connectivity across the city. This new electric transit corridor promises to dramatically ease traffic congestion on some of Faisalabad's busiest routes, offering residents a sustainable alternative to traditional road transport.

The proposed Orange Line will span 20.3 kilometers, is planned to connect Tahirpura to Faisal Town. The line will include 22 stations and is expected to serve approximately 90,918 passengers daily.

The Orange Line corridor is proposed as a mixed-elevation alignment. The route begins as an elevated structure from Faisal Town up to Al Najaf Colony, after which it transitions to an at-grade alignment up to Railway Station. From the Railway Station, the corridor rises again as an elevated section towards GCU Faisalabad, and subsequently continues at-grade up to the terminal station at Tahir Pura. In all at-grade sections, the BRT alignment is positioned along the centre of the roadway, replacing the existing median, with carriageway widening carried out on the outer sides to accommodate mixed traffic lanes.

Figure 1-1 shows the location map of the proposed Project.

1.4 SCOPE OF STUDY

The scope of this EIA Study aims at collection and scrutinizing of data related to physical, biological and socio-economic environment of the project area and to prepare the baseline environmental profile. It also aims the identification, prediction and evaluation of the possible environmental impacts of the proposed project on its immediate surroundings on both short and long-term bases. Based on the nature and scale of those impacts, appropriate mitigation measures are proposed in this EIA Report.

1.5 PURPOSE OF EIA REPORT

The purpose of this EIA Report is to identify and assess significant adverse environmental and social impacts and to suggest mitigation and remedial measures to make the proposed project environmentally friendly and sustainable during the construction and operational stages. Also, to propose intuitional arrangement and to develop cost estimate to implement those mitigation measures.

1.6 THE PROPONENT AND CONSULTANT

a) Proponent Contact/Address
Chairman/ Project Director

Punjab Mass Transit Authority (PMA)
Government of Punjab
Telephone Number: 042-111-222-627

b) Consultant Contact/Address

National Engineering Services Pakistan Private Limited (NESPAK)
GT&GE Division, NESPAK House
1-C, Block – N, Model Town Extension, Lahore.
Tel: 042-99090000 Ext. 233

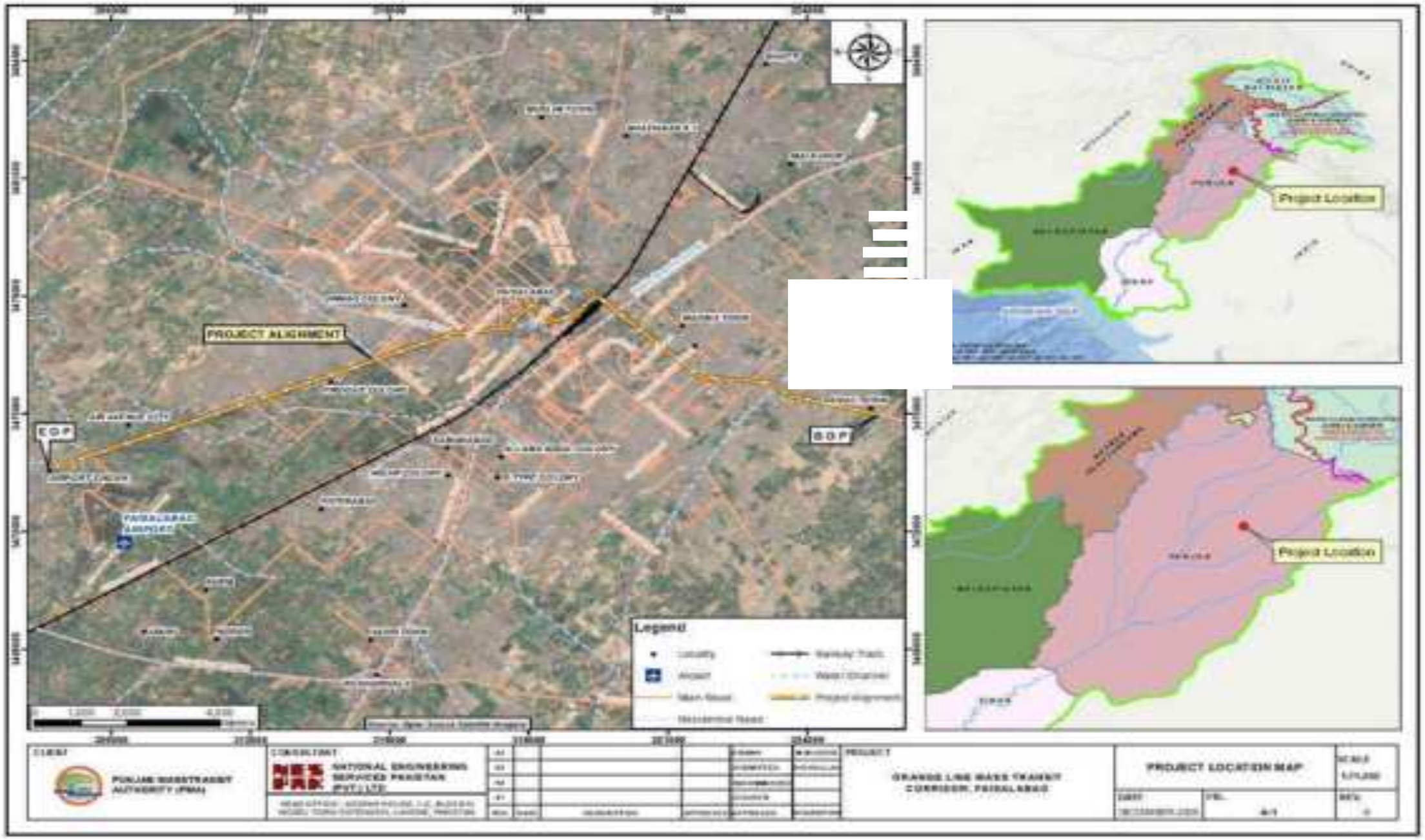

Figure 1.1: Location Map of the Proposed Project

1.7 EIA TEAM COMPOSITION

Based on the requirements of ToR and objectives of the study, NESPAK formed a team of experts comprising a team leader (Environmental Expert) with professional support from the Environmental Scientists, Engineer, Sociologist and Ecologist. The professional staff was involved in analyzing the data, impact assessment and mitigation measures and report compilation. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design engineers to the EIA team. Detail of EIA team is given in **Table 1.1** below:

Table 1.1: Team Composition for the EIA Study

Sr. No.	Name of Expert	Designation
1.	Mir Ghazanfar Afzal	Principal Engineer/Head ERSD Section
2.	Ms. Shehnila Hanif	Senior Environmental Scientist
3.	Ms. Ridha Kamran	Senior Environmental Scientist
4.	Mr. Muhammad Sajjad	Senior Sociologist
5.	Mr. Muhammad Farooq	Ecological Expert
6.	Mr. Muneeb Yousaf	GIS Analyst

1.8 METHODOLOGY

The following methodology was adopted for carrying out the EIA study of the proposed project:

1.8.1 Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the study. Subsequent to the concept clarification and understanding, a detailed data acquisition plan was developed for the internal use of the EIA consulting team. The plan identified specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and facilitation needs for the execution of the data acquisition plan.

1.8.2 Data Collection

In this step, primary and secondary data were gathered through field observations, concerned departments and published materials to establish baseline of physical, biological and socio-economic environmental conditions.

- Literature Review;
- Site Reconnaissance;
- Analysis of Maps and Plans;
- Public Consultations; and
- Environmental Sampling, Testing and Analysis.

1.8.3 Review of Environmental Laws and Institutional Requirements

All applicable national and international laws, legislations, guidelines and treaties were reviewed relevant to the proposed project components.

1.8.4 Delineation of Corridor of Impact (COI)

COI includes the area in the surroundings of the proposed alignment receiving direct impact of project activities. The COI delineated for the proposed project is 15 m from the boundary of the project area.

1.8.5 Survey of COI

A team of Environmental Scientists, Ecologist and Sociologist carried out the environmental and social survey of the COI in January, 2026 to familiarize themselves with the local conditions and the environmental settings. During the survey, the information regarding the topography, soils, surface water, groundwater, flora & fauna, affected infrastructure, social settings and villages/towns along the COI was observed. **Figure 1-2** shows COI Map of the proposed Project.

1.8.6 Environmental Baseline Survey of the Project

Prior to the start of field activities comprehensive checklists, proformas and maps will be developed to collect the information related to following parameters:

Physical Environment

The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including land use pattern, soil composition, topography, etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc.);
- Ambient air quality and noise level monitoring data;
- Existing solid waste management and effluents disposal practices and storm water drainage;
- Buildings and infrastructure details, including residential, commercial and animal shed for complete/partial relocation;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Archaeological monuments; and
- Other private/public infrastructures such as roads, telephone poles, hand pumps, tube wells etc.

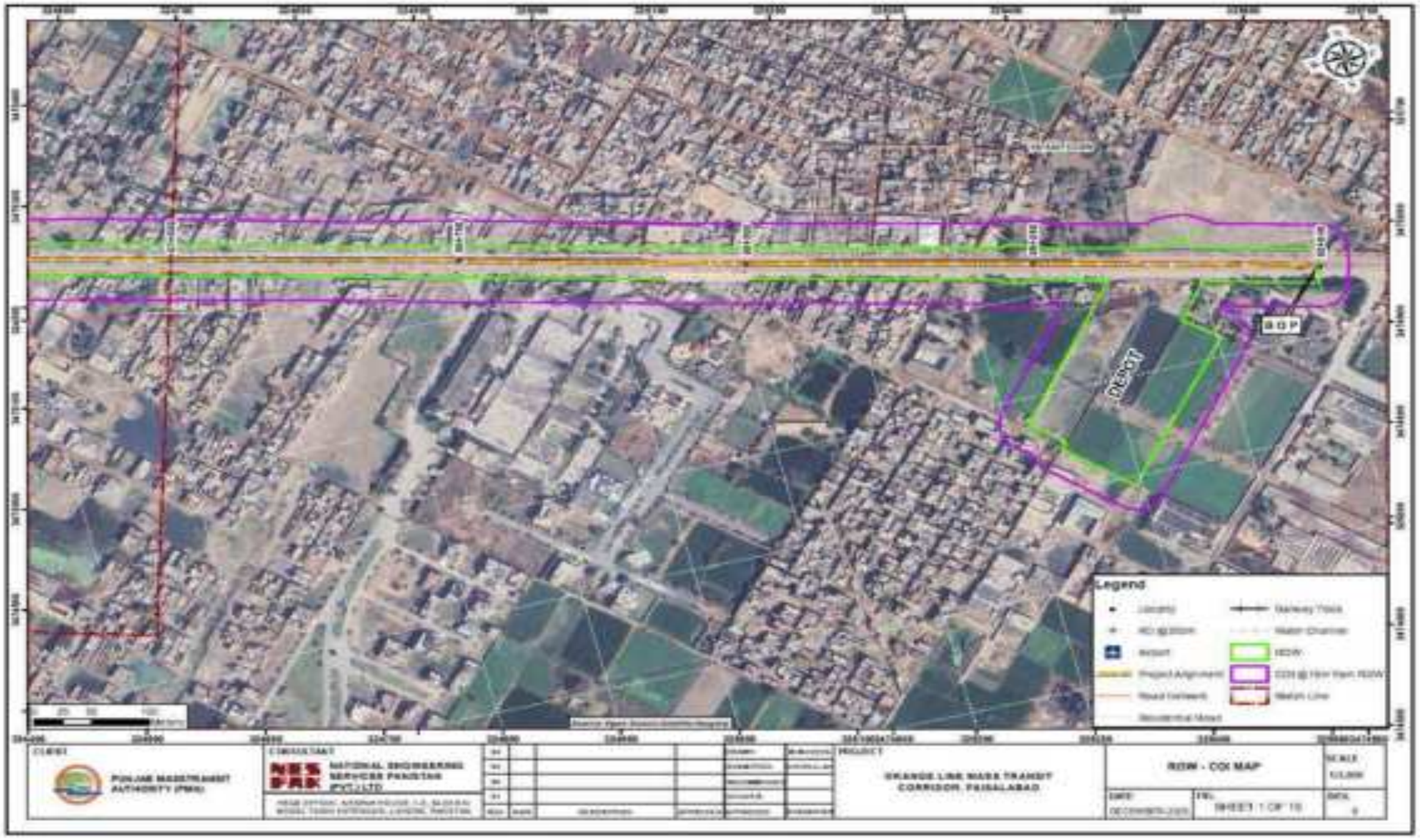

Figure 1.2 (a): COI Map of the Proposed Project

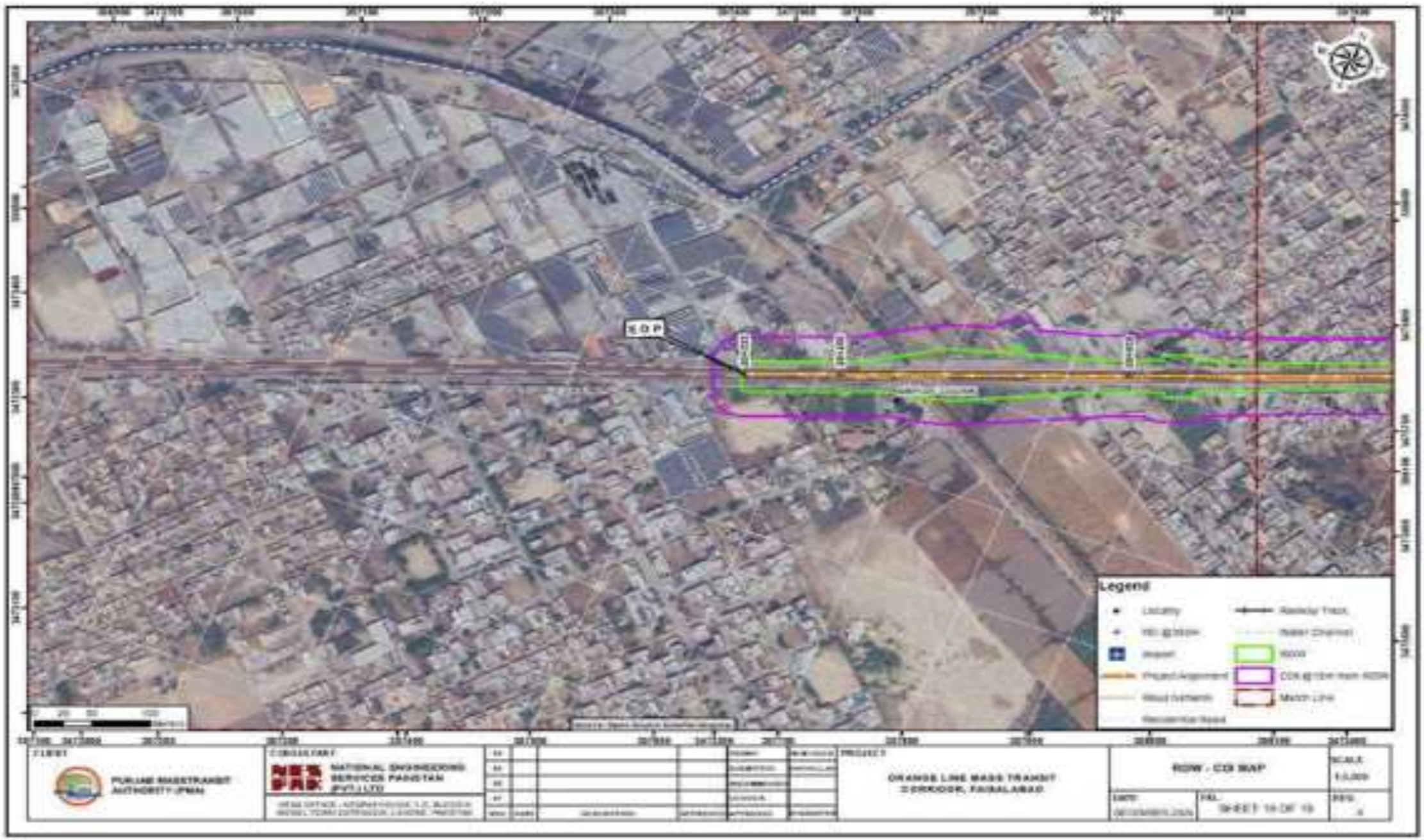

Figure 1.2 (b): COI Map of the Proposed Project

Ecological Environment

The status of the flora and fauna of the study area were determined by a review of literature of the area, and an assessment of both terrestrial and aquatic environments on the basis of previous studies.

a) Flora

The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species, assessment of stage of growth (mature or sapling), etc.

b) Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field.

c) Endangered species

Data related to endangered species (both flora and fauna,) was collected and no endangered species has been found in the project area.

Socio-Cultural Environment

The consultants utilized a combination of literature, field investigations, census report, meetings through public consultation and interviews to describe the existing social environment and assessment of the potential impact of the construction of the proposed project. Data was gathered on the following aspects of the social environment:

- Land use and Municipal Status;
- Demographics;
- Livelihoods;
- Community Facilities;
- Solid Waste Management;
- Proposed Developments;
- Archaeological and Cultural Heritage; and
- Identification and Evaluation of Environmental Impacts.

1.8.7 Stakeholder Consultations

The Consultant identified Project stakeholders and held meetings with them during the surveys to receive feedback on the expected environmental issues related to the Project impacts and suggested mitigation measures. Meetings were carried out with the local public, relevant departments including Environment Protection Department Punjab, Forest & Wildlife Department Punjab, Educational and health institutions, etc. to discuss the issues/constraints and get their views and feedback to mitigate the potential environmental as well as social impacts associated with the implementation of the proposed Project.

1.8.8 Screening of Potential Environmental Impacts and Mitigation Measures

Based on the generally established baseline conditions in the adjacent as well as in the Project Area, potential physical, ecological and social impacts of the proposed Project were identified, evaluated and quantified, wherever possible. A logical and systematic approach was adopted for impact identification and assessment by utilizing a combination of the secondary data, satellite imagery, environmental checklists, field observations and discussion with the local residents of the Project Area. To mitigate the significant adverse impacts, adequate mitigation measures and implementation framework were proposed so that the proponent could incorporate them beforehand in the design phase.

1.8.9 Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) has been prepared to ensure the adequacy and effectiveness of the suggested mitigation measures by clearly identifying the roles and responsibilities of the agencies, monitoring mechanism, monitoring plan for environmental and social parameters to be monitored with their frequency, existing and suggested framework, necessary approvals and the required further studies. Similarly, costs for environmental monitoring and social component/social mitigation measures were also estimated.

1.9 STRUCTURE OF THE REPORT

Section 1 **"Introduction"** briefly presents the project background, objectives, methodology and need of the EIA study.

Section 2 **"Policy, Legal and Administrative Framework"** comprises policy guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed Project.

Section 3 **"Traffic Assessment & Analysis of Alternatives"** furnishes information about the studied alternatives, traffic assessment and estimation of ridership and mode shift analysis.

Section 3 **"Description of Project"** furnishes information about the location of the proposed project, cost and size of the project, its major components etc.

Section 4 **"Environmental Baseline"** describes physical, biological and socio-economic conditions prevalent in the project area.

Section 5 **"Stakeholder Consultation"** A series of public consultations were conducted to get the feedback/ concerns of the different category of stakeholders including provincial departments i.e. Environment Department, Wildlife Department, Parks & Horticulture Authority (PHA), Schools, hospitals etc., local community and other general public residing near the Study Area. Consultation process included focus group discussion, semi-structured interviews, one to one meeting and interviews with the government, private and civil society institutions. Basic concerns of the stakeholders were related to construction phase impacts and implementation of mitigation measures.

Section 6 **"Anticipated Environmental Impacts and Mitigation Measures"** identifies and evaluates impacts of the project activities during the construction and operation stages and recommends with the measures proposed to mitigate potential environmental impacts of the proposed project.

Section 7 **"Environmental Management Plan"** outlines environmental mitigation plan, institutional arrangements for the implementation of the proposed mitigation measures, monitoring requirements, environmental cost etc.

Section 8 **"Conclusion and Recommendations"** elaborates the conclusion of subject environmental study and suggests the recommendations to address the issues raised from proposed construction activities.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

2.1 GENERAL

This section provides an overview of the policy framework and legislation that applies to control the environmental consequences as a result of proposed Project implementation and operation. The project needs to comply with all the applicable environmental policies, laws, guidelines, acts and legislations of Government of Pakistan and Provincial Government.

2.2 SUMMARY OF RELEVANT STRATEGIES, POLICIES, ACTS AND LEGISLATION

The summary of major relevant strategies, policies, acts and legislation from environmental perspective are briefly described in **Tables 2.1 & 2.2** below:

Table 2.1: Main Strategies/Policies Related to Environment and their Relevance to the Project

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
1	National Conservation Strategy, 1992	Pakistan National Conservation Strategy (NCS), which was approved by the federal cabinet in March 1992, is the principal policy document on environmental issues in the Country. The NCS outlines the Country's primary approach towards encouraging sustainable development, conserving natural resources and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.	The core areas that are relevant in the context of the proposed project are pollution prevention during construction, conserving biodiversity and supporting forestry and plantation.
2	National Environmental Policy, 2005	In March 2005, GoP launched its National Environmental Policy, which provides a framework for addressing the environmental issues. Section 5 of the policy commits for integration of environment into development planning as instrument for achieving the objectives of National Environmental Policy. It also provides broad guidelines to the Federal Government, Provincial Governments, Federally Administered Territories and Local Governments to address their environmental concerns and to ensure effective management of their environmental resources.	Clause (b) of sub-section 5.1 states that Environmental Assessment related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
3	National Climate Change Policy, 2021	The National Climate Change Policy provides a framework for addressing the issues that Pakistan faces or will face in future due to the changing climate. In view of Pakistan's high vulnerability to the adverse impacts of climate change, in particular extreme events, adaptation effort is the focus of this policy document. The vulnerabilities of various sectors to climate change have been highlighted and appropriate adaptation measures spelled out. The policy covers measures to address issues in various sectors such as water, agriculture, forestry, coastal areas, biodiversity and other vulnerable ecosystems. Notwithstanding the fact that Pakistan's contribution to global Greenhouse Gas (GHG) emissions is very small, its role as a responsible member of the global community in combating climate change has been highlighted by giving due importance to mitigation efforts in sectors such as energy, forestry, agriculture and livestock. Furthermore, appropriate measures relating to disaster preparedness, capacity building, institutional strengthening; technology transfer; introduction of the climate change issue in higher education curricula; ensuring environmental compliance through Initial IEE and EIA in the development process; addressing the issue of deforestation and illegal trade in timber; promoting Clean Development Mechanisms (CDM); and raising Pakistan's stance regarding climate change at various international forums, have also been incorporated as important components of the policy. The policy thus provides a comprehensive framework for the development of Action Plans for national efforts on adaptation and mitigation.	This policy document is a 'living' document and will be reviewed and updated regularly to address emerging concepts and issues in the ever-evolving science of climate change. This policy will accelerate due to the emissions from the construction machinery and equipment.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
4	National Drinking Water Policy, 2009	The National Drinking Water Policy provides a framework for addressing the key issues and challenges facing Pakistan in the provision of safe drinking water to the people. Drinking water is the constitutional responsibility of the provincial governments and the specific provision function has been devolved to specially created agencies in cities and Town and Tehsil Municipal Administrations under the Local Government Ordinance 2001.	This policy is applicable for the proposed project during construction phase in terms of regular water quality monitoring.
5	National Water Policy, 2018	The National Water Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize time and cost overruns in completion of water sector projects, improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents; equitable water distribution in various areas and canal commands, measures to reverse rapidly declining groundwater levels in low-recharge areas, increased groundwater exploitation in high-recharge areas, effective drainage interventions to maximize crop production, improved flood control and protective measures, steps to ensure acceptable and safe quality of water, minimization of salt build-up and other environmental hazards in irrigated areas, institutional reforms to make the managing organizations more dynamic and responsive.	The core areas that are relevant in the context of the proposed project are drinking water demand, sewage disposal, handling of wastewater.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
6	National Forest Policy, 2015	The goal of this policy is to expansion, protection and sustainable use of national forests, protected areas, natural habitats and watersheds for restoring ecological functions, improving livelihoods and human health in line with the national priorities and international agreements. In line with the Federal functions of national policy, planning and implementation of international agreements, specific objectives of the National Forest Policy include: a) Promoting ecological, social and cultural functions of forests through sustainable management and use of forest produce including wood and non-wood forest products; b) Implementing a national level mass afforestation programme to expand and maintain optimum forest cover; c) Maximizing forest areas by investing in available communal lands/ shamlat, and Guzara forests and urban forestry; d) Facilitating and harmonizing inter-provincial movement, trade and commerce of wood and non-wood forest products through the Federal Forestry Board; e) Inter-linking natural forests, protected areas, wetlands and wildlife habitats to reduce fragmentation; f) Enhancing role and contribution of forests in reducing carbon emissions and enhancing forest carbon pools; g) Facilitating implementation of international conventions and agreements related to Forestry, Wetlands, Biodiversity and Climate Change; and h) Promoting standardized and harmonized scientific forest planning, research and education including for community-based management.	The proposed Project dose not involves any national forests, protected areas, natural habitats and watersheds, so this policy is not applicable.
7	Pakistan Labour Policy, 2010	The main objective of the Labour Policy, 2010 is the social and economic well-being of the labour of Pakistan. The Labour Policy, 2010 has following 4 parts: • Legal Framework; • Advocacy: rights of workers and employers;	The labour force will be employed for construction of the proposed Project. The provision of policy will apply to all the employed labourers.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		• Skill development and employment; and • Manpower export.	
9	National Disaster Risk Reduction Policy, 2013	NDMA, being the lead focal agency for disaster preparedness and management, has therefore, embarked upon formulation of a comprehensive National Disaster Risk Reduction Policy through wider consultations with all stakeholders including all provinces, state of AJ&K and regions. This policy covers disasters risk reduction in a more holistic way and introduces a proactive and anticipatory approach by laying special emphasis on risk assessment and prevention.	This policy will be elicit if any unforeseen natural and man-made disaster occurs during construction and operation phase.

Table 2.2: Main Legislation/Acts Related to Environment and their Relevance to the Project

Sr. No.	Act	Brief Coverage	Relevance to Project
1.	Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017)	The Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017) is comprehensive legislation and provides the legislative framework for protection, conservation, rehabilitation and improvement of the environment. The 'environment' has been defined in the Act as: (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the interrelationships between any of the factors specified in sub-clauses 'a' to 'f'. The notable points of the law are: • No proponent of a project shall commence construction or operation unless he has filed an IEE/EIA with the Provincial Agency designated by the Provincial EPAs an EIA, and has obtained an approval; • Establishment and formation of the Punjab Environmental Protection Council(PEPC);	The provision of the act is applicable to proposed Project for conducting an EIA according to section 12 and to obtain environmental approval from the EPA. The section 11 of the act is applicable in term of compliance with Punjab Environmental Quality Standards (PEQS). Similarly, section 13 of the act prohibits the import of hazardous waste. The provisions of section 16 are also applicable to comply with the discharge or emission of any effluent, waste, air pollutant or noise or disposal of waste or handling of hazardous substance. Under section 17, penalties will apply if anyone fails to comply with the provisions of section 11, 12, 13 and 16.

Sr. No.	Act	Brief Coverage	Relevance to Project
		• Prohibition of certain discharges or emissions; • Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and • Provincial Government can issue notices and enforce them to protect the environment. In the recent amendment of 2012, legislatives powers related to environment and ecology are given to provincial governments from the Federal government. The provinces are required to enact their own legislation for environmental protection. Other amendments include increasing the penalties for violations. For the proposed Project, Environmental Protection Department (EPD)/Environmental Protection Agency (EPA), Government of Punjab (GoPb) is the concerned authority. The capability of regulatory institutions for environmental management is ultimately responsible for the success of environmental assessments and that development projects are environmentally sound and sustainable.	
2.	Pakistan Environmental Protection Agency, (Review of IEE and EIA) Regulations, 2022	These regulations set out: • Key policy and procedural requirements for filing an EIA; • The purpose of environmental assessment; • The goals of sustainable development; • The requirement that environmental assessment be integrated with feasibility studies; • The jurisdiction of the Federal and Provincial EPA's and Planning & Development (P&D) Departments; • The responsibilities of proponents; • Duties of responsible authorities; • Provides schedules of proposals that the project requires either IEE or an EIA; • The environmental screening process of the projects under schedule I, II and III; and	The provisions of these regulations are applicable for environmental screening of the project, which implies that an EIA is required for the proposed project. The process described in the regulation will be useful for PMA to follow the procedure to file an EIA with Punjab EPA and to understand its review process along with timelines to be followed.

Sr. No.	Act	Brief Coverage	Relevance to Project
		• The procedure for the environmental approval for filing the case with the concerned EPA for the granting of the NOC.	
3.	Punjab Environmental Quality Standards (PEQS), 2016	PEQS promulgated recently in 2016. Specified standards under PEQS are for: • Drinking Water; • Ambient Air; • Noise; • Industrial Gaseous Emissions; • Municipal and Liquid Industrial Effluents; • Motor vehicle exhaust and noise; and • Treatment of Liquid and Bio-Medical Waste.	All projects to be implemented in Punjab must conform to PEQS during all the phases i.e. construction and operation.
4.	Guidelines for the Preparation and Review of Environmental Reports, 1997	These guidelines describe the format and content of IEE/EIA reports to be submitted to PEPA for obtaining NOC/approval. The guidelines present: • The environmental assessment report format; • Assessing impacts; • Mitigation and impact management and preparing an environmental management plan; • Reporting; • Review and decision making; • Monitoring and auditing; and • Project Management.	The guidelines are applicable for the preparation of the EIA.
5.	Guidelines for Environmental Assessment	Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development Projects. The guidelines that are relevant to the proposed Project are listed below. • Guidelines for the Preparation and Review of Environmental Reports, Pakistan Environmental Protection Agency, 1997; • Guidelines for Public Consultation, Pakistan Environmental Protection Agency, May, 1997; and • Sectoral Guidelines: Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997.	The guidelines are applicable for the preparation of the EIA.
6.	Pakistan Climate Change Act, 2017	This Act aims to meet obligations under international conventions relating to climate change and to provide for adoption of comprehensive adaptation and mitigation	This Act will accelerate due to the emissions from the construction machinery.

Sr. No.	Act	Brief Coverage	Relevance to Project
		policies, plans, programmes, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto.	
7.	National Clean Air Act, 2000	The Act aims to control vehicular emissions, pollution from industry, and indoor air pollution in rural and urban areas.	This Act will trigger if vehicles and machinery used for construction activities emanate air pollutants above the permissible limit.
8.	Land Acquisition Act (LAA), 1894 Including Later Amendments	The Land Acquisition Act, 1894, is a "law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be paid on account of such acquisition". The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between client and the owners of land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached.	This Act will anticipate if proposed project involves permanent acquisition of land in the project area.
9.	Punjab Parks and Horticulture Authority Act, 2012	This act entails regulation, development, and maintenance of public parks, green belts and green areas in the Punjab; regulation of billboards, sky signs and outdoor advertisements; to promote open and unrestricted views of the Punjab.	This act will trigger as green belts will be developed for the proposed project which needs to be maintained during operation phase.
10.	Punjab Wildlife Act, 1974	The Punjab Wildlife Act (1974) is developed for the regulation of activities relating to protection, conservation and management of wildlife in Punjab.	The proposed project may involve cutting of trees which may result in loss of habitat, therefore, the provisions of this law are applicable.
11.	Punjab Plantation and Maintenance of	The Punjab Plantation and Maintenance of Trees Act, (1974) regulates tree plantations and enforces measures for their protection.	The requirements of this act are applicable in terms of planting new trees and their

Sr. No.	Act	Brief Coverage	Relevance to Project
	Trees Act, 1974		maintenance by the occupier of the existing land who would have the physical possession.
12.	Pakistan Antiquities Act 1975 & Punjab Antiquities Amendment Act 2012	The Punjab Antiquities Amendment Act, 2012 is adopted from the Pakistan Antiquities Act of 1975 with a few minor changes. The Antiquities Act, 1975 (amended in 1990) states the following: • "Ancient" is any object that is at least 75 years old; • All accidental discoveries of artefacts must be reported to the Federal Department of Archaeology; • The Government is the owner of all buried antiquities discovered on any site, whether protected or otherwise; • All new construction within a distance of 200 feet from protected antiquities is forbidden; • No changes or repairs can be made to a protected monument, even if it is owned privately, without approval of the responsible authorities; and • The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage.	The law will be applicable to the project mainly due to its two provisions: ▪ According to the law, any construction activity within 61 m or 200 ft. of protected antiquities, are prohibited. The provisions of this act would also be applicable, if any accidental archaeological discoveries may occur during the excavation works for the construction of proposed Project.
13.	The Punjab Special Premises (Preservation), Ordinance, 1985	The Punjab Special Premises (Preservation), Ordinance (1985) provides the legal framework for preservation of premises of historical, cultural, archaeological, and architectural value in the Punjab province. This legislation empowers the provincial government to notify heritage sites and sites of cultural and archaeological importance and to prohibit implementation of developmental schemes or new constructions within the notified areas around the special premises. So far 246 sites stand notified under the Punjab Ordinance.	The provision of the ordinance is applicable for protection and conservation of special premises declared by department of Youth Affairs, Sports, Archeology & Tourism, Punjab. The ordinance is applicable in terms of land acquisition, entrance, exploitation and destruction of special premises near site.
14.	Pakistan Penal Code, 1860	The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents.	The provisions of the Penal Code, 1860 are applicable to the project in terms of penalties for effecting human lives and public property. It also addresses the control of noise, air emissions and effluent disposal.

Sr. No.	Act	Brief Coverage	Relevance to Project
15.	Labour Laws as part of Constitution of Pakistan 1973,	The Constitution of Pakistan contains a range of provisions with regards to labour rights, in particular: • Article 11 of the Constitution prohibits all forms of slavery, forced labour and child labour; • Article 17 provides a fundamental right to exercise the freedom of association and the right to form unions; • Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and • Article 37(e) makes provision for securing just and human conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment. Labour law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labour laws.The labour laws are a comprehensive set of laws in Pakistan dealing with the following aspects: • Contract of Employment; • Termination of Contract; • Working Time and Rest Time; • Working hours; • Paid Leave; • Maternity Leave and Maternity Protection; • Other Leave Entitlements; • Minimum Age and Protection of Young Workers; • Equality • Pay Issues; • Workers' Representation in the Enterprise; • Trade Union and Employers Association Regulation; and • Other Laws.	The labour laws will be relevant as it would deal with employment of labour for the construction of propose project. Following are the major labour laws which are applicable to the project: • Bonded Labour System (Abolition) Act, 1992 • Employment of Child Act, 1991 • Minimum Wages Ordinance, 1961 • Industrial Relations Act, 2010 • West Pakistan Minimum Wages for Unskilled Workers' Ordinance, 1969
16.	Punjab Municipal Water Act, 2014	The basic aim of the Act is to recognize, regulate and manage present and future municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province. This Act is in draft stage.	This Act will elicit if there is misappropriation of water supply during construction activities.
17.	The Punjab Water Act, 2019	This act ensures comprehensive management and regulation of water resources in the Punjab in the interest of	This this act will be triggered as Main Canal exists near the Project Area.

Sr. No.	Act	Brief Coverage	Relevance to Project
		conservation and sustainability.	
18.	Hazardous Substance Rules, 2003	The rule describes the procedure of handling, transportation and disposal of hazardous substances and hazardous waste. Inter alia, general safety precautions for handling hazardous substances as well as safety precautions for workers, and notification requirements in the event of an accident are described in these rules. Requirements for project waste management plans are also defined. These include a requirement for updating the plan every three years, the need to provide for management of hazardous waste in a manner that will prevent adverse environmental impacts and to ensure that hazardous and non-hazardous waste are not mixed.	This rule is applicable to the proposed project due to involvement of hazardous waste handling, use and disposal during the construction stage.
19.	Punjab Environmental Protection (Motor Vehicles) Rules, 2013	Subject to the provisions of this act, and the rules and regulations, no person shall operate a motor vehicle from which air pollutants and noise are being emitted in an amount, concentration or level which is in excess of the Punjab Environmental Quality Standards, or where applicable the standards established under clause (g) of subsection (1) of section 6 of the act.	This act will be elicited during construction and operational phase due to use of motor vehicles that produces air pollutants and noise.
20.	ISO 18001 Occupation Health and Safety Assessment Series (OHSAS)	OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems to help organizations to control occupational health and safety risks. The OHSAS specifications are applicable to any institute that desires to establish an OH&S management system to eradicate or reduce risk to employees and other interested parties who may be exposed to the risks allied with the project activities. The construction of the proposed project may involve various health and safety issues to construction labour, therefore these ISO 18001 guidelines will be applicable and pertinent.	This series will be elicit during construction and operational phase to ensure health and safety of workers associated with the project activities.
21.	The Punjab Occupational Safety And Health Act, 2019	This Act entails provision of occupational safety and health of the workers at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological	The Act will trigger during construction and operational phase to ensure health and safety of workers at workplace associated with the project activities.

Sr. No.	Act	Brief Coverage	Relevance to Project
		and psychological needs of the employees at workplace.	
22.	Punjab Restriction on Employment of Children Act, 2016	According to the sub-section 11(a) of this Act, an occupier who employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment for a term which may extend to six months, but which shall not be less than seven days, and a mandatory fine between 10,000 and 50,000 rupees.	This Act will trigger if contract hire skilled and unskilled labour under age 15.
23.	Punjab Protection of Women against Violence Act, 2016	The act is administered by federal government which provides guidelines for the provision of disaster management plans, offer necessary technical assistance to the Provincial Governments and Provincial Authorities as well for preparing their disaster management plans in case of any mishap.	This act is valid to the subject project in case of any unseen situation.
24.	Electricity Act, 1910	The Act provides a legal basis for distribution of Power. It enables a licensee to conduct operations for supply of electricity and binds the license to payment of compensation in respect of any damages caused during the construction, Operation and Maintenance (O&M) of Power distribution facilities.	This act will be applicable if any damages occur during construction of the power facilities.
25.	Cutting of Trees (Prohibition) Act, 1975	The Act was enforced in 1975 to place restrictions on cutting of trees in order to restrain unchecked trend of tree felling without replacement plantations.	This act will be applicable to the subject project as the cutting of trees may be involved.
26.	Punjab Forest Act (Amended), 2010	The act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests.	The proposed project is urban in nature and no protected forest is situated in the Project area.
27.	The Punjab Protected Areas Act, 2020	The Act provides provisions for the protection, preservation, conservation and management of ecologically important areas such as National parks, Nature reserves, Wildlife sanctuaries, Wilderness areas, Buffer zone, Wetlands, etc.	This act will not be triggered as there is no protected area in and around the study area.

Sr. No.	Act	Brief Coverage	Relevance to Project
28.	The Punjab Heritage Foundation Act, 2005	This act entails preservation, conservation, maintenance and rehabilitation of the Punjab Heritage through various means, including technical or financial assistance and to create awareness among the people for preservation of the Punjab Heritage.	This act will not be triggered as no heritage sites are present in and around the proposed project route.
29.	The Canal and Drainage Act, 1873	The Canal and Drainage Act 1873 (CDA) focuses on construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also covers issues related to canal navigation. It briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to "corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used." In addition, Section 73 of the CDA gives power to arrest without warrant or to be taken before the magistrate a person who has wilfully damaged or obstructed the canal or "rendered it less useful."	This act will be applicable as the proposed project is intersects the Upper Chenab Canal.
30.	The Punjab Emergency Service Act, 2006	It deals with the establishment of emergency service for a purpose of maintaining a state of preparedness to deal with emergencies, to provide timely response, rescue and emergency medical treatment to the affected persons and recommending measures to be taken by related organizations to avoid any emergency situation. It describes procedures to establish emergency service, emergency board, emergency fund, emergency ambulance and rescue vehicles, offence and punishment, etc.	This act is applicable to the proposed project to provide timely response, rescue and emergency medical treatment to the affected persons during construction and operation phase of project.
31.	National Disaster Management Act, 2010	National Disaster Management Act, 2010 was passed by Parliament of Pakistan in 2010. The Act applies to whole Pakistan. The Act was passed in backdrop of 2010 Floods in Pakistan and strengthens Disaster Management system.	This act is applicable to the proposed project. The proposed project will require special consideration to disasters and risk management strategies as per the Act.
32.	Seismic Building Code of Pakistan 2007	This code stipulates the minimum requirements for seismic safety of building and structures and the provisions of the Building Code of Pakistan (Seismic Provisions-2007) shall apply for engineering design of buildings, like structures and	This Code is applicable to the proposed project as it includes the formation of structures.

Sr. No.	Act	Brief Coverage	Relevance to Project
		related components. Construction of buildings shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the Act.	
33.	Punjab Mass Transit Authority Act, 2015	It deals with the establishment of Punjab Mass Transit Authority for purposes of construction, operation and maintenance of mass transit system in the major cities of the Punjab; for providing safe, efficient and comfortable urban transportation system. It describes powers, budget, functions of authority, development of Mass Transit Authority Fund and penalties for contravention.	This act is applicable to the proposed project. The proposed project will require the construction of new transit system.

2.3 INTERNATIONAL PROTOCOL / CONVENTIONS

As Pakistan is a member of a number of international organizations such as United Nations Organization (UNO), Organization of the Islamic Conference (OIC), South Asian Association for Regional Cooperation (SAARC), Economic Cooperation Organization (ECO) etc., so it has to follow the international protocols and obligations related to the environment. The major protocols, ratification dates by Pakistan and obligations related to the proposed project are provided in the **Table 2.3** below:

Table 2.3: International Agreements/Conventions Relevant to the Project

Sr. No	Agreement/Convention	Ratification	Description/Relevance
1.	The Rio Declaration, 1992 Web Link: http://www.unesco.org/education/pdf/RIO_E.PDF	Pakistan signed the treaty on 13Jun 1992 and ratified on 1 June 1994	The Rio Declaration comprises 27 principles which address important issues such as; sustainable development to integrate environmental protection into the development process; common but differentiated responsibilities to conserve, protect and restore the earth's ecosystems; public participation and information access at the national level, reduce and eliminate unsustainable patterns of production and consumption.
2.	Kyoto Protocol, 1992 Web Link: https://unfccc.int/kyoto_protocol	Pakistan has ratified Kyoto Protocol in 2005	The Kyoto Protocol is a protocol to reduce Greenhouse gasses that cause climate change. It was agreed on 11th December, 1997 at the 3rd Conference of the countries to the treaty when they met in Kyoto, and entered into force on 16th February, 2005. As of November 2007,

Sr. No	Agreement/Convention	Ratification	Description/Relevance
			175 countries have ratified the protocol. One hundred and thirty-seven (137) developing countries have ratified the protocol, including Brazil, China, India and Pakistan but have no obligation beyond monitoring and reporting emissions.
3.	Convention on Biological Diversity, 1994 Web Link: https://www.cbd.int/	Pakistan signed this treaty in 1992 and it was ratified by cabinet in 1994.	The Convention on the Biological Diversity (CBD) has three main goals: Conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.
4.	UN Convention to Combat Desertification (UNCCD), 1994 Web Link: https://www.unccd.int/	Pakistan signed the Convention on 15th October 1994 and ratified it on 24 February, 1997	The UNCCD is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.
5.	Stockholm Convention on Persistent Organic Pollutants (POPs), 2004 Web Link: https://www.un.org/press/en/2004/unep204.doc.htm	The Stockholm Convention on Persistent Organic Pollutants was signed on 22 May 2001 and entered in to force on 17 May, 2004. Pakistan signed the convention on December 6, 2001	Convention seeks to protect human health and the environment from POPs as set out in Article-1, which are chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.
6.	Paris Agreement, 2015	The Paris Agreement's central goal is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below two degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to one and half degrees Celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows	The implementation of the proposed project will reduce the emission of greenhouse gases (GHG) due to the construction of the proposed project.

Sr. No	Agreement/Convention	Ratification	Description/Relevance
		consistent with a low GHG emissions and climate-resilient pathway.	
7.	Sustainable Development Goals (SDGs)	At the Sustainable Development Summit on 25th September 2015, UN Member States adopted the 2030 Agenda for Sustainable Development, which includes a set of 17 Sustainable Development Goals (SDGs) to end poverty, fight inequality and injustice, and tackle climate change by 2030. Pakistan has displayed commendable commitment to the 2030 Agenda for Sustainable Development as it was one of the first countries to endorse it globally in 2015. On 16th February 2016, the Parliament unanimously approved the Sustainable Development Goals (SDGs) as the national development agenda.	The SDGs that will prevail for the proposed project are as follows: • Promote Gender Equality and Empower Women: The contractor during construction phase will be responsible to hire women for construction activities to elude gender discrimination and to promote women empowerment. • Combat HIV/AIDS Malaria and Other Diseases: Contractor will be responsible to conduct medical surveillance of the workers before hiring to combat HIV/AIDS Malaria and other diseases. • Ensure Environmental Sustainability: Contractor will be responsible to ensure environmental sustainability of the proposed Project Areas by ensuring implementation of EMP to mitigate adverse environmental impacts from construction activities during construction phase.

2.4 ADMINISTRATIVE FRAMEWORK

2.4.1 Punjab Mass Transit Authority (PMA)

The implementing agency of the proposed Project is Punjab Mass Transit Authority (PMA). The management of PMA will ensure that all the proposed mitigation measures are effectively implemented at the design, construction, and operation stages of the proposed Project.

2.4.2 Environmental Protection and Climate Change Department (EP&CCD), Punjab

Pakistan Environmental Protection and Climate Change Department (EP&CCD) is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to provincial environmental protection agencies for review, approval and monitoring of environmental examination/assessment projects. As the proposed Project also falls in Faisalabad District therefore Punjab-EPA will be responsible for reviewing the report, issuing

environmental approval and overall/broad based monitoring of the proposed project activities.

3 TRAFFIC ASSESSMENT AND ANALYSIS OF ALTERNATIVES

3.1 GENERAL

This Chapter presents the detailed assessment of the existing transportation system and travel behavior within Faisalabad City in order to identify mobility challenges, evaluate transport demand patterns, and propose sustainable and efficient solutions.

3.2 TRAFFIC ASSESSMENT

Faisalabad is the third-most-populous city in Pakistan and the second-largest in the eastern province of Punjab. Historically one of the first planned cities within British India, it has long since developed into a cosmopolitan metropolis. It has been referred to as the "Manchester of Pakistan".

Strategically located in central Punjab, Faisalabad enjoys excellent connectivity to major cities and markets via the M–3 and M–4 Motorways, the Grand Trunk (GT) Road, and an extensive network of regional roads. This advantageous location has fueled rapid industrialization and urban growth, attracting both local and foreign investments. Faisalabad is also home to the Dry Port, which facilitates domestic and international trade, and is directly linked to the national railway network.

The city is divided into eight administrative towns and hosts several industrial estates, such as the M–3 Industrial City and the Faisalabad Industrial Estate Development & Management Company (FIEDMC) zones. These industrial areas generate substantial freight and employee travel demand, impacting traffic conditions both within the city and on its periphery.

In addition to its industrial role, Faisalabad is a prominent educational and cultural center, with institutions like the University of Agriculture Faisalabad (UAF) and the National Textile University (NTU) attracting thousands of students from across the country. The combination of industrial activity, commercial expansion, educational institutions, and residential growth has led to increasing pressure on the city's transportation infrastructure.

With the growing number of motorized vehicles, including commercial freight trucks, public transport buses, motorcycles, and private cars, Faisalabad faces significant traffic management challenges such as congestion, parking shortages, and road safety concerns. The city's road network includes a mix of primary arterial roads, secondary arterials, collector streets, and local access roads, yet many key corridors experience heavy peak-hour traffic delays.

Figure 3.1: Existing Road Network Map of Faisalabad

3.2.1 Existing Conditions of Transport and Mobility

Faisalabad's transport network consists of a combination of radial arterial roads converging toward the central business district (CBD) and a series of ring roads under various stages of development. Key features include:

- High dependency on road transport, with no operational mass transit system;
- Predominance of motorcycles, rickshaws, and minibuses for short- to medium-distance travel;
- Congestion hotspots along Jhang Road, Canal Road, Samundri Road, and Susan Road, particularly during peak hours;
- Right-of-Way Encroachment, Informal parking, roadside vendors, and illegal structures;
- reduce effective capacity. Lack of formalized, high-capacity public transport leading to extended travel times and reduced reliability.

This has resulted in frequent traffic congestion, increased travel time variability, reduced road safety, and environmental concerns. These conditions are particularly severe during peak hours, indicating unstable flow and elevated user delays.

3.2.2 Need for Mass Transit

The current transport situation in Faisalabad is characterized by:

- Inadequate capacity to meet growing travel demand;
- High vehicle operating costs and increased fuel consumption due to congestion;
- Rising environmental concerns from vehicular emissions.

In response, the Government of Punjab has prioritized the development of integrated mass transit corridors to enhance mobility, reduce congestion, and improve urban livability in Faisalabad

3.2.3 Travel Demand Patterns

An Origin–Destination (OD) analysis was carried out to understand the spatial distribution of trips within Faisalabad and the role of the proposed mass transit corridors in meeting current and future travel demand.

- The CBD, centered around Clock Tower (Ghanta Ghar), is the most significant trip attractor in the city;
- It accounts for 26% of all trips, with 44% of these originating from nearby urban areas;
- 60% of trips are under 9 km, with 5 km trips being the most common;
- Only 20% of passengers travel beyond 13 km, indicating that intercity travel via public transport is limited and that most demand is intra-urban;
- The Orange Line is the most heavily used transport corridors for accessing the CBD;
- It connects high-density residential areas and key employment zones directly to the city center.

3.2.4 Mass Transit Planning

- The high concentration of trips toward the CBD supports the prioritization of high capacity, frequent transit services along radial corridors converging on the city center.
- Short-to-medium trip lengths indicate that corridor planning should focus on dense station spacing within the core to maximize accessibility, while feeder services can capture trips from peripheral areas.
- The dominance of the Orange Line alignment in existing travel patterns validates their selection as priority corridor for phased implementation.

3.3 ASSESSMENT OF POTENTIAL CORRIDOR FOR PUBLIC TRANSIT

The primary objective of the study is to comprehensively assess the existing transportation system and travel behavior within Faisalabad City that includes:

- Comprehensive assessment of Faisalabad's existing transport network, including major roads, intersections, and the coverage of informal public transport services such as wagons, auto-rickshaws, and Qingqi.
- Analyze travel patterns and behavior across the city, including trip purposes, peak hour demand, modal split, trip lengths, and origin–destination flows to understand how people move within the city.
- Examine vehicle registration trends and mode dependency, with a special focus on the dominance of motorcycles and informal transport, highlighting their implications on congestion, safety, and urban mobility.
- To provide the safe, efficient, affordable and reliable public transit serve to the commuters

3.3.1 Existing Public Transport Route Mapping Surveys

One of the essential steps in designing the public transport survey is the mapping of all existing operating public transport routes, i.e. Informal Transport (Qingqi) of Faisalabad. **Figure 3.1** illustrate the existing public transport (Qingqi/wagons) routes of Faisalabad.

The Consultant verified public transport routes by assessing their actual route alignments using Global Positioning System (GPS) tools, where required, and confirmed the operational status of each route. In addition, information on informal transport modes, including Qingqi rickshaws and Light Occupancy Vehicles (LOVs), was collected from bus stops and subsequently mapped. All verified and collected transport data were processed and presented through maps developed using GIS-based mapping software, specifically QGIS.

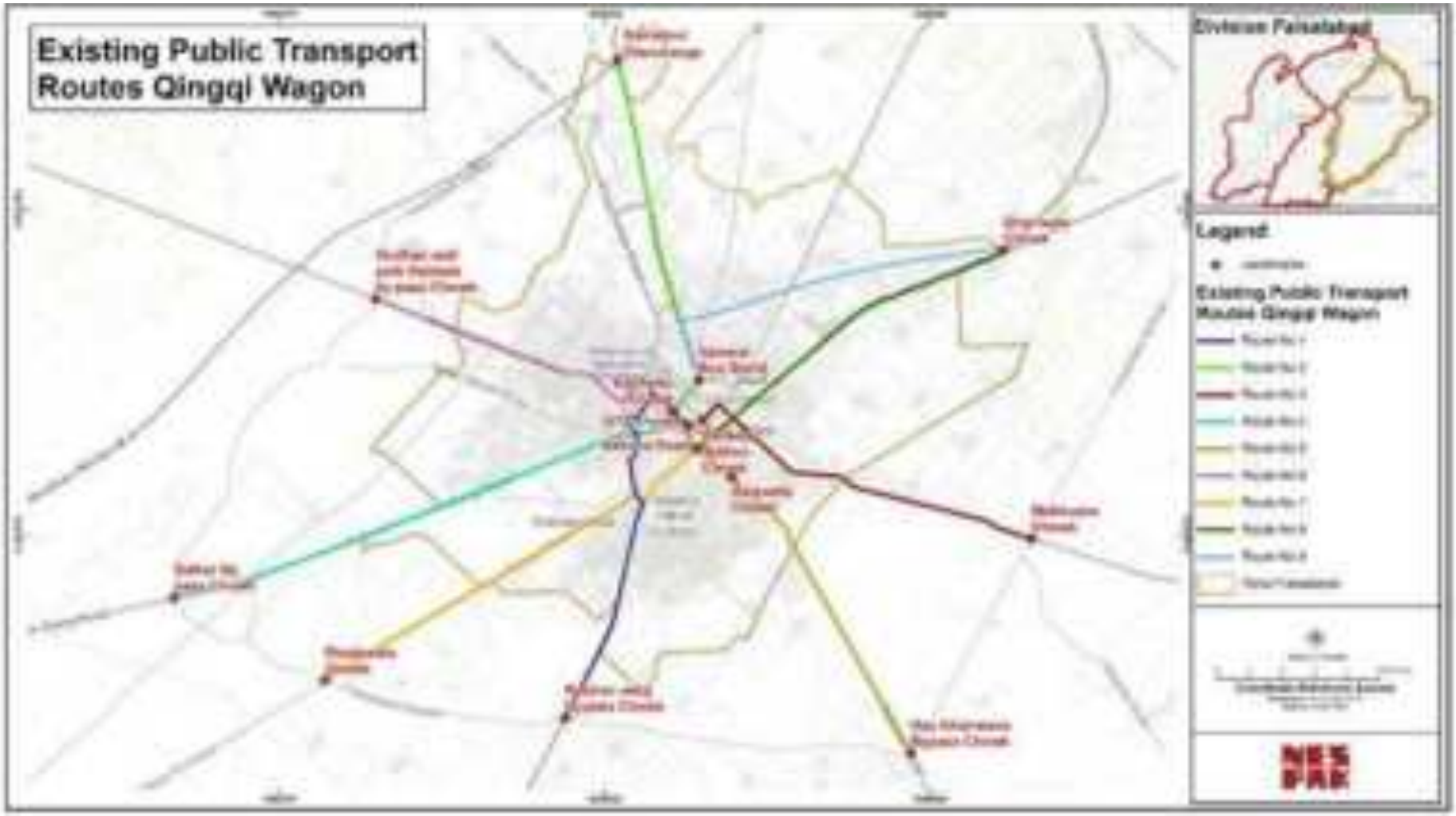

Figure 3.2: Faisalabad Existing Public Transport Routes

3.3.2 Boarding and Alighting Survey

An on-board passenger boarding/alighting survey was conducted by recording the number of passengers entering and exiting the public transport vehicle at each stop. The use of GPS helped determine the existing operating bus route, boarding/alighting of passenger's survey locations are illustrating in **Figure 3.3**. Subject survey use to identify sensitive analysis to locate the stop and use to calculate the ridership of existing route.

The rational for route selection is based on frequency of the operations of the fleet. The above criteria were applied to all existing public transport routes. Based on this, routes were selected for this survey.

3.3.3 Manual Classified Count Survey

To assess the overall traffic composition and volume on the selected road, manual classified count surveys were carried out at 49 points along the corridor. These surveys involved manually recording the number and type of all vehicles passing each survey point during specific time intervals.

Multiple count points were selected to observe variations in traffic patterns along the corridor. At each point, surveyors recorded all vehicle types including cars, motorcycles, rickshaws, buses, trucks, and others providing valuable data on the traffic volume and mode share across different sections of the road.

In total, 16 hours of manual classified counts were conducted at 15-minute intervals. Manual Classified Count Survey has been conducted on major merging locations revealed through Public Transport Mapping exercise. The survey locations are shown in the **Figure 3.4**.

3.3.4 Origin-Destination Surveys

Origin-Destination (OD) surveys are a fundamental tool in transportation planning used to understand travel behavior, trip patterns, and transport demand within a city. These surveys collect detailed information about individual or vehicle trips, including where a trip begins (origin), where it ends (destination), the purpose of the trip, mode of travel, travel time, distance, and frequency of travel.

In the context of Faisalabad, O–D surveys were conducted at key intersections and transport corridors to capture typical daily movement across the city. These surveys involved roadside interviews of drivers and passengers, particularly on major entry and exit points, to determine travel flows. Information was also gathered on trip purpose (e.g., work, education, shopping, social visits), vehicle occupancy, and preferred travel modes.

The data collected from O–D surveys plays a crucial role in identifying travel demand corridors, commuting patterns, and modal preferences. It helps in estimating the volume of through traffic versus local traffic, understanding peak demand areas, and assessing the need for public transport services or infrastructure improvements.

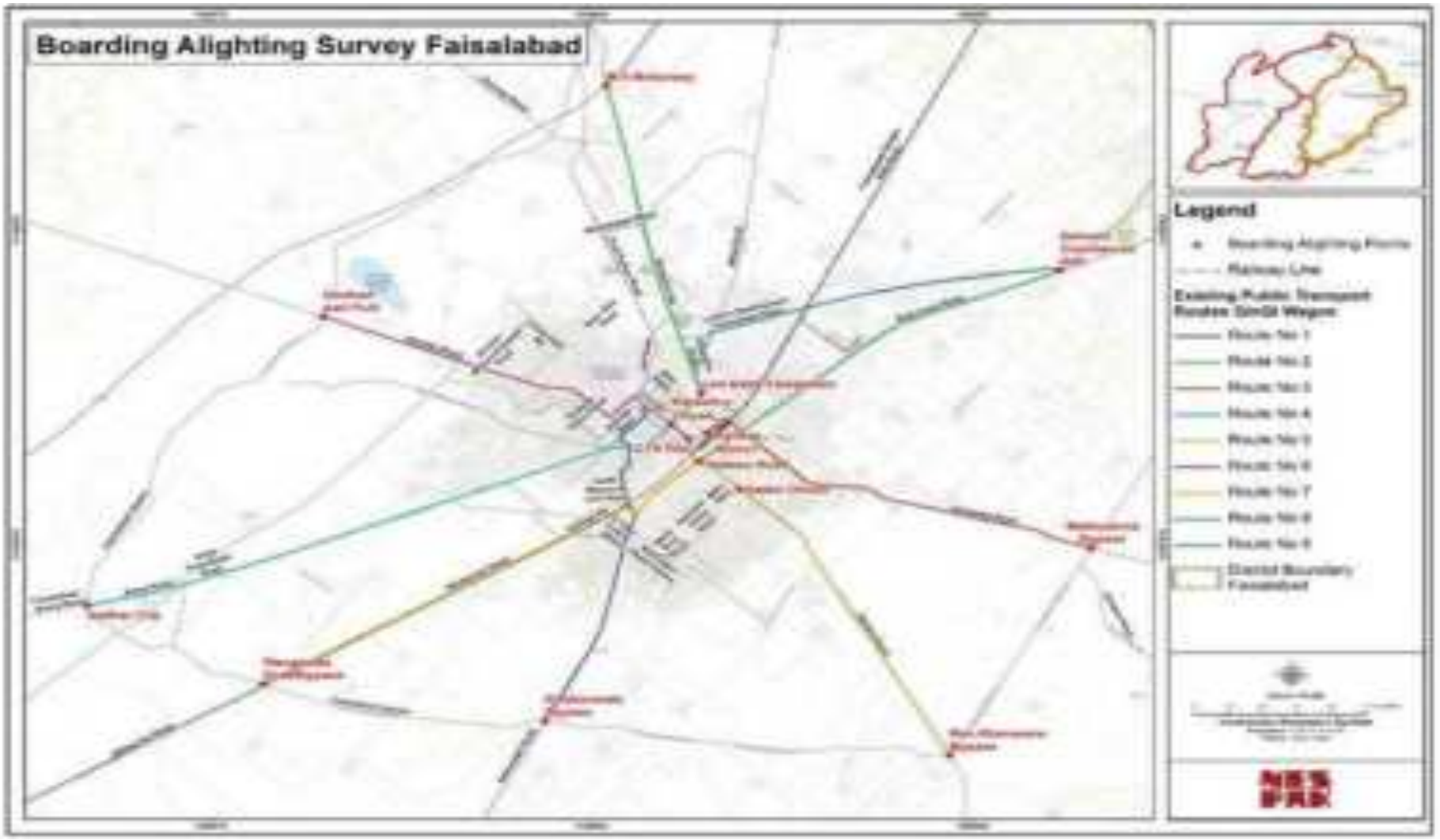

Figure 3.3: Boarding and Alighting Survey

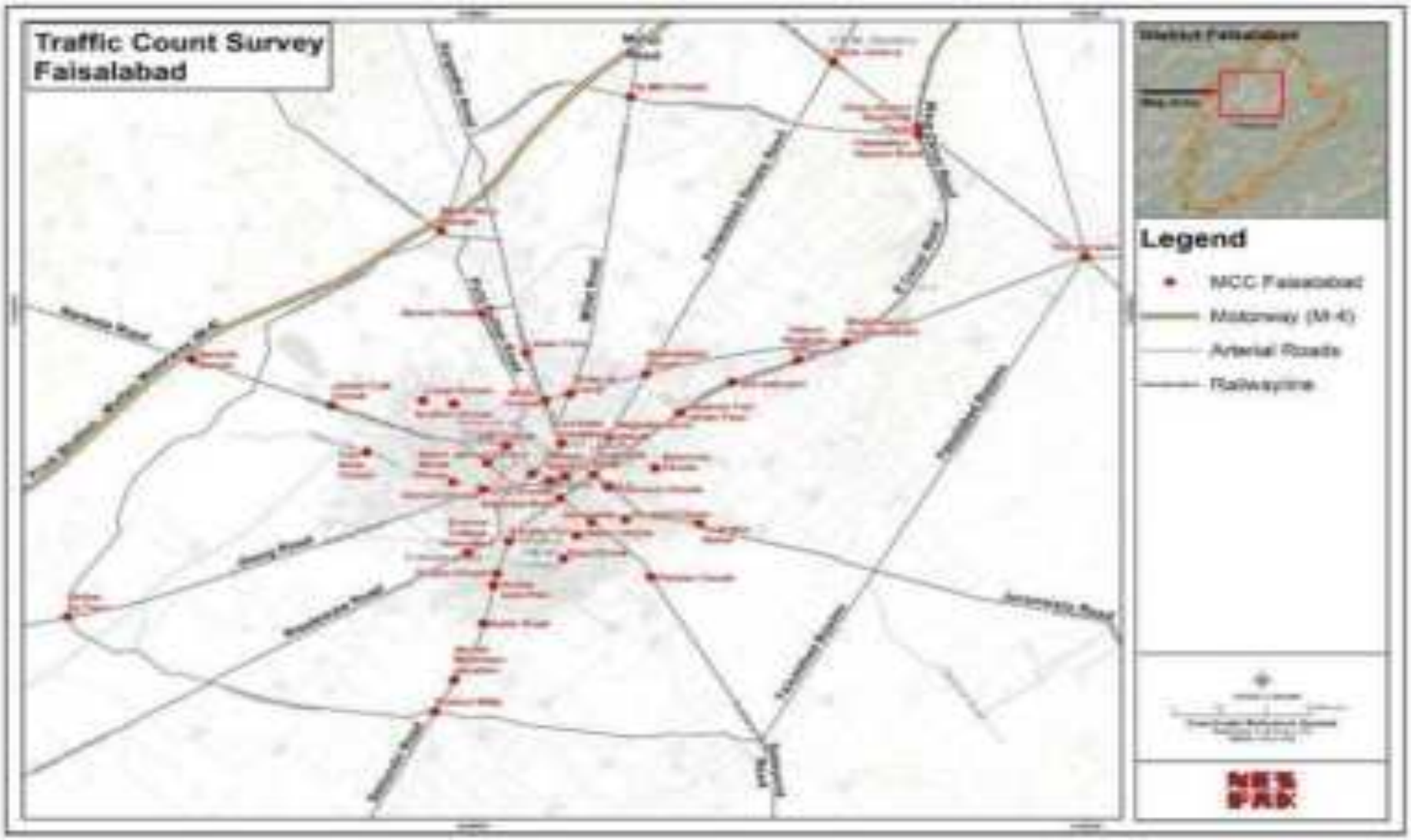

Figure 3.4: Traffic Count Locations

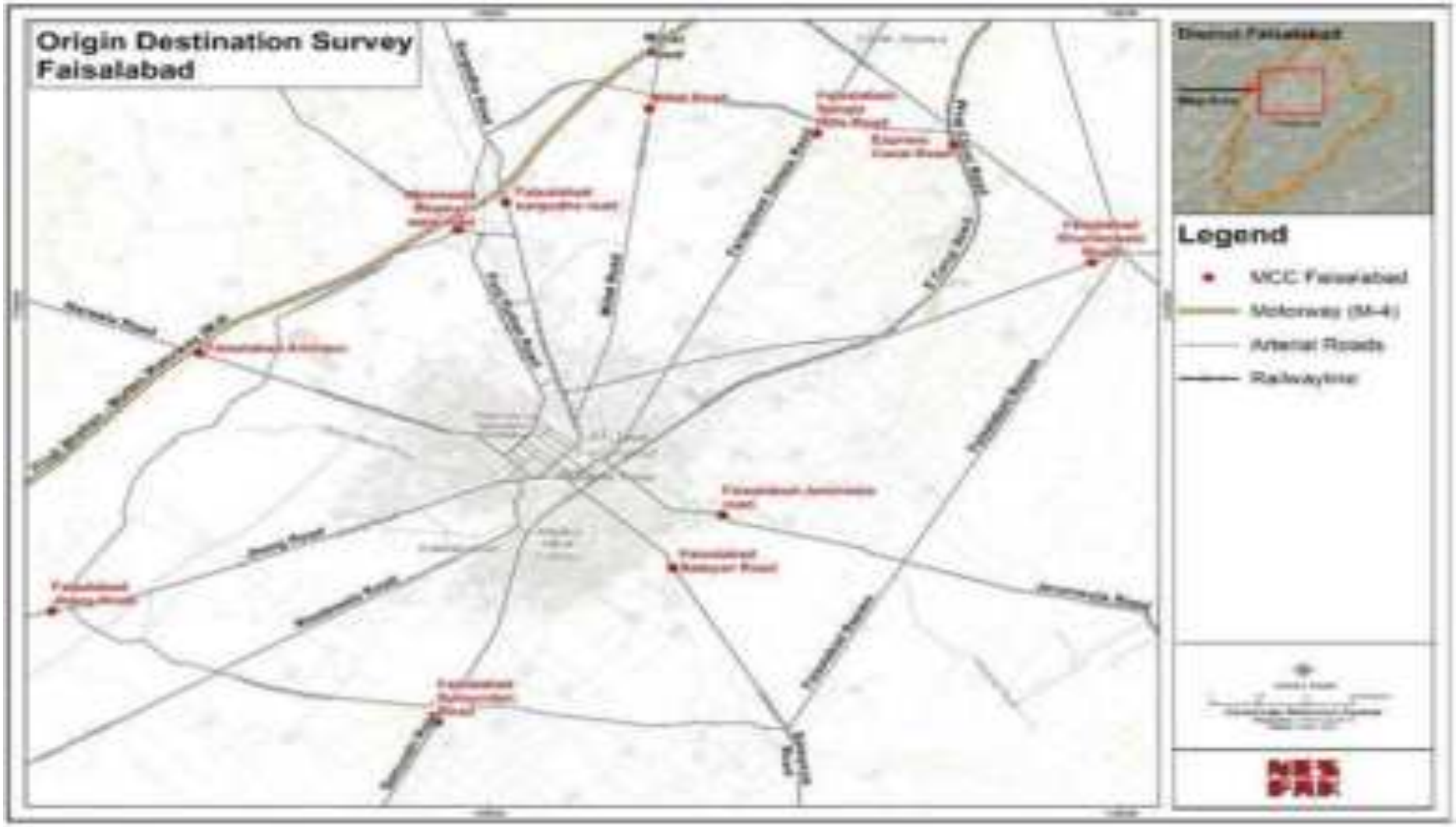

Figure 3.5: O-D survey along with MCC

3.3.5 Ridership Forecasting for Proposed Orange Line

A comprehensive Ridership Assessment has been conducted for the proposed corridor in Faisalabad. The study employed a multi-criteria analysis approach including Manual Classified Counts (MCC), Origin-Destination (OD) surveys, and Boarding-Alighting analysis to determine potential ridership and operational requirements.

To estimate potential ridership on the proposed Transit corridors, a detailed analysis of existing traffic flows was carried out. All trips with both origin and destination located within Faisalabad City and that travelled along the proposed Transit corridor were identified and considered.

The identified traffic was categorized by mode based on Manual Classified Counts (MCC) collected at key intersections along the corridor. To convert vehicle counts into passenger volumes, mode-specific occupancy rates were applied. These occupancy rates were derived from field observations and surveys conducted during the study.

3.3.6 Mode Shift

Following the determination of existing passenger volumes, a mode shift analysis was conducted to estimate the number of users likely to transfer to the proposed transit Line.

Conservative shift percentages were adopted, especially for informal and low-capacity modes like rickshaws, Qingqi, and wagons, recognizing that the transit would offer superior reliability, speed, and comfort. Lower shift rates were assumed for private vehicles, given their lower sensitivity to public transport improvements. This shift percentage reflect observed travel behavior in similar urban contexts and take into account the expected attractiveness of the transit line.

3.3.7 Daily Ridership Estimation

Based on the filtered travel demand and applied mode shift factors, the existing routes were analyzed, which revealed that the corridor from Jhang Road to Jaranwala Road shows higher ridership compared to the other corridor and estimated ridership is approximately 90,918 passengers per day. This figure represents a conservative estimate, grounded in current travel patterns, observed vehicle occupancies, and mode shift behavior in Faisalabad. This ridership estimate forms the basis for future planning of service frequency, vehicle fleet size, and operational capacity.

3.4 PERFORMANCE ANALYSIS

Traffic performance along the Orange Line corridor was evaluated using the Highway Capacity Manual (HCM) methodology[2], based on classified traffic counts and projected

[2] Specifically using the methodology for Urban Multilane Segments, which are high-capacity urban arterials characterized by multiple lanes, directional flow, at-grade access points, and a posted speed limit typically between 45–50 mph.

growth scenarios. The analysis focused on critical intersections along the corridor and assessed traffic flow efficiency in terms of vehicle flow per lane, density, and Level of Service (LOS).

3.4.1 Performance Measures

- Volume per lane (PCU/hr/lane)
- Density (pc/mi/ln)
- Level of Service (LOS) A to F

3.4.2 Demand Scenarios

- Existing Scenario – Current traffic conditions without improvements.
- Future Scenario – Projected traffic growth without mass transit intervention.
- Future + Development Scenario – Projected traffic conditions with Orange Line implementation and anticipated mode shift to transit (10%).

3.4.3 LOS Classification

LOS is classified based on the calculated density ranges, as per HCM LOS thresholds for urban multilane roads.

- LOS ranges from A (free-flow conditions) to F (unstable, over-saturated flow), representing increasing degrees of congestion and reduced service quality (Table 3.1).

Table 3.1: LOS Classification with Density (pc/mi/ln) by HCM

LOS	Density (pc/mi/ln)	Description
A	≤ 11	Free flow, high maneuverability
B	> 11 – 18	Stable, reasonable freedom of movement
C	> 18 – 26	Stable, but maneuverability begins to decline
D	> 26 – 35	Approaching unstable flow
E	> 35 – 45	Unstable, flow at or near capacity
F	> 45	Breakdown, oversaturated conditions

3.4.4 Key Observations

- Chenab Chowk & GTS Chowk: LOS remains C even in future scenarios, indicating acceptable flow due to balanced demand.
- Ghumti Chowk & Railway Station Chowk: Perform well with LOS A–B in most cases, showing low congestion risk.
- Kohinoor Chowk & Todi Wali Nehar: Moderate conditions with LOS B–C.
- Jaranwala Road: Critical bottleneck with LOS E across all scenarios, requiring priority traffic management interventions.
- Future + Development Scenario: Mode shift to Orange Line reduces traffic density slightly, but structural congestion persists at Jaranwala Road.

Table 3.2: Intersection-wise LOS and Density – Orange Line Corridor

Operational Analysis of Orange Line																
S.No.	Intersection	Bound	PCU	No. of Lanes	Existing Scenario				Future Scenario				Future + Development Scenario				
					Veh/Ln	Speed (mph)	Density (pc/mi/ln)	LOS	Veh/Ln	Speed (mph)	Density (pc/mi/ln)	LOS	No. of Lanes	Veh/Ln	Speed (mph)	Density (pc/mi/ln)	LOS
1	Chenab Chowk	NEB	2470	3	823	40	20.58	C	954	40	23.86	C	3	859	40	21.48	C
		WB	3011	3	1004	40	25.09	C	1164	40	29.09	D	3	1047	40	26.18	D
2	Ghumdi Chowk	NEB	1163	3	388	40	9.69	A	449	40	11.24	B	3	404	40	10.11	A
		SWB	1665	3	555	40	13.88	B	643	40	16.08	B	3	579	40	14.48	B
3	GTS Chowk	SEB	2275	3	758	40	18.96	C	879	40	21.98	C	3	791	40	19.78	C
		SWB	941	3	314	40	7.84	A	364	40	9.09	A	3	327	40	8.18	A
4	Railway Station Chowk	NEB	1870	3	623	40	15.58	B	723	40	18.07	C	3	650	40	16.26	B
		SWB	1837	3	612	40	15.31	B	710	40	17.75	B	3	639	40	15.97	B
6	Jaranwala Road	SEB	4618	3	1539	40	38.48	E	1785	40	44.61	E	3	1606	40	40.15	E
		NWB	4256	3	1419	40	35.47	E	1645	40	41.12	E	3	1480	40	37.00	E
7	Kohinoor Chowk	SEB	2620	3	873	40	21.83	C	1012	40	25.31	C	3	911	40	22.78	C
		NWB	1763	3	588	40	14.69	B	681	40	17.03	B	3	613	40	15.33	B
8	Todi Wali Nehar	SEB	2039	3	680	40	16.99	B	788	40	19.70	C	3	709	40	17.73	B
		NWB	1921	3	640	40	16.01	B	742	40	18.56	C	3	668	40	16.70	B

3.5 MODE SHIFT ANALYSIS (ORANGE LINE)

The successful implementation of the Orange Line Corridor is expected to generate a significant mode shift from private and informal transport modes (cars, motorcycles, rickshaws) toward high-capacity transit. This shift was estimated based on current mode shares, elasticities of demand, and benchmark studies from similar BRT systems in Pakistan and South Asia.

Table 3.3: Mode Shift Estimation – Orange Line

Mode	Existing Share Range (%)	Avg. Share (%)	Expected Shift (%)	Calculated Shift Contribution (%)
Car	20–30	25	3	0.75
Motorcycle	55–65	60	10	6
Rickshaw	5–13	9	35	3.15
Total				**9.9**

3.5.1 Key Observations

- The Orange Line is expected to attract both low-income public transport users (rickshaws) and motorcycle commuters, improving system affordability and sustainability.
- Reduced reliance on motorcycles and rickshaws will also yield safety and environmental benefits, lowering accident risks and emissions.
- While private car shift is limited, even a small reduction alleviates pressure on key intersections like Abdullahpur, Chenab Chowk, and Jaranwala Road.

3.6 CONCLUSIONS

The Orange Line BRT corridor presents a strategic mass transit solution for Faisalabad, addressing critical mobility challenges across major residential, commercial, and institutional zones. The mixed alignment—comprising elevated and at-grade sections—ensures operational efficiency while optimizing right-of-way usage and minimizing urban disruption.

Key findings from the performance analysis indicate that the corridor significantly improves traffic conditions, reduces travel time, and facilitates a sustainable mode shift from private and para-transit vehicles to high-capacity public transport. The proposed alignment successfully integrates with existing road infrastructure and future feeder systems, enhancing accessibility and urban connectivity.

3.7 PROPOSED ALTERNATIVES

To meet the primary objectives of the project, three different alternatives were studied at the early stages of the project. The detail of these alternatives is given below:

Alternative-I : No Project Option
Alternative-II : Proposed BRT System

3.7.1 Alternative – I - No Project Option

Presently, proposed alignment is being used as main access road to travel from all around Faisalabad and adjoining areas. The accelerated growth of population has led to increase in vehicular traffic on existing Jhang Road and Jaranwala Road. This is the main access road, which provide links to other major roads. Due to excessive use of these roads, the traffic congestion and traffic load is becoming a major issue. Without the project, the existing traffic problem at Jhang Road and Jaranwala Road and the level of service will further aggravate with the passage of time. Thus, it is important to upgrade the existing public transport facilities to cater the increased vehicular movement and traffic congestion.

3.7.2 Alternative – II – Proposed BRT System

Alternative-II considers solving the problems of lack of quality public transport system, traffic congestion and associated time delays, conflicts/accidents and reduction in air and noise pollution. Reduced fuel consumption and consequent emissions are also the benefits of this option.

In the light of above discussion, Alternative-II is the most feasible option as it will help resolving traffic congestion resulting in reduction in associated time delays, reduction in fuel consumption, reduction in conflicts/accidents, air pollution and noise. Smooth flow of traffic will also help in lesser wear and tear of vehicles.

3.7.3 Recommended Option

The Orange Line BRT project enhances overall traffic stability, improve accessibility to major activity centers, reduce travel times, and promote a mode shift from private vehicles to public transport, and boosts corridor efficiency. It introduces no adverse impact on general traffic flow, assuming key design measures such as signalized U-turns and lane discipline are properly enforced.

4 PROJECT DESCRIPTION

4.1 GENERAL

This Chapter presents the detailed project description along with project cost, land requirement, implementation schedule, workforce and water requirements, etc.

4.2 OBJECTIVES OF THE PROJECT

The overall objective of the proposed project is to provide a safe, efficient, comfortable and reliable transport facility to the commuters of the project area. The proposed project will greatly benefit the commuters by providing better quality and environmentally friendly public transport, reducing the number of vehicles on the road, reducing fuel consumption and consequently air emissions from vehicular exhaust especially in case of traffic congestion.

The following objectives have been considered in the implementation of the project:

- Transfer large number of passengers quickly over short distance with little land use;
- Provide the public with environmentally friendly and quality public transport;
- Provide transport safety, transport productivity, travel reliability, travel choices, and social equity;
- Reduce accidents caused by traffic congestions;
- To help save travelling time;
- Reduce the fuel consumption by reducing the demand of private vehicles;
- To create job opportunities for laborers and semi-skilled staff.

4.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project lies in District Faisalabad, Punjab.

4.4 PROJECT IMPLEMENTATION SCHEDULE

The tentative implementation period for proposed Project is eighteen (18) months.

4.5 COST OF THE PROJECT

Tentative cost of the proposed Orange Line is PKR 81,924.507 Million.

4.6 PROPOSED MASS TRANSIT PROJECT

In line with the Government of Punjab's continued commitment and in line with the Chief Minister Punjab's Vision to expand sustainable and integrated public transport system in Faisalabad, the Punjab Mass Transit Authority (PMA) proposes to undertake a comprehensive feasibility study for the development of a Mass Transit System in Faisalabad.

The initiative aims to offer affordable and eco-friendly transport to the city's growing population. Once operational, the project is expected to benefit nearly 90,918 passengers daily respectively, easing congestion on major city routes and providing an efficient public transportation alternative.

The system is designed to integrate with the city's existing transport infrastructure while providing direct access to major residential, commercial, and industrial zones.

4.6.1 Dedicated Corridor

The Orange Line corridor (20.3 km) is proposed as a mixed-elevation alignment. The route begins as an elevated structure from Faisal Town up to Al Najaf Colony, after which it transitions to an at-grade alignment up to Railway Station. From the Railway Station, the corridor rises again as an elevated section towards GCU Faisalabad, and subsequently continues at-grade up to the terminal station at Tahir Pura.

In all at-grade sections, the BRT alignment is positioned along the centre of the roadway, replacing the existing median, with carriageway widening carried out on the outer sides to accommodate mixed traffic lanes. **Figure 4.1** shows the Route Alignment of Proposed Orange Line Transit System.

4.6.2 Proposed Stations

The Orange Line Corridor will be served by 22 stations, strategically located to maximize accessibility to residential neighborhoods, commercial centers, and institutional areas. Stations are spaced at an average of 800–1,000 meters, ensuring convenient walking distances while maintaining operational efficiency. **Figure 4.2** illustrates the Proposed Stations along the Route of Orange Line Transit System.

4.6.3 Depot Location & Facilities

Efficient operation of a high-capacity transit system requires a strategically located depot for vehicle storage, maintenance, and operational management. For the Orange Line Corridor, two depot sites (10 acres each) has been identified Near Airport Road and Faisal Town to meet both current and future operational needs. **Figure 4.3** indicates the location of Proposed Depot.

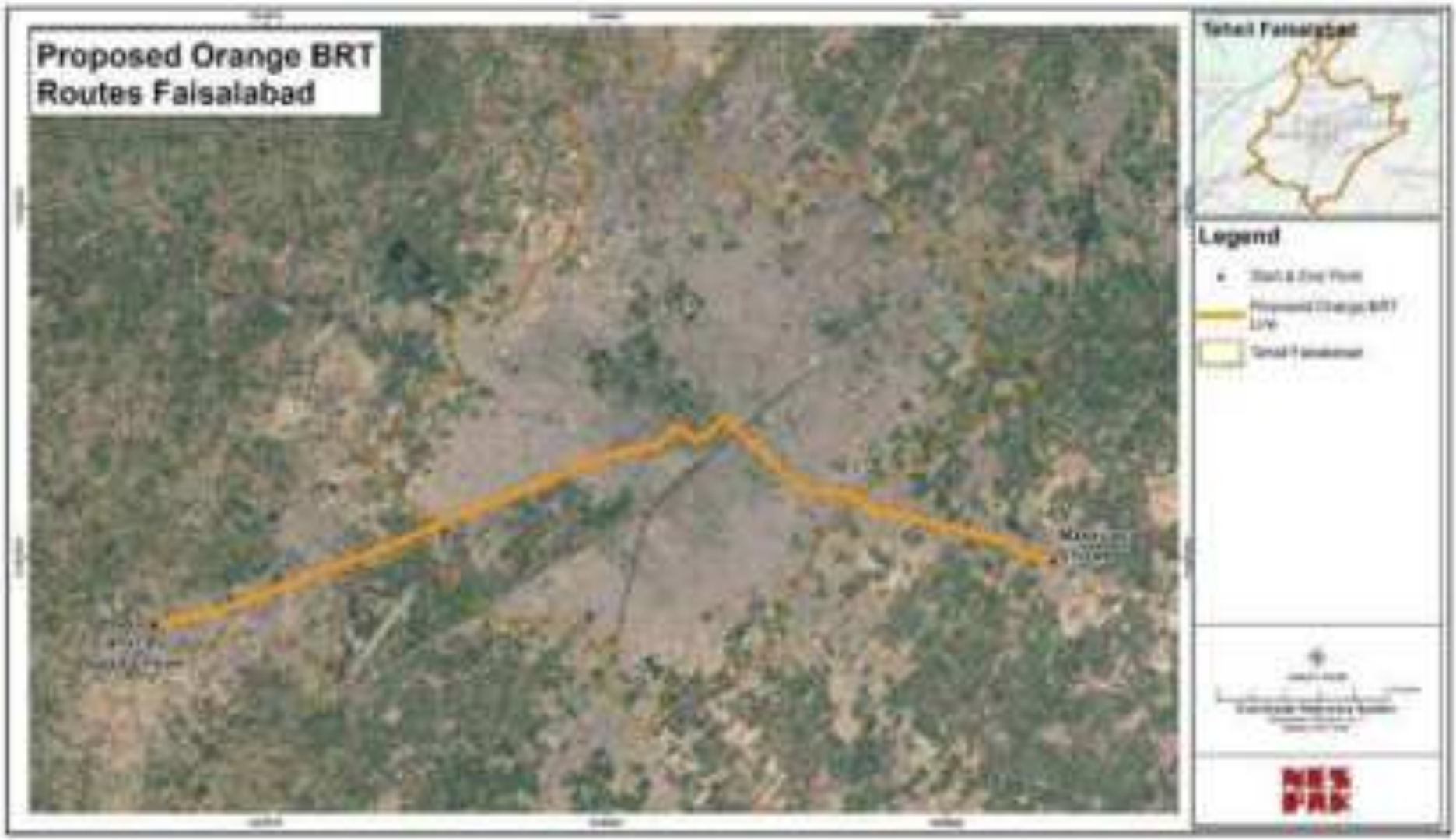

Figure 4.1: Alignment of the Proposed Mass Transit System, Faisalabad

Figure 4.2: Stations Along Proposed Orange Line Route

Figure 4.3: Location of Proposed Depots

4.7 DESIGN FEATURES OF THE PROJECT

- Proposed Line : Orange Line
- Designated Corridor : (Tahir Pura - Faisal Town)
- Length : 20.3 km
- Stations : 22 No.
- Station Spacing : 800–1,000 meters (average)
- Alignment Type : Mixed Elevated and At Grade
- Ridership : 90,918
- Designated Mode : SRT/EV Buses
- Headway : 6 min
- Typical Speed : 70 Km/hr
- Fleet Requirement : 2 SRT and 27 Buses
- No. of Depots : 02
- Depot Location : Near Airport Road & Faisal Town (10 acres)

The layout plans for proposed Depots, Stations & alignment is given in **Figure 4.4-4.13**.

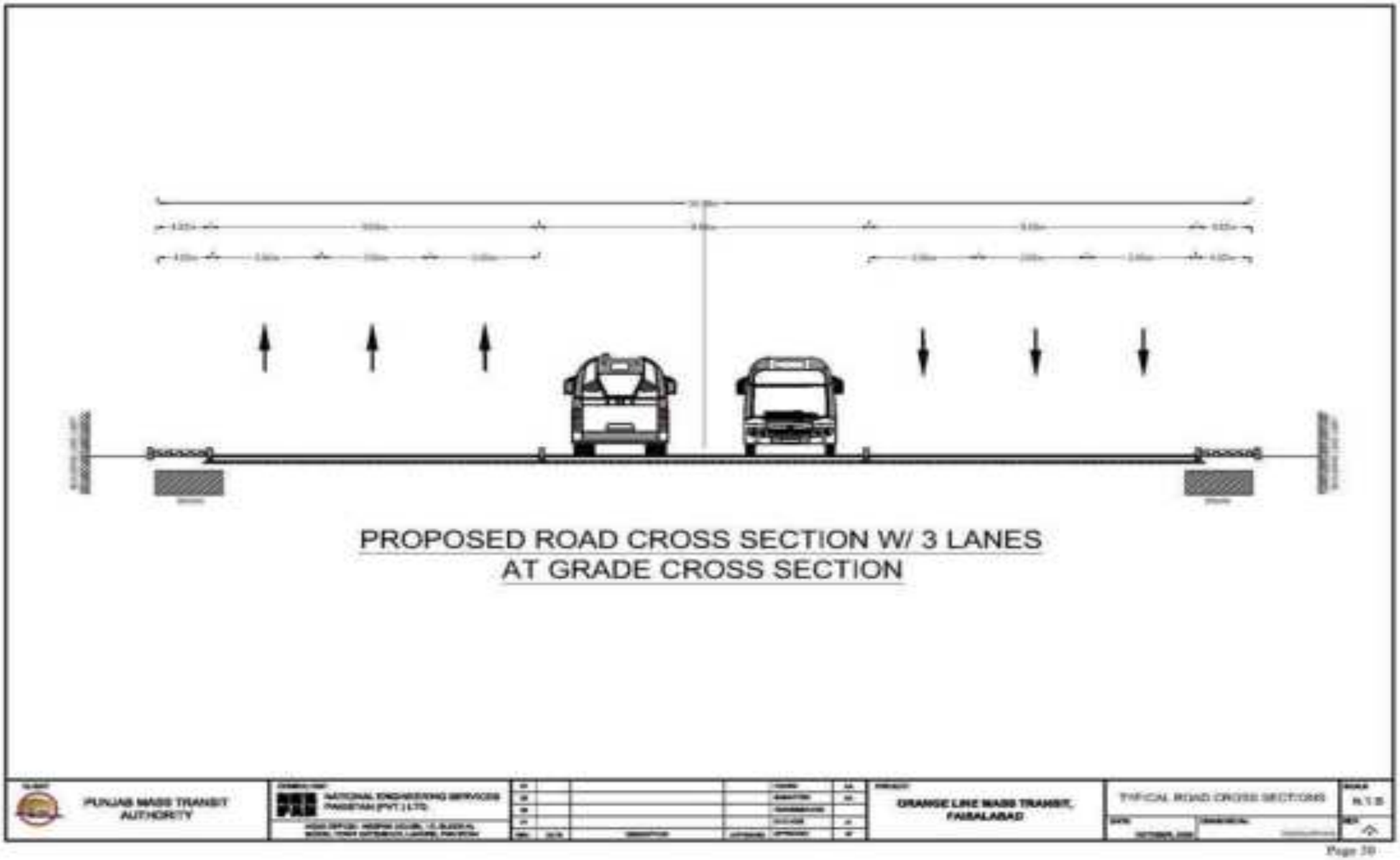

Figure 4.4: Typical Cross Section of Proposed At-Grade Mass Transit Corridor

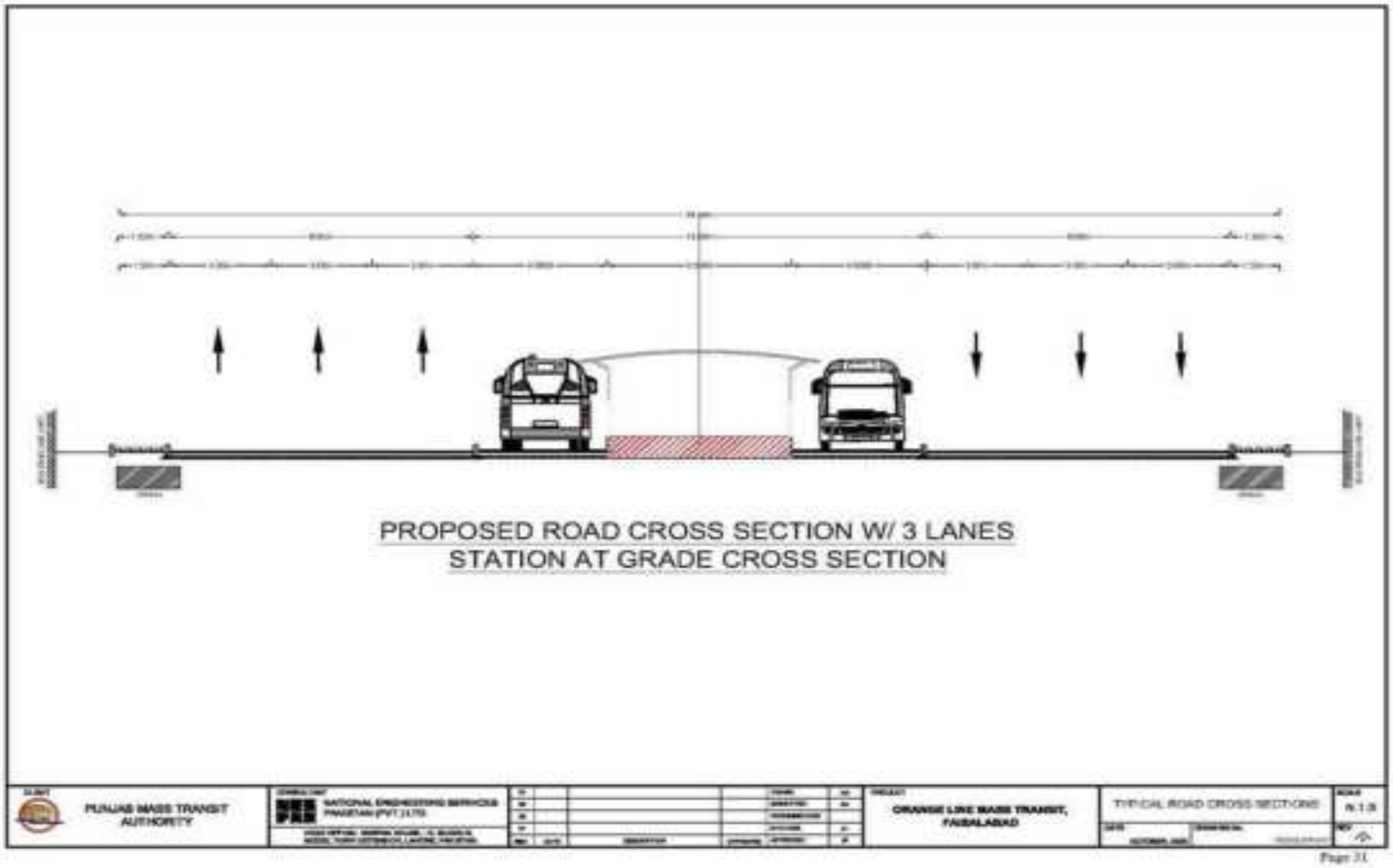

Figure 4.5: Typical Cross Section of Proposed At-Grade Mass Transit Station

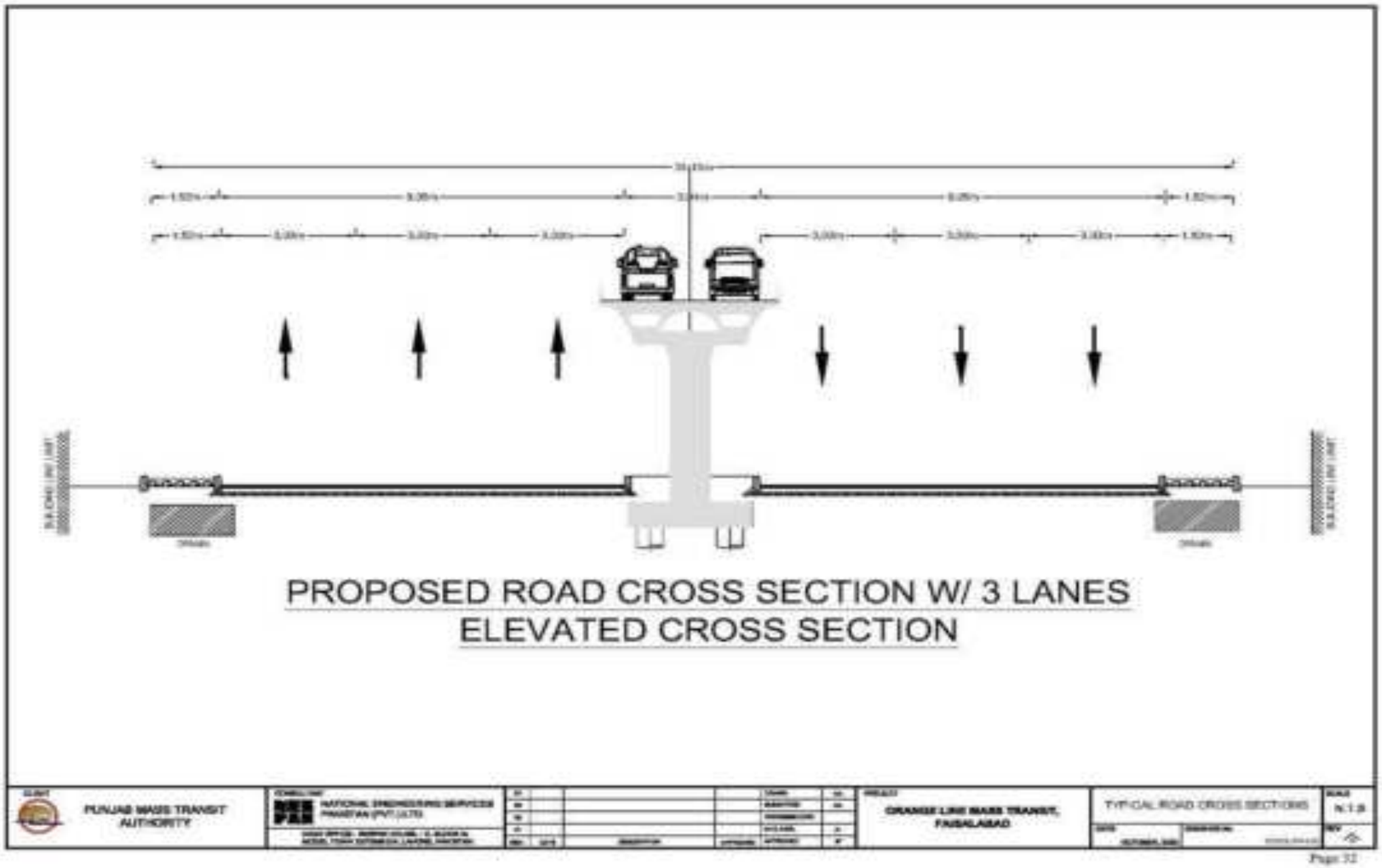

Figure 4.6: Typical Cross Section of Proposed Elevated Mass Transit Corridor

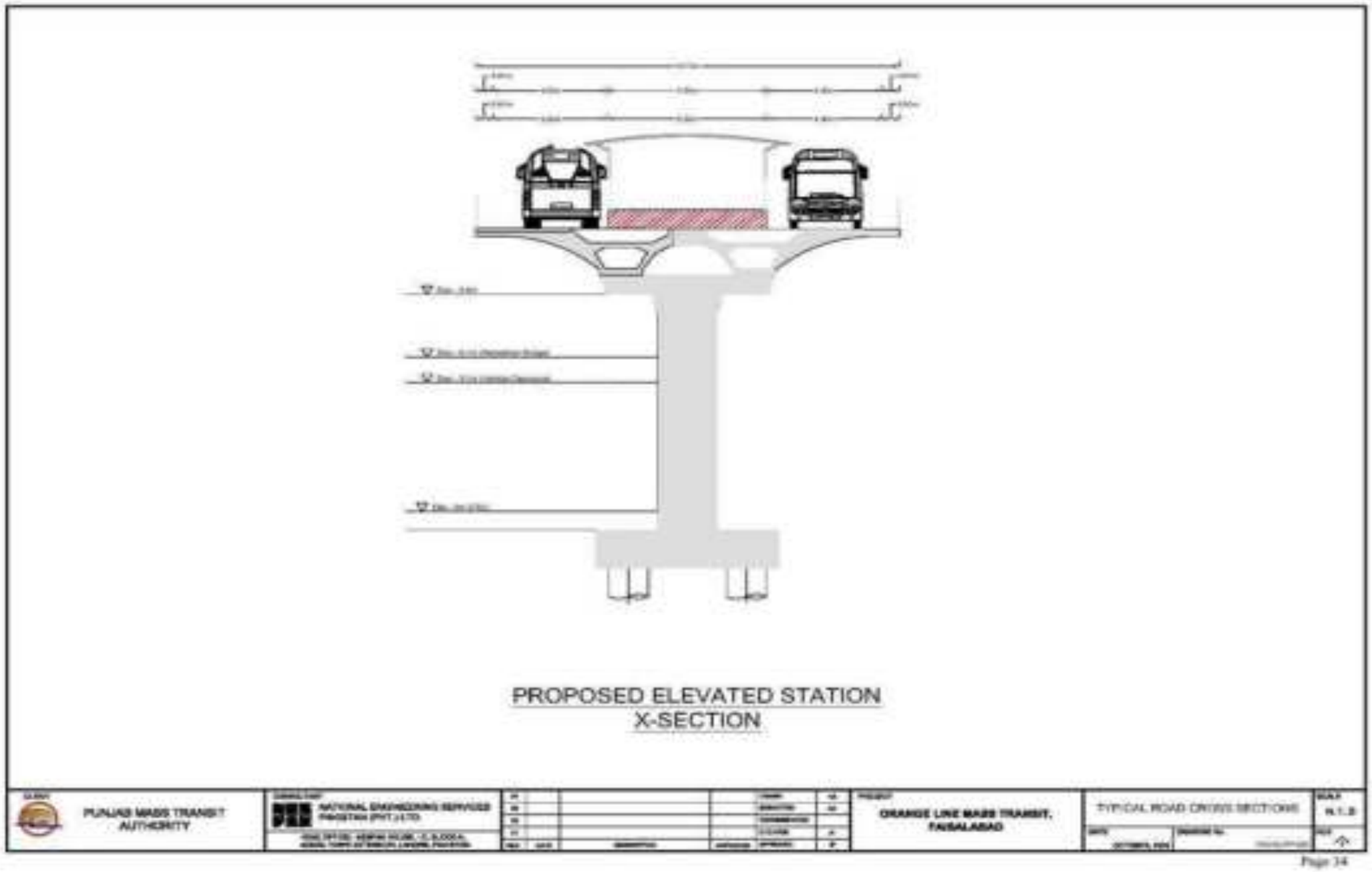

Figure 4.7: Typical Cross Section of Proposed Elevated Station

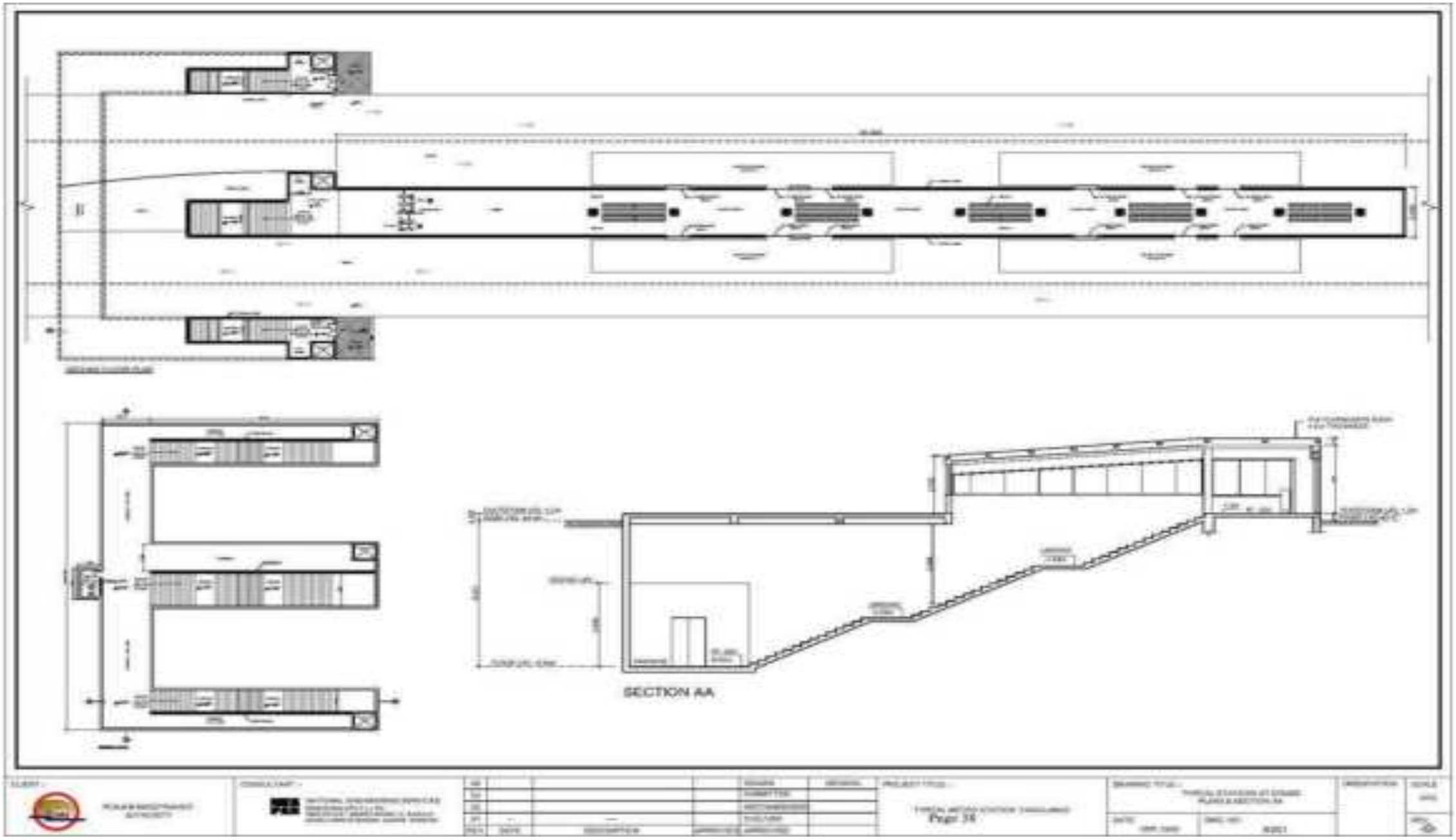

Figure 4.8 (a): Proposed Concept Design Orange Line Stations

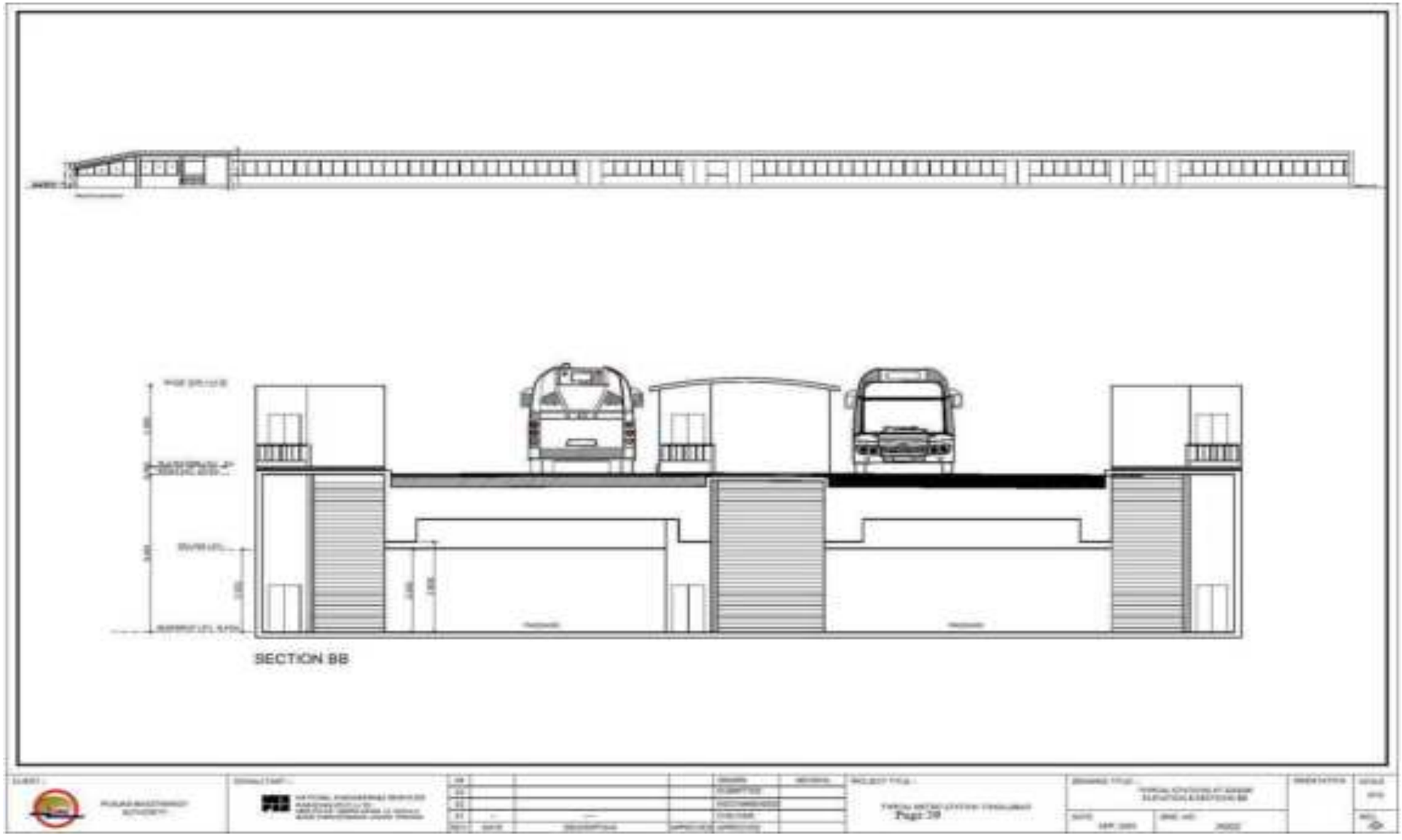

Figure 4.8 (b): Proposed Concept Design Orange Line Stations

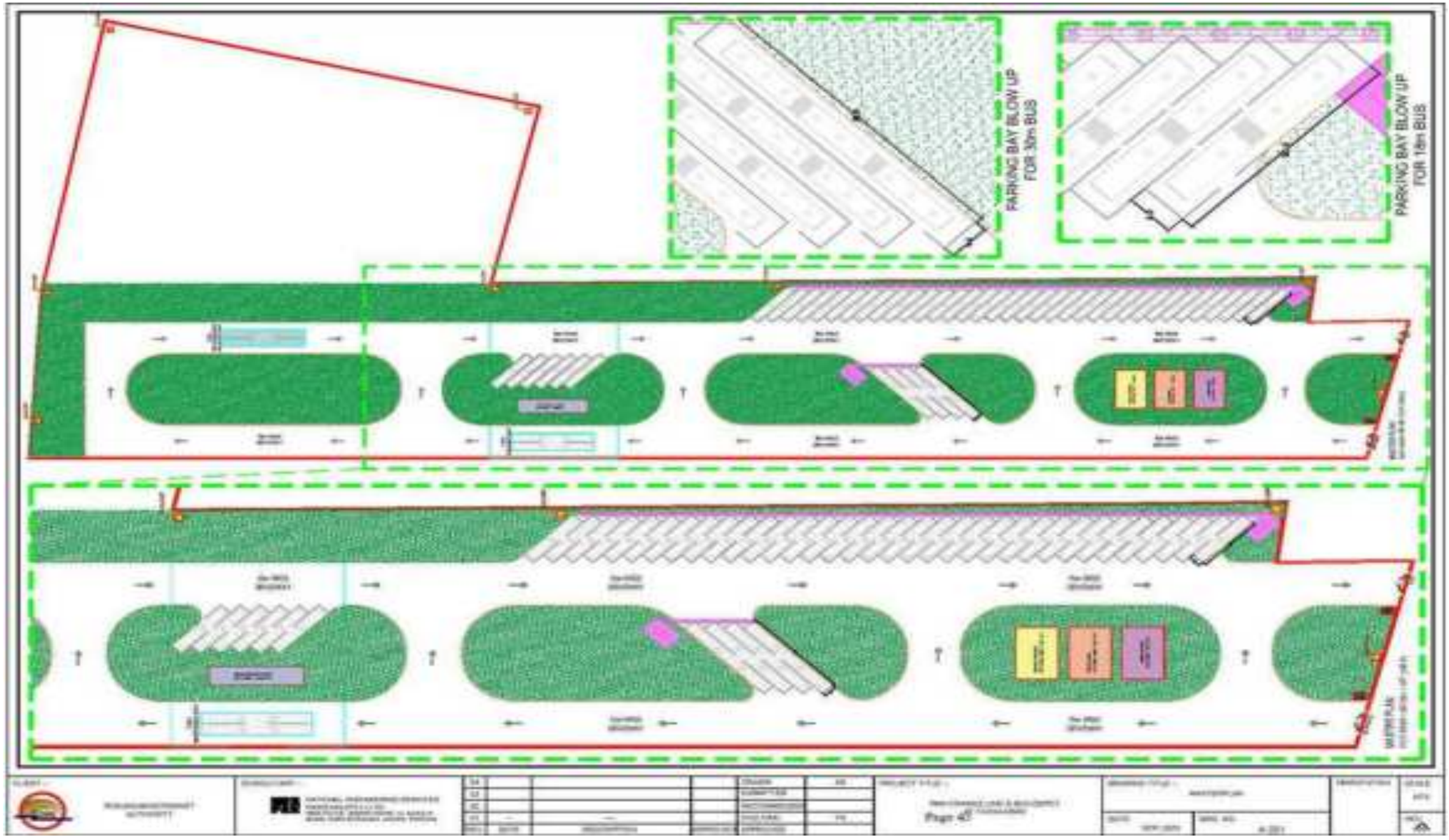

Figure 4.9: Proposed Design Layout of Orange Line Depot

Figure 4.10: Proposed Concept Plan of Orange Line (At-Grade)

Figure 4.11: Proposed Concept Plan of Orange Line Stations (At-Grade)

Figure 4.12: Proposed Concept Plan of Orange Line (Elevated)

Figure 4.13: Proposed Concept Plan of Orange Line Stations (Elevated)

4.8 CONSTRUCTION MATERIAL

The materials used in construction of the proposed project would include following but not limited to: cement, sand, aggregates, stones, reinforced cement concrete frame (RCC Frame), brick infill, brick cladding coarse aggregates (crush), fine aggregates (sand), water, asphalt, reinforcement cement and steel.

a) Crushed Aggregate of required specifications will be utilized by the contractor from available sources nearby the project area.

b) Good quality natural fine aggregate or sand of acceptable gradation will be obtained from nearby licensed or approved entities dealing with fine aggregates.

c) Asphalt, reinforcement and cement material will be transported from the nearby factories or approved dealers for construction purposes.

4.9 EXPECTED EQUIPMENT'S FOR CONSTRUCTION

The list of the machinery and the equipment expected to be used for the proposed Project are provided in **Table 3.3**.

Table 4.1: Machinery and Equipment Requirement for the Proposed Project

Sr. No.	Machinery Name	Sr. No.	Machinery Name
1	Dump Truck	12	Self-Propelled Pneumatic Roller
2	Front End Loader	13	Asphalt Distributor
3	Dozer	14	Batching Plant
4	Grader	15	Concrete Transit Truck
5	Vibratory Roller	16	Concrete Pump
6	Water Tankers	17	Excavator
7	Aggregate Spreader	18	Water Pumps
8	Three Wheel Rollers	19	Cranes
9	Tandem Roller	20	Vibrators
10	Asphalt Plant	21	Generators
11	Paver		

4.10 CONSTRUCTION CAMPS

Construction camps for the construction of proposed Project components will be located within the premises of proposed Project.

However, if construction camp is to be located outside the project boundary, following criteria shall be adopted by the Contractor to identify and for the establishment of the construction camp sites before start of the construction:

- There should be no or minimum resettlement issues for the location of the camps;
- Camp site should be away from the residential areas and sensitive receptors;

- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

4.11 WORKFORCE REQUIREMENTS

Manpower demand estimation is an essential component to facilitate deployment of manpower. Tentative workforce required for proposed Project during construction phase will be about 200 workers/employees. Unskilled labor should be hired locally.

4.12 SOURCE OF WATER

Contractor will be responsible to arrange water for construction works. However, it is supposed that water bowsers will be used by the contractor on the site for construction activities. The source of water during the operation phase for the proposed Project will be the tube wells installed inside the project boundary.

4.13 WATER REQUIREMENT

The water consumption for construction phase is estimated to be 8,000 liters/day for 200 workers during construction phase of the proposed Project.

4.14 WASTEWATER GENERATION AND TREATMENT MECHANISM

The wastewater generation is estimated to be 6,600 liters/day for 200 construction workers during construction phase of the proposed Project[3]. Temporary toilets with cesspit will be adequately installed and treated periodically, and after the completion of work, the ground will be restored.

4.15 SOLID WASTE

The solid waste generation is estimated to be 120 kg/day for 200 construction workers during construction phase of the proposed Project[4].

4.16 POWER REQUIREMENT / POWER SOURCE

[3] Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day
[4] Source: Estimated solid waste generation rate in the study area is about 0.6 kg/person/day.

The main source of electricity/electric power during construction phase will be diesel generators for construction camps. The source of power for operation phase will be Faisalabad Electric Supply Company (FESCO).

5 ENVIRONMENTAL BASELINE

5.1 GENERAL

For any development project, the prevailing environmental conditions need to be assessed prior to the stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures, which forms the basis for the implementation of the proposed project in terms of prevailing environmental and social conditions in the study area.

The existing environmental conditions of the proposed project have been considered within the AOI as shown in **Figure 1.2** with respect to physical, biological and socio-economic aspects. The Study Area is selected on the basis of the Project's potential environmental and social impacts on the local resources. Information has been collected from variety of sources, including published literature, DCRs, field observations, etc. Consultations were also held with the general public and stakeholders of the project area in order to seek the public opinion on the implementation of the proposed Project.

5.2 PHYSICAL RESOURCES

The following section provides an overview of the information on physical environment of the proposed Project study area collected from primary as well as secondary sources. The major parameters covered include Physiographic and Topography, Geology, Soil, Seismicity, Climate and Meteorology, Ambient Air & Noise, Water Resources, Solid Waste, and Land Use.

5.2.1 Topography

Faisalabad, formerly known as Lyallpur, is the third-most-populous city in Pakistan, and the second-largest in the eastern province of Punjab. The total area of the district is of 58.56 square kilometer. It lies between longitude 73° and 74° East and latitude 30° and 31.5° North, at an elevation of 1504 meters above sea level in the rolling flat plains of northeast Punjab. The flat alluvial plan is formed by Chenab and Ravi rivers. The River Ravi flows along the southern-eastern boundary of the district. The land close to the river is relatively lower than that away from the river towards the west. There is no interruption in the monotony of the plain and there is only a fall of some 38 meters from north-east to the south-west of the district. The Topography Map of the Study Area is shown as **Figure 4.1**.

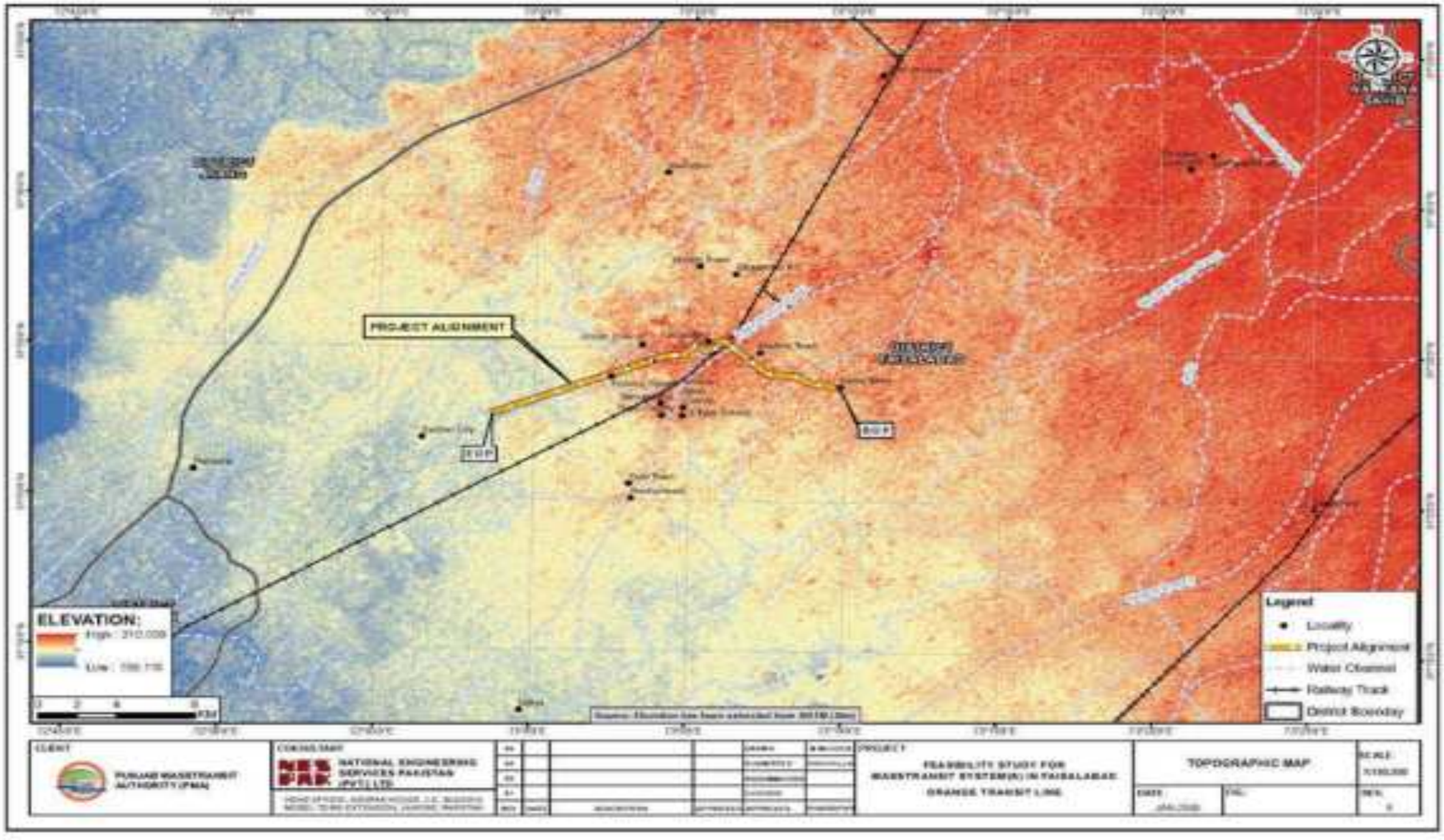

Figure 5-1: Topography Map of the Study Area

5.2.2 Geology

The district of Faisalabad is part of the alluvial plains between the Himalayan foothills and the central core of the Indian subcontinent. The alluvial deposits are typically over a thousand feet thick. The interfluves are believed to have been formed during the Late Pleistocene and feature river terraces. These were later identified as old and young floodplains of the Ravi River on the Kamalia and Chenab Plains. The old floodplains consist of Holocene deposits from the Ravi and Chenab rivers7. The Quaternary deposits comprised of silty clay and sand in varying proportions which are accumulated by braided tributaries of Indus river system, originating from the north-west Himalayas[5].

5.2.3 Soil

The soil of Faisalabad comprises of alluvial deposits mixed with loess (silt loam or very fine sandy loam) having calcareous characteristics. The sub soils and sub strata encountered in the area have been formed by alluvial transported by ancient streams of the Indus River System. The soil is generally very fertile in nature[6].

5.2.4 Seismology

The Project site falls in the Punjab plain, which has low to moderate level of seismicity. The Project region has been subjected to severe shaking in the past due to earthquakes in the Himalayas. The known main active fault of the Himalayas is the Main Boundary Thrust (MBT). The epicenters of low to moderate magnitude earthquakes, recorded in the Punjab plain are associated with the subsurface fractures in the basement rocks, which are concealed by thick alluvial deposits. The basement high, depicted by outcrops of basement rocks near Sargodha, Chiniot, Shahkot, and extending from Sargodha to Faisalabad and further southeast towards Indian border, shows a concentration of earthquakes with magnitude up to 5.5 on the Richter scale.

According to Building code of Pakistan, 2007, the Project Area (Faisalabad) falls in Seismic Zone 2A of Pakistan (low to moderate damage), and peak ground acceleration (PGA) from 0.08 to 0.16 g.

[5] Commission on Engineering Geological Maps of the International Association of Engineering Geology - CEGM- IAEGC, No. 15, 1976.

[6] City District Government Faisalabad, 2019

Figure 5-2: Geological Map of the Study Area

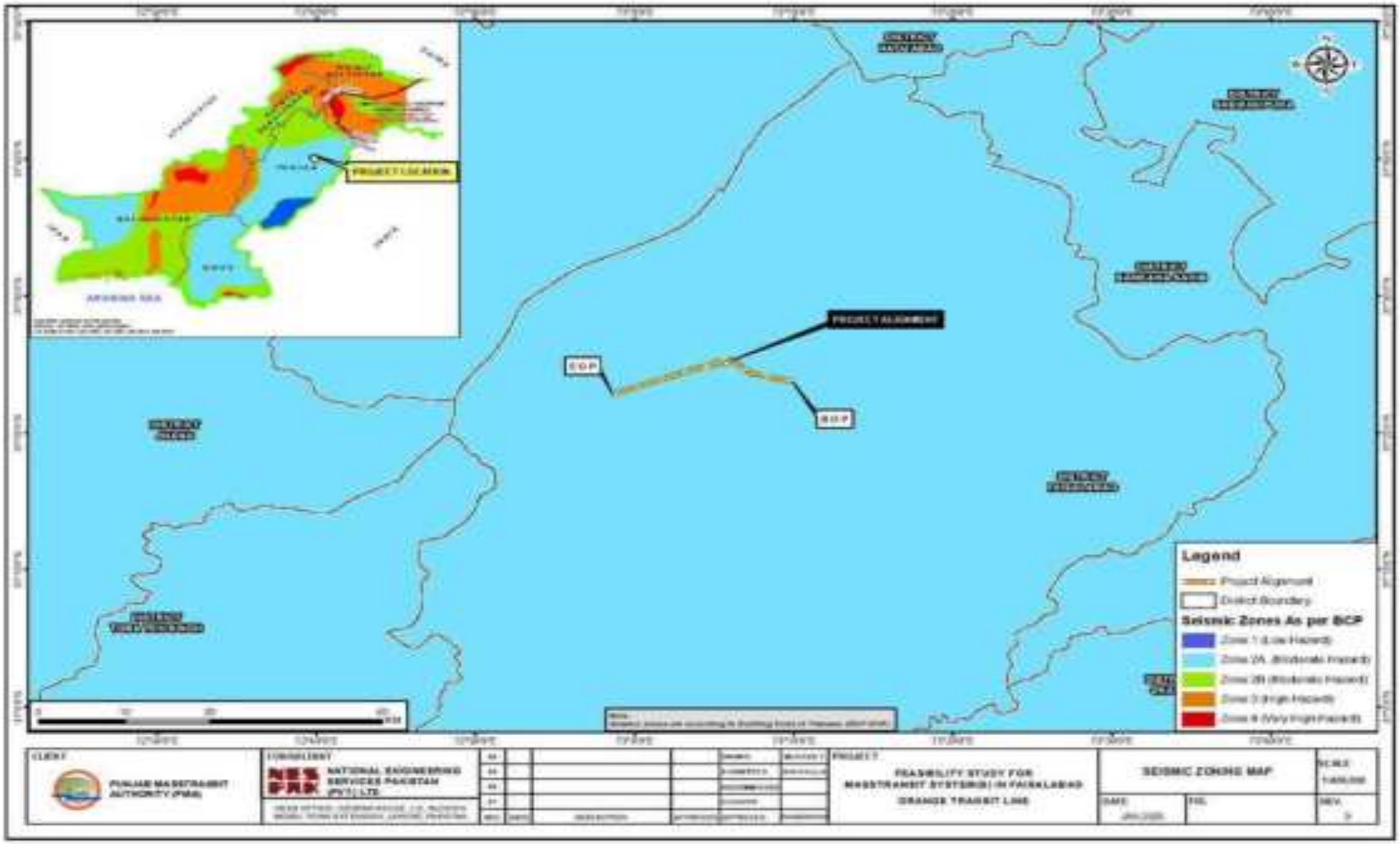

Figure 5-3: Seismic Zone Map of the Project Area

5.2.5 Climate and Meteorology

The seasonal climatic conditions must be considered for the design and execution of the developmental projects. The climate including air, temperature, precipitation, humidity and evaporation are an influencing factor, affecting the construction of engineering structures. However, to determine the overall effect of the climatic stresses, daily and seasonal temperature changes, site altitude, direct solar radiation, and precipitation must be considered.

Temperature, precipitation, relative humidity, evaporation, wind speed and wind direction of the study area (District Faisalabad) is discussed below.

Temperature

Figure 5.4 shows the graphical presentation of mean temperatures in the Study Area for the year 2015-2025. The mean max. temperature measured is 43°C in June and the lowest temperature was observed in January, i.e. 9°C.

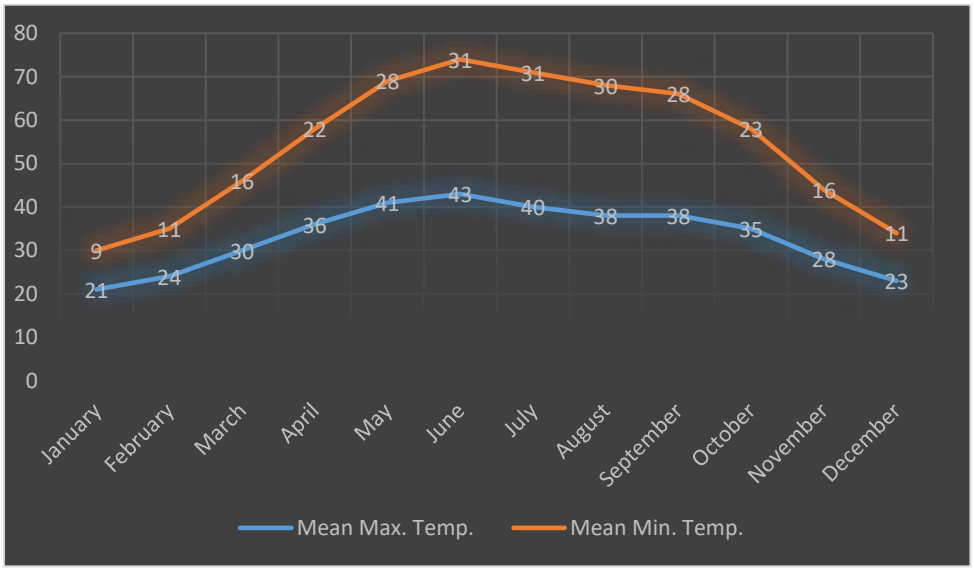

Figure 5-4: Mean Maximum and Minimum Temperature in the Study Area (2015-2025)

Precipitation (Rainfall)

Figure 5.5 shows the mean monthly precipitation in the study area for the year 2015-2025.

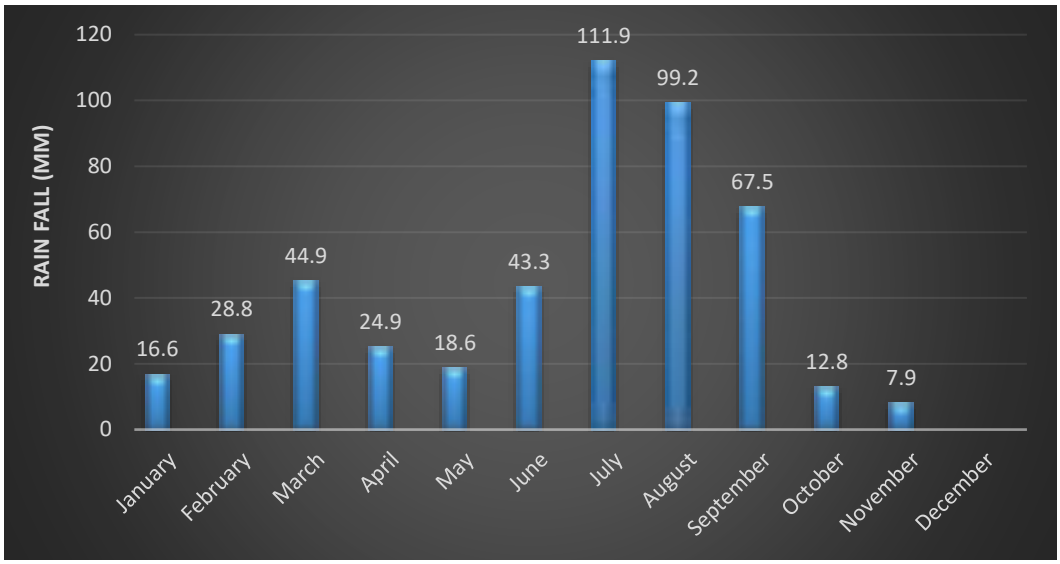

Figure 5-5: Average Precipitation in the Study Area (2015-2025)

Relative Humidity

A mean daily data of humidity on a monthly basis from 2015 to 2025 is shown in Figure 5.6.

Figure 5-6: Mean Relative Humidity in the Study Area (2015-2025)

Wind Speed and Wind Gust

Figure 5.7 depicts average wind speed on a monthly basis in the study area from year 2015 to 2025.

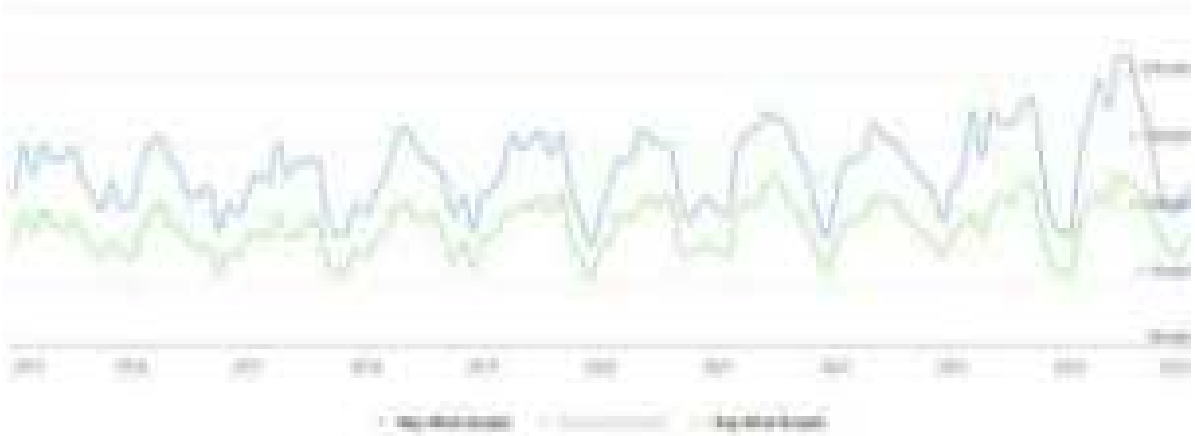

Figure 5-7: Average Wind Speed in the Study Area from 2015 to 2025

5.2.6 Ground Water

Groundwater is the main source of water supply in Faisalabad city and is managed by Water and Sanitation Agency-Faisalabad (WASA-F) and Public Health and Engineering Department (PHED). Unfortunately, groundwater is quite saline making it unfit for human consumption. Therefore, to meet the city's water demand, WASA-F draws water from different well-fields (Chiniot well-field: 120 m to 140 m, and Jhang Branch Canal: 133 m to 165 m)[7] along with other small water works in the city which together produce around 110 MGD of water supplied to consumers by WASA-F. These are discussed as below:

i. Chenab (Chiniot) Well-Field

Chiniot Well-Field is located near Chenab River in Chiniot district. A total of twenty nine (29) tube wells are installed in Chiniot well-field and design discharge capacity of one tube well is 400 m3/hour with 20 hours working capacity per day with a maximum discharge capacity of 224,000 m3/day (about 49 MGD). However, the maximum discharge has reduced to 160,000- 170,000 m3/day or even less because some of the tube wells are not functional or the average working hours are reduced to about 18 hours or 20 hours per day. The main reasons for non- functionality or reduced operational hours of tube-wells are delay in necessary repair and maintenance and/or budget limitations on the payment of electricity bills requisite for operation. The static ground water level ranged between 2 to 5 m from ground level at the time of installation.

ii. Jhang Branch Canal (JBC) Well-Field

Tube wells installed along the Jhang Branch Canal are known as the JBC Well-Field, located 13 km from Faisalabad city's terminal reservoir. A total of 25 tube wells were installed in the JBC Well-Field in 2011, adding 91,000 m3/day (about 20 MGD) to the water system in accordance with the design criteria. To keep the ground water level stable, the discharge design of each tube well was set at about 200 m3/hour with working capacity of about 20

[7] Water and Sanitation Agency, 2017. Water Supply, Sewerage and Drainage Master Plan for Faisalabad, Interim Report.

hours per day for each tube well. The static ground water level ranged between 3 m to 8 m from ground level at the time of installation.

iii. Tube wells along the Rakh Branch Canal (RBC)

Rakh Branch Canal (RBC) passes through the center of Faisalabad city where the old tube wells (16 numbers) were installed along RBC. These were the only tube wells situated near Faisalabad city until 2007. New tube wells (22 numbers) were constructed in 2008 and 2016 respectively in upstream of RBC to avoid contamination from pollution occurring in the urban areas. Therefore, the target water supply flow rate from old and new tube wells along RBC was 82,000 m3/day (about 18 MGD). But, the actual discharge in the present situation from RBC tube wells is about 60,000 m3/day (about 13 MGD). Static water level at the time of tube well installation was within the range of 6-10 m from ground level.

iv. Jhal Khanuana (JK), Millat Town (MT) and Gulfishan Colony Water Works

Jhal Khanuana (JK) water works is situated on the left bank of RBC and is used to withdraw water from the canal. Water from JK is subjected to treatment through slow filtration process and flows into the main water channels of the city.

Similar to the JK water works, another slow filtration water plant was installed at Millat Town that draws raw water from one of the main tributaries of JBC. Design capacity of the installed water works is approximately 5,000 m3/day (about 1.0 MGD) and provides water to new residential area of Millat Town independently. Additionally, about 7,500 m3/day (1.5 MGD) of the water is added to the system by water works plant installed at Gulfishan Colony, Faisalabad city.

5.2.7 Surface Water Hydrology

Faisalabad region is surrounded by the two main rivers of Punjab; Chenab River towards the north and Ravi River towards the south. The entire district lies in the Rechna Doab (the area between Ravi River and Chenab). The Rechna irrigation system comprises of Upper Chenab Canal (UCC), Lower Chenab Canal (LCC), Marala-Ravi Link canal, Bomban–Wala Ravi Badian Depalpur (BRBD) Canal, and Trimu-Sidhnai Link canal. The surface water resources present in the Faisalabad are discussed below in detail.

Chenab River

The Chenab River originates from the upper Himalayas in India. The river flows from the north- east to the south-west direction of national borders between Pakistan and India, and then finally joins the River Indus. Chenab River flows almost 30 km away to the north of Faisalabad city39. Discharge of the Chenab River is monitored upstream and downstream of the Khanki Head and the Qadirabad Barrage Works as shown in **Figure 5.8**. The Qadirabad Barrage is built about 100 km upstream of Chiniot city which is located along Chenab River (north of Faisalabad city). The Khanki Head Works is installed about 30 km upstream of the Qadirabad Barrage.

5.2.8 Solid Waste

Faisalabad Waste Management Company (FWMC) is responsible authority to ensure efficient collection, transportation, recovery, treatment and disposal of waste generation in Faisalabad. The total waste generation of Faisalabad is approximately 1,300-1,600 tons[8] per day and per capita waste generation is 0.6 kg/capita/day. Only 1,250[9] out of 1,600 tons/day of waste is being collected and dumped by FWMC, and remaining waste is being dumped at road side and in nearby canals / drains / nullahs by residents. Machinery used for collection of waste is container, arm roll, trolley, dumper and loaders.

Plate 5.1: Existing Waste Management Practices along the GT Road

[8] Hafsa Yasin and Muhammad Usman, 2017. Site investigation of open dumping site of Municipal Solid Waste in Faisalabad. Earth Science Pakistan (ESP) 1(1) (2017) 23-2

[9] https://www.fwmc.com.pk/

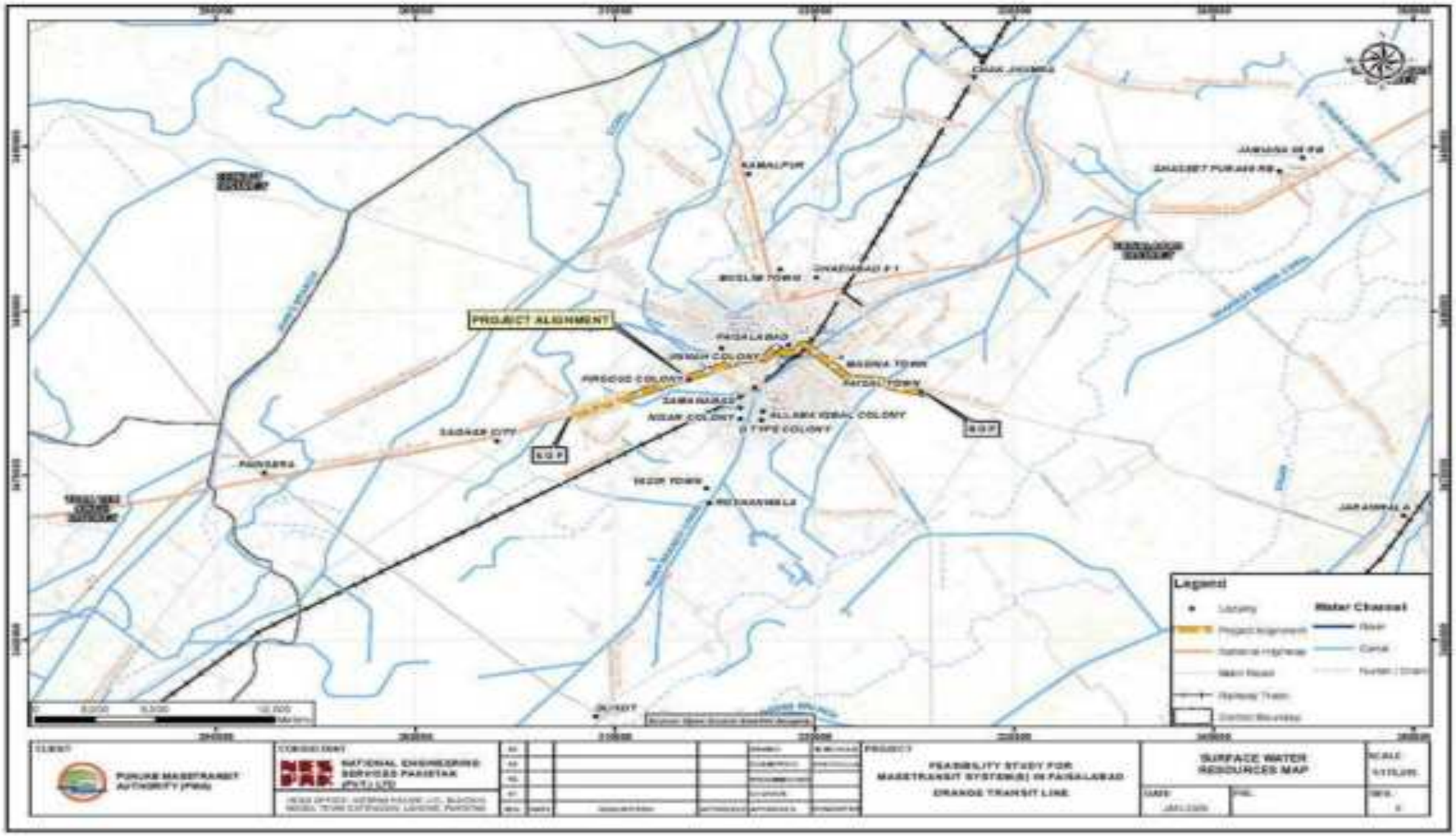

Figure 5.8: Surface Water Resources Map of the Study Area

5.3 ENVIRONMENTAL MONITORING

The environmental parameters for ambient air, noise level and groundwater were monitored in January, 2026 and these results were used for establishing the baseline profile of the Study Area. Environmental monitoring reports of are attached as **Annex-II**. **Figure 5.9** shows the Environmental Monitoring Map of the proposed project.

5.3.1 Air Quality

The ambient air quality monitoring for Nitrogen Dioxide (NO_2), Nitrogen Oxide (NO), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Ozone (O_3), Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}) and Suspended Particulate Matter (SPM) was carried out in the Project Area. The sampling was conducted for 24 hours duration for NO_2, NO, SO_2, $PM_{2.5}$, PM_{10} and SPM, 1 hour for O_3 and 8 hours for CO.

The detailed results of ambient air quality monitoring have been attached in **Annex-II**, while the average concentrations of ambient air pollutants are given in **Table 5.1**. A pictorial view of environmental monitoring is shown in **Plate 5.2**.

Table 5.1: Ambient Air Quality Analysis

Parameter	Unit	Monitoring Duration	Average Concentration of Pollutants				Limits as Per PEQS, 2016
			AA-1 (Near Faisalabad Agriculture University, Jhang Road)	AA-2 (GTS Chowk Faisalabad)	AA-3 (Near Kohinoor Plaza, Jaranwala Road)	AA-4 (Near Sitara Park, Jaranwala Road)	
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	36.80	38.80	32.60	39.40	80 µg/m³ for 24 Hours
Nitrogen Oxide (NO)	µg/m³	24 Hours	19.72	21.33	16.53	23.73	40 µg/m³ for 24 Hours
NOx	µg/m³	24 Hours	56.52	60.12	49.12	63.12	120 µg/m³ for 24 Hours
Sulfur Dioxide (SO_2)	µg/m³	24 Hours	38.86	44.76	33.86	41.76	120 µg/m³ for 24 Hours
Carbon Monoxide (CO)	mg/m³	08 Hours	2.65	2.80	2.36	2.94	5.0 µg/m³ for 8 Hours
Ozone (O_3)	µg/m³	01 Hours	29.40	34.40	36.6	39.9	130 µg/m³ for 01 Hours
Particulate	µg/m³	24 Hours	***141.42***	***154.32***	***136.32***	***159.12***	35 µg/m³

Matter ($PM_{2.5}$)							for 24 Hours
Particulate Matter (PM_{10})	µg/m^3	24 Hours	***174.73***	***181.43***	***164.73***	***191.23***	150 µg/m^3 for 24 Hours
Suspended Particulates Matter (SPM)	µg/m^3	24 Hours	351.15	370.75	336.05	385.35	500 µg/m^3 for 24 Hours
Lead	µg/m^3	24 Hours	0.20	0.19	0.18	0.20	1.5 µg/m^3 for 24 Hours

µg/m^3: micrograms per cubic meter
PEQS: Punjab Environmental Quality Standards

Table 4.1 indicates that all the parameters are well within permissible limits of PEQS except PM_{10} & $PM_{2.5}$ which may due to high vehicular movements in the project area, traffic congestion and dust emissions.

Plate 5.2: A view of Ambient Air Monitoring in Project Area

5.3.2 Noise Level

Noise level monitoring was carried out in the project area location in the study area. Major sources of noise observed at the site were vehicular traffic in and around the study area.

The detailed results of noise monitoring have been attached in **Annex-II**, while the average concentrations of noise level are given in **Table 5.2**.

Table 5.2: Average Concentration of Noise Level

Averaging Time	PEQS, 2016 Category B (Commercial Area)	NL-01 Average Value in dB (A)	NL-02 Average Value in dB (A)	NL-03 Average Value in dB (A)	NL-04 Average Value in dB (A)
Day-time	65	86.88	88.58	85.60	87.78
Night-time	55	58.99	62.40	59.10	61.30

The above results show that the average noise values at day and night time are very high w.r.t permissible limits of PEQS due to high vehicular movements in the project area and traffic congestion.

Plate 5.3: A view of Noise Monitoring in Project Area

5.3.3 Drinking Water Quality

Drinking water sample were collected from the project area and were analyzed for physical, chemical and microbiological parameters. **Table 5.3** shows the results of ground water analysis.

Table 5.3: Results of Ground Water Analysis

Sr. No.	Parameter	Unit	Test Results GW-01 (Kakuana Road)	Test Results GW-02 (Govt. Girls College Commerce, Hashmat Khan Road)	Test Results GW-02 (MC Girls High School, Jhang Road)	Punjab Standards for Drinking Water Quality, 2016
A.	**Physical and Chemical Analysis**					
1.	pH	-	7.32	7.32	7.34	6.5-8.5
2.	Odor	-	Odorless	Odorless	Odorless	Non-Objectionable
3.	Taste	-	Sweet	Salty	Salty	Non-Objectionable
4.	Color	Pt-Co	<1.0	<1.0	<1.0	≤ 15 TCU
5.	Turbidity	NTU	<0.1	<0.1	<0.1	< 5 NTU
6.	Total Hardness	mg/l	216.0	594.0	378.0	< 500 mg/l
7.	Total Dissolved Solids	mg/l	346.0	4588.0	3276.0	< 1000
8.	Chloride	mg/l	23.82	992.60	1062.08	< 250
9.	Cyanide (Cn)	mg/l	<0.01	<0.01	<0.01	≤ 0.05
10.	Fluoride (F)	mg/l	<0.01	<0.01	<0.01	≤ 1.5
11.	Nitrite	mg/l	<0.01	1.39	2.06	≤ 3
12.	Nitrate	mg/l	1.4	7.13	10.04	≤ 50
13.	Phenolic Compound	mg/l	<0.01	<0.01	<0.01	-
14.	Residual Chlorine	mg/l	<0.1	<0.1	<0.1	0.2-0.5
15.	Aluminum (Al)	mg/l	<0.028	<0.028	<0.028	≤ 0.2
16.	Cadmium	mg/l	<0.0028	<0.0028	<0.0028	0.01
17.	Copper	mg/l	<0.0045	<0.0045	<0.0045	2
18.	Chromium	mg/l	<0.0054	<0.0 054	<0.0054	≤ 0.05
19.	Mercury	mg/l	<0.0008	<0.0008	<0.0008	≤ 0.001
20.	Antimony (Sb)	mg/l	ND	ND	ND	≤ 0.005
21.	Nickel	mg/l	<0.008	<0.008	0.3716	≤ 0.02
22.	Zinc	mg/l	<0.0033	<0.0033	0.1279	5.0
23.	Arsenic	mg/l	<0.01	<0.01	<0.01	≤ 0.05
24.	Barium	mg/l	<0.031	<0.031	<0.031	0.7
25.	Boron	mg/l	<0.1	<0.1	<0.1	0.3
26.	Manganese	mg/l	<0.0016	0.12	0.0102	≤ 0.5
27.	Lead	mg/l	<0.013	<0.013	<0.013	≤ 0.05
28.	Selenium	mg/l	ND	ND	ND	0.01
B.		**Microbiological Analysis**				
1.	Total Coliforms	CFU/ 100ml	08	03	02	Must not be detectable in any 100ml Sample
2.	Faecal Coliforms	CFU/ 100ml	02	01	Absent	

The above table illustrates that some physical and chemical parameters along with microbial parameters are higher than permissible limits of Punjab Standards for Drinking Water Quality, 2016, and this water is not suitable for drinking purposes.

Plate 5.4: A view of Drinking Water Sampling at Project Site

5.3.4 Surface Water Quality

Surface Water sample were collected from the Upper Chenab Canal and Lohian Wala Nullah and analyzed for chemical parameters. The analysis results of surface water samples are compared with PEQS. **Table 5.4** shows the results of waste water analysis.

Table 5.4: Surface Water Analysis of the Project Area

Sr. No.	Parameter	Test Results		PEQS, 2016
		Express Canal	Dhulowala Minor Canal	
1.	pH	7.39	7.28	6-9
2.	Total Dissolved Solids (TDS)	68.0	1176.0	1000
3.	Total Suspended Solids (TSS)	11.0	62.0	200
4.	Oil and Grease	<0.2	<0.2	10
5.	Biochemical Oxygen Demand (BOD_5)	5.0	35.0	80
6.	Chemical Oxygen Demand (COD)	7.39	87.0	150
7.	Phenolic Compounds (as Phenols)	<0.01	<0.01	0.1
8.	Chloride (Cl^-)	7.94	297.78	1000
9.	Fluoride (F^-)	<0.01	<0.01	10
10.	Cyanide (CN^-)	<0.01	<0.01	1.0
11.	An-ionic Detergents	ND	04	20
12.	Sulfate (SO_4^{2-})	21.81	171.63	600

Sr. No.	Parameter	Test Results		PEQS, 2016
		Express Canal	Dhulowala Minor Canal	
13.	Sulfide (S^{2-})	<0.2	<0.4	1.0
14.	Ammonia (NH_3)	<0.002	2.24	40
15.	Cadmium (Cd)	0.0028	0.0017	0.1
16.	Chromium (Cr)	<0.0054	<0.0054	1.0
17.	Copper (Cu)	<0.0045	0.0169	1.0
18.	Lead (Pb)	0.1483	0.8606	0.5
19.	Mercury (Hg)	<0.0008	<0.0008	0.01
20.	Selenium (Se)	ND	ND	0.5
21.	Nickel (Ni)	0.0346	0.2764	1.0
22.	Silver (Ag)	0.5083	0.458	1.0
23.	Zinc (Zn)	0.2378	0.1536	5.0
24.	Arsenic (As)	<0.01	<0.01	1.0
25.	Barium (Ba)	0.0733	<0.031	1.5
26.	Iron (Fe)	1.3140	1.4237	8.0
27.	Manganese (Mn)	0.2686	0.1710	1.5
28.	Boron (B)	<0.1	<0.1	6.0
29.	Total Chlorine	<0.1	1.6084	1.0
30.	Pesticides	ND	ND	-
31.	Total Toxic Metals	1.0933	ND	2.0

The above table shows that, in surface water parameters are within permissible limits of PEQS.

Plate 5.5: A view of Surface Water Sampling at Project Site

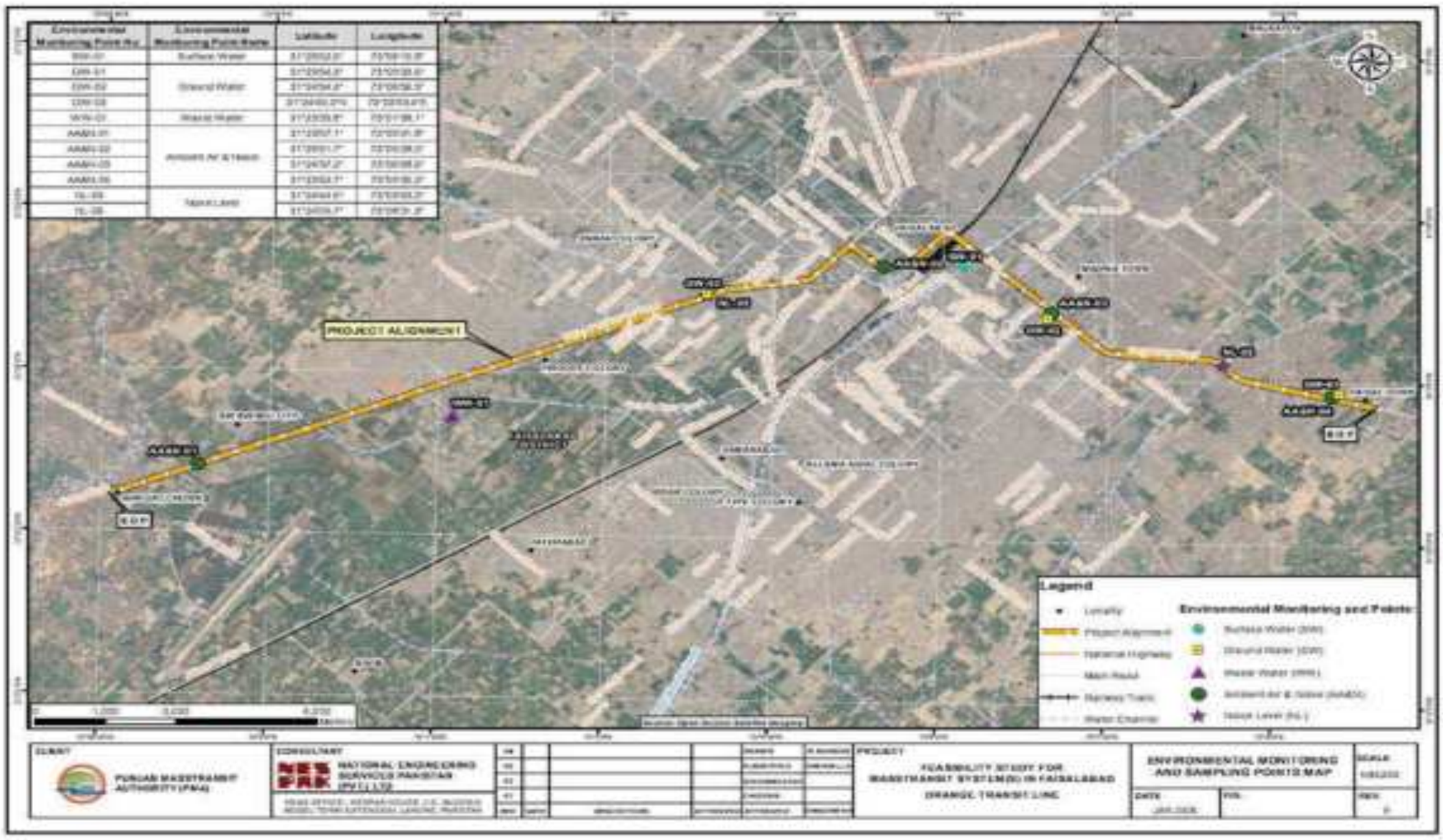

Figure 5.9: Environmental Monitoring Map of Proposed Project

5.4 LAND USE PATTERN

The land use of the study area is mainly of Barren / Open Area, Builtup Area, green belts and roads. **Table 5.5** depicts land use cover of the Project area. Pictorial views of current landuse are provided in **Plate 5.6**. The land use map of the proposed Project site is shown in **Annex-III**.

Table 5.5: Land Use Type

Landuse Type	Area (acres)
Barren / Open Area	55.28
Bridge	0.099
Builtup Area	196.61
Canal	0.28
Green Belt	21.48
Graveyard	1.51
Open Space	35.59
Road / Track	136.05
Trees / Bushes	8.7

Plate 5.6: Current Land Use of the Project Area

5.5 ENVIRONMENTAL SENSITIVE RECEPTORS

Sensitive receptors are mainly people or other organisms that may have a significantly increased sensitivity and exposure to the pollutants and social disturbance, due to the developmental projects. Thus, sensitive receptors are necessary to be identified, to evaluate the potential impacts of the proposed project on public health and the surrounding environment.

The sensitive receptors identified for the proposed project within COI are: educational institutions; health facilities; and religious institute as shown in **Plate 5.7**. They are sensitive to issues arise due to emission of air pollutants, noise and vibration, traffic congestion, temporary edifice of construction camps and mobilization issues during construction phase. Detailed Sensitive Receptors Map of the study area is attached as **Figure 5.10**.

Plate 5.7: Major Sensitive Receptors of the Project Area

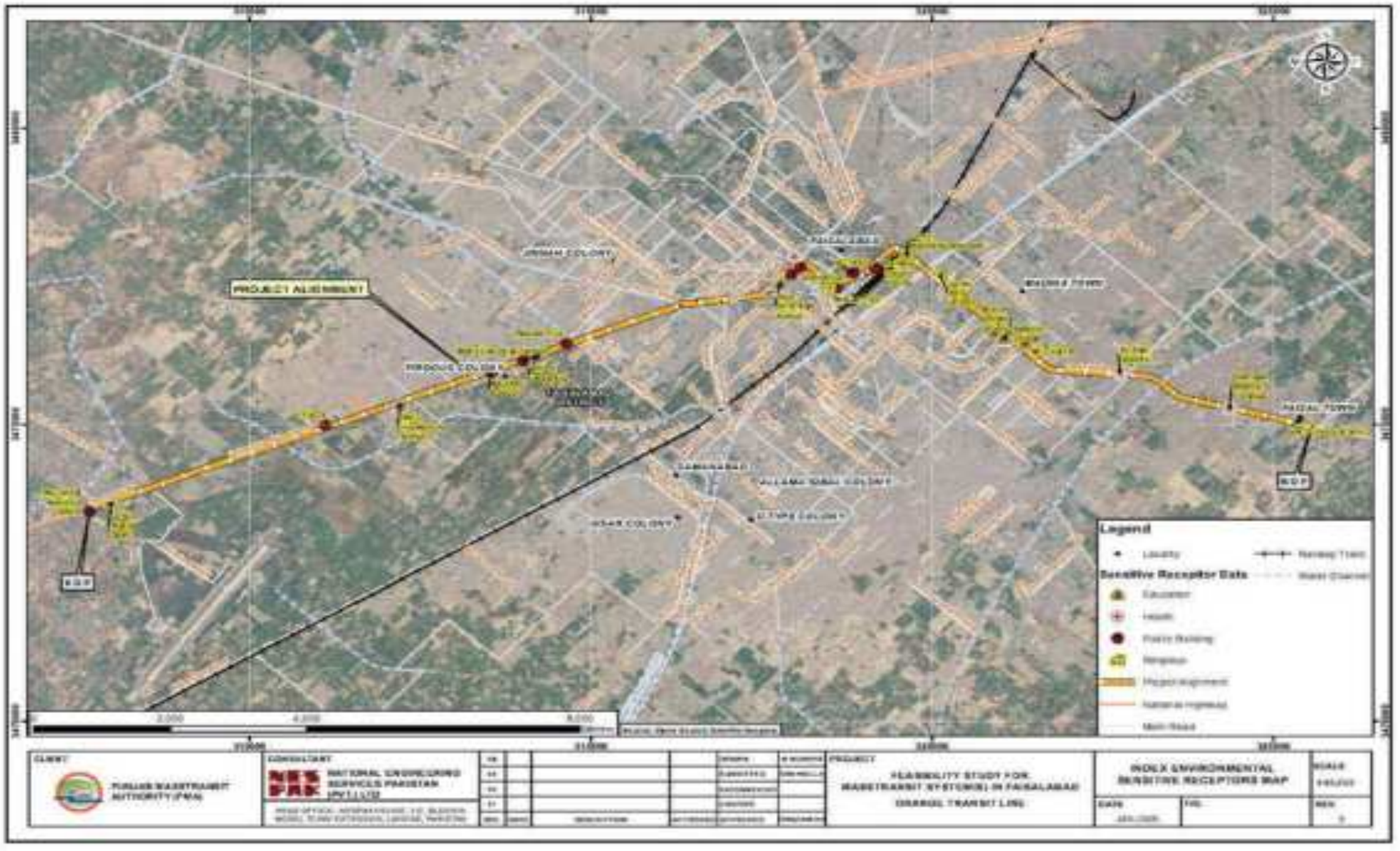

Figure 5.10: Sensitive Receptor Map of the Study Area

5.6 ECOLOGICAL RESOURCES

Ecological study of the area has been conducted using standard ecological assessment technique based on primary and secondary information and inclusion of additional information collected during site visit, discussion and meetings with groups of communities/public living in and around Project area coupled with expert visual observations. Following is the description of the baseline ecological environment of the area.

In general, Faisalabad city is an urban environment with built up area. The natural flora and fauna-based ecosystems and species are insignificant and less in number. Due to disturbances and absence of favorable habitat, the faunal frequency is observed to be lowest in the project area.

Based on the field evaluation and assessment, departmental consultation and secondary data sources, the proposed project area is categorized as “Modified Habitats” that contains a large proportion of nonnative species and human interference has substantially modified the primary ecological functions and species composition of the project area. No species of conservation importance are reported in project area and there are no critical/natural habitats.

5.6.1 Flora

Ecologically, the project area falls in Tropical Thorn Forests Zone with extremely degraded status of indigenous biodiversity. The physical environment along the project corridor comprises of semi-arid climatic conditions. The original Vegetation was predominantly of xerophytic shrubs, grasses, and scattered trees, adapted to low rainfall and high temperatures which has been modified due to human interventions and urbanization in the area. Biodiversity is generally low in tracts.

5.6.1.1 Existing Flora (Vegetation) Along the Project Corridor

Vegetation along the project corridor includes roadside plantation done by the Punjab Forest Department - Faisalabad Forest Division on Jhang Road and established greenbelt and median planation, and landscaping by PHA, Faisalabad. These greenbelts and medians are maintained by the Parks and Horticulture Authority (PHA) and aim to increase the city's green cover.

The roadside plantation is mainly of young (Pole Crop including saplings) to mature trees of Eucalyptus, Shisham, Bakin, Semal, Mulberry, Pelcan, kachnar, Beri, Jaman, Amaltas, Ailstonia, Ficus and variety of ornamental shrubs, palm trees, conocarpus and fruit plants.

5.6.1.2 Trees

Some of the principal trees, shrubs (plants) and herbs (ground covering plants) of the Project area are given below in **Table 5.6**, which illustrates their nomenclature including local names, English names and Botanical names.

Table 5-6: Trees of the Current Region

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status
1.	*Azadarichta indica*	Neem	Not Evaluated
2.	*Eucalyptus camalduolenis*	Saufda	Least Concern
3.	*Dalbergia sissoo*	Shisham	Least Concern
4.	*Terminilia arjuna*	Arjun	Least concern
5.	*Senegalia Senegal*	Gum Arabic tree	Not Evaluated
6.	*Acacia nilotica*	Babul	Not Evaluated
7.	*Ficus virens*	White fig	Least Concern
8.	*Eucalyptus citriodora*	Safeeda	Least Concern
9.	*Ficus benghalensis*	Fig tree	Not Evaluated
10.	*Mangifera indica*	Aam, Mango	Data Deficient
11.	*Phoenix dactylifera*	Khajoor, Date Palm	Least Concern
12.	*Phoenix sylvestris*	Jangli khajor	Not Evaluated
13.	*Morus alba*	Toot/Mulbery	Not Evaluated
14.	*Ziziphus jujube*	Beer	Least Concern
15.	*Conocarpus erectus*	Cono	Least Concern
16.	*Moringa oleifera*	Suwanja	Least Concern
17.	*Ficus benjamina*	Weeping fig	Least Concern
18.	*Syzygium cumini*	Jamun	Least Concern
19.	*Melia azedarach*	Bakain	Least Concern
20.	*Albizia lebbeck*	Siris	Least Concern
21.	*Bismarkia nobilis*	Silver bismarkia palm	Not Evaluated
22.	*Cordia sebestena*	Geiger tree	Least Concern
23.	*Cordia myxa*	Lasura	Least Concern
24.	*Ficus elastic*	Rubber tree	Not Evaluated
25.	*Delonix regia*	Gul e mohar	Least Concern
26.	*Cassia fistula*	Amaltas	Least Concern
27.	*Leucaena leucocephala*	Iple-Iple tree	Not Evaluated
28.	*Terminalia arjuna*	Terminlia tree	Least Concern
29.	*Bombax ceiba*	Semal	Least Concern
30.	*Washintonia filfera*	Washintonia Palm	Least Concern
31.	*Alstonia scholaris*	Alstonia	Least Concern
32.	*Ficus benghalensis*	Bhor	Least Concern
33.	*Ficus religousa*	Peeple	Least Concern
34.	*Ficus elastic*	Rubber Plant	Least Concern
35.	*Lagerstoemia speciosa*	Legerstoemia	Least Concern
36.	*Cordyline terminalis*	Cabbage Palm	Least Concern
37.	*Jacaranda mimosifolia*	Jacaranda	Least Concern
38.	*Bauhinia varigata*	Kachnar	Least Concern

5.6.1.3 Shrubs and Herbs

Shrubs and herbs which are commonly found in the study area are summarized in **Table 5.7**.

Table 5.7: Shrubs and Herbs in the Project Area

Sr. No.	Scientific Name	Local/Common Name	IUCN Conservation Status
1	*Jasminum grandiflorum*	Jasmine	Not Evaluated
2	*Hibiscus rosa-sinensis*	Hibiscus	Not Evaluated
3	*Murraya exotica*	Murva	Least Concern
4	*Lagerstoemia speciose*	Lagerstoemia	Not Evaluated
5	*Grewia tenax*	White crossberry	Least Concern
6	*Duranta plumieri*	Duranta	Least Concern

5.6.1.4 Grasses

The most common grass of the tract is Dacca grass or Khabal (Cynodondactylon). It is a useful fodder grass.

5.6.2 Fauna

Environments for flourishing of faunal species are not encouraging. Fauna is impoverished and degraded, resulting from non-availability of habitat. This process has irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation and hence it offers very little chance for the survival/growth of fauna in the macro environment of project area. There are even otherwise, no threatened species in the project area. There are some of characteristic bird species that have adapted to this environment and in nearby areas. These include Indian roller, common mynah, pigeon, common crow and house sparrow.

5.6.2.1 Mammals

Based on secondary data review and consultation with the Wildlife Department, the presence of large and small mammals has not been reported within the project area or its surroundings, which are predominantly urban in nature. Only common Mongoose is reported occasionally.

Table 5.8: Mammalsof the Study Area

Sr. No.	Common Name	Scientific Name	IUCN status
1	Common Mongoose	*Herpestesed wardsii*	Least Concern

5.6.2.2 Birds

In the project site and its adjoining areas, no endangered bird species exist. The proposed project is also not falling in migratory bird flyway (migration corridor). Some flying birds including common birds like sparrows, crows, bulbuls, mynas and egrets are observed and reported by the Wildlife

Table 5.9: Birds in the Project Area

Sr. No.	Common Name	Scientific Name	IUCN Conservation Status
1.	Sanderling	*Calidris alba*	Least Concern
2.	Pariah kite	*Milvusmigrans*	Least Concern
3	Mynah	*Acridotheros tristis*	Least Concern
4.	Bulbul	*Pycnontidae*	Least Concern
5.	House Sparrow	*Passer domesticus*	Least Concern
6.	House Crow	*Corvus splendens*	Least Concern
7.	Heron	*Ardeolagrayii*	Least Concern
8.	Egret	*Egrettagarzetta*	Least Concern
9.	Plover	*Charadriinae*	Least Concern
10.	Black headed Gull	*Chroicocephalus ridibundus*	Least Concern
11.	Little Tern	*Sterna albifrons*	Least Concern
12.	Pariah kite	*Milvusmigrans*	Least Concern

5.6.2.3 Endangered species

There are no endangered species of flora and fauna in the study area.

5.6.2.4 Wildlife Sanctuaries and Game Reserves

No wildlife sanctuary or game reserve is located in the vicinity of the study area.

5.6.2.5 Critical Habitats

No critical habitats exists near the project area or the study area therefore it can be stated that this project does not affect any critical habitat as, no critical habitat is located close to the project area.

5.6.3 Horticulture

No significant horticulture practices were reported except a few of guava, papaya and lemon trees were observed in CoI during the site surveys. Some sporadic trees of Date Palm, Citrus, fig and Jaman have been planted in the study area.

5.7 SOCIO-ECONOMIC ASPECTS

5.7.1 General

The socioeconomic baseline covers the demography, administrative and political settings, religious and cultural, economic aspects, infrastructure and facilities, and gender aspects.

To document the socio-economic conditions of the population settled in the Project Area, social surveys of the selected Households (HH) were carried out. One of the major steps after the identification of the affected areas and their estimated populations during the initial survey of January, 2025 using the random sampling methodology.
The basic objectives of the social survey was to:

- Observe and document the existing socio-cultural settings of the study area;
- Identify the potential impacts associated with the implementation of the proposed project;
- Get feedback from community about existing and potential social issues; and
- Evaluate the possibilities of addressing them in the report.

Socio-economic survey of the study area was carried out and baseline information was collected from direct and indirect affectees during the field visit.

5.7.2 Methodology

Relevant secondary data/information was collected from various departments at the central and the provincial level was cross checked to establish their authenticity.

Both qualitative and quantitative assessments were done for the social assessment study covering different social environment parameters of the project location by interacting with social groups and relevant stakeholders of the project area. Quantitative survey methods involved filling up of questionnaires at local areas and household levels by sociologists and enumerators. The questionnaires contained mostly structured questions for collection of the required data.

The study area for socio-economic survey includes the areas which will be directly and indirectly affected due to the proposed Project activities. Social survey of total one hundred thirty-five (135) respondents were conducted. The households were selected by using random sampling technique, a type of probability sampling. Questionnaires were developed to collect the baseline data, based on the demographic and socio-economic indicators. Interviewing technique was used as a tool for data collection. In order to quantify the existing baseline conditions of the study area, collected data was digitized and analyzed.

In addition, the survey was followed by public consultations through group discussions, key informant interviews, participatory observation and by using a structured proforma.

5.7.3 Task Specific Approach

In conducting the social survey, full concentration was given to identify area of impacts and collection of necessary data/information on the existing social environment (economic, social, cultural etc.). This was done by holding discussions / meetings followed by in-depth survey and administering structured / semi-structured questionnaires. Assessment was also made about the project impact on the livelihood of the people.

5.7.4 Discussion with Officials

The Consultant had frequent discussions with the client and the concerned project officers to get a clear understanding about the project. This facilitated sharing of ideas, conceptual clarity and minimized constraints in carrying out the task.

5.7.5 Data Collection and Field Survey

The Consultant conducted field survey/investigation on various socio-economic aspects to assess the existing socio-economic environment of the project area as well as identify likely impacts under a changing situation with and without the proposed Project. Accordingly, the social study covered the beneficiaries, the affected people and concerned stakeholders in the area and elicited their views / suggestions for mitigation / enhancement of different types of impacts.

5.7.6 Community/Stakeholders' Participation

Community consultations with different stakeholders, beneficiaries and affected communities of the Project Area were organized to facilitate stakeholders' / peoples' participation in the project activities of the proposed project and their views and feedbacks were incorporated for planning/preparation of the proposed project. Such consultations would strengthen the

commitment of a wide cross-section of the affected people, public representatives, government employees and professional groups by giving them an opportunity to participate in key decisions.

5.7.7 Administrative and Political Settings

Faisalabad District falls under the administrative jurisdiction of Punjab, Pakistan. At the federal level, the district is represented by 5 seats in the National Assembly, while at the provincial level it holds 11 seats in the Provincial Assembly of Punjab. Administratively, Faisalabad is divided into six tehsils: Faisalabad City, Faisalabad Sadar, Jaranwala, Samundri, Tandlianwala, and Chak Jhumra. Under the Local Government system, the district comprises one District Council and multiple Municipal Committees corresponding to its major urban centers, overseeing municipal services, development, and local governance.

5.7.8 Demography Characteristics Of Faisalabad

At the time of the 2023 census, Faisalabad district had population of 9,075,819 of which 3,691,999 were in Faisalabad City. Faisalabad had a sex ratio of 108 males to 100 females and a literacy rate of 77.34% for males and 69.11% for females. 4,392,979 (48.40%) lived in urban areas. 2,200,114 (24.27%) were under 10 years of age. **Table 5.10** gives the details of the demographic characteristics of the district.

Table 5.10: Demographic Characteristics of the District Faisalabad

Households	Population-2023				Sex Ratio 2017	Average H.H Size	1998-2017 Average Annual Growth Rate
	Male	Female	Transgender	All Sexes			
1,382,773	4,731,224	4,343,633	962	9,075,819	108.92	6.5	2.38

Source: Pakistan Bureau of Statistics (Census 2023)

5.7.9 Rural And Urban Distributions

According to the 2023 Census, Faisalabad District includes both rural and urban areas, with a predominantly rural population. Most residents live in rural areas due to the district's agrarian economy and reliance on agriculture as a primary livelihood. Urbanization is gradually increasing, particularly in Faisalabad city and surrounding towns such as Jaranwala, Samundri, and Chak Jhumra, which serve as centers for trade, services, and small-scale industries. Out of the total estimated 620,000 households in the district, a smaller but growing share is concentrated in urban areas, reflecting steady urban expansion, while rural settlements continue to dominate the overall settlement pattern.

5.7.10 Religion

The population of Faisalabad District is predominantly Muslim, comprising approximately 96–97% of the total population. Christians form the second-largest religious community, making up about 2–3%, while other religions or those not stated account for a very small

fraction. This religious composition reflects the broader pattern of central Punjab, with Islam as the dominant faith and small minority communities primarily residing in urban and peri-urban areas.

5.7.11 Mother Tongue

Punjabi is the predominant mother tongue spoken by the majority of the population in Faisalabad District. Other languages include Urdu (around 2%), Pashto (about 0.5%), and Saraiki (approximately 0.1%), indicating limited linguistic diversity within the district.

5.7.12 Ethnic Structure

The ethnic composition of Faisalabad District includes major groups such as Jatt, Rajput, Arain, Gujjar, Malik, Sheikh, Butt, Mughal, and Kamboh, present in both rural and urban areas. These communities are traditionally engaged in agriculture, trade, and small-scale businesses. Additionally, artisanal and service-based groups, including Lohar (blacksmiths), Tarkhan (carpenters), Kumhar (potters), Mochi (cobblers), Nai (barbers), and Julaha (weavers), are mainly found in rural areas, contributing to the district's social and occupational diversity.

5.7.13 Industry, Trade and Trade Centers

Faisalabad, often termed the "Manchester of Pakistan," is the nation's premier industrial and manufacturing hub, anchored by a massive and vertically integrated textile sector that forms the backbone of its economy. The city hosts one of the largest concentrations of textile mills in Asia, operating a complete value chain from spinning fine-count yarns and weaving fabrics to high-value processing (dying, printing, finishing) and garment manufacturing. This industrial prowess is complemented by a strong agro-processing base, including rice milling, edible oil refining, large-scale dairy production, and flour milling, which capitalizes on the city's location in Punjab's fertile plains. Beyond textiles and agriculture, Faisalabad has a diversified landscape of light engineering, producing agricultural implements, industrial machinery parts, chemicals, pharmaceuticals, and plastics. The commercial ecosystem is supported by specialized wholesale markets, the Faisalabad Dry Port, and a growing services sector. However, this intensive industrial activity presents significant environmental challenges, particularly regarding water pollution from textile effluents and groundwater depletion, necessitating a critical shift towards sustainable practices and advanced waste management to ensure the long-term viability of this economic powerhouse.

Project Area

The proposed project passes through a densely commercial and mixed-use zone, connecting major trade centers with high traffic and informal commercial activity. While construction may cause temporary disruptions, these can be mitigated through traffic management and stakeholder coordination. In the long term, the project is expected to improve mobility, market access, economic integration, and reduce vehicular emissions, supporting commercial growth in the corridor.

5.7.14 Transportation

Faisalabad District is well connected to other parts of Punjab and Pakistan via an extensive road network, linking it to cities such as Lahore, Jhang, Sheikhupura, and Chiniot. Within urban centers, including Faisalabad city, Jaranwala, Samundri, and Chak Jhumra.

Public transportation in the city primarily includes buses, auto-rickshaws, and motorcycle rickshaws for short-distance travel. Ride-hailing services such as Uber and Careem are increasingly available. Local bus services connect urban areas with surrounding rural communities, supporting mobility for work, trade, and education.

Urban transport is inadequate and unsatisfactory. Local residents primarily rely on motorcycle rickshaws, which are neither safe nor comfortable.

5.7.15 Archaeological and Cultural Property/ Places of Interest

Faisalabad has a rich historical and cultural background, shaped by its colonial-era development, industrial heritage, and vibrant agrarian traditions. Key sites of interest include:

- Clock Tower (Ghanta Ghar) and the Eight Bazaars
- British-era Buildings and Canal Colonization Infrastructure
- Lyallpur Museum and other Local Museums
- Shrines and Religious Sites

5.8 SURVEY FINDINGS

Detailed findings of the survey comprising of different parameters are discussed in the following section.

5.8.1 Gender Distribution of the Respondents

About 135 respondents, comprising 97% male and 3% female population in the project was contacted to carry out socio-economic and impact assessment survey.

5.8.2 Population and Family Size

A socio-economic survey of 135 households was conducted as per methodology, which indicated that the population of the surveyed households is about 864 persons and among them, there were more males (52%) than females (48%). The average family size is 5.6 persons per household and mostly people live in nuclear family system. The gender wise distribution of the 135 respondents' families are given in **Table 5.11**.

Table 5.11: Population and Family Size of the Respondents

Total Respondents	Population				Total Population	
	Male	%	Female	%		%
135	450	52	414	48	864	100

Based on the social survey carried out in January 2026

5.8.3 Age Composition

The demographic characteristics of the sample survey show (**Table 5.12**) that 25% of the respondents were up to 25 years of age. Age of 39% of the respondents were 26– 35 years, 20% were 36 – 45 years and 16% were more than 45 years of age. These figures show that by and large respondents were mature enough to give their opinion about the construction of propose project and foresee its impacts.

Table 5.12: Age Composition of the Respondents

Sr. No.	Age composition	Number	Percentage (%)
1	15-25	34	25
2	26-35	52	39
3	36-45	27	20
4	Above 45	22	16
Total		**135**	**100**

5.8.4 Marriage and Marital Status

Endogamy is the prevalent trend of marriage. Most of the people are monogamous as second marriage is expensive. Mothers have very little role in decision-making about marriages of their sons and daughters. As per social survey, the majority of respondents (i.e. 68%) were married, 30% were unmarried and 2% were divorced. **Table 5.13** shows the marital status of the respondents.

Table 5.13: Marital Status of the Respondents

Sr. No.	Marital Status	Number	Percentage (%)
1	Married	93	68
2	Un-Married	41	30
3	Divorced	01	2
Total		**135**	**100**

5.8.5 Literacy

Educational distribution of the respondents shows that seventeen (12%) of the respondents were illiterate. 9% were educated up to primary level. However, 16% and 34% were educated up to middle and matric level respectively. Moreover, 11% respondents were educated up to intermediate and 14% respondents described their education level up to graduation and 4% above graduation. Educational level of the respondents is shown in **Table 5.14**.

Table 5.14: Educational Level of the Respondents

Sr. No.	Education	Number	Percentage (%)
1	Illiterate	16	12
2	Primary	12	09
3	Middle	22	16
4	Matric	46	34
5	Intermediate	15	11
6	Graduation	19	14
7	Above Graduation	05	04
Total		**135**	**100**

5.8.6 Languages Spoken

Punjabi is the predominant language being spoken in the Area while Urdu is a common language.

5.8.7 Housing

5.8.7.1 Ownership Status of the Houses

Sampled respondents were asked about their housing ownership status in order to know their level of living standard as reflected in **Table 5.15**. Majority (69%) of the respondents were living in their own houses and 30% rented houses and remaining 1% were constructed their house on landlord land or encroaches.

Table 5.15: Ownership Status of Houses

Sr. No.	Ownership Status	Number	Percentage (%)
1	Self-Owned	93	69
2	Rented	41	30
3	Other	1	1
Total		**135**	**100**

5.8.7.2 Housing Construction Pattern

A mix-housing pattern was observed among the project area, where 28% of the respondents were living in semi pacca houses, while 70% respondents had pacca houses. Only 2% of the respondents mentioned that they were living in kutcha houses, made with mud and inferior construction material. **Table 5.16** shows construction pattern of houses of the respondents.

Table 5.16: Housing Conditions

Sr. No.	Type of House	Number	Percentage (%)
1	Semi Pacca	38	28
2	Pacca	94	70
3	kutcha	3	2
	Total	**135**	**100**

5.8.8 Economic Aspects

Faisalabad's economy is diversified, with agriculture, industry, and trade as key contributors. The district is a major industrial and textile hub of Punjab, producing textiles, yarn, and garments, alongside significant agricultural output including wheat, sugarcane, and vegetables. Faisalabad's industrial and commercial activities support agro-based processing, manufacturing, and trade, making the city a vital economic center within central Punjab.

5.8.8.1 Occupations

Socio-economic condition of the respondents was also studied during the field survey. Majority 29% of the respondents were running their own business or shops, 25% were doing private service, 22% of the respondents were doing different types of labor including industrial and general labor for earning their livelihood 8% were in Government Jobs. While 6% of the respondents were students, 6% reported themselves as drivers of buses, vans, auto, taxi, etc., and 4% mechanic. The detailed statistics regarding occupational status of the respondents is presented in **Table 5.17** given below.

Table 5.17: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage
1	Business/Shopkeepers	39	29
2	Private Service	34	25
3	Labor Workers	30	22
4	Govt. Employee/ Retired	11	8
5	Students	8	6
6	Driver	8	6
7	Mechanic	5	4
Total		**135**	**100**

5.8.8.2 Income Levels

Socioeconomic findings of the survey revealed that 13% of the respondents were falling in the low-income group of up to rupees 30,000. On the other hand, 30% were earning in the range of 30,001 to 40,000 rupees, and 19% of the respondents were earning their monthly income between the ranges of 40,001 to 50,000 rupees per month. Whereas, 16% of the respondents were earning between 50,001 to 60,000 and remaining 25% were earning above 60,000 per month. **Table 5.18** shows the average monthly income of the respondents.

Table 5.18: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
1	Up to 30,000	17	13
2	30,001 – 40,000	40	30
3	40,001 – 50,000	26	19
4	50,001-60,000	22	16

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
5	Above 60,000	33	25
Total		**135**	**100**

5.8.8.3 Expenditures

Household expenditure depends on the earning of the household members, about 16 % of respondents reported their monthly expenditure up to 30,000, and 22% respondents found within the range of 30,000- 40,000 per month. While, 19% were falling between the expenditure range of 40,001 to 50,000 and 16% recorded their monthly expenditures between the ranges of 50,001-60,000 per month. However, 27% of the respondents were having their expenses more than 60,000 per month. **Table 5.19** shows the average monthly expenditures of the respondents.

Table 5.19: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage
1	Up to 30,000	22	16
2	30,001 – 40,000	30	22
3	40,001 – 50,000	25	19
4	50,001-60,000	21	16
5	Above 60,000	37	27
Total		**135**	**100**

The monthly expenditure and pattern of the expenditure provides an indication for assessing the standard of living of a household. The expenditure on food items includes cereals, pulses, flour, sugar, cooking oil/ ghee, and milk while the expenditure on non-food items are education, medical treatment, clothes, shoes, and toiletries.

5.8.9 Religious and Cultural Aspects

5.8.9.1 Religion, Ethnic and Minority Groups

Among the surveyed respondents, 98% were Muslims and 2% were non-Muslims. The core unit of social organization is the caste system (“baraderi” in local language) in which groups are either defined based on specific occupatioSn or lineage. Jatt, Malik, Rajpoot, Kamoka, Arain,Sheikh and Kharal are major casts in the project area. The social life of the local population is traditionally on urban.

5.8.9.2 Family System

Joint family system is the dominant culture in the project area. It was observed that the family structure in the area was very strong and members played a pivot role in solving their social and cultural problems.

During the socioeconomic survey of the respondents, it was observed that the majority of the respondent i.e. 61% were living within a joint family system, while 39% of the household were living in a nuclear family system. The information relating to the family system in respect of the sample population is shown in **Table 5.20**.

Table 5.20: Family System of the Respondents

Sr. No.	Family System	Number	Percentage
1	Joint	83	61
2	Nuclear	52	39
Total		**135**	**100**

5.8.10 Basic Amenities in the Project Area

Social infrastructure and amenities are crucial to creating sustainable communities. This assessment sets spaciousness of a household's dwelling, household amenities like availability of electricity and modern appliances, nature of access to water, fuel for cooking (ease of fetching in what are primarily women's tasks), and type of sanitation facilities available as primary indicators for assessing standard of living.

5.8.10.1 Educational Facilities

Faisalabad offers a range of educational services through public and private institutions, covering primary to higher education. Key higher education institutions include:

- University of Faisalabad, Main Campus
- Allama Iqbal Open University, Regional Campus
- Punjab Group of Colleges (including Punjab College of Science)
- Divisional Public School & College
- Government Post Graduate College Faisalabad
- Government College for Women
- Various private schools and colleges, such as The Educators,
- Beaconhouse, and Dar-e-Arqam

The proposed project is mostly located within the city area, where government and private educational facilities are available within a short distance.

5.8.10.2 Health Facilities

Faisalabad District has an extensive network of public and private healthcare facilities serving both urban and rural populations. Major hospitals, including the District Headquarters (DHQ) Hospital Faisalabad and Tehsil Headquarter Hospitals in surrounding towns, provide general medicine, surgery, emergency care, and maternal health services. Private hospitals, clinics, charitable institutions, and diagnostic centers, including local labs, support accessible and affordable medical care.

While tertiary-level specialties such as organ transplants or advanced oncology are limited, the district's health infrastructure continues to grow. Numerous private practitioners, Hakims, and homeopathic doctors provide essential primary care throughout both urban and rural areas, ensuring widespread basic healthcare coverage.

The proposed project is mostly located within the city area, where government and private health facilities are available within a short distance.

5.8.11 Civic Facilities

Electricity, telephone, Sui gas, sewerage, and solid waste management facilities are present in most of the project area and its surroundings.

5.8.11.1 Sources of Drinking Water and quality.

Drinking water, also known as potable water, improved drinking water is water safe enough for drinking and food preparation. Access to safe drinking water is not only a basic need and a precondition for healthy life, but is also a basic human right. The quality of water is directly linked to the quality of health.

Drinking water quality in Faisalabad City is a significant concern due to the high proportion of unsafe drinking water sources. The survey findings indicate that the majority of respondents (84%) obtain drinking water from pumps installed near the canal, where recharge from canal water results in comparatively better water quality. In contrast, 5% of respondents obtain drinking water from Reverse Osmosis (RO) plants, while the remaining 11% rely on public water supply systems for drinking purposes.

Furthermore, respondents were asked about the quality of the water they use for drinking. Of the total respondents, 87% expressed satisfaction with the drinking water quality, while the remaining 13% were dissatisfied due to contamination and pollution.

5.8.12 Principal Mode of Transportation

In the study area, majority of the individuals (28%) primarily rely on public transportation. A smaller group of respondents (4%) use private transportation as their main means of travel. Additionally, 68% reported using both public and private modes of transport, indicating a flexible approach to commuting depending on circumstances.

Table 5.21: Principal Mode of Transport

Sr. No.	Principal Mode of Transport	Number	Percentage
1	Public	38	28
2	Private	06	04
3	Both	91	68
Total		**135**	**100**

5.8.13 Satisfaction Level with Existing Transport System

Survey respondents were asked to evaluate their satisfaction of existing service quality. These service quality factors were included: Availability of service, fare, comfort, safety/security, Cleanliness and Time Management. Overall 72% of the respondents indicated that they are not satisfied with the existing transportation service while only 28% reported that they are satisfied (**Table 5.22**).

Table 5.22: Satisfaction Level with Existing Transport System

Sr. No	Opinion	Number	Percentage (%)
1	Yes	38	28
2	No	97	72
Total		**135**	**100**

5.8.14 Awareness & Implementation of Proposed Project

5.8.14.1 Awareness about the Project

A large number of respondents were those, who had prior knowledge of the project. The awareness of the local population about the proposed project is depicted in the **Table 5.23**. All respondents were briefed about the features of the proposed project and its components.

Table 5.23: Awareness about the Project

Sr. No	Opinion	Number	Percentage (%)
1	Yes	122	90
2	No	13	10
Total		**135**	**100**

5.8.14.2 Acceptability of the Proposed Project

During the survey, a vast majority of respondents was in favor of the proposed project, keeping in view its importance and need of the metropolitan city. The reason for accepting the proposed project is the availability of better transport system and improved travelling facilities are expected due to implementation of the project. Contrary to this, few responses were against the construction of the proposed project specifically from rickshaw operators. Due to loss of income source and livelihoods during operation of the project. **Table 5.24** shows acceptability of the project.

Table 5.24: Acceptability of the Project

Sr. No	Opinion	Number	Percentage (%)
1	Yes	116	86
2	No	19	14
Total		**135**	**100**

5.8.14.3 Reasons of Acceptance the Project

Out of 135 respondents, 116 (86%) considered the proposed project to be effective for the reasons presented in **Table 5.25**.

Table 5.25: Reasons of Acceptance

Sr. No.	Reasons	Number	Percentage (%)
1	Better Public Transport System	56	48
2	Smooth Flow of Traffic	21	18
3	Time Saving	17	15
4	Economical and Comfortable	13	11
5	Beneficial for the Development of Area	9	8
Total		**116**	**100**

The remaining 19 respondents (14%) perceived the proposed project as ineffective because it would disrupt business activities, and they considered poverty reduction to be more important than transport development.

5.8.14.4 Perceived Impacts

During the field survey, the anticipated project impacts were asked by the respondents at different stages of the project implementation. The responses of the respondents are obtained and summarized in the **Table 5.26**.

Table 5.26: Perceived Impacts

Sr. No.	Impacts	Number*	Percentage (%)*
1	Better Travelling Facilities	87	64
2	Economical service	67	50
3	Dust & Noise during construction phase	15	11
4	Disturbance of Livelihoods	19	14
5	Reduction in traffic congestion on the road	7	5
6	Loss of Business during construction phase	15	12

*Multiple Responses

6 PUBLIC CONSULTATIONS

6.1 GENERAL

Timely and broad-based stakeholder involvement is an essential element for an effective environmental assessment, as it is linked with project Planning, appraisal and development in general. Public involvement during EIA has a tendency to improve project design environmental soundness and social acceptability.

Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the project design, will lead to better outcomes and lay the basis for on-going positive relationships between the stakeholders. It gives the feeling of an ownership to the local population. Public involvement is necessary for smooth implementation of the project and especially the local community whose support is also required for the success of the project.

The project management and implementation authorities are committed for undertaking public consultation at Provincial and local levels as a part of project planning/design for getting necessary environmental permissions.

This Chapter presents the objectives, process, and outcome of the consultations carried out with the key stakeholders of the project during the present EIA study. A consultation framework, describing the consultations to be carried out during the subsequent phases of the project implementation ensuring ongoing and inclusive dialogues with key stakeholder is also provided in this chapter.

6.2 OBJECTIVES

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process. Specific tasks and purposes of consultations with stakeholders have been given in the **Table 6.1**.

Table 6.1: Tasks and Purposes of Consultations

Task	Purpose of Consultation with Stakeholders
Why consultation with the stakeholders?	• To build trust to ensure sustained support Mass Transit Project Faisalabad. • To learn about public concerns that need to be addressed and taken into account in designing of the project concept and preparation mitigation measures and programs. • To learn about the strengths, skills and organizations that the stakeholders can bring to support project planning and implementation.
Modes and benefits of consultation	• Listening and dialogue with stakeholders to keep the project at tuned to public concerns early, to pre-empt breakdowns in public confidence. • Engaging the public as advocates for the project construction and to support the implementation of social, resettlement, and environment and health

Task	Purpose of Consultation with Stakeholders
	programs.

Other objectives of public involvement include:

- Informing the stakeholders about the proposed project;
- Providing an opportunity to those who remained unable to present their views and values, therefore allowing more sensitive consideration of mitigation measures and trade-offs;
- Providing those involved with planning the proposal with an opportunity to ensure that the benefits of the proposal are maximized and that no major impacts have been overlooked;
- Providing an opportunity for the public to influence the project design in a positive manner;
- Increasing public confidence in front of proponent, reviewers and decision makers;
- Providing better transparency and accountability in decision making;
- Reducing conflict through the early identification of contentious issues, and working through these to find acceptable solutions;
- Creating a sense of ownership of the proposal in the minds of the stakeholders; and
- Developing the project which is truly sustainable.

6.3 IDENTIFICATION OF STAKEHOLDERS

Identification of stakeholder is an important step which ensures that all the concerned stakeholders are identified for the following:

- Sharing of information with stakeholders about the proposed project activities and potential impacts of proposed project on the physical, ecological and socio-economic conditions in the COI/AoI; and
- To address the most relevant concerns of the stakeholders on project and its activities including the upfront negative impacts.

6.3.1 Primary Stakeholders

Primary stakeholders are those who are directly concerned with the project or directly affected both positively and negatively by the project interventions. The primary stakeholders of this project include land owner, local residents and the proposed Project Affected Persons (PAPs). Apart from this, the beneficiaries of the project and the implementing agency are also primary stakeholders for the proposed project.

6.3.2 Secondary Stakeholders

Secondary stakeholders are people or groups that are indirectly affected from the project activities or have their interest in the proposed project such as Punjab-EPA, PMA, Forest Department, Municipal Corporation, Parks and Horticulture Authority (PHA) and other line agencies / departments of GoP.

Details regarding roles and responsibilities of the concerned agencies and departments are given below **Table 6.2**.

Table 6.2: Role of Concerned Agencies/Departments

Project Stakeholders	Roles and Responsibilities
Punjab Environmental Protection Agency	• Punjab-EPA is the regulatory authorities and mainly responsible for the development and implementation of the environmental policies and strategies in order to integrate the environmental issues and sustainable development approaches into the legal and regulatory frameworks as per Punjab Environmental Protection Act, 2012 (Amended 2017). • Punjab-EPA is responsible for the issuance of NOC of the Proposed Project. • EPA is responsible for the compliance of EMP and NOC provision during the construction and operation stages of the Project.
Forest Department	• Implementing strategies and policies to conserve and protect forests. • Ensuring the preservation of diverse plant and animal species in forests and natural ecosystems to maintain ecological balance. • Implementing government policies, laws, and regulations related to forests, wildlife, and environmental conservation. • Contributing to global efforts in mitigating climate change by preserving forests, which act as carbon sinks, and promoting sustainable practices to reduce carbon emissions.
Wildlife Department, Punjab	• The Wildlife Department, Punjab is responsible for the conservation, protection, and management of wildlife and their habitats across the province. • Operating under the Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974 (amended), the department manages protected areas, including national parks, wildlife sanctuaries, and game reserves, and regulates the hunting and trade of wild species. • It is also engaged in biodiversity conservation, species protection programs, captive breeding, and rehabilitation of endangered species. • In addition, the department conducts research and awareness campaigns to promote public involvement in wildlife protection and supports eco-tourism in wildlife-rich regions. The department plays a vital role in ensuring compliance with national and international conservation agreements, including CITES.
Parks & Horticulture Authority (PHA)	PHA is primarily responsible for the planning, development, and maintenance of parks, green spaces, and horticultural projects in Faisalabad. Their main roles include: • Urban Beautification: Enhancing the aesthetic appeal of the city through landscaping, tree planting, and the installation of decorative features. • Park Development and Maintenance: Establishing and maintaining public parks, recreational areas, and green belts to promote environmental sustainability and provide leisure spaces for residents. • Horticulture Promotion: Organizing flower shows, tree plantation drives, and awareness campaigns to encourage community involvement in greenery and environmental conservation. • Environmental Improvement: Contributing to air quality improvement and urban cooling by increasing green cover and reducing urban heat islands. • Infrastructure Enhancement: Developing pathways, benches, lighting,

Project Stakeholders	Roles and Responsibilities
	and other infrastructure in parks and public spaces for better utility and accessibility.

Considering the importance of the project, consultations were carried out at all possible levels i.e., departmental and local level. The process of consultation is an on-going process which continues during the project life cycle and even after the submission of this report and so on. Stakeholders were identified, categorized and consulted at departments and community's level.

During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. Key stakeholders of the Project include government departments such as Environmental Protection Agency, Forest Department, PHA, and local communities.

6.4 CONSULTATION AND PARTICIPATION PROCESS

For ascertaining the perceptions of different stakeholders about the project (during construction/operation), consultation meetings were held with them. These meetings were carried out in the vicinity areas of proposed project. The meetings with stakeholders were carried out in January, 2025.

6.4.1 Methods of Public Consultation

Public Consultation was carried out in order to establish stakeholder's opinion regarding project implementation. The following methods were used for public consultation with project stakeholders:

- Focus Group Discussions (FGDs);
- Formal and Informal Meetings;
- Scoping Sessions
- Individual Interview

The detail of consultations has been provided in the following sub-sections.

6.5 CONSULTATIONS WITH STAKEHOLDERS AT DEPARTMENTS LEVEL

The stakeholder consultations were held with officials of the relevant departments. Details of department officials contacted are given in **Table 6.3**.

Table 6.3: List of Government Officials Consulted

Sr. No.	Department/Venue	Name/Designation	Date
1.	Punjab Environmental Protection and Climate Change Department-Faisalabad	Ms. Mashal, Field Inspector Environment	08-01-2026
2.	Forest Department, Punjab –	Mr. Naseem Iqbal, Conservator of	09-01-2026

Sr. No.	Department/Venue	Name/Designation	Date
	Faisalabad	Forests Faisalabad	
3.	Wildlife Department, Punjab-Wildlife Office Faisalabad	Mr. Azeem Zaffar, Deputy Director Wildlife	09-01-2026
4.	Parks and Horticulture Authority (PHA) Faisalabad	Mr. Jawad Ahmad Shah, Director Horticulture	08-01-2026
5.	Education Department Faisalabad	Mr. Muhammad Wasim Sajd, Deputy Director Education	12-01-2026
6.	Social Welfare and Bait ul Mall Faisalabad	Ms. Khalida Rafiq, Divisional Director	12-01-2026
7.	Rescue 1122 Faisalabad	Mr. Usman Medical Emergency Officer	12-01-2026

Table 6.4 indicates the detail of issues raised/discussed and suggestions given during the consultation:

Table 6.4: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Suggestions
1.	EP&CCD Punjab	• It was suggested that all the relevant Acts, laws, regulations, guidelines especially Punjab Environmental Protection Act, 2017 should be followed during the preparation of EIA report; • Stakeholder Consultations with all the relevant departments should be carried out; • Environmental Monitoring at all environmental sensitive areas along the route should be considered; • Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles. • Health and Safety Management Plan should be prepared and implemented to avoid health and safety issues occurring during construction period of the Project. • Solid waste produced should be properly managed and disposed of in identified designated areas. • Waste Bins should be placed at appropriate places along the route and at stations during operation phase. • Construction material should be removed as early as possible on the construction sites. • Construction activities should be restricted during smog season. • Alternate routes should be provided in consultation with Traffic Police to the residents, educational and health institutions and road users for their movement and to avoid the chaotic situation of traffic at this bottleneck. • Proper barricading shall be provided along excavation sites to avoid accidents and casualties. • If tree cutting is involved then it should be avoided as much as possible and tree plantation plan should be suggested. • Mitigation measures should be implemented in true letter and spirit.
2.	Wildlife Department	• The representatives of wildlife department were briefed about the proposed activities of the project. • As project is falling in urban area along the Jhang Road and

		route of orange line, no damages to the habitats of wildlife were recommended; • Loss of trees will be discouraged to keep the ecosystem balance and to protect habitat of wildlife of the region; • There is no protected area in and around the project area; • Required details of the faunal species of the region were also provided.
3.	Forest Department	• No designated forest areas fall within the proposed Project boundary. However, the proposed alignment passes through areas with forest tree plantations, which are likely to be affected. Accordingly, a formal request shall be submitted to the department to provide an inventory of the impacted trees along with the associated compensation costs; • Extensive plantation may be conducted to ensure Project sustainability and to enhance/conserve the local environment; • A feasible provision of budget for the tree plantation plan shall be included in the Project cost; and • Minimum disturbance to the local flora and green cover of the project area; • Required details of the floral species of the Project area were also provided.
4.	Parks and Horticulture Authority (PHA)	The NESPAK team visited the subject office to brief the officials regarding the Project and share details; and • They appreciated the proposed Project and shared the information mentioned below: ▪ Tree cutting will be avoided up to maximum level; ▪ Extensive plantation may be conducted to ensure Project sustainability and to enhance/conserve the local environment; ▪ A feasible provision of budget for the tree plantation plan shall be included in the Project cost; and • Required details of the floral species of the Project area were also provided. • A formal request be submitted to the PHA, to provide an inventory of trees under the management of PHA that are likely to be affected by the proposed Project alignment, along with the associated replanting and compensation costs.
5.	Municipal Corporation	• Discussed about the status of the proposed project. • Requirement of the construction plan will be shared with the representatives soon. • Utilities will be restored at the earliest. • Alternative traffic management plan need to be provided for effective project implementation.
6.	Education Department Faisalabad	• Construction activities should be scheduled to avoid peak operating hours of educational institutions in order to minimize traffic congestion and ensure the safety of students. • Adequately designed and strategically located stations/stops should be provided in close proximity to educational and health institutions to enhance accessibility and convenience for students and patients. • Provision of fare concessions for students to promote the use of public transportation. • Bus frequency and fleet deployment should be increased during institutional peak hours to effectively meet higher passenger demand and prevent overcrowding.

7.	Social Welfare and Bait ul Mall Faisalabad	• Project implementation should aim to minimize any disturbance to existing livelihoods. • Demolition of commercial structures should be limited to the extent necessary. • Disruption to ongoing business activities should be minimized wherever possible. • Ramp facilities should be provided at bus stops to ensure accessibility for persons with disabilities. • Buses should include reserved seating for persons with disabilities and senior citizens. • Employment opportunities for women should be created and actively promoted. • Opportunities for business and livelihoods should be facilitated at bus stops and bus depots.
8.	Rescue 1122 Faisalabad	• Project implementation should be designed to minimize any adverse impacts on existing livelihoods. • Demolition of commercial structures should be restricted to the minimum necessary to facilitate the Project. • The proposed alignment is recommended to be elevated near Jhang Road, where existing road widths are limited and access is constrained due to the presence of Good Transport Depots. • Traffic congestion is anticipated during both construction and operational phases as a result of road narrowing and increased vehicular activity at grade level. • Bus stops should be equipped with ramp facilities to ensure accessibility for persons with disabilities. • Buses should provide reserved seating for persons with disabilities and senior citizens to ensure equitable access.

Consultation with the Forest Department

Consultation with Parks & Horticulture Authority

Consultation with Wildlife Department

Consultation with Rescue 1122

Consultation with Social Welfare and Bait ul Maal Faisalabad Division

Consultation with District Education Officer

Plate 6.1: Pictorial View of the Departmental Consultations

6.6 CONSULTATIONS WITH STAKEHOLDERS AT INSTITUTIONS LEVEL

Details of the institutions contacted are provided in **Table 6.5**, while **Table 6.6** presents the issues raised, discussions held, and suggestions provided by stakeholders during the consultation process.

Table 6.5: List of Institutes Consulted

Sr. No.	Institution/Venue	Name/Designation	Date
1.	Postgraduate Agricultural Research Station (PARS)	Mr. Abdul Waheed, Farm Officer	12-01-2026
2.	Agriculture University (Old Campus Chenab Road)	Mr. Rana Nadeem Abbas, Director Student Affairs	12-01-2026
3.	Government College University Faisalabad	Mr. Tanveer Ali Raza, Deputy Register	12-01-2026
4.	Agriculture University (Science New Campus Jhang Road)	Dr. Hafiz Muhammad Asif Javed, Assistant Professor Head of	12-01-2026

Sr. No.	Institution/Venue	Name/Designation	Date
		Department Physics	
5.	Ayyub Agriculture Research Institute	Dr. Sajid-ur-Rehman, Director General	12-01-2026
6.	Nuclear Institute for Agriculture & Biology (NIAB)	Muhammad Arfan Tahir, Head Administration	12-01-2026
7.	Children Hospital Airport Road	Dr. Muhammad Talha, Admin Branch MS Assistant	09-01-2026
8.	Sitara Dildar Petrol Pump by GO Petroleum	Mr. Faizan Shumail Tabasum, Manager	12-01-2026
9.	Al-Rehman Schools and College Jhang Road Faisalabad	Mr. Ali Asghar, Vice Principle	08-01-2026
10.	Madina Petroleum by Euro Company Gojra Road, Faisalabad	Mr. Nisar Ahmed, Manager	08-01-2026
11.	Ali Ahmed Petroleum by Zoom Petrol Pump Gojra Faisalabad Road	Mr. Tahir Rasheed, Owner	08-01-2026

Table 6.6: Concerns and Suggestions of Representatives of Institutes Consulted

Sr. No.	Institutes	Concerns/Suggestions
1.	Postgraduate Agricultural Research Station (PARS) (Agriculture University Research Center Jhang Road, Faisalabad)	• Potential concerns related to existing tree plantations located outside the designated agricultural farm boundary of the Postgraduate Agricultural Research Station (PARS) should be carefully assessed and duly considered during Project planning and alignment finalization. • Provision of a mandatory public transport stop at the PARS Community Center is recommended, as the facility caters to a substantial number of students, researchers, and staff. • It shall be ensured that farm security arrangements of PARS remain fully intact and are not compromised at any stage during the implementation of the proposed Project activities.
2.	Agriculture University (Old Campus Chenab Road)	• Provision of station outside the University premises is recommended to facilitate convenient access for students while maintaining campus security. • Implementation of an affordable and subsidized fare structure is suggested to ensure economic accessibility for students. • Potential traffic congestion in the surrounding area should be carefully assessed and managed through appropriate traffic planning and control measures. • The proposed public transport facility is expected to particularly benefit out-of-station students by improving their mobility and access to educational facilities. • Security concerns associated with increased public movement should be addressed through coordination with University administration and relevant law enforcement agencies.
3.	Government College University Faisalabad	• Provision of pedestrian bridge and the station outside the University premises is recommended to ensure ease of access for students while preserving campus security protocols. • Adoption of an affordable and, where feasible, subsidized fare structure is recommended to enhance economic accessibility for the student population. • Potential traffic congestion in the vicinity should be

Sr. No.	Institutes	Concerns/Suggestions
		systematically evaluated and mitigated through appropriate traffic management and control measures. • The proposed public transport facility is anticipated to provide significant mobility benefits to out-of-station students by improving access to educational facilities. • Security risks arising from increased public movement should be mitigated through effective coordination with University administration and relevant law enforcement authorities.
4.	Agriculture University (Science New Campus Jhang Road, Faisalabad)	• The proposed bus service will benefit a large number of students, particularly those commuting from distant areas, as the new campus is located far from the city and students frequently face local transport issues. • The initiative will be highly beneficial for students relying on public transport, ensuring safer and more reliable access to the campus. • The provision of this service will also support business expansion by improving accessibility and increasing user engagement.
5.	Ayyub Agriculture Research Institute Jhang Road Faisalabad	• The proposed public transport facility is expected to significantly improve daily commuting convenience and accessibility for institute staff. • It is recommended that the bus route or station be developed at grade level in front of the institute rather than as an elevated structure, as the surrounding area is actively used for experimental and academic functions and should remain undisturbed; institutional privacy should also be preserved. • With an estimated workforce of approximately 1,000 employees, the proposed bus service is anticipated to provide substantial mobility benefits to institute staff. • The introduction of this bus service is expected to yield positive environmental outcomes by reducing air emissions associated with local buses, rickshaws, and private vehicles. • The institute has expressed its willingness to cooperate and extend necessary support during the construction phase, as required.
6.	Nuclear Institute for Agriculture & Biology (NIAB) Jhang Road Faisalabad	• The proposed bus route crosses the WASA drain; therefore, coordination with WASA authorities is essential during construction to prevent any interference with the drainage infrastructure. • Construction of an overhead structure in front of NIAB is not recommended, as foreign staff reside on-site, and their privacy and security must be fully maintained. • The institute employs approximately 1,000 staff members, the majority of whom commute daily from Model Bazar. Provision of a dedicated bus stop at Model Bazar is recommended to facilitate staff commuting and enhance convenience.
7.	Children Hospital	• A dedicated bus stop should be established outside the Children's Hospital to facilitate convenient access for visitors, particularly as a large proportion of patients travel from other cities and will benefit from improved public transport connectivity. • The hospital receives approximately 1,500–2,000 outpatient visits daily, in addition to around 500–600 patients attending the emergency department. • Provision of a pedestrian bridge is recommended to ensure safe road crossing for visitors and staff, thereby reducing the risk of

Sr. No.	Institutes	Concerns/Suggestions
		traffic-related accidents.
8.	Sitara Dildar Petrol Pump by GO Petroleum (Jhang Road Faisalabad)	• The Project will be highly beneficial for the local community by improving accessibility and transportation options. • The existing green belt should not be disturbed during construction to preserve greenery and environmental quality. • The ongoing sewerage and drainage issues along the alignment route should be addressed as part of Project planning to prevent future problems. • Construction activities should be carefully planned to avoid disrupting ongoing businesses, as many daily-wage workers are employed in these establishments. • Proper attention should be given to maintaining cleanliness at the Project site throughout the construction phase.
9.	Al-Rehman Schools and College Jhang Road Faisalabad	• The proposed bus Project is expected to significantly benefit locally commuting students, the majority of whom reside nearby. It is therefore recommended that a dedicated bus stop be provided in front of the school to ensure safe and convenient access. • Many local students have previously experienced accidents involving rickshaws and buses; the Project is anticipated to enhance student safety by reducing their exposure to such risks. • Construction activities inconveniences to students during the construction phase should be carefully managed and mitigated. • The area in front of the school experiences frequent congestion from rickshaws and local transport; the new bus service is expected to alleviate traffic and improve overall pedestrian safety. • Special fare concessions are recommended for students, particularly those from low-income families, to promote access to education and support increased enrollment.
10.	Madina Petroleum by Euro Company Gojra Road, Faisalabad	• Commercial activities in the area, including petrol sales, may be temporarily affected during construction, particularly during daytime hours when customer traffic is highest, while construction vehicles (dumpers, trucks) primarily operate at night. • Alternate access routes should be provided during construction to ensure uninterrupted access to petrol stations and other essential services for the public. • Construction schedules should be planned to minimize disruption to peak business hours, and traffic management plans should be implemented to avoid congestion near commercial hubs. • Advance public notifications and signage should be provided to inform customers of temporary route changes and construction activities. • Coordination with local business owners is recommended to identify critical service points and implement mitigation measures such as temporary access lanes or dedicated entry points.
11.	Ali Ahmed Petroleum by Zoom Petrol Pump Gojra Faisalabad Road	

Consultation with Farm Officer Postgraduate Agricultural Research Station (PARS)

Consultation at Children Hospital

Consultation with Director Student Affairs, University of Agriculture Old Campus

Consultation with Deputy Registrar GCU

Consultation with students at GCU

Consultation with students at Agriculture University

Plate 6.2: Pictorial View of the Departmental Consultations

6.7 COMMUNITY CONSULTATIONS

For ascertaining the perceptions of different stakeholders about the project, meetings were held with communities within the project area. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders about the project and potential impacts both positive and adverse likely to occur due to its implementation.

6.7.1 Methods of Public Consultation

The following methods were used for public consultations with project stakeholders in order to ascertain their stakes regarding project implementation. The views of the beneficiaries were formally recorded. People of surrounding communities (males and females) were also consulted along with general public) who were residing or working in the surroundings of the proposed project.

- Community/Public Consultations
- Individual meetings with Locals

The public consultations were conducted to inform the communities impacts and record their concerns and views. Following main aspects were discussed with the communities during the consultation meetings;

- Introduction of the project with components,
- Possible positive and negative impacts on local community;
- Use of public transport,
- Problems faced during the traveling on public transport, and
- Available facilities in the public transport and along the road.

6.7.2 Categories of Stakeholders Contacted

Different categories of stakeholders contacted, during consultation is shown in the **Table 6.7**.

Table 6.7: Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category
1	Public transport users
2	People of the surrounding communities
3	Local Residents
4	Business/ shop owners
5	Government and private Servants
6	Rikshaw and taxi owners and drivers
7	Representatives of Institutes
8	Representatives of the factories
9	Factory Workers

6.7.3 Locations of the Public Consultations

The public consultations were conducted with the community members during the detailed survey. The detail of the locations with number of participants is provided in the Table 6.8.

Table 6.8: Consultation with Location and Number of Participants

Sr. No.	Venue	Date	No. of Participants
1	Near Airport Chowk	08-01-2026	16
2	Jhang Road	08-01-2026	10
3	Chenab Chowk	10-01-2026	21
4	Jalwani Market	10-01-2026	18
5	Konoor Chowk	11-01-2026	23
6	City Bus Terminal	11-01-2026	25
7	Municipal (Khalsa) College	11-01-2026	15
8	Makuana	11-01-2026	18
9	Government College University	12-01-2026	20
10	Agricultural University	12-01-2026	20

Table 6.9: Summary of Findings of the Consultations

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
1.	The construction of the proposed Project may lead to temporary mobility disruptions for the local community, restricting access to residences and affecting livelihoods due to the clearance of commercial structures. Livelihood impacts on movable business operators, including rickshaw, taxi, and bike operators, are anticipated.	The alternate route should be provided to the local communities for convenience in mobility to their settlements. Construction activities should be halted during peak hours. Proper compensation shall be paid for the acquired land as per prevailing market rates.	The possible alternate route will be provided before the commencement of the civil work on the proposed Project. Land must be acquired from the landowners in accordance with the agreement before the commencement of construction activities.
2.	Health and safety and noise issues will arise for residents and students due to the construction activities.	Labour will be bound to work and stay in the designated area or camp sites to ensure the safety and privacy of female residents. Ensure minimum transportation of construction materials and use of construction machinery during peak working hours and at night.	The contractor should be bound to take all protective and precautionary measures to protect the health of the local people.
3.	Disturbance of the social amenities.	Participants were of the view that due to the construction of the proposed Project, several social amenities will be disturbed. These social amenities should be restored before the commencement of the construction work to avoid any inconvenience for the local community.	Social amenities should be restored before the execution of the civil work.
4.	The movement of construction machinery and	The appropriate diversion plan will be developed to avoid traffic	The Contractor should be bound to make a site-specific

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
	loaded trucks transporting materials during the construction period will lead to increased congestion on the access road.	blockage/disruption due to the use of heavy machinery, especially near sensitive receptors such as schools and mosques.	traffic management plan in consultation with the traffic police during the construction phase.
5.	Due to construction activities as well as the influx of labour, the movement of the citizens particularly of females, residing in the area will be restricted.	In order to tackle this situation, construction should be carried out in scheduled hours. So that after construction hours, the local community, particularly females can easily move in the area.	People should be aware of complete construction activity plans so that they can move in the area freely and safely.
6.	Dust emissions from construction activities such as deep excavations, transportation of construction materials and use of construction machinery.	Dust pollution will be controlled by water sprinkling regularly.	The contractor should be bound to take all protective and precautionary measures to keep safe the health and properties of the local people.
7.	Job and labour opportunities for local people.	The skilled and unskilled workforce should be hired from the local community. It will enhance the acceptability of the proposed Project among local people.	The contractor should be bound to hire skilled and unskilled workers from the local community as a priority.

During consultations with communities, public transport users, road users, and residents, participants put forward several important recommendations aimed at enhancing the success and effectiveness of the Project. These key suggestions include:

- Impacts on commercial structures and access to businesses along the proposed routes should be minimized.
- In narrow alignments near commercial markets, elevated structures should be considered to maintain access and support business operations (e.g., Jaranwala Road near MC College).
- Designated spaces should be provided for movable business operators to minimize livelihood disruption.
- Access for rickshaw, taxi, and bike operators should not be restricted along the route to avoid livelihood impacts.
- Customer access to commercial markets must be maintained throughout construction.
- Local residents should be prioritized for employment opportunities during construction, including both skilled and unskilled labor.
- Construction machinery and vehicles should be confined to designated areas to avoid obstructing the daily movement of local residents and sensitive locations.
- Alternate access routes should be provided during construction to maintain mobility for residents and stakeholders.

- Utilities displaced by the Project should be rehabilitated on a priority basis to minimize disruption to stakeholders.
- Construction near educational institutes should be scheduled during holidays or nighttime to minimize disturbance.
- Pedestrian bridges should be constructed at major crossings, near educational institutions, and densely populated areas to ensure pedestrian safety.
- Project facilities should be located outside existing residential areas to minimize disruption.
- The proposed route should be extended to Makkuana Bypass and City Bus Terminal to enhance connectivity.
- Ramp facilities should be provided at stations and bus stops to ensure accessibility.
- Each bus should operate at intervals of 5–10 minutes during peak hours to meet passenger demand and reduce overcrowding.
- Affordable and reasonable fare structures should be maintained, with special concessions for students, women, and low-income commuters.
- Reserved seating and free travel cards should be provided for female passengers.
- The service will particularly benefit daily wage workers and students commuting from Airport Road and other areas, reducing travel time and cost.
- Buses and Rail are expected to reduce environmental pollution and improve travel comfort.
- The local community should be informed in advance about construction schedules and activities to ensure safety and mobility.
- Employment opportunities for locals, including women, should be actively promoted to enhance project acceptability and support livelihoods.

Plate 6.2: Pictorial View of the Departmental Consultations

6.8 GENDER CONSULTATIONS

Recognizing the important role of women in both the household and society, gender consultations were conducted in four settlements to gather the perspectives of women. These consultations aimed to understand their views on the availability of public transport in the city and to capture their feedback on the proposed project.

The participants were briefed about the proposed project, and women actively engaged in the discussions, expressing their support for the initiative. While most of the women were initially unaware of the project, they recognized its value to the local community once informed. During the consultations, they also highlighted specific concerns related to the impact of the project's execution on women. A summary of the participants is provided in **Table 6.10**.

Table 6.10: Summary of Gender Consultations

Sr. No.	Venue	Date	Participants
1	Jhang Road	08-01-2026	16
2	Chenab Chowk	08-01-2026	10
3	Jalwani Market	10-01-2026	6

Sr. No.	Venue	Date	Participants
4	Government College University	12-01-2026	12
5	Agricultural University	12-01-2026	20
6	Municipal (Khalsa) College	12-01-2026	5

The concerns/suggestions raised by the participants along with the responses are provided in Table **6.11.**

Table 6.11: Gender Concerns and their Responses

Sr. No.	Concerns/Suggestions	Response
1.	The construction activities will cause inconvenience to the mobility of the women	The contractor will ensure that construction work does not disrupt local women's access to local routes or their daily activities. In this regard, an alternate route will be established, as per the provisions of the detailed design, before the commencement of civil works.
2.	Privacy issues for local females and school/college students during construction work due to outside labour in the Project Area.	Labourers will be required to work and reside within designated areas or campsites, and contractors will be instructed to prioritize hiring the majority of the workforce from local communities. Special privacy measures, such as protective barriers, will be implemented around educational institutions to safeguard women's privacy. Additionally, contractors will conduct comprehensive GBV (Gender-Based Violence) prevention training for all Project workers.
3.	Women and children may have health issues due to poor air quality, dust and noise.	Water will be regularly sprinkled to control dust emissions, and construction activities will be limited during peak hours to minimize noise-related disturbances.
4.	Job and labour opportunities for local females.	The provision of special jobs for female will be ensured during the implementation stage and duly incorporated in E&S documents and bidding/tender documents accordingly.

Participants also provided valuable feedback during the consultations, with key suggestions summarized as follows:

- Bus stops should include toilet facilities and separate cabins for female passengers.
- Elevators should be installed where required to ensure accessibility for all, including persons with disabilities.
- Affordable and reasonable fare structures should be maintained, with special concessions for students, women, and low-income commuters.
- Provision of female staff should be ensured to enhance comfort and ensure cultural appropriateness for female passengers.
- Enhance lighting, CCTV coverage, and deploy female security staff to improve safety and comfort.

Plate 6.3 shows the pictorial view of community and gender consultations.

Plate 6.3: Pictorial View of the Gender Consultations

6.9 GRIEVANCE REDRESS MECHANISM

In order to receive and facilitate the resolution of affected person's concerns, compliments, and grievances about the Project's environmental performance, a Grievance Redress Mechanism (GRM) will be established for the proposed Project. GRM will include a proactive

component where by at the commencement of construction of Project the local community will be formally informed of Project implementation details by the PMA, the supervision consultant (SC) and the contractor (designs, scheduled activities, access constraints etc.), so that all necessary Project information will be communicated effectively to the affected person's and community and their immediate concerns can be addressed.

The GRM will address the affected person's concerns and complaints proactively and promptly, using an understandable and transparent process that is culturally appropriate, and readily accessible to all segments of the affected people at no costs. The mechanism will not impede access to the country's judicial or administrative remedies.
PMA will establish a Grievance Redress Committee (GRC) prior to the contractor's mobilization to the site. The function of the GRC is to address the concerns and grievances of the local communities and affected parties as necessary.

GRC will comprise of representatives from local communities, the contractor's Environmental Specialist, SC's Environmental Specialist and PMA Environmental & Social Safeguard Specialists. The role of the GRC is to address the Project related grievance of the local communities that are unable to be resolved satisfactory through the initial stages of the Grievance Redress Mechanism (GRM). PMA Environmental & Social Safeguard Specialists will assist local communities to nominate the representatives for GRM.

Representatives from the community will be responsible to conduct formal meetings between the Project team (contractor, SC and PMU) and communicating community members' and affected people's grievances and concerns to the contractor during Project implementation. A complaint register will be maintained at workers' camp on routine basis. The complaint register will contain minimum of the following information:

- Name and address of complainant;
- Complaint description;
- Action taken/recommended;
- Name of responsible person;
- Status of resolution of complaints; and
- Other necessary information/record and reasons in case issue not resolved.

6.10 PROPOSED FUTURE CONSULTATIONS PROGRAM

The stakeholder consultation and engagement is an ongoing process and will continue throughout the Project's construction as well as operation and maintenance phases. The ongoing consultation process could be scheduled on need basis with the stakeholders including but not limited to the concerned government departments, local administration, and community representatives & affected persons from the proposed Project Area.

The overarching goal of consultations and community engagement is to support and facilitate the Project's design and implementation, to reduce conflicts and Project opposition, and to increase Project's acceptability.

The consultations will be carried out during the construction and operation phases of the proposed Project. Consultations will be undertaken in all the communities twice or more time in a year, depending on the number of concerns raised under each consultation. Ongoing stakeholders' engagement activities include:

- Continuous reporting on the implementation status of environmental and social management measures identified during the EIA process, including documentation of stakeholder feedback on the effectiveness and adequacy of these measures;
- Regular communication with local communities and relevant stakeholders to provide updates on Project progress, planned activities, and any changes in Project design or schedule, while systematically recording their comments, concerns, and suggestions; and
- Ongoing operation and monitoring of the GRM to ensure timely registration, investigation, and resolution of complaints or concerns raised by affected individuals or groups.

Efforts will be made to maximize the consultations during the Project implementation. The consultations will be carried out with the objectives to develop and maintain communication linkages between the Project promoters and stakeholders, provide key Project information to the stakeholders, and to solicit their views on the Project and its potential or perceived impacts, and ensure that views and concerns of the stakeholders are incorporated during the implementation with the objectives of reducing or offsetting negative impacts and enhancing benefits of the proposed Project. The framework for the future consultations is elaborated in **Table 6.12**, but not limited to the following.

Table 6.12: Proposed Consultations Framework

Sr. No.	Stakeholders	Project Phase	Frequency of Consultation
1.	Institutions/Departments	• Pre-Implementation • During the Project Implementation • At Closure period	• One round of consultation before the implementation of the Project. • Quarterly during Construction Phase. • Biannually during operation phase. • Once before the closure of the Project.
2.	Local Communities/ Key Persons	• Pre-Implementation • During the Project Implementation • At Closure period	• Consultation at different stages i.e., before implementation, periodic meetings during the construction phase and at the time of Project completion.
3.	NGOs/CBOs	• Pre-Implementation • During the Project Implementation • At Closure period	• Periodic meetings will be conducted as per requirement of the Project.

During the operational phase of the Project, consultations with stakeholders are important to assess the benefits of the Project and impacts on the local communities.
A comprehensive stakeholder consultation plan shall be prepared by the contractor(s) to get feedback from the stakeholders and to resolve the issues during the construction and operational phases of the Project.

7 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 GENERAL

This chapter identifies the beneficial as well as the potentially significant adverse environmental and social impacts during design/pre-construction, construction and operation phases of the proposed Project on the physical, ecological and socio-economic domains of the environment. The appropriate mitigation and remedial measures are proposed in this chapter. A project impact evaluation matrix has been developed to evaluate the potential impacts of the proposed Project. A brief qualitative description of each aspect and the affected environment in Study Area / AOI is presented below.

7.2 NOTION OF SIGNIFICANCE

The term ***"Environmental Impact"*** or simply *"**Impact**"* covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorised in terms of:

Direction - Positive or Negative
Duration - Long or Short Term
Effect - Direct or Indirect
Extent - Wide or Local

Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this EIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having "moderate", "high" and "very high" significance is provided with mitigation measures.

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance criteria matrix as shown below. Most of the potential impacts can be mitigated by implementation of various types of mitigation measures; however, some residual environmental impacts may remain after mitigation.

7.3 METHODOLOGY FOR IMPACT EVALUATION

The methodology adopted for the evaluation of the impacts included the following assessment tools, (i) project impact evaluation matrix and (ii) overlays. These tools were

used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent, etc.

7.3.1 Project Impact Evaluation Matrix

The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e. X-axis) the different environmental parameters likely to be affected by the proposed Project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix was used by dividing the project action into different phases (construction and operational phases). A Project Impact Evaluation Matrix is given as **Table 7.1**.

7.3.2 Overlays

In order to identify spatial based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristic (for example, land acquisition). Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the project's AOI, recorded on a series of maps, typically one for each variable. These maps were overlaid to produce a composite map. The resulting composite maps characterize the Project area's land use, physical, social, ecological and other relevant parameters related to proposed intervention. The overlays maps used in this EIA for the quantification of the landuse categories is given in Chapter 4: Description of Environment.

7.4 DELINEATION OF STUDY AREA / AOI

For an EIA Study, a clear delineation of the Study Area / AOI is required. Study Area / AOI is the area within which the potentially significant impacts of the proposed Project activities (direct or indirect) are envisaged. In this report, the Study Area / AOI of the proposed project is considered as 25m from project boundary where the impacts on the environment due to the proposed Project activities are assessed. Based on the available Google Earth Imagery and ARC GIS software, Project footprints were overlaid on the existing Project Area Imagery. Utilizing the information collected through the detailed site visit, consultations with the locals and concerned departments and foreseen impacts of the proposed Project, a tentative AOI was delineated.

Table 7.1: Environmental Impacts Matrix for Construction Phase

Project Impact Matrix

Environmental Component / Project Component	Physical Environment								Ecological Environment					Socio Economic Environment										
	Soil (Erosion / Stability / Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Wastewater Generation	Emission of GHGs	Traffic Issues	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Loss of Trees	Loss of Crops/Orchards	Conflict over Resources	Public Utilities	Accessibility	Community Stability	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities
A. Planning & Design Phase																								
Topographic Survey of Project	2	2	o	o	o		o	o	o	0	o	o	o	o	o	o	o	o	o	0	o	o	o	o
Geotechnical Investigation	o	o	2	o	o		o	o	o	o	o	2	0	o	o	o	o	o	0	2	o	o	o	o
Socio-Economic Surveys	2	2	o	o	o		o	o	o	0	o	o	o	o	o	o	o	o	o	0	o	o	o	o
B. Construction Phase																								
Site Clearance	9	9	9	2	8	4	2	2	o	12	o	10	0	6	10	3	o	2	2	9	4	2	o	6
Earthwork and Excavation	9	9	9	2	8	8	4	4	o	12	o	8	o	6	2	3	2	o	2	9	4	2	o	6
Establishment of Construction Camps & Workshop	2	2	4	o	8	8	o	2	o	4	o	4	0	8	o	o	4	4	4	8	4	2	o	6
Transportation & Storage of Construction Materials	4	6	6	4	4	2	o	4	o	2	o	o	0	o	o	o	4	o	2	6	4	o	o	4
Use of Construction Material and Heavy Machinery	3	8	9	o	4	o	o	2	o	4	o	o	o	o	2	2	o	o	2	8	o	4	o	4
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	2	o	o	2	o	o	o	2	o	o	o	o	o	6	4	o	4	4
Spoil Disposal	3	3	o	2	6	o	o	o	o	6	o	4	o	o	o	o	2	o	4	4	6	o	o	2
Structural & Civil Work	8	8	8	2	7	2	2	2	o	6	o	o	o	2	2	o	2	4	4	9	4	3	o	8
Drainage, Water Supply & sewerage works	4	6	6	2	6	4	2	2	o	6	o	o	o	2	2	o	2	4	4	9	4	4	o	8
Construction of residential/commercial units	o	2	4	4	6	4	2	2	o	2	o	o	o	o	o	o	o	2	o	4	o	o	o	8
C. Operational Phase																								
Movement of Residents, Employees & Visitors	2	4	4	4	9	10	4	4	o	4	o	6	o	o	0	0	4	o	o	2	6	6	6	6
Consumption of water	o	o	o	4	o	o	o	o	o	o	o	o	o	o	0	0	o	o	o	o	o	o	o	o
Municipal solid waste and wastewater generation	o	o	o	o	6	o	6	6	o	o	o	o	o	o	0	0	o	o	2	6	4	o	o	2
Maintenance of Area Facilities	o	2	2	2	6	2	o	o	o	o	o	o	o	o	0	0	o	o	o	6	o	o	o	2
Landscaping/ Maintenance of Green areas	o	2	2	o	2	o	o	o	o	o	o	o	o	o	0	0	o	o	o	4	4	o	o	2

Positive Impact Score	Impact Significa	
0	Negligible	
2 to 4	Low	
5 to 8	Medium	
9 to 12	High	
>12	Very High	

7.5 POSITIVE IMPACTS

7.5.1 Enhance Urban Mobility

Provide a high-capacity, zero-emission public transport system that improves access to employment, education, healthcare, and other essential services across Faisalabad.

7.5.2 Reduce Traffic Congestion

Shift commuters from private vehicles and informal public transport modes to a reliable, efficient mass transit system, particularly on high-demand corridors such as Jhang Road, Jaranwala Road, and Govt. College Road.

7.5.3 Improve Travel Time and Reliability

Offer rapid, predictable, and frequent transit service through dedicated right-of-way and optimized stop spacing to significantly reduce travell durations.

7.5.4 Promote Environmental Sustainability

Deploy electric buses to minimize air pollution, greenhouse gas emissions, and noise levels, contributing to a cleaner and healthier urban environment.

7.5.5 Enable Integrated and Inclusive Mobility

Facilitate seamless intermodal connections through feeder routes, bicycle paths, and pedestrian walkways, ensuring last-mile connectivity and inclusivity for all users, including women, elderly, and persons with disabilities

7.5.6 Support Economic Growth and Urban Development

Enhance the efficiency of the city's industrial and commercial activities by reducing transport-related delays and improving the movement of people within key economic areas.

7.6 POTENTIAL ENVIRONMENTAL IMPACTS AND MINTIGATION MEASURES

There are some potential significant adverse environmental impacts on the local environment. The proposed Project is divided into three (03) phases i.e. Pre-construction / Planning and Design Phase, Construction Phase and Operation and Maintenance (O&M) Phase. The Pre-Construction Phase includes all stages before the Construction Phase (i.e. site investigation work i.e. topographical, seismic studies etc.); Construction Phase includes all stages from mobilization of Contractor to the completion of Project; and Operation Phase starts after the Construction Phase which includes the inspection and repair works.

Adverse impacts envisaged at these three (03) phases of the proposed Project along with their proposed remedial or mitigation measures are detailed below:

7.6.1 Potential Environmental Impacts during Pre-Construction / Design Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during Pre-construction / Design phase.

7.6.1.1 Design & Layout Planning

Incompatible layout plan and engineering design of the project's structures can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and not designing the structures taking into account, the prospective and futuristic needs can result in structures with low social acceptability and functionality. This impact is permanent and moderate negative in nature.

Mitigation Measures:

- All structural, layout and engineering designing of Orange Line should be in strict accordance with the applicable bylaws and engineering parameters.

7.6.1.2 Topography

The topography of the project area is flat. The topography of the project areas will not be changed as proposed BRT system will run on existing Jhang and Jaranwala road. However, excavation of land is involved for the construction of stations which may contribute to minor change in the topography of the area. The main impact generating activities during construction will be cutting and dismantling of existing pavements, including erosion of topsoil cover and soil erosion may occur on roadside due to excavation of earth/cutting operations. The changes due to construction of the proposed tunnel, however, will be of localized nature. This impact is temporary and moderate negative in nature.

Mitigation Measures:

- The project design would consider aesthetic concerns such as the tree plantation which is already recommended in the EIA Report;
- Best engineering design measures should be adopted keeping in view the aesthetics of the project area; and
- Ground disturbances should be limited to only the areas necessary for project related construction activities.

7.6.1.3 Storm Water Drainage / Urban Flooding

Improper design of storm water drainage of the proposed Project may result in stagnant water on the road due to which following impacts are expected to arise:

- Deterioration of road surface and reduction of its bearing capacity;
- Inconvenience for commuters/pedestrians;
- Stagnant water may provide the breeding ground for disease vector; and
- Foul odour may be generated.

This impact is temporary and minor negative in nature.

Mitigation Measures

Mitigation measures will include provision of appropriate drainage structures with appropriate design capacity to avoid urban flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water on At-grade road surface.

7.6.1.4 Seismic Hazard

As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic Zone 2A (low to moderate hazard), where 2A represents peak horizontal ground acceleration from 0.08g to 0.16g. In this Zone, designing of various types of structures should be done on the basis of PGA. A high intensity earthquake impacting the project site can adversely impact the development. This factor requires special consideration of the designers keeping in view of the recent earthquake of October 08, 2005. This will be a local and high adverse impact.

Mitigation Measures:

- The proposed structures should be designed and constructed to withstand high intensity earthquakes. For seismic hazard analysis, updated structural, geotechnical and seismic studies should be conducted; and
- To mitigate the seismic hazard, Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering.

7.6.1.5 Emergency Management

Emergency management in case of natural and man-made disaster is a major concern. Increased incidents of disasters especially act of terror, fire, earthquakes etc. demand proper planning. The impact is considered to be high negative, and long-term. An inefficient firefighting system and insufficient storage of fire water may pose a sever e threat to human life and to the proposed Project. An Emergency Response Plan is attached as **Annex-V**.

a. Electrical Hazards

The workers of the proposed Depots & stations may be exposed to electrical hazards including shocks, fires and burns caused by faulty electrical wiring, unsafe installations, frayed cords, substandard power trips, and defective equipment.

Mitigation Measures

- Appropriately grounded and double insulation of every single piece of equipment, machine, and device should be kept in the design;

- Proper installation check and periodic maintenance by a competent electrician should be planned; and
- All power strips should be planned in the design to place in well-ventilated areas for adequate heat dispersion.

b. Fire Fighting System

Inefficient firefighting system and insufficient storage of fire water may pose a severe threat to human life and to the proposed Project.

Mitigation Measures

Following mitigation measures may be incorporated by the design team regarding safety of fire outbreaks in building.

- Separate water storage tank should be designed for firefighting;
- Fire Hose Cabinets connected to pressurized water line at different locations of the building may also be considered in the design;
- System should be pressurized by means of an automatic booster system consisting of two duty pumps and jockey pump;
- A separate fire alarm system should be designed for the Project building; and
- Assigning of special number to be dialed to inform about the fire to emergency response team.

c. Lightning

Lightning is a constant hazard for buildings (Depots & stations) and equipment. One lightning strike can damage the buildings and may cause failures to the electronic devices inside the building and sometimes it may even result in fire leading to human and financial loss.

Mitigation Measures

- Design of an efficient Lightning Protection System (LPS) should be ensured to minimize the damage to the building(s) by creating a path (divert) for the lightning discharge to the ground.

d. Building Illumination / Lighting

Design of a good illumination is necessary for the Depots & stations buildings to be constructed as if the buildings are designed without taking into consideration for illumination, it may affect safety of the people who are using the building; adversely affect the performance of the workers and other activities within the building. Light can also have an adverse impact upon our local environment, typically through the unwanted effects of exterior lighting at night, often referred to as Light Pollution or Obtrusive Light. This is a long term and moderate adverse impact.

Mitigation Measures

- Illumination/ lightning system should be designed for the project building in such a way so as to maximize the use of natural day light and minimize the use of electric lighting; and
- Special consideration should be given to control obtrusive light (light pollution) to safeguard the night time environment which can affect surroundings of the building.

7.6.1.6 Site Selection of Construction Camps

Improper site selection and location of construction camp(s) may lead to various social and environmental impacts which include loss of vegetation due to setting up construction camps, indiscriminate generation of solid waste, and discharge of sanitary effluent, water pollution and health & safety issues in the surrounding settlements. This impact is low negative and short term.

Mitigation Measures:

- Construction camps should be designed to be self-contained to reduce demand on infrastructure and services of nearby communities and to minimize the removal of existing macro-plants;
- There should be no resettlement issue for the location of the camps;
- Camp site should be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

7.6.1.7 Flora

During the pre-construction phase, activities such as installation of construction camps, construction of temporary facilities & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific, permanent, medium significant and needs to be encountered prior to the start of construction stage.

Mitigation Measures

- The camps, mobility of machinery and construction of temporary facilities should be proper planned and well designed to avoid any loss to local green cover;
- It is recommended to establish the construction camps where minimum or no vegetation exists;

- Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and
- An inventory of trees/vegetation may be prepared by the contractor with the help of concerned department (PHA/Forest) before clearing the site.
- The location of construction camp should be selected so, as to have limited environmental impact during construction phase and to reduce the cost and land requirement.

7.6.1.8 Fauna

As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected but it will be insignificant as it is already roadside area passing through the main city. The routes of the available wildlife and other habitats may be slightly affected due to camps set-up and machinery movements and installations. Temporary access road (if any) may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible, possible and low significant.

Mitigation Measures

- The standard measures must be adopted to minimize noise due to machinery movements and installations;
- Wildlife movements and routes must be considered during activities and should be avoided to their maximum level;
- The alternate routes and points are recommended to avoid any damage to locally available fauna;
- The camps shall be designed as properly fenced and gated to check the entry of animals in search of eatable goods; and
- A waste management plan so that the wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.

7.6.1.9 Public Utilities

Due to the proposed project, public utilities (electric poles, water pipes, power/ telephone lines, etc.) may be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature.

Mitigation Measures:

- The provision in the design and budget for the relocation of the existing utility infrastructure wherever required and shall be finalized in consultation with the concerned department; and
- All public utilities (e.g. electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project shall be relocated well ahead of time before the actual commencement of the construction work.

7.6.1.10 Social Issues

During the construction phase of the project, it might be difficult for the students to get access to their school/colleges. Similarly, the patients may also face difficulty of access to the hospitals. Moreover, this will result in causing inconvenience to the nearby residents and business owners for affecting their daily life activities. There may also be a crossing problem for the pedestrians during the construction/ operation stage of the project. This impact is temporary and moderate negative in nature.

Mitigation Measures:

- The provision of pedestrian overhead bridges or crossings on every station, public awareness through media, proper traffic diversion plans, appropriate sign boards, and timely completion of the project.

7.6.2 Potential Environmental Impacts during Construction Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during construction phase.

7.6.2.1 Topography

Construction activities are not expected to impact the topography of the area significantly except for those areas where physical activities including digging and excavation areas, storing or dumping sites for excessive material, storing areas and movement of heavy construction machinery will be carried out. The excavated material will be generated due to the construction of various infrastructure components of the project like stations, sub-ways and depots. The area where excavated material is to be dumped will also be negatively impacted. This impact is Site-specific and medium significant in nature.

Mitigation Measures:

The excavated material will require safe disposal by the Contractor. Most of the excavated material could be used in back filling process and concrete aggregate to be used in construction. A detailed development and operation plan for borrow areas must be prepared by the contractor at the pre-development phase (before the starts of extraction of material from each borrow area). Contractor should strictly follow the provisions of approved plan in order to minimize any adverse impact associated with the borrow areas. Likewise, excavated material should be dumped at suitable and approved disposal sites.

7.6.2.2 Land Acquisition and Resettlement

The proposed BRT system will be developed within the exiting ROW and Govt. land along the existing road. However, some private land may be required for the purpose of proposed corridor widening and associated facilities i.e. minor road works, construction of bus Depots, stations, facilities for pedestrians, motorcyclists and non-motorized transport. This impact will be permanent and high significant in nature.

Mitigation Measures

Mitigation measures will involve careful site selection by the design team to minimize the impacts by avoiding the residences of affected families. The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose. This impact can be mitigated by ensuring compliance of Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees.

The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the affected persons by providing sufficient budget in the project cost. According to Land Acquisition Act 1894, the following points needs to be considered while determining compensation for the project affectees:

- Due consideration should be given to minimum land acquisition in design phase by selecting careful site for the construction of proposed project;
- The market value of land at the date of publication of notification under section 4 sub section (1);
- The market value of land and 15% compulsory land acquisition surcharge, should be given;

- The damage if any sustained by the person interested at the time of the collector's taking possession of the land by reason of acquisition injuriously affecting his other property, moveable, or immoveable, in any other manner, or his earning; and
- As a consequence of the acquisition of the land by the collector, the person affected is compelled to change his residence or place of business, the reasonable expenses incidental to such change.

Therefore, compensation should be made to the affected people as per Land Acquisition Act, 1894 and market value for the loss of assets. Adequate budget will be provided in the Project cost for this compensation.

7.6.2.3 Soil Erosion and Contamination

Impact on topsoil and soil stability is mainly expected during the preparatory and construction works, which will be caused by the arrangement of the construction camp, construction site, replacement of the equipment, earthworks, arrangement of temporary and permanent infrastructures, etc.

The soil would be exposed to erosion due to removal of vegetation, establishing construction camps / workshops and excavation etc. The most significant aspects in the construction phase of are excavation works and construction of roads. These will expose soils in the affected project area leaving them vulnerable to erosion by surface run-off and wind. The overall threat could exist for the durations of construction works in the monsoon season.

Besides, there is high possibility for soil pollution with substances due to leakages of fuels and oils from the heavy vehicles and machinery used for construction and due to applied chemicals during this phase.

Mitigation Measures:

- In order to prevent the damage and contamination of soil at the project site, surface layer of the soil should be removed and stored temporarily in pre-selected locations. The soil should be stockpiled separately. Stockpiles should be protected from wind and atmospheric precipitation and should be at least 50 meters away from surface water body;
- Stored excavated material shall be covered and preferably reused;
- Sprinkling of water may help in reducing the erosion soil;
- Use of heavy machinery should be restricted as far as possible to work sites only to avoid the destruction of soil structure;
- Vehicles and equipment should be checked regularly. In case of damage and fuel / oil leakage, it should be repaired immediately. Damaged Vehicles should not be allowed on the construction sites;
- In case of spillage of pollutants, spilled material should be localized and contaminated site should be immediately cleaned; Staff should be provided with appropriate means (adsorbents, shovels, etc.) and with personal protective equipment as well;
- All spoils should be disposed of at site designated by GWMC and the site should be restored back to its original conditions;
- Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and shall be covered;
- Washing yards shall be paved to avoid seepage of runoff from the yard;
- After completion of construction works, all kind of waste (including hazardous waste) will be collected and removed from the area. Hazardous waste should be removed for further management by the licensed contractor; and
- Perennial grasses and shrubs trees should be planted to control the runoff on the site.

7.6.2.4 Deterioration of Ambient Air Quality

Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. Besides, multifarious construction activities and increased vehicular traffic (construction vehicles) would also contribute to the localized airborne dust. The larger sized particles, under influence of gravity, tend to settle down in the immediate vicinity of the source. The Suspended Particulate Matter (SPM) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard. The objectionable impacts of settling of the suspended dust would be its dry deposition on vegetation, motor vehicles, structures, and other exposed surfaces. Exhausts from fossil fuel burning in the construction machinery will also deteriorate local air quality. Similarly, exhausts from generators can also have impacts on air quality in the vicinity. The deteriorated ambient air quality may cause health hazards to the residents of nearby localities.

Dust Emissions are generated mainly from the following construction activities:

- Site clearance and use of heavy vehicles and machinery/equipment etc. at construction site;
- Procurement and transport of construction materials such as sand, cement, etc. to the construction site;
- Other Gaseous emissions during construction result from operation of construction vehicles, plant and equipment; and
- Asphalt heating.

The overall impact on the quality of air during the construction phase will be high adverse, however, it will be temporary and limited to the project's implementation phase only.

Mitigation Measures:

The construction phase impacts of the proposed Project could be effectively mitigated by the implementation of simple procedures by the Contractor including but not limited to the following:

- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned;
- Preventive measures against dust should be adopted for on-site mixing and unloading operations;
- Construction materials (sand, gravel, and rocks) and spoil materials will be transported through trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS for carbon emissions and noise;
- Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s);
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions;
- Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;
- Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions without intervention of the operators;
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works;
- Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
- All excavation work should be sprinkled with water;
- Construction workers should be provided with masks for protection against the inhalation of dust;

- Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases;
- Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants should be taken up; e.g. providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and
- Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EMP).

7.6.2.5 Noise and Vibration

The noise and vibration will be produced due to the operation of construction machinery equipment. Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment. Noise and vibration are perceived as one of the most undesirable consequences of construction activity. The above machinery is expected to generate noise levels that would be severe in the Project Area. The noise and vibration may cause health hazards to the residents of nearby urban settlements along the proposed Orange Line corridor.

The likely impacts due to noise are:

- Psychological effects of distraction of attention, irritation and short temperedness in the exposed persons due to persistently higher noise levels;
- Noisy settings and higher background levels can cause temporary threshold shift and the consequent habit of speaking loud, which may cause damage to vocal cords in the persons exposed;
- Potential impact from vibration during the construction period consists of damage to buildings from heavy earthmoving equipment; and
- Moreover, vibrations from machinery and equipment such as hand-held compactors and concrete vibrators can produce easy fatigability and generalized aches in the persons operating these machines.

This impact is medium negative, local and short term.

Mitigation Measures:

There are a variety of ways by which construction equipment and worksite noise can be controlled. The following is a list of ways to control noise level at the worksite of the proposed Project:

Quieter Equipment: A cost-effective way to reduce noise at a construction worksite is to buy quiet equipment. In addition, equipment in use should be the most suitable for the job. Avoid using equipment that is over-powered and, conversely, avoid using under powered equipment. Whenever possible the quietest equipment alternative should be used. In general, electronic powered equipment is quieter than diesel powered equipment and hydraulically powered equipment is quieter than pneumatic power.

Modifying Existing Old Equipment: The most common way to reduce the noise levels of common construction equipment is through worksite modifications. Some common worksite modifications consist of retro-fitting existing equipment with damping materials and mufflers.

Barrier Protection: An effective way of reducing noise is to locate noisy equipment behind purpose-built barriers. The barriers can be constructed on the work site from common construction building material (plywood, block, stacks or spoils) or the barriers can be constructed from commercial panels which are lined with sound absorbing material to achieve the maximum shielding effect possible. To be effective, the length of the barrier should be greater than its height. The noise source should not be visible and barrier should be located as close as possible to either the noise source or the receiver.

Work Activity Scheduling: Work activity scheduling are administrative means to control noise exposure. Planning how noise sources are sited and organized on a work site can reduce noise hazards. Jobs can be rotated so that exposure time is limited. Transferring workers from a high exposure task to a lower exposure task could make the employee's daily noise exposure acceptable. Administrative controls include activity planning, for example, scheduling pavement breaking operations so as to reduce the number of work site workers exposed. In addition, noisy equipment should not be run for periods longer than necessary and should be switched off when not in use.

Maintenance: Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining plant and equipment in good order not only increases its life, but makes it safer to use and quieter. Loose and worn parts should be fixed as soon as possible. Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools.

Noise Perimeter Zones (NPZs): The NPZs are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZs are areas where noise levels of 90 dB (A) or more are roped off and marked to keep out all workers who don't have to be there. NPZs can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZs can be set up at that distance. Noise does not radiate from the source at the same level in all directions. Noise from machinery can be higher in one direction than another because the noise can also be either absorbed or reflected from surfaces it contacts, such as the ground or a wall. Therefore, measurements should be taken at several points in an area where people might be working. Once noise levels that are 90 dB (A) or more are determined, rope off this area as the Noise Perimeter Zone. Exclude all workers who do not need to be in that zone. All workers who need to work within the zone must wear hearing protection.

7.6.2.6 Water Quality

The potential sources of water pollution associated with the construction of proposed Project are runoff from the construction works area that may contain increased loads of sediments, suspended solids and other contaminants. Potential sources of pollution from the site include:

- Runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g. grouting and cement material with the rain;
- Wash water from dust suppression sprays;
- Fuel and lubricants from maintenance of construction vehicles and mechanical equipment;
- Spillage of liquids stored on-site such as oil, diesel, and solvents etc. are likely to result in water pollution; and
- Uncontrolled discharge of debris and rubbish such as packaging, construction material and refuse.

The groundwater may get contaminated from the wastewater generation from the construction camps, leachate from improper dumping of solid waste. The impact is medium adverse in nature.

Mitigation Measures:

As a mandatory step, all the effluents will be disposed as per the requirements of PEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. These measures are described below:

- Construction camp will be established in area with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met;
- The proponent will ensure that the construction work is confined within the project boundary and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected;
- The contractor will ensure that construction debris do not find their way into the drainage which may get clogged;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken for the proposed project, like drainage structures;
- Wastes will be collected, stored and taken to approve disposal site;
- Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must be brought down to less or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent. For wastewater apart from BOD, COD of 150 mg/l will also be checked; and
- Similarly, if the sewage after treatment is to be discharged in to the land it will meet the requirements of the PEQS for disposal of wastewater.

7.6.2.7 Blockage of Water Channels and Natural Drainage

The proposed project is crossing the Rajbah and some other nullahs/ drains at different locations. These water channels and drains may get blocked and the catchment of the

downstream may be disturbed during construction phase. This impact can be categorized as local, temporary and irreversible.

Mitigation Measures

To minimize the impact of the project on the geophysical environment, a number of measures have been included in the design that will need to be considered when constructing the project facilities. A second class of measures is related to the day-to-day management of the project during construction phase.

Following specific measures are required to minimize potential impacts:

- Unnecessary widening beyond the proposed design of the road shall be avoided at straight portions and on bends;
- The natural drainage pattern will not be disturbed, culverts and bridges will be constructed where required;
- Surplus soil and cleared vegetation will be disposed-off properly so as to avoid disturbance and blockage of natural drainage; and
- The Project Director (PD) of PMA in consultation with Irrigation Department allow local re-adjustments in foundation treatment or any other small changes, wherever required.

7.6.2.8 Borrow Areas/ Open Pits

Borrow / open pits and its excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments.

Borrow/ open pits may also result in potential sources of mosquito breeding and may prove hazardous to human beings, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and high adverse in nature.

Mitigation Measures:

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pit shall be restricted upto 5' and the sides of the excavation will have a slope not steeper than 1:4;
- Soil erosion along the borrow pit shall be regularly checked to prevent/mitigate impacts on adjacent lands;
- In case borrow pits fill with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- The Guideline Quarry Management Plan is attached as **Annex-VI**.

7.6.2.9 Operation of Construction Camps / Camp Sites

Mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil degradation, loss of vegetation

and assets on the selected land, solid waste and water pollution in the vicinity settlements. Furthermore, cultural differences, behavior of construction workers, potential disregard for local cultural norms can lead to increased tension between local communities and workers residing in the construction camps. This impact is temporary and moderate negative in nature. Table 7.2 summarizes potential impacts and proposed mitigation measures associated with construction camps.

Table 7.2: Summary of Workers Camp Impacts & Mitigation Measures

Potential Impact	Proposed Avoidance and Mitigation Measures
Environmental ▪ Temporary habitat loss or disturbance ▪ Temporary visual intrusion ▪ Noise emissions at a single location ▪ Waste generation ▪ Discharge of sanitary effluents and rainwater run-off to nearby water bodies	***Environmental*** ▪ Reinstate any temporary facilities to pre-existing conditions in ecologically sensitive areas. ▪ Implement landscaping plan for all facilities in areas where high landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures. ▪ Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary. ▪ Provide adequate warnings of impeding works to all potential receptors within a 1 km corridor surrounding the RoW via public notices and local news.
Social ▪ Worker camp site: consultation surrounding potential construction camp sites revealed concerns regarding the location of proposed sites for Worker Camps.	***Social*** State land will be a second preference for worker camp locations, followed by land where there is a willing lessee. Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values. Training will be provided to all staff on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages: ▪ A briefing on camp rules ▪ A community relations orientation to increase awareness about the local area, cultural sensitivities and the project Code of Conduct ▪ Awareness-raising on health considerations, including sexually transmitted diseases (STDs). The construction contractor is required to develop a Construction Camp Management Plan to address: ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases.

Potential Impact	Proposed Avoidance and Mitigation Measures
	A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan, which provides policies and a disciplinary framework with respect to worker behavior.
Camp Location The final location will be determined by the construction contractors and agreed with the PMA.	***Camp Location*** The construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption.

Some additional mitigation measures should include:

- The contractor(s) should provide plan to PMA for removal & rehabilitation of site upon completion;
- Photographical and botanical inventory of vegetation before clearing the site; and
- Compensatory plantation to be scheduled when construction works near end.
- Camps will be designed to be self-contained to reduce demand on infrastructure and services of nearby communities;
- A comprehensive safety and security plan for the camp will be prepared which will comprise of a training manual, use of safety equipment and emergency preparedness;
- Waste Management Plan (**Annex-VII**) will be implemented to ensure safe handling, storage, collection and disposal of wastes and the training of employees who handle waste;
- The contractor(s) shall ensure removal and rehabilitation of site upon completion.

7.6.2.10 Wastewater Generation at Construction Camps

Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains, water channels etc. apart from soil contamination. The wastewater generation is estimated to be 6,600 liters/day[10] for 200 construction workers during construction phase of the proposed Project. This impact can be categorized as moderate adverse, site-specific and temporary.

Mitigation Measures:

To dispose the liquid waste generated from the construction activities, the following steps should be taken by the Contractor:

[10] Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks (as shown in **Figure 7.1**);
- Proper monitoring to check the compliance of PEQS will be carried out;
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; and
- The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along with details of wastewater collection, transportation and its disposal.

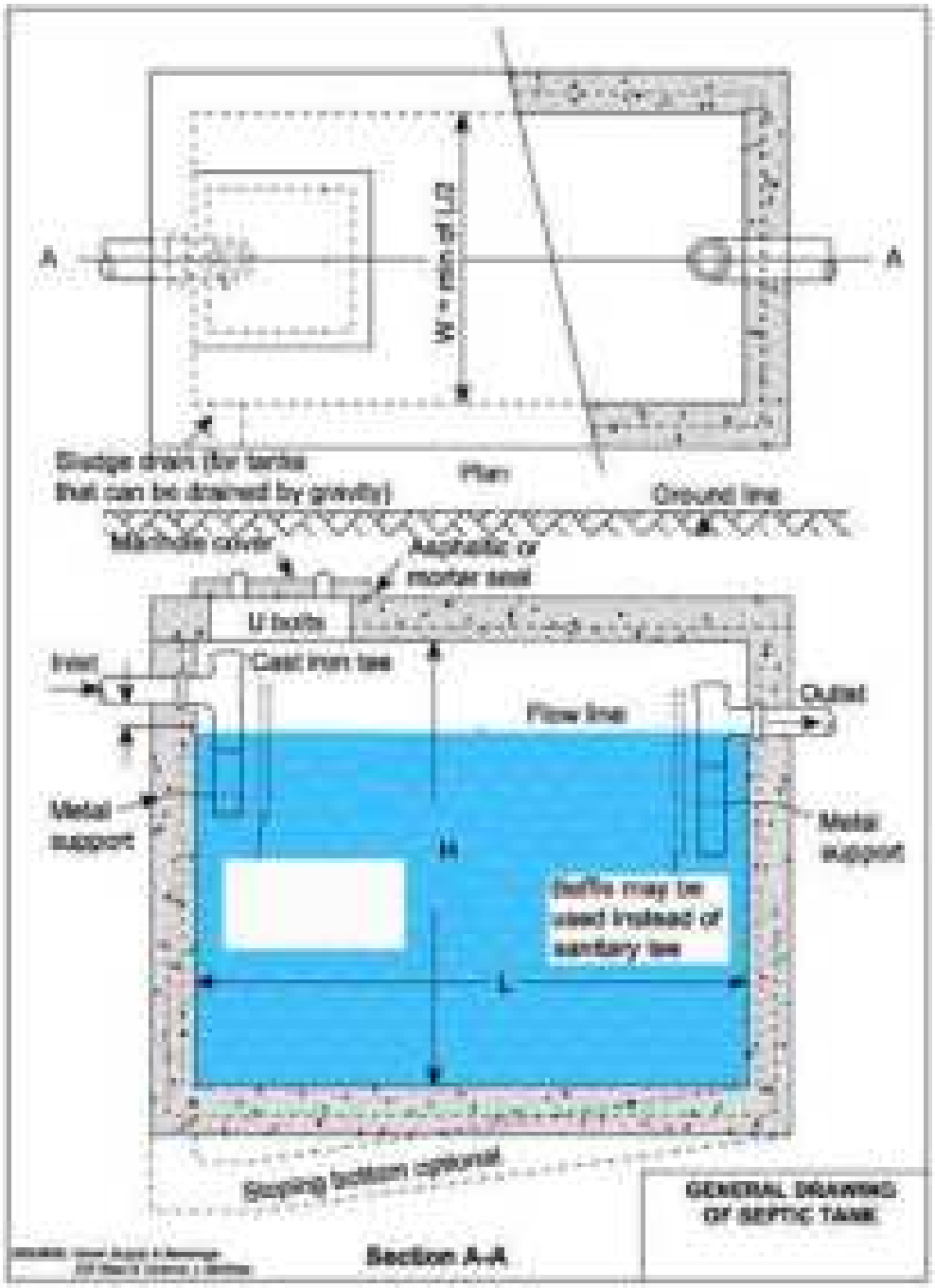

Figure 7.1: General Drawing of Septic Tank

7.6.2.11 Solid Waste Generation at Construction Camps

The solid waste generation is estimated to be 120 kg/day[11] for 200 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase of the proposed Project. The municipal waste will be in the form of food, cans, paper and wastewater from construction camps toilets and washing yards. Construction waste will include excavated soil, sand, gravel, rocks, asphalt, pieces of concrete, bricks, wood, metal pieces and electrical wires. Whereas, hazardous waste can be comprised of paints and construction chemicals. All these, if left unattended, can become a source of nuisance and environmental pollution in the Project Area.

Insecure and unhygienic disposal of the solid wastes particularly garbage and trash may cause degradation of soil and land. Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents. Throwing away of solid wastes into water channels and the wastewater network can result into choking of the latter. These impacts are temporary and minor negative in nature.

Mitigation Measures:

- Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan;
- Training of work force in the storage and handling of hazardous materials and chemicals Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste; proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc.;
- Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions;
- Emergency response plan shall be prepared to address the accidental spillage of fuels and hazardous goods;
- Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying appropriate technologies;
- Reusing bitumen spillage; and disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5 m);
- Used oil shall be collected in separate containers stored on impervious platform with restricted access and shall be sold to licensed contractor and the burning of waste oil shall be strictly restricted;
- Segregating and stockpiling scarified/ milled bituminous material and reusing this material in sub grade/shoulders;
- Construction waste such as waste wood can be recovered and recycled into wood for new building projects, and cement, bricks, and plaster can be crushed and reused in other construction and building projects; and

[11] Source: Estimated solid waste generation rate in the study area is about 0.6 kg/person/day.

- The contractor should ensure implementation of proposed Construction Waste Management Plan and it must be reviewed during the entire construction phase in the light of changing weather conditions.

7.6.2.12 Traffic Management

Due to the proposed project construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling especially through Jhang Road, Jaranwala Road, College Road etc. and other approached roads. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, dust emissions, noise related impacts, etc. Considering these consequences, this impact can be categorized as site-specific, medium negative and temporary.

Mitigation Measures:

To minimize traffic problems in the proposed Project Area, following measures will be considered:

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads;
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work;
- Proper sign boards will be provided for smooth flow of traffic;
- Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents;
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays; and
- In the light of Guideline Traffic Management Plan **(Annex-VIII)** a site specific TMP will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.

7.6.2.13 Issues of Smog

Construction activities related to proposed project can significantly contribute to smog issues in the City, primarily due to various pollutants released during the construction phase. Some of the key elements contributing to smog during construction include:

- Particulate Matter (PM): Construction activities generate dust and particulate matter, especially from excavation, demolition, material handling, and transportation of construction materials. These fine particles can remain suspended in the air for long periods, contributing to smog formulation and enhancement of existing smog issue.

- Vehicular Emissions: Construction sites often involve heavy machinery and trucks for transportation of materials. These vehicles emit pollutants such as nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter that will contribute to smog formation in reaction with sunlight and other pollutants in the atmosphere.
    - Incomplete Combustion: Inefficient combustion of fuels, often used in construction equipment, can release pollutants like sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter, which contribute to smog formation.
    - Lack of Dust Control Measures: Inadequate measures to control dust and particulate matter at construction sites, such as un-covered construction materials, lack of water sprinkling, or absence of dust barriers, can significantly contribute to increased airborne particles.

Mitigation Measures:

To mitigate or reduce smog issues and impacts of construction activities on smog formation, following measures can be taken:

- Implement robust air quality monitoring systems to track pollution levels and take necessary actions accordingly.
- Implement and enforce regulations regarding air emissions as per PEQS, dust control measures, and the use of cleaner technologies in construction machinery and vehicles.
- Encourage the use of electric or hybrid machinery and vehicles to reduce air emissions.
- Employ effective dust control measures, such as water sprinkling, covering materials, and using dust barriers, to minimize the release of particulate matter.
- Educate construction workers and the public about the importance of adopting eco-friendly practices to reduce smog formation.
- Vehicle Inspection & Certification System (VICS) should be implemented in true letter & spirit to reduce environmental pollution caused by unfit motorized vehicles.

7.6.2.14 Climate Change and Green House Gas Abatement

The main sources of greenhouse gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. The mobile sources will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale. The climate change due to global warming, may result in following impacts over a period of time:

- Extended summer season;
- Higher temperatures may result in more precipitation falling as rain rather than snow, hence earlier and greater runoffs, increased runoff may pose greater challenges for water management;
- Increased natural hazards such as landslides and debris flows, extreme/unpredictable rainfall events, wind storms, droughts and wildfire:
- Due to shift in temperatures and precipitation patterns runoff, stream/lake temperatures, suitable habitats may move upland, thereby declining in size,

ecosystems become fragmented, number and composition of species will change with particular threats to sensitive species; and
- Increased damages to transportation infrastructure from extreme events, causing difficulties for access and emergency evacuation, and involves higher maintenance costs.

Mitigation Measures:

- Regular motioning of the vehicles for engine efficiency;
- All stakeholders (PMA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO_2 burden;
- Elimination of unnecessary idling can save fuel, prolong engine life, and reduce emissions. It can also help reduce the noise levels associated with construction. Unnecessary idling occurs when trucks wait for extended periods of time to load or unload materials or supplies, or when equipment is left on when it is not being used. Constructions workers may take breaks and leave equipment running unnecessarily or may idle equipment because it is an ingrained habit;
- Managing equipment operations and training workers to reduce unnecessary idling is a relatively easy way to lower operating costs and help reduce the environmental impact of construction;
- A preventive maintenance program by the contractor seeks to maintain engines at their original level of performance and eliminate the high cost of catastrophic engine failure. Preventive maintenance is the systematic inspection, detection, and correction of potential construction equipment failures. It significantly reduces fuel consumption and emissions; and
- Use of low sulfur and good quality fuel in the construction vehicles or operating equipments that will reduce maintenance costs and harmful emissions.
- Alternative energy resources shall be considered where possible; and
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.

7.6.2.15 Natural and Man-Made Disasters

Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.

Mitigation Measures:

Mitigation measures include the following:

- An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with Supervision Consultant and PMA and should be implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and PMA staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Emergency numbers should be clearly posted at active construction sites; and

- Minor incidents and near misses should be reported by the contractor, and preventive measures should be formulated accordingly by the PMA management.

7.6.2.16 Occupational Health and Safety

Occupational Health and Safety (OHS) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc.

Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the OHS related issues e.g. struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. The proposed project area is also sensitive from the law and order point of view and the security as well as the safety of the Contractor and Consultant staff will be a major issue. Considering these consequences, this impact can be categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures:

Following mitigation is given to avoid the accidental risks:

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- Complying with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract;
- Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage;
- Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site;
- Work areas will be cordoned off where necessary;
- Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and
- Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work;
- An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services; and
- The Occupational Health and Safety Plan is attached as **Annex-IX**.

7.6.2.17 Community Health and Safety

The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, etc. The proposed Project will also have potential of air (dust pollution), noise and vibrational impacts on nearby community. The labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may also be aggravated if workers from one group are moving into the territory of the other. Considering these consequences, this impact can be categorized as site-specific, medium term, temporary and irreversible.

Mitigation Measures:

- Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- There will be proper control on construction activities and oil spillage leakage of vehicles;
- The labourers with different transmittable diseases will be restricted within the construction site;
- Ensure that the site is restricted for the entry of irrelevant people particularly children;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Provision of proper safety and diversion signage at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders;
- The mitigation measures provided in the following sub-sections for air and noise shall be adopted to reduce the air pollution, noise pollution and vibrational impacts on nearby community;
- The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will be prevented by successful initiative typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health service;
- Reducing the impacts of vector borne diseases will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water;

- The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by PMA; and
- Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

7.6.2.18 Communicable Diseases

The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like HIV/AIDS. Majority of the people living in the surrounding of the Project, and potential labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases.

Mitigation Measures:

The Contractor shall:

- Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS;
- SOPs related to the construction industry advised by National Action Plan, shall be implemented by the contractor and should be strictly monitored;
- Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages;
- Ensure cleanliness and hygienic conditions at the labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department; and
- Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.

7.6.2.19 Resource Conservation

The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their sustainable use is necessary for the future use.

Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is very important. The impact is negative and long term in nature.

Mitigation Measures:

Following practices shall be adopted to conserve these natural resources:

- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment's;
- The efficient and well maintained equipment's and machinery should be used;
- The equipment and machinery should be turned off when not in use;
- Regular maintenance of machinery to avoid fuel leakages;
- Reduction of wastage of water through training of workers involved in water use should be planned;
- Plan for reuse of construction waste materials may be formulated;
- A good camp design and an efficient worksite management plan should be prepared that may help the contractor to reduce the water demand, and wastewater and solid waste volumes to the lowest levels;
- Use of solar panels at camp sites to conserve energy; and
- The Resources Conservation Plan is attached as **Annex-X**.

7.6.2.20 Discovery of Heritage Sites/ Structures during Excavation

During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archeology, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains. Chance finds procedure (given in **Annex-XI**) shall be adopted in case of any accidental discovery of cultural heritage.

7.6.2.21 Flora

The proposed project will necessitate the clearance of existing vegetation within the construction footprint, particularly along the proposed road corridor. Based on GIS data and preliminary assessments, it is estimated that approximately 933, trees, pole crops (young trees) and saplings, may be impacted as a result of the proposed project activities.

The number of possibly impacted vegetation is tentative and indicative, which will be finalized by the forest department/PHA during construction phase. Removal of small- and medium-sized trees will be undertaken strictly in accordance with the approved project layout.

Compensatory measures, including tree plantation and payment of applicable compensation, shall be implemented in coordination with the Parks and Horticulture Authority (PHA), Forest Department, and other relevant regulatory agencies, in compliance with applicable environmental laws, regulations, and guidelines.

Moreover, exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). Overall, it can be stated that the large number of trees may be damaged in the proposed project activities.

This impact is site-specific, medium negative and high significant.

Mitigation Measures:

- Incorporate technical design measures to minimize removal/damage of trees, if possible;
- Tree cutting and vegetation disturbance shall be avoided to the maximum extent practicable to minimize adverse impacts on natural regeneration processes and to ensure minimal ecological and environmental loss;
- Disturbance/ Cutting of trees shall be avoided as far as possible and select the alternate route for the proposed project (if possible);
- Trees should be replanted, relocated or transplanted wherever possible, instead of cutting;
- Where feasible, small- to medium-sized trees and shrubs likely to be affected shall be relocated to suitable available spaces within or around the project green belt;
- A tree plantation program shall be formulated with the recommendations and technical support of PHA and Forest Department;
- Tree plantation plan should be implemented preferably in the project area or nearby blank spaces (along the roads, parks & green areas etc. where suitable) within 500m radius possibly;
- The Punjab Mass Transit Authority (PMA) shall obtain the required No Objection Certificates (NOCs) from the Forest Department and PHA prior to any tree cutting or vegetation clearance;
- As a principal of 1:10, ten trees shall be planted in place of felling of one tree in consideration of mortality;
- Total 10,000 trees will be planted at available spaces in lieu/compensation and area enhancement;
- Mawakai Forests should be established at appropriate sites in the existing parks in the city or in its sub-urbs to off-set the tree cutting or tree loss occurring in the ROW of the Project;
- Rehabilitation of existing parks in the city or planting of additional trees in the parks wherever possible should be undertaken to maximum extent;
- The proponent shall implement the program with the help of PHA and Forest Department and in consultation with concerned consultant ecologist;
- Open fires should be banned in the area to avoid hazards of fire in the project area;
- Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste / barren land rather than on forested or green land;
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth;
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement;
- The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes; and
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.

7.6.2.22 Fauna

During construction phase the existing population of birds, mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing fauna will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.
Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.

Noise generated from machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the fauna of the Project Area. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is indirect, site-specific, temporary, reversible and medium significant.

Mitigation Measures:

- Care shall be taken during construction activities for avoiding purposely or chance killing of animals;
- If any wild species and habitat is found during construction, it must be dealt carefully and local wildlife department officials should be informed;
- Hunting, poaching and harassing of animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard;
- The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department;
- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding;
- Noise generating activities shall not be carried out during the night by the work force;
- Wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and
- Noise produced due to construction activities may be kept to acceptable level.

7.6.2.23 Employment

Due to construction of the proposed Project, economic and commercial activities will be generated in the study area, as the laborers and semi-skilled staff from nearby communities will have an opportunity to work for the construction of the proposed Project. Similarly, the restaurants, hotels, and tea stalls present in and around the proposed Project Area will also get benefits in an income generation, as workers will visit them for food and nourishment. The impact is temporary and positive in nature.

7.6.2.24 Social/ Cultural Conflicts

During the construction phase of the project, conflicts may arise between labor force and Local communities that exists near the Project Area. Use of local resources (existing infrastructure and utilities) by the construction workers can generate stress on the local residents. Furthermore, difference in cultural values may also cause discomfort to local residents. This impact is temporary and moderate adverse in nature.

The construction activity may disturb the business and livelihoods of the workers doing their businesses along the alignment due to the excavation activities. There are various categories of commercial activities along the Orange Line BRT Corridor and off-Corridor. The owners of the commercial structures will have a temporary impact on sources of livelihood during construction phase. This impact will be, temporary and low adverse in nature.

Mitigation Measures

- Local labor should be preferably employed for the construction works;
- Careful planning and training of work force to minimize disturbance to the local people; and
- Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals.

7.6.2.25 Restriction of Access and mobility

Approach/ hindrance problems for the local residents in the surrounding areas business owners, students and movement of the daily commuters will be disturbed due to construction activities. The movement of construction material carrying vehicles will cause traffic congestions at the entrance/exits of above mentioned areas. Moreover, the construction activities will produce dust and noise pollution that will cause nuisance to the residents of the surrounding areas. This impact is temporary and minor adverse in nature.

Mitigation Measures

- Assurance of timely completion of the construction works according to the agreed schedule by PMA;
- Schedule movement of vehicles carrying construction materials after school/college hours or during night time;
- Provision of alternate routes for the project site where the construction is being carried out;
- Effective traffic management with the help of Traffic Police during the peak hours to avoid traffic congestions and provide ease of traffic;
- Continuous water sprinkling at the active sites to suppress the dust;
- Restricting the construction activities to only daytime; and
- Contractor should prepare and strictly implement SOPs for the workers to protect the privacy of the residents.

7.6.2.26 Impact on Structures

Impact on Commercial Structures and Business Disturbance

The proposed project will result in impacts on commercial structures and associated business activities, primarily due construction activities along the project corridor. Partial loss of commercial structures may occur, leading to disturbance of businesses. In addition, construction-related activities such as site clearance, material storage, and movement of construction machinery may temporarily restrict access to commercial establishments. These disruptions may result in reduced customer access, interruption of business operations, and loss of income for affected businesses. The impact is assessed as adverse, temporary to permanent in nature (depending on the extent of structure loss), and moderate in nature.

Mitigation Measures

Appropriate mitigation measures, including access management, phased construction, and compensation will be required to minimize economic disruption to affected commercial entities.

The inventory and detailed measurement of structures and the number of Affected Household to be affected for clearing of RoW for the proposed Project and detailed measurement survey should be carried out for preparing the compensation.

Following measures shall be adopted to mitigate the adverse impacts:

- Compensation of the structures should be evaluated and provided as per market rates;
- Affected Persons should be compensated on full replacement cost of each category to construct a new structure of the same type;
- Compensation of livelihood disturbance should be provided for the period of instruction of commercial activities;
- Proper consultations and coordination's with APs during resettlement process.
- Compensation for affected structures should be evaluated and provided as per market rates.
- Affected Persons should be compensated on full replacement cost of each category to construct a new structure of the same type; and
- Proper consultations and coordination's with PAPs during resettlement process.

Educational Institutes Structures

Boundary walls of some Educational Institutes in the city will be affected, while clearing the required RoW.

Mitigation Measures

The structures to be affected will be evaluated by the relevant department and will be restored and rebuild according to the specification of the existing building.

Public Utilities and Fixtures

The proposed project is expected to impact existing public utilities, resulting in disruption of public services and temporary inconvenience to local residents within the Area of Influence (AOI). Utilities located within the project footprint, including electricity distribution poles, water supply pipelines, and sewage infrastructure, are likely to be disturbed or relocated during construction activities. Such disturbances may lead to temporary service interruptions unless appropriately managed. The impact is assessed as adverse**,** temporary in nature, and moderate in magnitude**.**

Mitigation Measures

Mitigation measures will include:

- Proper compensation and restoration mechanism of public and private utilities should be prepared;
- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department;
- All public utilities likely to be affected by the proposed Project will be relocated well ahead of time before the actual commencement of the construction work.
- Strengthening of utilities, wherever required;
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project Area;
- Timely public notification of unexpected disruption of services; and
- The Contractor shall in no instance excavate around or over live buried electrical cable or pressurized gas lines during the construction, or allow such to be suspended across open excavations in a manner that, in the opinion of the Resident Engineer, threatens public or worker safety. Neither shall water lines be left suspended and unsupported across open excavations.

7.6.2.27 Impacts on Livelihood

The construction activity may disturb the business and livelihoods of the shopkeepers, business operators and workers doing their work in the CoI due to the excavation activities, traffic diversion and access issues.

Mitigation Measures

- Proper compensation should be provided to all the affectees losing their livelihoods along the COI;
- Livelihood restoration should be provided to mitigate the adverse impacts on livelihood and restoration of commercial activates which will be monitored;
- Initial assessment of compensation should be carried out for the income loss of the affectees based upon the current approximation of the AoI and construction camps.
- Project Construction should be completed on time; and
- Proper awareness and training should be conducted among the affectees regarding Project benefits.

7.6.2.28 Gender Issues

Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community.

During construction phase gender-based violence might arise due to discrimination made against women by unequal work distribution and unequal pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the roads, bus stops and markets. Educational institutions near the project alignment are also sensitive regarding gender issues. This impact is high negative in nature during construction phase.

Mitigation Measures

- The contractor will be required to provide qualified key personnel to address the specific risks identified in the project. Contractors will specify key staff with the technical skill and experience to implement the mitigation measures;
- The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers, thereby minimizing labor influx;
- The bidders will be required to submit Codes of Conduct (CoCs) with their bids;
- The CoCs will set clear boundaries for acceptable and un-acceptable behaviors of all individuals and companies and will be signed by companies, managers and individuals;
- All project consulting firms will also be required to submit Codes of Conduct with their proposals;
- The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace;
- The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct; and
- Provisions will be set in contracts for dedicated payments to contractors for Sexual Exploitation and Abuse prevention activities (e.g. training) against evidence of completion. The portion of the contract price will be guaranteed by a performance security linked to environmental and social contractor performance.

7.6.2.29 Child Labor

Inhabitants of the project area have mix economic background and different sources of income. Children of low-income groups mostly involve in different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.

Mitigation Measures

The risk of hiring of underage workers for the project activities will be minimized by adopting the following mitigation measures:

- Awareness should be created among the local communities about the adverse impacts of child labour. For the public awareness, meetings should be held in the Project Area, and announcements should be made using the available local platforms with the involvement of all sectors of the society;
- Contractor through contractual agreement should be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities should be monitored by the social and environmental staff of the implementing agency;
- Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labour policies in Punjab and Pakistan; and
- Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them.

7.6.3 Potential Environmental Impacts during Operational Phase

The anticipated environmental impacts related to the proposed Project have been studied for the operational phase of the project as discussed hereunder.

7.6.3.1 Landscape

During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. This will have a positive impact of permanent nature. The presence of adequate flora at available spaces along the Mass Transit corridor will help in absorbing flue gases emitting from a large number of vehicles and private transport passing through the project area, which shall help to improve the air quality.

Mitigation Measures

The saplings planted in the project area against the trees affected should be properly maintained throughout their growth.

7.6.3.2 Efficient Public Transport System

The operation of proposed Orange Line Mass Transit System will improve public transportation efficiency, as BRTS offers faster, more reliable, and higher-capacity service compared to conventional buses. This often leads to a modal shift, encouraging commuters to choose public transit over private vehicles, which helps reduce traffic congestion and lowers pollution levels.

The dedicated lanes and signal priority for BRTS reduce delays and enhance punctuality. Additionally, the system promotes more organized boarding and alighting at well-designed stations, improving passenger safety and comfort. Low fares make transit more affordable for a broader section of the population, providing economic relief and improving access to jobs, education, and essential services.

7.6.3.3 Reduction in Travel Times

Due to separate lanes and uninterrupted movement, Mass Transit Systems can reduce travel times for passengers. No long queues are expected due to automated ticketing system and prepaid card systems facilitate passengers from waiting at the stations for undefined time periods. These impacts are permanent and have a major positive impact on social life of citizens.

7.6.3.4 Air Quality

Improvement in road condition as well as development of mass transit system will help to reduce traffic related emissions by reducing private vehicles on Jhang Road and Jaranwala Road by allowing a smoother traffic flow. The operational phase will improve the air quality of the project area by reducing vehicular emissions and traffic congestion. This impact is permanent and positive.

7.6.3.5 Noise and Vibrations

The proposed Orange Line is forecast to reduce the private transport in Faisalabad. The reduction in vehicles will result in reduction of noise associated with traffic. The noise generated due to Orange line is expected to be minimal due to electric traction. This impact is permanent and positive.

7.6.3.6 Water Quality

Project's operation is unlikely to affect the nearby surface water bodies. No major adverse impact on groundwater is anticipated during the operational phase with the exception of some occasional oil spills, which may be restricted to the road surface, however, may be sometimes washed into groundwater during rains etc. Also, there will be no abstraction of groundwater for any of the project activities during the operation phase.

7.6.3.7 Solid Waste Generation

Twenty-Two (22) bus stations will be located along Orange Line BRT Corridor. The estimated daily ridership in the buses will be 90,918. These passengers will use the bus stations for boarding and alighting including staff allocated on these bus stations to provide different services to the passengers and for the maintenance of the bus stations. The solid waste will be generated from these stations, refreshment and ticketing booths comprising wrappings, papers, eatables, empty cans or bottles, food residues etc.

If this solid waste is not properly collected, stored and disposed at appropriate place, it can result in i) nuisance at the collection sites, ii) spreading of waste on streets and roads iii) clogging of drains iv) odor and breeding of mosquitos and flies and outbreak of diseases for perishable waste material. The impact will be high adverse in nature.

Mitigation Measures:

- A comprehensive solid waste management system should be formulated for the operation phase; Waste storage containers with color coding should be placed at designated locations;
- Waste segregation should be done at source and requisite planning needs to be done to implement the segregation techniques through residents and commercial building users;
- Installation of sign boards for solid waste at all the stations of Orange Line; and
- Daily housekeeping of stations should be carried out to minimize the generation of waste.

7.6.3.8 Traffic Management

Traffic management during the operation of a proposed Orange line is crucial to ensure smooth, efficient, and safe movement of both BRT vehicles and other road users. Major challenges that impact BRTS efficiency and reliability are entrance of unauthorized vehicles in dedicated BRT lanes, which leads to congestion and delays. Additionally, poorly coordinated traffic signals and insufficient implementation of signal priority for BRT buses can cause delays at intersections.

Moreover, inadequate pedestrian crossings and crowded platforms leading to conflicts between pedestrians, vehicles, and cyclists. The impact will be high adverse in nature.

Mitigation Measures

- BRT vehicles are given priority at intersections through adaptive traffic signals;
- Strict enforcement to prevent unauthorized vehicles from entering BRT lanes;
- Use of surveillance cameras, automated fines, or physical barriers;
- Managing mixed traffic on roads where BRT shares space with other vehicles; and
- Liaison with the Traffic Police Department on the roads, surrounding the project for continuous flow of traffic.

7.6.3.9 Maintenance of BRT Corridor

During the operation phase, related road/corridor maintenance works will be conducted time to time which may lead to social and environmental issues like traffic management, inconvenience to local residents, public safety, vehicular emissions, dust and increase in noise. This is a temporary and moderate negative impact.

Mitigation Measures

- Best Management Practices should be used for all the maintenance works;

- Timely completion of all the maintenance works according to the agreed schedule;
- Traffic management plan should be devised and implemented; and
- HSE protocols should be strictly followed and implemented to avoid any incident/accident.

7.6.3.10 Drainage

During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travelers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the surface and can cause traffic jams. The impact may consider to be moderate adverse in nature.

Mitigation Measures:

- The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and
- Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the road alignment.

7.6.3.11 Impacts of Operation of Depots

Noise

Noise will be generated from bus depots from different activities such as arrival and departure of buses, maintenance activities, and other operations. The bus depots are located at commercial and residential areas of the city. The noise from bus depot operation can disturb the comfort of the nearby community. The impact will be high adverse in nature.

Wastewater from Washing Area

The washing area of buses will generate contaminated wastewater containing dirt, oil and detergents. If the wastewater is disposed without any treatment, then there are chances that it can contaminated soil and water resources. The impact will be high adverse in nature.

Mitigation Measures:

- Special consideration will be given to the noise control aspect during bus depot design stage. The noise barriers will be installed at noise prone areas such as workshop and generator. The generator will be enclosed in the room with silencer installed at its emission point to avoid dispersion of noise at the bus depots and nearby community.
- The wastewater from washing area will be passed through grease trap and sedimentation tank for the removal of oil and grease and dust particles prior to disposal in the sewerage system or in the wastewater drain.

7.6.3.12 OHS Considerations

Occupational health and safety issues at depots/stations can arise from several sources. High-voltage electrical equipment poses risks of shock, burns, and arc flash. Fire hazards come from flammable materials like fuels, solvents, and batteries. Chemical handling during maintenance can lead to spills and health issues, including skin irritation and respiratory problems. Noise from HVAC systems and maintenance work may cause hearing damage, while fumes and dust affect respiratory health. Repetitive tasks and heavy lifting can result in musculoskeletal injuries, and slip, trip, and fall hazards come from spills and clutter. Additionally, unforeseen incidents such as accidents, natural disasters, and medical emergencies may arise during operation. The impact is high adverse and may vary from temporary to permanent duration.

Mitigation Measures

- Educate employees on potential hazards such as chemical handling, electrical safety, and ergonomic practices.
- Develop and regularly update emergency response plans for various scenarios.
- Conduct regular drills to ensure staff are prepared for emergencies.
- Provide appropriate PPE, such as gloves, safety glasses, hard hats, and hearing protection shall be regularly inspected for effectiveness
- Maintain clean, organized workspaces to prevent slips, trips, and falls.
- Ensure adequate ventilation in maintenance areas to reduce exposure to fumes and dust.
- Clearly mark and keep emergency exits accessible at all times.
- Store chemicals and hazardous materials in labeled, secure containers.
- Ensure only qualified personnel handle electrical systems and charging stations.
- Conduct regular inspections and maintenance of electrical equipment to prevent accidents.
- Implement fire prevention measures, including safe storage of flammable materials and regular equipment checks.
- Equip the facility with fire extinguishers, alarms, and sprinkler systems, and train staff in their use.
- Implement measures to reduce noise from maintenance activities and equipment.
- Provide hearing protection for employees working in high-noise areas.
- Conduct regular health screenings and provide access to occupational health services.
- Promote hygiene practices and provide vaccinations to prevent illness.
- Educate employees on potential hazards such as chemical handling, electrical safety, and ergonomic practices.

7.6.3.13 Emergency Preparedness and Response

During the operation phase, emergencies like fire and disasters such as earthquakes and flooding may occur. This impact is negative, temporary and moderate in nature.

Mitigation Measures

- An Emergency Response Plans for storm flooding, earthquakes, and manmade disasters must be developed by the PMA, in close consultation with Fire Fighting

Department (FFD), Rescue 1122 Services and Provincial Disaster Management Authority (PDMA);

- Training of management staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Responsible person to implement the Emergency Response Plan should be clearly designated;
- Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises;
- Firefighting machinery and vehicles should be maintained regularly; and
- Regular drills for fire emergencies should be carried out.

7.6.3.14 Impact on Flora/Fauna

During the operational phase of the proposed project, no significant impacts are envisaged or release of any significant pressure detrimental to flora and fauna. The presence of adequate flora at available spaces in the project area will help in absorbing flue gases emitting from vehicles and public transport passing through the project area, which shall help to improve the air quality.

Mitigations Measures:

- The landscape plan provided in the master plan must be completely implemented;
- The implementation of plantation plan recommend in compensation for cutting of trees should start during operational stage, to ensure the ecological balance and to avoid any impact on local Environment;
- Large scale plantation of seedlings/ saplings of suitable indigenous tree species, shrubs and ornamental plants in the form of tree groves, should be carried out in accordance with the tree plantation plan to improve aesthetic value and offset the effect of removal of vegetation;
- Proper check and balance of above mentioned activities is highly recommended. Plantations raised must be maintained according to the Silvicultural practices which include proper irrigation, cleaning, pruning and thinning at prescribed intensity, silt clearance and trench-opening; and
- Maintenance and security of the plantation should be done for at-least five years.

7.6.3.15 Environmental Quality

Environmental quality is an indicator of regional quality of life, supporting the health and well-being of the public and the attractiveness and sustainability of the urban and natural environment. The BRTS environmental improvement mechanisms include the effects within three general categories:

Technology Effect: Reduced vehicle emissions due to the electric bus systems.

Ridership Effect: Trips diverted from private vehicles which increase transit ridership.

System Effect: Reduced vehicle emissions from reduced congestions.

These impacts are permanent and have a major positive impact on environment.

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 GENERAL

Environmental Management Plan (EMP) is a tool for the implementation of the all the suggested measures to make the project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological and socio-economic issues of the proposed Project, and describes the institutional framework and reporting mechanism to implement EMP for the proposed Project.

This section provides brief description of environmental issues, mitigation measures to eliminate or reduce environmental and social impacts to an acceptable level, institutional framework for the implementation of the mitigation measures and environmental monitoring plan for air quality, water quality, and noise pollution parameters during construction and operational phase. A budgetary plan is also developed, indicating estimated costs to be incurred to mitigate potential adverse impacts of the proposed Project.

8.2 EMP COMPONENTS

The EMP comprises following main components:

- EMP Objectives;
- Scope of the EMP;
- Environmental Policy, Legislation and Framework;
- Institutional Requirements;
- Environmental Mitigation and Management Matrix;
- Environmental Monitoring Plan;
- Planning for EMP Implementation;
- Training and Capacity Building;
- Communication & Documentation;
- Management Plans;
- Chance Find Procedure;
- Public Disclosure;
- EMP Cost; and
- Summary of Environmental Cost.

8.3 OBJECTIVES OF EMP

The main objectives of the EMP are to:

- Provide the details of the Project impacts along with the proposed mitigation measures, and the corresponding implementation activities;
- To ensure that all necessary corrective actions are carried out and monitored in time to counter any adverse environmental impact under a systematic monitoring approach;

- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Define the role and responsibilities of the Project Proponent (PMA), Contractor(s), Supervisory Consultant(s) and other key players in order to effectively communicate environmental and social issues among them;
- Define a monitoring mechanism, reporting frequency and identify monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented;
- Design the training and capacity building plan for enhancing the capacities of the Project Proponent (PMA), Contractor(s), Supervisory Consultant(s) on environmental and social management;
- Identify the resources required to implement the EMP and outline the corresponding financing arrangements; and
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.

8.4 INSTITUTIONAL REQUIREMENTS

The institutional requirements for the Construction and Operation & Maintenance (O&M) phases of the proposed Project are provided in below sections.

8.4.1 Institutional Setup for Implementation and Management of EMP

The key players involved during construction phase of the proposed Project are the PMA as employer/proponent, PEPA, the Supervisory Consultant (SC) and the Contractor. The roles and responsibilities of these organizations are outlined below.
The following staff will be involved in the implementation of EMP:

- PMA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager.

The employer/ proponent (PMA) will make Contractor bond through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental Permit. The EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies requirements, before commencement of construction works. The organizational setup for implementation of EMP during construction phase is provided in Figure 8.1.

8.4.2 Overall Oversight Arrangements

A Project Steering Committee comprising of Chairman PMA, Project Director PMA and Deputy Director, PMA will provide overall guidance and oversight and will be responsible for ensuring effective implementation of the project.

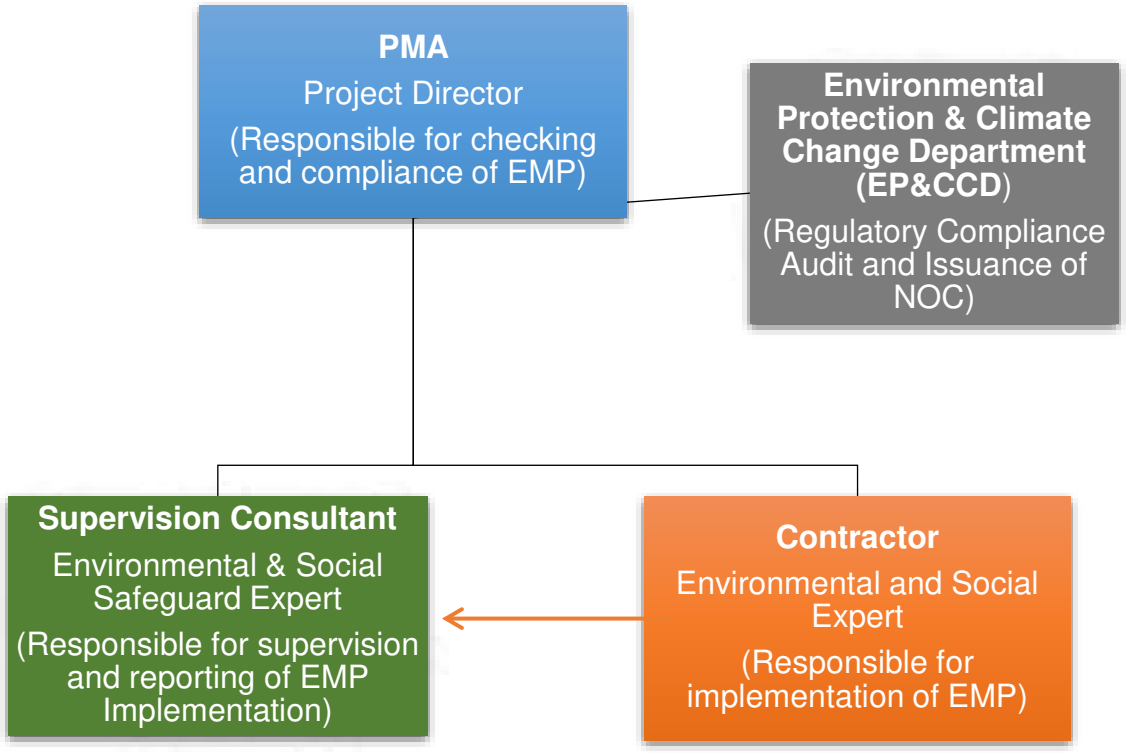

Figure 8.1: Organizational Setup for the Implementation of EMP at Construction Stage

8.4.3 Roles and Responsibilities for EMP Implementation during construction Phase

a. PMA/ Employer Concerned Staff

The specific responsibilities are as follows:

- Setting up systems for environmental management;
- Ensuring that the Contractor(s) develop and carry out environmental implementation plans that are consistent with the EMP;
- Liaising between the Project staff and the Supervisory Consultant's staff to monitor environmental and social compliance during construction phase;
- Ensuring that the required environmental and social training is provided to the concerned staff;
- Responsible for carrying out random site visits to the construction sites to review the environmental performance of the contractors;
- Monitoring the progress of environment and social related activities;
- Make sure that the contractor is implementing the additional measures, suggested by the Supervisory Consultant in monthly environmental monitoring reports;
- Assessment of the crops, trees, valuation of property (if any), public utilities and negotiation with the affectees for fixation of compensation to be paid for temporary as well as permanent acquisition of the land;
- Assist in checking genuine ownerships of the claimants, in consultation with the Revenue staff for prompt payment to the affectees;

- To assist Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the EPA-Punjab on status of EMP implementation.

b. Supervision Consultant (SC)

A professional consulting firm will be hired by PMA and responsible for Contract Administration and Construction Supervision. The firm will be fully empowered as the 'Engineer' in accordance with International Federation of Consulting Engineers (FIDIC) stipulations. The Consultant will administer the civil work's contracts, make engineering decisions, be responsible for quality assurance, provide general guidance and furnish timely responses to the Contractors in all matters relating to the civil works, and ensure that all clauses of the Contract Agreement including environmental and social clauses between the civil works Contractors' and PMA are respected. The Project Engineer will have a full-time field based environmental and social specialist to ensure the implementation of EMP. Two separate experts, one for environment and one for social aspects, will be hired. The environmental and social specialist of SC will also develop training modules, conduct environmental and social trainings for the contractor's staff, and ensure social issues are properly addressed and mitigated during the project life.

Environmental and Social Experts (ESEs) of SC will oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP as mentioned in the contract documents. He will provide guidance to the contractor's ESE for implementing each of the activity as given in EMP. ESEs will be responsible for record keeping, providing instruction through the Resident Engineer (RE) for corrective actions and will ensure the compliance of various statutory and legislative requirements.

However, overall responsibilities of ESEs are as follows:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Discussing various environmental and social issues and environmental mitigation, enhancement and monitoring actions with all concerned personnel's;
- Inspect, supervise and monitor all the construction and allied activities related to the EMP for the project and oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Visiting construction sites including incomplete construction work sites, where there is no contractor's activities, active construction work sites, completed areas of work sites as well as ancillary sites such as borrow areas, quarries, asphalt and crusher sites, hot mix plant sites, construction camps and work shop areas to ensure contractors compliance with EMP stipulations and conditions of statutory bodies;
- Assisting contractor in all matters related to public contacts including public consultation pertaining to environmental and community issues;
- To organize periodic environmental training programs and workshops for the consultant's and contractor's staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. Responsibilities of Contractor

Site Environmental and Social Expert of contractor will carry out the implementation of the mitigation measures at construction site. Contractor will be bound through contract documents to appoint the Site Environmental and Social Expert with relevant educational background and experience. The responsibilities of ESE of Contractor are as follows:

- Responsible for Implementation of the mitigation measures at construction site;
- Preparation of Site Specific Environmental and Management Plan (SSEMP) including Evacuation Plan, HSE Management Plan, Material Transportation Plan, Traffic Management Plan, Emergency Response Plan, Monitoring Plan, and asphalt and batching plant area plans, and will submit all the plans to the SC.
- ESE of contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- ESE will prepare the monthly compliance and monitoring reports as per schedule and will submit it to the SC;
- Provision of proper Personal Protective Equipment's (PPEs) to the workers and train them for their proper use;
- ESE will conduct the environmental, health and safety trainings for the staff and labors; and
- The Contractor shall submit the Code of Conduct that will apply to all of the contractor's staff. The contractor shall submit an outline of how the Code of Conduct will be implemented. The aspects to be addressed include:

    - Ensure compliance with applicable environment, health and safety standards and procedures associated with risks of Project activities;
    - Ensure compliance with all acquired approvals, applicable to the proposed Project;
    - Ensure protection of local community (including vulnerable and disable assemblies), and the Contractor's staff, sub-contractors and daily wage workers;
    - Ensure employment of fulltime security guards, and necessary security measures and instruments (CCTV) at site;
    - Ensure provision of adequately stocked first aid kit at site for dealing with accidental injuries, and natural hazards;
    - Prohibit use of illegal items such as weapons, alcohol and drugs at site;
    - Ensure that Project property is protected against vandalism, theft, and noxious activity;
    - Ensure that positive attitude of respect and warmth is given to staff and community members;
    - Ensure good housekeeping practices shall be adopted at site;
    - Ensure that employment decisions are not made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin;
    - Ensure establishment and strictly enforcement of "No Sexual Harassment Policy";
    - Ensure provision of necessary sanitation requirements for site workers (both for men and women);
    - Ensure workers only use specified sanitary facilities provided by their employer and not in open areas;

- Restriction on burning solid waste;
- Restriction on dumping solid and liquid waste into nearby water bodies;
- Prohibition for cutting trees, and clearing vegetative areas for construction camps, and for cooking purpose as a source of fuel; and
- Prohibition on illegal hunting of local fauna.

The Code of Conduct should be written in local and simple language (Urdu and English) and signed by each site staff to specify that they have received a copy of the code; code explained and clarified to them; acknowledged adherence to this Code of Conduct as a condition of employment; and understood that violations of the Code can result in serious consequences. A copy of the code shall be displayed at strategic location of the site, and mainly in the contractor's site office.

d. Punjab Environmental Protection Agency (PEPA)

PEPA is the regulatory authority for issuance of NOC for the proposed Project. As part of its mandate, protection of environment is their responsibility. Therefore, the agency will undertake an audit (as and when required) of the activities of the Project (both phases i.e. Construction and Operation) with respect to the protocols as defined in EMP and in NOC. The specific responsibilities are as follows:

- Liaison with the Environmental Committee of PMA on the proposed Project to ensure compliance of measures as given in the EMP and in NOC issued by them for the construction activities of the proposed Project;
- Environmental Audit of the activities being undertaken by the Environmental Committee of PMA and all other relevant stakeholders as provided in the EMP and NOC through random site visits and meetings.

8.4.4 Institutional Arrangement for Implementation of EMP during O&M Phase

The proposed Project will be administrated by PMA during the O&M phase. PMA has established District Support & Monitoring Department to monitor the development works of every district and for technical support for District Government. Therefore; it is suggested that the Project Director of the proposed Project shall depute / hire Environment and Social Expert through District Support & Monitoring Department to monitor and implement EMP during operation phase.

The specific responsibilities of Environment and Social Expert are as follows:

- Coordinating with the operational staff working under the Regional General Manager and Project Director to monitor environmental compliance during operation phase;
- Advising on, and monitoring tree plantations along the road alignment as suggested in EMP;
- Reporting on the progress of environmental compliance to the Project Director and EPA-Punjab;
- Assess and propose mitigation measures for unforeseen long-term environmental and social impacts of operation; and

- Sustaining a working partnership among the PMA, EPA-Punjab, Agriculture, Irrigation, Forest and Wildlife departments of Faisalabad District to ensure compliance of EMP during operation phase.

8.5 ENVIRONMENTAL MITIGATION AND MANAGEMENT MATRIX

Environmental Mitigation and Management Matrix (EMMM) is considered as one of the main elements of EMP. The EMMM provides the framework for the implementation of the mitigating measures against each identified potential adverse impacts, and management and monitoring of the same during the design, construction and operation phases of the proposed Project. Table 8.1 shows impacts, mitigations and the responsible authority and organization for the implementation of the same during design, construction and operation phase.

The Contractor(s) will be responsible for the preparation of Site Specific EMP (SSEMP) on the same format of this EMMP along with the site-specific plans based on the guidelines provided in this Section.

Table 8.1: Environmental Mitigation and Management Plan during Design Phase

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1.	**Environmentally Responsive Design Consideration** Designing of the project components without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. Improper designed infrastructure may lead to technical, environmental and financial problems. If not properly planned and designed, it may lead to both social and environmental concerns.	• The infrastructure of proposed Project should be designed keeping in view the future population and projected flows; and • All structural, layout and engineering designing should be in strict accordance with the applicable national and international by-laws and engineering parameters;	• Audits and Checks	Design Consultant	Proponent
2.	**Seismic Hazard** As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic Zone 2A (low to moderate hazard), A high intensity earthquake impacting the project site can adversely impact the development.	• The proposed structure should be designed and constructed to withstand high earthquakes. For seismic hazard analysis, updated structural, geotechnical and seismic studies should be conducted; • To mitigate the seismic hazard, Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
3.	**Emergency Management** Emergency management in case of natural and man-made disaster is a major concern. Increased incidents of disasters especially act of terror, fire, earthquakes etc. demand proper planning. An inefficient firefighting system and insufficient storage of fire water may pose a severe threat to human life and to the proposed Project.	• A separate building for fire brigade, emergency response equipment and staff may be considered in the design;	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
4.	**Site Selection for Construction Camps** Improper site selection and location of construction camp(s) may lead to various social and environmental impacts which include loss of vegetation due to setting up construction camps, indiscriminate generation of solid waste, and discharge of sanitary effluent, water pollution and health & safety issues in the surrounding settlements. This impact is negative, local, low, short term and definite.	• Construction camps should be designed to be self-contained to reduce demand on infrastructure and services of nearby communities and to minimize the removal of existing macro-plants; • There should be no resettlement issue for the location of the camps; • Camp site should be away from the residential areas and sensitive receptors; • Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road; • The camps must be located in a place where the drainage from and through the camps will not threaten any	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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		domestic or public water supply; • Camp site must be adequate in size to prevent overcrowding of necessary structures; • The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems; • The camp site must not be subject to periodic flooding; and • There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.			
5.	**Flora** During the pre-construction phase, activities such as installation of construction camps, construction of temporary facilities & mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific, permanent, irreversible, possible, medium significant and needs to be encountered prior to the start of construction stage.	• The camps, mobility of machinery and construction of temporary facilities should be proper planned and well designed to avoid any loss to local green cover; • It is recommended to establish the construction camps where minimum or no vegetation exists; • Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and • The location of construction camp should be selected so, as to have limited environmental impact during construction phase and to reduce the cost and land requirement.	• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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6.	**Fauna** As movement and installations of machinery and vehicles will take place, so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary road may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible and low significant.	• The standard measures must be adopted to minimize noise due to machinery movements and installations; • Wildlife movements and routes must be considered during activities and should be avoided to their maximum level; • The alternate routes and points are recommended to avoid any damage to locally available fauna; • The camps shall be designed as properly fenced and gated to check the entry of animals in search of eatable goods; and • A waste management plan so that the wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.	• Audits and Checks	Design Consultant	Proponent
7.	**Public Utilities** Due to the proposed project, public utilities (electric poles) may be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature	• The provision in the design and budget for the relocation of the existing utility infrastructure wherever required and shall be finalized in consultation with the concerned department; and • All public utilities (e.g. electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project shall be relocated well ahead of time before the actual commencement of the construction work.	• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Construction Phase					
8.	**Topography** Construction activities are not expected to impact the topography of the area significantly except for those areas where physical activities including digging and excavation areas, storing or dumping sites for excessive material, storing areas and movement of heavy construction machinery will be carried out. The excavated material will be generated due to the construction of various infrastructure components of the project like stations, depots, underpasses and Parking facilities. The area where excavated material is to be dumped will also be negatively impacted. This impact is Site-specific, Temporary, Irreversible, Possible and Low Significant.	The excavated material will require safe disposal by the Contractor. Most of the excavated material could be used in back filling process and concrete aggregate to be used in construction. A detailed development and operation plan for borrow areas must be prepared by the contractor at the pre development phase (before the starts of extraction of material from each borrow area). Contractor should strictly follow the provisions of approved plan in order to minimize any adverse impact associated with the borrow areas. Likewise, excavated material should be dumped at suitable and approved disposal sites.	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent, SC
9.	**Soil Erosion and Contamination** Impact on topsoil and soil stability is mainly expected during the preparatory and construction works, which will be caused by the arrangement of the construction camp, construction site,	• In order to prevent the damage and contamination of soil at the project site, surface layer of the soil should be removed and stored temporarily in pre-selected locations. The soil should be stockpiled separately. Stockpiles should be protected from wind and atmospheric precipitation and should be at least 50 meters away from	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	replacement of the equipment, earthworks, arrangement of temporary and permanent infrastructures, etc. The soil would be exposed to erosion due to removal of vegetation, establishing construction camps / workshops and excavation etc. The most significant aspects in the construction phase of are excavation works and construction of roads. These will expose soils in the affected project area leaving them vulnerable to erosion by surface run-off and wind. The overall threat could exist for the durations of construction works in the monsoon season. Besides, there is high possibility for soil pollution with substances due to leakages of fuels and oils from the heavy vehicles and machinery used for construction and due to applied chemicals during this phase.	surface water body; • Stored excavated material shall be covered and preferably reused, e.g. in construction of dykes etc.; • Sprinkling of water may help in reducing the erosion soil; • Use of heavy machinery should be restricted as far as possible to work sites only to avoid the destruction of soil structure; • Vehicles and equipment should be checked regularly. In case of damage and fuel / oil leakage, it should be repaired immediately. Damaged Vehicles should not be allowed on the construction sites; • In case of spillage of pollutants, spilled material should be localized and contaminated site should be immediately cleaned; Staff should be provided with appropriate means (adsorbents, shovels, etc.) and with personal protective equipment as well; • All spoils should be disposed of at site designated by LWMC and the site should be restored back to its original conditions; • Non-bituminous wastes from construction activities will be dumped in approved sites, in line with the guidelines for dump sites, and shall be covered; • Washing yards shall be paved to avoid seepage of runoff from the yard;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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		• After completion of construction works, all kind of waste (including hazardous waste) will be collected and removed from the area. Hazardous waste should be removed for further management by the licensed contractor; and • Perennial grasses and shrubs trees should be planted to control the runoff on the site.			
10.	**Water Quality** The potential sources of water pollution associated with the construction of proposed Project are runoff from the construction works area that may contain increased loads of sediments, suspended solids and other contaminants. Potential sources of pollution from the site include: • Runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g. grouting and cement material with the rain; • Wash water from dust suppression sprays; • Fuel and lubricants from maintenance of construction vehicles and mechanical equipment; • Spillage of liquids stored on-site such as oil, diesel, and solvents etc. are	• As a mandatory step, all the effluents will be disposed as per the requirements of PEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. These measures are described below: • Construction camp will be established in area with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met; • The proponent will ensure that the construction work is confined within the project boundary and water bodies are prevented from pollution during construction; • The solid waste will be disposed of in designated landfill sites to sustain the water quality for domestic	• Visual observation and photographic record • Regular environmental monitoring, sampling and testing reports	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	likely to result in water pollution; and • Uncontrolled discharge of debris and rubbish such as packaging, construction material and refuse. The groundwater may get contaminated from the wastewater generation from the construction camps, leachate from improper dumping of solid waste. The impact is medium adverse in nature.	requirements; • Regular water quality monitoring according to determined sampling schedule; • Water required for construction shall be obtained in such a way that the water availability and supply to nearby communities remain unaffected; • The contractor will ensure that construction debris do not find their way into the drainage which may get clogged; • To maintain the surface water flow/drainage, proper mitigation measures will be taken for the proposed project, like drainage structures; • Wastes will be collected, stored and taken to approve disposal site; • Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must be brought down to less or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent. For wastewater apart from BOD, COD of 150 mg/l will also be checked; and • Similarly, if the sewage after treatment			

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		is to be discharged in to the land it will meet the requirements of the PEQS for disposal of wastewater.			
11.	**Deterioration of Ambient Air Quality** Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. Besides, multifarious construction activities and increased vehicular traffic (construction vehicles) would also contribute to the localized airborne dust. The Suspended Particulate Matter (SPM) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard. The objectionable impacts of settling of the suspended dust would be its dry deposition on vegetation, motor vehicles, structures, and other exposed surfaces. Exhausts from fossil fuel burning in the construction machinery will also deteriorate local air quality. Similarly,	• All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions; • Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned; • Preventive measures against dust should be adopted for on-site mixing and unloading operations; • Construction materials (sand, gravel, and rocks) and spoil materials will be transported through trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS for carbon emissions and noise; • Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s); • Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions;	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records.	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	exhausts from generators can also have impacts on air quality in the vicinity. The deteriorated ambient air quality may cause health hazards to the residents of nearby localities.	• Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators; • Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a preset time can reduce emissions, without intervention of the operators; • PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works; • Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather; • All excavation work should be sprinkled with water;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Construction workers should be provided with masks for protection against the inhalation of dust; • Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases; • Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants should be taken up; e.g. providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and • Regular monitoring of air quality in accordance with the formulated environmental monitoring plan (given in EMP).			
12.	**Noise and Vibration** The noise and vibration will be produced due to the operation of construction machinery equipment. Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment. Noise and vibration are perceived as one of the most undesirable consequences of construction activity.	• There are a variety of ways including Quieter Equipment; Modifying Existing Old Equipment; Barrier Protection; Work Activity Scheduling; Maintenance; Noise Perimeter Zones (NPZs) by which construction equipment and worksite noise can be controlled.	• Physical observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	The above machinery is expected to generate noise levels that would be severe in the Project Area. The noise and vibration may cause health hazards to the residents of nearby urban settlements along the proposed Orange Line corridor.				
13.	**Operation of Construction Camps/Camp Sites** Mismanagement of construction camp activities can lead to various social and environmental impacts which include health and safety, traffic problems, soil degradation, loss of vegetation and assets on the selected land, solid waste and water pollution in the vicinity settlements. Furthermore, cultural differences, behavior of construction workers, potential disregard for local cultural norms can lead to increased tension between local communities and workers residing in the construction camps.	• The project will seek to avoid sitting camps where their presence might contribute to any conflicts with locals; • Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values; • Camps will be designed to be self-contained to reduce demand on infrastructure and services of nearby communities; • A comprehensive safety and security plan for the camp will be prepared which will comprise of a training manual, use of safety equipment and emergency preparedness; • Training will be provided to all staff on camp management rules and overall discipline and cultural awareness; • Waste Management Plan will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste; • Site for construction camp will be	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		selected to minimize the removal of existing macro-plants at camp sites; • Photographical and botanical inventory of vegetation before clearing the site; • Compensatory plantation to be done when construction work near ends; and • The contractor(s) shall ensure removal and rehabilitation of site upon completion.			
14.	**Wastewater Generation at Construction Camps** Wastewater will be generated at the construction camps by the workers. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains, water channels etc. apart from soil contamination. The wastewater generation is estimated to be 6,600 liters/day[12] for 200 construction workers during construction phase of the proposed Project.	To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor: • Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks (as shown in Figure 6.1); • Proper monitoring to check the compliance of PEQS will be carried out; • Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; and • The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent, SC

[12] Design Criteria of Public Health Engineering for Water Supply, Sewerage and Storm Water Drain (Domestic sewage generation = 80% of water consumed/day)

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		with details of wastewater collection, transportation and its disposal.			
15.	**Solid Waste Generation at Construction Camps** The solid waste generation is estimated to be 90 kg/day[13] for 200 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase of the proposed Project. The municipal waste will be in the form of food, cans, paper and wastewater from construction camps toilets and washing yards. Construction waste will include excavated soil, sand, gravel, rocks, asphalt, pieces of concrete, bricks, wood, metal pieces and electrical wires. Whereas, hazardous waste can be comprised of paints and construction chemicals. All these, if left unattended, can become a source of nuisance and environmental pollution in the Project Area. Insecure and unhygienic disposal of the solid wastes particularly garbage and	• Solid Waste generated during construction and camp sites will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; • Training of work force in the storage and handling of hazardous materials and chemicals Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste; proper labeling of containers, including the identification and quantity of the contents, hazard contact information, etc; • Waste disposal plan must be reviewed during the entire construction phase in the light of changing weather conditions; • Emergency response plan shall be prepared to address the accidental spillage of fuels and hazardous goods; • Immediate collection of spilled oils/fuels/lubricants by collection of contaminated soils and skipping oils from surface water by applying	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent, SC

[13] Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.

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	trash may cause degradation of soil and land. Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents. Throwing away of solid wastes into water channels and the wastewater network can result into choking of the latter.	appropriate technologies; • Reusing bitumen spillage; and disposing non-usable bitumen spills in a deep trench providing clay linings at bottom and filled with soil at the top (for at-least 0.5 m); • Used oil shall be collected in separate containers stored on impervious platform with restricted access and shall be sold to licensed contractor and the burning of waste oil shall be strictly restricted; • Segregating and stockpiling scarified/ milled bituminous material and reusing this material in sub grade/shoulders; • Construction waste such as waste wood can be recovered and recycled into wood for new building projects, and cement, bricks, and plaster can be crushed and reused in other construction and building projects; and • The contractor should ensure implementation of proposed Construction Waste Management Plan and it must be reviewed during the entire construction phase in the light of changing weather conditions.			
16.	**Traffic Management** Due to the proposed project construction activities and movement of heavy	To minimize traffic problems in the proposed Project Area, following measures will be considered:	• Vehicle maintenance record • Training record • Implementation of	Construction Contractor	Proponent, SC

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	project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling especially through Jhang & Jaranwala Road and other Project Area access roads. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences.	• Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population; • Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads; • Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work; • Proper sign boards will be provided for smooth flow of traffic; • Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents; • Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays; and • Traffic Management Plan will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.	TMP • Regular visual observations		
17.	**Green House Gas Abatement**	• Regular motioning of the vehicles for	• Regular	Construction	Proponent,

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The main sources of greenhouse gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed Project will include both mobile and stationary sources. The mobile sources will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases cause global warming and other climatic changes on regional and global scale. The climate change due to global warming, may result in following impacts over a period of time: • Extended summer season; • Higher temperatures may result in more precipitation falling as rain rather than snow, hence earlier and greater runoffs, increased runoff may pose greater challenges for water management; • Increased natural hazards such as landslides and debris flows, extreme/unpredictable rainfall events, wind storms, droughts and wildfire: • Due to shift in temperatures and precipitation patterns runoff,	engine efficiency; • All stakeholders (PMA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO_2 burden; • Elimination of unnecessary idling can save fuel, prolong engine life, and reduce emissions. It can also help reduce the noise levels associated with construction. Unnecessary idling occurs when trucks wait for extended periods of time to load or unload materials or supplies, or when equipment is left on when it is not being used. Constructions workers may take breaks and leave equipment running unnecessarily or may idle equipment because it is an ingrained habit; • Managing equipment operations and training workers to reduce unnecessary idling is a relatively easy way to lower operating costs and help reduce the environmental impact of construction; • A preventive maintenance program by the contractor seeks to maintain engines at their original level of performance and eliminate the high cost of catastrophic engine failure. Preventive maintenance is the systematic inspection, detection, and correction of potential construction	environmental monitoring, sampling and testing reports • Vehicle inspection record • Plantation record	Contractor	SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	stream/lake temperatures, suitable habitats may move upland, thereby declining in size, ecosystems become fragmented, number and composition of species will change with particular threats to sensitive species; and • Increased damages to transportation infrastructure from extreme events, causing difficulties for access and emergency evacuation, and involves higher maintenance costs.	equipment failures. It significantly reduces fuel consumption and emissions; and • Use of low sulfur and good quality fuel in the construction vehicles or operating equipment that will reduce maintenance costs and harmful emissions. • Alternative energy resources shall be considered where possible; and • PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.			
18.	**Natural and Man-Made Disasters** Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.	• An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with Supervision Consultant and PMA and should be implemented in close consultation with the RESCUE Services and other concerned departments; • Training of the Contractor and PMA staff and employees regarding the emergency procedures and plans should be regularly conducted; • Emergency numbers should be clearly posted at active construction sites; and • Minor incidents and near misses	• Trainings, drills, record keeping • ERP implementation • Visual observation and photographic record.	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		should be reported by the contractor, and preventive measures should be formulated accordingly by the PMA management.			
19.	**Occupational Health and Safety** Occupational Health and Safety (OHS) related impacts will arise during construction phase activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc.	• Providing basic medical training to specified work staff and basic medical service and supplies to workers; • Complying with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract; • Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage; • Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site; • Work areas will be cordoned off where necessary; • Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and	• Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster management plan in case of natural disaster occurrence	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and • An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services.			
20.	**Community Health and Safety** The construction activities and vehicular movement at construction sites may result in roadside accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents, etc. The labour works with different transmittable diseases may cause spread out of those diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Conflicts may arise between the local community and the	• Providing basic medical training to specified work staff and basic medical service and supplies to workers; • There will be proper control on construction activities and oil spillage leakage of vehicles; • The labourers with different transmittable diseases will be restricted within the construction site; • Ensure that the site is restricted for the entry of irrelevant people particularly children; • Efforts will be made to create awareness about road safety among the drivers operating construction vehicles; • Timely public notification on planned construction works; • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links; • Provision of proper safety and	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
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	construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated.	diversion signage at sensitive/accident-prone spots; • Setting up speed limits in close consultation with the local stakeholders; • The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will be prevented by successful initiative typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health service; • Reducing the impacts of vector borne diseases will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water; • The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by PMA; and • Contractor will take due care of the			

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		local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.			
21.	**Issues of Smog** Construction activities related to proposed project can significantly contribute to smog issues in the City, primarily due to various pollutants released during the construction phase i.e. Particulate Matter (PM), Vehicular Emissions, Incomplete Combustion and Lack of Dust Control Measures.	• Implementation of robust air quality monitoring systems to track pollution levels and take necessary actions accordingly. • Implement and enforce regulations regarding air emissions as per PEQS, dust control measures, and the use of cleaner technologies in construction machinery and vehicles. • Encourage the use of electric or hybrid machinery and vehicles to reduce air emissions. • Employ effective dust control measures, such as water sprinkling, covering materials, and using dust barriers, to minimize the release of particulate matter. • Educate construction workers and the public about the importance of adopting eco-friendly practices to reduce smog formation. • Vehicle Inspection & Certification System (VICS) should be implemented in true letter & spirit to reduce environmental pollution caused by unfit motorized vehicles.	Audits and Checks	Construction Contractor	SC, Proponent

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22.	**Communicable Diseases** The laborers in the Contractor Camp, truck drivers and like personnel who interact with each other have the potential for the spread of communicable diseases like COVID-19 and HIV/AIDS. Majority of the people living in the surrounding of the Project, and potential labor are not aware of the source, mode of communication or consequences of HIV/AIDS. Although their religious and cultural value system, to a large extent excludes the outbreak or rapid communication of COVID-19 and HIV/AIDS, yet its occurrence in such a situation cannot be precluded. It is necessary that awareness and preventive campaigns are run from time to time in the labor camps and the field offices of the Project to prevent the communicable diseases. There is a chance of spreading of an epidemic of Coronavirus disease (COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area	The Contractor shall: • Arrange to run an active campaign, in the labor camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS; • SOPs related to the construction industry advised by National Action Plan for COVID-19 Pakistan to control spreading of COVID-19, shall be implemented by the contractor and should be strictly monitored. • Strengthen the existing local health and medical services for the benefit of labor as well as the surrounding villages; • Ensure cleanliness and hygienic conditions at the labor camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department; • Locating a labor camp at least away from the villages (local settlement), and • Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
23.	**Resource Conservation** The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement. Almost all the materials to be used in the construction of proposed Project are non-renewable and therefore their sustainable use is necessary for the future use. Fuel will be used to operate construction machinery and asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is very important also to help to reduce air emissions.	• Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment's; • The efficient and well maintained equipment's and machinery should be used; • The equipment and machinery should be turned off when not in use; • Regular maintenance of machinery to avoid fuel leakages; • Reduction of wastage of water through training of workers involved in water use should be planned; • Plan for reuse of construction waste materials may be formulated; • A good camp design and an efficient worksite management plan should be prepared that may help the contractor to reduce the water demand, and wastewater and solid waste volumes to the lowest levels; and • Use of solar panels at camp sites to conserve energy. •	• Audits and Checks	Construction Contractor	Proponent, SC
24.	**Discovery of Heritage Sites/ Structures during Excavation** During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately	• Chance finds procedure shall be adopted in case of any accidental discovery of cultural heritage.	• Implementation of chance find procedure	Construction Contractor	SC, Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	report through Supervision Consultant to Directorate General (DG) of Archeology, Government of Punjab to take further suitable action to preserve those antiques or sensitive remains.				
25.	**Flora** The proposed project will necessitate the clearance of existing vegetation within the construction footprint, particularly along the proposed road corridor. Based on GIS data and preliminary assessments, it is estimated that approximately 733, trees, pole crops (young trees) and saplings, may be impacted as a result of the proposed project activities. The number of possibly impacted vegetation is tentative and indicative, which will be finalized by the forest department/PHA during construction phase. In addition to above, some ornamental bushes, shrubs and grasses may also be affected in the green belts due to construction activities. Moreover, exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely	• Incorporate technical design measures to minimize removal/damage of trees, if possible; • Tree cutting and vegetation disturbance shall be avoided to the maximum extent practicable to minimize adverse impacts on natural regeneration processes and to ensure minimal ecological and environmental loss; • Disturbance/ Cutting of trees shall be avoided as far as possible and select the alternate route for the proposed project (if possible) as the impact on local vegetation is expected as high; • Trees should be replanted, relocated or transplanted wherever possible, instead of cutting; • Where feasible, small- to medium-sized trees and shrubs likely to be affected shall be relocated to suitable available spaces within or around the project green belt; • A tree plantation program shall be formulated with the recommendations and technical support of PHA and Forest Department;	• Implementation of Tree Plantation Plan • Visual Observations	Construction Contractor in association with PHA & Forest Department	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	affect health and vigor of plants. During construction activities the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). Overall, it can be stated that the large number of trees may be damaged in the proposed project activities.	• Tree plantation plan should be implemented preferably in the project area or nearby blank spaces (along the roads, parks & green areas etc. where suitable) within 500m radius possibly; • The Punjab Mass Transit Authority (PMA) shall obtain the required No Objection Certificates (NOCs) from the Forest Department and PHA prior to any tree cutting or vegetation clearance; • As a principal of 1:10, ten trees shall be planted in place of felling of one tree in consideration of mortality; • Total 10,000 trees will be planted at available spaces in lieu/compensation and area enhancement; • Mawakai Forests should be established at appropriate sites in the existing parks in the city or in its sub-urbs to off-set the tree cutting or tree loss occurring in the ROW of the Project; • Rehabilitation of existing parks in the city or planting of additional trees in the parks wherever possible should be undertaken to maximum extent; • The proponent shall implement the program with the help of PHA and Forest Department and in consultation with concerned consultant ecologist;			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Open fires should be banned in the area to avoid hazards of fire in the project area; • Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste / barren land rather than on forested or green land; • However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth; • Construction vehicles, machinery and equipment will remain confined within their designated areas of movement; • The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes; and • Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed. •			
26.	**Fauna** During construction phase the existing population of birds, mammals and reptiles of the construction areas will be	• Care shall be taken during construction activities for avoiding purposely or chance killing of animals; • If any wild species and habitat is found during construction, it must be	• Visual Observations	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	affected due to disturbance arising from construction activities involving excavation, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing fauna will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase. Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped. Noise generated from machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the fauna of the Project Area. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers	dealt carefully and local wildlife department officials should be informed; • Hunting, poaching and harassing of animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labor force accordingly and clear orders should be given in this regard; • The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department; • Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding; • Noise generating activities shall not be carried out during the night by the work force; • Wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and • Noise produced due to construction activities may be kept to acceptable level.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
27.	**Social/ Cultural Conflicts** During the construction phase of the project, conflicts may arise between labor force and Local communities that exists near the Project Area. Use of local resources (existing infrastructure and utilities) by the construction workers can generate stress on the local residents. Furthermore, difference in cultural values may also cause discomfort to local residents.	• Local labor should be preferably employed for the construction works; • Careful planning and training of work force to minimize disturbance to the local people; and • Public notification through print or electronic media during the entire construction phase to avoid any inconvenience in accessibility to the locals.	• Visual observations • Regular monitoring, audit and checks	Construction Contractor	Proponent, SC
28.	**Restriction of Access and mobility** Approach/ hindrance problems for the local residents in the surrounding areas business owners, students and movement of the daily commuters will be disturbed due to construction activities. The movement of construction material carrying vehicles will cause traffic congestions at the entrance/exits of above mentioned areas. Moreover, the construction activities will produce dust and noise pollution that will cause nuisance to the residents of the surrounding areas.	• Assurance of timely completion of the construction works according to the agreed schedule by PMA; • Schedule movement of vehicles carrying construction materials after school/college hours or during night time; • Provision of alternate routes for the project site where the construction is being carried out; • Effective traffic management with the help of Traffic Police during the peak hours to avoid traffic congestions and provide ease of traffic; • Continuous water sprinkling at the active sites to suppress the dust; • Restricting the construction activities to only daytime; and	• Visual observations • Regular monitoring, audit and checks	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Contractor should prepare and strictly implement SOPs for the workers to protect the privacy of the residents.			
29.	**Impact on Structures** The proposed project will result in impacts on commercial structures and associated business activities, primarily due construction activities along the project corridor. Partial loss of commercial structures may occur, leading to disturbance of businesses. In addition, construction-related activities such as site clearance, material storage, and movement of construction machinery may temporarily restrict access to commercial establishments. These disruptions may result in reduced customer access, interruption of business operations, and loss of income for affected businesses. Boundary walls of some Educational Institutes city will be affected while clearing the required RoW. The proposed project is expected to impact existing public utilities, resulting	• Appropriate mitigation measures, including access management, phased construction, and compensation will be required to minimize economic disruption to affected commercial entities. • The inventory and detailed measurement of structures and the number of Affected Household to be affected for clearing of RoW for the proposed Project and detailed measurement survey should be carried out for preparing the compensation. • Compensation of the structures should be evaluated and provided as per market rates; • Affected Persons should be compensated on full replacement cost of each category to construct a new structure of the same type; • Compensation of livelihood disturbance should be provided for the period of instruction of commercial activities; • Proper consultations and coordination's with APs during	• Visual observations • Regular monitoring, audit and checks	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	in disruption of public services and temporary inconvenience to local residents within the Area of Influence (AOI). Utilities located within the project footprint, including electricity distribution poles, water supply pipelines, and sewage infrastructure, are likely to be disturbed or relocated during construction activities. Such disturbances may lead to temporary service interruptions unless appropriately managed.	resettlement process. • Compensation for affected structures should be evaluated and provided as per market rates. • Affected Persons should be compensated on full replacement cost of each category to construct a new structure of the same type; and • Proper consultations and coordination's with PAPs during resettlement process. • The education structures to be affected will be evaluated by the relevant department and will be restored and rebuild according to the specification of the existing building. • All public utilities likely to be affected by the proposed Project will be relocated well ahead of time before the actual commencement of the construction work. Strengthening of utilities, wherever required.			
30.	**Impacts on Livelihood** The construction activity may disturb the business and livelihoods of the shopkeepers, business operators and workers doing their work in the CoI due	• Proper compensation should be provided to all the affectees losing their livelihoods along the COI; • Livelihood restoration should be provided to mitigate the adverse impacts on livelihood and	• Visual observations • Regular monitoring, audit and checks	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	to the excavation activities, traffic diversion and access issues.	restoration of commercial activates which will be monitored; • Initial assessment of compensation should be carried out for the income loss of the affectees based upon the current approximation of the AoI and construction camps. • Project Construction should be completed on time; and • Proper awareness and training should be conducted among the affectees regarding Project benefits.			
31.	**Gender Issues** Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community. During construction phase gender-based violence might arise due to discrimination made against women by unequal work distribution and unequal	• The contractor will be required to provide qualified key personnel to address the specific risks identified in the project. Contractors will specify key staff with the technical skill and experience to implement the mitigation measures; • The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers, thereby minimizing labor influx; • The bidders will be required to submit Codes of Conduct (CoCs) with their bids; • The CoCs will set clear boundaries for acceptable and un-acceptable behaviors of all individuals and companies and will be signed by companies, managers and individuals;	• Regular monitoring, audit and checks • Record Keeping	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	pay structure among others. Sexual harassment against women might occur as a consequence of mixing of men and women at the construction site, and moving on the roads, bus stops and markets. Educational institutions near the project alignment are also sensitive regarding gender issues. This impact is high negative in nature during construction phase.	• All project consulting firms will also be required to submit Codes of Conduct with their proposals; • The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace; • The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct; and • Provisions will be set in contracts for dedicated payments to contractors for Sexual Exploitation and Abuse prevention activities (e.g. training) against evidence of completion. The portion of the contract price will be guaranteed by a performance security linked to environmental and social contractor performance.			
32.	**Child Labor** Inhabitants of the project area have mix economic background and different sources of income. Children of low-income groups mostly involve in	• Awareness should be created among the local communities about the adverse impacts of child labour. For the public awareness, meetings should be held in the Project Area, and announcements should be made	• Regular monitoring, audit and checks • Record Keeping	Construction Contractor	Proponent, SC

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	different earning activities, as their parents prefer to get their children hired in small shops as helpers, and waiters in hotels for earning money, and supporting household livelihoods. Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.	using the available local platforms with the involvement of all sectors of the society; • Contractor through contractual agreement should be bound to follow the labor standards, rules and regulations during hiring the labor force and all activities should be monitored by the social and environmental staff of the implementing agency; • Client and Supervision consultant should ensure that contractor shall have its employment policy in accordance with relevant act and labour policies in Punjab and Pakistan; and • Contractor should ensure the presence of all persons at site are adults and have their proper identity cards with them			
		O&M Phase			
33.	**Solid Waste Generation** Twenty-Two (22) bus stations will be located along Orange Line BRT Corridor. The estimated daily ridership in the buses will be 90,918. These passengers will use the bus stations for boarding and alighting including staff allocated on these bus stations to	• A comprehensive solid waste management system should be formulated for the operation phase; Waste storage containers with color coding should be placed at designated locations; • Waste segregation should be done at source and requisite planning needs to be done to implement the segregation techniques through residents and commercial building	• Implementation of WMP • Regular monitoring, audit and checks	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	provide different services to the passengers and for the maintenance of the bus stations. The solid waste will be generated from these stations, refreshment and ticketing booths comprising wrappings, papers, eatables, empty cans or bottles, food residues etc. If this solid waste is not properly collected, stored and disposed at appropriate place, it can result in i) nuisance at the collection sites, ii) spreading of waste on streets and roads iii) clogging of drains iv) odor and breeding of mosquitos and flies and outbreak of diseases for perishable waste material. The impact will be high adverse in nature.	users; • Installation of sign boards for solid waste at all the stations of Orange Line; and • Daily housekeeping of stations should be carried out to minimize the generation of waste.			
34.	**Traffic Management** Traffic management during the operation of a proposed orange line is crucial to ensure smooth, efficient, and safe movement of both BRT vehicles and other road users. Major challenges that impact BRTS efficiency and reliability are entrance of unauthorized vehicles in dedicated BRT lanes, which leads to congestion and delays.	• BRT vehicles are given priority at intersections through adaptive traffic signals; • Strict enforcement to prevent unauthorized vehicles from entering BRT lanes; • Use of surveillance cameras, automated fines, or physical barriers; • Managing mixed traffic on roads where BRT shares space with other vehicles; and	• Implementation of TMP • Regular monitoring, audit and checks	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Additionally, poorly coordinated traffic signals and insufficient implementation of signal priority for BRT buses can cause delays at intersections. Moreover, inadequate pedestrian crossings and crowded platforms leading to conflicts between pedestrians, vehicles, and cyclists. The impact will be high adverse in nature.	• Liaison with the Traffic Police Department on the roads, surrounding the project for continuous flow of traffic. •			
35.	**Maintenance of BRT Corridor** During the operation phase, related road/corridor maintenance works will be conducted time to time which may lead to social and environmental issues like traffic management, inconvenience to local residents, public safety, vehicular emissions, dust and increase in noise. This is a temporary and moderate negative impact.	• Best Management Practices should be used for all the maintenance works; • Timely completion of all the maintenance works according to the agreed schedule; • Traffic management plan should be devised and implemented; and • HSE protocols should be strictly followed and implemented to avoid any incident/accident.	• Regular monitoring, audit and checks	Proponent	
36.	**Drainage** During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the	• The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and • Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the	• Regular monitoring, audit and checks	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	travelers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the surface and can cause traffic jams. The impact may consider to be moderate adverse in nature.	road alignment.			
37.	**Impacts of Operation of Depots** ***Noise*** Noise will be generated from bus depots from different activities such as arrival and departure of buses, maintenance activities, and other operations. The bus depots are located at commercial and residential areas of the city. The noise from bus depot operation can disturb the comfort of the nearby community. The impact will be high adverse in nature. ***Wastewater from Washing Area*** The washing area of buses will generate contaminated wastewater containing dirt, oil and detergents. If the wastewater is disposed without any treatment, then there are chances that it can	• Special consideration will be given to the noise control aspect during bus depot design stage. The noise barriers will be installed at noise prone areas such as workshop and generator. The generator will be enclosed in the room with silencer installed at its emission point to avoid dispersion of noise at the bus depots and nearby community. • The wastewater from washing area will be passed through grease trap and sedimentation tank for the removal of oil and grease and dust particles prior to disposal in the sewerage system or in the wastewater drain.	• Regular monitoring, audit and checks	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	contaminated soil and water resources. The impact will be high adverse in nature.				
38.	**Emergency Preparedness and Response** During the operation phase, emergencies like fire and disasters such as earthquakes and flooding may occur. This impact is negative, temporary and moderate in nature.	• An Emergency Response Plans for storm flooding, earthquakes, and manmade disasters must be developed by the PMA, in close consultation with Fire Fighting Department (FFD), Rescue 1122 Services and Provincial Disaster Management Authority (PDMA); • Training of management staff and employees regarding the emergency procedures and plans should be regularly conducted; • Responsible person to implement the Emergency Response Plan should be clearly designated; • Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises; • Firefighting machinery and vehicles should be maintained regularly; and • Regular drills for fire emergencies should be carried out.	• Regular monitoring, audit and checks • Fire Drills	Proponent	
39.	**Flora** During the operational phase of the proposed project, no significant impacts	• The landscape plan provided in the master plan must be completely implemented; • The implementation of plantation plan recommend in compensation for	• Tree plantation plan • Visual observations • Audit and Checks	Proponent in association with PHA or Forest Department	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	are envisaged or release of any significant pressure detrimental to flora. The presence of adequate flora at available spaces in the project area will help in absorbing flue gases emitting from vehicles and public transport passing through the project area, which shall help to improve the air quality.	cutting of trees should start during operational stage, to ensure the ecological balance and to avoid any impact on local Environment; • Large scale plantation of seedlings/ saplings of suitable indigenous tree species, shrubs and ornamental plants in the form of tree groves, should be carried out in accordance with the tree plantation plan to improve aesthetic value and offset the effect of removal of vegetation; • Proper check and balance of above mentioned activities is highly recommended. Plantations raised must be maintained according to the Silvicultural practices which include proper irrigation, cleaning, pruning and thinning at prescribed intensity, silt clearance and trench-opening; and • Maintenance and security of the plantation should be done for at-least five years.			

KEY

DC	Design Consultant
CC	Construction Contractor
SC	Supervision Consultant
PMA	Punjab Mass Transit Authority

8.6 ENVIRONMENTAL MONITORING

Environmental Monitoring is undertaken during both the construction and operational phases, to ensure the effectiveness of the proposed mitigation measures against identified adverse environmental impacts in the EIA report.

The main objectives of the construction phase monitoring plan will be to:

- Monitor the actual impact of the works on the project site physical, biological and socio-economic receptors;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds the anticipated impact;
- Ensure compliance with legal obligations including safety on construction site; and
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMMP; and
- Ensure the safe disposal of excess construction materials.

The main objectives of monitoring during the operational phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long term impacts of operation on physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMMP and recommend improvements, if and when necessary; and
- Compile periodic Environmental Monitoring reports on the basis of recommendations in EMMP.

8.6.1 Monitoring Strategy

Under the proposed monitoring strategy, it is recommended PMA should be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with Punjab-EPA. The monitoring program has been designed carefully considering the identified impacts mentioned in Chapter-7. Table 8.2 provides environmental monitoring schedule for construction and operations stages of the proposed Project.

Table 8.2: Environmental Monitoring Schedule

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
1.	Water Resources/ Water Quality	Monitoring of Physical, Chemical and Biological parameters and its compliance with PEQS, 2016 for surface water and drinking water.	• Major receptors are Drains, distributaries and commercial / residential areas within the AOI of the proposed project. • Other proposed effluent discharge points are: ▪ Contractors camps; ▪ Concrete preparation plants; ▪ Fuel (Petrol. Oil and Grease) products storages; and ▪ Vehicle and machines repairing and servicing yards.	• Visual checks of laboratory activities; and • Discrete grab sampling and laboratory testing of water samples by EPA-Punjab Certified Laboratory for monitoring.	• Once before the start of construction activities; • On quarterly basis during the construction phase; • Bi-annually for at least one year during O&M phase; and • Visual inspection daily.	• PMA • Contractor • PMA	• As per PEQS, 2016.
2.	Soil Contamination	Soil contamination due to effluent / surface runoff and uncontrolled solid waste disposal activities at sites.	• Proposed Project Area; and • Other proposed sampling sites are: ▪ Construction camps; ▪ Equipment washing yards; ▪ Spillage points of fuel, chemicals and lubricants.	• Visual observations and checking of laboratory activities; • Sampling and laboratory testing for soil samples.	• Once before the start of construction activities; • On quarterly basis during the construction phase; • Bi-annually for at least one year during O&M phase; and • Visual inspection daily.	• PMA • Contractor • PMA	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
3.	Dust Emissions	Monitoring of PM_{10} and $PM_{2.5}$ and its compliance with PEQS, 2016 for Ambient Air.	Sensitive receptors (residential area, educational and health institutions, religious places and construction camps) within the AOI of the proposed project.	• Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	• PMA • Contractor • PMA	
4.	Noise Pollution	Monitoring of Noise Level and its compliance with PEQS 2016 for Noise.	Sensitive receptors (residential area, educational and health institutions, religious places and construction camps) within the AOI of the proposed project.	• Visual checks of laboratory activities; and • Onsite Noise Monitoring using Sound Meter.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	• PMA • Contractor • PMA	
5.	Fumes and gases	Monitoring of CO, CO_2, SOx, NO_x, Lead and $PM_{2.5}$ PM_{10}, Vehicular emissions and its compliance with PEQS 2016.	Sensitive receptors (concrete plants, construction camps and vehicular emissions) within the AOI of the proposed project.	• Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	• PMA • Contractor • PMA	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Responsibility	Duration
6.	Ecological Resources	Disturbance to natural habitat and uncontrolled floral cutting which can be avoidable.	Natural habitats within the AOI of the proposed project.	• Visual checks to ensure that only marked trees are cut within the Project corridor; and • Monitoring of Wildlife / birds hunting.	• Once before the start of construction activities; and • Visual inspection daily / weekly during construction and O&M phase.	• PMA • Contractor • PMA	
7.	Safety of workers	Medical record of workers	Construction site.	• Checking of accident/ near miss records. • Medical surveillance of Construction workers	• On quarterly basis during the construction phase.	• Contractor	
8.	Restoration of work sites	Site cleared and no solid and construction waste in the study area	Construction site and camp sites	• Visual inspection	• After completion of construction work	• Contractor	

8.6.2 Responsibilities for Environmental Testing and Reporting

The Construction Contractor (CC) will be responsible for environmental monitoring and reporting throughout the construction phase under the supervision of Environmental Engineer of Supervision Consultant (SC); in coordination with Project Director, PMA. During construction phase, environmental testing reports will be prepared on quarterly basis and one comprehensive report will be prepared at the end of the construction phase and will be submitted to each of the following authorities and institutions: (i) PMA and (ii) EPA- Punjab.

During the first year of the project operation, concessionaire will be responsible to conduct environmental testing and monitoring along with its cost through a third party contractor and EPA-Punjab certified lab. The reports will be prepared biannually and one comprehensive report will be prepared annually and submitted to the EPA-Punjab. Contents of the final report will include results of environmental monitoring in comparison to the standards for the various parameters, location and sampling time along with recommendations for the future environmental testing and monitoring.

8.6.3 Budget Estimate for Environmental Monitoring and Compliance

Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase has been summarized in Table 8.3.

Table 8.3: Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
A) Construction Phase (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x4x4= 16	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	480,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x4x4= 16	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	32,000/-
Drinking Water Quality	**Physical Parameters:** Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids **Biological Parameters:** E. Coliform, Fecal Coliform and Total Coliform **Chemical Parameters:** Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds	1x2x4= 8	Quarterly @ Rs. 20,000 per sample	CC and SC	-	160,000/-
Surface Water Quality	**Physical Parameters:** Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids	1x2x4= 8	Quarterly @ Rs. 20,000 per sample	CC and SC	-	160,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli **Chemical Parameters:** Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic, Barium, Iron, Manganese, Boron and Total chloride					
					TOTAL (A) =	***832,000/-***
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x3x2 = 6	Biannually @ Rs. 30,000 per sample	PMA	24 hours	180,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x3x2 = 6	Biannually @ Rs. 2,000 per point	PMA	24 hours	12,000/-
Drinking Water Quality	**Physical Parameters:** Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids	1x2x2 = 4	Biannually @ Rs. 20,000 per point	PMA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform **Chemical Parameters:** Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds					
Surface Water Quality	**Physical Parameters:** Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids **Biological Parameters:** Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli **Chemical Parameters:** Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic,	1x2x2 = 4	Biannually @ Rs. 20,000 per point	PMA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Barium, Iron, Manganese, Boron and Total chloride					
					TOTAL (B) =	***352,000/-***
					GRAND TOTAL (A+B) =	***1,184,000/-***

KEY

CC	Construction Contractor	SC	Supervision Consultant
PMA	Punjab Mass Transit Authority		

Notes:

- Provision must be given in annual budget of operation phase for environmental monitoring. For this, the cost of operation phase (i.e. Rs. 352,000/-) must be considered with an annual increment of 10%.
- All the environmental parameters will be analyzed as per Punjab Environmental Quality Standards (PEQS), 2016.

8.7 TREE PLANTATION

To minimize the negative impacts arising due to tree cutting, plantation at available spaces will be carried out especially along the boundary and parks of proposed project.

Implementation of Plantation Plan shall be carried out by the Client in coordination with Forest Department/PHA, which has the requisite expertise and experience for such tasks. Detailed Tree Plantation Plan for plantation of 10,000 No. of trees has been prepared. The tentative cost for the plantation is about Rs. 19.32 Million. Detailed Tree Plantation Plan is attached as Annex-XII.

8.8 TRAINING AND CAPACITY BUILDING

An environmental and social training and technical assistance (TA) program is to be carried out before the implementation of the proposed project as it strengthens the institutional capacity required to manage the environmental and social issues. Contractor's environmental awareness and appropriate knowledge of environmental protection is critical to the successful implementation of the EMP because without appropriate environmental awareness, knowledge, and skills required for the implementation of the mitigation measures, it would be difficult for the Contractor(s) workforce to implement effective environmental protection measures.

PMA will be responsible to engage TA consultant to conduct environmental and social training programs. The objective of the TA will be as follows:

- To help in establishment of appropriate systems;
- To train senior PMA staff, Contractor and Sub-Contractor workers and Supervision Consultant employees, responsible for managing environment and social tasks and planning during construction and post construction phase; and
- Training courses on specialized areas such as air, water and noise pollution monitoring.

Table 8.4 provides brief detail of the capacity building and training plan for the proposed project.

Table 8.4: Capacity Building Programs and Technical Assistance Services

Provided by	Contents	Trainees	Duration
TA Individuals, Consultants and Organizations specializing in Environmental Management and Monitoring	Short Seminars and Courses on: • Environmental laws and regulations; • Environmental Sustainability; and • Environmental Management and Monitoring Plan (EMMP)	Environmental staff of contractor and SC, PMA Staff and Contractor Workers	3 Days
TA Individuals, Consultants and Organizations specializing in Social	Short Seminars and Courses on: • Occupational Health and Safety Plan (OHS);	Environmental staff of contractor and	3 Days

Provided by	Contents	Trainees	Duration
Management and Monitoring, and Occupational Health and Safety	• Basic First Aid; • Occupational and Community Health and Safety Management; • Labour Camp Management; • Traffic Management; • COVID-19 Protection and Control; • Use and Importance of Personal Protective Equipment's (PPEs); and • Fire Safety and Emergency Response Measures.	SC, PMA Staff and Contractor Workers	
TA Individuals, Consultants and Organizations specializing in Environmental and Social Management and Monitoring	Short Seminars and Courses on: • Environmental Management Plan (EMP); • Environment Health and Safety Management; • Occupational Health and Safety; • Basic First Aid; • Waste Management; • Fire Safety and Emergency Response Measures; • Electrical Safety; and • Use and Importance of Personal Protective Equipment's (PPEs)	Operation and Maintenance Staff of PMA	3 Days

8.9 COMMUNICATION & DOCUMENTATION

Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

8.9.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.

8.9.2 Database

The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliances;
- Corrective actions
- List of environmental data; and
- List of environmental data to be maintained:

- Soil and land pollution;
- Disposal of waste;
- Water resources;
- Fuel oil and chemical spills;
- Vegetation record;
- Noise pollution;
- Air and dust pollution;
- Socio-economic data; and
- Ecological sensitivities.

8.9.3 Meetings and Reporting

Monthly meetings will be held at site during the construction phase. The purpose of these meetings will be to discuss the routine activities, non-compliances and their remedial measures. Various reports will also be produced at periodic time intervals, as provided in **Table 8.5** along with information regarding persons responsible for report preparation and review process. Additionally, minutes of meeting will also be submitted as part of routine environmental reports.

Table 8.5: Periodic Reporting Mechanism

Sr. No.	Report Category	Prepared by	Reviewed by
1	Monthly	Contractors' environmental staff	PMA / SC
2	Quarterly	Contractors' environmental staff	PMA / SC
3	Semi-Annual Environmental Monitoring Report (SAEMR)	Construction Supervision Consultant (CSC)	PMA / SC
4	Annual Report	Contractors' environmental staff	PMA / SC
5	Completion Report	Contractors' environmental staff	PMA / SC

8.9.4 Social Complaint Register

The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

8.9.5 Photographic Records

Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

8.9.6 Non-Compliance of the EMP

The implementation of the proposed EMP involves inputs from various functionaries. The Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the

Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Contractor claimed under the heads of environmental components.

8.9.7 Review of Recorded Data

All the data and communication recorded and maintained by the Contractor will be periodically reviewed and checked by SC and PMA and necessary action will be recommended to Contractor to improve the recording and documentation.

8.10 MANAGEMENT PLANS

Various site-specific management plans will be prepared by Contractor as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, approval of these site-specific plans from PMA should be sought before start of construction activities. These site-specific plans are listed below but not limited to these:

- Tree Plantation / Reforestation Plan;
- Health, Safety and Environment (HSE) Management Plan;
- Emergency Preparedness and Response Plan;
- Site Restoration and Rehabilitation Plan;
- Waste Management Plan;
- Drinking Water Supply and Sanitation Plan
- Traffic Management Plan;
- Change Management Plan
- Quarry Management Plan; and
- Resource Conservation Plan.

8.11 PUBLIC DISCLOSURE

PMA will disclose this EIA to all the stakeholders prior to the start of the construction. This report will be made available to the stakeholders at places as designated by the PEPA. In addition, executive summary of the Report will be translated into Urdu language and made available to the affected communities and locals. The copies will also be kept at construction site for ease in accessibility of the locals. This will ensure the locals to be aware of the Project impacts, its mitigation, responsible staff and mode of implementation. In addition, the executive summary will also be published on PMA website.

8.12 EMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas PMA will be responsible for implementation of mitigation measures and environmental Monitoring during operation phase. For an effective implementation of environmental mitigation measures during construction and operational phase, it is very important to provide sufficient funds for the implementation of environmental and social mitigation measures, monitoring and training.

The estimated cost of environmental and social mitigation measures, monitoring and training is given in the Table 8.6.

The cost for EMP will be part of the contract document with the Contractor. The same may also be included in the total project cost for the implementation of EMP. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account.

Table 8.6: Environmental and Social Testing, Mitigation and Training Cost

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
1.	Medical screening for workers	Rs. 6,000 per person for 200 employees *Pre-Construction Phase:* 200 x 6,000 x 1 = 1,200,000 *Construction Phase:* 200 x 6,000 x 2 = 4,000,000	2,400,000 /-	Medical screening of the workers before deployment on site and twice a year during whole construction period.
2.	Material Storage, handling and use	Includes cost of Four Number of tarpaulins (Rs. 20,000 each) and storage at separate area and installment of barrication. 4x20,000=80,000 Lum sum 300,000	380,000/-	Four tarpaulins are proposed during the whole construction phase for the protection of material and dust control.
3.	Water Sprinkling	Sprinkling of water to control dust at site on alternate day @ 50,000/Month	600,000/-	Sprinkling of water to control dust emissions at site during whole construction period.
4.	Handling of solid waste	Includes the cost of collection, segregation, transportation, disposal and management of domestic, commercial and construction wastes	1,200,000/-	Rs. 100,000 per month for 12 months to collect construction waste from all the active sites on daily basis.
5.	Health and Safety of Workers	For 200 employees for the provision of dust masks, safety shoes, gloves, first aid box, ear plugs, safety helmets and safety jackets (Hi Vis) and provision of dust bins, warning tap, safety cones and safety sign boards.	3,468,500/-	Health and Safety Cost for 200 Workers was calculated for PPEs and other site arrangements. For detail, please refer to Annex–XIII.
6.	HSE Expert	HSE Expert to monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc. during construction and operational phase *Construction Phase:* 1 x 12 x 200,000 = 2,400,000	4,800,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		Operational Phase: 1 x 12 x 200,000 = 2,400,000		
7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	1,184,000/-	Refer to **Table 7.3** for detailed schedule and cost of environmental testing during construction and operation phase.
8.	Cost of environmental and social training	Short Seminars, Courses, Trainings and Lectures on Environment, Social and Occupational, Health and Safety constituents and components (Rs. 200,000/- per session during construction phase). 3 x 300,000 = 600,000	900,000/-	Refer to **Table 7.4** for details.
9.	Environmental Audit	Environmental Auditing through third party twice a year during construction and operational phase 2x 400,000 = 800,000 *Operational Phase:* 2 x 400,000 = 800,000	1,600,000/-	Cost for at least two auditors along with logistics, travels and accommodation charges.
10.	Tree Plantation	Plantation of different trees may be cut down during construction phase. Therefore, Compensatory planting of ten trees against each fallen tree of similar floral function should be planned after detailed assessment to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median.	19,320,000	For detail, please refer to Annex–XII.
		Total =	***35,852,500/-***	

The total estimated cost for the environmental management, monitoring and auditing during construction and O&M (annual cost will be updated for next upcoming years accordingly) comes to about **PKR 35.85 Million**.

9 CONCLUSION AND RECOMMENDATIONS

9.1 GENERAL

The EIA report has been prepared in accordance with the requirements of the Punjab Environmental Protection Act, 2012 and 2017 (Amended) and Punjab-EPA Regulations, 2022 for review of IEE and EIA and Pakistan EIA procedures.

9.2 CONCLUSION

Significant efforts were made to identify the main physical, ecological, social, cultural and environmental issues related to the construction and operation of the proposed Project. During the pre-construction, construction and operational phases, following are the main issues and concerns:

- Disturbance to the public movement and loss of livelihood during construction;
- Reduction in the daily routine activities of local residents, business operators, students, etc. during construction;
- Noise and air pollution due to the working of construction machinery during construction and traffic operation phases of the Project;
- Solid waste and wastewater generation during construction phase;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Cutting of plants/bushes/crops falling within the proposed CoI;
- Occupational and community health and safety issues; and
- Solid waste handling and disposal and waste water generation during operation phase.

9.3 RECOMMENDATIONS

An Environmental Monitoring/Management Plan for both phases (construction and operation) has been developed as part of the report which provides a detailed mitigation matrix that covers impacts, mitigation measures, roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the proposed project.

Based on the field visit, environmental monitoring and analysis of primary and secondary data, following recommendations have been conferred so that the Proponent gets the necessary direction and clarity to ensure efficient environment friendly and compliant operation:

- Implementation of Traffic Management plan with the help of traffic police during construction phase to avoid inconvenience to locals;
- Implementation of Tree Plantation Plan in true letter and spirit;
- The construction of the proposed Project should be done in with environmental and social SOPs;

- Proper location(s) for construction camps should be selected by contractor in close coordination with PMA that cause minimal/no damage to the prevailing environmental conditions of the project area;
- Formulation and implementation of a comprehensive safety and security plan by contractor before the start of the construction activities for the camps which should be comprised of a training manual, use of safety equipment, emergency preparedness and code of ethics;
- Wearing of Personal Protective Equipment (PPEs) such as helmet, masks, adequate footwear for bituminous pavement works, protective goggles and gloves should be made compulsory during construction activities and formulation and implementation of Health and Safety Plan (HSP) for construction workers;
- Preparation and implementation of Solid Waste Management Plan during construction stage by contractor in close coordination with concerned authorities for collection, reuse, recycling and disposal of waste;
- Employment opportunities should be provided to local people for skilled and unskilled works during construction stage;
- A provision of adequate budget in the overall cost of the Project and on-site space for plantation as per guidelines of the concerned departments should be provided in the design of proposed project to compensate tree cutting and to eradicate air pollution. Moreover, tree plantation must also be implemented;
- Soil contamination should be controlled by proper storage of chemicals;
- Surface runoff and wastewater generated during construction stage should be controlled and collected in septic tanks and soakage pits;
- Dust and fugitive emissions should be controlled by maintenance of equipment, fine tuning of the vehicles and regular sprinkling of water on soil;
- Noise and vibration should be controlled by equipment maintenance, by providing noise barrier and by scheduling the construction activities to avoid peak activity hours in the area;
- Provision of waste water treatment plant to treat the sewerage during the operation phase;
- A comprehensive solid waste management plan to cater the waste during operation phase; and
- For effective implementation of suggested mitigation measures, the environmental mitigation and monitoring cost/EMP must be the part of the bidding document of the Contractor.

ANNEXURES

ANNEX-I
TOOLS FOR BASELINE DATA

NATIONAL ENGINEERING SERVICES OF PAKISTAN (PVT) LIMITED

Project: _____

Questionnaire for Socioeconomic Survey

(Both for Male, Female and Transgender)

Date:_____

Village/Settlement _____ (b) District: _____ Thesil: _____

1. Name of the Respondent _____ Father's Name _____
2. Contact Number _____
3. Sex a. Male b. Female c. Transgender
4. What is your Religion?_____
5. What is your age? _____

Marital Status: a. Married b. Unmarried c. Widow/Widower d. Divorcee

6. What is your caste /ethnic group? _____
7. What is your mother tongue? _____
8. What is your education?

   a. Illiterate b. Primary c. Middle d. Metric
   e. Intermediate f. Graduation g. Above Graduation h. Other

9. What is the type of your family system? 1. Joint 2. Nuclear
10. Total number of family members? 1. Male _____ 2. Female _____ Total_____
11. What is your profession?

    Govt. Job 2. Private Job 3. Business / Shop 4. Labor
    5. Farmer/Agriculture 7. Livestock 8. Student 8. Any other

    (Please Specify) _____

12. What is your average family monthly income (Rs)? _____
13. How much is your average family monthly expenditures (Rs)? _____
14. What is type of ownership of your Residential Structure (house)?

    1. Self-Owned 2. Rented 3. Other (Spesify) _____

15. What is type of construction of your residential structure?

    1. Pacca 2. Semi-pacca 3. Kacha 4. Hut

16. What are the sources of drinking water for use?

    1. Public Water Supply 2. Ground water 3. Canal 4. Any other (Please Specify)_____

    Are you satisfied with the water quality? 1. Yes 2. No

    If no, please specify reasons: _____

17. Principle mode of transport from this locality to major urban centers?

1. Public 2. Private 3. Both

Satisfaction about public transport facilities in the city: Yes_____ No._____

If no reasons: _____

Fenquency of travliing in the Public transport: Daily_____ Weekly_____ Monothly___

18. Do you know about the Project? Yes:_____ No:_____

19. In Your openion what, will be the possible impact of the Project: _____

20. Access To Social Amenities In The Area*(Tick)*

ACCESS TO SOCIAL AMENITIES IN THE AREA*(TICK)*			Amenities if available Satisfaction level	
Social Amenities	Available	Not Available	Satisfactory	Non-Satisfactory
1-Electricity	1-Yes	2-No	1	2
2-Gas	1-Yes	2-No	1	2
3-Water Supply	1-Yes	2-No	1	2
4-Telephone	1-Yes	2-No	1	2
5-Drainage	1-Yes	2-No	1	2
6-Hospital	1-Yes	2-No	1	2
7-School School (Boys-Girls)	1-Yes	2-No	1	2
8-Collage (Boys-Girls)	1-Yes	2-No	1	2
9- Univesity	1-Yes	2-No	1	2
9-Road	1-Yes	2-No	1	2
10- Public Tranport	1-Yes	2-No	1	2
11-Religious Institue	1-Yes	2-No	1	2
12-Solid waste Management	1-Yes	2-No	1	2
9- Swearage System	1-Yes	2-No	1	2

21. In your opinion, should this Project be implemented here and what will be possible impacts of this project? 1. Yes No.

If Yes, then reason	**Response**	**If No, then reason**	**Response**

22. Any other concern: Any other concern with respect to the proposed Project?

_____

23. What protectie measures do you suggest to safeguard your interests? _____

_____

24. In your opinion, what are some pressing needs of this area? _____

25. General Remarks of the Respondents: _____

26. General Observations of Interviewers: _____

Name and Signature of Interviewer:_____

NATIONAL ENGINEERING SERVICES OF PAKISTAN (PVT) LIMITED

Project: _____

1- Identification: Date_____

Settlement: _____Tehsil: _____ District: _____UC_____

Location of Meeting_____ Resource Person _____

Contact No._____

2- Problem Faced During Travelling in Public Transport: _____

_____

3- Suggestion for Improvement of Public Transport: _____

_____

4- Facilities Required in the New Public Transport and Along the Route: _____

_____

5- Positive Impacts of the Proposed Project : _____

_____

6- Negative Impacts of the Proposed Project : _____

_____

7- Question & Response

Question	Response

8- General Remarks & Suggestion of the Participants: _____

_____

9- General Observations: _____

List of Participants

Sr. No.	Name/Father Name	Occupation	Signature/ Thumb

Conducted by: Name: _____Signature_____

ANNEX-II
ENVIRONMENTAL MONITORING REPORT

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15146

ENVIRONMENTAL MONITORING, SAMPLING AND TESTING REPORT

FOR

EIA STUDY OF FAISALABAD MASS TRANSIT PROJECT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED

Prepared by: Green Crescent Environmental Consultants Pvt. Ltd.

Karachi Office: House No. 309-B, Block Gamal View, Housing Society, Lahore, Pakistan.
Islamabad Office:

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15210

Environmental Monitoring, Sampling & Testing Analysis Report

- Ground Water
- Surface Water
- Waste Water
- Ambient Air
- Meteorological Data
- Noise Monitoring

NESPAK (PVT) LTD.

Monitoring & Sampling Date:
09th Jan 2026 to 09th Jan. 2026

Job Reference No.: GCEC-PK-PU-06/2026

Pakistan Office: House No. 388-B, Block Canal View Housing Society, Lahore, Pakistan
Mehrabpur Office: Flat # AC, 4th Floor, Jahangir Tower, 8 H-13 Markaz, Islamabad.

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# ISA/ 15211

Client Detail:	
Name of Contact Person:	Mr. Muhammad Jahan Zeb
Designation:	General Manager/ Head GT & GE Division
Telephone:	042-99080400
Address:	NESPAK House, 1-C Block-N, Model Town Extension Lahore

GCEC Detail:	
Director:	Mr. Mian Khurram Umer
Telephone:	+92 42 35912869
Fax:	+92 42 35912864
Email:	[redacted]
Address:	House No. 368-B Block B, Canal View, Lahore

Signature:

Pakistan Office: House No 368-B, Block Canal View Housing Scheme, Lahore, Pakistan.
Tel: (0)42-35912869-70 Fax: (0)42-35912864
Email: [redacted] Web: www.gcec.pk

Islamabad Office:
Plot # 67, 6th Floor
Gangaria Tower, E-11/2 Markaz
Islamabad.
Ph: 051-2250450

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr No# 25A/ 15212

CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Sample Details			
Job Bill No:		Client Name:	HEPSE (Pvt) Ltd
Telephone No.		Sample Matrix:	
Sample Date:		Sampled By:	
Sample Receipt Date:		Date of Completion of Analysis:	
Grab/ Composite:			

Sample Identification

Parameters	Analysis Method	Unit	LOD	Result	PQL
PHYSICAL & CHEMICAL ANALYSIS					
pH					
Odor					
Taste					
Color					
Turbidity					
Total Hardness					
Total Dissolved Solid (TDS)					
Ammonia					
Chloride					
Cyanide (CN)					
Fluoride (F)					
Nitrate					
Nitrite					
Phenolic Compound					
Residual Chlorine					
Aluminum (Al)					
Cadmium					
Copper					
Chromium					
Antimony (Sb)					
Nickel					
Iron					
Barium					
Manganese					
Boron					
Silver					
Lead					
Selenium					
Arsenic					
Mercury					
MICROBIOLOGICAL ANALYSIS					
Total Coliforms					
Fecal Coliforms (Ecoli)					

Abbreviations

NQ: Not Quantified **LOD:** Limit of Reporting **PQL:** Practical Quantification Limit/ Threshold

Note

* Conclusion of all the parameters and tolerance conditions are the value of standard and as provided as per WHO Agreement. The all environmental conditions are maintained at 25±2°C and Humidity at 50±5%.

Prepared By:

Reviewed By:

Pakistan Office: House No. 268-B, Block Canal View Housing Society, Lahore, Pakistan.
Tel: 0333-4142219, 0321-4163219
Fax: 042-37520584-85, 0320-4142219
Email: info@greencrescent.com.pk, www.gcec.pk

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Flat # 6C, 6th Floor
Hamsa Tower, 2-113 Markaz
Islamabad.
Ph: 051-2291140

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15213

CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Sample Details			
Job Ref. No.		Client Name	
Telephone No.		Sample Name	
Sample Date		Sampled By	
Sample Receipt Date		Date of Completion of Analysis	
Grab/Composite			
Sample Identification			
S/C			
Sampling Coordinates			

Parameters	Analysis Method	Unit	LLOD	Result	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
pH					
Odor					
Turbidity					
Total Hardness		mg/l			
Total Dissolved Solid (TDS)		mg/l			
Ammonia		mg/l			
Chloride		mg/l			
Cyanide (CN)		mg/l			
Fluoride (F)		mg/l			
Nitrite		mg/l			
Nitrate		mg/l			
Phenolic Compound		mg/l			
Residual Chlorine		mg/l			
Aluminum (Al)		mg/l			
Cadmium		mg/l			
Copper		mg/l			
Chromium		mg/l			
Antimony (Sb)		mg/l			
Nickel		mg/l			
Zinc		mg/l			
Barium		mg/l			
Manganese		mg/l			
Iron		mg/l			
Boron		mg/l			
Lead		mg/l			
Selenium		mg/l			
Arsenic		mg/l			
Mercury		mg/l			
MICROBIOLOGICAL ANALYSIS					
Total Coliforms					
Fecal Coliforms (Ecoli)					

Abbreviations:

NDL: Non Detected **LLOD:** Lower Limit of Reporting **PEQS:** Pakistan Environmental Quality Standards

Note:

Prepared By:

Reviewed By:

Pakistan Office: House No. 368-B, Block Canal View Housing Society, Lahore, Pakistan
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Fax: (042) 35802869-70 Cell: 0321-4142218
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Usmania Tower, G-11/3 Markaz
Islamabad.
Ph: (051) 2370161

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr No# 25A/ 15214

CHEMICAL ANALYSIS TEST REPORT (GROUND WATER)

Sample Details			
Job Ref. No:		Client Name:	NESPAK (Pvt) Ltd.
Telephone No.		Sample Matrix:	
Sample Date:		Sampled By:	
Sample Receipt Date:		Date of Completion of Analysis:	
Scope/Completion:	Grab Sampling		
Sample Identification			
ID #			
Sampling Coordinates:			

Parameters	Analysis Method	Unit	LOQ	Result #1	PSQS
PHYSICAL & CHEMICAL ANALYSIS					
pH					
Odor					
Taste					
Color					
Turbidity					
Total Hardness					
Total Dissolved Solid (TDS)					
Ammonia					
Chloride					
Cyanide (CN)					
Fluoride (F)					
Nitrate					
Nitrite					
Phenolic Compounds					
Residual Chlorine					
Aluminum (Al)					
Cadmium					
Copper					
Chromium					
Antimony (Sb)					
Nickel					
Zinc					
Barium					
Manganese					
Iron					
Boron					
Lead					
Selenium					
Arsenic					
Mercury					
MICROBIOLOGICAL ANALYSIS					
Total Coliforms					
Fecal Coliforms (Ecoli)					

Abbreviations:
NDL: Not Detected **LOQ:** Limit of Quantification **PSQS:** Punjab Environmental Quality Standards
Note:
*

Prepared By:

Reviewed By:

Approved By:

Pakistan Office: House No. 366-B, Block D, Model Town Extension, Lahore, Pakistan.
Tel: 042-35839434-35, 35839436, Fax: 042-35839437
Email: info@greencrescent.com.pk, Web: www.greencrescent.com.pk

Islamabad Office:
Tel: 051-4863434, Fax: 051-4863435

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 14722

CHEMICAL ANALYSIS TEST REPORT (SURFACE WATER)

Disclaimer: [illegible]

Sample Details			
Lab Ref. No:	[illegible]	Client Name:	[illegible]
Telephone No:	[illegible]	Sample Matrix:	[illegible]
Sample Date:	[illegible]	Sample of No:	[illegible]
Sample Receipt Date:	[illegible]	Date of Completion of Analysis:	[illegible]
Grab/ Composite:	[illegible]		

Sample Identification	
01	[illegible]
	Sampling Coordinates: [illegible]

Parameters	Analysis Method	Unit	LOD	Result 01
PHYSICAL & CHEMICAL ANALYSIS				
Temperature	[illegible]	°C		[illegible]
pH	[illegible]	pH unit	[illegible]	[illegible]
Total Dissolved Solid (TDS)	[illegible]	mg/l	[illegible]	[illegible]
Oil and Grease	[illegible]	mg/l	[illegible]	[illegible]
Biological Oxygen Demand	[illegible]	mg/l	[illegible]	[illegible]
Chemical Oxygen Demand	[illegible]	mg/l	[illegible]	[illegible]
Total Suspended Solid	[illegible]	mg/l	[illegible]	[illegible]
Phenolic Compound	[illegible]	mg/l	[illegible]	[illegible]
Chloride (Cl)	[illegible]	mg/l	[illegible]	[illegible]
Fluoride (F)	[illegible]	mg/l	[illegible]	[illegible]
Cyanide (CN)	[illegible]	mg/l	[illegible]	[illegible]
Detergent	[illegible]	mg/l		[illegible]
Sulphate	[illegible]	mg/l	[illegible]	[illegible]
Sulphide	[illegible]	mg/l	[illegible]	[illegible]
Ammonia	[illegible]	mg/l	[illegible]	[illegible]
Silica	[illegible]	mg/l	[illegible]	[illegible]
Cadmium	[illegible]	mg/l	[illegible]	[illegible]
Chromium	[illegible]	mg/l	[illegible]	[illegible]
Copper	[illegible]	mg/l	[illegible]	[illegible]
Lead	[illegible]	mg/l	[illegible]	[illegible]
Nickel	[illegible]	mg/l	[illegible]	[illegible]
Zinc	[illegible]	mg/l	[illegible]	[illegible]
Barium	[illegible]	mg/l	[illegible]	[illegible]
Manganese	[illegible]	mg/l	[illegible]	[illegible]
Iron	[illegible]	mg/l	[illegible]	[illegible]
Boron	[illegible]	mg/l	[illegible]	[illegible]
Total Chlorine	[illegible]	mg/l	[illegible]	[illegible]
Total Toxic Metals	By Calculation	mg/l		[illegible]
Mercury	[illegible]	mg/l	[illegible]	[illegible]
Arsenic	[illegible]	mg/l	[illegible]	[illegible]
Selenium	[illegible]	mg/l	[illegible]	[illegible]
Potassium	[illegible]	mg/l		[illegible]

Abbreviations:
N/D: Not Detected LOD: Limit of Reporting

Notes:
*[illegible]

Prepared By:

Reviewed By:

Approved By:

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr.No# 35A/ 15216

CHEMICAL ANALYSIS TEST REPORT (WASTE WATER)

Disclaimer: [illegible]

Sample Details			
Job Ref. No:	[illegible]	Client Name:	[illegible]
Telephone No:	[illegible]	Sample Matrix:	[illegible]
Sample Date:	[illegible]	Sampled By:	[illegible]
Sample Receipt Date:	[illegible]	Date of Completion of Analysis:	[illegible]
Grab/Composite:	[illegible]		
Sample Identification			
Id:	[illegible]		
	Sampling Coordinates:	[illegible]	

Parameters	Analysis Method	Unit	LOR	Results	PEQS
PHYSICAL & CHEMICAL ANALYSIS					
Temperature	[illegible]	°C		[illegible]	
pH	[illegible]	pH unit	[illegible]	[illegible]	[illegible]
Total Dissolved Solid (TDS)	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Oil and Grease	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Biological Oxygen Demand	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Chemical Oxygen Demand	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Total Suspended Solid	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Phenolic Compound	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Chloride (Cl)	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Fluoride (F)	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Cyanide (CN)	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Detergent	[illegible]	mg/l		[illegible]	[illegible]
Sulphide	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Sulphate	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Ammonia	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Silica	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Cadmium	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Chromium	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Copper	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Lead	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Nickel	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Zinc	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Barium	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Manganese	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Iron	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Boron	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Total Chlorine	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Total Toxic Metals	[illegible]	mg/l		[illegible]	[illegible]
Mercury	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Arsenic	[illegible]	mg/l	[illegible]	[illegible]	[illegible]
Antimony	[illegible]	mg/l		[illegible]	[illegible]
Pesticides	[illegible]	mg/l		[illegible]	[illegible]

Abbreviations:
ND: Non Detected — LOR: Limit of Reporting — PEQS: Punjab Environmental Quality Standards

Note:
* [illegible]

Prepared By:

Reviewed By:

Pakistan Office: House No. 35-B, Block Canal View Housing Society, Lahore, Pakistan.
[illegible]

International Office:
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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 254/ 15174

Ambient Air Monitoring Location-01

Near Faisalabad Agriculture University, Jhang Road

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Sr. No# ESA/ 15217

Ambient Air Quality Monitoring

Disclaimer: [illegible]

Job Reference Number	GCEC/ESA/[illegible]/2026
Monitoring Point	Near Faisalabad Agriculture Extension, Jhang Road
Date of Intervention	09 Jan 2026 to 09 Jan 2026
Monitoring Coordinates	31°[illegible]'N, 72°[illegible]'E

Sr. #	Time	CO (mg/m³)	NO (ug/m³)	NO_2 (ug/m³)	NO_2 (ug/m³)	SO_2 (ug/m³)
1.	[illegible]	2.16	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	2.40	[illegible]	[illegible]	[illegible]	[illegible]
3.	[illegible]	2.19	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	2.46	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	2.32	[illegible]	[illegible]	[illegible]	[illegible]
6.	[illegible]	2.60	[illegible]	[illegible]	[illegible]	[illegible]
7.	[illegible]	2.36	[illegible]	[illegible]	[illegible]	[illegible]
8.	[illegible]	2.79	[illegible]	[illegible]	[illegible]	[illegible]
9.	[illegible]	2.36	[illegible]	[illegible]	[illegible]	[illegible]
10.	[illegible]	2.69	[illegible]	[illegible]	[illegible]	[illegible]
11.	[illegible]	2.60	[illegible]	[illegible]	[illegible]	[illegible]
12.	[illegible]	2.46	[illegible]	[illegible]	[illegible]	[illegible]
13.	[illegible]	2.36	[illegible]	[illegible]	[illegible]	[illegible]
14.	[illegible]	2.59	[illegible]	[illegible]	[illegible]	[illegible]
15.	[illegible]	2.39	[illegible]	[illegible]	[illegible]	[illegible]
16.	[illegible]	2.66	[illegible]	[illegible]	[illegible]	[illegible]
17.	[illegible]	2.50	[illegible]	[illegible]	[illegible]	[illegible]
18.	[illegible]	2.79	[illegible]	[illegible]	[illegible]	[illegible]
19.	[illegible]	2.99	[illegible]	[illegible]	[illegible]	[illegible]
20.	[illegible]	2.80	[illegible]	[illegible]	[illegible]	[illegible]
21.	[illegible]	2.69	[illegible]	[illegible]	[illegible]	[illegible]
22.	[illegible]	2.39	[illegible]	[illegible]	[illegible]	[illegible]
23.	[illegible]	2.99	[illegible]	[illegible]	[illegible]	[illegible]
24.	[illegible]	3.03	[illegible]	[illegible]	[illegible]	[illegible]
Average Concentration		**2.68**	**[illegible]**	**[illegible]**	**[illegible]**	**[illegible]**

Operator Analyst:

Reviewed By:

Approved By:

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 254/ 13218

Ambient Air Quality Monitoring

Disclaimer: The report is not valid in Court Cases, Commission Reports, Claims, Enquiry Report or Litigation Plea. Sample(s) were tested as received from Client. Environmental Protection (Tests, Procedure and Control) Rules, 2016 is

Job Reference Number	GCES/ [illegible]
Monitoring Point	Near Faisalabad Agriculture University, Jhang Road
Date of Intervention	05-Jan-2020 to 06-Jan-2020
Monitoring Coordinates	31°25'07.1"N 73°04'21.8"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.00	30.00	40.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.00	19.72	40.0
NO_x	µg/m³	24 Hours	1.00	46.32	1210
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.00	30.00	1210
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	2.03	5.0*
Ozone (O_3)	µg/m³	24 Hours	-	29.40	130**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	145.62	550
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	174.73	1210
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	5.00	203.25	500.0
Lead Airborne Particles	µg/m³	24 Hours	-	0.20	1.5

Abbreviations:
µg/m³= Microgram per Cubic Meter
mg/m³= Milligram per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*8H long standard for CO
**8H long standard for O3

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15219

Meteorological Data

Disclaimer: [illegible]

Job Reference Number	[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
[illegible]					

Data Analyst: [illegible]

Reviewed By: [illegible]

[illegible]

Pakistan Office: [illegible]
Islamabad Office: [illegible]

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 254/ 15175

Noise Level Monitoring Report

Job Reference Number	
Monitoring Point	
Date of Intervention	
Monitoring Coordinates	

Sr. #	Time	Method/Technique	Unit	Results (Avg	PEQS (Commercial)
		Night Time			
1.			dB		
2.			dB		
3.			dB		
4.			dB		
5.			dB		
6.			dB		
7.			dB		
8.			dB		
	Night Time Average		dB		
		Day Time			
9.			dB		
10.			dB		
11.			dB		
12.			dB		
13.			dB		
14.			dB		
15.			dB		
16.			dB		
17.			dB		
18.			dB		
19.			dB		
20.			dB		
21.			dB		
22.			dB		
23.			dB		
24.			dB		
	Day Time Average		dB		

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr No# 254/ 15176

Ambient Air Monitoring Location-02

GTS Chowk Faisalabad

(FAISALABAD)

Islamabad Office

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15220

Ambient Air Quality Monitoring

Disclaimer: [illegible]

Job Reference Number	[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	SO_2 (µg/m³)	H_2S (µg/m³)
1.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Average Concentration	**2.00**	**21.33**	**28.00**	**68.22**	**44.76**

Duly Analyst

Reviewed By:

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 284/ 15221

Ambient Air Quality Monitoring

Disclaimer: [illegible]

Job Reference Number	[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Nitrogen Oxide (NO)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
NH_3	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Sulphur Dioxide (SO_2)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Carbon Monoxide (CO)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Ozone (O_3)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Particulate Matter ($PM_{2.5}$)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Particulate Matter (PM_{10})	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Suspended Particulate Matter (SPM)	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]
Lead Airborne Particles	[illegible]	24 Hours	[illegible]	[illegible]	[illegible]

Abbreviations:
µg/m³: Microgram per Cubic Meter
mg/m³: Milligram per Cubic Meter
LDL: Lowest Detection Limit
PEQS: Punjab Environmental Quality Standards
*SR found installed for CO
**SM found installed for O3

Quality Analyst

Reviewed By

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Islamabad Office
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Meteorological Data

Disclaimer: The report is not valid in Court/Govt. Laboratory/Statistics Purpose. Complaints Subject to Jurisdiction of Lahore. Sample(s) as received. Results relate only to the parameters tested. Green Crescent Environmental Consultants Pvt. Ltd. shall not be responsible for any misuse of the report.

Job Reference Number	GCEC/PK/IT/ [illegible]
Monitoring Point	GTR Chowk Faisalabad
Date of Intervention	06 Jan 2026 to 07 Jan 2026
Monitoring Coordinates	31°25'01.7"N 73°07'05.9"E

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
12:00	13	W	1.2	75	715.5
13:00	12	SW	1.5	73	715.6
14:00	12	W	1.1	72	715.5
15:00	11	NW	0.8	75	715.3
16:00	11	N	0.5	78	715.3
17:00	10	N	0.3	81	715.3
18:00	10	NE	0.7	79	715.5
19:00	10	NE	0.8	78	715.5
20:00	9	E	1.1	76	715.6
21:00	9	E	0.9	77	715.5
22:00	9	NE	0.6	79	715.5
23:00	8	NE	0.4	80	715.7
00:00	8	N	0.3	81	715.8
01:00	7	NW	0.4	83	715.7
02:00	7	W	0.5	85	715.6
03:00	7	NW	0.6	85	715.7
04:00	6	N	0.3	87	715.9
05:00	6	W	0.2	88	715.9
06:00	7	N	0.4	87	715.8
07:00	8	N	0.5	85	715.6
08:00	9	NE	0.6	83	715.5
09:00	9	E	0.7	80	715.4
10:00	10	NE	0.9	77	715.3
11:00	11	NE	1.0	76	715.2

Operator Analyst

Reviewed By

Approved By

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15177

Noise Level Monitoring Report

Job Reference Number	
Monitoring Point	
Date of Intervention	
Monitoring Coordinates	

Sr. #	Time	Method/Technique	Unit	Results LAeq	PEQS (Commercial)
		Night Time			
1.			dB		
2.			dB		
3.			dB		
4.			dB		55.0
5.			dB		
6.			dB		
7.			dB		
8.			dB		
	Night Time Average		dB	62.88	55.0
		Day Time			
9.			dB		
10.			dB		
11.			dB		
12.			dB		
13.			dB		
14.			dB		
15.			dB		
16.			dB		65.0
17.			dB		
18.			dB		
19.			dB		
20.			dB		
21.			dB		
22.			dB		
23.			dB		
24.			dB		
	Day Time Average		dB	88.08	65.0

Checked/Analyzed By

Reviewed By

Approved By

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Ambient Air Monitoring Location-03

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15223

Ambient Air Quality Monitoring

Disclaimer: [illegible]

Job Reference Number	[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Sr. #	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NH_3 (µg/m³)	SO_2 (µg/m³)
1.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Average Concentration	**2.36**	**86.83**	**52.69**	**44.32**	**33.46**

Duplicity Analyst

Reviewed By

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15224

Ambient Air Quality Monitoring

Disclaimer: This report is not valid for Court Cases, Environment Protection Orders, Guidelines Related to Ambient Air Quality, or any agreement made under Punjab Environment Protection (Amendment) Rules, 2012 etc.

Job Reference Number	GCEC/PK/PC/16/2020
Monitoring Point	Near Robinson Plaza (opposite Road), Faisalabad
Date of Intervention	07 Jan, 2020 to 08 Jan, 2020
Monitoring Coordinates	31°24'07.2"N, 73°04'58.2"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	µg/m³	24 Hours	1.01	33.69	80.0
Nitrogen Oxide (NO)	µg/m³	24 Hours	1.01	16.35	40.0
NO_x	µg/m³	24 Hours	1.01	49.12	120.0
Sulphur Dioxide (SO_2)	µg/m³	24 Hours	1.01	33.86	120.0
Carbon Monoxide (CO)	mg/m³	24 Hours	0.01	2.36	5.0*
Ozone (O_3)	µg/m³	24 Hours		76.0	130.0**
Particulate Matter ($PM_{2.5}$)	µg/m³	24 Hours	1.00	136.32	35.0
Particulate Matter (PM_{10})	µg/m³	24 Hours	1.00	164.79	150.0
Suspended Particulate Matter (SPM)	µg/m³	24 Hours	1.00	370.95	500.0
Lead Airborne Particles	µg/m³	24 Hours		0.14	1.5

Abbreviations:
µg/m³= Microgram per Cubic Meter
mg/m³= Milligram per Cubic Meter
LDL= Lowest Detection Limit
PEQS= Punjab Environmental Quality Standards
*8h limit standard for CO
**8h limit standard for O_3

Data Analyst

Reviewed By

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15225

Meteorological Data

Disclaimer: [illegible]

Job Reference Number	[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
[illegible]					

Reviewed By:

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Fax: 042-35869483
Email: [illegible]
International Office:
[illegible]

Noise Level Monitoring Report

Job Reference Number	
Monitoring Point	
Date of Intervention	
Monitoring Coordinates	

Sr. #	Time	Method/Technique	Unit	Results (Aeq)	PEQS (Commercial)
		Night Time			
1.			dB		
2.			dB		
3.			dB		
4.			dB		
5.			dB		
6.			dB		
7.			dB		
8.			dB		
	Night Time Average		dB		
		Day Time			
9.			dB		
10.			dB		
11.			dB		
12.			dB		
13.			dB		
14.			dB		
15.			dB		
16.			dB		
17.			dB		
18.			dB		
19.			dB		
20.			dB		
21.			dB		
22.			dB		
23.			dB		
24.			dB		
	Day Time Average		dB		

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 284/ 15190

Ambient Air Monitoring Location-04

Near Sitara Park City Jaranwala Road (FAISALABAD)

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T: (092-42) 3516 3582-85 (092-42) 3516 3586
Islamabad Office:
Plot # 4C, 4th Floor

Ambient Air Quality Monitoring

Job Reference Number	[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Sr. #	Time	CO (mg/m³)	NO (ug/m³)	NO_2 (ug/m³)	NO_x (ug/m³)	SO_2 (ug/m³)
1.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Average Concentration	**2.94**	**23.73**	**39.48**	**63.22**	**41.76**

Duly Analyst

Reviewed By

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15227

Ambient Air Quality Monitoring

Disclaimer: The report is not valid in Court Case, Environment Protection Order, Compliance Agencies Directives/Show Agencies or any agency other than Punjab Environmental Protection (Amendment) Rules, 2018 etc.

Job Reference Number	GCEC/PK/PC/16/2020
Monitoring Point	Near Stone Park Chk Jalandhar Road, Faisalabad
Date of Intervention	09 Jan 2020 to 09 Jan 2020
Monitoring Coordinates	31°25'22.7"N 73°05'36.2"E

Parameter	Unit	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	24 Hours	3.00	30.40	80.0
Nitrogen Oxide (NO)	$\mu g/m^3$	24 Hours	3.00	23.75	80.0
NO_x	$\mu g/m^3$	24 Hours	3.00	63.12	120.0
Sulphur Dioxide (SO_2)	$\mu g/m^3$	24 Hours	3.00	41.75	120.0
Carbon Monoxide (CO)	mg/m^3	24 Hours	0.03	2.94	5.0*
Ozone (O_3)	$\mu g/m^3$	24 Hours	-	30.0	130.0**
Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	24 Hours	3.00	100.12	35.0
Particulate Matter (PM_{10})	$\mu g/m^3$	24 Hours	3.00	191.25	150.0
Suspended Particulate Matter (SPM)	$\mu g/m^3$	24 Hours	3.00	305.20	500.0
Lead Airborne Particles	$\mu g/m^3$	24 Hours	-	0.20	1.5

Abbreviations:
$\mu g/m^3$: Microgram per Cubic Meter
mg/m^3: Milligram per Cubic Meter
LDL/l: Lowest Detection Limit
PEQS: Punjab Environmental Quality Standards
*8h mean standard for CO
**1H mean standard for O_3

Reviewed By:

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Islamabad Office:
Ph: (92) (0)51-[illegible]

Meteorological Data

Disclaimer: This report is not valid for Court Cases, Environmental Protection Orders, Compliance Agency Assessment Plans, Spillage or any agitation arise under Water Pollution and Protection, Energy Resources and Control Rules, 2021 etc.

Job Reference Number	GCEC-[illegible]
Monitoring Point	[illegible]
Date of Intervention	[illegible]
Monitoring Coordinates	[illegible]

Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
11:00	9	N	0.6	76	735.2
12:00	9	NE	0.9	76	735.9
13:00	10	ENE	1.1	75	736.6
14:00	10	N	0.8	75	736.9
15:00	10	N	1.7	77	736.3
16:00	9	NNW	1.3	77	735.8
17:00	9	W	1.1	78	736.9
18:00	9	SW	1.8	78	736.3
19:00	8	NNW	1.6	79	736.2
20:00	8	N	1.4	79	736.8
21:00	7	NNE	1.2	80	736.9
22:00	7	E	1.7	80	737.0
23:00	7	NNE	2.2	81	737.2
00:00	7	E	2	81	737.7
01:00	6	SE	1.3	81	737.9
02:00	6	ESE	1.6	82	738.0
03:00	6	ENE	1.7	82	738.4
04:00	6	E	0.7	82	738.9
05:00	6	W	1.1	83	739.1
06:00	7	NW	0.8	83	738.9
07:00	8	S	1.3	81	738.7
08:00	9	S	1.2	79	738.2
09:00	9	WSW	1.6	78	738.6
10:00	10	S	1.7	76	738.3

Prepared Analyst:

Reviewed By:

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15181

Noise Level Monitoring Report

Job Reference Number	
Monitoring Point	
Date of Intervention	
Monitoring Coordinates	

Sr. #	Time	Method/Technique	Unit	Results (Avg.	PEQS (Commercial)
		Night Time			
1.		Noise Meter	dB		
2.		Noise Meter	dB		
3.		Noise Meter	dB		
4.		Noise Meter	dB		
5.		Noise Meter	dB		
6.		Noise Meter	dB		
7.		Noise Meter	dB		
8.		Noise Meter	dB		
	Night Time Average		dB		
		Day Time			
9.		Noise Meter	dB		
10.		Noise Meter	dB		
11.		Noise Meter	dB		
12.		Noise Meter	dB		
13.		Noise Meter	dB		
14.		Noise Meter	dB		
15.		Noise Meter	dB		
16.		Noise Meter	dB		
17.		Noise Meter	dB		
18.		Noise Meter	dB		
19.		Noise Meter	dB		
20.		Noise Meter	dB		
21.		Noise Meter	dB		
22.		Noise Meter	dB		
23.		Noise Meter	dB		
24.		Noise Meter	dB		
	Day Time Average		dB		

Deputy Manager

Reviewed By

Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 25A/ 15182

Noise Level Monitoring Report

Job Reference Number	
Monitoring Point	
Date of Intervention	
Monitoring Coordinates	

Sr. #	Time	Method/Technique	Unit	Results LAeq	PEQS (Commercial)
		Night Time			
1.		Noise Meter	dB		
2.		Noise Meter	dB		
3.		Noise Meter	dB		
4.		Noise Meter	dB		65.0
5.		Noise Meter	dB		
6.		Noise Meter	dB		
7.		Noise Meter	dB		
8.		Noise Meter	dB		
	Night Time Average		dB	86.25	55.0
		Day Time			
9.		Noise Meter	dB		
10.		Noise Meter	dB		
11.		Noise Meter	dB		
12.		Noise Meter	dB		
13.		Noise Meter	dB		
14.		Noise Meter	dB		
15.		Noise Meter	dB		
16.		Noise Meter	dB		65.0
17.		Noise Meter	dB		
18.		Noise Meter	dB		
19.		Noise Meter	dB		
20.		Noise Meter	dB		
21.		Noise Meter	dB		
22.		Noise Meter	dB		
23.		Noise Meter	dB		
24.		Noise Meter	dB		
	Day Time Average		dB	86.37	65.0

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Green Crescent
Environmental Consultants Pvt. Ltd.

Sr. No# 254/ 15193

Noise Level Monitoring Report

Job Reference Number	
Monitoring Point	
Date of Intervention	
Monitoring Coordinates	

Sr. #	Time	Method/ Technique	Unit	Results LAeq	PEQS (Commercial)
		Night Time			
1.			dB		
2.			dB		
3.			dB		
4.			dB		
5.			dB		
6.			dB		
7.			dB		
8.			dB		
	Night Time Average		dB		
		Day Time			
9.			dB		
10.			dB		
11.			dB		
12.			dB		
13.			dB		
14.			dB		
15.			dB		
16.			dB		
17.			dB		
18.			dB		
19.			dB		
20.			dB		
21.			dB		
22.			dB		
23.			dB		
24.			dB		
	Day Time Average		dB		

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Islamabad
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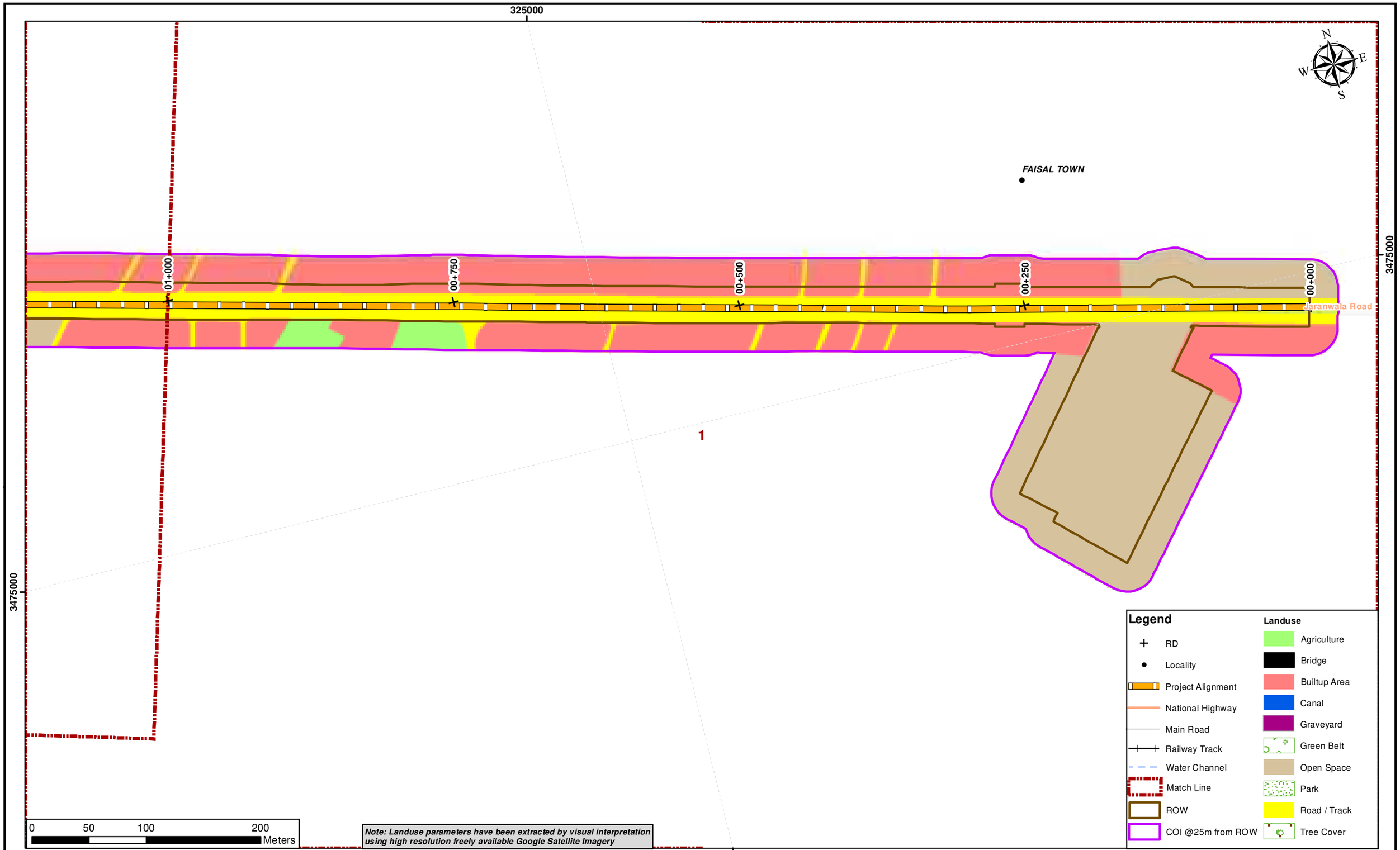
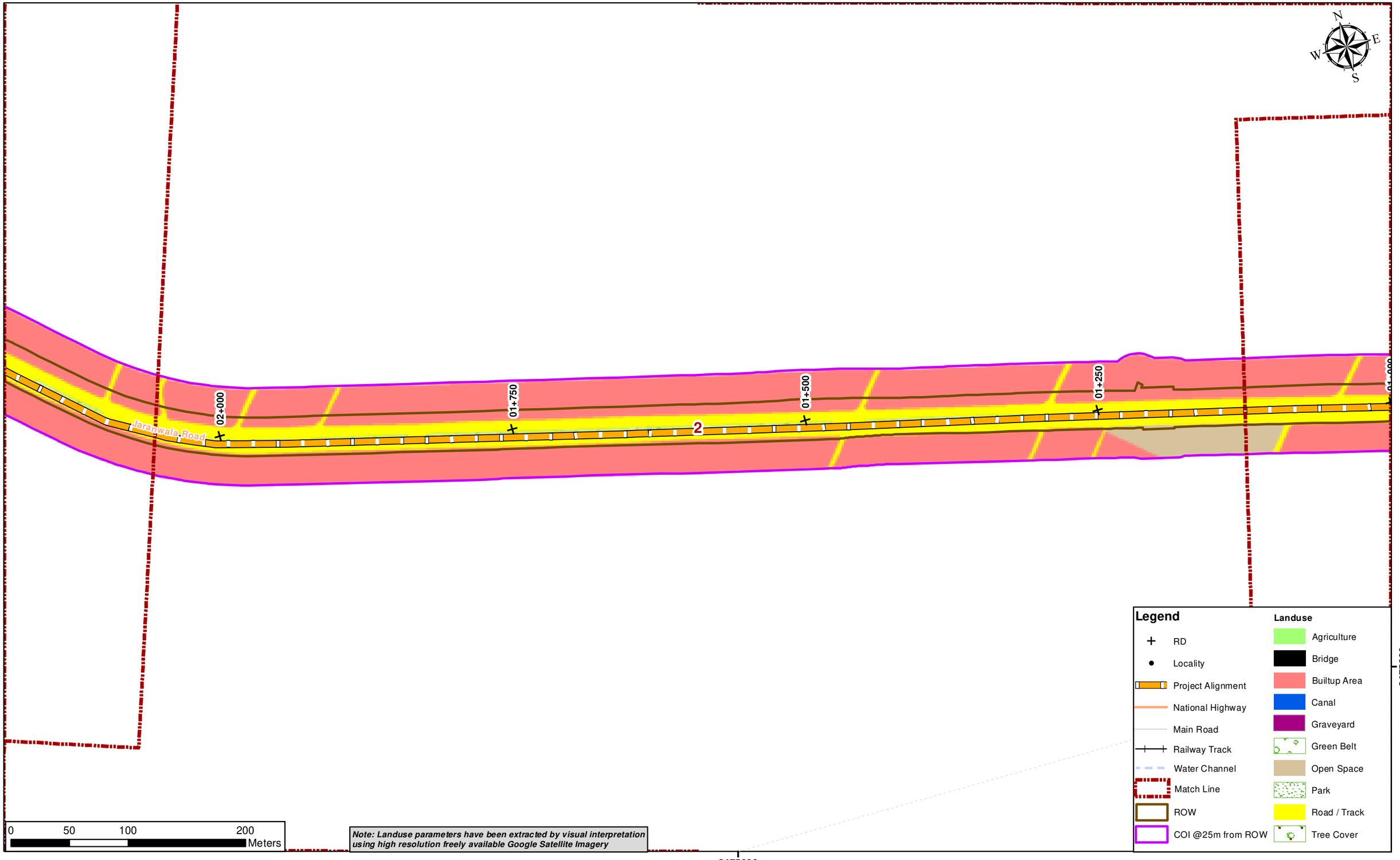
ANNEX-III
LANDUSE MAP



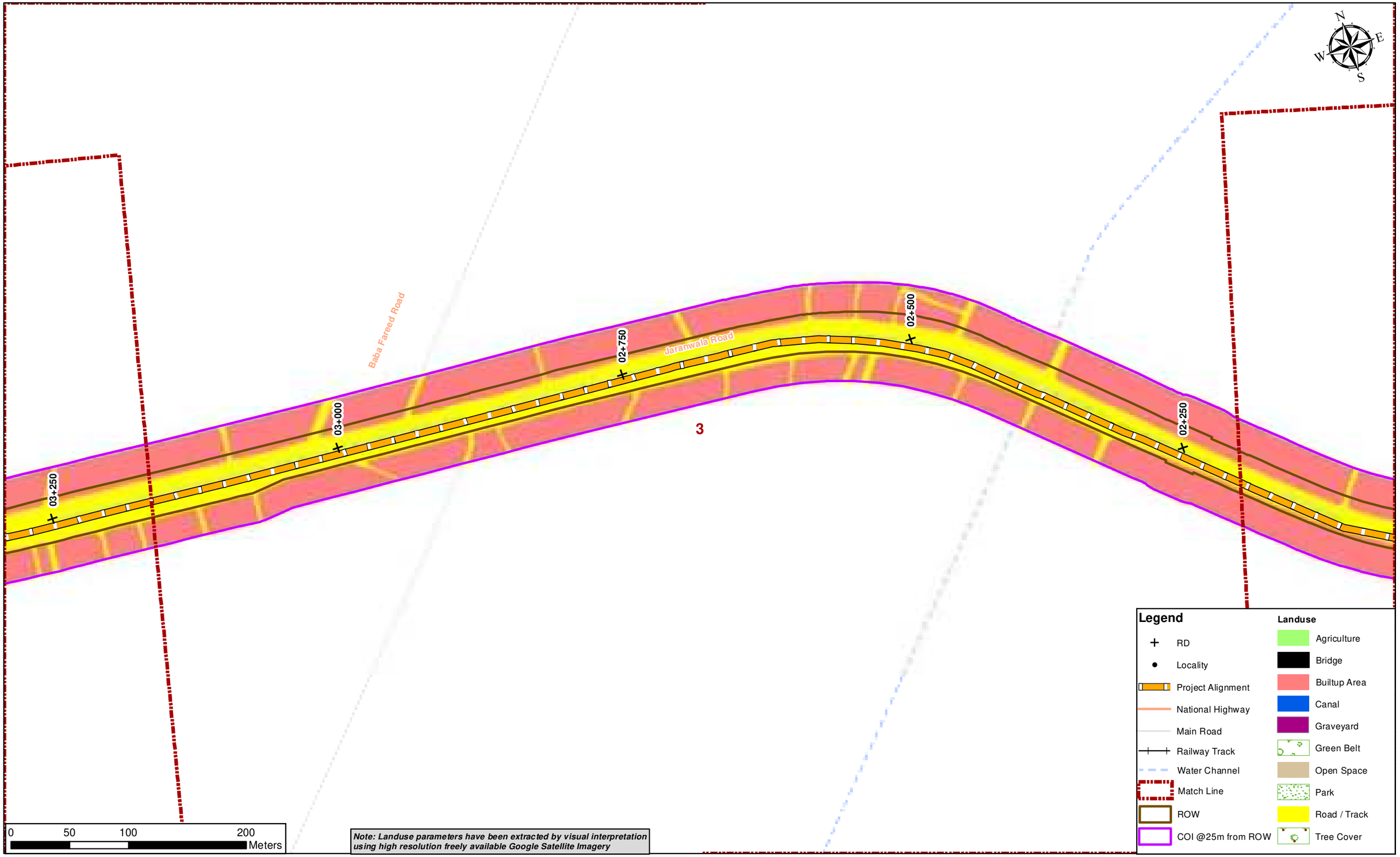
CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE	LANDUSE MAP	SCALE: 1:3,000	
			DATE: JAN-2026	FIG.: Sheet 1 of 19	REV.: 0

REV.	DATE	DESCRIPTION	APPROVED	APPROVED	GHAZANFAR
04				DRAWN	M.MUNEEB
03				SUBMITTED	SHEHNILLA
02				RECOMMENDED	
01				CHD/VER.	



CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE	LANDUSE MAP	SCALE: 1:3,000	
			DATE: JAN-2026	FIG.: Sheet 2 of 19	REV.: 0

REV.	DATE	DESCRIPTION	APPROVED
04			DRAWN: M.MUNEEB
03			SUBMITTED: SHEHNILLA
02			RECOMMENDED:
01			CHD/VER.:
			APPROVED: GHAZANFAR



CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04			DRAWN	M.MUNEEB
		03			SUBMITTED	SHEHNILLA
		02			RECOMMENDED	
		01			CHD/VER.	
		REV.	DATE	DESCRIPTION / APPROVED	APPROVED	GHAZANFAR

PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD
ORANGE TRANSIT LINE

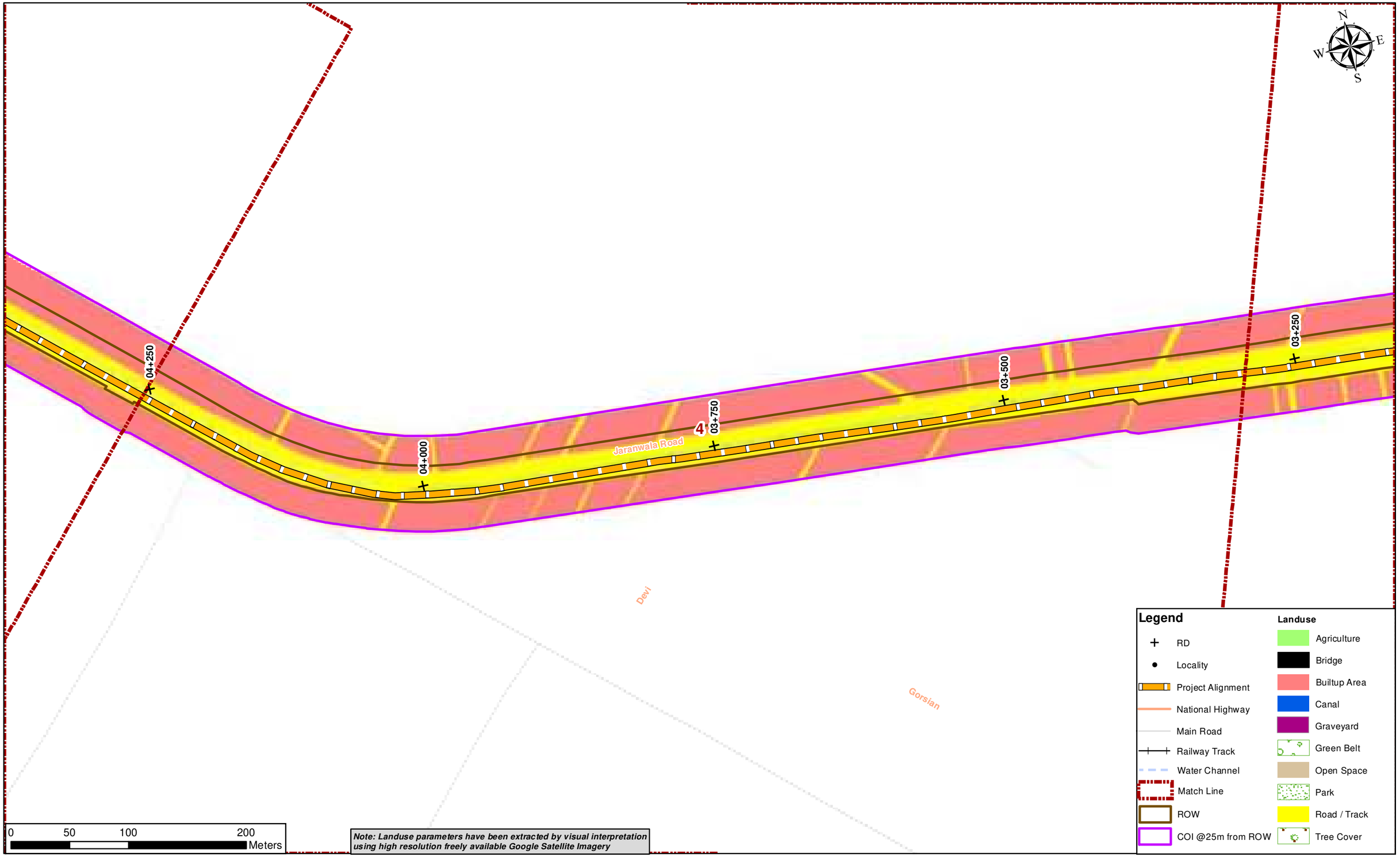
LANDUSE MAP

SCALE: 1:3,000

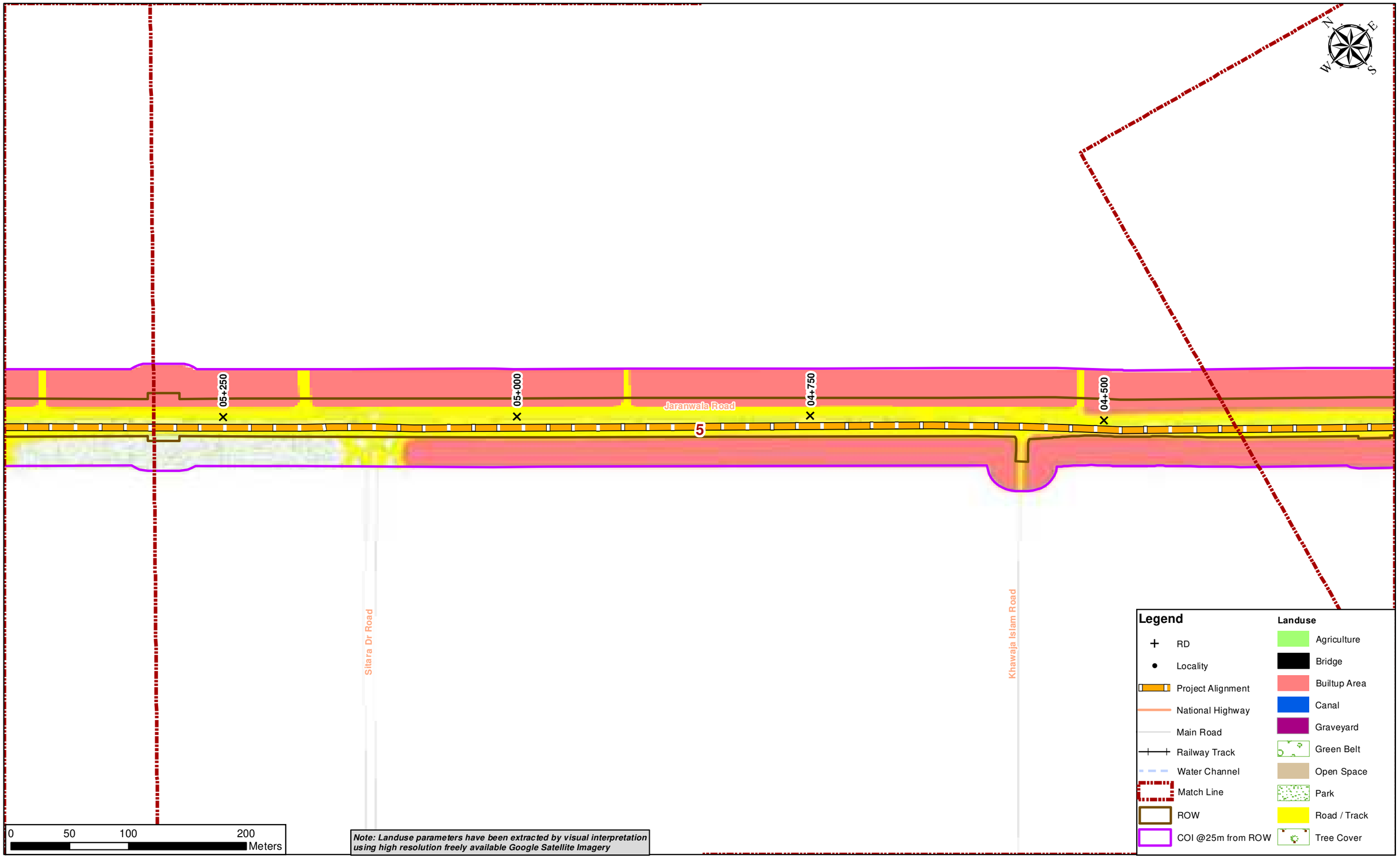
DATE: JAN-2026

FIG.: Sheet 3 of 19

REV.: 0



CLIENT	CONSULTANT			PROJECT	
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04	DRAWN: M.MUNEEB	FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE	LANDUSE MAP
		03	SUBMITTED: SHEHNILLA		SCALE: 1:3,000
		02	RECOMMENDED:		DATE: JAN-2026
		01	CHD/VER.:		FIG.: Sheet 4 of 19
		REV. / DATE / DESCRIPTION / APPROVED	APPROVED: GHAZANFAR		REV.: 0



CLIENT	CONSULTANT	04		DRAWN	M.MUNEEB
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	03		SUBMITTED	SHEHNILLA
		02		RECOMMENDED	
		01		CHD/VER.	
		REV.	DATE / DESCRIPTION / APPROVED	APPROVED	GHAZANFAR

PROJECT

FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD

ORANGE TRANSIT LINE

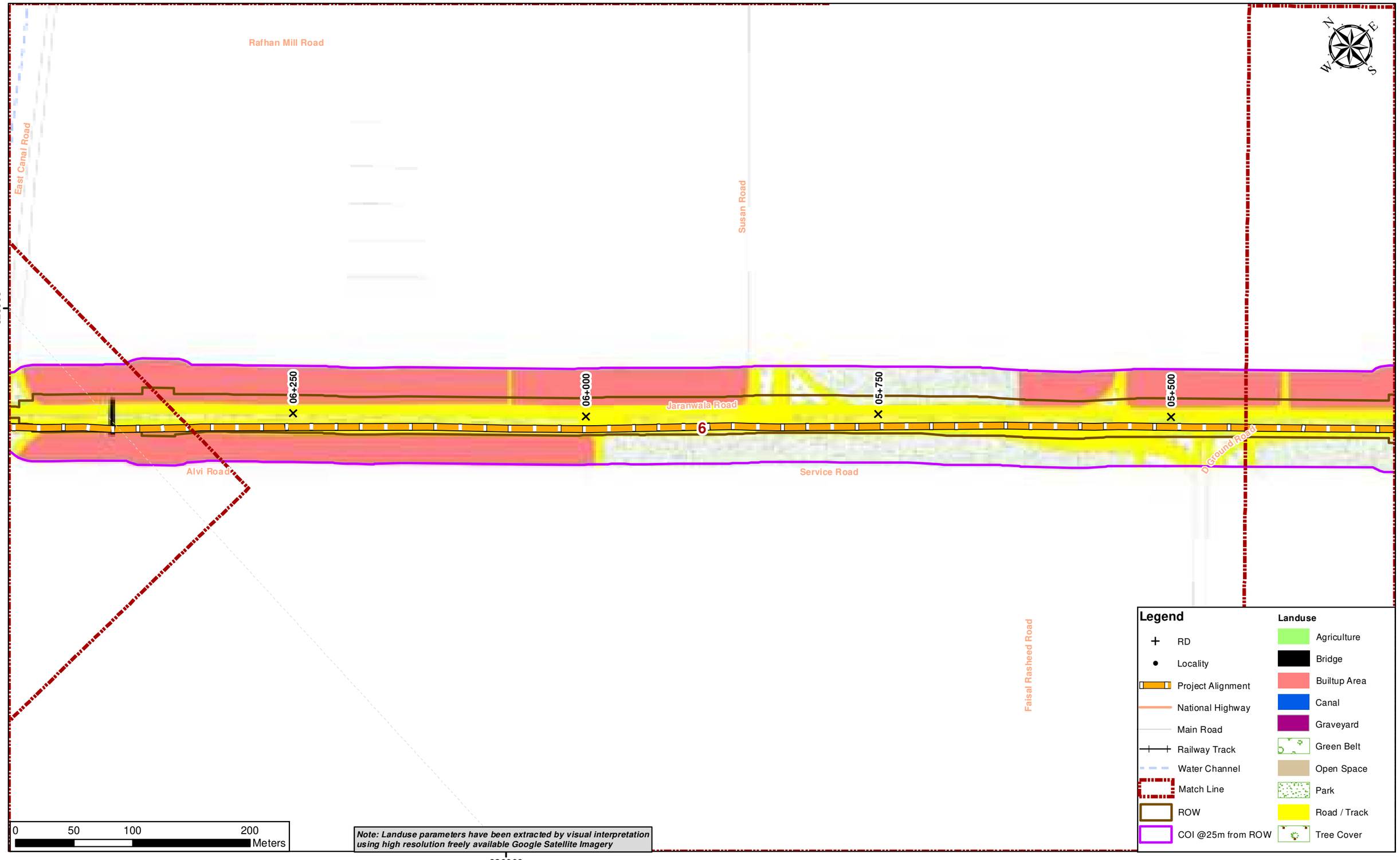
LANDUSE MAP

SCALE 1:3,000

DATE JAN-2026

FIG. Sheet 5 of 19

REV. 0



CLIENT	CONSULTANT			PROJECT	
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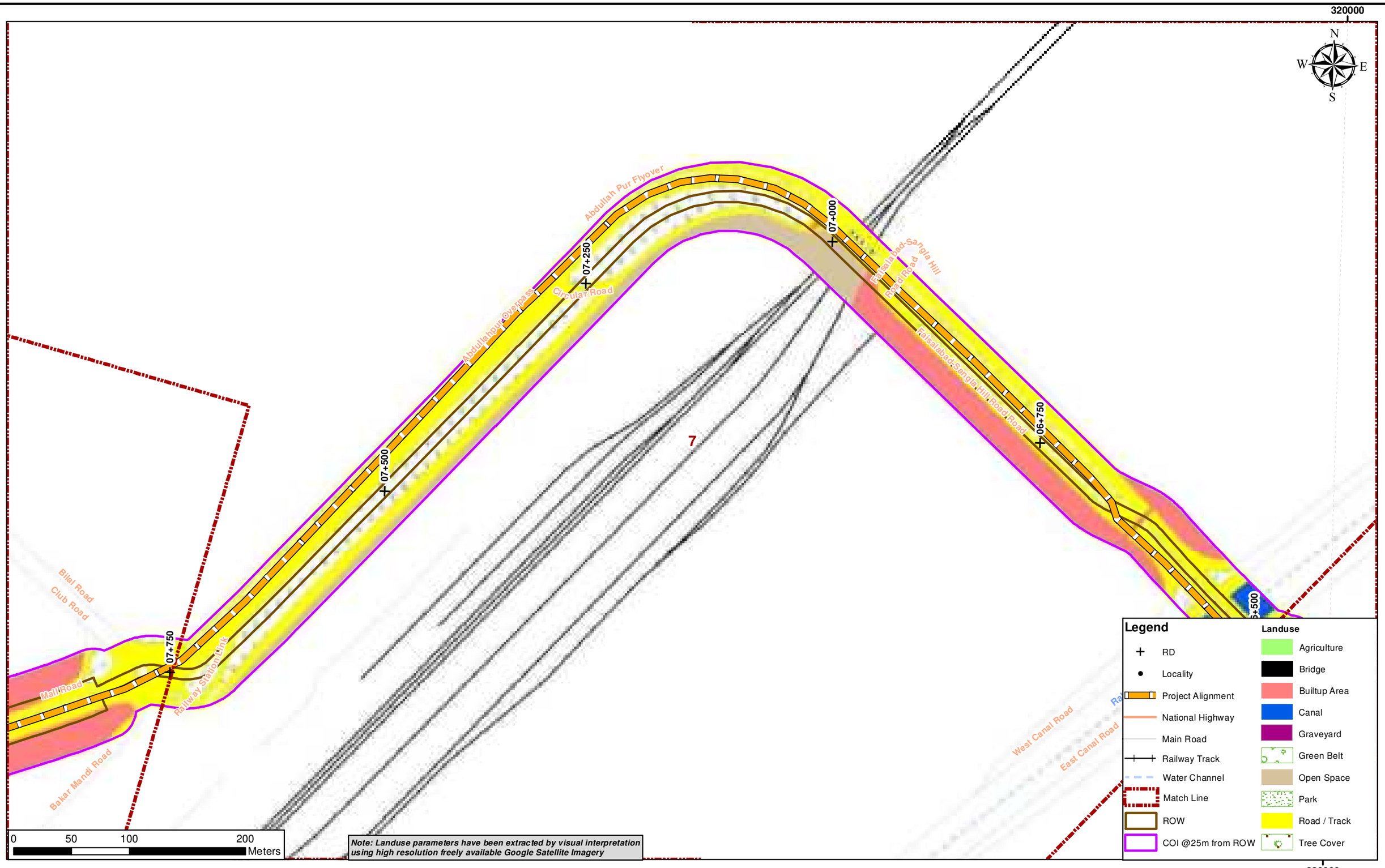
		03	SUBMITTED	SHEHNILLA	
		02	RECOMMENDED		
		01	CHD/VER.		
		REV. / DATE / DESCRIPTION / APPROVED	APPROVED	GHAZANFAR	

LANDUSE MAP		SCALE 1:3,000
DATE JAN-2026	FIG. Sheet 6 of 19	REV. 0



CLIENT	CONSULTANT	04				DRAWN	M.MUNEEB	PROJECT
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD	03				SUBMITTED	SHEHNILLA	FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE
	HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	02				RECOMMENDED		LANDUSE MAP
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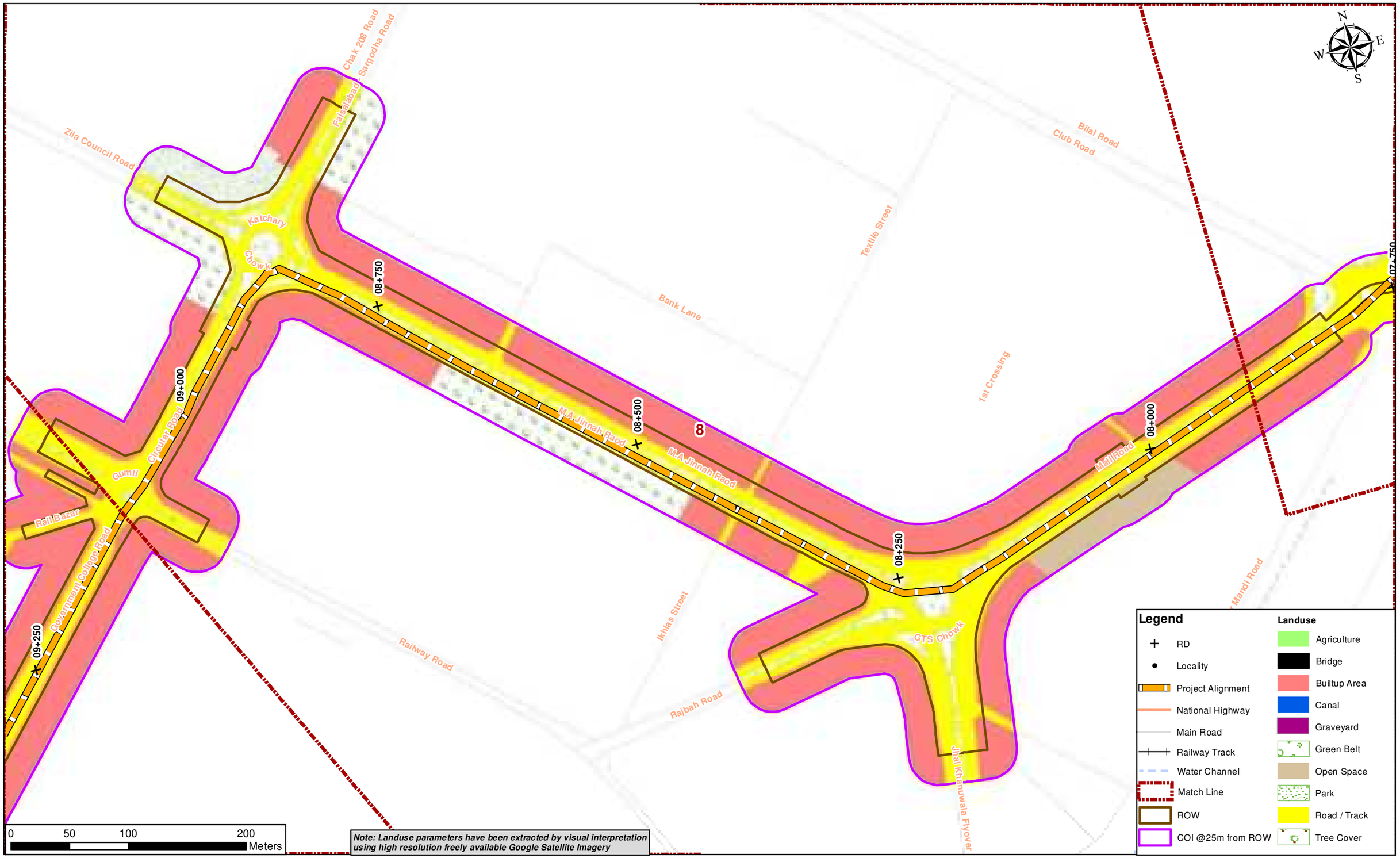

CLIENT	CONSULTANT	04				DRAWN	M.MUNEEB	PROJECT	LANDUSE MAP	SCALE
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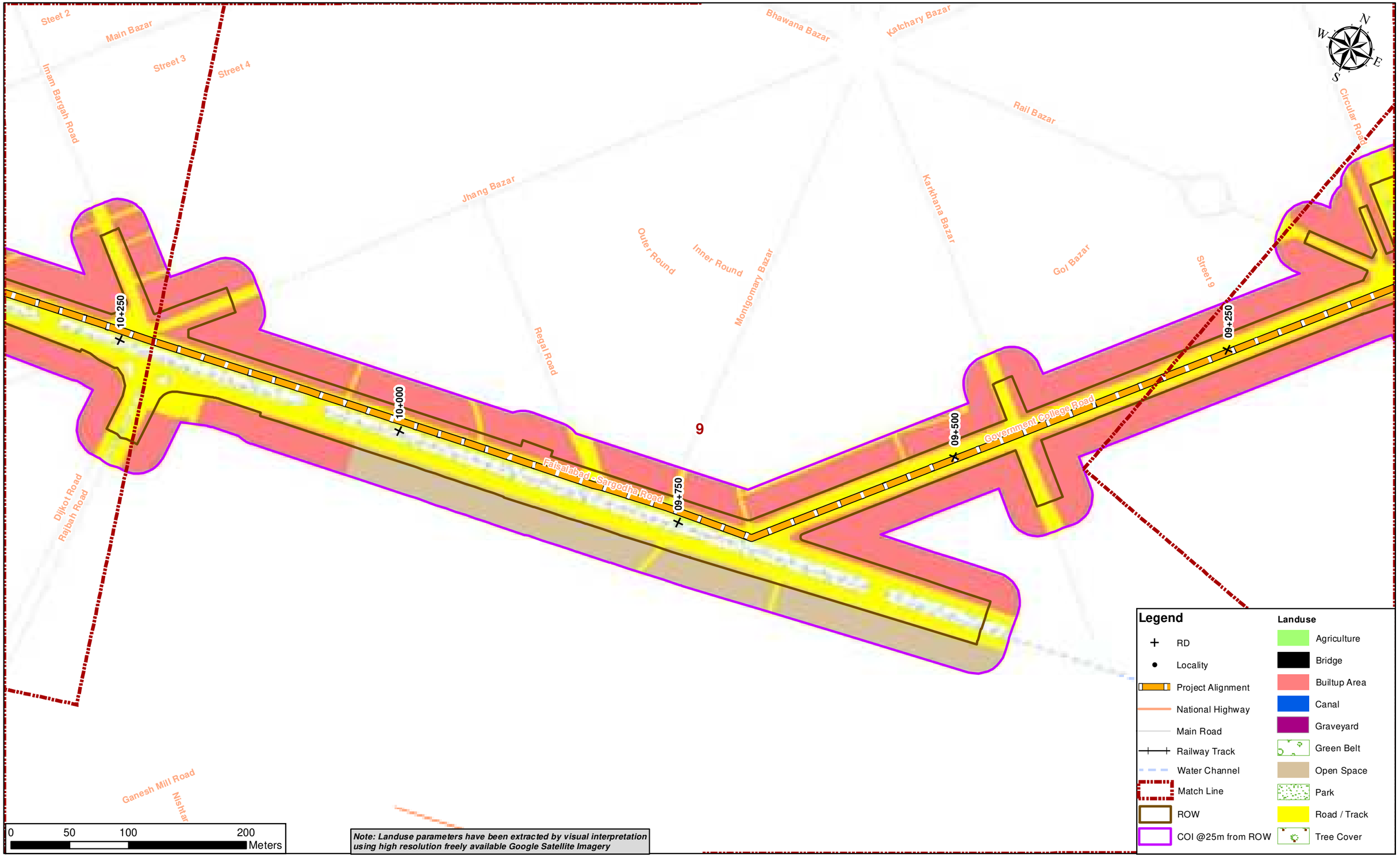
	HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	02				RECOMMENDED			DATE JAN-2026	FIG. Sheet 8 of 19
		01				CHD/VER.				REV. 0
		REV.	DATE	DESCRIPTION	APPROVED	APPROVED	GHAZANFAR			



CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04			DRAWN	M.MUNEEB
		03			SUBMITTED	SHEHNILLA
		02			RECOMMENDED	
		01			CHD/VER.	
		REV.	DATE	DESCRIPTION / APPROVED	APPROVED	GHAZANFAR

PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD
ORANGE TRANSIT LINE

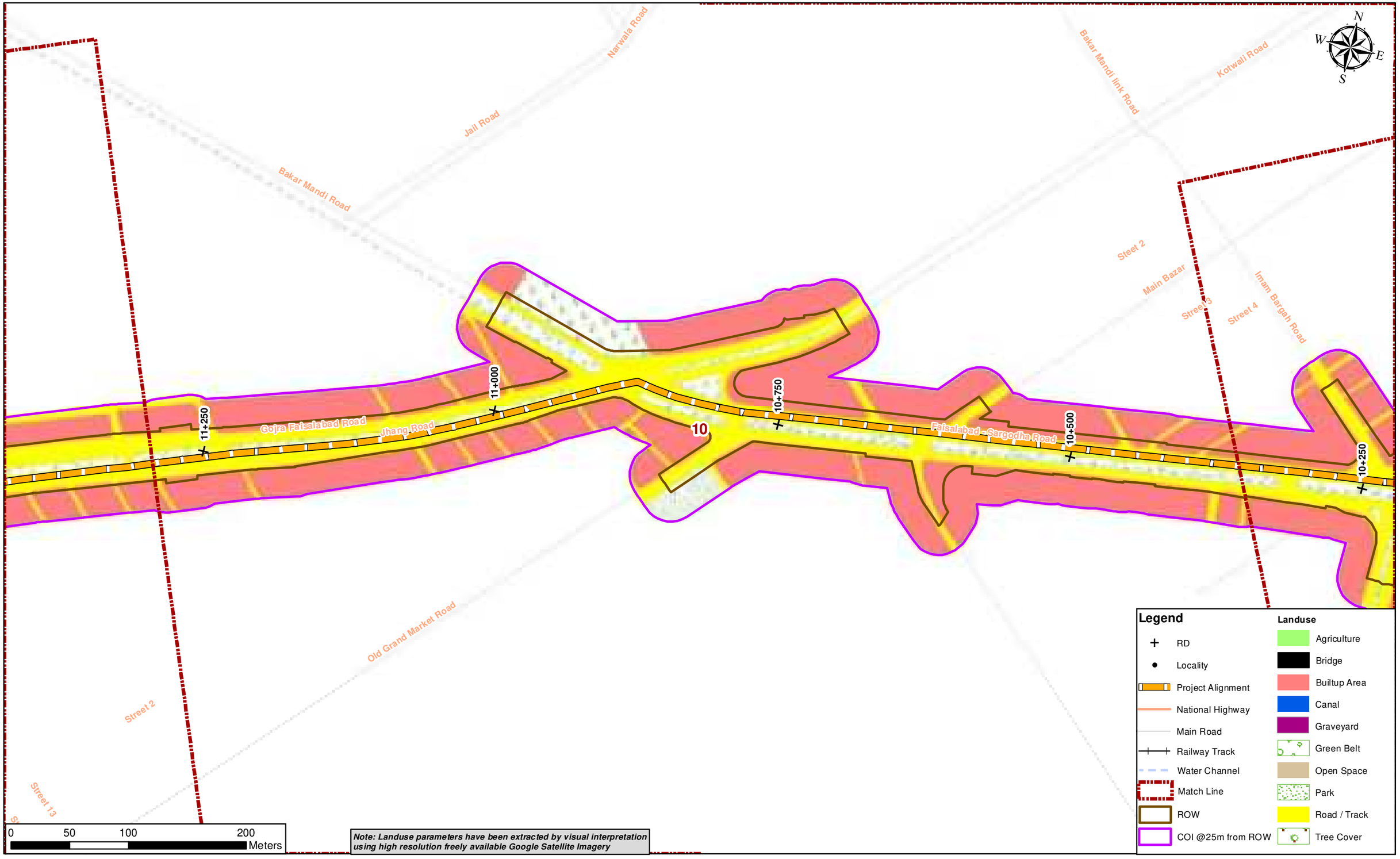
LANDUSE MAP

SCALE: 1:3,000

DATE: JAN-2026

FIG.: Sheet 9 of 19

REV.: 0



CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04			DRAWN	M.MUNEEB
		03			SUBMITTED	SHEHNILLA
		02			RECOMMENDED	
		01			CHD/VER.	
		REV.	DATE	DESCRIPTION / APPROVED	APPROVED	GHAZANFAR

PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD
ORANGE TRANSIT LINE

LANDUSE MAP

SCALE 1:3,000

DATE JAN-2026

FIG. Sheet 10 of 19

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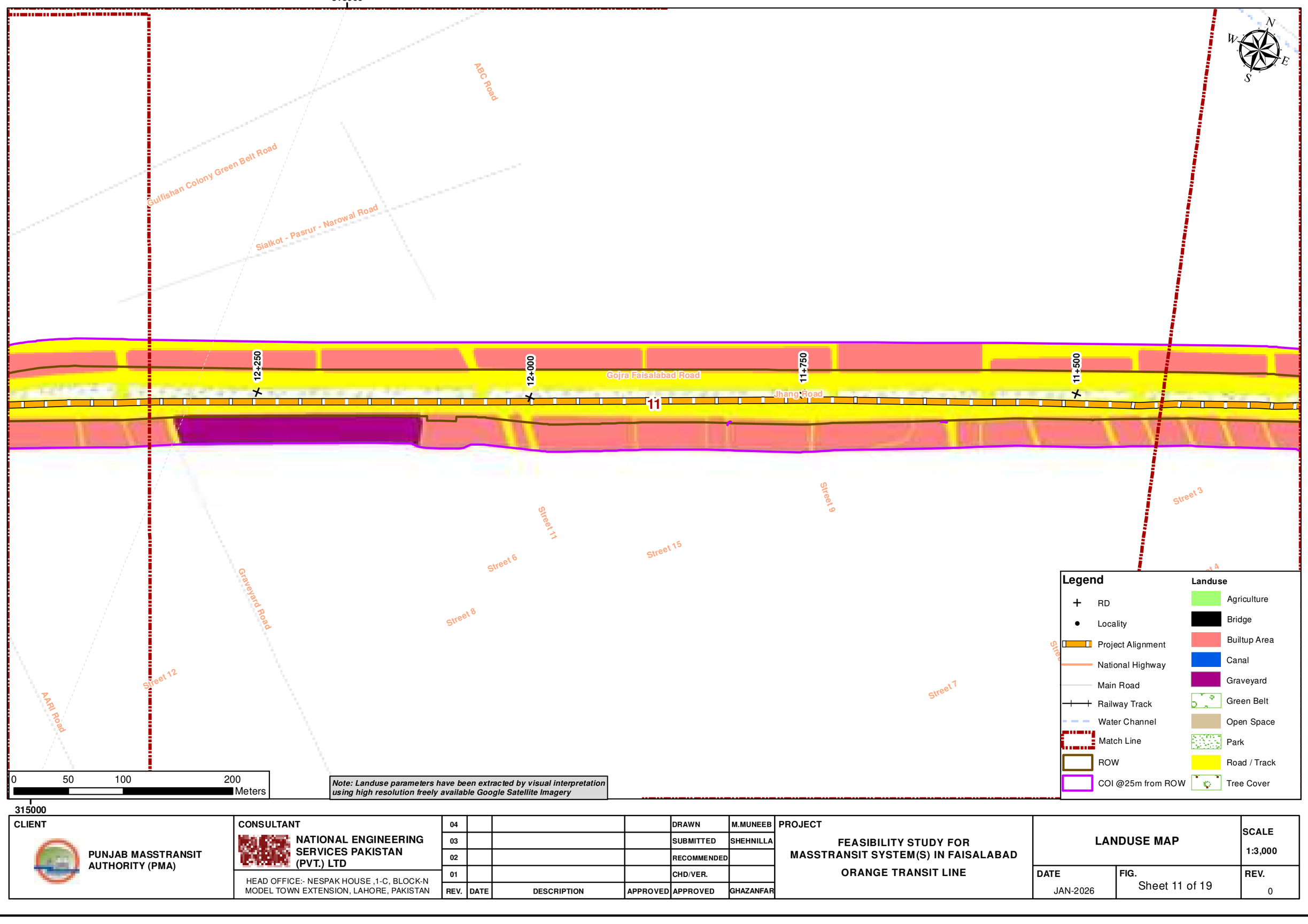
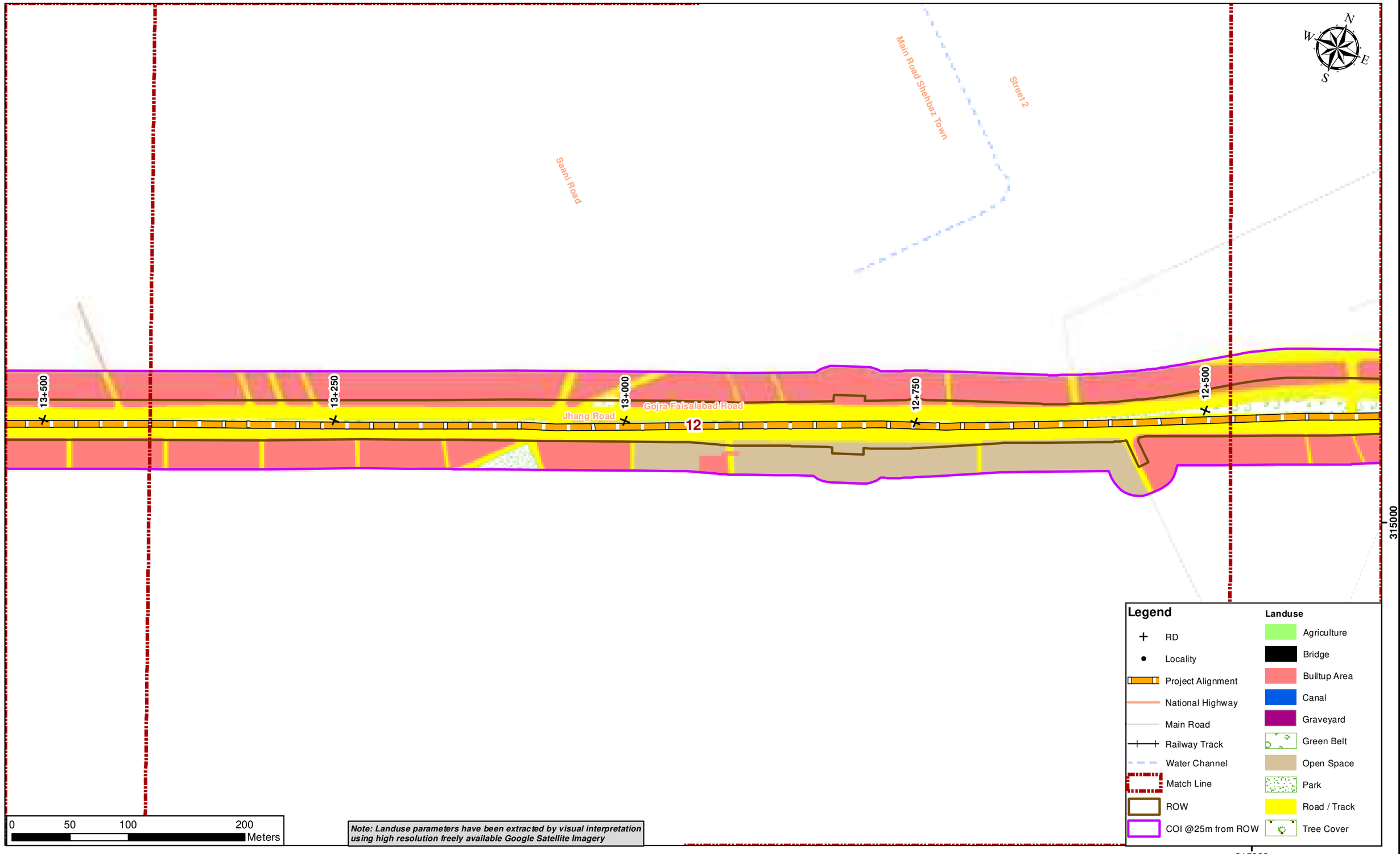


315000

CLIENT	CONSULTANT	04				DRAWN	M.MUNEEB	PROJECT
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD	03				SUBMITTED	SHEHNILLA	FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD
		02				RECOMMENDED		ORANGE TRANSIT LINE
	HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	01				CHD/VER.		LANDUSE MAP
		REV.	DATE	DESCRIPTION	APPROVED	APPROVED	GHAZANFAR	DATE: JAN-2026 / FIG.: Sheet 11 of 19 / SCALE: 1:3,000 / REV.: 0



Note: Landuse parameters have been extracted by visual interpretation using high resolution freely available Google Satellite Imagery

CLIENT	**CONSULTANT**	04		DRAWN	M.MUNEEB
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD	03		SUBMITTED	SHEHNILLA
	HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	02		RECOMMENDED	
		01		CHD/VER.	
		REV.	DATE / DESCRIPTION / APPROVED	APPROVED	GHAZANFAR

PROJECT

FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD

ORANGE TRANSIT LINE

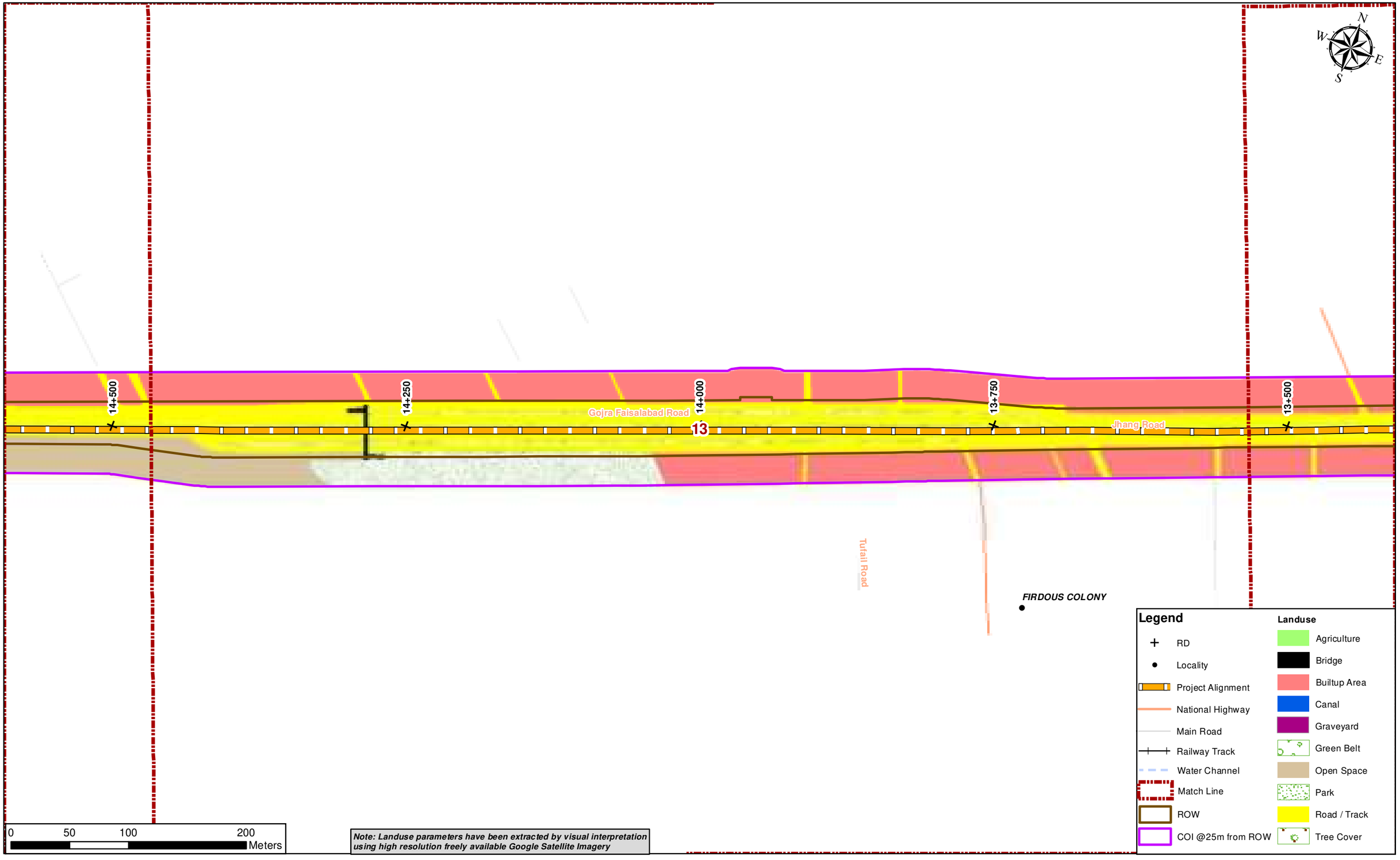
LANDUSE MAP

SCALE 1:3,000

DATE JAN-2026

FIG. Sheet 12 of 19

REV. 0



Note: Landuse parameters have been extracted by visual interpretation using high resolution freely available Google Satellite Imagery

CLIENT

PUNJAB MASSTRANSIT AUTHORITY (PMA)

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD

HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	M.MUNEEB
SUBMITTED	SHEHNILLA
RECOMMENDED	
CHD/VER.	
APPROVED	GHAZANFAR

PROJECT

FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD

ORANGE TRANSIT LINE

LANDUSE MAP

SCALE 1:3,000

DATE JAN-2026

FIG. Sheet 13 of 19

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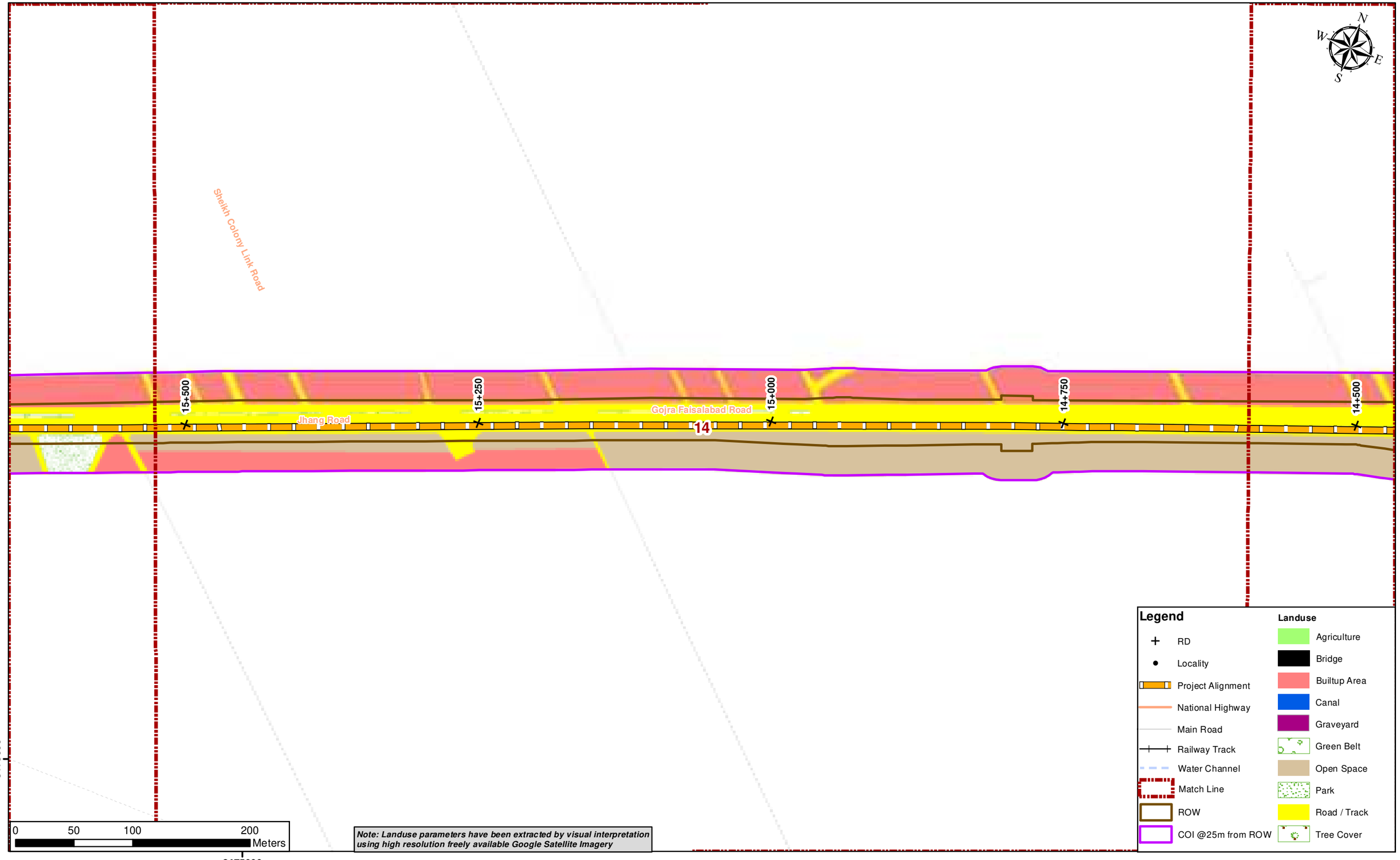

CLIENT

PUNJAB MASSTRANSIT AUTHORITY (PMA)

CONSULTANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD

HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN

REV.	DATE	DESCRIPTION	APPROVED
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DRAWN	M.MUNEEB
SUBMITTED	SHEHNILLA
RECOMMENDED	
CHD/VER.	
APPROVED	GHAZANFAR

PROJECT

FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD

ORANGE TRANSIT LINE

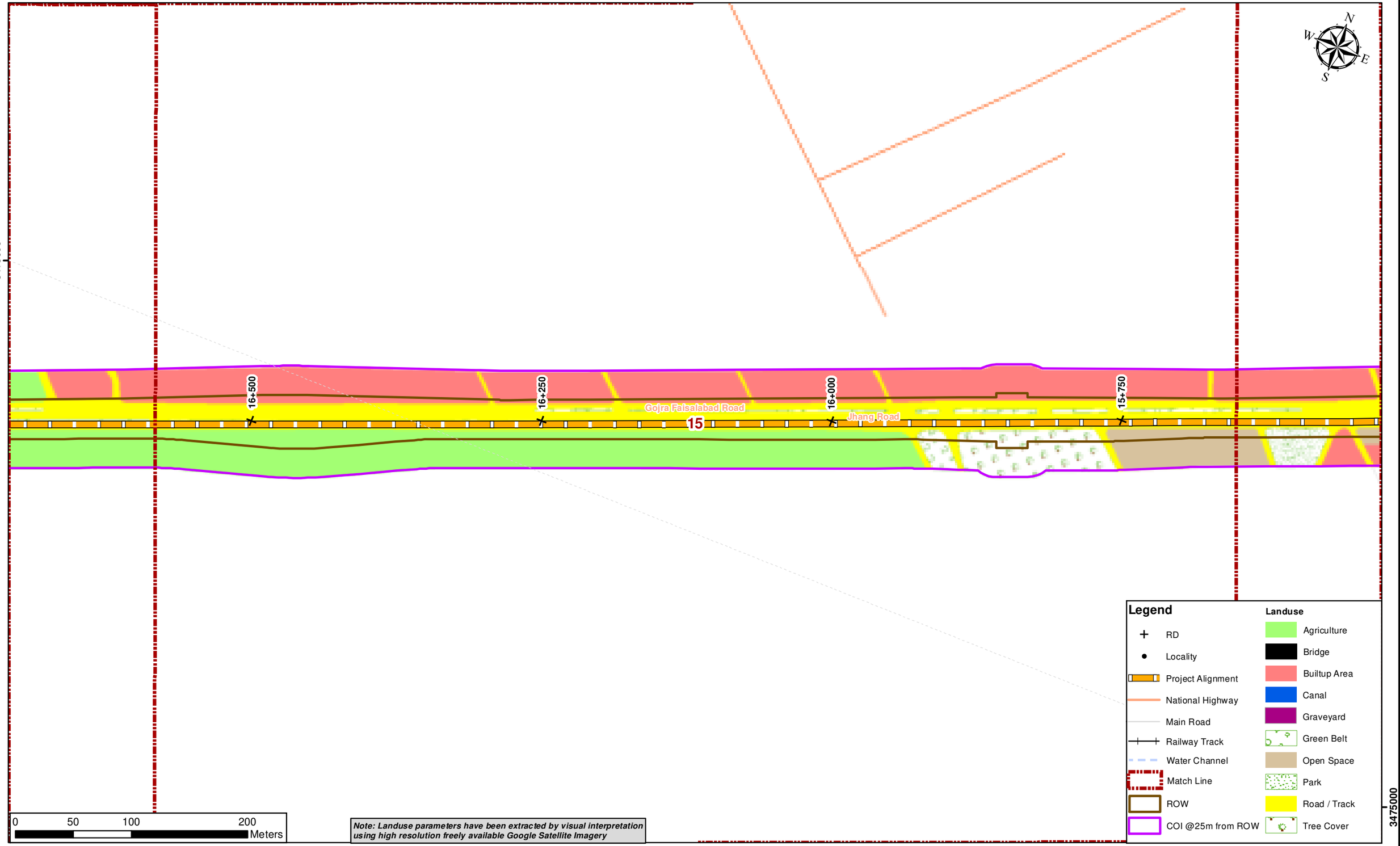
LANDUSE MAP

SCALE 1:3,000

DATE JAN-2026

FIG. Sheet 14 of 19

REV. 0



CLIENT	CONSULTANT			PROJECT	
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04	DRAWN: M.MUNEEB	FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE	LANDUSE MAP
		03	SUBMITTED: SHEHNILLA		SCALE: 1:3,000
		02	RECOMMENDED:		DATE: JAN-2026
		01	CHD/VER.:		FIG.: Sheet 15 of 19
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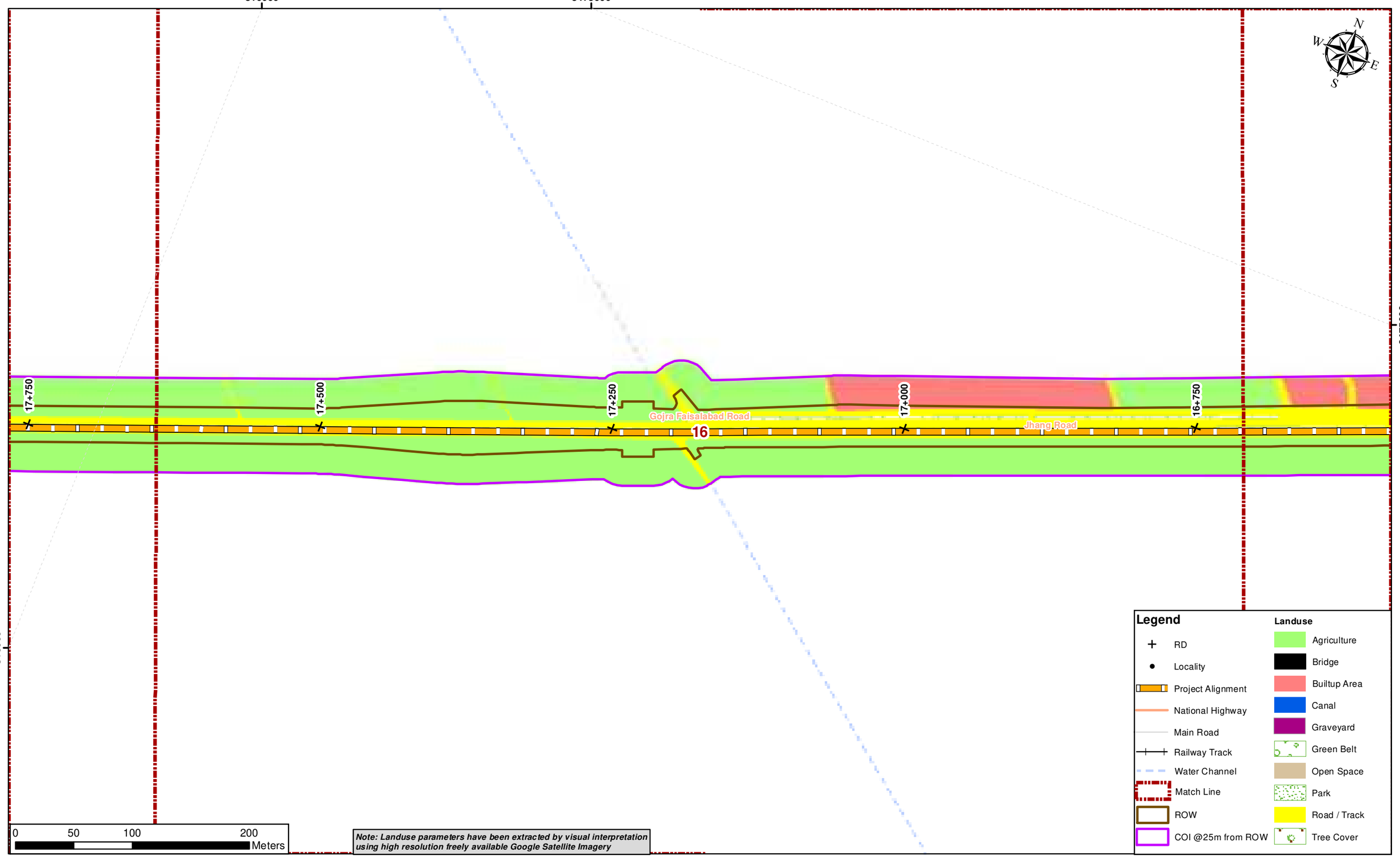

CLIENT	CONSULTANT			PROJECT	
PUNJAB MASSTRANSIT AUTHORITY (PMA)	NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN			FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE	LANDUSE MAP

REV.	DATE	DESCRIPTION	APPROVED		
04				DRAWN	M.MUNEEB
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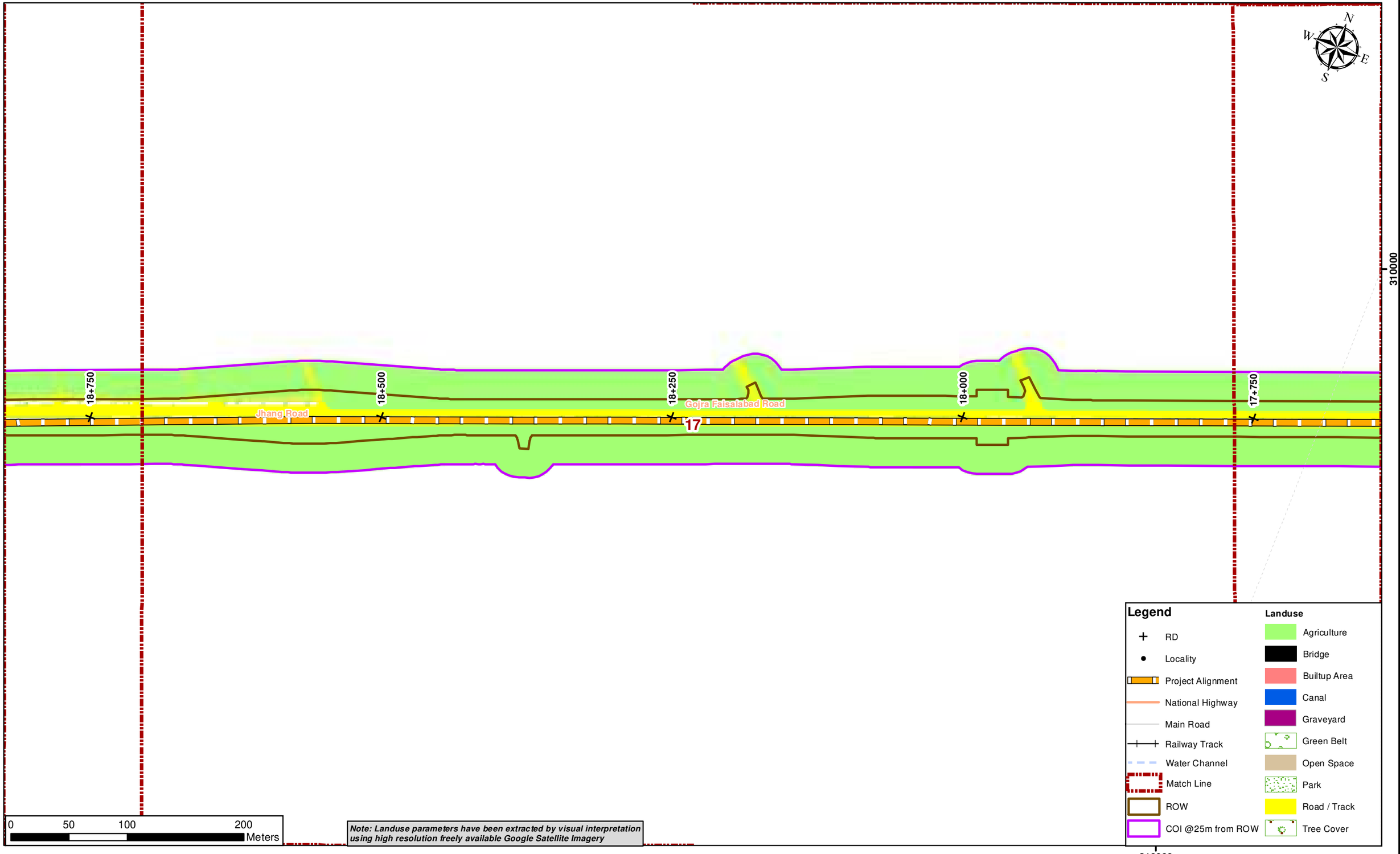

CLIENT	**CONSULTANT**	04			DRAWN	M.MUNEEB
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		02			RECOMMENDED	
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		REV.	DATE	DESCRIPTION	APPROVED	APPROVED GHAZANFAR

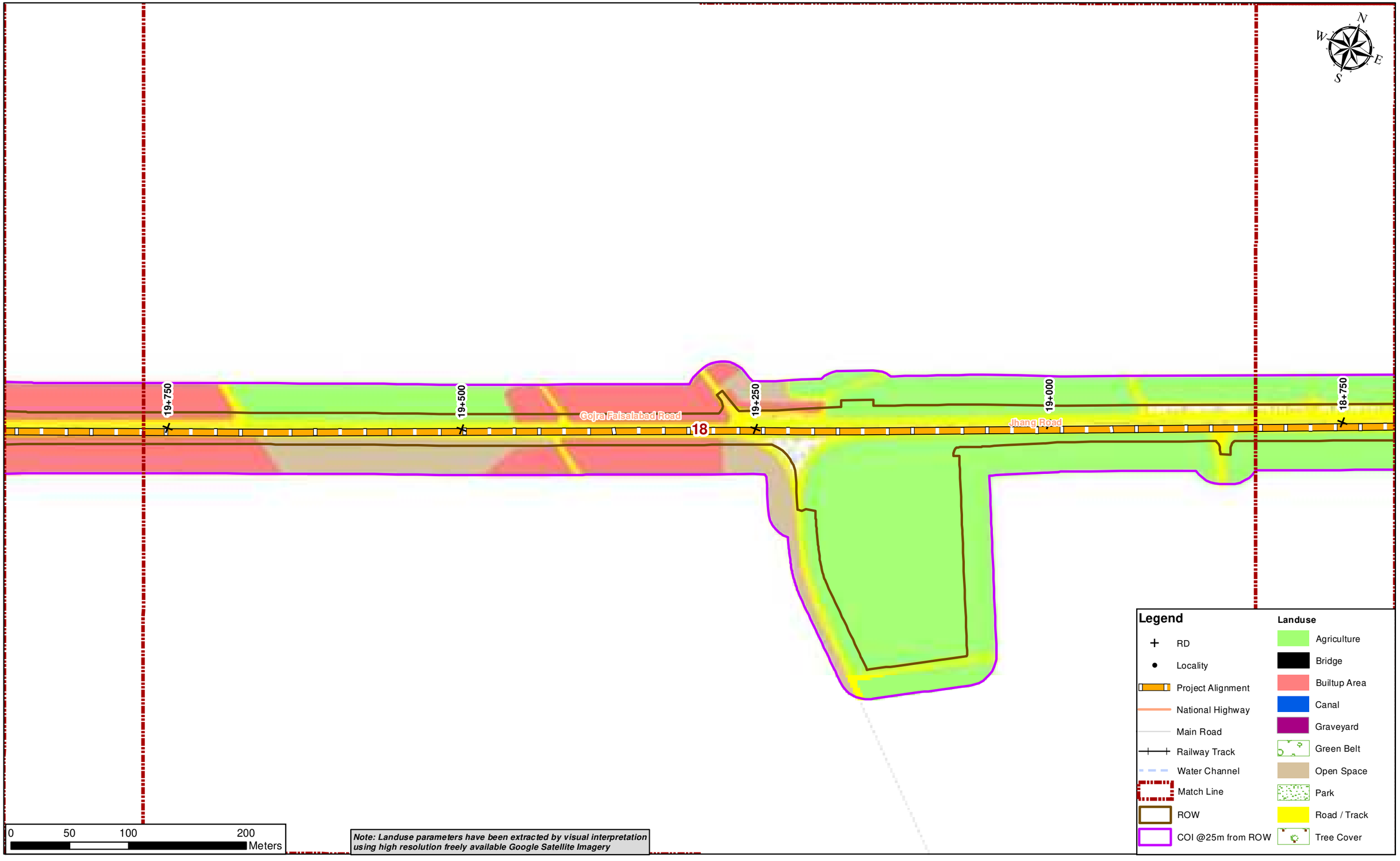
PROJECT

FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD

ORANGE TRANSIT LINE

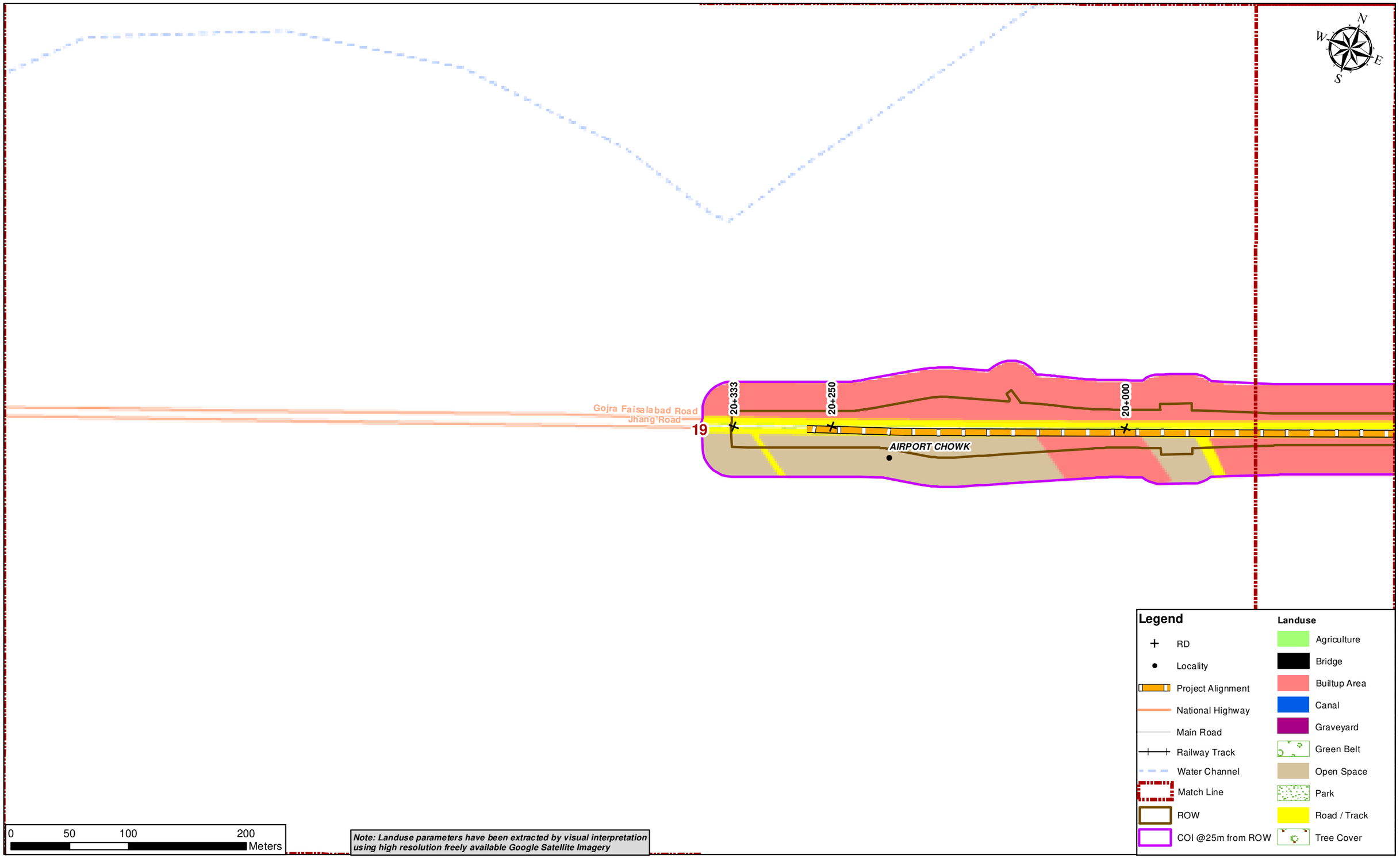
LANDUSE MAP

SCALE	DATE	FIG.	REV.
1:3,000	JAN-2026	Sheet 17 of 19	0



CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04				DRAWN	M.MUNEEB	PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD ORANGE TRANSIT LINE
		03				SUBMITTED	SHEHNILLA	
		02				RECOMMENDED		
		01				CHD/VER.		
		REV.	DATE	DESCRIPTION	APPROVED	APPROVED	GHAZANFAR	

LANDUSE MAP		SCALE: 1:3,000
DATE: JAN-2026	FIG.: Sheet 18 of 19	REV.: 0



CLIENT: PUNJAB MASSTRANSIT AUTHORITY (PMA)	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD HEAD OFFICE:- NESPAK HOUSE ,1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04			DRAWN	M.MUNEEB
		03			SUBMITTED	SHEHNILLA
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PROJECT: FEASIBILITY STUDY FOR MASSTRANSIT SYSTEM(S) IN FAISALABAD
ORANGE TRANSIT LINE

LANDUSE MAP

SCALE: 1:3,000

DATE: JAN-2026

FIG.: Sheet 19 of 19

REV.: 0

ANNEX-IV
SANITATION PLAN

SANITATION PLAN

1. INTRODUCTION

This plan outlines the measures that can improve conditions of sanitation at construction sites during construction and operation phases.

2. PURPOSE OF THE PLAN

The plan intends to ensure sanitation including the control of water supplies, excrete and wastewater disposal, refuse disposal, vectors of diseases, housing conditions, food supplies and handling, atmospheric conditions and the safety of the working environment.

3. MANAGEMENT OF SANITATION DURING CONSTRUCTION PHASE

i) Responsibility

The Health and Safety Inspector designated by construction contractor shall also inspect sanitation conditions and ensure safe working environment for workers.

ii) Location of Camp Sites

- The accommodation and ancillary facilities for labor shall be constructed and maintained to standards and scales approved by the Resident Engineer.
- The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.
- All sites must be managed to avoid ditches and depressions to minimize nuisance due to stagnant water.

iii) Water Supply

An adequate and convenient water supply, approved by the appropriate health authority, will be provided in each camp for drinking, cooking, bathing and laundry purposes.

Potable water supply systems for labor camps occupants shall meet the drinking water quality standards of PEQS, 2016. In addition, the design of water system facilities shall be based on the suppliers Engineer's estimates of water demands. The drinking water must be monitored regularly for drinking water quality parameters.

At all construction camps and other workplaces, good and sufficient water supply shall be provided and maintained to eliminate chances of waterborne diseases to ensure the health and hygiene of the workers.

iv) Toilet Facilities and Hygiene

According to health and safety guidelines OR-OSHA number of toilets required at construction site is as one (01) toilet for 20 workers. **Table 1** shows the number of toilets required in

accordance with the number of employees at construction site. The total numbers of employees at construction site are estimated to be 150 persons.

Table 1: Number of Toilets Required for Employees at Construction Site

No. of Employees	No. of Toilets and Urinals by OSHA	Total No. Toilets and Urinals Required at Construction Site
Up to 20 Employees	1 Toilet	10 Toilets
Up to 40 Employees	1 Urinal	5 Urinals

Within the premises of every workplace, toilets and urinals shall be provided in an accessible place, and the accommodation, separately for each of these, as per standards prevailing in the province and country.

Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located, so as to be accessible.

A toilet room must be located within 200 feet of the camp. No toilet may be closer than 100 feet to kitchen and sleeping area.

These toilets must be distinctly marked by signs printed in native language of the persons occupying the camp, or marked with easily understood pictures or symbols.

Urinals troughs in privies must drain freely into the pit or vault, and the construction of this drain must be such as to exclude flies and rodents from the pit.

Proper facility for hand washing and other cleaning activities to be provided as follows:

- Provide individual hand towels from a sanitary dispenser and receptacles for disposing of waste towels;
- Providing hand soap and industrial hand cleaner for removing paints and other contaminants;
- Prohibited use of gasoline or solvent for hand washing; and
- Keep the floor of facilities dry to prevent spills and falls.

v) Waste Disposal

The sewage system for the camp must be designed, built and operated in compliance with the relevant legislation so that no health hazard occurs and no pollution to the air, ground or adjacent watercourse takes place.

Garbage bins must be provided in the camps and regularly emptied and the garbage disposed of in a hygienic manner.

Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta should be done in the already existing sewerage system in the area.

On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the engineer.

vi) Maintenance of Sanitary Facility

Proper maintenance of toilets and other sanitary facilities shall assure by health and safety inspector. Toilets and other sanitary facilities shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year.

All rooms, and equipment of building and the grounds surrounding them shall be maintained in a clean and operable condition, and be protected from rubbish accumulation.

All necessary means shall be employed to eliminate and control any infestations of insects and rodents within all parts of any labor camp.

4. MANAGEMENT OF SANITATION DURING OPERATIONAL PHASE:

A proper sanitation plan is to be adopted for maintaining the hygienic conditions during the operational phase of the Project. These includes

- Site Clearance;
- Sewage Pipe Clearing, and
- Solid Waste Management.

i) Site Clearance

The construction contractor shall ensure the clearance of construction machinery, vehicle and other equipment used during the construction period after the completion of the Project.

ii) Solid Waste Management

Municipal solid waste produced in and around the construction site will be collected and managed properly by the contractor. Waste bins will be placed in and around the construction site; regular cleaning of the construction site shall be carried out using mechanical sweepers and at least two (02) to four (04) sweepers will be deputed for the proposed Project to assure regular cleaning.

iii) Awareness and Training

A training and awareness sessions shall be conducted for workers before commencement of the Project. The implementation of sanitation plan would be more effective if the importance of hygiene; sanitation and safety are known to the workers.

ANNEX-V
EMERGENCY RESPONSE PLAN

GUIDELINE EMERGENCY PREPAREDNESS AND RESPONSE PLAN

1.1 PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

i. Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
ii. Ensure all personnel are aware of the importance of this procedure to protection of life and property.

1.2 EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

i. Construction Accident
ii. Road & Traffic Accident
iii. Hazardous material spills
iv. Structure collapse or failure
v. Trauma or serious illness
vi. Sabotage
vii. Fire
viii. Environmental Pollution
ix. Loss of person
x. Community Accident

1.3 RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table 1** below.

Table 1: Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	▪ Overall control of personnel and resources. ▪ The Emergency Coordinator will support and advise the Site Safety Supervision as necessary. ▪ Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
Site Safety Supervision (Emergency Commander)	▪ Overall responsibility for activating emergency plan and for terminating emergency actions. ▪ Be alternative of emergency response chairpersons. ▪ Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. ▪ Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. ▪ Notify outside authorities if assistance is required. ▪ Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation.

Action Group	Responsibility
	▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
Security Team	▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
Rescue & Medical Team	▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus. ▪ Assist outside medical services personnel when they arrive
General Administration Team	Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community.
Environment Team	In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas.

Action Group	Responsibility
Other Staff and Employees	▪ All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. ▪ Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

1.4 PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure 3.1 Emergency Procedures for Fire

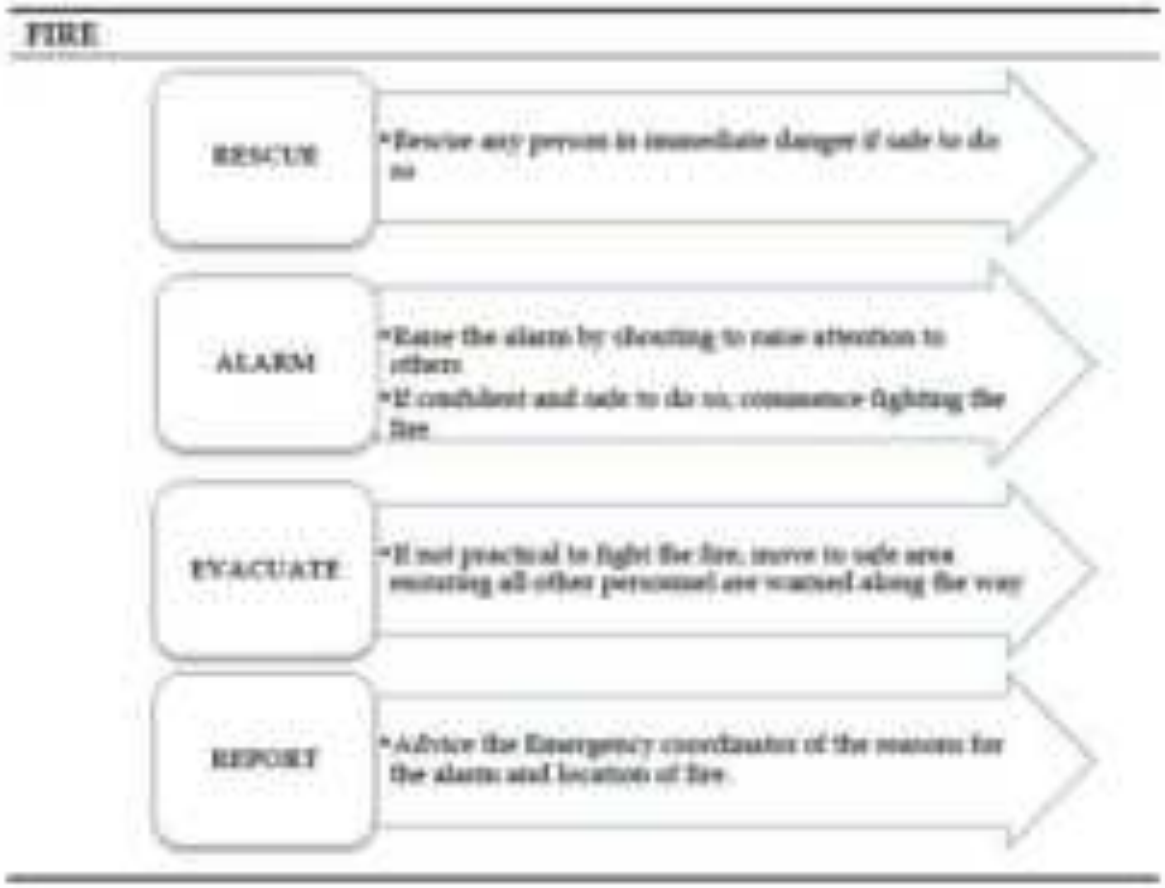
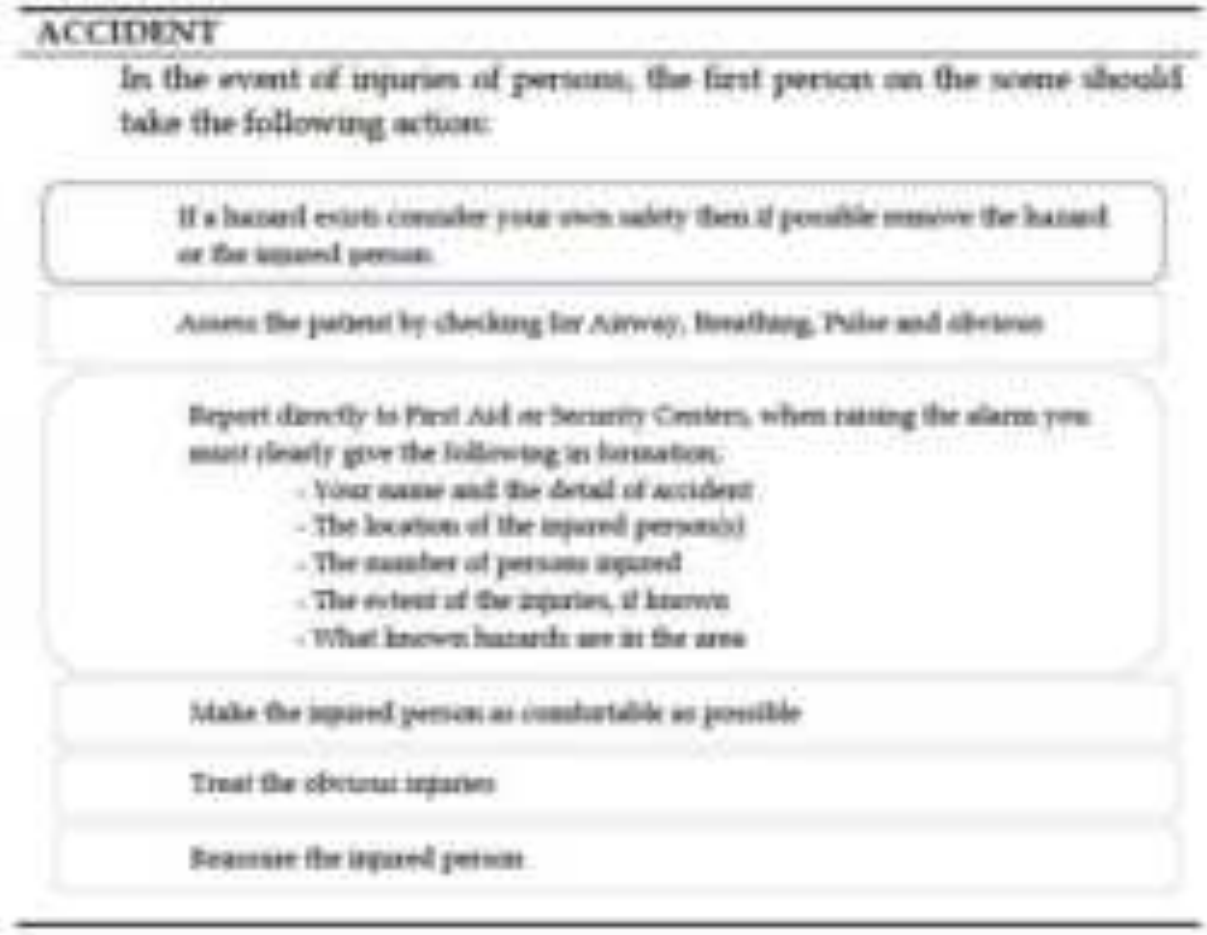


Figure 3.2 Emergency Procedures for Serious Accident



3.5 COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoiding politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

1.5 FIRST AID PERSONS

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,

- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.
- Assist medical services personnel when they arrive.

1.6 GENERAL ADMINISTRATION TEAM

Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

1.7 SECURITY TEAM

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

1.8 EMERGENCY COORDINATOR

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.

1.9 INCIDENT AND ACCIDENT REPORT

Details of the actual job being done at the time:

Details of Accident / Incident / What actually happened?

Section B: Accident Cause (Basic cause mark X / Contributing cause if any mark O)

UNSAFE CONDITION		UNSAFE ACTS	
1	Inadequately Guarded	1	Operating Without Authority / Training
2	Unguarded	2	Operating at Unsafe Speed
3	Defective Tools, Equipment, or Substance	3	Making SHE Device Inoperative
4	Unsafe Design or Construction	4	Using Unsafe Equipment or Equipment Unsafely
5	Hazardous Arrangement	5	Unsafe Loading, Placing, Mixing
6	Unsafe Illumination	6	Taking Unsafe Position
7	Unsafe Ventilation	7	Working on Moving or Dangerous Equipment
8	Unsafe Clothing	8	Distraction, Teasing, Horse Play
9	Insufficient Instruction	9	Failure to use Personal Protective Devices
10	Lack of system of work	10	Lack of effective instruction or supervision

Why was the unsafe act committed? _____ Why did the unsafe condition exist? _____

Section C: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to:
Stop the Behaviour	Remove	Site Engineer, or
Study the job	Guard	Site Manager, or
Instruct (tell, show, try, check)	Warn	Project Manager, or
Follow Up	Supervisory Training	Safety Committee
Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

1.10 SUGGESTED CONTENTS OF EPRP

The Contractor should prepare the EPRP based on the guidelines provided in the above sections. The suggested structure of the EPRP is listed below:

1. Purpose
2. Applicable Scope
3. Preparation Basis
4. Emergency Response System
   - 4.1 Generals
   - 4.2 Emergency Response System
   - 4.3 Responsibilities
5. Major Safety Risks
6. Precautionary Measures
   - 6.1 Training and Exercise
   - 6.2 Hazard Source Monitor
   - 6.3 Alert Action
   - 6.4 Management Measures
7. Control Measures
   - 7.1 Response
   - 7.2 Response Procedures
   - 7.3 Emergency Response
   - 7.4 Emergency Completion and Restoration

8 Emergency Response Report and Settlement

9 Supporting Measures
   - 9.1 Communication
   - 9.2 Emergency Team
   - 9.3 Funding for Emergency
   - 9.4 Provisions and Resources

10. Records

ANNEX-VI
GUIDELINE QUARRY MANAGEMENT PLAN

Quarry Management Plan

1.0 Introduction

After the completion of construction phase of the proposed project, it is the responsibility of the contractor to restore the site that has been disturbed due to construction activities.

2.0 General Quarry Planning and Progressive Rehabilitation

A well-considered quarry development plan prior to starting work, or when opening up new areas will greatly reduce the effort required to achieve appropriate leading practice environmental and safety outcomes for quarry rehabilitation and closure.

The selection of a site, sequencing of quarrying and rehabilitation and final land-use should all be carefully planned prior to commencement of work at a quarry or borrow pit.

2.1 Progressive Rehabilitation

Progressive rehabilitation refers to the rehabilitation of completed parts of a quarry while extractive operations continue in other parts of the quarry. As new quarry sections are opened, worked out areas should be progressively rehabilitated to avoid increasing the total disturbed area of a quarry. Overburden and topsoil can be stripped from areas being opened up and placed directly onto worked out areas which are being rehabilitated. This will avoid double handling of materials and prevent degradation of the topsoil.

Progressive rehabilitation helps to minimize the visual impact of a quarry, control dust and erosion. It also assists in fostering good landowner and community relations.

Recommended progressive rehabilitation practices are:

- Agree on the final land form and use of a site with the relevant landowner.
- Rehabilitate in accordance with the intended final use of the land.
- Plan and develop the quarry in stages towards terminal areas so that progressive rehabilitation works can commence as soon as possible).
- Once the final landform is established, re-vegetate areas to stabilize the landform and to give the vegetation maximum time to establish while the quarry is still in operation.

2.2 Re-vegetation

Establishing a self-sustaining cover of vegetation is the best way to stabilize disturbed sites in the long term. Re-vegetation also minimizes the visual impact of quarries. Generally, the vegetation type which existed before the disturbance, or a similar vegetation type will regenerate most successfully.

Prior to the commencement of a quarrying activity the type of re-vegetation should be agreed with the landowner, and should be consistent with the proposed final land-use.

Some indigenous plant species may not thrive in areas where soil conditions are substantially different after quarrying. If this is the case, and the objective is to re-establish vegetation, which fulfils the function of the original native vegetation, then some species from outside the quarry area, may have to be introduced. Care must be taken to avoid introducing a species, which could become an unacceptable fire hazard, invade surrounding areas of native vegetation or become agricultural weeds.

Where agriculture is the planned land-use then the species planted should be those commonly used for pasture or crops known to be successful on soils of similar texture, drainage status, pH and fertility. Suitable legumes should always be considered for their ability to improve soil fertility.

3.0 Rehabilitation of Borrow Pits

Borrow pits are areas either in a road reserve or adjacent land holdings that have been used to extract materials such as gravels and soils. They can vary considerably in size, depending on the quantity of material taken and the borrow pits' reserve body of remaining material. The variable size, shape and nature of borrow pits preclude very specific recommendations; however the following general conditions apply:

- Before extraction commences, licenses and permits should be checked and limits of disturbance and/or clearing must be clearly marked out on the site before any ground disturbing activity takes place; and
- At the completion of extraction, the former borrow pit must be made stable and safe. This usually requires the sides of the pit to be reshaped with gentle safe grades. All disturbed areas associated with borrow pits must be retopsoiled, seeded, fertilized and mulched (if appropriate) as part of the restoration plan. Main Roads has been discouraging the conversion of borrow pits to stock watering points.

ANNEX-VII
WASTE MANAGEMENT PLAN

CONSTRUCTION WASTE MANAGEMENT PLAN

1. GENERAL INTRODUCTION

Construction work refers to a wide range of materials depending on their origin; they are categorized as excavation material, demolition materials and worksite waste material. Construction waste material of the proposed project consists mainly of concrete, bentonite, masonry, limestone, sandstone, metal, and wood. In addition to this, significant amount of municipal waste will also generates from the construction camps.

2. ORIGINS AND CAUSES OF CONSTRUCTION WASTE

Origins of Waste	Causes of Waste
Contractual	▪ Errors in contract documents; and ▪ Contract documents incomplete at commencement of construction.
Design	▪ Design changes; ▪ Design and detailing complexity; ▪ Design and construction detail errors; ▪ Unclear and unsuitable specifications; and ▪ Poor coordination and communication (late information, last minute client requirements, slow drawing revision and distribution).
Procurement	▪ Ordering errors (i.e. ordering items not in compliance with specification); ▪ Over allowances (i.e. difficulties to order small quantities); and ▪ Supplier errors.
Transportation	▪ Damage during transportation; ▪ Difficulties for delivery vehicles accessing construction sites; ▪ Insufficient protection during unloading; and ▪ Inefficient methods of unloading
On-Site Management and Planning	▪ Lack of on-site waste management plans; ▪ Improper planning for required quantities; ▪ Delays in passing information on types and sizes of materials and components to be used; ▪ Lack of on-site material control; and ▪ Lack of supervision.
Material Storage	▪ Inappropriate site storage space leading to damage or deterioration; ▪ Improper storing methods; and ▪ Materials stored far away from point of application.
Material Handling	▪ Materials supplied in loose form; ▪ On-site transportation methods from storage to the point of application; and ▪ Inadequate material handling.
Site Operation	▪ Accidents due to negligence; ▪ Unused materials and products; ▪ Equipment malfunction;

Origins of Waste	Causes of Waste
	▪ Poor craftsmanship; ▪ Use of wrong materials resulting in their disposal; ▪ Time pressure; and ▪ Poor work ethics.
Residual	▪ Waste from application processes (i.e. over preparation of mortar); ▪ Off-cuts from cutting materials to length; ▪ Waste from cutting uneconomical shapes; and ▪ Packaging.
Other	▪ Weather ▪ Vandalism ▪ Theft

3. CONSTRUCTION WASTE MANAGEMENT PLAN

i) Waste Management Goals

The contractor established goal that this project will generate at least 50 percent less waste into landfills and the processes shall be employed to ensure that this goal is met. These shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection, minimizing poor quantity estimation, and through design.

ii) Responsibility

a) The Contractor shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor and the onsite posting of this plan.

b) The site supervisor shall be responsible for the implementation of the onsite portions of this program including the training of subcontractor personnel.

iii) Waste Prevention Planning

a) In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable city waste disposal requirements.

b) Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where practical and possible. Waste disposal in landfills shall be minimized as much as possible.

c) Project Construction Documents: The Contractor will contractually require all subcontractors to comply with the Construction Waste Management Plan (WMP)". A copy of the WMP will accompany all subcontractor agreements and require subcontractor participation.

d) The "Construction Waste Management Plan" shall be implemented and executed as follows and as on the chart:

   i) Salvageable materials will be diverted from disposal where feasible;
   ii) There will be a designated area on the construction site reserved for materials that can be recycled;
   iii) Areas shall be marked to designate what recycle materials are to be stored there; and
   iv) Hazardous waste shall be managed by a licensed hazardous waste vendor.

iv) Communication and Education Plan

a) This Waste Management Plan will be posted onsite;
b) Each subcontractor will be made aware of the intent of this project with respect to reduction of waste and recycling. Onsite recycling containers and/or areas will be plainly marked;
c) The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan;
d) All recycling containers and areas will be clearly marked;
e) Lists of acceptable and unacceptable materials will be posted at the site; and
f) All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

v) Motivation Plan

The Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the job site.

vi) Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on the proposed project, their expected disposal methods and handling procedures. New items may be added as needed.

Material	Disposal Method	Handling Procedure
Land Clearing Debris	Keep separate for reuse and or wood sale. Suitable materials may be delivered to a composting site. Separate topsoil and rock for future landscaping use.	Keep separated in designated areas onsite.
Clean Dimensional Wood and Palette Wood	Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Painted or Treated Wood	Reuse, off site recycle, and landfill.	Keep separated in designated areas onsite. Place in "Trash" container.
Concrete	Recycle when possible.	Keep separated in designated areas onsite.
Concrete Masonry Units	Keep separate for re-use by on-site construction or by site employees	Keep separated in designated areas onsite
Metals	Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in "Metals" container.
Gypsum drywall (unpainted)	Recycle with supplier when possible.	Keep scraps separate for recycling – stack on pallets in provided onsite. All scrap drywall should be taken back by contractor to drywall supplier
Paint	Reuse onsite; donate to Habitat for Humanity Restore.	Keep separated in designated areas onsite
Insulation	Reuse and landfill.	Keep separated in designated areas onsite.
Glass	Recycle locally.	Keep separated in designated areas onsite.
Plastics	Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.

vii) Waste Disposal Company:

a) Lahore Waste Management Company
b) Local Government

viii) Recycle Hauler

a) To be determined;
b) Contact Address; and
c) Some or all recycle may be hauled by the authorized representative.

ix) Possible Recycle Locations and Acceptable Materials

a) Coordinate with companies in Lahore or which are registered with LWMC that accept materials for recycle; and
b) Using the above as a resource, a list will be kept indicating local opportunities for recycle of expected materials. New locations should be added as needed.

ANNEX-VIII
TRAFFIC MANAGEMENT PLAN

GUIDELINE TRAFFIC MANAGEMENT PLAN

1. Need for Plan

During the construction period of the project, considerable vehicular movement carrying large amounts of material and machinery is expected. This will definitely interrupt the local traffic and is therefore important to manage the traffic to avoid the nuisance to local residents in terms of noise, dust, congestion and inconvenience.

2. The plan

The objective of Traffic Management Plan (TMP) is to define the requirements that should be implemented to mitigate any potential negative risks to the environment, workers or the community resulting from construction traffic.

The TMP will advise and inform site Contractors and external suppliers of equipment and materials of access and entry points along with other key information such tipping areas and wash-out areas. It is intended to compliment and work alongside relevant EMP. The TMP will be classed as “live” and therefore be subjected to updates as required.

The Contractor, at the time of the execution of the project, will prepare a comprehensive TMP in coordination with local traffic police department, RUDA, emergency services and local administrative department. RUDA and CSC will review and approve the Contractor’s TMP. The Contractor’s TMP shall include following mitigation measures during its preparation:

- Undertake a road conditions assessment prior to and following the peak construction period, to assess any damage to road infrastructure that can be attributed to Project development.
- Repair damage as appropriate or enter into a voluntary agreement with the relevant roads authority to reimburse the cost of any repairs required to the public road network as a result of the Project.
- Spoil dumpsites located close to project site to minimize journey distance and limit movements to site access roads.
- Construction of worker accommodation on site to reduce light vehicle movements relating to travel to/ from the site.
- Provision of bus/minibus services for personnel living in nearby settlements.
- Movements of construction workers will be planned to avoid the busiest roads and times of day when traffic is at its greatest.
- Schedule deliveries and road movements to avoid peak periods.
- Driver training for HGV drivers and refresher course every six months for project drivers.
- Speed restrictions for project traffic travelling through communities (to be agreed with National Highway Authority and Client).
- Run a safety campaign to improve the people’s knowledge of the traffic hazard on their roads, public information and other activities to address the issues.

- Run a pedestrian awareness programme.
- Temporary signage

The traffic management plan for the project corridor is provided below.

3. Other Recommendations

It is important to manage public access routes during construction because it can cause delay to local traffic and create a safety hazard both on and offsite. People working and living near the tower sites would be annoyed by the emissions, noise and visual intrusion of queuing vehicles. Some important factors involved in access routes and site traffic are as follows:

3.1. Public Access Routes

The use of public road for site access may be restricted in terms of:

- Vehicle size, width and type of load
- Time limits
- Parking
- Pedestrian conflicts

Contractor should have consultation with the local police or local authority to address these issues and to effectively manage them before the beginning of the construction.

3.2. Site Workers Traffic

Site personnel should not be permitted to park vehicles right on the road; this will lead to disruption in material deliveries. Designated parking areas with appropriate parking space will be needed for this purpose; any plain area near construction site can be used for this purpose.

3.3. Site Rules

- Access to and from the site must be only via the specified entrance.
- On leaving the site, vehicles must be directed to follow the directions given.
- Drivers must adhere to the site speed limits.
- All material deliveries to site must keep allocated time limits.
- No material or rubbish should be left in the loading-unloading area.
- Develop a map for alternate routes showing material delivery services.
- Assign designated personnel on site to receive deliveries and to direct the vehicles.
- Monitor vehicle movement to reduce the likelihood of queuing or causing congestion in and around the area.
- Project vehicles should have a unanimous badge or logo on windscreen displaying that they belong to the project.

4. Contractor's Obligation

The traffic management plan of the Contractor should be safe enough and widening of any access roads and construction of the detours (as applicable and practical) must be completed

prior to start of project construction activities so that heavy vehicular transportation for construction activities do not hinder the normal course of traffic lanes. Contractor must ensure that road closures are carried out by a competent person. The Contractor obligation must include the display of traffic signs according to the need to divert the traffic volume and to guide the road users in advance. The traffic sign, traffic light should be placed from any diverting route or road marking.

The Contractor should consider the environmental and social impacts of the traffic during construction. It will be sole responsibility of the Contractor to implement a plan which produces minimum nuisance to the local people and to the environment. Safety of the people should be given due importance. It will be under Contractor obligation to notify the traffic management plan and its later changes to CSC, RUDA, emergency services and Traffic Police, and also publish weekly programme in the local newspaper.

ANNEX-IX
OCCUPATIONAL HEALTH AND SAFETY PLAN

GUIDELINE OCCUPATIONAL HEALTH AND SAFETY PLAN

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

1.1 SCREENING AND REGULAR UNANNOUNCED CHECKING OF WORKERS

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as COVID-19, HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

1.2 MINIMIZING HAZARDS AND RISKS AT THE WORKPLACE

To ensure safety at all work sites, the following will be carried out:

i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.
iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.
v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be

constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;

vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.

viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.

ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.

x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.

xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

1.3 PROVISION OF PERSONAL PROTECTIVE EQUIPMENT

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide without any cost to the workers, the following protective equipment:

i. High visibility clothing for all personnel during road works must be mandatory.

ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.

iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.

iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.

v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.

vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.

vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.

viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table 1: PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather

Type of Work	PPE
	gloves and dust respirator.

1.4 PROCEDURES TO DEAL WITH EMERGENCIES SUCH AS ACCIDENTS, SUDDEN ILLNESS AND DEATH OF WORKERS

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

i. Provision of dispensaries by the individual EPC contractor.
ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee's contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

1.5 RECORD MAINTENANCE AND REMEDIAL ACTION

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved, cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

1.6 COMPENSATION FOR INJURIES AND DEATH

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Pakistan. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

1.7 AWARENESS PROGRAMS

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS, COVID-19), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

1.8 NOMINATION OF A HEALTH AND SAFETY FOCAL PERSON

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

i. Function as the focal person/representative for all health and safety matters at the workplace;
ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;
iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

1.9 SUGGESTED CONTENTS OF OCCUPATIONAL HEALTH AND SAFETY PLAN

The suggested contents of Occupational Health and Safety Plan to be developed by the Contractor(s) are described below:

a Purpose
b Scope of Application
c Complying Basis
d Occupational Health and Safety Objectives
e Organization and Responsibility
  - Contractor's Project Manager
  - HSE Management Department of the Contractor(s)
  - Medical Treatment Room of the Contractor(s)
  - Subcontractor's Project Manager
  - Subcontractor's HSE Managers
  - Occupational Health and Safety
  - Community Health and Safety
f Health Plan
  - Labour Protection
  - Sanitary Epidemic Prevention
g Safety Plan
  - Summary
  - Qualification Review
  - Safety Training
  - Construction Plans and Documents
  - Control Measures
  - Monitoring Measures
  - Management of the Key Safety Accidents
h Public Security Plan
i Local Community Health and Safety

ANNEX-X
RESOURCES CONSERVATION PLAN

RESOURCE CONSERVATION PLAN

1. INTRODUCTION

The most of the resources in this world are finite and non-renewable in nature. We are completely dependent on these resources to fulfill all our daily requirements. Therefore, sustainable development calls for the need to conserve resources in a way that meet our needs of present generation as well as future generation, especially the non-renewable resources.

2. OBJECTIVE OF THE PLAN

The Resource Conservation Plan is intended to make an effort towards achieving sustainable development. The objective of the resource conservation plan is to:

- Minimize the use of natural resources; and
- Mitigate and prevent pollution contaminating the natural resources.

3. PLANNING

Careful estimations of quantities of material, fuel, water and energy required directly or indirectly shall be done to avoid excessive or unnecessary wastage of these materials. In addition to this, pollution prevention strategies shall also be devised to prevent contamination of resources.

- The estimations include the following:
  - Estimation of construction material required for the project;
  - Estimation of fuel consumption for construction machinery, construction vehicles and generators;
  - Estimations of the energy requirements during all the stages of the project; and
  - Estimations of water consumption for construction activities and construction camp sites.
- Strategies shall be planned to reduce loads on the identified resources to be consumed;
- Best management practices shall be devised to control or reduce pollution resulting from the activities during different stages of the project; and
- An inspector shall be assigned responsibility to oversee the ongoing activities to check the compliance of the planned strategies.

4. EXECUTION OF THE PLAN

The planned strategies shall be implemented to conserve the natural resources including but not limited to the following:

Material

- Material supplied shall be in conformance with the estimated quantities and excess material shall be returned to the supplier;
- Material wastage shall be avoided by using best management practices;
- Waste produced during the project execution shall be disposed off safely to the designated disposal sites through approved contractors; and
- Reuse of the materials shall be appreciated.

Energy

- Reduce trips and optimize routes to and from the construction site for all kinds of activities;
- Regular maintenance of equipment and vehicles to avoid leaks and sustain efficient fuel consumption;

- Switch off idle equipment and vehicles to avoid wastage of fuel;
- Minimize warm up time, unnecessary acceleration and deceleration of the construction equipment and vehicles;
- Avoid unnecessary burning of fuel for cooking in construction camps;
- Avoid unnecessary use of heating and cooling systems during extreme weathers events;
- Construction shall start in early hours of the day to avoid heat in summers and utilization of day light; and
- Alternate energy sources shall be considered for electricity generations during construction and operation to conserve fossil fuel as it is non-renewable resource.

Water

- Avoid using potable water for sprinkling, curing and washing of equipment and vehicles. Surface water or treated effluent can be used instead;
- Wastage of water should be controlled through providing proper valves and through controlling pressure of the water;
- Unnecessary equipment washings should be avoided;
- Awareness amongst workers shall be raised to conserve water and immediately report for any leaks detected; and
- Ensure protection of canal water from contamination resulting from construction activities.

Pollution

- Emissions shall be reduced and controlled as far as possible and direct discharges to air shall be avoided by strictly adhering to the mitigation measures outlined in EIA report;
- Waste water shall not be discharged directly and must be managed as per the recommendations presented in EIA; and
- Construction and demolition waste, and municipal solid waste shall not be dumped and burnt openly, and shall be handled according to the preventative measure given in EIA study.

5. CHECKING AND CORRECTIVE ACTIONS

The Client shall bind the construction contractor through contract agreement to comply with the strategies outlined in the Resource Conservation Plan. The Environmental Committee shall also appoint an Inspector who shall monitor the daily onsite activities and shall report any issues and concerns raised in relation to Resource Conservation Plan. The inspector shall recommend adequate corrective actions to mitigate the issues raised.

ANNEX-XI
CHANCE FIND PROCEDURE

ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

1. BACKGROUND

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975, protects archaeological sites, whether on Provincial Government owned or private land. They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

2. POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

3. RELEVANT LEGISLATION

It ensures the protection, preservation, development and maintenance of antiquities in the provinces of Pakistan. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the relevant provincial governments to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, any archaeological discovery made during the course of the project.

4. REMEDIES AND PENALTIES

The Antiquities Act, 1975 provides for heritage inspection or investigation orders, temporary protection orders, civil remedies and penalties to limit contraventions. These powers provide:

''A contravention of any provision of this Act or the rules shall, where no punishment has been specifically provided be punishable with rigorous imprisonment for a term which may extend to two years, or with fine up to rupees ten hundred thousand, or with both. ''

5. ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

i. Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
ii. Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.

iii. If the site supervisor determines that the item is of potential significance, an officer from the Department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
iv. Work will not re-commence in this location until agreement has been reached
v. between DoA and PMA as to any required mitigation measures, which may include excavation and recovery of the item.
vi. A precautionary approach will be adopted in the application of these procedures.

6. DETAILED PROCEDURAL STEPS

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part under the Land Acquisition Act, 1894 (I of 1894), as for a public purpose.

ANNEX-XII
TREE PLANTATION PLAN

TREE PLANTATION/ AFFORESTATION PLAN

The basic purpose of afforestation/plantation of suitable species in the project area is to reduce the risk been made due to cutting of trees for the proposed project. The risk made will be compensated by planting of saplings to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk been made but will also increase the carrying capacity of the area regarding many positive aspects.

Plantation will be done after the removal of trees during the construction work immediately. Plantation of indigenous trees species is highly important to maintain the biodiversity and ecological balance. It is also important to prevent global warming, soil erosion and pollution. Afforestation purifies the environment and helps in reducing the carbon dioxide level. Along with the importance of construction, the afforestation activity will further help in enhancing the socio-economic condition of the area and project sustainability.

Note: *The compensation for wood trees, fruit trees and orchards may be notified by the Forest and Agriculture or competent authority with Ecologists consultant team after proper field survey/assessment and consultation with local communities, for this purpose special team to be constituted under the approval of competent authority, to assess the losses and propose compensations.*

IMPORTANCE OF TREE PLANTATION

- Trees contribute to their environment by providing oxygen, improving air quality, climate amelioration, conserving water, preserving soil, and supporting wildlife.
- Trees control climate by moderating the effects of the sun, rain and wind. Leaves absorb and filter the sun's radiant energy, keeping things cool in summer.
- Trees also preserve warmth by providing a screen from harsh wind.
- Trees also lower the air temperature and reduce the heat intensity of the greenhouse effect by maintaining low levels of carbon dioxide.
- Both above and below ground, trees are essential to the eco-systems in which they reside.
- Trees absorb and store rainwater which reduce runoff and sediment deposit after storms. This helps the ground water supply recharge, prevents the transport of chemicals into streams and prevents flooding.
- Trees, shrubs and turf also filter air by removing dust and absorbing other pollutants like carbon monoxide, sulfur dioxide and nitrogen dioxide.

OBJECTIVES

- To Restore native species
- To improve the quality of air and reduce its pollution
- To add color to the landscape and enhances the beauty of the environment

- To uplift the quality of our living environment through active planting, proper maintenance and preservation of trees together with other vegetation.
- To Protect and conserve flora and fauna of the project area.
- To attract rain which is a positive impact on the project area at all.
- To reduce sedimentation by plantation in the project area which will act as protection wall against wind born dust particles.

Plantation Plan

Plants will be raised along the nearby available area or roads, two on either side of the road. Distance from the outer boundary of the ROW and between two plants will be kept as 4 meters. Thus in one kilometer, 250 number of plants are to be raised in single row. Total number of plants to be raised along the road is 10,000 Number. Thus a total of 10,000 trees shall be planted in lieu of expected 733 effected plants. The tree count is tentative and GIS based which may be authenticated during construction phase of the project.

**The Punjab Forest Department may update the standards of planting and choice of species as per the requirements and suitability.*

Trees Recommended

Following Trees are Recommended for Plantation.

Sr. No.	**Local Name**	***Scientific Name***
1.	Neem	*Azadirachta indica*
2.	Sukh Chain	*Pongamia pinnata*
3.	Sirris	*Acacia lebbek*
4.	Jacarnda	*Jacaranda moniosifolia*
8.	*Pilkan*	*Ficus virens Spp*
9.	Jaman	*Eugenia jambolina*
10.	Kachnar	*Bauhinia variegate*

PLANTATION TECHNIQUE

Plantation of suitable broad leaved species is to be carried out in the project area or immediate vicinity (as per suitability) of the project area. The project area can be afforested and vegetation cover can be improved by adopting standard afforestation technique of digging pits. The project area is suitable for plantation activities and can be managed thoroughly with care.

WHEN TO PLANT

Planting should be completed early in the rains in as short a time as possible. The trees must be given time to become well established prior to the dry season. A good rule of thumb is to start planting when the soil is moist to a depth of 15-25 cm or to the bottom of the planting hole. Failures because of planting too late are more common than that of planting too early. To obtain good

results and avoid labor shortage in these areas considerable preparatory planning is needed. The size of the plantation might have to be adapted to the availability of labor.

COST

Break-up of Expenditure per Avenue kilometer @ Rs. 1500/- per diem: Break-up of Expenditure per Avenue kilometer or 250 plants @ Rs. 1500/- per diem:

FIRST YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Layout	1 Av.km	2 MD/Av.km	3000.00
2.	Digging of Pits 2.5 Cft. each 2.5x250 = 625 cft.	625 cft.	5 MD/Av.km	7500.00
3.	Cost of Plant	250 No.	Rs100/- plant	25,000.00
4.	Cost of planting of plants	250 No.	Rs. 25/- plant	6250.00
5.	Carriage of plants from private nursery to site including loading/unloading	250 No.	Rs. 10/- plant	2500.00
6.	Cost of Manure and Bhall (silt) including carriage	1 Av. Km		20,000.00
7.	H/watering 50 times 250x50 with water bowser, one driver and one coolie	12500 no.	5MD/per %0	100,000.00
8.	Weeding twice 250x2	500 no.	2 MD/per %	15,000.00
9.	Reopening of Pits twice (250x2)/cft/pit	500 cft.	2 MD/per %	15,000.00
10.	Unforeseen			5750.00
Total				**200,000.00**

SECOND YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plant 20% Restocking	50 No.	Rs.100/- plant	5,000.00
2.	Cost of planting	50 No.	Rs. 25/- plant	1250.00
3.	Carriage of plants	50 No.	Rs. 10/- plant	500.00

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
4.	H/watering 50 times with water bowser, one driver and one coolie	12500 no.	5MD/per %0	100,000.00
5.	Reopening of Pits twice (250x2)	500 cft.	2 MD/per %	1,5000.00
6.	Weeding twice 250x2	500 no.	2 MD/per %	1,5000.00
7.	Unforeseen			1250.00
Total				**1,38,000.00**

THIRD YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	Cost of Plant 10% Restocking	25 No.	Rs.100/- plant	2500.00
2.	Cost of planting	25 No.	Rs. 25/- plant	625.00
3.	Carriage of plants	25 No.	Rs. 10/- plant	250.00
4.	H/watering 40 times x250 no.	10,000 no.	5MD/per %0	75000.00
5.	Reopening of Pits twice (250x2)	500	5MD/per %0	3750.00
6.	Unforeseen			2875.00
Total				**85,000.00**

FOURTH YEAR

Sr. No.	Item	Quantity	Rate	Amount (Rs.)
1.	H/watering 30 times	7500 no.	5MD/per %0	56250.00
2.	Pruning and cleaning of plants	250 no.	5MD/per %0	1875.00
3.	Unforeseen			1875.00
Total				**60,000.00**

Cost for raising 1 Av. Km and Maintenance or 250 plants in single row: = PKR.4,83,000/- For 4 years.

Total cost for 40 Av. KM standard Plantation and maintenance for 4 years= PKR. 19,320,000

Total Cost in million = PKR.19.320

ANNEX-XIII
BREAKUP OF HEALTH AND SAFETY COST

Annex-XIII

BREAKUP OF HEALTH AND SAFETY COST

Items	Quantity	Cost / Item (Rs.)	Total Cost (Rs.)	Rationale
(A) Personal Protective Equipments PPEs				
Dust masks	9,600	30	288,000	One dust mask to be used in a week by each labourer for 24 months and for 96 weeks.
Safety Shoes	400	3,000	1,200,000	Two safety shoes are supposed to be used for 12 months by each labourer and for 200 labourers for 12 months construction period .
Gloves	2,400	200	480,000	twelve pairs of gloves is to be used by each labourer for 12 months and 2,000 gloves are estimated to be used by 200 labourers.
First Aid Box	8	5,000	40,000	One First Aid Box is proposed for 25 labourers and for 200 labourers 08 aid boxes are estimated.
Ear Plugs	9,600	50	480,000	One set of ear plug to be used for a week by each labourer and for 48 weeks (12 months) it is estimated to be 19,200 for 200 labourers.
Safety Helmets	600	1,000	600,000	Three safety helmets are to be used by each labourer for 12 months and for 200 labourers 600 safety helmets are estimated.
Safety Jackets (Hi Vis)	400	800	320,000	Two safety Jacket (Hi Vis) to be used by each labourer for 12 months to be used by 200 labourers.
Sub-Total (A)			***3,408,000***	
(B) Others				
Provision of Dust Bins	10	800	8,000	Ten dust bins are proposed to be placed at construction site for the whole construction period.
Warning Tape	20	500	10,000	---
Safety Cones	20	1,000	20,000	20 safety cones are estimated to be placed at active construction sites.
Safety Sign Boards	15	1,500	22,500	20 safety sign boards are proposed to be placed at active construction sites.
Sub-Total (B)			***60,500***	
Grand Total (A + B)			***3,468,500***	

Time required for Construction = 12 Months
No. of labour required during construction = 200