RAVI URBAN DEVELOPMENT AUTHORITY (RUDA)

CONSTRUCTION OF BRIDGE TO JAHANGIR TOMB OVER RAVI RIVER



ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

MARCH 2026

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CONSTRUCTION OF BRIDGE TO JAHANGIR TOMB OVER RAVI RIVER

Environmental Impact Assessment (EIA)

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LIST OF ABBREVIATONS

BCP	Buildig Code of Pakistan
CDM	Clean Development Mechanisms
CCMP	Construction Camp Management Plan
COVID-19	Coronavirus disease
CoI	Corridor of Impact
CCI	Council of Common Interest
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessments
EMP	Environmental Management Plan
EMMM	Environmental Mitigation and Management Matrix
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
FGDs	Focused Group Discussions
GoP	Government of Pakistan
GoPb	Government of Punjab
HCS	Highway Capacity Software
IEE	Initial Environmental Examination
IGF	Inspector General Forestry
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
PEQS	Punjab Environmental Quality Standards
NOC	No Objection Certificate
NPO	No Project Option
NPZ	Noise Perimeter Zones
NGO's	Non-Governmental Organizations
PMD	Pakistan meteorological department
NCS	Pakistan National Conservation Strategy
PGA	Peak Ground Acceleration
PPE	Personnel Protective Equipment
PAPs	Project Affected Persons
PEPA	Punjab Environmental Protection Agency
PEQs	Punjab Environmental Quality Standards
QMP	Quarry Management Plan
R & D	Research and Development
RUDA	Ravi Urban Development Authority
RRUDP	River Ravi Urban Development Project
STDs	Sexually-Transmitted Disease
SSEMP	Site Specific EMP
SOP	Standard Operating Procedures
SC	Supervisory Consultant

EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Lahore the capital of the province of Punjab is rapidly urbanizing being a regional urban center of key commercial, financial, industrial and socio-cultural significance. The population of Lahore in 2023 census report is estimated at around 13 million. In view of City's projected population and issues related to the water in the River Ravi, Government of Punjab (GoPb) has planned Ravi River Front Urban Development on both banks of the River Ravi (46 KM long stretch) that is contiguous to Lahore District's northern and western boundaries.

Ravi Urban Development Authority (RUDA) has engaged National Engineering Services Pakistan (NESPAK) Limited to provide Consultancy Services for the preparation of Environmental Impact Assessment (EIA) study of the proposed Project, to fulfill the requirements of the Punjab Environmental Protection and Climate Change Department (Punjab-EPCCD). This document presents the findings of Environmental Impact Assessment (EIA) of Jhangir Tomb Access Bridge.

ES-2 LEGAL AND ADMINISITRATIVE FRAMEWORK

As per Punjab Environmental Protection Act (Amendment) 2017, under Section 12 (1) IEE/EIA is mandatory. According to the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022 the proposed Project falls under the Category D (Transport) of Schedule II, which requires an EIA study for major road projects with bridges having total length more than 500 m before commencement of construction. Therefore, an Environmental Impact Assessment (EIA) report was prepared by NESPAK.

ES-3 DESCRIPTION OF THE PROJECT

The proposed project falls under administrative jurisdiction of District Lahore, Punjab. The proposed bridge is new alignment having total length of 1.0 km. Right of Way (ROW) of the proposed bridge is 600 ft. No. of Lanes on the bridge is 02 lanes dual carriageway. The proposed project is expected to be completed within 12 months. The estimated cost of the construction works of proposed access roads is **Rs. 9,874.995 Million.**

ES-4 DESCRIPTION OF THE ENVIRONMENT

Considering the potential impacts of the proposed Project, existing baseline environmental conditions of the proposed project's Corridor of Impact (CoI) has to be used as a benchmark for comparison of the physical, ecological and socio-economic conditions before and after construction phases of the Project. This baseline will also provide the datum for assessing the impacts and suggesting the mitigation measures, which will be implemented effectively at various phases of the project activities.

Physical Environment:

The topography of the district Lahore is flat. The project area is located in the upper part of Punjab plain near to the River Ravi. The area is underlain by thick alluvial deposits comprising of clays, silts and sands deposited by River Ravi.

According to Building code of Pakistan, 2007 issued by Government of Pakistan, the project area falls in Seismic Zone 2A of Pakistan (low to moderate damage), and peak ground acceleration (PGA) from 0.08 to 0.16 g.

Ecological Environment:

The access roads are situated in semi-arid region. The land owners also raised trees Kikar (*Acacia nilotica),* Shisham (*Dalbergia sissoo),* Ber (*Zizyphus sp.),* Sufeda (*Eucalyptus camaldulensis),* Mulberry (*Morus alba),* Neem (*Azadirachta indica),* Sirris (*Albizia lebbek),* Dherek (*Melia azedarach),* Bakain (*Melia azadirachta),* Sumbal (*Bombax ceiba)*. No compact plantation or woodlots exist in the Project Area, but scattered trees are growing in the farm lands in scattered pattern consisting of Kikar, Shisham, Rubber plant, Eucalyptus etc.

The study area being agricultural land and is not very rich in wildlife Mammals. However, common mammals are Jackal (*Canis aurecus*), Squirrel (*Funambulus*), Fox (*Vulpus vulpus*), Rats (*Mus musculus*) and Mangoose (*Herpestes auropunctatus*). Wild bear (Sus scrofa) is also reported in the area, but its number has been reduced to a bare minimum as a result of extensive hunting and shooting.

No endangered flora and fauna was found in the tract.

Socio-Economic Environment:

The project area falls in District Lahore. The present population of Lahore is about 13 million as per digital census 2023. According to Census of 2017, total population of the district was 11.13 million[1], with an annual growth rate of 4.07 percent since 1998. Gender-wise, 52.35% of the population is male, while 47.64% is female, and transgender people make only 0.01% of the population.

ES-5 ANTICIPATED PROJECT IMPACTS AND MITIGATION MEASURES

Significant efforts were made to identify the main environmental (physical, ecological, social, and cultural) issues related to the design, construction and operation of the proposed project. The positive impacts due to the proposed project are: an efficient access to RUDA project area; a safe, congestion free facility to the commuters of project area. The significant adverse impacts and their mitigations during the construction and operation phases are here under:

- The noise and vibration will be produced due to the operation of construction machinery and equipment. There are a variety of ways by which construction equipment and worksite noise can be controlled that includes use of Quieter

[1] Pakistan Bureau of Statistics

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 nullahs, drains and water channels. Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks. Proper monitoring to check the compliance of PEQS will be carried out; and sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit;
- Solid waste will be generated from construction camps and construction site 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. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;
- Air quality will be deteriorated by fugitive emissions and dust; from construction activities and movement of vehicles/equipment. Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise; Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s);
- Trees and plantation may be affected due to construction activities A compensatory plantation plan has been provided recommending ten (10) trees against each fallen tree of similar floral function at the available spaces in/around the project area;
- Traffic problems may arise for the commuters in the project area due to construction activities and movement of heavy vehicles. Traffic management plan has been recommended to manage traffic issues.

ES-6 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The EMP of the proposed project mainly comprises institutional requirements; environmental mitigation and management; environmental monitoring plan; planning for EMP implementation; and EMP cost. The total cost required to effectively implement the mitigation measures is approximately Rs. 16.145 Million for one year, 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 and implementation during construction shall be ensured by Contractor(s).

ES-7 CONCLUSIONS AND RECOMMENDATIONS

Findings 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 of the road and by implementing mitigation measures recommended in EMP.

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.

1. INTRODUCTION

1.1 PROJECT BACKGROUND

The Government of the Punjab (GoPb) under its Ravi Urban Development Authority (RUDA) intends to develop urban areas of the province Punjab into sustainable, livable and well-managed engines of economic growth to tackle the growing urban requirements of Punjab. Urban development and its management are critically linked with sound, comprehensive and strategic metropolitan level long-term planning and sustainability. Over the years, rapid urbanization has changed the socio-economic and physical characteristics of the cities. The physical growth of the cities has emerged in a very different way from the land uses proposed in master plans and other planning documents.

Lahore the capital of the province of Punjab is rapidly urbanizing being a regional urban center of key commercial, financial, industrial and socio-cultural significance. The population of Lahore in 2023 census report is estimated at around 13 million. In view of City's projected population and issues related to the water in the River Ravi, Government of Punjab (GoPb) has planned Ravi River Front Urban Development on both banks of the River Ravi (46 KM long stretch) that is contiguous to Lahore District's northern and western boundaries.

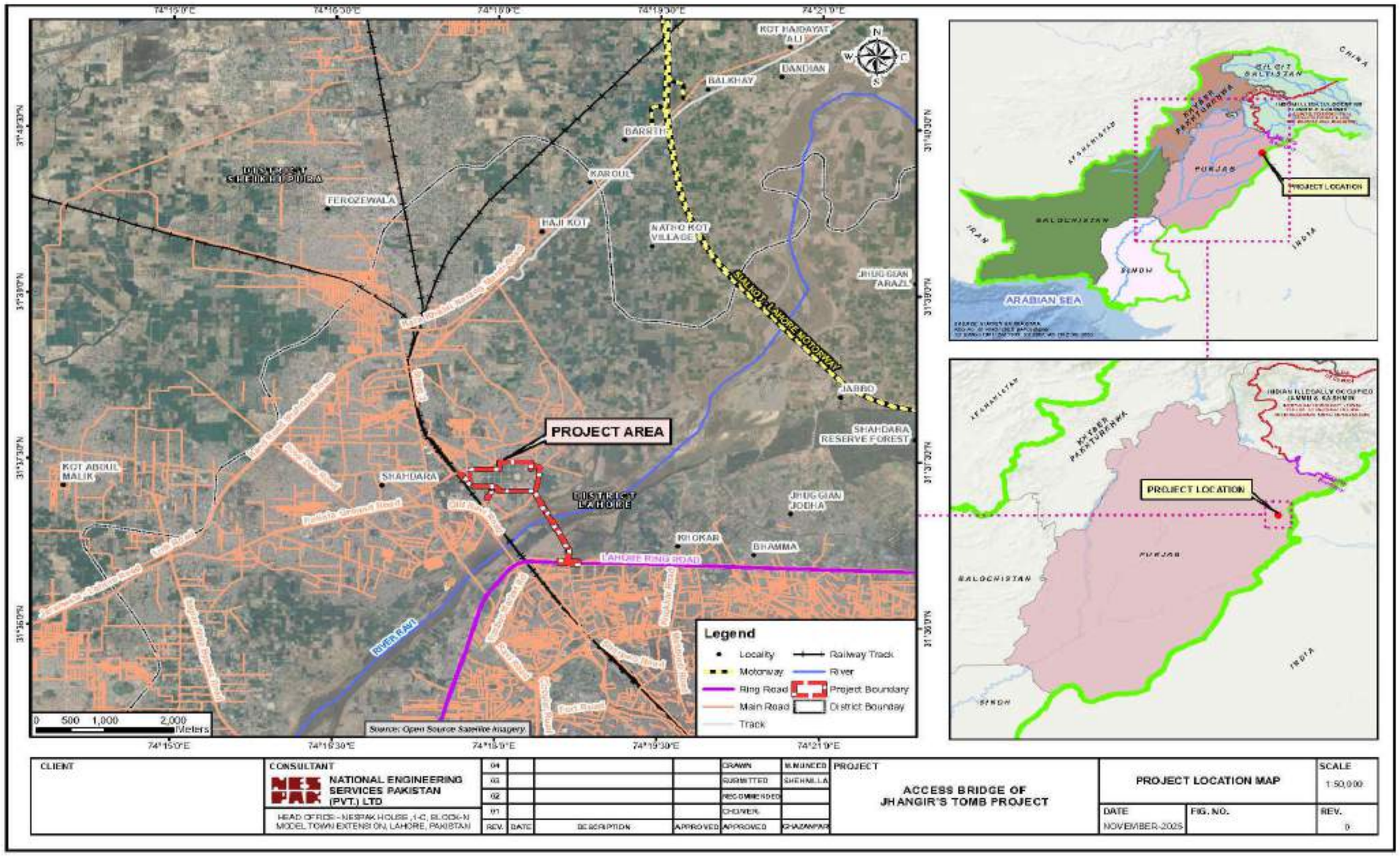
The proposed project involves Construction of Bridge to Jahangir Tomb over River Ravi to establish a direct, safe, and efficient linkage between the Lahore Ring Road (LRR) and the Jahangir Tomb complex, thereby improving regional connectivity, facilitating tourism, and easing traffic congestion in the surrounding areas. This document presents the findings of Environmental Impact Assessment (EIA) of Bridge to Jahangir Tomb over River Ravi.

1.2 REQUIREMENT FOR EIA STUDY OF THE PROPOSED PROJECT

As per Punjab Environmental Protection Act (Amendment) 2017, under Section 12 (1) IEE/EIA is mandatory. According to the Punjab Environmental Protection (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2022 the proposed Project falls under the Category D (Transport) of Schedule II, which requires an EIA study for major road projects with bridges having total length more than 500 m before commencement of construction. Therefore, an Environmental Impact Assessment (EIA) report was prepared by NESPAK.

1.3 NATURE, SIZE AND LOCATION OF THE PROJECT

The proposed Project will span the River Ravi with a total bridge length of 1,195 meters. The bridge will have a Right of Way (ROW) of 18.29 meters, accommodating two traffic lanes in each direction, along with shoulders, safety barriers, and pedestrian pathways. The proposed Project falls in administrative jurisdiction of District Lahore of Punjab Province. **Figure 1.1** shows the location map of the proposed project.



CLIENT	CONSULTANT: NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. HEAD OFFICE: NESPAK HOUSE, 1-C, BLOCK-N MODEL TOWN EXTENSION, LAHORE, PAKISTAN	04				DRAWN	ENGINEER	PROJECT: ACCESS BRIDGE OF JHANGIR'S TOMB PROJECT	PROJECT LOCATION MAP; SCALE: 1:50,000
		03				SUBMITTED	SHEHNILA		
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		REV.	DATE	DESCRIPTION	APPROVED	APPROVED	GHAZANFAR		

Figure 1.1: Location Map of the Proposed Project

1.4 SCOPE OF STUDY

The scope of this EIA Study aims at collection of data related to physical, biological and socio-economic environment of the project area and to update/prepare the baseline environmental profile. It also aims the update, 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 conduct assessment of significant adverse environmental and social impacts and to suggest mitigation and remedial measures to make the proposed project environment friendly and sustainable during the construction and operational stages. Also, to propose institutional arrangement and to develop cost estimate to implement those mitigation measures.

1.6 PROJECT PROPONENT

a) Proponent Contact/Address

Chairman/ Project Director
Ravi Riverfront Urban Development Project (RRUDP)
Ravi Urban Development Authority (RUDA)
Government of the Punjab
151 Abu Bakar Block, Garden Town facing Canal Road Lahore, Punjab
Tel: +92 42 99263541

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

1.7 CONSULTANT'S EIA TEAM

Based on the requirements of TOR and objectives of the study, NESPAK formed a team of experts comprising Environmentalists, 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 specialists 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	Head ERSD Section/ Quality Assurance
2.	Ms. Shehnila Hanif	Senior Environmental Scientist

Sr. No.	Name of Expert	Designation
3.	Ms. Ridha Kamran	Senior Environmental Scientist
4.	Mr. Muhammad Sajjad	Senior Sociologist
5.	Mr. Ibadullah Khan	Senior Ecologist

1.8 APPROACH AND METHODOLOGY

The following methodology was adopted for preparing 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 was gathered through field observations, concerned departments and published materials to establish baseline of physical, biological and socio-economic environmental conditions.

- Literature Review;
- Site Reconnaissance;
- X xAnalysis 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 project receiving direct impacts of project activities. The CoI delineated for the proposed project is 50 m each side of the proposed road. CoI map is shown as **Figure 1.2.**

1.8.5 Survey of COI

A team of Environmentalists, Ecologist and Sociologist carried out the environmental and social survey of the COI in in November 2025 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. Map showing COI has been attached as **Figure 1-2**.

1.8.6 Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out within the COI as mentioned above. For data collection, formal meetings were held and data collected through visual observations, interviews with the local residents and officials. In order to collect the relevant published information, government offices were also visited.

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

Physical Environment

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

- Land resources (including topography, land use pattern, soil contamination and soil erosion etc.);
- Water resources (including available surface and groundwater resources and hydrology, 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.

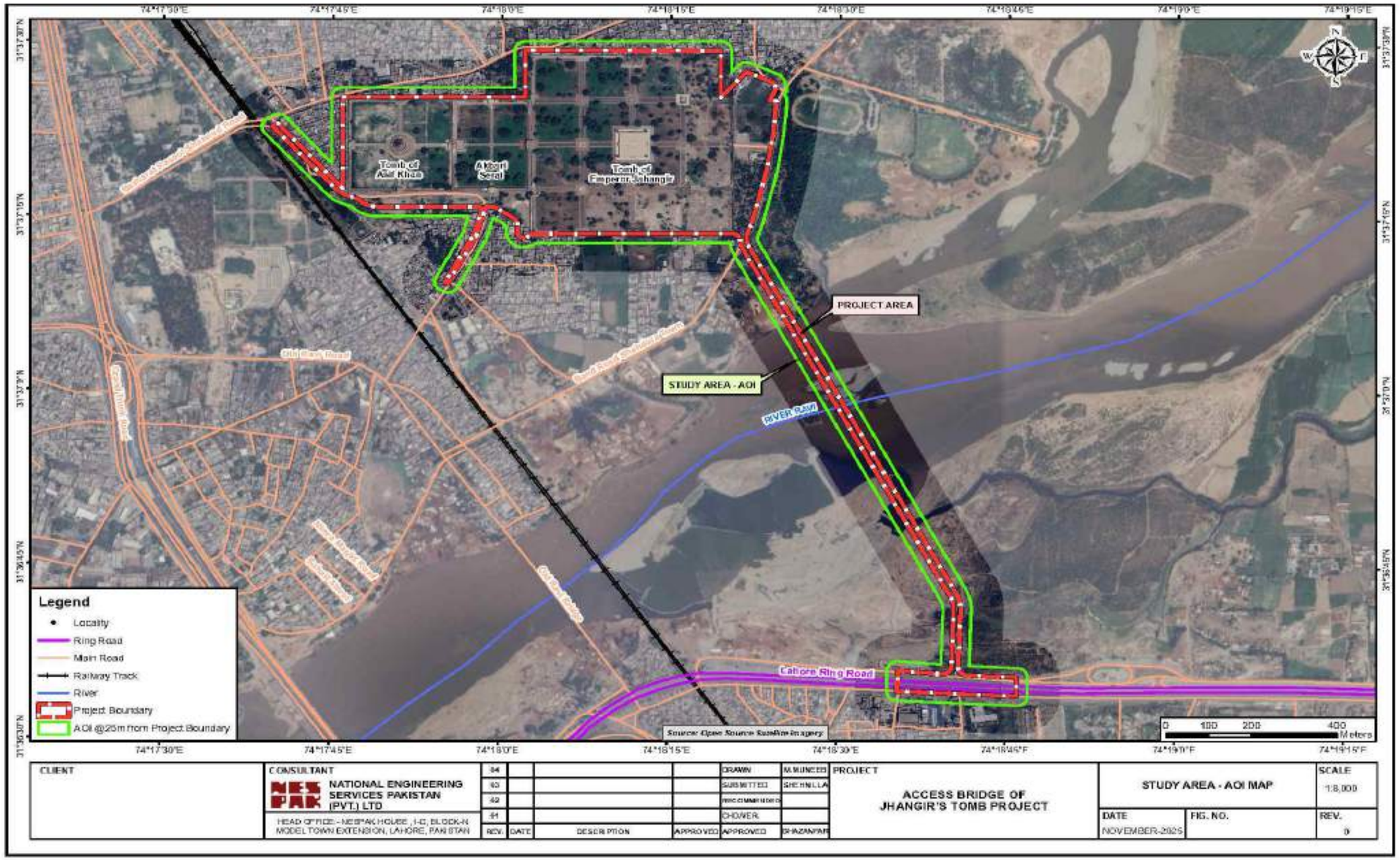

Figure 1.2: COI Map of the Proposed Project

1.8.7 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.

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 reports, meetings through public consultations and interviews to describe the existing social environment and assessment of the potential impacts 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.

1.8.8 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 community, relevant departments including Punjab Environmental Protection & Climate Change Department (EP&CCD), Punjab Forest and Wildlife Department, Fisheries Department and Walled City of Lahore Authority (WCLA) to discuss the issues/constraints and got their views and feedback to mitigate the potential environmental as well as social impacts associated with the implementation and operation of the Project.

1.8.9 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, socioeconomic survey proformas, 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.

1.8.10 Environmental Management Plan (EMP)

The Environmental Management Plan 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 "Project Description" furnishes information about the studied alternatives, location of the proposed project, cost and size of the project, its major components and alternatives considered for the proposed project.

Section 4 "Description of the Environment" describes physical, biological and socio-economic conditions prevalent in the project area.

Section 5 "Stakeholder Identification and Consultations" identifies the main stakeholders and their concerns raised through scoping sessions, and deals with the measures to mitigate the social impacts.

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 project.

Section 7 "Environmental Management Plan" outlines environmental mitigation plan, institutional arrangements for the implementation of the proposed mitigation measures, monitoring requirements, EMP 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. LEGAL AND ADMINISTRATIVE FRAMEWORK

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 and bilateral and multilateral agreements.

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.
3	Punjab Climate	The Punjab Climate Change Policy and	This policy and action

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
	Change Policy & Action Plan 2024	Action Plan address the region-specific impacts of climate change in alignment with Pakistan's National Climate Change Policy (NCCP). Its aim is to mainstream climate resilience and adaptation in development planning across vulnerable economic and social sectors. The policy and action plan highlight the challenges faced by Punjab due to its varied agro-ecological zones and extreme weather events like floods, droughts, and rising temperatures. It outlines strategies for low-carbon development and climate resilience by focusing on sustainable urban development, improved agricultural practices, and disaster risk reduction. A significant component of the policy and action plan is the "Triple Win" strategy, which emphasizes low carbon emissions, climate resilience, and co-benefits that strengthen the water-energy-food nexus. This strategy is aiming for sustainable economic growth by prioritizing sectors like agriculture, energy, and industry while addressing climate risks. The policy and action plan also stress the need for financial resources, technology transfer, and capacity building to achieve its objectives. It recommends creating a provincial climate change trust fund, enhancing public and private sector cooperation, and engaging in international climate finance mechanisms.	plan 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 and action plan will accelerate due to the possible emissions from the construction machinery and equipment.
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 Punjab Local Government Ordinance 2021 and Punjab Local Government Act 2022.	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	The core areas that are relevant in the context of the proposed project are drinking water

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		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.	demand, sewage disposal, handling of wastewater.
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: • Promoting ecological, social and cultural functions of forests through sustainable management and use of forest produce including wood and non-wood forest products; • Implementing a national level mass afforestation program to expand and maintain optimum forest cover; • Maximizing forest areas by investing in available communal lands/ shamlat, and Guzara forests and urban forestry; • Facilitating and harmonizing inter-provincial movement, trade and commerce of wood and non-wood forest products through the Federal Forestry Board; • Inter-linking natural forests, protected	The proposed Project involves within its ROW, the River bed area of Ravi River and the Karol Forest (which is a protected). Moreover, urban forestry triggers the Policy due to presence of riverside plantation.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		areas, wetlands and wildlife habitats to reduce fragmentation; • Enhancing role and contribution of forests in reducing carbon emissions and enhancing forest carbon pools; • Facilitating implementation of international conventions and agreements related to Forestry, Wetlands, Biodiversity and Climate Change; and • Promoting standardized and harmonized scientific forest planning, research and education including for community-based management.	
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; • Skill development and employment; and • Manpower export.	The labour force will be employed for construction of the proposed project. The provision of policy will apply to all the employed laborers.
8	National Resettlement Policy, 2002	In March, 2002 Pakistan Environmental Protection Agency (Pak-EPA), GOP has issued its National Resettlement Policy, which explains the basis for compensation, rehabilitation and relocation of the affectees. It also explains the requirements and implementation of Resettlement Action Plan (RAP).	This policy will be triggered if resettlement issues will arise for the construction of proposed project.
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 elicited if any unforeseen natural and man-made disaster occurs during construction and operational phase.
10	National Action Plan for COVID-19 Pakistan	Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at https://www.nih.org.pk/wp-	This Action Plan for COVID-19 is applicable to the proposed project due to COVID outbreak during project

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf. The Government of Pakistan has launched the real-time data portal for COVID-19 http://covid.gov.pk/. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf.	implementation.
11	Punjab Climate Change Policy (Draft), 2017	The Punjab Climate Change Policy (PCCP) address the region-specific impacts of climate change in alignment with Pakistan's National Climate Change Policy (NCCP). Its aim is to mainstream climate resilience and adaptation in development planning across vulnerable economic and social sectors. The policy highlights the challenges faced by Punjab due to its varied agro-ecological zones and extreme weather events like floods, droughts, and rising temperatures. It outlines strategies for low-carbon development and climate resilience by focusing on sustainable urban development, improved agricultural practices, and disaster risk reduction. A significant component of the policy is the "Triple Win" strategy, which emphasizes low carbon emissions, climate resilience, and co-benefits that strengthen the water-energy-food nexus. This strategy is aiming for sustainable economic growth by prioritizing sectors like agriculture, energy, and industry while addressing climate risks. The PCCP also stresses the need for financial resources, technology transfer, and capacity building to achieve its objectives. It recommends creating a	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 possible emissions from the construction machinery and equipment.

Sr. No.	Policy/Strategy	Brief Coverage	Relevance to Project
		provincial climate change trust fund, enhancing public and private sector cooperation, and engaging in international climate finance mechanisms.	

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 (as Amended up to 2017)	The Punjab Environmental Protection Act, 1997 (as Amended up to 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); • Prohibition of certain discharges or emissions; • Punjab Environmental Quality Standards (PEQS) for wastewater, air emissions and noise; and • Provincial Government can	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 EP&CCD. The section 11 of the Act is applicable in terms 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
		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 and Climate Change Department (EP&CCD)/Environmental Protection Agency (EPA), Government of the Punjab (GoP) 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.	Punjab 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 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 RUDA to follow the procedure to file an EIA with Punjab EP&CCD and to understand its review process along with timelines to be followed.

Sr. No.	Act	Brief Coverage	Relevance to Project
		• The environmental screening process of the projects under schedule I, II and III; and • 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	The guidelines are applicable for the preparation of the EIA.

Sr. No.	Act	Brief Coverage	Relevance to Project
		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.	
6.	Ravi Urban Development Authority Act 2020	The Ravi Urban Development Authority Act 2020 (the "Act 2020") was promulgated to establish Ravi Urban Development Authority (the "Authority") for carrying out the purposes of the Act ibid. The Act 2020 focuses on the administrative, procedural and operational activities of the Authority with certain prohibitions attached to its functions. The preamble of the Act 2020 is exhaustive in nature pointing out the entire actions in public interest for the purpose of comprehensive system of planning and development in the area specified in Master Plan of the Project so as to improve the quality of life as per legislative objectives and further to establish an integrated modern and regional development approach and a continuing process of planning and development to achieve the highest environmental standards, quality of life and modern standard facilities so as to make a healthy and prosperous community in the designated area duly determined by the Government to rehabilitate water aquifer and the dying Ravi River into fresh perennial water body with a state-of-the-art water front and urban development on reclaimed and adjoining lands.	This Act is directly related to the establishment of proposed project as it falls under jurisdiction of RUDA.

Sr. No.	Act	Brief Coverage	Relevance to Project
		The objectives of the Act 2020 are to provide quality life along with developed infrastructure and modern standard facilities.	
7.	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 policies, plans, programs, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto.	This Act will accelerate due to the anticipated emissions from the construction machinery.
8.	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 involves the cutting of trees where unavoidable, which will be managed through extensive tree plantation, therefore, the provisions of this law will be helpful.
9.	Punjab Plantation and Maintenance of Trees Act, 1974	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 maintenance by the occupier of the existing land who would have the physical possession.
10.	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	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.

Sr. No.	Act	Brief Coverage	Relevance to Project
		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.	
11.	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.
12.	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	The labour laws will be relevant as it would deal with employment of labour for the construction of proposed project.

Sr. No.	Act	Brief Coverage	Relevance to Project
		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.	
13.	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.
14.	The Punjab Water Act, 2019	This act ensures comprehensive management and regulation of water resources in the Punjab in the interest of conservation and sustainability.	This Act will be triggered for sustainable use of water required for construction purposes.
15.	Hazardous Substance Rules,	The rule describes the procedure of handling, transportation and	This rule is applicable to the proposed project which will

Sr. No.	Act	Brief Coverage	Relevance to Project
	2018	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.	guide on hazardous waste handling, use and disposal during the construction stage.
16.	Punjab Environmental Protection (Motor Vehicles) Rules, 2013	Subject to the provisions of this act, and the rules and regulations, no person vehicle from which air pollutants and noise are being shall operate a motor emitted in an amount, concentration or level which is in excess of the Punjab Environmental Quality Standards (PEQS), 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 and associated generation of air pollutants and noise.
17.	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 and psychological needs of the employees at workplace.	The Act will safeguard health and safety of the workers at workplace associated with the project activities during construction and operational phase to ensure health and safety of workers.
18.	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	This Act will restrict the contractor to hire skilled and unskilled labour under age 15.

Sr. No.	Act	Brief Coverage	Relevance to Project
		which shall not be less than seven days, and a mandatory fine between 10,000 and 50,000 rupees.	
19.	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 and will ensure protection of women against any violence and harassment.
20.	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 restrict the contractor not to cause damage during construction of the power facilities.
21.	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 if the cutting of tree will be involved.
22.	Punjab Forest Act (Amended), 2016	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 provisions of this act triggers if proposed project involve any disturbance to nearby reserved forests in the Project area.
23.	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.
24.	The Punjab Heritage	This act entails preservation,	This Act will deal with

Sr. No.	Act	Brief Coverage	Relevance to Project
	Foundation Act, 2005	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.	heritage sites present in and around the proposed project route. There are no heritage sites in the proposed project.
25.	The Punjab Emergency Services 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 will be helpful to the proposed project to provide timely response, rescue and emergency medical treatment to the affected persons during construction and operational phase of project.
26.	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 will address flood protection. The proposed project will require special consideration to disasters and risk management strategies as per the Act.
27.	Seismic Building Code of Pakistan 2007 & 2021	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 related components. Construction of buildings shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the Act.	This Code is applicable to the proposed project as it includes the formation of structures earthquake proof.
28.	Punjab Irrigation, Drainage and Rivers Act, 2023	This Act states that all-natural waters in Punjab vest to the Government of Punjab. This Act	This Act is applicable to the proposed Project since there is planned construction along

Sr. No.	Act	Brief Coverage	Relevance to Project
		defines the rights of the riparian owners, rights to water accessed by public road etc. and abstraction rights to ground water sources owners for all-natural waters including those of rivers, canals, lakes, dams and drains etc. This Act also promulgates the requirements for the irrigation and reclamation schemes. This Act promotes sustainable water practices in the Punjab Province. It provides for better and sustainable irrigation, drainage, and control and management of rivers, streams, lakes, ground water and navigation in Punjab. The Act establishes minimum standards for irrigation and drainage services, which Canal Officers are required to maintain. An independent unit is maintained to measure the quality of services against these standards. It requires the preparation of village irrigation plans for each outlet, involving owners and occupiers of lands in the irrigation area. The Act empowers the government to draw up schemes for drainage works necessary for improvement, proper cultivation or irrigation of lands, or protection from floods. The cost of such schemes can be charged to the owners of benefited lands. Obstruction removal and drainage works carried out under the Act may require compensation to be paid to affected parties.	the River Ravi for carrying out the training works of the river and storage of water due to the construction of Barrages.
30	Punjab Environmental Protection (Smog Prevention and Control) Rules 2023	The rules define smog as a type of air pollution caused by the presence of high levels of particulate matter (PM), nitrogen dioxide (NO_2), and ozone (O_3) in the air. The rules identify the main sources of smog, including: Industrial activities, Vehicle emissions, Agricultural burning,	During the proposed project implementation, it shall be made sure that vehicle and construction activities do not generate air pollutants exceeding the limits set by PEQS 2016.

Sr. No.	Act	Brief Coverage	Relevance to Project
		Construction activities and Waste disposal. The rules require the establishment of a monitoring system to track smog levels and report on the data. These rules have also defined the standards for air quality (which are referred to PEQS), smog control measures and penalties to ensure the compliance.	

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	UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972 Web Link: http://whc.unesco.org/en/%20convention%20text/	Pakistan ratified this convention on 23 July 1976.	Convention concerning the Protection of the World Cultural and Natural Heritage - requires parties to adopt a general policy on the protection of the natural and cultural heritage, to set up services for such protection, to develop scientific and technical studies, to take appropriate legal, technical, scientific and administrative measures and to foster training and education for such protection.
2	The Rio Declaration, 1992 Web Link: http://www.unesco.org/education/pdf/RIO_E.PDF	Pakistan signed the treaty on 13 Jun, 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;

Sr. No	Agreement/Convention	Ratification	Description/Relevance
			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.
3	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, 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.
4	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.
5	UN Convention to Combat Desertification (UNCCD), 1994	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

Sr. No	Agreement/Convention	Ratification	Description/Relevance
	Web Link: https://www.unccd.int/		long-term strategies supported by international cooperation and partnership arrangements.
6	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 (POPs) 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 tissues of humans and wildlife.
7	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 consistent with a low GHG emissions and climate-resilient pathway.	The implementation of the proposed project will reduce the emission of Greenhouse Gases (GHGs) due to the construction of the proposed project.
8	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	The MDGs 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

Sr. No	Agreement/Convention	Ratification	Description/Relevance
		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.	hire women for construction activities to elude gender discrimination and to promote women empowerment, a procedure will be devised. 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, COVID 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.
9	The World Heritage Convention, 1972	Pakistan ratified the convention on 23 July 1976, making its sites eligible for inclusion on the list.	The Convention aims at the identification, protection, conservation, presentation and transmission to future generations of cultural and natural heritage of Outstanding Universal Value. By signing the World Heritage Convention, each country (or State Party) pledges to identify, protect, conserve and preserve the World Heritage properties located within its territory to ensure that this shared heritage can be passed on to future generations. States Parties are also tasked with nominating properties within their borders to be considered for inclusion on the World Heritage List. The nominations are presented to the World Heritage Committee,

Sr. No	Agreement/Convention	Ratification	Description/Relevance
			who decides whether or not they should be inscribed, after they have been evaluated by ICOMOS and IUCN.

2.4 ADMINISTRATIVE FRAMEWORK

2.4.1 RUDA

The implementing agency of the proposed project is Ravi Urban Development Authority (RUDA). The management of RUDA 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 EP&CCD, Punjab

Pakistan Environmental Protection Agency 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 falls in Lahore and Sheikhupura Districts of Punjab Province, therefore, Punjab-EP&CCD will be responsible for reviewing the report, issuing environmental approval and overall/broad based monitoring of the proposed project activities.

3. DESCRIPTION OF THE PROJECT

3.1 GENERAL

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

3.2 OBJECTIVES OF THE PROJECT

The objective of the proposed project is to establish a direct, safe, and efficient linkage between the Lahore Ring Road (LRR) and the Jahangir Tomb complex, thereby improving regional connectivity, facilitating tourism, and easing traffic congestion in the surrounding areas.

3.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed Project lies in District Lahore, Punjab.

3.4 PROJECT IMPLEMENTATION SCHEDULE

The tentative implementation period for proposed Project is one (01) year.

3.5 COST OF THE PROJECT

Tentative cost of the proposed Project is about PKR 9,874.995 Million.

3.6 SALIENT FEATURES OF THE PROJECT

The scope of the Project encompasses Two Lane Dual Carriageway Access Bridge to Jhangir's Tomb with Earthwork & Allied Activities, pedestrian walkways etc. The Design features of the proposed Project are provided below:

3.7 DESIGN FEATURES

- Length : 1.0 km
- Proposed ROW : 60 ft
- Gateways : 02
- Slip Roads : 02
- Roundabout at Ring Road
- Improvement of Existing Bund Road
- Construction of Periphery Road (from boundary of Jahangir Tomb complex to connecting the bridge)

Layout Plan and Cross section of proposed project is provided as **Figure 3.1** and **Figure 3.2**.

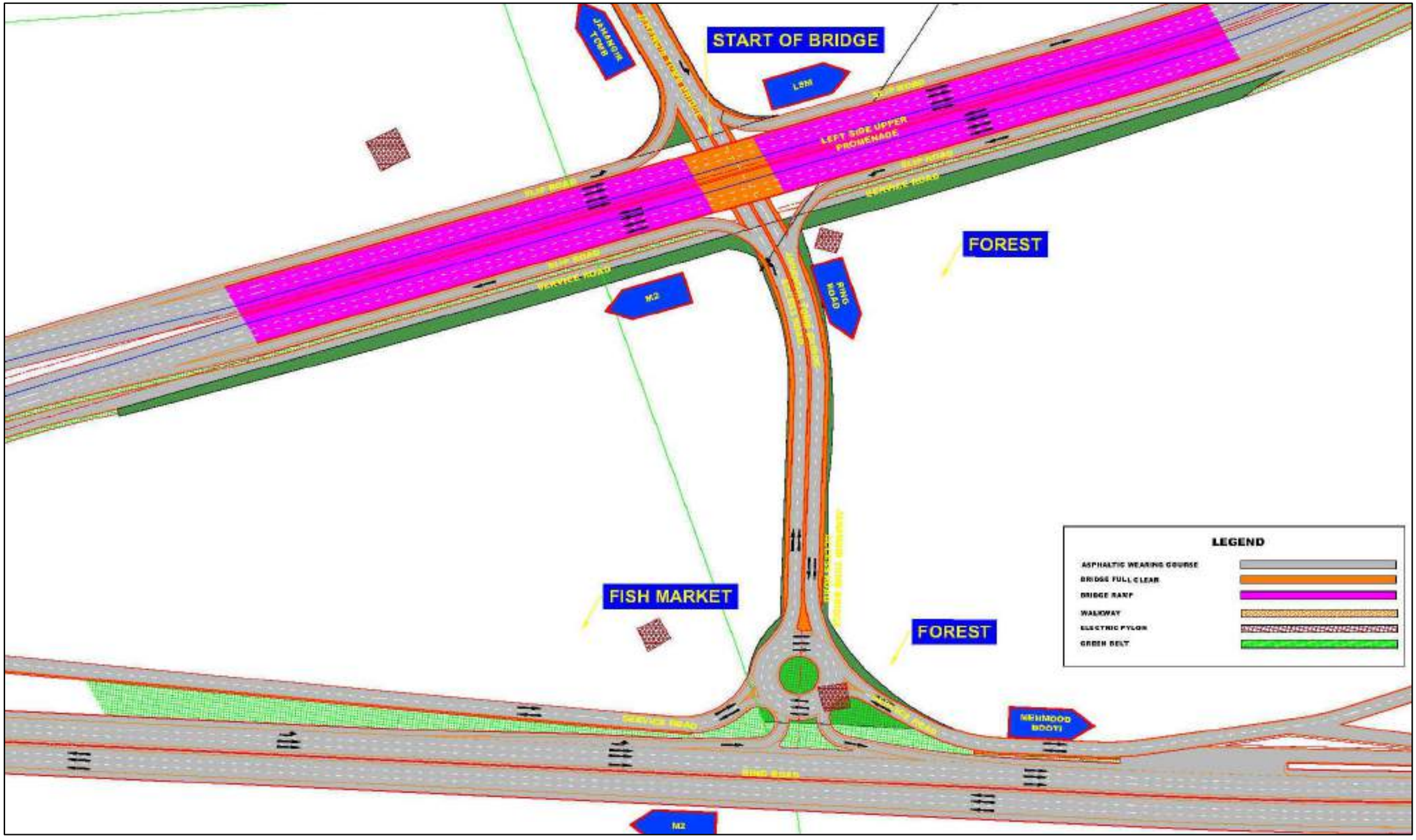

Figure 3.1: Layout Plan of Proposed Bridge

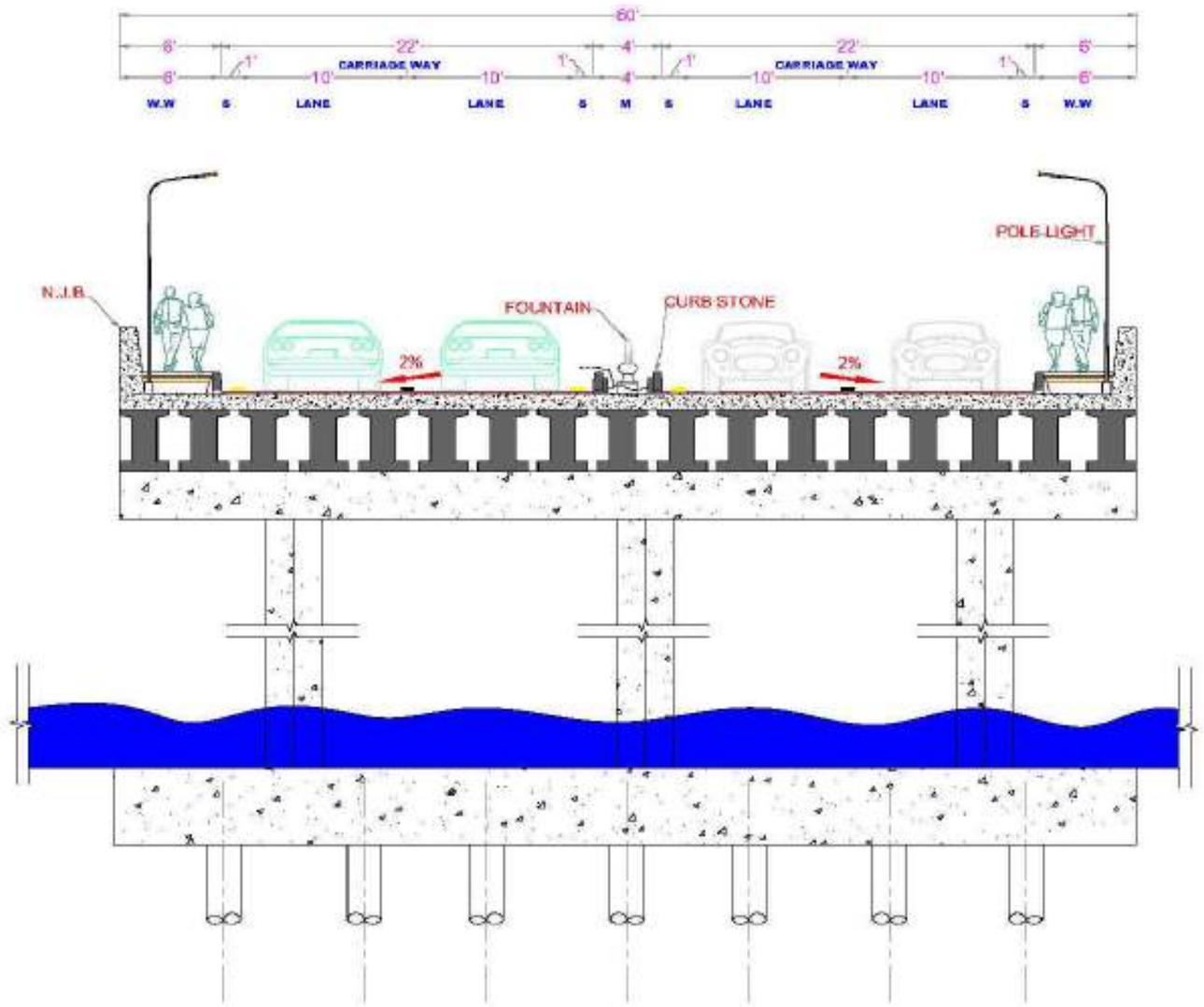

Figure 3.2 (a): Cross section of Bridge

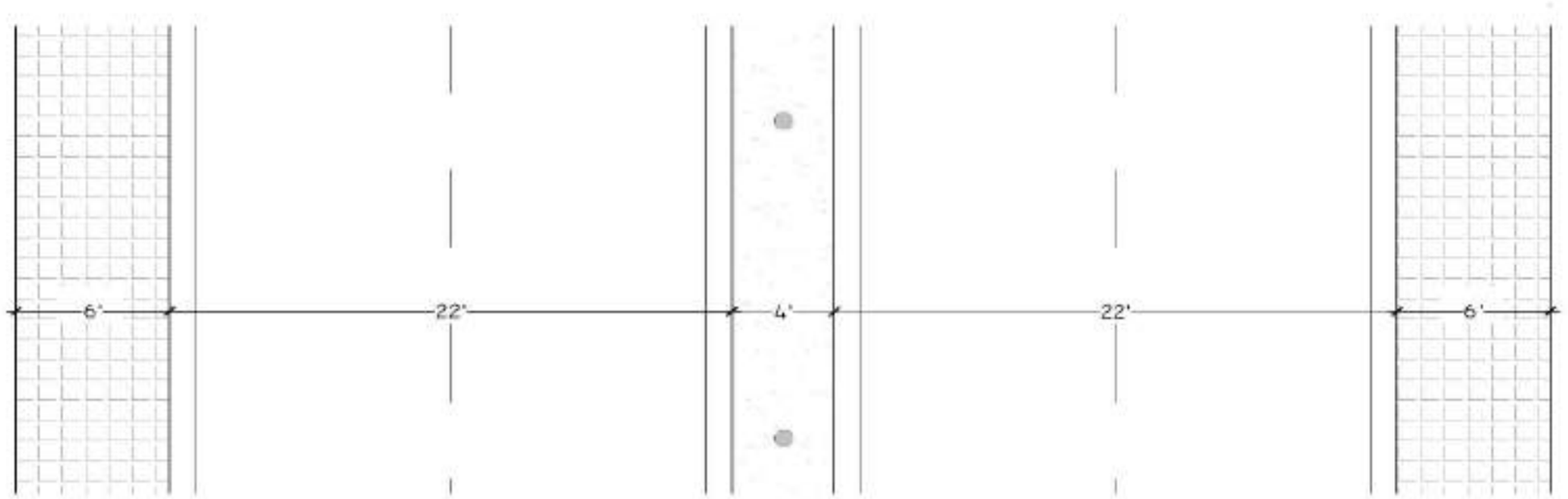

Figure 3.1 (b): Cross section of Bridge

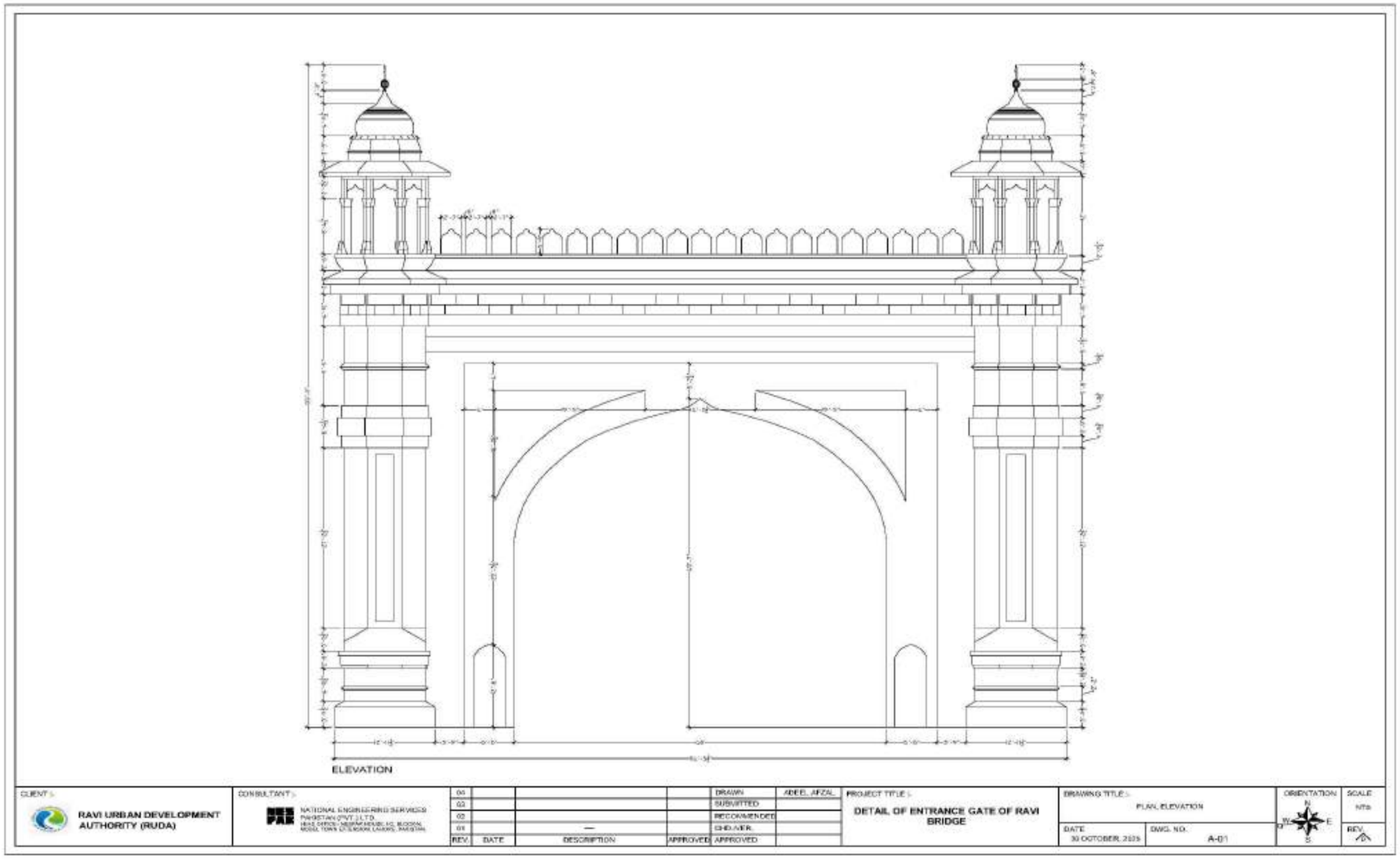

Figure 3.3: Cross section of Ravi Bridge Gateway



Figure 3.4: Prospective View of Jahangir's Tomb Access Bridge

3.8 CONSTRUCTION MATERIALS

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.

3.9 CONSTRUCTION ACTIVITIES AND REQUIRED MACHINERY

Construction activities involve following:

- Earth work (clearing of vegetation/ trees and top soil);
- Roadwork (Levelling, preparation of sub grade, sub base, base and wearing course); and
- Structure works.

The list of the machinery and the equipment required for the proposed project is provided in **Table 3.1.**

Table 3.1: Machinery and Equipment Requirement

Sr. No.	Type of Machinery/ Equipment	Sr. No.	Type of Machinery/ Equipment
1	Bulldozer	12	Rollers
2	Excavator	13	Tandem
3	Dump Trucks	14	Vibratory Combination Rubber Mounted Tandem Roller
4	Grader	15	Crane
5	Grader with Scarifier	16	Beam Launching Truss
6	BackHoe	17	Piling Equipment
7	Water Tanker	18	Vibrator for Concrete
8	Front End Loader	19	Road Marking Machine
9	Paver	20	Concrete Batching Plant
10	Power Broom	21	Asphalt Premix Plant
11	Bitumen Pressure Distributor	22	Laboratory with Equipment

3.10 CONSTRUCTION CAMPS

Camp site will be selected keeping in view the availability of adequate area for establishing camp site, including parking areas for machinery, store and workshop, access to communication and local markets, and an appropriate distance from sensitive areas in the

vicinity. Keeping in view the following criteria guidelines, the Contractor has to identify the construction camp site before start of the construction activities:

- There should be no resettlement issue for the location of the camp;
- Camp site should be away from the residential areas and sensitive receptors;
- Selection of site for construction camp shall be near the project area having proper access to the nearby main/link road;
- The camp must be located in a place where the drainage from and through the camp 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.

3.11 WORKFORCE REQUIREMENTS

Tentative workforce required for proposed project during construction phase will be about 100 workers/employees. Unskilled labor should be hired locally.

3.12 SOURCE OF WATER

Contractor will be responsible to arrange water for construction works. However, it is supposed that water tanks will be used by the contractor on the site for construction activities.

3.13 WATER REQUIREMENT

The water consumption for construction phase is estimated to be 4,000 liters/day for 100 workers during construction phase of the proposed project.

3.14 WASTEWATER GENERATION AND TREATMENT MECHANISM

The wastewater generation is estimated to be 3,200 liters/day for 100 construction workers during construction phase of the proposed Project[2]. Temporary toilets with cesspit will be adequately installed and treated periodically, and after the completion of work, the ground conditions will be restored.

3.15 SOLID WASTE

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

The solid waste generation is estimated to be 60 kg/day for 100 construction workers during construction phase of the proposed Project[3].

3.16 POWER REQUIREMENT / POWER SOURCE

The main source of electricity/electric power during construction phase will be the nearest grid. The source of power for operation phase will be Water & Power Development Authority (WAPDA).

[3] Source: Estimated solid waste generation rate in the study area is about 0.6 kg/person/day (https://www.lwmc.com.pk/uc-plan.php).

4. DESCRIPTION OF ENVIRONMENT

4.1 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 with respect to physical, biological and socio-economic aspects. The Study Area of the proposed Project is selected as 50 m from project boundary 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, field observations and surveys, conducted specifically for this project have been analysed for this study. 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. Various questionnaires and checklists were utilized as a tool for baseline data collection during field visit.

4.2 PHYSICAL ENVIRONMENT

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

4.2.1 Topography

Lahore is generally flat and slopes towards south and south-west at an average gradient of 1:3000. The general height varies from 150 to 200 meters above the mean sea level (MSL). It is divided into two parts i.e. the low-lying area along River Ravi and the comparatively upland area in the east, away from Ravi. The low lands are generally inundated by the river water during intense rainfall events.

The Topography Map of the Study Area is shown as **Figure 4-1**.

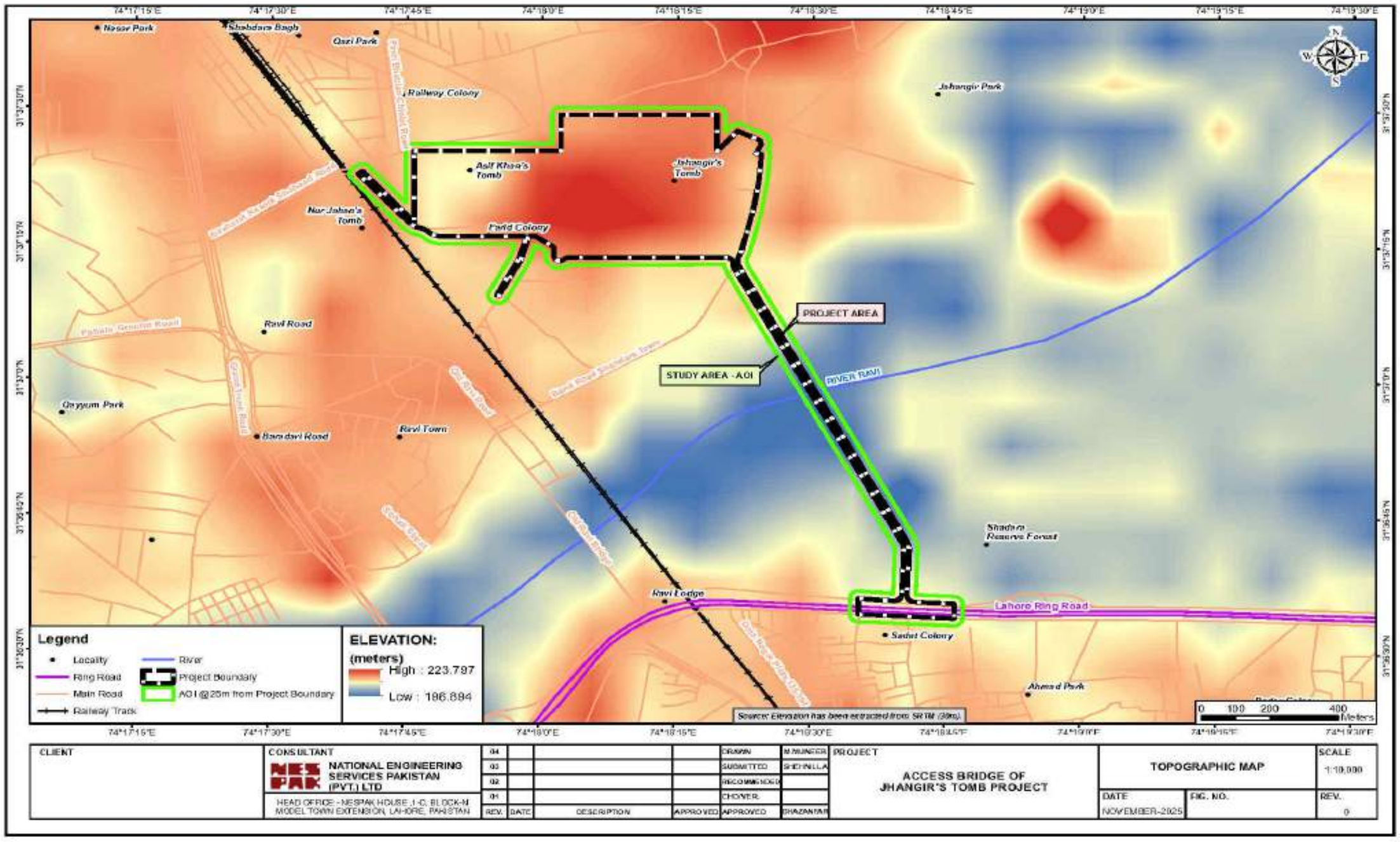

Figure 4.1: Topography Map of the Study Area

4.2.2 Geology

Lahore city lies on the alluvial plain called Bari Doab[4]. Bari Doab is a part of the Indo-Gangatic alluvial plain formed by the Indus River and its tributaries. It is bounded by Ravi and Chenab rivers in the northwest and west, and Sutlej River in the Southeast. A northeastern boundary of Doab lies near the foothills of the Himalayan Ranges.

The Bari Doab is covered by quaternary alluvium which overlies semi-consolidated tertiary rocks or metamorphic and igneous rocks of Precambrian age. Except for a small area in the northeastern art of Doab where basement rock was encountered no information is available at present regarding the distribution of tertiary and Precambrian rocks in the Doab.

The thickness of alluvial deposits in Lahore is reported to be more than 300 meters. These alluvial deposits are underlain by the basement rocks of the Indian shield. The alluvial deposits mainly consist of sands, with intercalation of silt and clay layers of varying thickness. Project site is located in meander belt deposits.

The project area does not have any valuable minerals. Although, scientific in depth, investigations haven't been carried out, yet the surveys conducted have failed to discover any minerals worth the name till to-date.

The only minerals worth to value are kallar and kankar[5] in the district Lahore. Kallar is the grey powdery substance collected and taken out from the old village sites and other deserted abodes in the district. It is used for the manufacture of crude saltpeter and also as manure for the top dressing of young cotton and tobacco plants (no longer in the line of extensive cultivation). With the passage of time the demand for Kallar diminished and its use as a trading commodity is on the decline. Kankar is used for metaling Roads and its smaller particulars are burnt for lime. It is a kind of limestone gravel and is found, after being dug out at a depth varying from one to eight feet, in many parts of the district particularly the uplands. However; the project area does not have any valuable minerals.

4.2.3 Soil

The soil in the Lahore District is cohesion less and is of alluvial type deposited by Ravi River. The types of soil layers that are present below the ground level includes: silt, silty clay, silty sand, poorly graded sand with silt and lean clay. **Figure 4-3** shows the Soil Map of the Study Area.

[4] Kadwai, S.U. and Siraj, A. (1964), "*The Geology of Bari Doab, West Pakistan",* WAPDA Water and Soil Investigation Division (Bulletin No. 8)

[5] Malik, A. (2015). Geotechnical statistical evaluation of Lahore Site Data and Deep Excavation Design

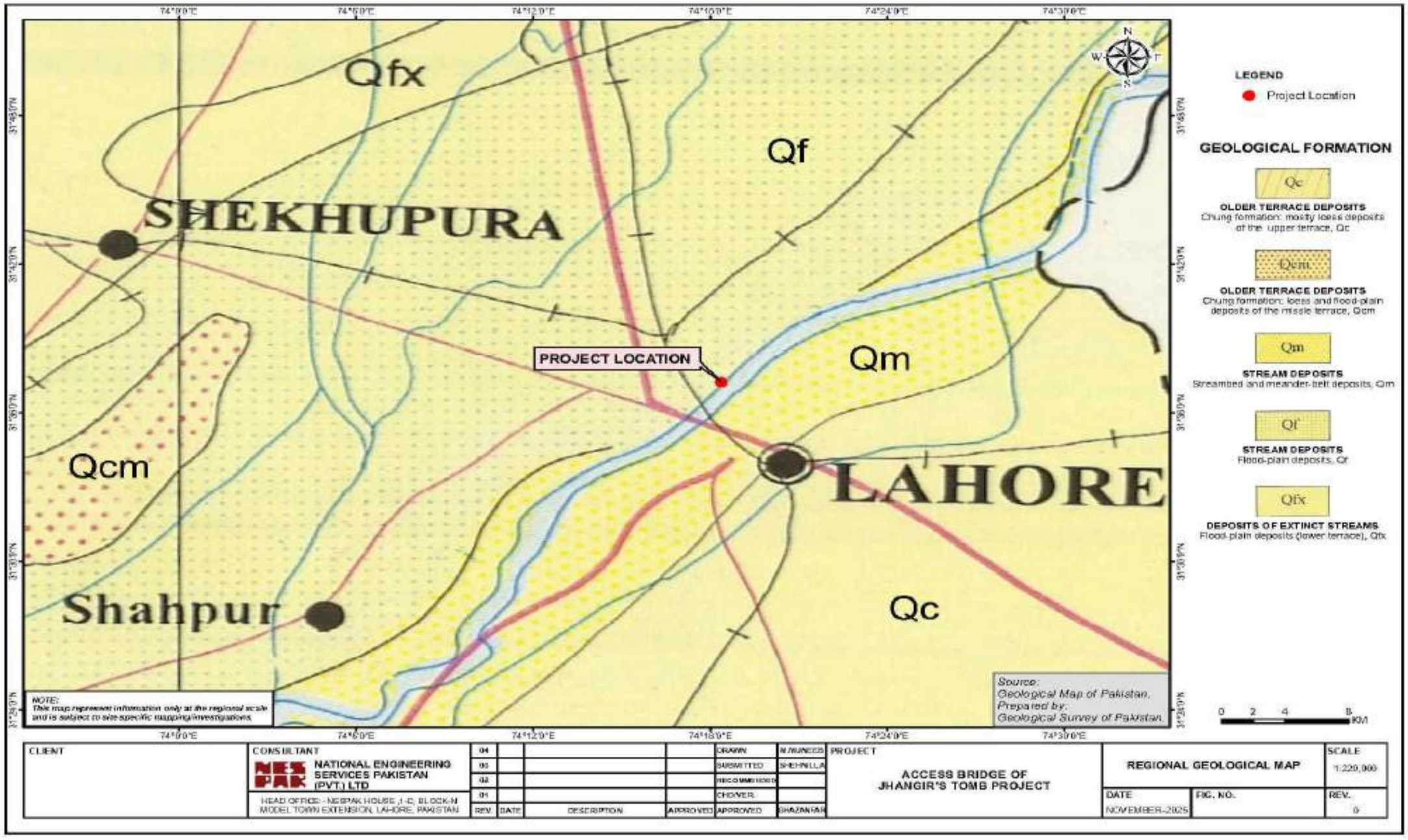

Figure 4.2: Regional Geological Map of the Study Area

4.2.4 Seismology

The project area lies in the Punjab Plain which shows low to moderate level of seismicity. 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 the thick alluvial deposits.

The project region has been subjected to severe shaking in the past due to earthquakes in the Himalayas. The prominent active fault; nearest to Lahore, is the Main Boundary Thrust (MBT) which extends approximately 180 km to the northeast along the Himalayan front. Over the past destructive earthquakes have been documented along this fault emphasizing its significance in seismic activity in the region. The most recent is the October 08, 2005 Kashmir earthquake, which caused heavy devastation in Kashmir and adjoining areas of KP. The destructive earthquakes of 1827 and 1905 were felt in Lahore wherein some important historic buildings were reportedly damaged.

According to Building code of Pakistan, 2007 issued by Government of Pakistan, the project area falls in Seismic Zone 2A of Pakistan (low to moderate damage) with Peak Ground Acceleration (PGA) from 0.08 to 0.16 g. **Figures 4-3** shows the seismic zoning map of Project Area.

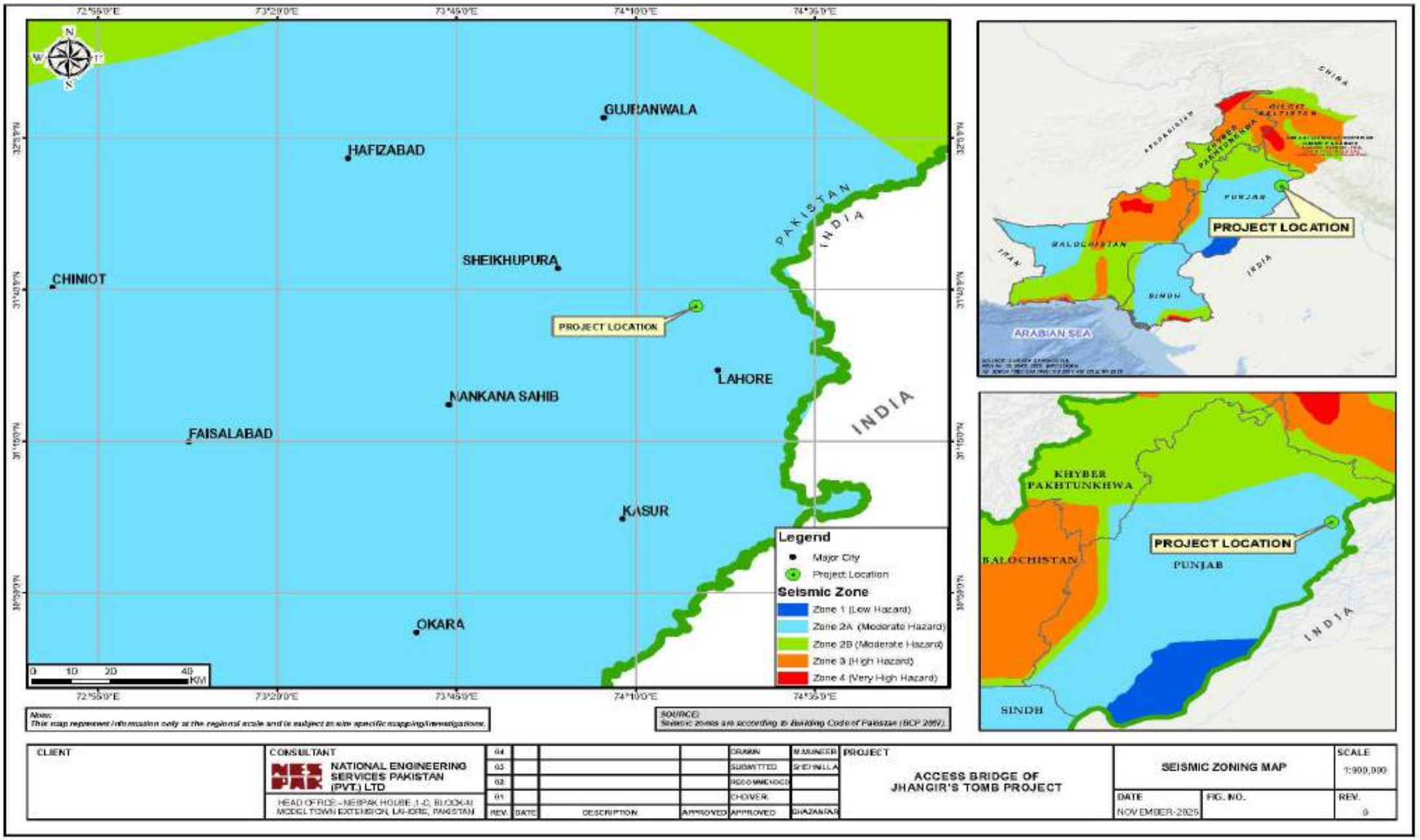

Figure 4.3: Soil Map of the Study Area

4.2.5 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 Lahore) is discussed below.

Temperature

Figure 4-4 shows the graphical presentation of average low and high temperatures in the Study Area for the year 2010-2025.

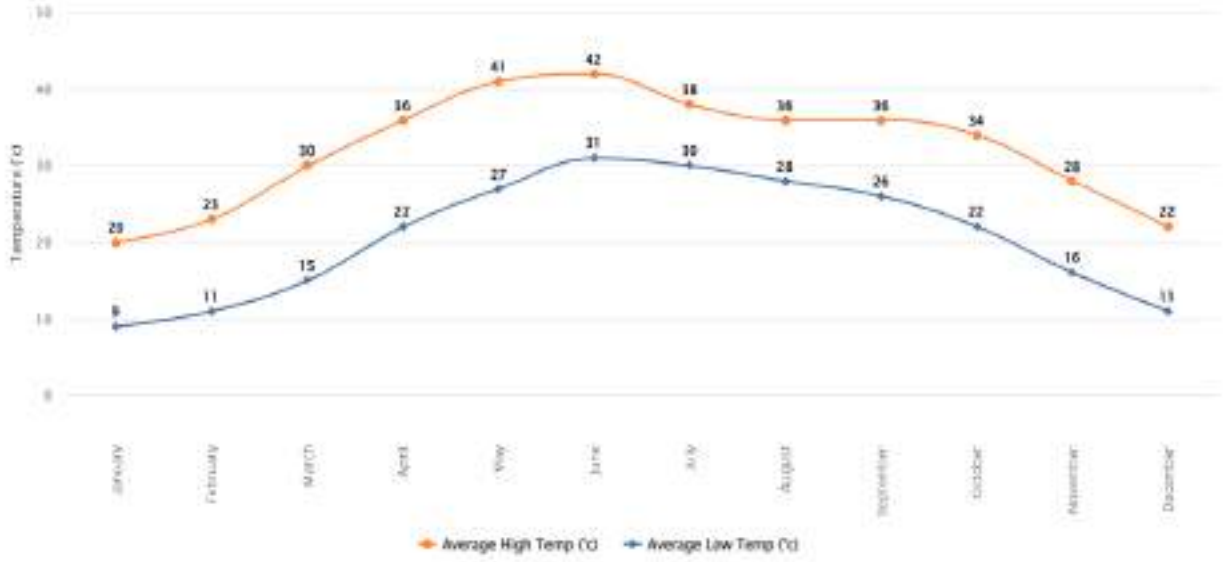

Figure 4.4: Mean Maximum and Minimum Temperature in Lahore (2010-2025)[6]

Precipitation (Rainfall)

Figure 4-5 shows the mean monthly precipitation in the study area for the year 2010-2025.

[6] Source: Lahore Annual Weather Averages - Punjab, PK (worldweatheronline.com)

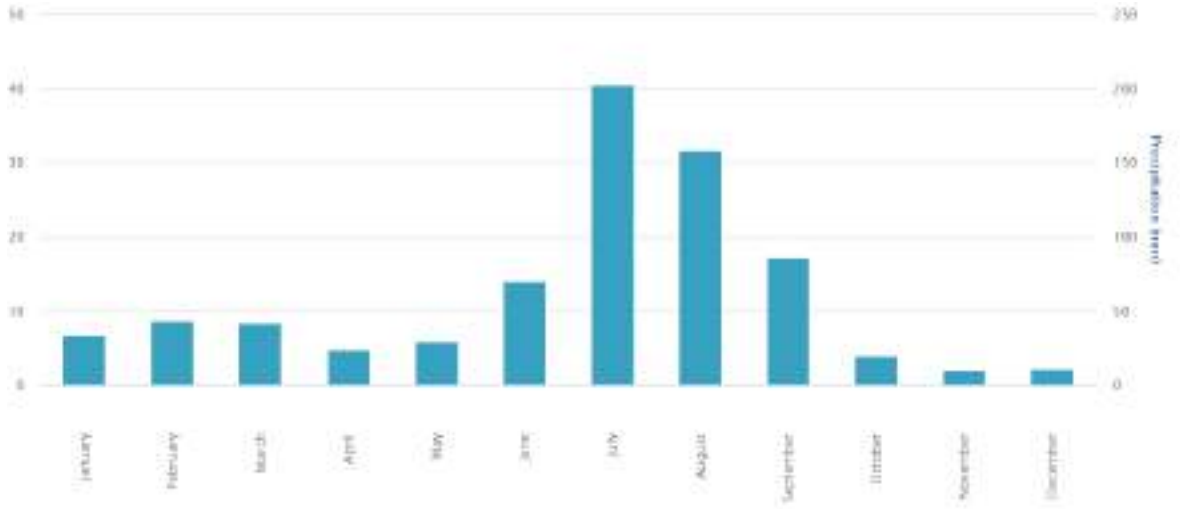

Figure 4.5: Average Rainfall in Lahore (2010-2025) [7]

Relative Humidity

A mean daily data of humidity on a monthly basis from 2010 to 2025 is shown in **Figure 4-6**.

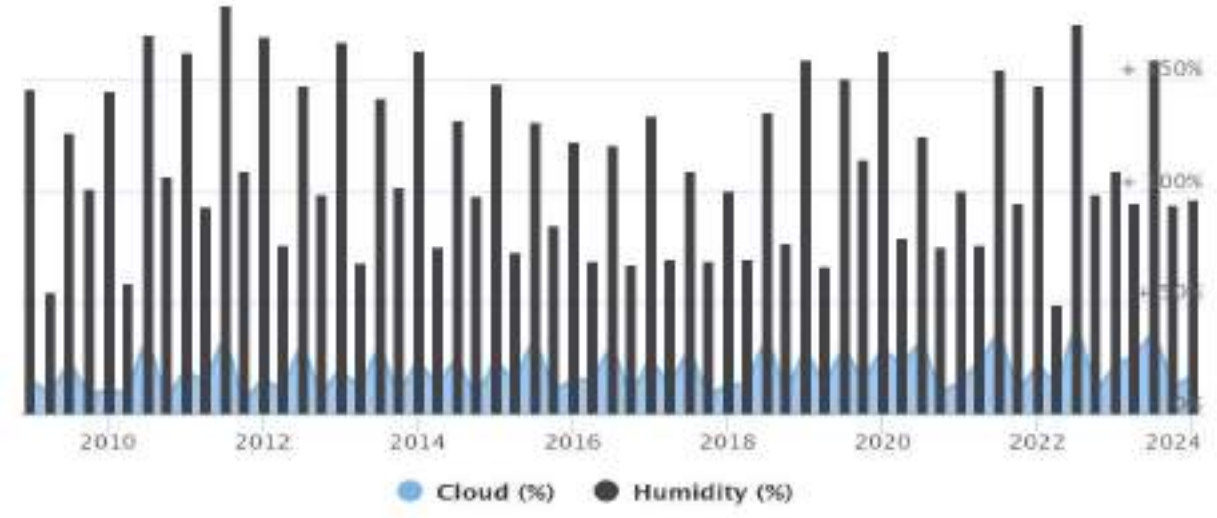

Figure 4.6: Mean Relative Humidity in Lahore (2010-2025)[8]

Wind Speed and Wind Gust

Figure 4-7 depicts average wind speed on a monthly basis in the study area from year 2010 to 2025.

[7] Source: Lahore Annual Weather Averages - Punjab, PK (worldweatheronline.com)
[8] Source: Lahore Annual Weather Averages - Punjab, PK (worldweatheronline.com)

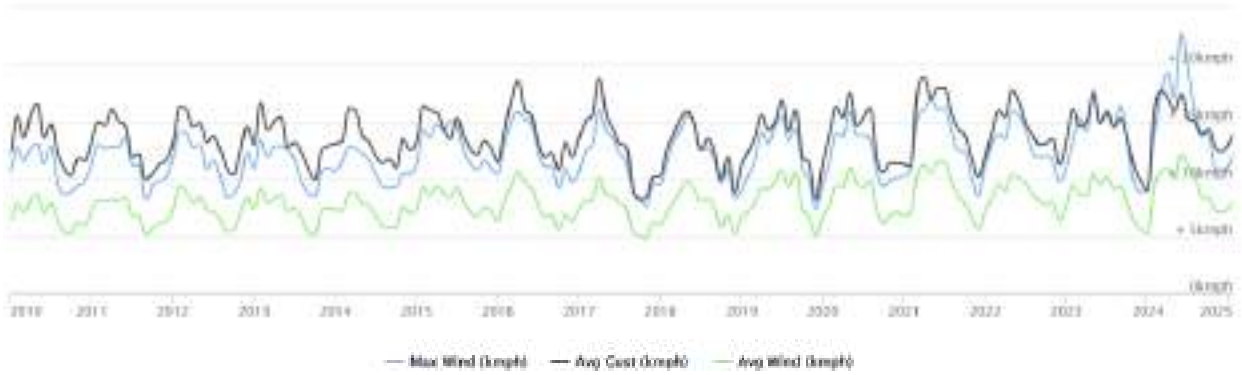

Figure 4.7: Average Wind Speed and Gust in Lahore (2010 to 2025)[9]

4.2.6 Surface Water Hydrology

The main surface water resources in the Lahore city are Ravi River, Lahore Branch Canal, Khaira Distributary and the BRBD canal.

Ravi River

The Ravi River is a trans-boundary river crossing North Western India and Eastern Pakistan. In the past, River Ravi was the main source for recharge of groundwater aquifer, but due to increasing water demand and diversion of its water in India, it can no longer meet the required aquifer recharge of Lahore city. The quality of water of Ravi River has a direct impact on quality of water present in the adjacent aquifer.

BRBD Canal

BRBD canal flows in the east of Lahore, from North to South. It crosses Grand Trunk Road, at a distance of about 6 kilometers; from Lahore Ring Road. The Canal takes off from Upper Chenab Canal (UCC) at Bambanwala, itself off takes from Marala Barrage with full discharge. The BRBD is about 175 kilometer long. It is an earthen channel except a short lined central segment. Although design capacity at head is 7,260 cusecs, the maximum discharge is around 4,600 cusecs. Among others, one of the reasons of limiting discharge to 4,600 cusecs is the limited design capacity of Syphon for crossing of River Ravi. The Canal is brick lined from RD 260 to RD 373 and crosses the River Ravi and GT road at RDs 281 and 325[10] respectively.

Lahore Branch Canal

The other surface water source is the Lahore Branch Canal (LBC), which takes off from BRBD canal at about RD 230. LBC is an open channel with lining at both sides. Due to its limited discharge of about 400 cusecs, this canal cannot be considered as surface water source for Lahore, even to draw 100 cusec discharge.

[9] Source: Lahore Annual Weather Averages - Punjab, PK (worldweatheronline.com)

[10] Final Feasibility Study Report on Lahore Water and Wastewater Management Project-February, 2019

The surface water hydrology map of the study area is shown in **Figure 4-8**.

4.2.7 Ground Water

Presently, main clean water source in Lahore is ground water that meets all the requirements including domestic, industrial and commercial, which is being extracted through tube wells installed in the city.

Water and Sanitation Agency (WASA) is the competent authority for the planning, designing, development and maintenance of water supply, sewerage and drainage system in the study area. WASA is responsible for:

- Rehabilitation and augmentation of the existing system.
- Operation and maintenance of water supply, sewerage & drainage system.
- Undertaking bulk production, filtration/treatment, transmission and retail distribution of purifying water.
- Collection, pumping, treatment & disposal of sewage & industrial waste.
- Enforcement against defaulters and unauthorized connections etc.
- Short term and long-term planning for tapping additional water sources & its implementation to meet water supply and sewerage demand projected.

WASA Lahore maintains a wide network of about 3,200 Km pipelines for water supply providing water to the residents of Lahore city including Project Area. WASA have installed 316 tube wells in the city for provision of pure and hygienic water to the residents. Average daily water supply to the Lahore city is about 329 MGD through 610,000 water connections.[11]

4.2.8 Drainage System

There are total eight (08) major drains in the Lahore city i.e. Sattu Kattla drain, Lakshami Drain, Suk Nehar Drain, Upper Chota Ravi Drain, Lower Chota Ravi Drain, Siddique Pura Drain, Cantonment Drain and Shahdara Drain along with 76 minor drains which finally fall into aforementioned major drains. At present, all these drains collect wastewater from different areas of Lahore and finally fall into River Ravi and greatly deteriorated the quality of river water. **Figure 4-12** shows the major drains in the study area.

[11] https://wasa.punjab.gov.pk/infodesk_watersupply

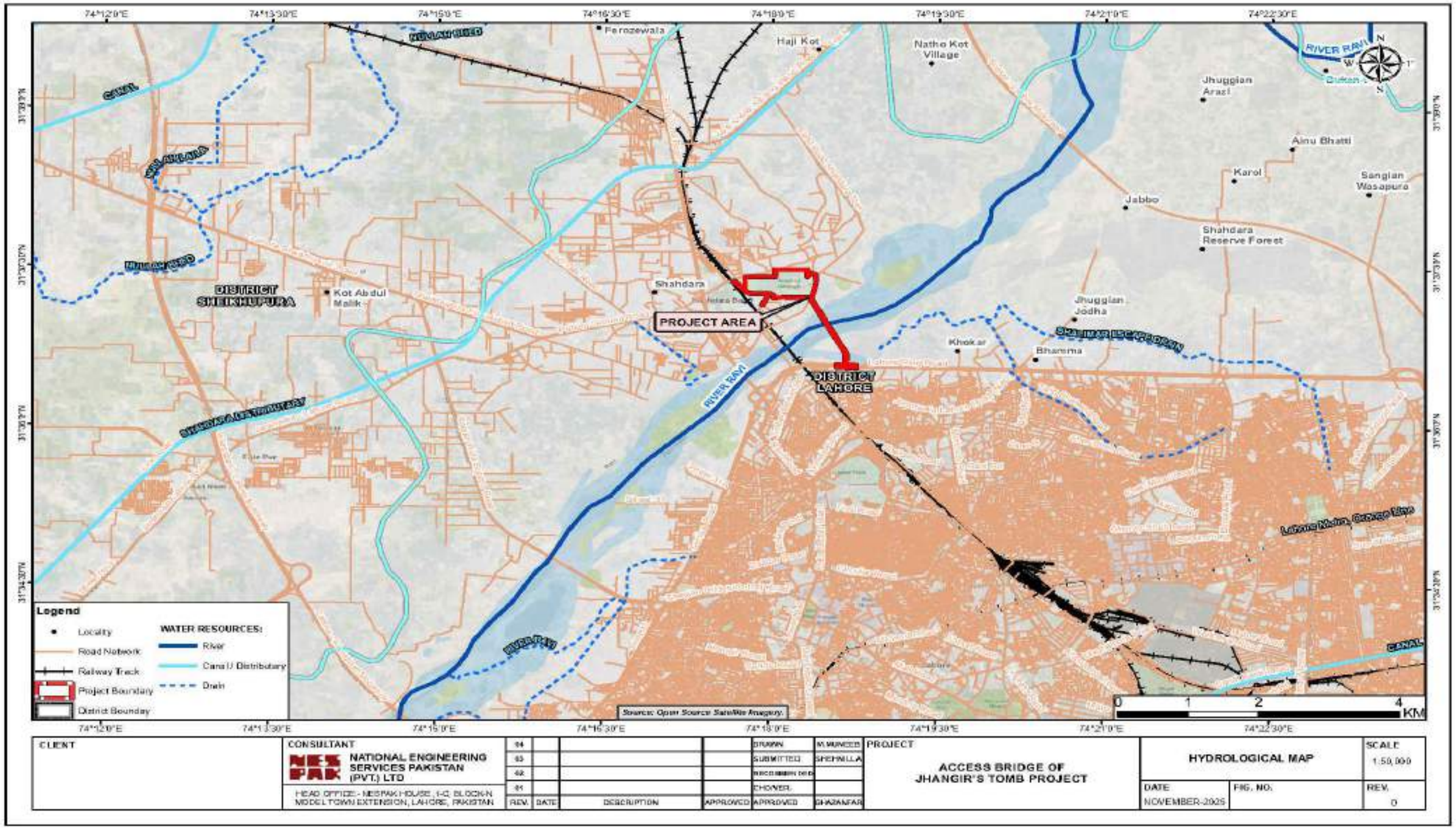

Figure 4.8: Surface Water Resources Map of the Study Area

4.2.9 Floods

Floods in the Lahore District take place due to heavy rains in the monsoon season causing serious damage to life and property. Flows in the river have a great temporal variation, which results from structural interventions from Indian side and Rainfall pattern. The flow in Ravi River is measured by gauging station installed on Railway Bridge near Shahdara. Monthly averages flow from October to March are very less. The average flow in these six months is 46.4 cumecs[12]. The maximum average flow occurs in the months of July, which is 546 cumecs. While minimum average flow is in December, which is 40.4 cumecs.

In 2025, the Ravi River, along with the Sutlej and Chenab, experienced severe, record-breaking monsoon flooding in Pakistan's Punjab province during August and September, triggered by intense rainfall and dam releases from India, affecting millions, causing massive displacement, infrastructure damage, and significant loss of life, with some areas seeing the worst flooding in decades.

According to Indus Waters Treaty in 1960, right of Ravi River belong India. India uses the water of Ravi for the purpose of Irrigation and generation of electricity. Before entering into Pakistan, Madhopur Headwork is present in India, with spillway capacity of 17,750 cumecs, further 24 km upstream is the Ranjit Sagar Dam (Thein Dam), having spillway capacity of 20,678 cumecs (CWC India). The Ranjit Sagar Dam was put into operation in 2011. This massive storage, if released at the rate of maximum spillway capacity, can create a huge flood.

4.2.10 Solid Waste

Lahore Waste Management Company (LWMC) is responsible to ensure efficient collection, transportation, recovery, treatment and disposal of solid waste generated in the study area. LWMC renders following sanitation services throughout the Lahore city including study area:

- Collection of waste by placement of containers & bins and through door to door collection;
- Collection and removal of waste to the approved disposal sites;
- Manual / Mechanical sweeping of main and arterial roads, streets and squares with vacuumed vehicles; and
- Mechanical washing.

LWMC has placed waste storage containers at different points in the study area, waste collected by pickup from these containers and unloaded into nearby compactor or transfer station. Estimated solid waste generation rate in the study area is about 0.6 kg/person/day [13].

However, from the field survey, it was observed that the situation of solid waste dumping/collection in the study area is not satisfactory as waste was dumped as open heaps along the road sides and in open plots by the public.

[12] *'Safe Passage of Riverine Flood from Highly Urbanized City: A Case Study of Lahore City in Pakistan'. Atiq et al., J Civil Environ Eng 2018, 8:4*

[13] https://www.lwmc.com.pk/uc-plan.php

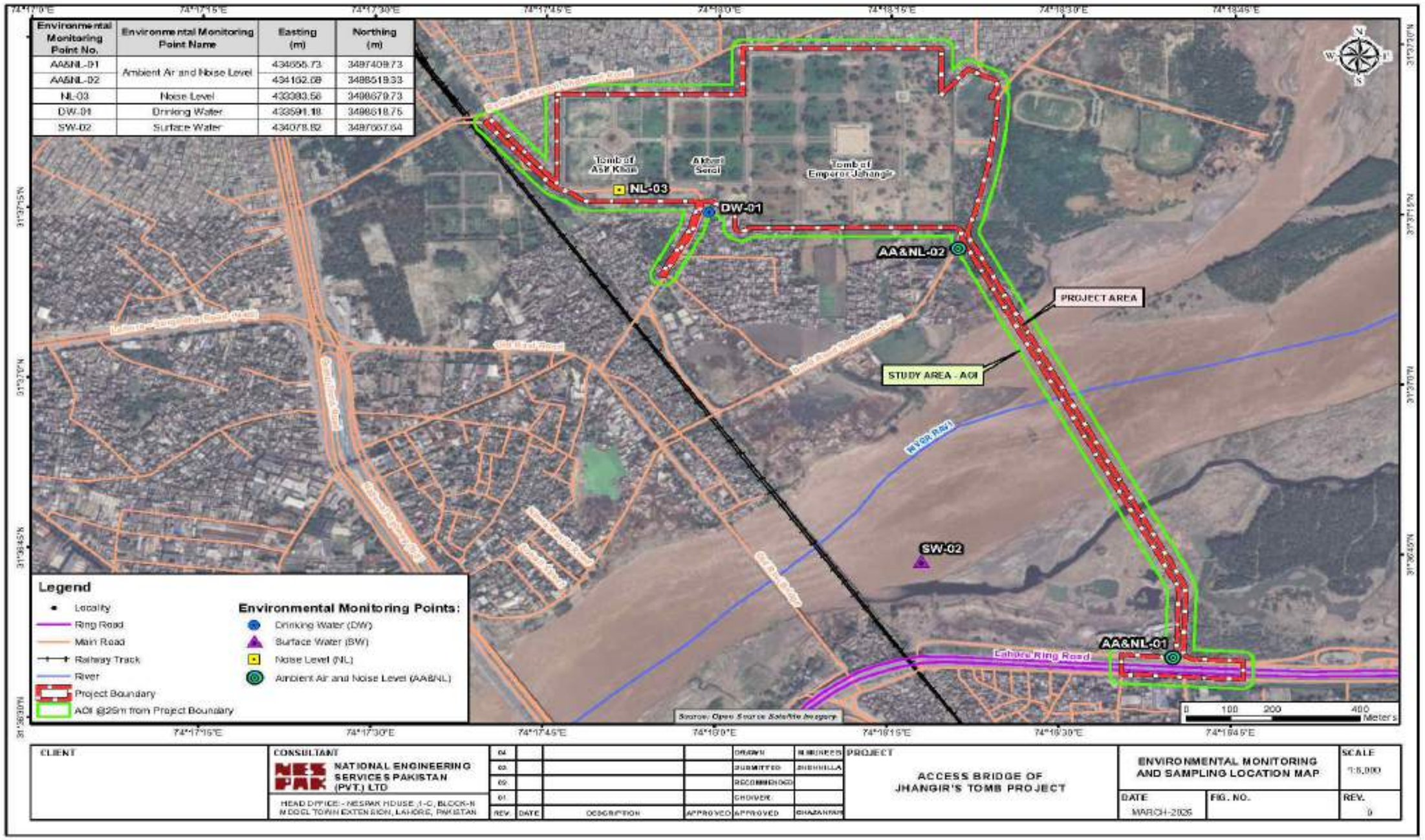

Figure 4.9: Sampling Location Map of Environmental Monitoring

4.3 ENVIRONMENTAL MONITORING, SAMPLING AND TESTING

The environmental monitoring of parameters like ambient air quality, noise level, surface water and groundwater help us to analyze the prevailing environment conditions in and around the study area, and to protect it from any adverse activities due to the proposed Project implementation.

4.3.1 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 at Project Site. 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 average concentrations of ambient air pollutants are given in **Table 4-2**. A pictorial view of monitoring is shown in **Plate 4-1**.

Table 4-1: Average Concentration of Ambient Air Pollutants

Parameter	Average Concentration of Pollutants		Limits as Per PEQS
	A&N 1	A&N 2	
Carbon Monooxide(CO)	2.73 µg/m³	3.39 mg/m	5 mg/m³ (8 hours)
Sulfur Dioxide (SO_2)	**151.62 µg/m³**	**162.71 µg/m³**	120µg/m³
Ozone (O_3)	3.33 µg/m³	1.25 µg/m³	130 µg/m³ (1 Hour)
Oxides of Nitrogen as NO	31.96 µg/m³	**41.91 µg/m³**	40 µg/m³
Oxides of Nitrogen as NO_2	76.80 µg/m³	**106.57 µg/m³**	80 µg/m³
Particulate Matter $PM_{2.5}$*	**212 µg/m³**	**210 µg/m³**	35 µg/m³
Particulate Matter PM_{10}*	**292 µg/m³**	**303 µg/m³**	150 µg/m³
Suspended Particulate Matter (SPM)*	**504 µg/m³**	**513 µg/m³**	500 µg/m³

µg/m³: micrograms per cubic meter **PEQS:** Punjab Environmental Quality Standards

Table 4.1 indicate that maximum parameters are significantly exceed the permissible limits of Punjab Environmental Quality Standards (PEQS), 2016 at the Project site including Particulate Matter ($PM_{2.5}$, PM_{10}, and Suspended Particulate Matter - SPM), raising serious concerns about air quality.

4.3.2 Noise Level

Noise level monitoring was carried out in the study area. The average concentrations of noise level are given in **Table 4-2**.

Table 4-2: Average Concentration of Noise Level

Averaging Time	PEQS, 2016 Commercial Area	NL-01 Average Value in dB (A)	NL-02 Average Value in dB (A)	NL-02 Average Value in dB (A)
Day-time	65	72	71	67
Night-time	55	67	64	61

The above results show that the average noise values at day & night times are exceed the permissible limits of PEQS in the Study Area due to high traffic.

4.3.3 Drinking/Ground Water Quality

Drinking water samples were also collected in the study area and were analyzed for physical, chemical and microbiological parameters. **Table 4-4** shows the results of ground water analysis. A pictorial view of monitoring is shown in **Plate 4-1**.

Table 4-3: Results of Ground Water Analysis

Sr. No.	Parameter	Unit	Test Results (Ground Water) GW-01	Punjab Standards for Drinking Water Quality, 2016
A.	**Physical and Chemical Analysis**			
1.	pH	-	7.67	6.5-8.5
2.	Odor	-	Non-Objectionable	Non-Objectionable
3.	Taste	-	Non-Objectionable	Non-Objectionable
4.	Color	Pt-Co	0	≤ 15 TCU
5.	Turbidity	NTU	0	< 5 NTU
6.	Total Hardness	mg/l	372	< 500 mg/l
7.	Total Dissolved Solids	mg/l	410	< 1000
8.	Chloride	mg/l	35	< 250
9.	Cyanide (Cn)	mg/l	0	≤ 0.05
10.	Fluoride (F)	mg/l	<0.11	≤ 1.5
11.	Nitrite	mg/l	0	≤ 3
12.	Nitrate	mg/l	2	≤ 50
13.	Phenolic Compound	mg/l	0	-
14.	Residual Chlorine	mg/l	0	0.2-0.5
15.	Aluminum (Al)	mg/l	<0.005	≤ 0.2
16.	Cadmium	mg/l	<0.006	0.01
17.	Copper	mg/l	<0.164	2
18.	Chromium	mg/l	<0.004	≤ 0.05
19.	Mercury	mg/l	<0.001	≤ 0.001

Sr. No.	Parameter	Unit	Test Results (Ground Water) GW-01	Punjab Standards for Drinking Water Quality, 2016
20.	Antimony (Sb)	mg/l	<0.005	≤ 0.005
21.	Nickel	mg/l	<0.002	≤ 0.02
22.	Zinc	mg/l	0.028	5.0
23.	Arsenic	mg/l	<0.005	≤ 0.05
24.	Barium	mg/l	<0.0035	0.7
25.	Boron	mg/l	<0.02	0.3
26.	Manganese	mg/l	<0.015	≤ 0.5
27.	Lead	mg/l	<0.005	≤ 0.05
28.	Selenium	mg/l	<0.01	0.01
B. Microbiological Analysis				
1.	Total Coliforms	CFU/ 100ml	Absent	Must not be detectable in any 100ml Sample
2.	Faecal Coliforms	CFU/ 100ml	Absent	

mg/l: Milligram per Liter **BDL: Below** Detectable Limit

The above table illustrates that all physical and chemical parameters are well within permissible limits of PEQS Environmental Quality Standards, 2016.

4.3.4 Surface/ Wastewater Quality

The surface water quality was measured at two (02) different locations. The water samples were analyzed for the parameters specified in PEQS. The detailed wastewater results are given in **Table 4-5**.

Table 4-4: Surface Water/Wastewater Quality Monitoring

Sr. No.	Parameter	Test Results		PEQS, 2016
		Location 1 (SW)	Location 2 (WW)	
1.	pH	7.33	8.29	6-9
2.	Biochemical Oxygen Demand (BOD_5)	**328**	**158**	80
3.	Chemical Oxygen Demand (COD)	**615**	**298**	150
4.	Total Suspended Solids (TSS)	**342**	82	200
5.	Total Dissolved Solids (TDS)	483	660	1000
6.	Phenolic Compounds (as Phenols)	0	0	0.1
7.	Grease and Oil	04	07	10
8.	Chloride (Cl^-)	115	115	1000
9.	Fluoride (F^-)	0.31	0.28	10
10.	Cyanide (CN^-)	0	0	1.0
11.	An-ionic Detergents (as MBAs)	2.5	2.9	20
12.	Sulfate (SO_4^{2-})	25	54	600

Sr. No.	Parameter	Test Results		PEQS, 2016
		Location 1 (SW)	Location 2 (WW)	
13.	Sulfide (S^{2-})	0	0	1.0
14.	Ammonia (NH_3)	0	0	40
15.	Cadmium (Cd)	<0.006	<0.006	0.1
16.	Chromium (Cr)	<0.004	<0.004	1.0
17.	Copper (Cu)	0.165	0.165	1.0
18.	Lead (Pb)	<0.005	<0.005	0.5
19.	Mercury (Hg)	<0.001	<0.001	0.01
20.	Selenium (Se)	<0.01	<0.01	0.5
21.	Nickel (Ni)	<0.02	<0.02	1.0
22.	Silver (Ag)	<0.002	<0.002	1.0
23.	Total Toxic Metals	0.24	0.24	2.0
24.	Zinc (Zn)	0.030	0.035	5.0
25.	Arsenic (As)	<0.005	<0.005	1.0
26.	Barium (Ba)	<0.0035	<0.0035	1.5
27.	Iron (Fe)	0.0782	0.0920	8.0
28.	Manganese (Mn)	<0.015	<0.015	1.5
29.	Boron (B)	<0.02	<0.02	6.0
30.	Residual Chlorine (Cl_2)	0	0	1.0

It is evident from the monitoring results that all the parameters are well within prescribed limits of the PEQS, 2016. However, values of BOD and COD are exceeding the permissible limits.





Plate 4-1: A view of Monitoring at Project Site

Detailed environmental monitoring, sampling and testing reports have been provided as **Annex-II.**

4.4 LAND USE PATTERN

The land use of the study area consists of barren area, Surface water bodies, trees, built up area agriculture area and track/roads. **Figure 4-15** shows the Landuse Map of the study area, whereas, Land use statistics of the project area are summarized in **Table 4-5**. Pictorial view of land use is given in **Plate 4-2**.

Table 4-5: Land Use Statistics of the Project Area

Landuse Type	Area (acres)
Barren / Open Area	8.530
Builtup Area	3.034
Cultivated Land	0.173
Floodplain	0.868
Graveyard	4.002
Overhead Bridge	0.042
Park	0.171
River	1.448
Road / Track	7.138
Road Divider	0.446
Trees / Bushes	0.209



Plate 4-2: Landuse of the Study Area

4.5 ENVIRONMENTAL SENSITIVE RECEPTORS

Sensitive receptors are people/places more susceptible to the adverse effects of 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 environment and adopt necessary mitigation measures to minimize the impact. The major sensitive receptor has been identified within AOI of the proposed project is shown in **Figure 4-15**. Pictorial view of the sensitive receptors is given in **Plate 4-3**.



Plate 4-3: Sensitive Receptors in the Study Area

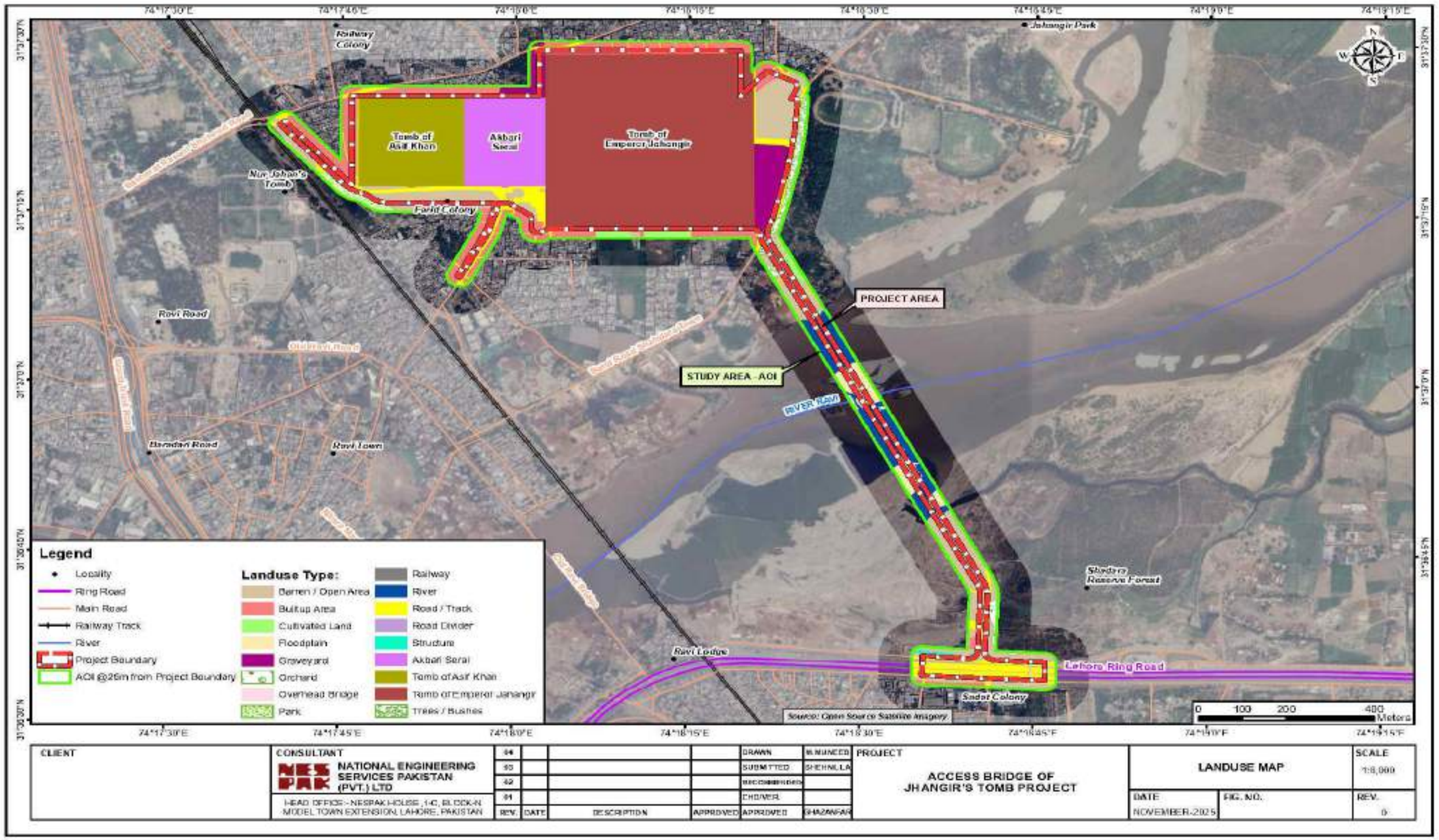

Figure 4.10: Land Use Map of the Study Area

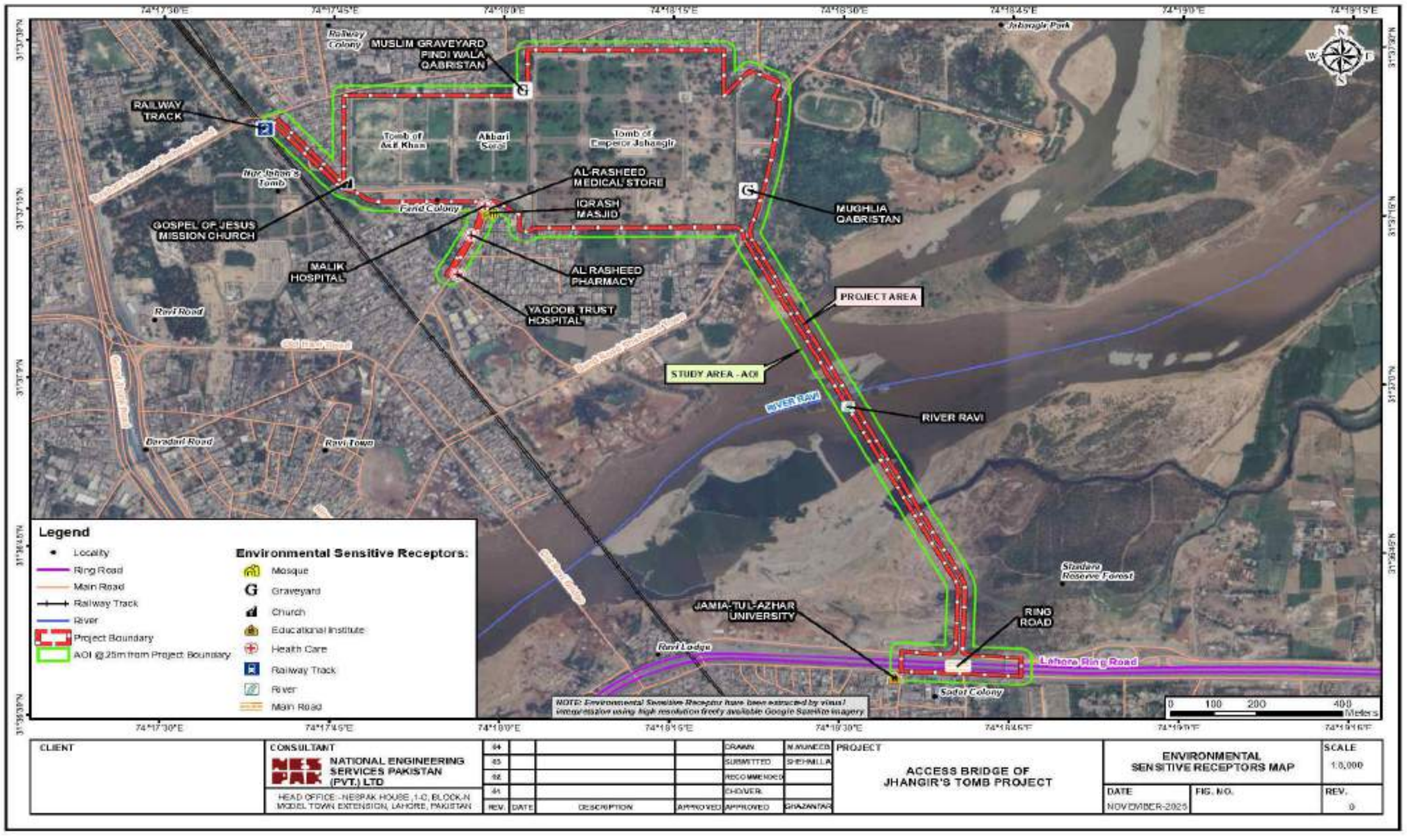

Figure 4.11: Sensitive Receptor Map of the Study Area

4.6 ECOLOGICAL ENVIRONMENT

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

4.6.1 Methodology

A comprehensive review of available literature was done to understand the ecological characteristics of the project area and its surroundings, including habitat types, flora, and fauna. The proposed alignment was assessed using both primary and secondary data sources.

A KMZ Map of the project area was analyzed using Google Earth to identify forests, water bodies, and environmentally sensitive features within the project right-of-way (ROW). The Major part of ROW of the proposed bridge passes through Shahdara Reserve Forest. A reconnaissance survey of the Shahdara Reserve Forest and other part of ROW was carried out jointly with the RUDA team to assess site conditions, riverine ecology, and riparian habitats.

Previous studies on flora and fauna were reviewed, and consultations were held with stakeholders from the Forest Department and Environmental Protection Agency (EPA), to obtain updated information. The survey covered ecosystem sensitivity, vegetation cover, and faunal presence. The number of trees within the ROW and Corridor of Impact (COI) was estimated using GIS techniques.

4.6.2 Habitat

The habitat within the project area is modified, with natural riverine vegetation largely replaced by irrigated plantations. However, scattered patches of native riverine species such as Kahi (Saccharum spontaneum) and Kana (Saccharum munja) still exist in some area near the river bed. The ecological condition of the Ravi River has deteriorated due to anthropogenic pressures, including riverbed excavation, bank erosion, urbanization, industrial discharge, and reduced freshwater inflows under the Indus Waters Treaty. Part of the Project area consists of urban sprawl and industrial area. However, the Shahdara Reserve Forest falls in ROW of the Project, the description of which is given as under:

4.6.3 Shahdara Reserve Forest

The Shahdara Reserve Forest, covering an area of 1,615 acres, was declared as Reserve Forest under Punjab Government Notification No. 115 dated 6 March 1879. Of this area, approximately 682 acres lie within the River Ravi bed. For management purposes, the Forest is divided into 15 compartments and two blocks: Shahdara Block (678 acres) and

Karol Block (937 acres). The proposed bridge alignment passes through the Shahdara Block.

An afforestation and landscaping project titled “Afforestation and Landscaping of Shahdara Reserve Forest Land near Mahmood Booti Landfill” was implemented in the Karol Block during 2014–2016. The project aimed to enhance biomass production, establish a carbon sink, and provide environmental benefits such as air purification and dust filtration. This plantation now serves as an important biological reserve in northern Lahore, one of the city’s most

4.6.4 Flora

The forest plantation of Shahadara Reserve Forest primarily comprises of Eucalyptus, Shisham, Kikar, Willow, Neem, Siris, Arjun, Pilkan, Conocarpus, Toot, Beri, Jhandi, Simbal, and Mulberry. Ornamental and shade species such as Bougainvillea, Amaltas, Kachnar, Bakain, Alstonia, Jamun, Sukh Chain, and Gul-e-Nishter have also been planted.

Pictorial views of flora in the project area are provided in **Plate 4.4**.



Plate 4.4: Pictorial Views of Flora in the Project Area

4.6.5 Fauna

a) Mammals

The study area, surrounded by agricultural land and urban development, supports limited wildlife diversity. A list of mammals found in the area is given in below **Table 4-9**.

Table 4-9: Mammals in the Study Area

Common Name	Scientific Name
Jackal	*Canis aureus*
Fox	*Vulpes bengalensis*
Porcupine	*Hystrix indica*
Squirrel	*Sciuridae*
Mouse	*Funambulus pennant*
Mongoose	*Herpestes javanicus*
Wild Boar	*Sus scrofa*

b) Reptiles and Amphibians

The subject species are dependent on the overall condition of environment of the region and associated with different environmental factors. Common reptiles found in the Study Area include snakes like Cobra (*Naja naja*), Indian Krait, and various lizard and toad species. List of Reptiles found in the area is given in **Table 4-10**.

Table 4-10: Reptiles in the Study Area

Sr. No.	Common Name	Scientific Name
1.	Indian Cobra	*Naja naja*
2.	Indian Krait	*Bungarus caeruleus*

c) Birds/ Avifauna

The project area was reported degraded in terms of avifauna habitats. Water fowls are seen in plenty during Kharif season, along agricultural fields. The common bird species found in the tract are the Common avifauna includes House Crow (*Corvus splendens*), House Sparrow, and Common Myna (*Acridotheres tristis*). Other species observed include Hoopoe (*Upupa epops*), Rose-ringed Parakeet (*Psittacula krameri*), and Bulbul (*Pycnonotus cafer*).

Birds seen and reported in the tract are given in **Table 4-11**.

Table 4-11: Common Birds in the Study Area

Sr. No.	Common Name	Scientific Name
1.	Mynah	*Acridotheres tristis*
2.	House Crow	*Corvus splendens*
3.	House sparrow	*Passer domesticus*
4.	Pigeon	*Columba livia*
5.	Quil	*Coturnix coturnix*
6.	Little Egret	*Egretta garzetta*

Pictorial views of fauna in the project area are provided in **Plate 4.5**.





Plate 4.5: Pictorial Views of Fauna in the Project Area

d) Aquatic Ecology

Aquatic characteristics of the Study Area (River Ravi) were examined to the assess the existing conditions and evaluate the potential impacts due to the implementation of the proposed Project on the aquatic environment of the Study Area.

The River Ravi is a monsoon type of river. Survey of the study area revealed that the bulk discharges of untreated domestic and industrial effluents through different tributaries into the River Ravi at various points has adversely affected the water quality and aquatic life. It, therefore, requires effective monitoring of pollutants and heavy metals in the aquatic ecosystem because polluted water can cause paralysis, meningitis, cancer, sterility, schistosomiasis, poliomyelitis and filariasis in animals.

Rapidly increasing anthropogenic activity adds deterioration in the riverine habitats. This habitat degradation when combines with change rivers flow patterns, it not only modifies ichthyofaunal distribution, but also alters the species composition and fish community structure of those water bodies. The environmental changes and anthropogenic modifications have diminished the natural fish breeding grounds of almost all indigenous fish fauna, (**Table 4-6**).

Table 4-6: Major Fish Species of Study Area

Sr. No.	Fish species
1.	*Aspidoparia morar*
2.	*Barilius bendelisus*
3.	*Barilius modestus*
4.	*Cirhinus mrigala*
5.	*Chanda nama*
6.	*Colissa lalia*
7.	*Oreochromis mossambiques*
8.	*Puntius ticto*

Sr. No.	Fish species
9.	*Parambasis baculis*

e) Endangered Species

No endangered flora and fauna were found on the track.

4.7 SOCIO-ECONOMIC ENVIRONMENT

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 Households (HH) were carried out.

The basic objectives of the social survey were 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 selected households of the study area was carried out. Baseline information was collected from direct and indirect affectees during the field visit.

4.7.1 Methodology

The socio-economic survey was carried out in the month of December 2025. A sample size of 60 was taken by using random sample technique. During the socio-economic survey, respondents were informed about the Project objectives, its location and basic design features. To get the maximum information about the local community and proposed Project area, both primary and secondary sources were used for data collection. To assess the socioeconomic conditions, a series of questions were asked during the socio-economic survey

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

4.7.2 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.

4.7.3 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.

4.7.4 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.

4.7.5 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.

4.7.6 Administrative and Political Settings

Lahore comprises five tehsils i.e. Lahore city and Lahore Cantt, Model Town, Raiwind Tehsil and Shalimar Tehsil. While these tehsils are further divided into nine towns as under: i. Nishtar Town; ii. Gulberg Town; iii. Aziz Bhatti Town; iv. Allama Iqbal Town; v. Ravi Town; vi. Shalamar Town; vii. Samanabad Town; viii. Wahgah Town; ix. Data Gunj Bakhsh Town.

Union Councils (UC) is the lowest tier of the local government and fifth tier of government in Pakistan; in rural areas, UCs are often known as "village councils". The territory represented by a village council usually comprises a large village and surrounding areas, often including nearby small villages. The term "union council" may be used for localities that are part of cities. A village council is an elected local government body headed by a mayor and a deputy mayor. Tehsil Council is the next tier of local government. About 4 to 5 UCs fall in the Tehsil Council (TC). Tehsil is a sub-unit of the district, which is the highest tier of the local government system, dealing with the administrative matters at district level.

A district is composed of Tehsils and is governed by the Deputy Commissioner (DC). Like other districts of the Punjab, the local government system of Lahore comprises UCs consisting of members directly elected by people through an open competition, which is also from the Electoral College for the selection of the members for the next higher tier.

4.7.7 Demography of Districts

The Project area falls in the Lahore District, and main features of the districts are given below:

4.7.8 Population and Family Size

According to Census of 2023, the population of Lahore District is 13,004,135 with an average annual growth rate of 2.64 percent from 2017 to 2023. The district has a sex ratio of 112.47 males to 100 females and a literacy rate of 79.62%: 81.41% for males and 77.59% for females.

4.7.9 Survey Findings

i. 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. Neither the groom nor the bride is allowed to choose his or her life partner in rural areas. The decision of the parents is considered final; however, sometimes the bridegroom is consulted before the final decision. As per social survey, the majority of respondents (i.e. 94%) were married and 06% were unmarried. Table: 4.12 shows the marital status of the respondents.

Table 4.12: Marital Status of the Respondents

Sr. No.	Marital Status	Number	Percentage
1	Married	56	94
2	Un-Married	4	06
Total		**60**	**100**

ii. Literacy

Educational distribution of the respondents shows that Fifteen (13%) of the respondents were illiterate. 23% were educated up to primary level. However, 21% and 17% were educated up to middle and matric level respectively. Moreover, 14% respondents were educated up to intermediate and 12% respondents described their education level up to graduation and above. Educational level of the respondents is shown in Table 4.13.

Table 4.13: Educational Level of the Respondents

Sr. No.	Education of the Respondents	Number	Percentage
1	Illiterate	8	13
2	Primary	14	23

3	Middle	13	21
4	Matric	10	17
5	Intermediate	8	14
6	Graduation and above	7	12
Total		**60**	**100**

iii. Languages Spoken

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

iv. Housing

A mix housing pattern was observed among the surveyed Households 18% of the respondents were living in semi pacca houses, while 73% respondents had pacca houses. Only 9% of the respondents mentioned that they were living in kutcha houses, made with mud and inferior construction material. Table 4.14 shows construction pattern of houses of the respondents.

Table 4.14: Housing Conditions

Sr. No.	Type of House	Number	Percentage
1	Semi Pacca[14]	11	18
2	Pacca[15]	44	73
3	kutcha[16]	5	9
	Total	**60**	**100**

The majority of the respondents had 2-3 rooms in their houses; few of them were having more than this equation.

The type of the toilet used by the household indicates living conditions and is strongly related to the health and hygiene of the household members. All the people (100%) had flush type of latrine inside of their homes.

v. Occupations

Occupation of the respondents were also asked during the field survey. Majority (50%) of the respondents were associated with farming. Nine (9%) of the respondents were running their shops while 4% of the respondents were mechanic of different fields. Almost 14% were engaged with different types of labor including industrial and general labor for earning their livelihood, while 12% were engaged with private jobs to earn their livelihood. Rest of the

[14] Constructed using a combination of pacca (strong, high-quality) and kutcha (inferior) materials.
[15] Pacca housing refers to dwellings that are designed to be solid and permanent, built of substantial material such as stone, brick, cement, concrete, or timber.
[16] Constructed of mud and kutcha (inferior) materials

respondents were associated with their own business and government jobs as reflected in Table 4.15.

Table 4.15: Occupation of the Respondents

Sr. No.	Profession	Number of Respondent	Percentage
1	Farmers	30	50
2	Shopkeepers	5	9
3	Mechanic	2	4
4	Laborers	9	14
5	Private Service	7	12
6	Business	4	7
7	Govt. Service	3	4
Total		**60**	**100**

vi. Income Levels

Socioeconomic findings of the survey revealed that 5% of the respondents were falling in the low-income group of up to rupees 30,000. On the other hand, 43% were earning in the range of 30,001 to 40,000 rupees, and 23% of the respondents were earning their monthly income between the ranges of 40,001 to 50,000 rupees per month. Whereas, 18% of the respondents were earning between 50,001 to 60,000 and 11% were earning above 50,000 per month. Table 4.16 shows the average monthly income of the respondents.

Table 4.16: Average Monthly Income of the Respondents

Sr. No.	Average Monthly Income (Rs.)	Number of Respondent	Percentage
1	Up to 30,000	3	5
2	30,001 – 40,000	26	43
3	40,001 – 50,000	14	23
4	50,001-60,000	11	18
5	Above 60,000	6	11
Total		**60**	**100**

During the field surveys, it was observed that in case of farming households, the major sources of income were from crops and livestock (dairy products). For non-farm or landless households, the main sources of income were activities, such as business, shopkeeper, government employment, private employment, and labor work

vii. Expenditure

Household expenditure depends on the earning of the household members, about 8% of respondents reported their monthly expenditure up to 30,000, and 42% respondents found within the range of 30,000- 40,000 per month. While, 22% were falling between the

expenditure range of 40,001 to 50,000 and 18% recorded their monthly expenditures between the ranges of 500,001-60,000 per month. However, 10% of the respondents were having their expenses more than 60,000 per month. Table 4.17 shows the average monthly expenditures of the respondents.

Table 4.17: Range of Monthly Expenditures of the Respondents

Sr. No.	Average Monthly Expenditures	Number of Respondent	Percentage
1	Up to 30,000	5	8
2	30,001 – 40,000	25	42
3	40,001 – 50,000	13	22
4	50,001-60,000	11	18
5	Above 60,000	6	10
Total		**60**	**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.

viii. Money Borrowed

Table 4.18 shows that significant majority i.e. 84% of respondents did not borrow money during the fiscal year 2023-2024. While only 16% borrowed money during this time.

Table 4.18: Money Borrowed

Sr. No.	Last Year Borrow Money	Number	Percentage
1	No	50	84
2	Yes	10	16
	Total	**60**	**100**

Generally, the credit is obtained to supplement the income to meet the routine and some extra expenditure of the household including investment, social needs and other unforeseen situations such as illness (medical care), marriage, education, and livestock. Credit is also obtained for agricultural needs (such as equipment, seeds and fertilizers) from both the formal (banks) and informal sources (e.g., friends, relatives, and landowners).

ix. Religion, Ethnic and Minority Groups

The population of the settlements in AOI is Muslim. The core unit of social organization is the caste system (“biraderi” in local language) in which groups are either defined on the basis of specific occupation or lineage. Natt and Rajppor are major casts in the project area The social life of the local population is traditionally on rural.

During the field survey, it became apparent that the major castes were important because they have a key role in decision-making regarding the resolution of social issues of family

matters. For instance, landlords as well as the head/or elder of the respective caste generally make decisions related to the social issues at local level as well as the social development work in their areas. Prior to any Project/ program to be initiated, it is essential to involve these groups right from start of the Project i.e. planning, design, implementation and operation, to make the Project successful. In the AOI, local councilors, chairman and deputy chairman are the influential persons.

x. Culture

The culture of Lahore is a manifestation of the lifestyle, festivals, literature, music, language, politics, cuisine and socio-economic conditions of its people. It is characterized by the blending of South Asian, Middle Eastern, Central Asian and Western influences. Lahore's culture is unique. It is sometimes referred as the cultural capital or the heart of Pakistan. Presently, it is the capital of the Punjab province of Pakistan. In the AOI, locals are very warm-hearted. People had strong beliefs in reputable saints, black magic, and other superstitions (“pir-faqeers”, “jogi”, “taweez”, “manat-ka-dhaga” in local language). However, recently due to increase in literacy, people have become somewhat factual. Locals have strong belief in caste system but people are getting educated, and the boundaries / differences are getting blurred.

In the AOI, old men wear Pagri (turban), dhoti/lacha, kurta (long shirt), khusa (handcrafted footwear) while women wear colourful shalwar kameez, paranda (colorful hanging worn by the Punjabi women in their hair), choli/duppata (scarf) and kola puri chappal (hand-crafted slippers with embroidery). The young generation (men and women) follow latest trends and fashion; mostly they wear different styles of shalwar kameez. Trouser and shirts are also worn by the locals but in less proportion as compared to shalwar kameez.

The extensive cuisine is both vegetarian and non-vegetarian. In rural areas along the river Ravi, locals use ghee or clarified butter and different spices extensively. Traditional food is also eaten such as, Desi Ghee Paratha (flat bread in clarified butter), Makai ki Rotti (flat bread made from corn flour), Sarson ka Saag (vegetable dish made from mustard leaves).

xi. Family System

Joint family system is the dominant culture in the AOI. 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.

Most of the families were living in joint family system, whereas only a small percentage of families were living as a single family (nuclear family system). Although the joint family system is generally undergoing a radical change, with a greater influence of media and education and people of the AOI do not feel good about this change. The major reason is that by living in a joint family system a lot of emotional attachments are enhanced and they feel that by separating in nuclear family system, their relationships will be damaged and family ties will be weakened.

As per the locals, joint family system is basically a form of organization. In this organization, there are defined norms and values to be followed strictly by all the members. All the members have their defined tasks and responsibilities to perform. There is equal share of each and every member of the family in the available resources in the form of money, food and other requirements and locals feels better in joint family system as compare to nuclear family. During the discussion with the locals, it was clarified that large family size is also treated as the strength of the family.

xii. Decision-making Methods and Conflict Resolutions System

The methods for decision-making about social conflicts in the AOI are “Panchayat” (an assembly of wise and respected elders), court and caste groups.

People prefer “Panchayat” in the AOI compared to court or other legal system because this method is more effective. “Panchayat” provides timely justice while other methods are complex and require time as well as money.

The people have a tradition to help each other in the hour of need. Common conflicts arise from time to time which are solved by the community at the local level through Numberdars, Councillors or Deputy Mayor of the UC. Generally, in case of a conflict between two individuals, only the families or closest friends take sides of the conflicting rivals so there are rare chances that personal conflict will transform into an ethnic dispute.

xiii. Educational Facilities

The educational facilities in the AOI comprises Middle schools for boys and girls in the project area. However, to avail higher secondary level education facilities locals have to go nearby areas of Lahore city. There are number of educational institutions exist in private and public sector in nearby areas.

The proposed Project is close to the Lahore City where almost every type of educational facilities are available. Educational facilities in Lahore are mainly being provided by the Government of Punjab, the city government, the private sector and voluntary organizations. To a limited extent, the high school education is also being managed by the Federal Government through the operation of few institutes located in the cantonment area.

During the field visit, it was noted that few institutions (private sector) provide education at matric or secondary level. Locals prefer to go to other areas of Lahore for higher education as it is a first-class place of learning in Pakistan.

xiv. Health Facilities

Health facilities are generally adequate in the AOI. To avail health facilities locals, go to Lahore. Ample medical and health facilities are available in the Lahore Metropolitan Corporation area and its suburbs. Shaukat Khanam Hospital and Pakistan Kidney and Liver Institute and Research Center (PKLI&RC) are the latest addition in the medical care facilities

in Lahore for cancer and the most dangerous disease of liver and kidney in the country. There are also other hospitals of voluntary organizations which provide health cover to the general public. Shalamar Hospital is one of the nearest hospital for the people of proposed project area. Moreover, King Zaid Bin Sultan Hospital is also a very advanced addition in the medical care for Lahore. Among the prominent hospitals are General Hospital, Lady Willington Hospital, Mayo Hospital, Fatima Jinnah Hospital, The Children Hospital, Services Hospital, and Ganga Ram Hospital etc.

xv. Civic Facilities

Electricity is available in Project area and its surrounding., while the proper drainage system is not available even the road network is also poor.

xvi. Sources of Drinking Water and quality.

Groundwater is being used for drinking purpose in surveyed villages adjacent settlements. Quality of ground water is poor due to sewage of waste water from drains ad factories.

xvii. Gender Aspects

Conditions of the women of the Study Area were assessed by carrying out women sample survey. The women and girls of the study area were observed busy in doing agriculture, livestock rearing, laundry, looking after the children, preparing food etc. There is a lack of employment opportunities for women. However, few women doing jobs in different professions like teaching, medical and Government and Private Sector were reported.

The emancipation of women is a campaign to give women equal rights and status with men. The emancipation of women (i.e., their liberation from economic and sexual oppression, their access to higher education and their escape from narrow gender roles) is not easily achieved due to the traditional setup. In this rural society, males dominate. Cultural tradition, social practices and low female literacy ratio have left women in a vulnerable position. Women are restricted to performing household work and are excluded from decision-making both on the domestic front and at the community level. Women's access to education and health care is limited because such services are not available close to home in the AOI.

Women in the AOI are also vulnerable through economic, social and psychological poverty. Economic poverty is due to lack of assets and low endowment of human capital. Social poverty derives from the inability of the society to accept women's equality and their economic, political and cultural rights, while psychological poverty is a product of the subjugation of women, under the dictates of customs and traditions, which deprives them even of control over their own lives.

In the rural set-up women are kept under-educated or uneducated. They are mainly dependent on male members of the family for economic reasons and cannot take decisions regarding their own lives. They have nominal say in family matters and are occasionally asked about their preference for marriage. Yet for the paucity of rights, women play a vital part in the society through performing essential, albeit menial, tasks and supporting their

families (e.g., preparation of fodder for animals, nurturing children, and cooking and cleaning for the family).

However, for the development of women in the area the Provincial Government has started many programs including a small loan scheme through the Punjab Rural Support Program (PRSP).

Information which was collected through secondary sources and group discussion with locals shows that major problems faced by women in the area are lack of primary health care facilities in local hospitals and the lack of education opportunities. Other problems include laborious work such as helping male members in preparation of fodder and managing livestock. These tasks not only affect their health but also take up major portion of their time.

5. PUBLIC CONSULTATION

5.1 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 tends 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.

5.2 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 5.1.

Table 5.1: Tasks and Purposes of Consultations

Task	Purpose of Consultation with Stakeholders
Why consultation with the stakeholders?	• To build trust to ensure sustained support for the project and build resilience for times of crisis. • To learn about public concerns that need to be addressed and considered 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 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.

5.3 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; and
- To address the most relevant concerns of the stakeholders on project and its activities including the upfront negative impacts.

5.3.1 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.

5.3.2 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-EPCCD, Wildlife Department, Forest Department, WCLA and other various line agencies / departments of GoP.

Details regarding roles and responsibilities of the concerned agencies and departments are given below Table 5.2.

5.4 APPROACH FOR THE CONSULTATION AND INFORMATION DISSEMINATION

A series of public consultations were required to get the feedback/concerns of the different category of stakeholders including provincial departments, district level departments, local community and other general public residing in the Project area.

Consultation process included meetings with locals. community meetings/consultations and semi-structured interviews and one to one meeting/ interviews with the government, private and civil society institutions. During the consultation process, the stakeholders were briefed about the project objectives and scope. Their fears and suggestions were recorded.

Consultations were conducted at two levels:

- Institutions/Departments Level
- Community level

1.1.1 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 5-3.**

Table 5-2: List of Government Officials Consulted

Sr. No.	Department/Venue	Name/Designation	Date
1.	Punjab-EPA	Mr. Talha, Assistant Director – EIA	11-12-2025
2.	Forest Department	Mr. Mudassir Hasan, Divisional Forest Officer-DFO Lahore Forest Division, Lahore	17-12-2025
3.	Fisheries Department	Mr. Shahid Tabassum, Deputy Director Fisheries	11-12-2025
4.	Wildlife Department	Mr. Junaid, Deputy Director Wildlife	11-12-2025
5.	WCLA	Mr. Mubashir Hassan, Deputy Director WCLA	11-12-2025
6.	LWMC	Ms. Hina Ali, PS to Manager Operations	11-12-2025

The **Table 5-4** indicates the detail of issues raised/discussed and suggestions given during the consultation:

Table 5-3: Detail of Issues/Points Raised/Discussed during Departmental Consultations

Sr. No.	Department/ Organization	Suggestions
1.	Punjab- EP&CCD	• It was suggested that all the relevant Acts, laws, regulations, guidelines especially Punjab Environmental Protection Act, 2017 should be followed during the preparation of IEE report; • Stakeholder Consultations with all the relevant departments should be carried out;

Sr. No.	Department/ Organization	Suggestions
		• Environmental Monitoring at all environmental sensitive areas in the Project area should be considered; • Green Land should not be utilized for construction purposes; • Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles; • Health and Safety Management Plan shall be prepared and implemented to avoid health and safety issues occurring during construction period of the Project; • Solid waste produced shall be properly managed and disposed of in identified designated areas; • Construction material will be removed as early as possible on the construction sites: • Alternate routes shall be provided in consultation with Traffic Police to the residents, educational 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; and • If tree cutting is involved then it should be avoided as much as possible and trees should be replanted and Tree Plantation Plan shall be provided.
2.	Wildlife Department	• The NESPAK team visited the subject office to brief the officials regarding the Project and share details. • They appreciated the proposed Project and shared the information mentioned below: ▪ No Wildlife protected area falls under the proposed Project area. ▪ They also suggested avoiding negative impacts on local biodiversity and green cover, if any. ▪ Loss of trees will be discouraged to keep the ecosystem balance and to protect habitat of wildlife of the region. ▪ Required details of the faunal species of the region were also provided.
3.	Forest Department	• The official was briefed by the NESPAK's relevant environment team regarding the proposed Project; • Detailed discussion was held among the forest officials and NESPAK team regarding the Project and it was shared that no designated forest area is falling in the proposed Project boundary; • Tree cutting will be avoided up to maximum level; • Tree cutting in Reserved Forest shall be avoided. • Extensive plantation may be conducted to ensure Project sustainability and to enhance/conserve the local environment; • A feasible provision of budget for tree plantation plan shall be included in the Project cost; and

Sr. No.	Department/ Organization	Suggestions
		• Required details of the floral species of the Project area were also provided.
4.	Fisheries Department	• The NESPAK team visited the subject office to brief the officials regarding the Project and share details. • They appreciated the proposed Project and shared the information mentioned below: ▪ No species of fishes are present / reported in the River. ▪ No fish hatchery & nurseries are present within the vicinity of the proposed Project.
5.	Walled City of Lahore Authority (WCLA)	• Compliance of Antiquities Act, 1975 & Punjab Antiquities Amendment Act 2012 should be conducted; • WCLA raised concerns that the proposed access bridge to Jahangir's Tomb may not adversely affect the historical integrity, authenticity, and visual setting of the protected Mughal-era monument if not designed and executed with due heritage sensitivity. • It was emphasized that construction activities associated with the bridge, including piling, excavation, and movement of heavy machinery, could generate vibrations that may pose structural risks to the historic fabric of Jahangir's Tomb and associated archaeological remains. • Concerns were expressed regarding changes to the historic landscape and skyline, noting that inappropriate bridge alignment, height, or materials could compromise the cultural and visual significance of the monument and its surrounding heritage setting. • It was recommended that any bridge design be subject to prior review and approval by WCLA, incorporating heritage-compatible architectural elements, minimized footprint, and avoidance of intrusive construction techniques.
6.	Lahore Waste Management Company (LWMC)	• Environment Team expressed concern over the presence of the LWMC Transfer Station along River Ravi during the construction phase, citing potential environmental and operational conflicts with proposed construction activities. • It was highlighted that continued operation of the transfer station may increase the risk of solid waste spillage, leachate generation, and contamination of the River Ravi, particularly during periods of intensified construction traffic and earthworks. • Based on these concerns, it is recommended that relocation of the LWMC Transfer Station to an alternative, environmentally suitable site should be carried out. • LWMC emphasized that a formal request letter from Ravi Urban Development Authority (RUDA) to Lahore Waste Management Company (LWMC) is required to initiate and authorize the shifting of the transfer station.



Consultation with EP&CCD



Consultation with WCLA



Consultation with Wildlife Department



Consultation with Forest Department



Consultation with Fisheries Department

Plate 5.1: Pictorial View of the Departmental Consultations

5.5 COMMUNITY CONSULTATION AND PARTICIPATION PROCESS

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.

5.5.1 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

5.5.2 Categories of Stakeholders Contacted

Different categories of stakeholders contacted, during consultation is shown in the Table 5.5.

Table 5.2: Stakeholders Contacted in the Project Area

Sr. No.	Stakeholder Category
1	People of the surrounding communities
2	Local Residents
3	Local Farmers
4	Business/ shop owners
5	Government and private Servants

5.5.3 Consultations with Local Communities

Extensive consultations were conducted with the local communities in the project area to record their views and incorporating in the project planning. Consultations were held with the participants at different locations in the proposed project area. The major categories participated in these meetings were local population, community groups and landowners.

The participants were briefed about the proposed project site with the help of design maps. During the consultations, participants were informed/briefed about the project objectives and extensive question and answer sessions were conducted to clarify the project related works and activities to resolve the environmental, social and issues. They were briefed that the purpose of the consultations and discussions is to find out the possible solutions of the issues which may be faced before and during the construction of the proposed project. The concerns and their possible solutions presented by the participants regarding proposed project were recorded to make further possible recommendations. The summary findings of the consultations is presented in an annotated form given below in Table 5.6.

Table 5.3: Summary Findings of the Consultations

Sr. No.	Concerns Raised by Participants	Mitigation Proposed by Participants	Action to be taken by Project Executors
1.	Loss of commercial, structures	Resettlement and proper compensation at replacement cost to Project Affected Persons for loss of structures and livelihood.	RUDA will ensure resettlement and proper compensation for affected structures and impact on livelihood through preparation and implementation of the compensation plan.
2.	Due to construction of the proposed road local people will face access problem to their farmland and resident.	Local people should not be restricted to their settlement and their farm land.	Proper access should be provided to the local people to reach. surrounding area easily.
3.	During the construction period, mobility of the local community will be disturbed.	Alternate route should be provided to the local communities for convenience in mobility.	Possible alternate route will be provided before the commencement of the civil work on the proposed project
4.	Disturbance of the social amenities.	Participants were of the view that due to construction of the proposed project, several social amenities will be disturbed. These social amenities should be restored before commencement of the construction work to avoid any inconvenience for the local community.	Social amenities should be restored before execution of the civil work.
5.	Due to construction activities as well as influx of labor, movement of the citizens particularly of females (working in fields), residing in the local area will be restricted.	In order to tackle this situation, construction should be carried out in scheduled hours. So that after construction hours, local community, particularly females can easily move in the area.	People should be aware about complete construction activity plans so that they can move in the area freely and safely.
6.	Dust and noise will disturb the nearby residential and commercial structures.	All protective measures should be taken to keep safe the local community from noise and dust.	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 labor opportunities for local people.	Skilled and unskilled work force should be hired from local community. It will enhance the acceptability of the proposed project among local people.	Contractor should be bound to hire the skilled and unskilled work force from the local community at priority.



Figure 5.1: Pictorial View of Community Consultations

5.6 PROPOSED 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, community representatives and PAPs 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 community members will be compensated by the GoP and they will be encouraged to participate in project activities during construction and operation phases. The consultations will be made in future to facilitate the community at the local level.

The consultations will be carried out during the construction and operation phases of 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:

- Ongoing reporting on progress on the implementation of environmental and social management measures identified during the EIA process and recording of comments on the effectiveness of these measures;
- Updating communities and other stakeholders about project developments and recording comments on these; and+
- Ongoing action of the grievance mechanism.

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 5.7, but not limited to the following:

Table 5.4: 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 start of implementation of project. • Bi-annually 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, before implementation, periodic meetings during construction phase and at the time of project completion.
3	NGOs/CBOs	• Pre-Implementation • During project Implementation • At Closure period	• Periodic meetings will be conducted as per requirement of the Project.

During the operational phase of the project consultation of stakeholder are important to assess the benefits of the project and impacts on the local communities. A comprehensive stakeholder consultation plan should be prepared by the contractor(s) to get feedback from the stakeholders and to resolve the issues during the operational phase of the project.

6. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 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.

6.2 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.

Magnitude of Impact	Sensitivity of Receptors			
	High (4)	Medium (3)	Low (2)	Negligible (1)
Major (4)	16	12	8	4
Moderate (3)	12	9	6	3
Minor (2)	8	6	4	2
Negligible (1)	4	3	2	1

Score	Impact Significance
1	Negligible
2 – 4	Low
5 – 8	Medium
9 – 12	High
> 12	Very High

6.3 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.

6.3.1 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 (design/pre-construction, construction and operational phases). A Project Impact Evaluation Matrix is given as **Table 6.1**.

6.3.2 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.

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	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Migratory birds	Beneficial Plants	Loss of trees	Loss of Crops/Orchards	Conflict over Resources	Mobility of Locals	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard	Community Stability	Tourism And Recreation	Grazing Area	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities	Restoration of Livelihood	Economic Uplift
A. Planning & Design Phase	1	2	3	4	5	8	8	9	10	11	12	13	14	15	16	17	18	18	20	21	22	23	24	25	26	27	28	29	30	31
Topographic Survey of Bypass	o	o	o	2	o	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	2	o	o	o	o	o	o
Geotechnical Investigation	o	o	2	3	o	o	o	o	o	o	2	3	o	o	o	o	o	o	o	o	o	o	2	4	o	o	o	o	o	o
Temporary Acquisition of Land	o	o	o	o	o	o	o	o	o	o	4	4	o	o	o	o	o	o	3	o	o	o	3	o	o	o	o	o	o	o
Parmanent Acquisition of Land	o	o	o	o	o	o	o	o	o	4	9	9	6	o	6	o	9	6	9	o	o	o	9	o	o	6	6	o	o	o
B. Construction Phase																														
RoW / Site Clearance	9	9	9	8	8	4	6	o	o	4	9	9	o	6	4	3	6	6	o	o	6	o	8	9	4	4	o	6	o	4
Earthwork in Filling and Excavation	9	9	9	8	8	4	4	o	o	o	o	o	o	6	2	3	o	o	2	o	o	o	6	9	4	4	o	6	o	4
Establishment of Construction Camps & Workshop	2	2	4	o	o	o	4	o	o	o	o	4	8	o	o	o	o	4	4	o	o	4	4	8	4	o	o	6	6	6
Transportation & Storage of Construction Materials	4	6	6	2	4	o	2	o	o	o	o	4	o	4	o	o	o	o	4	o	o	o	4	6	4	o	o	4	o	o
Use of Construction Material and Heavy Machinery	3	8	9	o	4	2	4	o	o	o	o	o	o	2	2	2	o	o	o	o	o	o	2	8	o	4	o	4	o	o
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	2	o	o	o	o	o	2	o	o	o	o	2	o	o	o	o	o	6	4	o	4	4	o	o
Spoil Disposal	3	3	o	6	6	4	6	o	o	o	4	6	o	o	o	o	o	o	2	o	o	o	4	4	6	o	o	o	o	o
Structural & Civil Work	8	8	8	7	7	4	6	o	o	o	o	o	2	o	2	o	o	o	2	o	o	4	6	9	4	4	o	8	o	8
Drainage Work	6	6	6	7	6	6	6	o	o	o	o	o	2	o	2	o	o	o	2	o	o	4	4	9	4	4	o	8	o	8
Miscellaneous Work (Road Ancillanes, Traffic Signs and Signals etc.)	o	4	6	4	4	2	2	o	o	o	o	o	o	o	2	o	o	o	o	o	o	o	o	6	o	o	o	6	o	6
Pavement Work	2	4	6	2	4	2	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	2	2	8	o	o	o	6	o	6
Finishing and Comissioning	o	2	4	o	4	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	4	o	o	o	4	o	4
C. Operational Phase																														
Operation of Road	o	2	2	o	o	o	4	o	o	o	6	o	o	6	4	8	o	o	6	4	o	o	8	6	8	4	8	6	6	6
Inspection & Monitoring	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	3	o	o	o	o	o	o	2	4	o	4	o	4	o	o
Road Maintenance	o	4	4	2	o	o	2	o	o	o	o	4	o	4	4	4	o	o	o	o	o	o	o	6	2	o	o	4	o	o
Maintenance of Miscellaneous Work	o	o	2	o		o	o	o	o	o	o	o	o	2	2	2	o	o	o	o	o	o	o	4	o	o	o	4	o	4

Positive Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Impact Significance
Negligible
Low
Medium
High
Very High

Adverse Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Table 6.1: Project Impact Evaluation Matrix

6.4 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 is the area where the Project 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. Map of the Study Area / AOI is shown as **Figure 1.2**.

6.5 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:

6.6 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.

6.6.1 Technical Design and Layout Planning

Incompatible layout plan and engineering design of the project's structures (ramps, bridges, etc.) can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and designing the structures without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. This future traffic factor if not considered in the design properly, will also affect the project road and public safety of the Project Area. Similarly, the locals may also face access problems for their land. This impact is permanent and major negative in nature.

Mitigation Measures

- The technical design of the proposed project must consider all the above-mentioned factors for the final design and should meet all the local and international (e.g. AASHTO) standards; and

- The proponent must review and validate all the design parameters considering the possible impacts (as mentioned) before the start of construction of proposed project.

6.6.2 Topography

The project area is a plain terrain, and the proposed project is construction of new bridge. So, there will be change in the topography of the project area is expected. This impact is permanent in nature.

Mitigation Measures

Mitigation measures will involve adoption of best engineering design measures keeping in view of the aesthetics of the project area.

6.6.3 Storm Water Drainage

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 flooding especially during the rains.
- Proper slopes shall be incorporated in design to avoid the stagnant water on at-grade road surface.

6.6.4 Seismicity

In Building Code of Pakistan (Seismic Provisions, 2007), the whole region of Pakistan is classified into five main Seismic Hazard zones i.e., i) Zone-1, ii) Zone-2A, iii) Zone-2B, iv) Zone-3, v) Zone-4 based on the peak horizontal ground acceleration and its ultimate tendency to damages during seismic events. The proposed Project Area falls in the seismic zone classified as "**Zone-2A**" with g-value 0.08 to 0.16, and is considered as Moderate Hazard seismicity zone.

In case of an earthquake, the proposed road expected to suffer damages if designed without consideration of seismic activities. This would be permanent and major negative in nature. However, No change (+/-) in the impact of seismology risk of the area is expected during the

project construction phase as none of the project activities is expected to be of such a powerful extent to influence the tectonic risk.

Mitigation Measures

- The proposed structures should be designed and constructed keeping in consideration high intensity earthquakes. For seismic hazard analysis, updated structural and seismic evaluations should be conducted by the design engineer/consultant. Moreover, geo-technical investigations must be conducted prior to construction phase;
- 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; and
- The structure of the proposed project should also be studied by the proponent (RUDA) to evaluate its durability/strength to withstand moderate to high intensity earthquake.

6.6.5 Land Procurement

Land required for proposed project is already procured by RUDA. Construction of proposed project may result in loss of forest land, infrastructure, commercial activities and disturbance to local people. This impact will be permanent and moderate adverse in nature.

6.6.6 Resource Conservation

Resources involved in the construction of proposed project would include water, fuel and construction materials.

Excessive water consumption by the construction staff may stress water resources in the project area and in certain cases may disturb the existing water supplies in the project area.

Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed project are non-renewable and therefore their efficient use is necessary to make it available for future use.

Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact is medium negative and permanent in nature.

Mitigation Measures

Following practices shall be adopted to conserve these natural resources:

- Use potable water bowsers for construction works and mineral water bottles/ filtered or treated ground water for drinking purpose;

- Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants;
- Reduction of wastage of water through training of workers involved in water use;
- Reuse of construction waste materials may be adopted wherever possible;
- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment;
- Efficient and well maintained equipment and machinery should be used;
- The equipment and machinery should be turned off when not in use;
- Ensure adequate insulation to reduce heat loss through batching plants;
- Regularly monitor CO and CO2 content of the flue gases to verify that combustion systems are using practical excess air volumes;
- Use of solar panels at construction camps may be considered and plan for use of solar panels at operational phase may also be considered; and
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.
- Resource Conservation Plan is attached as **Annex-III**

6.6.7 Change in Hydrologic Regime

The proposed bridge will cross River Ravi and flood prone area. There might be change in water flow pattern and disturbance to water flow occurred due to construction activities, which will cause adverse impacts on communities that rely on these water bodies. This impact is moderate negative in nature.

Mitigation Measures

For the crossing of the nullahs/distributaries and other similar structures bridges will be constructed and widened. While culverts and other possible arrangement will be accomplished in design for the crossing of nullahs/ drains. Bridges on water channels shall be properly designed to accommodate design flows. Provision of culverts to control flood damages and provision of safety of embankments will be considered during the design of these arrangements.

6.6.8 Public Utilities

Due to the proposed project, (if any) public utilities i.e. Electricity Polls, Power/Telephone Lines, etc. are affected may create 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

Mitigation measures will include:

- 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; and

- Public utilities (e.g. electric lines, water pipes, power/ telephone lines, etc.) if any, affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction works.

6.6.9 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.

Mitigation Measure:

- A separate building for fire brigade, emergency response equipment and staff may be considered in the design;

6.6.10 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.

6.6.11 Flora

During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and 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, temporary, medium significant and needs to be encountered prior to the start of construction stage. Karol Resaved forest may be impacted due to the proposed bridge alignment as it passes through the forest area.

Mitigation Measures:

- The camps, mobility of machinery and construction of temporary road shall 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 will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.
- The proposed road should be re-routed from the Karol Resaved forest and during the design phase forest area must be avoided.

6.6.12 Fauna

No threatened faunal species were recorded in the study area during the field survey. The habitat values for fauna in the study area are generally limited. However, movement and installations of machinery and vehicles during the construction phase will generate noise that will create nuisance for avi-fauna, wildlife and domestic mammals. The habitats of avi-fauna and domestic mammals may also be affected due to construction camps set-up and due to cutting of trees. This impact is site-specific, temporary and low adverse.

Mitigation Measures:

- The engineering design to integrate the principles of green infrastructure including habitat conservation, animal trespasses etc.;
- The sites for the construction's camps will be carefully selected keeping in mind the available faunal habitats along the study area. Moreover, the layout of camps needs to be designed while considering the faunal habitat of the area;
- Prior to commencing any construction work, any works required outside the construction footprint verified will be referred for advice on further assessment and approval requirements so that damage to any available habitat over there could be avoided at maximum;
- Proponent should take NOC from the relevant department (Punjab Forest Department) prior to construction phase.
- The construction camp management plan during the planning stage will consider fencing and gating to check the entry of animals in search of eatable goods; and
- Similarly, waste management plan of the camps will be considered at the planning stage to prevent wild animals and birds.

6.6.13 Socio-economic Environment

The project will result in loss of agricultural land which is the prime source of livelihood in the area. Livestock which is another source of income will face loss of food and shelter. Locals

may be relocated resulting in disturbance of livelihood. In addition to this, access of people may be hindered due to construction and implementation of access roads.

Mitigation Measures

Planning shall involve minimum disturbance to locals and their associated income and livelihood sources. In case, it is unavoidable, proper compensation shall be provided to locals. Alternate arrangements for access shall be provided.

6.7 POTENTIAL ENVIRONMENTAL IMPACTS DURING CONSTRUCTION PHASE

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

6.7.1 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 i.e. bridge, culverts, roads & walkways and paved areas, and parking facilities. The area where excavated material is to be dumped will also be negatively impacted. This impact is Site-specific, Temporary 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.

6.7.2 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, 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;
- 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.

6.7.3 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.

6.7.4 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.

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 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;

- 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).

6.7.5 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 villages such as Nath Kalan, Their, etc.

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.

6.7.6 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-IV**.

6.7.7 Construction Camps/Camp Sites

Due to the construction camps, loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc. However, the impact will be temporary and moderate adverse in nature. For these impacts, mitigation measures have been developed to minimize the likelihood, extent or duration of their occurrence and any associated adverse effects.

Table 6.3 summarizes potential impacts and proposed mitigation measures associated with construction camps.

Table 6.2: 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 to consider the noise in nearby 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	***Social*** State land will be a second preference for worker camp locations, followed by land where there is a willing lessee.

Potential Impact	Proposed Avoidance and Mitigation Measures
sites for Worker Camps.	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. 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 RUDA.	***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 RUDA for removal & rehabilitation of site upon completion;
- Photographical and botanical inventory of vegetation before clearing the site;
- Waste Management Plan (Annex-V) will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste; and
- Compensatory plantation to be scheduled when construction works near end.

6.7.8 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 3,200 liters/day[17] for 100 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 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; and
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.
- 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.

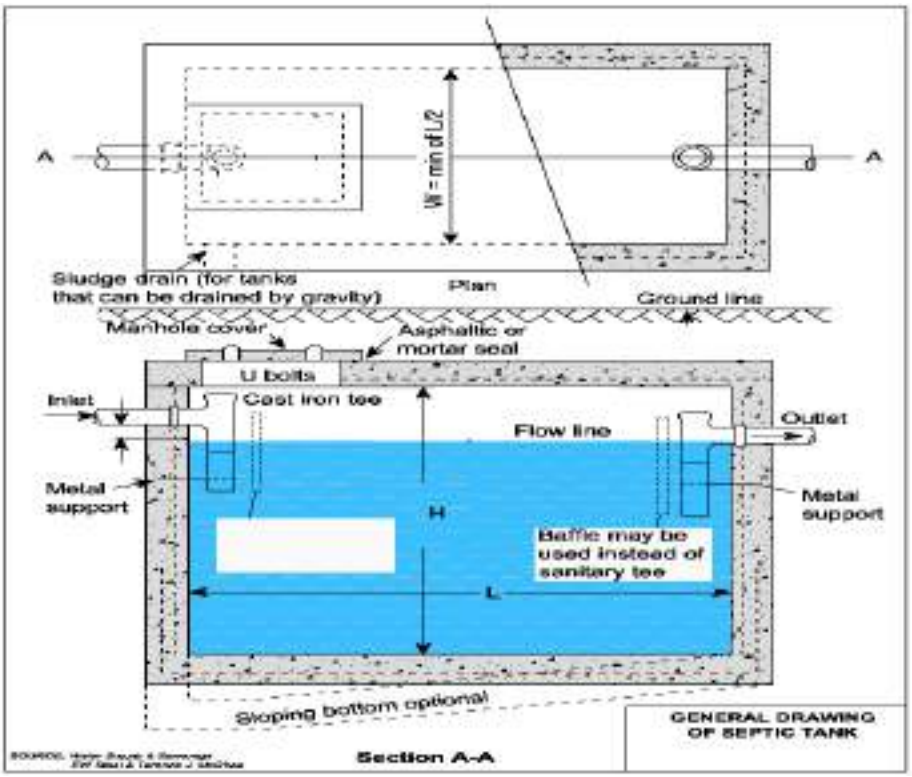

Figure 6.1: General Drawing of Septic Tank

6.7.9 Solid Waste Generation at Construction Camps

The solid waste generation is estimated to be 60 kg/day[18] for 100 construction workers during construction phase of the proposed Project. Different type of waste is likely to be

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

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

- 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. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;
- The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site;
- Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in Material Safety Data Sheets (MSDS) which must be located on site and accessible to all workers
- All persons interacting with hazardous wastes will be required to wear the appropriate PPE; and
- The waste will be properly sealed in containers with proper labels indicating the nature of the waste.

6.7.10 Waste Generation at Construction Site

The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. The quantification of construction material waste is not available but it is anticipated that less amount of such waste will be generated along the route length.

Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population. The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and render them unfit for plantation. Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants.

[18] Source: LWMC. Average is 0.6 kg/capita/day.

The wastes will be generated due to the construction activities and the materials used for construction. This waste would also require proper disposal to minimize any contamination of land and water resources. This impact can be categorized as moderate adverse 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
- 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.

6.7.11 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 Ring 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, 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-VI)** a site specific TMP will be prepared by the contractor and implemented to avoid traffic accidents, jams/public inconvenience.

6.7.12 Occupational Health and Safety

Occupational Health and Safety (OHS) related impacts will arise during construction activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. The falls during inspection or maintaining pile rigs, erection of framework and other related activities may also occur. 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 H&S 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 medium adverse in nature.

Mitigation Measures

Following mitigation is given to avoid the accidental risks:

- Punjab Occupational Safety and Health Act 2019 ensures the compliance of occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards;
- Compliance 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; and
- The Occupational Health and Safety Plan is attached as **Annex-VII**.
- An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services (Rescue 1122).

6.7.13 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 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;
- Seeking cooperation with local educational facilities (school teachers) at each village along the route for road safety campaigns;
- 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 RUDA; 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.

6.7.14 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. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.

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 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.

6.7.15 Climate Change and Green House Gas (GHG) 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 (RUDA, consultants, contractors, concessionaires) need to become aware that their actions at all stages of a project can contribute to reducing the CO2 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.

6.7.16 Issues of Smog

Construction activities related to proposed project can significantly contribute to smog issues in Lahore 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 (SO_2), nitrogen oxides (NO_x), 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.

6.7.17 Discovery of Heritage Sites and 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/Client to Directorate of Archeology and Museums Punjab to take further suitable action to preserve those antiques or sensitive remains. Chance find procedure (attached as **Annex-VIII**) shall be adopted in case of any accidental discovery of cultural heritage.

6.7.18 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.

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 RUDA and implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and RUDA staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Emergency numbers should be clearly posted at all disposal stations; and
- Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the RUDA Management.

An Emergency Preparedness and Response Plan is attached as **Annex-IX**.

6.7.19 Flora

The Project may involve destruction of vegetation cover on construction areas. It is initially examined that approximately 103 number of trees/saplings will be disturbed. The provided number of trees is approximate and tentative provided by GIS. The Shahdara Reserved Forest (Karol Block) may also be impacted and re-alignment needs to be considered at that patch. Following impacts are also expected on the floral species in the surrounding of the Project area:

- During the construction dust laden polluted air will form a dust film on leaves thus blocking sunshine and stomata consequently hindering photosynthesis processes causing detrimental effect on the plant health;
- Exhaust of noxious gases from movement of heavy machinery will further pollute air, which will adversely affect the health and vigor of plants;
- Establishment of contractor's camps and warehouses for storage of equipment and material will involve clearing of shrubs and grasses from the area, causing a negative impact; and
- During construction activities the contractor's workers may damage the ornamental plants and trees, for use as fire-wood to fulfill the camps requirements.

This impact is direct, local, permanent, irreversible and moderate significant.

Mitigation Measures:

- Trees that will be cut down during construction of road should be replanted / transplanted wherever possible;
- It is highly recommended to avoid protected forest area in all stages of the project
- Incorporate technical design measures to minimize removal of trees, if possible;
- Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized;
- A Tree Plantation and Compensatory Afforestation Plan shall be developed with technical guidance from Forest Department;
- A Tree Plantation Plan of 1740 trees (more than 1:10) to be planted, as provided in the report **Annex –X**.
- Due consideration shall be given to invasive/non-invasive species factor while plantation of trees;
- Local communities shall be engaged, where appropriate, in plantation and maintenance activities;
- Vegetation clearance at locations required for permanent project structures shall be minimized through careful setting of construction camps, workshops, and storage areas;
- To minimize the dust emissions, regular water sprinkling will be strictly followed;
- Open fires will be banned in the study area to avoid fire hazards;
- Clearing of vegetation cannot be avoided at the areas specified for Project structures, but damage to the natural vegetation shall be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on productive land;
- 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.
- NOC should be obtained from Punjab Forest Department and concerned authority for any tree cutting.

6.7.20 Fauna

Construction activities such as excavation, operation of heavy machinery, vehicular movement, labor influx, and establishment of camps may disturb local mammal and reptile

populations. Wildlife is likely to temporarily vacate areas directly affected by construction due to increased human activity.

Some reptiles particularly species of snakes and lizards may get killed during the earthwork's operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.

Birds will also 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. Cutting of trees may adversely affect their habitat as trees provide nesting and resting sites to them.

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

Mitigation Measures:

- 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 shall be given in this regard;
- The camps will be properly fenced and gated, to check the entry of birds and mammals in search of eatable goods. Similarly, wastes generated from camps will be properly disposed of, to prevent the chances of eating by animals, which may become hazardous to them;
- The contractor will make arrangements / measures to minimize vibration and noise pollution through good engineering practices;
- Noise control measures will be enforced during the construction phase such as provision of silencers on heavy construction vehicles especially near nesting areas and avoiding noise generating activities during the critical period of breeding;
- Efforts will be made to keep noise levels at acceptable levels (as per NEQS) produced by the construction activities;
- Over speeding of construction vehicles will be prohibited in the Project area, to avoid and minimize any accidental killing of birds, reptiles and mammals;
- Plantation of large number of trees along the proposed Project to regain the ecological habitat;
- Noisy work will not be carried out in night time so that there should be no disturbance to local birds and animals;
- Borrow pits will be fenced so that no animal can fall into these;
- If found any wild species during construction, it will be dealt carefully and local wildlife department officials will be called; and
- The Project will be completed timely to reduce the impacts.

6.7.21 Impact on Aquatic Habitat

Construction activities such as piling, excavation, and installation of bridge piers can disturb the riverbed and aquatic habitat. This may lead to displacement of fish, benthic organisms, and other aquatic species. Sensitive species may migrate away from the impact zone due to noise, vibration, and physical disturbance.

Bridge piers and abutments can modify the natural flow pattern of the river, potentially causing localized scouring or sediment deposition. Changes in flow velocity and channel structure may affect aquatic habitats, particularly for species dependent on specific flow conditions.

Mitigation Measures

- Schedule excavation and foundation works during low-flow periods to minimize sediment dispersion;
- Avoid unnecessary disturbance of the riverbed and restrict working footprint to designated areas;
- Stabilize exposed soils promptly through backfilling and compaction;
- Prohibit direct discharge of construction wastewater, cement slurry, or chemicals into the river;
- Designate secure areas for fuel storage and equipment maintenance away from the riverbanks;
- Implement spill prevention and response plans, including availability of spill kits on-site;
- Treat or settle wastewater in sedimentation tanks before discharge;
- Restrict in-stream works during fish breeding/spawning seasons to avoid ecological disruption;
- Conduct regular water quality monitoring (turbidity, pH, DO, etc.) during construction;
- Maintain minimum environmental flow conditions to sustain aquatic life;
- If any fish/species found during construction phase, immediately report to the Punjab Fisheries Department.

6.7.22 Social/ Cultural Conflicts

During the construction phase of the project, conflicts may arise between labor force and Local communities 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.

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.

6.7.23 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. The impact is temporary and positive in nature.

6.7.24 Impacts on Livelihood

The construction activity may disturb the business and livelihoods of the locals in terms of loss of shops and access. The impact is moderate negative in nature.

Mitigation Measures

- Proper compensation should be provided to all the affectees losing their livelihoods along the AOI;
- 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. This assessment should be reviewed and revised on the basis of final AOI and construction camp site determined during the construction phase;
- Project Construction should be completed on time; and
- Proper awareness and training should be conducted among the affectees regarding Project benefits, reasons for acquiring lands and compensations to be provided.

6.8 ANTICIPATED IMPACTS DURING OPERATIONAL PHASE

The anticipated impacts related to the proposed project have been studied for the operational phase and discussed hereunder:

6.8.1 Air Quality

Increased traffic levels in the project area may lead to higher values of air emissions that will affect the ambient air quality of the Project Area. The impact is permanent and minor negative in nature.

Mitigation Measures

Following mitigating measures are needed to be suggested:

- RUDA with the help of EPCCD may set up system to monitor air quality along project area at important intersections/sensitive receptors in accordance with PEQS for a specific period to record the quality of air during the operation phase. This may help in comparing the baseline conditions with the operation phase of the project;
- Setting up to system to monitor air quality along the project area in accordance with acceptable International Standards; Monitoring emissions of vehicle as per PEQS;

- Helping the owners and occupants of the affected premises/settlements to identify and implement special measure such as hedges and vegetation to reduce air pollution; and
- Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust and reduce the noise pollution too alongside the proposed project.

6.8.2 Noise and Vibration

The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas. Impact of noise generated from the vehicles moving on the proposed road will be permanent and moderate adverse in nature.

Mitigation Measures

- Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. Noise measurements should be carried out at locations with respect to the schedule specified in the Environmental Monitoring Plan (EMMP) to ensure the effectiveness of mitigation measures;
- Use of horn should be strictly prohibited in the close proximity of the built-up areas;
- Proper signboards should be installed to ensure reduce noise levels in the project area;
- Enforcement and penalties against traffic rules violators; and
- Noise barriers may be installed/constructed near the built-up areas.

6.8.3 Road Maintenance

During the operation phase related road 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.

6.8.4 Drainage and Urban Flooding

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.

6.8.5 Flora and Fauna

No adverse impacts are envisaged on flora and fauna of the study area during the operation phase.

1500 trees and ornamental plants will be planted in and around the road to enhance the aesthetics value, and to control noise and air pollution. It will provide the following benefits during operation phase:

- Creates a visual barrier and enhances the appearance
- Providing nesting place for the birds;
- Captures and reduces odor concentrations by absorbing gases, if any emits from Nullah;
- Trees will act as wind speeds barrier to protect building structures during intense wind storms and intense rainfall.

However, mismanagement of green areas will result in clogging of drains, nuisance due to stagnant water and chemical pollution. This impact can be categorized as negative, local, low, short term and probable.

Mitigation Measures:

- The implementation of plantation plan recommended in compensation for cutting of trees will start working during operational phase, to ensure the ecological balance and to avoid any impact on local environment;
- Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Trees. Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation. It will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the project area, which shall improve the air quality;
- The saplings planted in the Project Area against the trees affected should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients by relevant department;
- Maintenance of the green areas and the protection of saplings for at least four (04) years to ensure better growth and environmental / aesthetics conditions;
- Keep green areas weed free. Weeds will be monitored weekly and removed no less than every two weeks. Use of chemicals for weed control and suppression needs to be approved by the concerned authorities;

- Plantations raised must be maintained according to the silvicultural practices which includes proper irrigation, cleaning, pruning, thinning at prescribed intensity, silt clearance and trench-opening; and
- Use of fertilizers will be strictly monitored in order to avoid any incident. Natural nutrients will be preferred.

7. ENVIRONMENTAL MANAGEMENT PLAN

7.1 GENERAL

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.

7.2 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;
- Public Disclosure;
- EMP Cost; and
- Summary of Environmental Cost.

7.3 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 (RUDA), 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 (RUDA), 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.

7.4 INSTITUTIONAL REQUIREMENTS

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

7.4.1 Institutional Setup for Implementation and Management of EMP

The key players involved during construction phase of the proposed Project are the RUDA as employer/proponent, Punjab EPCCD/Notified Officer (District Environment Officer), 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:

- RUDA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager
- Punjab EPCCD/ Notified Officer.

The employer/ proponent (RUDA) will make Contractor bound through contract documents to implement the recommendations set forth in EMP and other terms and conditions of the Environmental Approval granted by EPCCD. The whole 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 7.1**.

7.4.2 Overall Oversight Arrangements

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

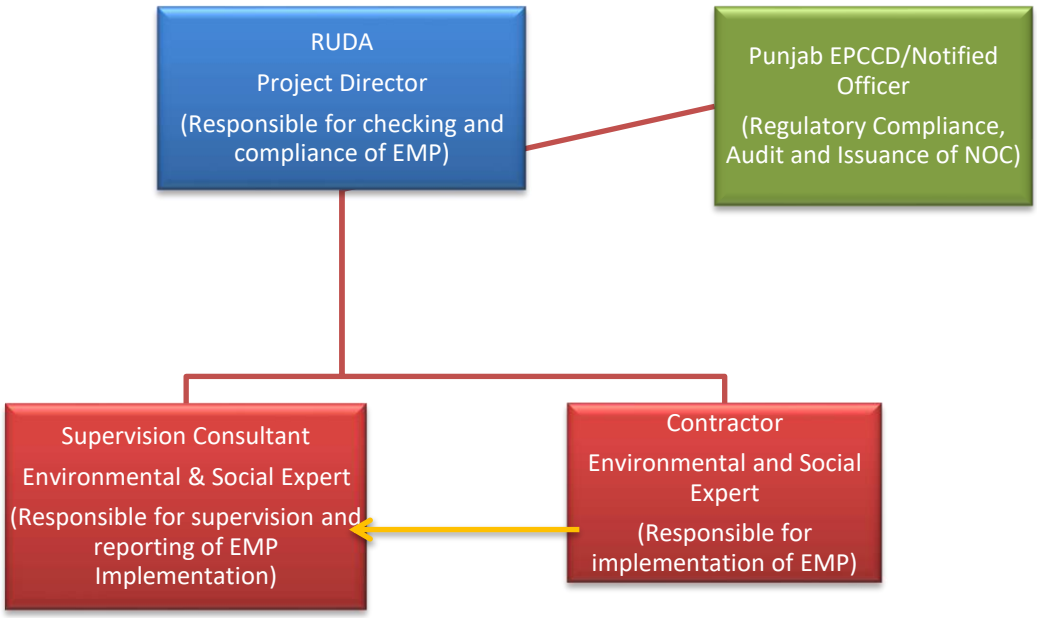

Figure 7.1: Organizational Setup for the Implementation of EMP (Construction Phase)

7.4.3 Roles and Responsibilities for EMP Implementation during construction Phase

a. RUDA/ Employer Concerned Staff

The specific responsibilities are as follows:

- To ensure implementation of mitigation measures proposed in EMP during the construction and operational phase of the Project;
- To organize monitoring of ambient air quality, water and noise. In case, the noise and emission levels exceed the acceptable levels; a penalty or ban must be enforced;
- To develop operational guidelines and implementation schedule;
- Receiving complaints from nearby community and assisting the local authority including liaison with Punjab-EPCCD/ Notified Officer - Environment;
- Ensuring availability of committed human resources and sufficient budget for successful implementation of EMP;
- To ensure that the proposed project is implemented in an environment friendly manner,
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the EPCCD-Punjab/ Notified Officer - Environment on status of EMP implementation.

b. Supervision Consultant (SC)

Environmental and Social Expert (E&SE) 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 E&SE for

implementing each of the activity as given in EMP. E&SE 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 E&SE are as follows:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- 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 are 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 environmental staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. Responsibilities of Contractor

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

- ESE of contractor will be 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.
- Implementation of the 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; 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.

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

The proposed Project will be administrated by RUDA during the O&M phase. Therefore; it is suggested that the Project Director of the proposed Project shall depute / hire Environment and Social Manager (E&S) to monitor and implement EMP during operation phase.

The specific responsibilities of E&S Manager are as follows:

- Coordinating with the operational staff working under the 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 EPCCD-Punjab;
- Assess and propose mitigation measures for unforeseen long-term environmental and social impacts of operation; and

Sustaining a working partnership among the RUDA, EPCCD-Punjab/ Notified Officer - Environment, Forest and Wildlife departments of Sheikhupura/ Lahore District to ensure compliance of EMP during operation phase.

7.5 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. All the mitigation measures during construction stage will be implemented by the Contractor, supervised by the Consultant and monitored by the Client. **Table 7.1** provides information about all impacts to be raised due to project activities during different phases of the Project i.e. pre-construction, construction and O&M and responsible organization for implementation of mitigation measures.

Table 7.1: Environmental Mitigation and Management Matrix

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
Preconstruction / Design Phase					
1.	**Technical Design and 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 designing the structures without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality.	• The technical design of the proposed project must consider all the above-mentioned factors for the final design and should meet all the local and international standards; • The proponent must review and validate all the design considering the possible impacts (as mentioned) before the start of construction of proposed Project.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
2.	**Topography** The project area is a plain terrain, and the proposed project is the part of Ravi Urban Development, so, there is no significant change in the topography of the project area is expected.	• Mitigation measures will involve adoption of best engineering design measures keeping in view of the aesthetics of the project area and provision of green belts for the landscape in design.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
3.	**Storm Water Drainage** Improper design of storm water drainage of the proposed Project may result in stagnant water on the road	• Provision of appropriate drainage structures with appropriate design capacity to avoid flooding especially during the rains; and • Proper slopes shall be incorporated in design to avoid the stagnant water.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
4.	**Seismic Hazard and Geo Hazard** As per Building Code of Pakistan, Seismic Provisions, 2007, the project area is located in Seismic "Zone-2A" with g-value 0.08 to 0.16. In this Zone, designing of various types of structures should be done on the basis of PGA. An 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; • 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; and • The structure of the proposed project should also be studied by the proponent (RUDA) to evaluate its durability/strength to withstand moderate to high intensity earthquake.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
5.	**Resource Conservation** Resources involved in the construction of proposed Project would include construction materials, water and fuel. Construction material to be used for construction activities includes coarse aggregates, fine aggregates, asphalt, cementious materials, reinforced and structural steel etc. Excessive water consumption for	• Use potable water bowsers for construction works and mineral water bottles/ filtered or treated ground water for drinking purpose; • Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants; • Reduction of wastage of water through training of workers involved in water use; • Reuse of construction waste materials may be adopted wherever possible; • Diesel and fuels with low sulphur content should be used to operate	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	drinking and washing purposes by the construction staff may pressurize water resources in the project area. Fuel (diesel, petrol) will be used to operate construction machinery, asphalt and batching plants. Sustainable use of energy resources is very important not only to continue future use but also to reduce air emissions.	construction machinery and equipment; • Efficient and well-maintained equipment and machinery should be used; • The equipment and machinery should be turned off when not in use; • Ensure adequate insulation to reduce heat loss through batching plants; • Regularly monitor CO and CO_2 content of the flue gases to verify that combustion systems are using practical excess air volumes; • Use of solar panels at construction camps may be considered and plan for use of solar panels at operational phase may also be considered; and • A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.			
6.	**Change in Hydrologic Regime** The proposed road passes through flood prone areas. There might be change in water flow pattern and disturbance to water flow occurred in future due to disposal of solid/construction waste, which will also cause adverse impacts on nearby communities.	• For the crossing of the river Ravi and other similar structures bridges will be constructed. While culverts and other possible arrangement will be accomplished in design for the crossing of river. Bridges on water channel shall be properly designed to accommodate future flows. Provision of culverts to control flood damages	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		and provision of safety of embankments will be considered during the design of these arrangements.			
7.	**Utilities** Due to the proposed project, public utilities i.e. Electricity Polls, Power/Telephone Lines, etc. will be affected creating disruption of public services and inconvenience to the local residents.	• 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; and • All public utilities (e.g. electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction works.	• Confirmation of design incorporation. • Audits and Checks	Design Consultant	Proponent
8.	**Flora** During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed that require significant space due to which available vegetation is expected to be removed. Shahdara Reserve Forest may be impacted due to	• The camps, mobility of machinery and construction of temporary road should be properly 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	• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	the proposed road alignment.	• The location of construction camp(s) will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement. • The proposed road should be rerouted from the Shahdara Reserve Forest and during the design phase forest area must be avoided.			
9.	**Fauna** No threatened faunal species were recorded in the study area during the field survey. The habitat values for fauna in the study area are generally limited. However, movement and installations of machinery and vehicles during the construction phase will generate noise that will create nuisance for avi-fauna and domestic mammals. The habitats of avi-fauna and domestic mammals may also be affected due to construction camps set-up and due to cutting of trees. This impact is site-specific, temporary and low adverse.	• The engineering design to integrate the principles of green infrastructure including habitat conservation, animal trespasses etc.; • The sites for the construction's camps will be carefully selected keeping in mind the available faunal habitats along the study area. Moreover, the layout of camps needs to be designed while considering the faunal habitat of the area; • Prior to commencing any construction work, any works required outside the construction footprint verified will be referred for advice on further assessment and approval requirements so that damage to any available habitat over there could be avoided at maximum;	• Audits and Checks	Design Consultant	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Proponent should take NOC from the relevant department (Punjab Forest Department) prior to construction phase. • The construction camp management plan during the planning stage will consider fencing and gating to check the entry of animals in search of eatable goods; and • Similarly, waste management plan of the camps will be considered at the planning stage to prevent wild animals and birds.			
10.	**Socio-economic Environment** The project will result in loss of agricultural land which is the prime source of livelihood in the area. Livestock which is another source of income will face loss of food and shelter. Locals may be relocated resulting in disturbance of livelihood. In addition to this, access of people may be hindered due to construction and implementation of access roads.	• Planning shall involve minimum disturbance to locals and their associated income and livelihood sources. In case, it is unavoidable, proper compensation shall be provided to locals. Alternate arrangements for access shall be provided.	• Audits and Checks	Design Consultant	Proponent
		Construction Phase			
11.	**Soil Erosion and Contamination** The clearing of vegetation can loosen	• Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in	• Visual observation and photographic record • Site restoration and	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	the soil and make it more susceptible to erosion due to wind and rain. Soil may be affected by erosion, compaction and contamination. Soil erosion may occur at active construction sites and at contractors' camps, as a result of uncontrolled run-off from equipment washing yards, excavation of earth/cutting operations and clearing of vegetation.	peripheral areas; • The provision for vegetation with a fast-growing crops/trees and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around bridges, culverts. Provision for rip-rap in discharge zones from drainage structures will be made in the design to reduce erosion. Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion; • The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; • Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals; • Soil contamination due to concrete transportation will be minimized by placing all containers in casings; • Solid waste generated at the camp sites will be properly treated and	rehabilitation plan implementation		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		safely disposed only in the demarcated waste disposal sites/areas; • If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned; and • Soils removed during construction would be stockpiled for reuse where possible; and • Runoff from washing of equipment and gadgets should be drained into either a septic tank or a sand-gravel bed for removal of the grit and contaminants.			
12.	**Borrow/ Open Pits** Borrow/ open pits and associated 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 become potential sources of mosquito breeding and may prove hazardous to humans, livestock and wildlife.	• Necessary permits will be obtained for any borrow pits from the competent authorities; • In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; • Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands; • In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and	• Visual observation and photographic record • Site restoration and rehabilitation plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.			
13.	**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 will 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) of the size smaller than 10 micrometre (PM10) tends to remain suspended in the environment for much longer and persistent time and is an environmental hazard.	• 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 trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise; • Regular water sprinkling of the site	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records • Water sprinkling records.	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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.	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			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		accordance with PEQS.			
14.	**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's. Noise and vibration are perceived as one of the most undesirable consequences of construction activity. The cumulative effects from several machines can be significant and may cause significant nuisances.	• 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
15.	**Construction Camps Sites** Due to the construction camps, loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc.	***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	• Physical observation • Regular environmental monitoring, sampling and testing • Vehicle maintenance records	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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*** 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			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		Management Plan to address: ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. 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 construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption; ▪ The contractor(s) should provide plan to RUDA 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.			
16.	**Wastewater Generation at Construction Camps** Wastewater will be generated at the construction camps by the workers. If	• Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems; • Proper monitoring to check the compliance of PEQS will be carried	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	the generated wastewater is not properly treated or disposed of, this may contaminate the ground water apart from soil contamination. The wastewater generation is estimated to be 3,200 liters/day for 100 construction workers.	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.			
17.	**Solid Waste Generation at Construction Camps/s** The solid waste generation is estimated to be 45 kg/day for 100 construction workers during construction phase of the proposed Project. Different type of waste is likely to be generated during the construction phase. The municipal waste will be in the form of food, cans, paper and wastewater from construction camps toilets and washing yards.	• 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. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste; • The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site; • Toxic waste will be handled, stored, transported and disposed-off separately. Safe handling precautions and product specific information is found in Material Safety Data Sheets (MSDS) which must be located on site and accessible to all workers	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		• All persons interacting with hazardous wastes will be required to wear the appropriate PPE; and • The waste will be properly sealed in containers with proper labels indicating the nature of the waste.			
18.	**Waste Generation at Construction Site** 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	• Construction Waste Management Plan (Annex-IV) will be implemented to ensure safe handling, storage, collection and disposal of construction wastes and the training of employees who handle waste; • Recyclable wastes e.g. steel bars will be sold to waste vendors; • Reusable material will be used as a filling material during ground levelling; • Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; and • The site will be restored back to its original conditions after construction completion.	• Visual observation and photographic record. • Waste Management plan implementation	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	temporary and minor negative in nature.				
19.	**Impact on Water Resources (Surface and Groundwater Contamination)** The proposed project falls in flood prone area and also crosses river Ravi. This surface water body may get contaminated by the fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at the construction camp sites. Moreover, runoff from the chemical storage areas may also contaminate the surface water bodies. In addition to that, construction waste, if left un-attended will result in leachate formation, which will percolate through the soil strata and reach to groundwater table and will contaminate it.	• 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 camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met; • The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality; • The proponent will ensure that the construction work is confined within the RoW and water bodies are prevented from pollution during construction; • The solid waste will be disposed of at designated landfill sites to sustain the water quality for domestic requirements; • Regular water quality monitoring	• Physical observation • Regular environmental monitoring, sampling and testing	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		according to determined sampling schedule; • The contractor will ensure that construction debris do not find their way into the drainage or irrigation channels which may get clogged; • To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas; • Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond; • Construction work close to the distributaries or other water bodies will be avoided, especially during monsoon period; • 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; and • Similarly, if the sewage after treatment is to be discharged on to the land it will meet the requirements of the PEQS for disposal of wastewater.			
20.	**Traffic Issues** The project area will be approached	• Movement of vehicles carrying construction materials and equipment/machinery will be restricted	• Vehicle maintenance record • Training record	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	through various major roads. These roads serve as main approach roads to the Project Area and due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the Project Area. 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.	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; • The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission; • 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; and • Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.	• Implementation of TMP • Regular visual observations		
21.	**Green House Gas Abatement** The main sources of greenhouse gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed	• Regular motioning of the vehicles for engine efficiency; • Avoid idling of construction vehicles; • Alternative energy resources shall be considered where possible; • PEQS applicable to gaseous	• Regular environmental monitoring, sampling and testing reports • Vehicle inspection record	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	project will include both mobile and stationary sources. The mobile source will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants.	emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.	• Plantation record		
22.	**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.	• An Emergency Response Plan (ERP) for natural and manmade disasters should be developed by contractor in coordination with SC and client should be implemented in close consultation with the RESCUE Services and other concerned departments; • Training of the Contractor and RUDA staff 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, and preventive measures should be formulated accordingly by the university Management.	• Trainings, drills, record keeping • ERP implementation • Visual observation and photographic record.	Construction Contractor	Proponent
23.	**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	• Punjab Occupational Safety and Health Act 2019 ensures the compliance of occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards; • Compliance with the safety	• Implementation of HSE Plan • Use of PPEs • Training Records • Work permits • Implementation of Emergency response plan and disaster	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	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.	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; and • An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services (Rescue 1122).	management plan in case of natural disaster occurrence		

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
24.	**Community Health and Safety** The construction activities and vehicular movement at construction sites may result in inflicting local communities who are not familiar with presence of heavy equipment. 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.	• 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; • Seeking cooperation with local educational facilities (school teachers) at each village along the route for road safety campaigns; • 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	• Implementation of HSE Plan • Use of PPEs • Community concerns record • Medical reports of worker	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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 RUDA; and • Contractor will take due care of the			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		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.			
25.	**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	• 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	• Implementation of HSE Plan • Use of PPEs • Implementation of COVID-19 Guidelines; • Medical reports of worker	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	(COVID-19) due to close interaction of the labor force during construction not only among the workers but also in the area. This impact can be categorized as direct, medium, site-specific, short term, temporary, medium to high probability and reversible.	and safety measures and related documents.			
26.	**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 of Archeology and Museums of Punjab to take further suitable action to preserve those antiques or sensitive remains.	• Chance finds procedure shall be adopted in case of any accidental discover of cultural heritage.	• Implementation of chance find procedure	Construction Contractor	Proponent
27.	**Emergency Response** The construction of the proposed project may encounter emergencies in addition to disasters such as earthquakes and fires. Lack of Emergency Response Plan (ERP) or an inefficient response plan may lead to an accident or critical injury.	• An Emergency preparedness and response is attached as Annex-IX should be adopted in case of any emergency.	• Implementation of chance find procedure	Construction Contractor	Proponent
28.	**Flora** The Project may involve destruction of	• Incorporate technical design measures to minimize removal of trees, if possible;	• Implementation of Tree Plantation Plan • Visual Observations	Construction Contractor in association with	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	vegetation cover on construction areas. It is initially examined that approximately **103 number** of trees/saplings will be disturbed. The provided number of trees is approximate and tentative provided by GIS.	• Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected; • A Tree Plantation Plan has been formulated (Annex-X) that shall be implemented with the technical support of concerned Agriculture and Forest Department; • As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality; • The Forest Department and agriculture department shall involve the local communities to carrying out plantation; • Open fires should be banned in the Project Area to avoid fire hazards; • 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 agriculturally productive land; • However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation		Forest Department	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
		will be carried out and minimum damage will be 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. The contractor' workforce shall use the paths and roads for movement and shall not be allowed to trespass through farmlands or forest areas; and • Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.			
29.	**Fauna** During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities. The existing animals 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.	• Care shall be taken during construction activities to avoid purposely or chance killing of animals; • If found any wild species and habitat during construction that must deal carefully and local wildlife department officials should be called; • Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labour 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	• Visual Observations	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Birds will also 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 construction machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers.	have to be controlled by the Wildlife Department; • Provision of culvert/tunnel for the movement of different faunal species across the project road present in the project area; • 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, clear orders should be given by the contractor; • Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and • Efforts should be made to keep noise levels at acceptable levels (as per PEQS) produced by the construction activities.			
30.	**Impact on Aquatic Habitat** Construction activities such as piling, excavation, and installation of bridge piers can disturb the riverbed and aquatic habitat. This may lead to displacement of fish, benthic organisms, and other aquatic species. Sensitive species may migrate away from the impact zone due to noise, vibration, and	• Schedule excavation and foundation works during low-flow periods to minimize sediment dispersion; • Avoid unnecessary disturbance of the riverbed and restrict working footprint to designated areas; • Stabilize exposed soils promptly through backfilling and compaction; • Prohibit direct discharge of construction wastewater, cement slurry, or chemicals into the river;	• Audits and Checks • Visual Observations	Construction Contractor	Proponent

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	physical disturbance. Bridge piers and abutments can modify the natural flow pattern of the river, potentially causing localized scouring or sediment deposition. Changes in flow velocity and channel structure may affect aquatic habitats, particularly for species dependent on specific flow conditions.	• Designate secure areas for fuel storage and equipment maintenance away from the riverbanks; • Implement spill prevention and response plans, including availability of spill kits on-site; • Treat or settle wastewater in sedimentation tanks before discharge; • Restrict in-stream works during fish breeding/spawning seasons to avoid ecological disruption; • Conduct regular water quality monitoring (turbidity, pH, DO, etc.) during construction; • Maintain minimum environmental flow conditions to sustain aquatic life.			
31.	**Social/ Cultural Conflicts** During the construction phase of the project, conflicts may arise between labor force and Local communities. i.e. Mari, Maralpar, Rat Garh and Aya Pind 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	Construction Contractor	Proponent
O&M Phase					
32.	**Landscape** After the completion of the proposed	• Proper implementation of the tree plantation plan will improve landscape of the project area.	• Monitoring of plant maintenance activities records	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	Project, the overall environmental conditions of the Project area will greatly improve due to plantation of trees and ornamental plants around the proposed alignment.				
33.	**Ambient Air Quality** Increased traffic levels in the project area may lead to higher values of air emissions that will affect the ambient air quality of the Project Area.	• RUDA with may set up system to monitor air quality along project area at important intersections/sensitive receptors in accordance with PEQS for a specific period to record the quality of air during the operation phase. This may help in comparing the baseline conditions with the operation phase of the project; • Setting up to system to monitor air quality along the project area in accordance with acceptable International Standards; Monitoring emissions of vehicle as per PEQS; • Helping the owners and occupants of the affected premises/settlements to identify and implement special measure such as hedges and vegetation to reduce air pollution; and • Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust and reduce the noise pollution too alongside the proposed project.	• Visual observation • Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records	Proponent	
34.	**Noise**	• Provision of adequate noise barriers	• Physical observation	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas.	such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. Noise measurements should be carried out at locations with respect to the schedule specified in the Environmental Monitoring Plan (EMP) to ensure the effectiveness of mitigation measures; • Use of horn should be strictly prohibited in the close proximity of the built-up areas; • Proper signboards should be installed to ensure reduce noise levels in the project area; • Enforcement and penalties against traffic rules violators; and • Noise barriers may be installed/constructed near the built-up areas.	• Regular environmental monitoring, sampling and testing reports • Vehicle maintenance records		
35.	**Road Safety and Maintenance** During the operation phase related road 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	• 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	• Physical observation • Road maintenance records	Proponent	

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
	emissions, dust and increase in noise.	followed and implemented to avoid any incident/accident.			
36.	**Drainage and Urban Flooding** During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travellers 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 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.	• Physical observation • Road maintenance records	Proponent	
37.	**Flora and Fauna** No adverse impacts are envisaged on flora and fauna of the study area during the operation phase. 1500 trees and ornamental plants will be planted in and around the road to enhance the aesthetics value, and to control noise and air pollution. It will provide the following benefits during operation phase: ▪ Creates a visual barrier and enhances the appearance ▪ Providing nesting place for the birds;	• The implementation of plantation plan recommended in compensation for cutting of trees will start working during operational phase, to ensure the ecological balance and to avoid any impact on local environment; • Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Trees. Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation. It will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the project area, which shall improve the air	• 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
	▪ Captures and reduces odor concentrations by absorbing gases, if any emits from Nullah; ▪ Trees will act as wind speeds barrier to protect building structures during intense wind storms and intense rainfall. However, mismanagement of green areas will result in clogging of drains, nuisance due to stagnant water and chemical pollution. This impact can be categorized as negative, local, low, short term and probable.	quality; • The saplings planted in the Project Area against the trees affected should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients by relevant department; • Maintenance of the green areas and the protection of saplings for at least four (04) years to ensure better growth and environmental / aesthetics conditions; • Keep green areas weed free. Weeds will be monitored weekly and removed no less than every two weeks. Use of chemicals for weed control and suppression needs to be approved by the concerned authorities; • Plantations raised must be maintained according to the silvicultural practices which includes proper irrigation, cleaning, pruning, thinning at prescribed intensity, silt clearance and trench-opening; and • Use of fertilizers will be strictly monitored in order to avoid any incident. Natural nutrients will be preferred.			

Sr. No.	Impacts	Mitigation Measure	Performance Monitoring Indicators	Responsibility	
				Implementation	Monitoring
38.	**Social Issues** The socio-economic impacts due to traffic congestion and air pollution may cause threat to human health in terms of loss of work time, waste of fuel, reduced efficiency of people and resultant increase in health expenditures.	• Redefining basic land use allocation standards; • Improvements in the design considerations of proposed road alignment so as to promote sustainable development of commercial areas; and • Land use policies such as development restrictions and zoning codes (residential or commercial) and implementation of related By-Laws.	• Visual observation • Regular monitoring, • Record keeping	Proponent	

7.6 ENVIRONMENTAL MONITORING PLAN

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 EMP; 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 EMP.

7.6.1 Monitoring Strategy

Under the proposed monitoring strategy, RUDA will 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/Notified Officer. The monitoring program has been designed carefully considering the identified impacts mentioned in **Chapter-7**. **Table 7.2** provides environmental monitoring schedule for construction and operations stages of the proposed project.

7.6.2 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, RUDA. 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) RUDA 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.

7.6.3 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 7.2.**

Table 7.2: 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}	1x2x4= 8	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	240,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x2x4= 8	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	16,000/-
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) =	***576,000/-***
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x2x2 = 4	Biannually @ Rs. 30,000 per sample	RUDA	24 hours	120,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x2x2 = 4	Biannually @ Rs. 2,000 per point	RUDA	24 hours	8,000/-
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	RUDA	-	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 / Wastewater 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, Barium, Iron, Manganese, Boron	1x2x2 = 4	Biannually @ Rs. 20,000 per point	RUDA	-	80,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	and Total chloride					
					TOTAL (B) =	***288,000/-***
					GRAND TOTAL (A+B) =	***864,000/-***

KEY

CC	Construction Contractor	SC	Supervision Consultant
RUDA	Ravi Urban Development 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. 288,000/-) must be considered with an annual increment of 10%.
- All the environmental parameters will be analyzed as per Punjab Environmental Quality Standards (PEQS), 2016.

7.7 TREE PLANTATION

To minimize the negative impacts arising due to tree cutting (approximately 103 No.), increased vehicular activity on the Access Bridge and to enhance the landscape of the project area, plantation at available spaces in the project area.

Plantation Plan shall be carried out by the Client in coordination with Forest Department, which has the requisite expertise and experience for such tasks.

The tentative cost for the plantation is about Rs. 2.5 Million. Detailed Tree Plantation Plan is attached as **Annex-X**.

7.8 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 EMMP 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.

RUDA 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 RUDA 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 7.3 provides brief detail of the capacity building and training plan for the proposed project.

Table 7.3: 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)	Members of Environmental Committee, RUDA Staff and Contractor Workers	3 Days
TA Individuals, Consultants and Organizations	Short Seminars and Courses on: • Occupational Health and Safety	Members of Environmental	3 Days

Provided by	Contents	Trainees	Duration
specializing in Social Management and Monitoring, and Occupational Health and Safety	Plan (OHS); • 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.	Committee, RUDA 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 RUDA	3 Days

7.9 COMMUNICATION & DOCUMENTATION

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

7.9.1 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.

7.9.2 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.

7.9.3 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 7.4 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 7.4: Periodic Reporting Mechanism

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

7.9.4 Social Complaint Register

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

7.9.5 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.

7.9.6 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.

7.9.7 Review of Recorded Data

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

7.10 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 RUDA 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;
- Disaster Management Plan;
- Drinking Water Supply and Sanitation Plan
- Traffic Management Plan;
- Change Management Plan
- Quarry Management Plan; and
- Resource Conservation Plan.

7.11 EMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas RUDA 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 7.5.**

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 7.5: 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 100 employees *Pre-Construction Phase:* 100 x 6,000 x 1 = 600,000 *Construction Phase:* 100 x 6,000 x 2 = 1,200,000	1,800,000 /-	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 100 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.	2,064,500/-	For detail, please refer to Annex–XI.
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 175,000 = 2,100,000 *Operational Phase:* 1 x 12 x 175,000 = 2,100,000	4,200,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.

7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	864,000/-	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. 100,000/- per session during construction phase). 3 x 300,000 = 900,000	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	Approximately 103 numbers of different trees may be cut down during construction phase. Therefore, Compensatory planting trees against each fallen tree of similar floral function should be planted to enhance the landscape of the project area. Plantation at available spaces may be carried out.	2,537,080	For detail, please refer to **Annex–X**.
Total =				**16,145,580/-**

The total estimated cost for the environmental management, monitoring and auditing during construction and O&M for one year (annual cost will be updated for next upcoming years accordingly) comes to about **PKR. 16.145 Million**.

8. CONCLUSION AND RECOMMENDATIONS

8.1 GENERAL

This report has been prepared to comply with Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017). The report provides conclusions based on the impacts assessed and the mitigation measures suggested.

8.2 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. Various stakeholders including government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents.

During the pre-construction, construction and operational phases, following are the main issues and concerns:

- Disturbance to the public movement and cultural norms during construction;
- Reduction in the daily routine activities of local residents 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;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Cutting of trees/bushes/crops falling within the proposed ROW;
- Occupational and community health and safety issues; and
- Solid waste handling and disposal and waste water generation and treatment during operation phase.

Results of the EIA Study have shown that there are no critical environmental impacts associated with the project. However, several concerns / impacts with regard to physical, ecological and social environment have been identified in report which needs to be mitigated by strict implementation of Environmental Management Plan. These impacts could also be reduced by proper and well planned meticulous design of the access bridge and by implementing an appropriate tree plantation plan. In fact, in times of diminishing economic and natural resources, using sustainable approaches in an urban infrastructure will help us to enhance quality of life and serve the needs of the present leaving provision for future generations to meet their needs.

8.3 RECOMMENDATIONS

An Environmental Monitoring/Management Plan (EMP) for both the 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:

- The master planning of the proposed Project should be done in accordance to Seismic Building Code of Pakistan, 2021;
- Proper location(s) for construction camps should be selected by contractor in close coordination with RUDA 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: _____

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

PNAC LAB 208 17025

EPA PUNJAB CERTIFIED

ASIAN ENVIRONMENTAL SERVICES (PVT) LTD.
www.asianenvirolab.com

ENVIRONMENTAL MONITORING & ANALYSIS REPORT

EIA STUDY FOR THE CONSTRUCTION OF JAHANGIR TOMB ACCESS BRIDGE

- Ambient Air Monitoring
- Noise Level Monitoring
- Drinking Water Analysis
- Surface Water Analysis
- Wastewater Analysis

Report Reference No: AES-ENV-NS-227/2025

Dated: 09th December, 2025

Asian Environmental Services (Pvt.) Ltd.
has prepared this report as per prerequisites of Customer.
Any other individual using the content of this document shall do so at their own liability.
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AMBIENT AIR MONITORING LOCATION NO 1

LAHORE FISH MARKET

Lahore



Document No. AES/LMS/FRM-115, Date of Issue 07 July, 2022, Revision No. 00

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AMBIENT AIR MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-01	**Monitoring Point**	Lahore Fish Market
Date of Monitoring	27-11-2025 to 28-11-2025	**Monitoring Coordinates**	31°36'36" **N** 74°18'38" **E**

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)	PM 2.5 (µg/m³)	PM 10 (µg/m³)	Ozone (µg/m³)
1	12:00	1.30	70.56	185.84	256.40	225.51	198	182	1.68
2	13:00	0.79	42.65	100.90	143.55	35.50	201	202	8.03
3	14:00	0.16	34.60	70.79	105.39	70.84	200	198	20.49
4	15:00	0.06	16.19	30.27	46.45	137.38	205	192	10.54
5	16:00	0.48	29.52	70.52	100.05	87.90	198	339	3.31
6	17:00	0.98	76.91	193.92	270.83	213.57	196	262	4.37
7	18:00	3.28	63.16	159.61	222.77	334.02	195	366	1.68
8	19:00	4.23	15.10	33.50	48.59	41.59	223	362	1.47
9	20:00	4.05	54.60	146.83	201.43	225.90	205	359	1.65
10	21:00	5.71	43.02	108.66	151.67	96.73	210	333	2.59
11	22:00	5.18	38.87	94.03	132.90	99.32	226	323	2.33
12	23:00	3.65	35.72	85.19	120.91	82.39	223	315	1.82
13	00:00	2.40	27.32	77.47	104.79	146.05	190	299	1.88
14	01:00	3.27	25.42	67.14	92.56	190.35	199	287	0.51
15	02:00	1.37	26.17	61.90	88.07	165.61	200	255	1.68
16	03:00	1.34	23.19	45.93	69.12	182.54	206	263	1.61
17	04:00	2.08	21.11	56.05	77.16	212.14	210	260	1.10
18	05:00	4.00	19.91	52.91	72.82	208.79	200	273	0.76
19	06:00	6.16	20.53	32.37	52.90	241.52	206	292	1.04
20	07:00	8.24	15.83	20.39	36.22	272.19	215	313	1.68
21	08:00	3.29	13.76	20.39	34.15	97.10	264	338	1.68
22	09:00	2.01	12.05	21.52	33.57	36.10	291	398	1.90
23	10:00	0.96	17.83	45.98	63.81	103.83	206	297	2.04
24	11:00	0.55	22.91	60.98	83.89	132.07	223	290	4.08
Average Concentration		**2.73**	**31.96**	**76.80**	**108.75**	**151.62**	**212**	**292**	**3.33**

Monitored By

Asian Environmental Services (Pvt) Ltd. LAHORE

Reviewed By
(TM)

Approved By
(QM/Chief Chemist)

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AMBIENT AIR MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-01	**Monitoring Point**	Lahore Fish Market
Date of Monitoring	27-11-2025 to 28-11-2025	**Monitoring Coordinates**	31°36'36" **N** 74°18'38" **E**

Parameters	Method of Measurement	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	Gas Phase Chemiluminescence	24 Hours	1.00	76.80	80.0 µg/m³	Optimal
Nitrogen Oxide (NO)*	Gas Phase Chemiluminescence	24 Hours	1.00	31.96	40.0 µg/m³	Optimal
NO_x*	Gas Phase Chemiluminescence	24 Hours	1.00	108.75	NGVS µg/m³	-
Sulphur Dioxide (SO_2) *	Ultraviolet Fluorescence method	24 Hours	1.00	**151.62**	120.0 µg/m³	High
Carbon Monoxide (CO)*	Non-Dispersive Infra-Red (NDIR)	24 Hours	0.01	2.73	05.0 mg/m³	Optimal
Ozone (O_3) *	Non-Dispersive Ultra-Violet Absorption Method	01 Hour	1.00	3.33	130 µg/m³	Optimal
Particulate Matter (PM_{10}) *	β Ray absorption method	24 Hours	1.00	**292**	150.0 µg/m³	High
Particulate Matter ($PM_{2.5}$) *	β Ray absorption method	24 Hours	1.00	**212**	35.0 µg/m³	High
Total Particulate Matter (TSP)	Gravimetric Sampling	24 Hours	1.00	**504**	500.0 µg/m³	High

*Parameters are approved from Punjab Environmental Protection Agency.
Note: The standard for CO monitoring is for 08 Hours, however the Average Obtained Concentration is of 24 Hours

Abbreviations:
LDL= Lower Detection Limit
PEQS= Punjab Environmental Quality Standards
µg/m³ = Micro Gram per Meter Cube
mg/m³ = Mili Gram per Meter Cube
NGVS = No Guideline Value Set

Remarks:
Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

Monitored By

Reviewed By (TM)

Approved By (QM/Chief Chemist)

Asian Environmental Services (Pvt) Ltd. LAHORE

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AMBIENT AIR MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-01	**Monitoring Point**	Lahore Fish Market
Date of Monitoring	27-11-2025 to 28-11-2025	**Monitoring Coordinates**	31°36'36" **N** 74°18'38" **E**

Sr. No.	Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	12:00	26	N	0.3	38	745
2	13:00	26	N	0.4	37	751
3	14:00	28	NW	0.2	33	755
4	15:00	26	NW	0.9	34	747
5	16:00	23	S	1.5	42	745
6	17:00	20	SE	1.7	48	748
7	18:00	18	SE	1.6	55	736
8	19:00	17	S	1.3	56	754
9	20:00	17	NE	1.8	56	745
10	21:00	17	NE	1.9	56	739
11	22:00	16	N	0.5	59	755
12	23:00	15	S	0.9	63	752
13	00:00	14	S	0.9	63	752
14	01:00	14	S	0.9	63	736
15	02:00	13	S	1.0	63	754
16	03:00	13	N	1.1	65	739
17	04:00	11	N	1.1	61	759
18	05:00	10	NW	1.2	68	742
19	06:00	11	NW	0.9	70	745
20	07:00	13	SE	0.3	72	758
21	08:00	15	SE	0.1	69	761
22	09:00	19	S	0.4	54	743
23	10:00	21	S	0.9	50	749
24	11:00	25	S	0.9	42	745

Monitored By

Asian Environmental Services (Pvt) Ltd. LAHORE

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NOISE MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-01	**Monitoring Point**	Lahore Fish Market
Date of Monitoring	27-11-2025 to 28-11-2025	**Monitoring Coordinates**	31°36'36" **N** 74°18'38" **E**

Sr. No.	Time	Noise dB (A)	
1	12:00	75	
2	13:00	76	
3	14:00	78	
4	15:00	75	
5	16:00	74	
6	17:00	72	Day Time
7	18:00	70	
8	19:00	71	
9	20:00	69	
10	21:00	68	
11	22:00	67	
12	23:00	69	
13	00:00	69	
14	01:00	68	
15	02:00	67	Night Time
16	03:00	66	
17	04:00	65	
18	05:00	66	
19	06:00	67	
20	07:00	68	
21	08:00	69	
22	09:00	70	Day Time
23	10:00	71	
24	11:00	72	

Time	PEQS	Average Values	Remarks
Day Time	65	**72**	High
Night Time	55	**67**	High

Abbreviations: **dB (A)**= Decibel (Relatable to human hearing) **PEQS**= Punjab Environmental Quality Standards

Remarks:

Optimal = Compliance with Permissible Range **Marginal** = Close to Extreme Edge **High** = Exceeds from Permissible Range

Low = Less Than Permissible Range

Monitored By **Reviewed By (TM)** **Approved By (QM/Chief Chemist)**

Asian Environmental Services (Pvt) Ltd LAHORE

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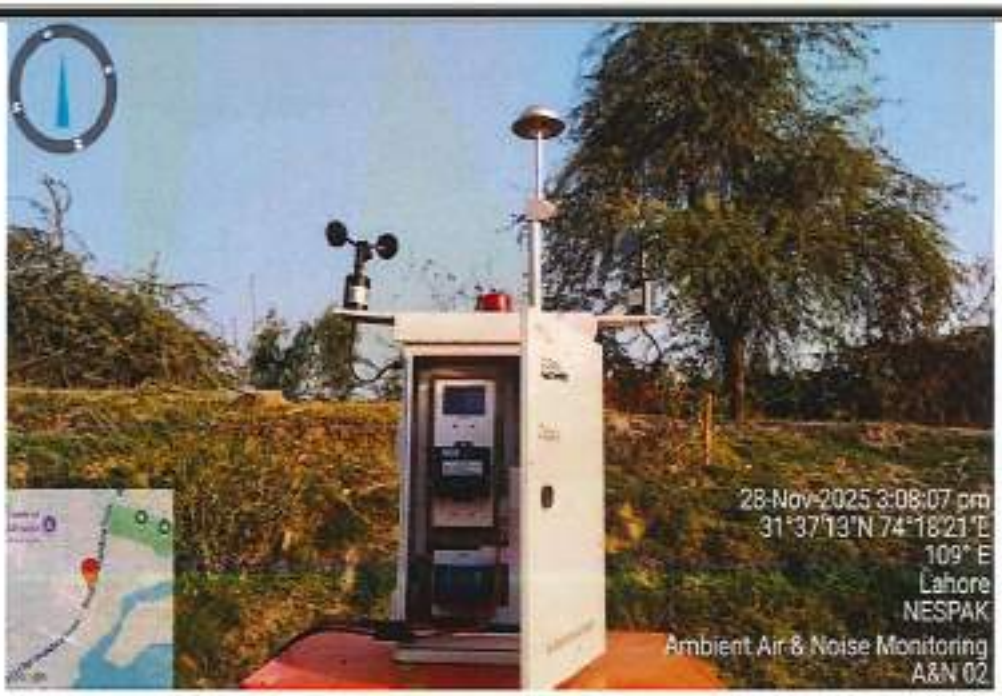
AMBIENT AIR MONITORING LOCATION NO 2
INFRONT OF MUGHLIA GRAVEYARD
Lahore



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AMBIENT AIR MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-02	**Monitoring Point**	Infront of Mughlia Graveyard
Date of Monitoring	28-11-2025 to 29-11-2025	**Monitoring Coordinates**	31°37'13" **N** 74°18'21" **E**

Sr. No.	Time	CO (mg/m³)	NO (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)	PM 2.5 (µg/m³)	PM 10 (µg/m³)	Ozone (µg/m³)
1	15:00	0.94	24.56	75.27	99.84	101.12	190	228	1.68
2	16:00	1.21	35.34	151.99	187.33	274.59	189	248	1.43
3	17:00	1.53	38.85	165.15	204.01	309.10	196	290	1.20
4	18:00	1.70	58.30	169.90	228.20	315.89	190	297	1.68
5	19:00	3.84	78.20	231.92	310.12	401.97	270	319	1.61
6	20:00	6.25	62.80	139.84	202.65	287.45	239	346	1.68
7	21:00	6.91	48.31	96.40	144.70	189.07	227	338	1.80
8	22:00	8.26	35.95	104.60	140.55	269.76	229	420	1.06
9	23:00	6.65	30.97	115.00	145.97	238.31	190	333	1.23
10	00:00	6.39	25.89	91.04	116.93	198.66	192	376	1.16
11	01:00	3.36	44.39	100.11	144.50	161.02	210	411	1.02
12	02:00	5.17	31.37	78.95	110.32	111.49	200	378	0.80
13	03:00	4.07	25.92	74.03	99.96	101.12	209	310	1.82
14	04:00	2.71	41.16	79.10	120.26	119.01	224	296	1.68
15	05:00	2.78	31.18	66.09	97.27	102.76	249	301	1.94
16	06:00	3.73	32.41	58.62	91.03	110.18	220	313	1.84
17	07:00	5.50	28.48	65.13	93.62	130.09	209	340	2.41
18	08:00	5.19	42.01	90.88	132.89	45.14	210	356	6.17
19	09:00	2.31	52.57	125.87	178.44	104.88	215	234	3.45
20	10:00	1.13	50.89	101.62	152.51	44.64	212	221	5.52
21	11:00	1.04	65.45	126.17	191.62	101.56	203	230	2.17
22	12:00	0.32	35.93	76.19	112.12	7.11	190	232	7.86
23	13:00	0.26	40.79	97.02	137.80	28.21	192	225	6.25
24	14:00	0.13	44.19	76.66	120.85	151.90	193	227	1.21
Average Concentration		**3.39**	**41.91**	**106.57**	**148.48**	**162.71**	**210**	**303**	**1.25**

Monitored By

Asian Environmental Services (Pvt) Ltd. LAHORE

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Approved By (QM/Chief Chemist)

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AMBIENT AIR MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-02	**Monitoring Point**	Infront of Mughlia Graveyard
Date of Monitoring	28-11-2025 to 29-11-2025	**Monitoring Coordinates**	31°37'13" **N** 74°18'21" **E**

Parameters	Method of Measurement	Monitoring Duration	LDL	Average Obtained Concentration	PEQS	Remarks
Nitrogen Dioxide (NO_2) *	Gas Phase Chemiluminescence	24 Hours	1.00	**106.57**	80.0 µg/m³	High
Nitrogen Oxide (NO)*	Gas Phase Chemiluminescence	24 Hours	1.00	**41.91**	40.0 µg/m³	High
NO_x*	Gas Phase Chemiluminescence	24 Hours	1.00	148.48	NGVS µg/m³	-
Sulphur Dioxide (SO_2) *	Ultraviolet Fluorescence method	24 Hours	1.00	**162.71**	120.0 µg/m³	High
Carbon Monoxide (CO)*	Non-Dispersive Infra-Red (NDIR)	24 Hours	0.01	3.39	05.0 mg/m³	Optimal
Ozone (O_3) *	Non-Dispersive Ultra-Violet Absorption Method	01 Hour	1.00	1.25	130 µg/m³	Optimal
Particulate Matter (PM_{10}) *	β Ray absorption method	24 Hours	1.00	**303**	150.0 µg/m³	High
Particulate Matter ($PM_{2.5}$) *	β Ray absorption method	24 Hours	1.00	**210**	35.0 µg/m³	High
Total Particulate Matter (TSP)	Gravimetric Sampling	24 Hours	1.00	**513**	500.0 µg/m³	High

*Parameters are approved from Punjab Environmental Protection Agency.
Note: The standard for CO monitoring is for 08 Hours, however the Average Obtained Concentration is of 24 Hours

Abbreviations:
LDL= Lower Detection Limit | PEQS= Punjab Environmental Quality Standards | µg/m³ = Micro Gram per Meter Cube
mg/m³ = Mill Gram per Meter Cube | NGVS = No Guideline Value Set

Remarks:
Optimal = Compliance with Permissible Range | Marginal = Close to Extreme Edge | High = Exceeds from Permissible Range
Low = Less Than Permissible Range

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AMBIENT AIR MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-02	**Monitoring Point**	Infront of Mughlia Graveyard
Date of Monitoring	28-11-2025 to 29-11-2025	**Monitoring Coordinates**	31°37'13" **N** 74°18'21" **E**

Sr. No.	Time	Ambient Temperature °C	Wind Direction	Wind Velocity m/s	Humidity %	Pressure (mm of Hg)
1	15:00	25	S	0.7	36	748
2	16:00	21	S	0.5	45	736
3	17:00	17	E	0.6	56	750
4	18:00	15	E	0.3	63	742
5	19:00	15	N	0.4	67	759
6	20:00	14	N	0.3	69	755
7	21:00	13	S	0.4	73	737
8	22:00	12	S	0.5	77	745
9	23:00	12	S	1.2	77	741
10	00:00	11	NW	1.4	75	758
11	01:00	11	NW	1.2	73	793
12	02:00	11	NW	0.8	69	742
13	03:00	10	SW	0.7	71	745
14	04:00	10	SW	0.3	70	748
15	05:00	9	N	0.7	68	739
16	06:00	10	N	0.4	67	759
17	07:00	12	N	0.4	65	753
18	08:00	13	W	0.2	69	758
19	09:00	19	W	1.9	49	736
20	10:00	22	NW	0.1	38	742
21	11:00	24	NW	0.2	35	744
22	12:00	26	NW	0.1	30	745
23	13:00	25	SE	0.1	29	736
24	14:00	25	SE	0.2	31	739

Monitored By

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NOISE MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227-2025-AA-02	**Monitoring Point**	Infront of Mughlia Graveyard
Date of Monitoring	28-11-2025 to 29-11-2025	**Monitoring Coordinates**	31°37'13" **N** 74°18'21" **E**

Sr. No.	Time	Noise dB (A)	
1	15:00	71	
2	16:00	72	
3	17:00	71	
4	18:00	73	Day Time
5	19:00	73	
6	20:00	71	
7	21:00	72	
8	22:00	69	
9	23:00	67	
10	00:00	68	
11	01:00	69	
12	02:00	65	Night Time
13	03:00	63	
14	04:00	61	
15	05:00	62	
16	06:00	60	
17	07:00	65	
18	08:00	66	
19	09:00	71	
20	10:00	70	Day Time
21	11:00	71	
22	12:00	71	
23	13:00	72	
24	14:00	73	

Time	PEQS	Average Values	Remarks
Day Time	65	**71**	High
Night Time	55	**64**	High

Abbreviations: dB (A)= Decibel (Relatable to human hearing) PEQS= Punjab Environmental Quality Standards

Remarks:
Optimal = Compliance with Permissible Range Marginal = Close to Extreme Edge High = Exceeds from Permissible Range
Low = Less Than Permissible Range

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NOISE MONITORING REPORT

Monitoring Details

Report Reference No	AES-ENV-NS-227/2025	**Monitoring Point**	Jahangir tomb road
Date of Monitoring	28-11-2025 to 29-11-2025	**Monitoring Coordinates**	31°37'16" **N** 74°17'51" **E**

Sr. No.	Time	Noise dB (A)	
1	14:00	60	
2	15:00	62	
3	16:00	63	
4	17:00	65	
5	18:00	67	Day Time
6	19:00	66	
7	20:00	68	
8	21:00	70	
9	22:00	70	
10	23:00	64	
11	00:00	62	
12	01:00	66	
13	02:00	61	Night Time
14	03:00	59	
15	04:00	58	
16	05:00	59	
17	06:00	60	
18	07:00	68	
19	08:00	69	
20	09:00	68	
21	10:00	66	Day Time
22	11:00	64	
23	12:00	66	
24	13:00	68	

Time	PEQS	Average Values	Remarks
Day Time	65	**67**	High
Night Time	55	**61**	High

Abbreviations:
dB (A)= Decibel (Relatable to human hearing) PEQS= Punjab Environmental Quality Standards

Remarks:
Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
Low = Less Than Permissible Range

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DRINKING WATER ANALYSIS REPORT

Sample Details

Report Reference No.	AES-ENV-NS-227/25-DW-162/25	**Report Issue Date**	09-12-2025
Nature of Sample	Drinking Water	**Sample Collection Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected/Sent by**	AES
Sample Collection Date	29-11-2025	**Sample Receiving Date**	01-12-2025
Analysis Completion Date	09-12-2025	**Laboratory Temperature & Humidity**	(25 ± 5) °C & (55 ± 15) %



Ambient Temperature & Humidity at the Time of Sample collected 23°C & 27%

Sample ID	AES-ENV-DW-162/2025	**Sample Location**	Near Daata General Store
Customer Detail	NESPAK		
Project Details	EIA study for the construction of Jahangir tomb access bridge		

Drinking Water Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Laboratory Analysis					
Color*	SMWW 2120 C	≤ 15 TCU	0	N.A.	Optimal
Taste*	SMWW 2160 C	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Odor*	SMWW 2150 B	Non-Objectionable	Non-Objectionable	N.A.	Optimal
Turbidity*	SMWW 2130 B	< 5 NTU	0	N.A.	Optimal
Total Hardness (as $CaCO_3$) **	SMWW 2340 C	< 500 mg/L	372	± 1.40	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	< 1000 mg/L	410	± 2.77	Optimal
pH**	SMWW 4500 H^+ B	6.5- 8.5	7.67	± 0.04	Optimal
Aluminum (Al)	SMWW 3111 B	≤ 0.2 mg/L	<0.005	N.A.	Optimal
Antimony (Sb)	SMWW 3114 B	≤ 0.005 mg/L	<0.005	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Barium (Ba)	SMWW 3113 B	0.7 mg/L	<0.0035	N.A.	Optimal
Boron (B)	SMWW 3113 B	0.3 mg/L	<0.02	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.01 mg/L	<0.006	N.A.	Optimal
Chloride (Cl) **	SMWW 4500-Cl^- B	< 250 mg/L	35	± 1.59	Optimal
Chromium (Cr)	SMWW 3113 B	≤ 0.05 mg/L	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3111 B	2.0 mg/L	0.164	N.A.	Optimal
Cyanide (CN^-)*	SMWW 4500-CN^- F	≤ 0.05 mg/L	0	N.A.	Optimal
Fluoride (F^-)**	SMWW 4500-F^- C	≤ 1.5 mg/L	0.11	± 0.06	Optimal
Lead (Pb)	SMWW 3114 B	≤ 0.05 mg/L	<0.005	N.A.	Optimal
Manganese (Mn)	SMWW 3113 B	≤ 0.5 mg/L	<0.015	N.A.	Optimal
Mercury (Hg)	SMWW 3114 B	≤ 0.001 mg/L	<0.001	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	≤0.02 mg/L	<0.02	N.A.	Optimal
Nitrate (NO_3^-) **	SMWW 4500-NO_3^- D	≤ 50 mg/L	2.2	± 0.02	Optimal
Nitrite (NO_2^-) *	SMWW 4500-NO_2^- B	≤ 3.0 mg/L	0	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.01 mg/L	<0.01	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500-Cl^- B	0.2 to 0.5 at Consumer &	0	N.A.	Optimal

9/12/2025

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DRINKING WATER ANALYSIS REPORT

Sample Details

Report Reference No.	AES-ENV-NS-227/25-DW-162/25	**Report Issue Date**	09-12-2025
Nature of Sample	Drinking Water	**Sample Collection Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected/Sent by**	AES
Sample Collection Date	29-11-2025	**Sample Receiving Date**	01-12-2025
Analysis Completion Date	09-12-2025	**Laboratory Temperature & Humidity**	(25 ± 5) °C & (55 ± 15) %



Ambient Temperature & Humidity at the Time of Sample collected 23°C & 27%

Sample ID	AES-ENV-DW-162/2025	**Sample Location**	Near Daata General Store
Customer Detail	NESPAK		
Project Details	EIA study for the construction of Jahangir tomb access bridge		

Drinking Water Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
		0.5-1.5 at Source mg/L			
Phenolic Compounds (as Phenols) *	SMWW 5530 D	NGVS mg/L	0	N.A.	Optimal
Zinc (Zn)	SMWW 3113 B	5.0 mg/L	0.028	N.A.	Optimal
Microbiological Analysis					
Total Coliforms*	SMWW 9222 B	0 CFU / 100 mL	0	N.A.	Optimal
Fecal Coliforms *	SMWW 9222 D	0 CFU / 100 mL	0	N.A.	Optimal

*Parameters are approved from Punjab Environmental Protection Agency (EPA).
**Parameters are accredited from Pakistan National Accreditation Council & approved from EPA.
The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

Abbreviations:

PEQS = Punjab Environmental Quality Standards | **SMWW 24th Edition** = Standard Methods for the examination of Water and Wastewater
TCU = True Color Unit | **N.A.** = Not Available | **CFU** = Colony Forming Unit
NTU = Nephelometric Turbidity Unit | **MU** = Measurement Uncertainty | **NGVS** = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range | Marginal = Close to Extreme Edge | High = Exceeds from Permissible Range
Low = Less Than Permissible Range

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Analyzed By 09/12/25

Asian Environmental Services (Pvt) Ltd. LAHORE

Reviewed By (TM) 9/12/2025

Approved By (QM/Chief Chemist) 09/12/25

----------End of Report----------

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SURFACE WATER ANALYSIS REPORT

Sample Details

Report Reference No.	AES-ENV-NS-227/2025-SW-31/25	**Report Issue Date**	09-12-2025
Nature of Sample	Surface water	**Sample Collection Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected/Sent by**	AES
Sample Collection Date	29-11-2025	**Sample Receiving Date**	01-12-2025
Analysis Completion Date	09-12-2025	**Laboratory Temperature & Humidity**	(25 ± 5) °C & (55 ± 15) %



Ambient Temperature & Humidity at the Time of Sample collected 23°C & 27%

Sample ID	AES-ENV-SW-31/2025	**Sample Location**	Ravi River
Customer Details	NESPAK		
Project Details	EIA study for the construction of Jahangir tomb access bridge		

SURFACE WATER ANALYSIS RESULTS

Parameter	Analysis Method	FAO Guidelines	Result	MU (CL95%)	Remarks
Laboratory Analysis					
pH**	SMWW 4500 H+ B	6.0 - 8.5	7.33	± 0.04	Optimal
Biochemical Oxygen Demand (BOD_5) *	SMWW 5210-B	-	328	N.A.	-
Chemical Oxygen Demand (COD)**	SMWW 5220 B	-	615	± 2.29	-
Total Suspended Solids (TSS) **	SMWW 2540 D	-	342	± 4.3	-
Total Dissolved Solids (TDS)**	SMWW 2540 C	0-2000	483	± 2.77	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 D	-	0	N.A.	-
Grease and Oil**	SMWW 5520 B	-	04	0.89	-
Chloride (Cl^-)**	SMWW 4500 Cl- B	0 - 1065	115	± 1.59	Optimal
Fluoride (F^-)**	SMWW 4500 F- C	-	0.31	± 0.06	-
Cyanide (CN^-)*	SMWW 4500 CN- F	-	0	N.A.	-
An-ionic Detergents (as MBAs)	SMWW 5540-C	-	2.5	N.A.	-
Sulfate (SO_4^{2-})**	SMWW 4500 SO42- C	-	25	± 3.63	-
Sulfide (S^{2-})*	SMWW 4500 S2- F	0-960	0	N.A.	Optimal
Ammonia (NH^3)*	SMWW 4500-NH3 D	-	0	N.A.	-
Cadmium (Cd)	SMWW 3113 B	-	<0.006	N.A.	-
Chromium (Cr)	SMWW 3113 B	-	<0.004	N.A.	-
Copper (Cu)	SMWW 3113 B	-	0.165	N.A.	-
Lead (Pb)	SMWW 3113 B	-	<0.005	N.A.	-
Mercury (Hg)	SMWW 3112 B	-	<0.001	N.A.	-
Selenium (Se)	SMWW 3114 B	-	<0.01	N.A.	-
Nickel (Ni)	SMWW 3113 B	-	<0.02	N.A.	-
Silver (Ag)	SMWW 3113 B	-	<0.002	N.A.	-
Total Toxic Metals	Calculated Value	-	0.24	N.A.	-
Zinc (Zn)	SMWW 3111 B	-	0.030	N.A.	-
Arsenic (As)	SMWW 3114 B	-	<0.005	N.A.	-

9/12/2025

Document No. AES/LMS/FRM-115. Date of Issue 07 July 2022. Revision No. 00

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Sample Collection Date	29-11-2025	**Sample Receiving Date**	01-12-2025
Analysis Completion Date	09-12-2025	**Laboratory Temperature & Humidity**	(25 ± 5) °C & (55 ± 15) %
Ambient Temperature & Humidity at the Time of Sample collected			23°C & 27%
Sample ID	AES-ENV-SW-31/2025	**Sample Location**	Ravi River
Customer Details	NESPAK		
Project Details	EIA study for the construction of Jahangir tomb access bridge		



SURFACE WATER ANALYSIS RESULTS

Parameter	Analysis Method	FAO Guidelines	Result	MU (CL95%)	Remarks
Barium (Ba)	SMWW 3113 B	-	<0.0035	N.A.	-
Iron (Fe)	SMWW 3113 B	-	0.0782	N.A.	-
Manganese (Mn)	SMWW 3111 B	-	<0.015	N.A.	-
Boron (B)	SMWW 3113 B	0-2	<0.02	N.A.	Optimal
Residual Chlorine (Cl_2)*	SMWW 4500 Cl- B	-	0	N.A.	-

*Parameters are approved from Punjab Environmental Protection Agency (EPA).
**Parameters are accredited from Pakistan National Accreditation Council & approved from EPA.
The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

Abbreviations:

FAO= Food and Agriculture Organization
SMWW 24th Edition = Standard Methods for the examination of Water and Wastewater
N.A. = Not Available
MU = Measurement Uncertainty
NGVS = No Guideline Value Set

Remarks:

Optimal = Compliance with Permissible Range
Marginal = Close to Extreme Edge
High = Exceeds from Permissible Range
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Analyzed By 9/12/25

Reviewed By (TM) 9/12/2025

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WASTEWATER ANALYSIS REPORT

Sample Details

Report Reference No.	AES-ENV-NS-227/2025-WW-197/25	**Report Issue Date**	09-12-2025
Nature of Sample	Wastewater	**Sample Collection Reference**	AES/LMS/QSP-014
Grab/Composite	Grab	**Sample Collected/Sent by**	AES
Sample Collection Date	29-11-2025	**Sample Receiving Date**	01-12-2025
Analysis Completion Date	09-12-2025	**Laboratory Temperature & Humidity**	(25 ± 5) °C & (55 ± 15) %



Ambient Temperature & Humidity at the Time of Sample collected 23°C & 27%

Sample ID	AES-ENV-WW-197/2025	**Sample Location**	Near Old Ravi Bridge
Customer Detail	NESPAK		
Project Details	EIA study for the construction of Jahangir tomb access bridge		

Wastewater Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Laboratory Analysis					
pH**	SMWW 4500 H^+ B	6 - 9	8.29	± 0.04	Optimal
Biochemical Oxygen Demand (BOD_5) *	SMWW 5210-B	80 mg/L	**158**	N.A.	High
Chemical Oxygen Demand (COD)**	SMWW 5220 D	150 mg/L	**298**	± 2.29	High
Total Suspended Solids (TSS)**	SMWW 2540 D	200 mg/L	82	± 1.12	Optimal
Total Dissolved Solids (TDS)**	SMWW 2540 C	3500 mg/L	660	± 8.78	Optimal
Phenolic Compounds (as Phenols) *	SMWW 5530 B, D	0.1 mg/L	0	N.A.	Optimal
Grease and Oil**	SMWW 5520 B	10 mg/L	07	± 0.89	Optimal
Chloride (Cl^-)**	SMWW 4500-Cl- B	1000 mg/L	115	± 1.59	Optimal
Fluoride (F^-)**	SMWW 4500-F- D	10 mg/L	0.28	± 0.06	Optimal
Cyanide (CN^-)*	SMWW 4500-CN- F	1.0 mg/L	0	N.A.	Optimal
An-ionic Detergents (as MBAs) *	SMWW 5540-C	20.0 mg/L	2.9	N.A.	Optimal
Sulfate (SO_4^{2-}) **	SMWW 4500-SO_4^{2-} D	600 mg/L	54	± 3.63	Optimal
Sulfide (S^{2-}) *	SMWW 4500-S^{2-} F	1.0 mg/L	0	N.A.	Optimal
Ammonia (NH_3) *	SMWW 4500-NH_3 C	40 mg/L	0	N.A.	Optimal
Cadmium (Cd)	SMWW 3113 B	0.1 mg/L	<0.006	N.A.	Optimal
Chromium (Cr)	SMWW 3113 B	1.0 mg/L	<0.004	N.A.	Optimal
Copper (Cu)	SMWW 3113 B	1.0 mg/L	0.165	N.A.	Optimal
Lead (Pb)	SMWW 3113 B	0.5 mg/L	<0.005	N.A.	Optimal
Mercury (Hg)	SMWW 3112 B	0.01 mg/L	<0.001	N.A.	Optimal
Selenium (Se)	SMWW 3114 B	0.5 mg/L	<0.01	N.A.	Optimal
Nickel (Ni)	SMWW 3113 B	1.0 mg/L	<0.02	N.A.	Optimal
Silver (Ag)	SMWW 3113 B	1.0 mg/L	<0.002	N.A.	Optimal
Total Toxic Metals	Calculated Value	2.0 mg/L	0.24	N.A.	Optimal
Zinc (Zn)	SMWW 3111 B	5.0 mg/L	0.035	N.A.	Optimal
Arsenic (As)	SMWW 3114 B	1.0 mg/L	<0.005	N.A.	Optimal

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Ambient Temperature & Humidity at the Time of Sample collected			23°C & 27%
Sample ID	AES-ENV-WW-197/2025	**Sample Location**	Near Old Ravi Bridge
Customer Detail	NESPAK		
Project Details	EIA study for the construction of Jahangir tomb access bridge		



Wastewater Analysis Results

Parameter	Analysis Method	PEQS	Result	MU (CL95%)	Remarks
Barium (Ba)	SMWW 3113 B	1.5 mg/L	<0.0035	N.A.	Optimal
Iron (Fe)	SMWW 3113 B	8.0 mg/L	0.0920	N.A.	Optimal
Manganese (Mn)	SMWW 3111 B	1.5 mg/L	<0.015	N.A.	Optimal
Boron (B)	SMWW 3113 B	6.0 mg/L	<0.02	N.A.	Optimal
Residual Chlorine (Cl_2) *	SMWW 4500 Cl- B	1.0 mg/L	0	N.A.	Optimal

*Parameters are approved from Punjab Environmental Protection Agency (EPA).
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The reported expanded uncertainty is based on combined standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

Abbreviations:

PEQS = Punjab Environmental Quality Standards
N.A. = Not Available
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Analyzed By

Asian Environmental Services (Pvt) Ltd LAHORE 09/12/25

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Ensuring Quality and Sustainability

ANNEX-III
RESOURCE 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-IV
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
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

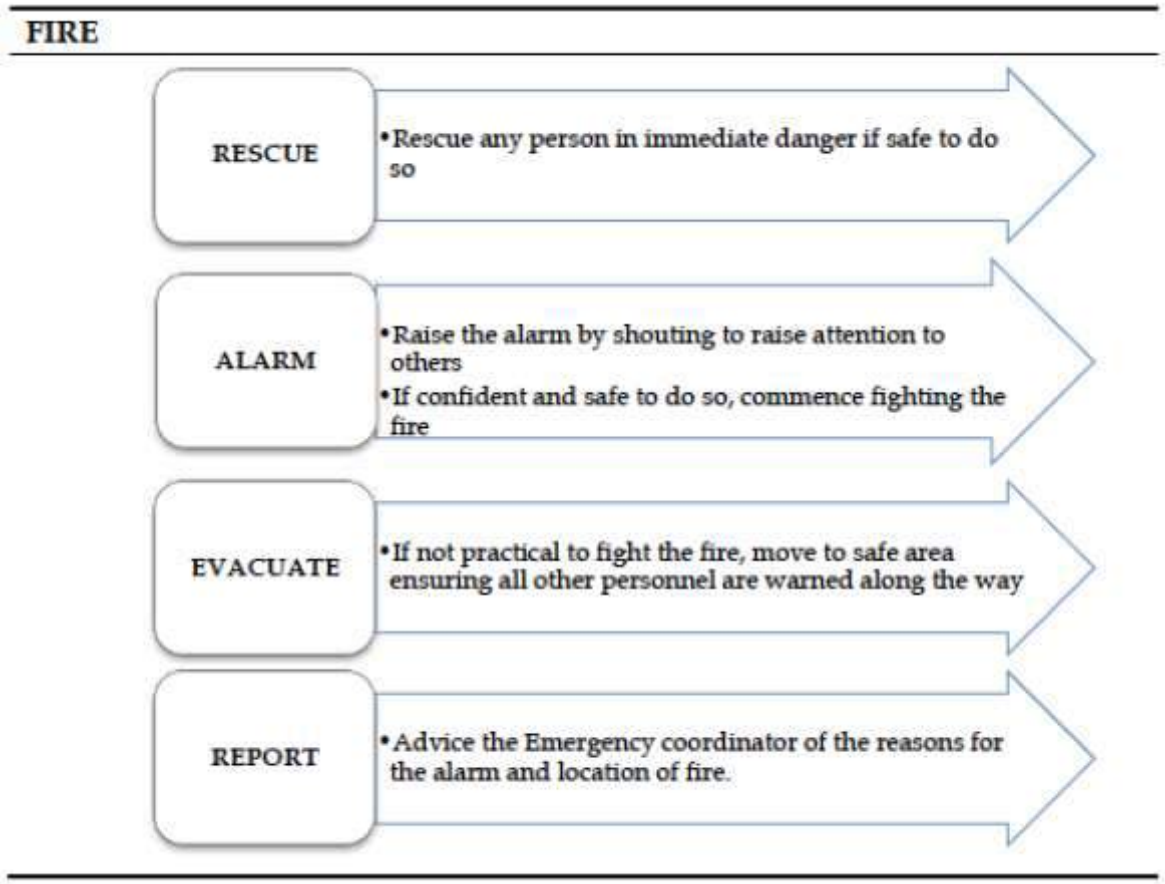
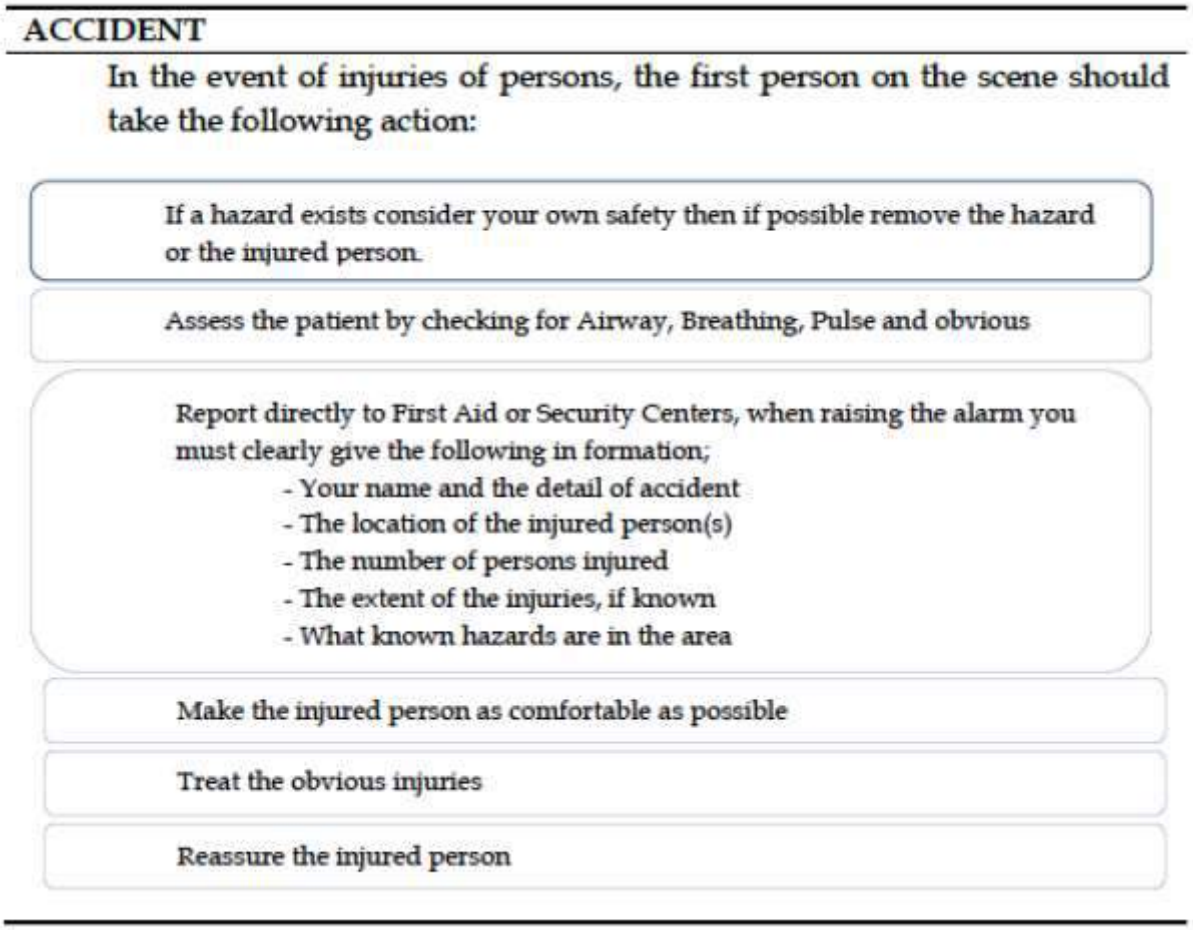


Figure 3.2 Emergency Procedures for Serious Accident



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

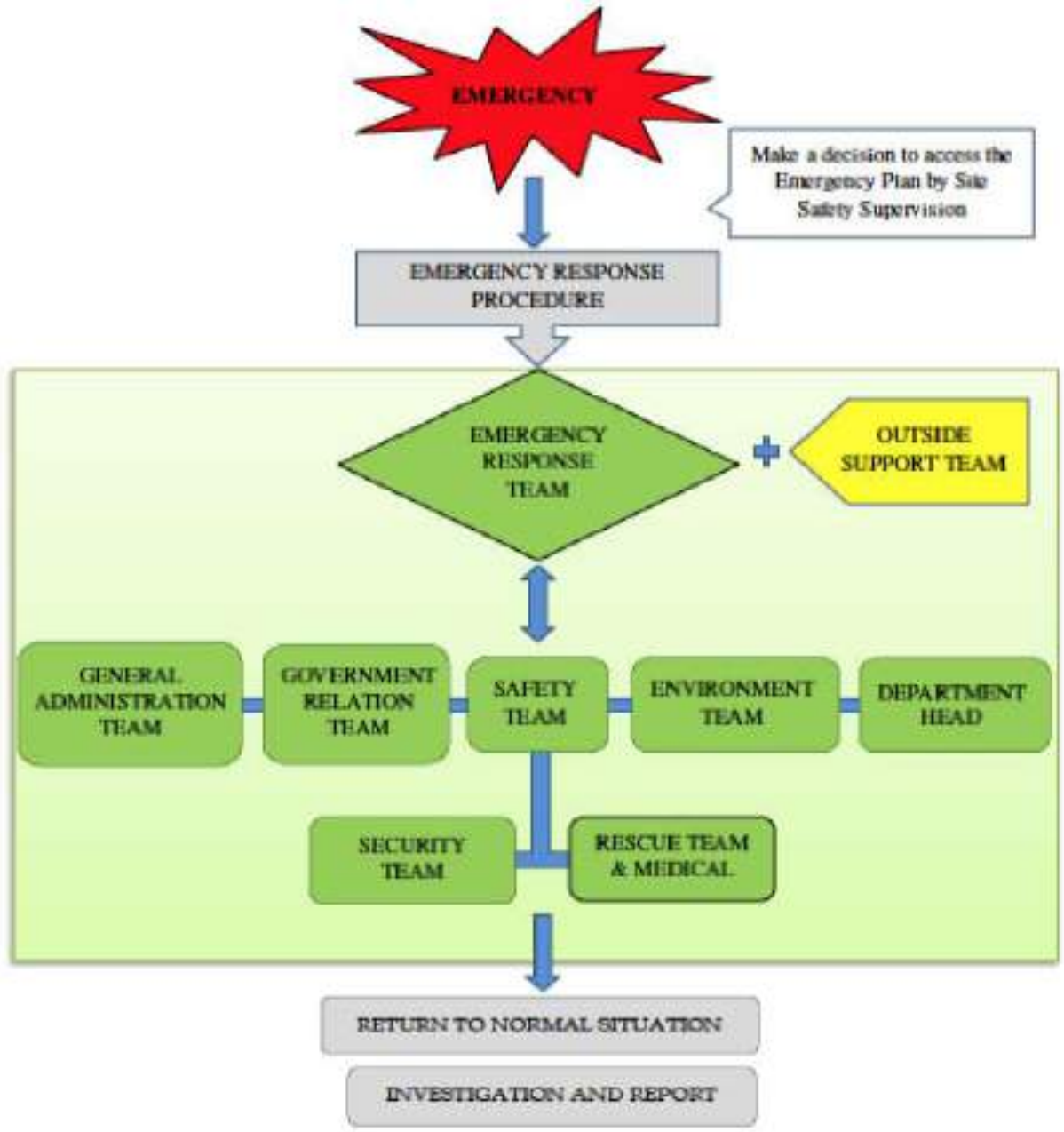
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

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.



Note: Name of contact person and call number from Owner/Contractor to be determined.

1.9 INCIDENT AND ACCIDENT REPORT

Section A: Identification Data

Report No:	Date of Reported:	Reporter:	Sign:
Job Title:		Company Name:	

Section B: Violence Rate

Accident Violence: ☐ 01-Death ☐ 02-Serious Injury ☐ 03-Lost Time Injury ☐ 04-First Aid ☐ 05- Not Injury ☐ 06-Near Miss

Property Damage Cost: ☐ 1-2,000 USD ☐ 2,001-10,000 USD ☐ 10,001-50,000 ☐ > 50,001

Section C: Environmental Impact

Affected area	☐ Construction area	☐ Public area	
Receptor	☐ None	☐ Workers	☐ Community
Type of pollution	☐ Physical	☐ Chemical	☐ Biological
Toxicity	☐ Non-toxic	☐ Low - toxic	☐ High - toxic
Return to Normal	☐ 1 day	☐ 1 day to 1 week	☐ ≥ 1 week
Cumulative impact	☐ Non-cumulative	☐ Cumulative	

Section D: Injured/Illness Employee

1.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years Weeks	In this Project Years Weeks
	☐ Male ☐ Female							

Site:	Company:	Reference:	Phone No:	Social Security Number

Part of Body Injured or Affected:

☐ Head	☐ Hands	☐ Face	☐ Nose
☐ Eyes	☐ Legs	☐ Teeth	☐ Neck
☐ Trunk	☐ Toes	☐ Elbow	☐ Shoulder
☐ Back	☐ Ankle	☐ Wrist	☐ Foot
☐ Arms	☐ Thump	☐ Fingers	☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration	☐ Amputation	☐ Puncture	☐ Fracture
☐ Strain & Sprain	☐ Burns	☐ Contusion	☐ Dry Heat Friction
☐ Hernia	☐ Foreign Body	☐ Chemical	☐ Contamination
☐ Skin (Occupationnel)	☐ Rash	☐ Irritation	

Remark: .....

2.Name:	Sex:	Date of Birth: Month	Day	Year	Age:	Regular Job Title:	Experience: In this job title Years Weeks	In this Project Years Weeks
	☐ Male ☐ Female							

Site:	Company:	Reference:	Phone No:	Social Security Number

Part of Body Injured or Affected:

☐ Head	☐ Hands	☐ Face	☐ Nose
☐ Eyes	☐ Legs	☐ Teeth	☐ Neck
☐ Trunk	☐ Toes	☐ Elbow	☐ Shoulder
☐ Back	☐ Ankle	☐ Wrist	☐ Foot
☐ Arms	☐ Thump	☐ Fingers	☐ Internal

Remark: .....

Nature of Injury or Illness:

☐ Laceration	☐ Amputation	☐ Puncture	☐ Fracture
☐ Strain & Sprain	☐ Burns	☐ Contusion	☐ Dry Heat Friction
☐ Hernia	☐ Foreign Body	☐ Contamination	☐ Chemical
☐ Skin (Occupationnel)	☐ Rash	☐ Irritation	

Remark: .....

Section E: Accidents/Incident Details

Date Accident/Incident Occurred:	Time Accident/Incident Occurred:	Exact Location of the Accident / Incident:

Details of the actual Job Being done at the time:

Details of Accident / Incident / What actually happened?

Section F: Accident Cause (Basic cause mark X / Contributing cause, if any mark O)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	☐ Inadequately Guarded	1	☐ Operating Without Authority / Training
2	☐ Unguarded	2	☐ Operating at Unsafe Speed
3	☐ Defective Tools, Equipment, or Substance	3	☐ Marking 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 G: 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

Section H: Witness Statement	
Witness Name	Interviewer Name

Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:

Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department;
: First Aid Cases will not applicable to this form;
: The accident report shall submit to Safety Department within 3 days
: Attached the photograph or sketch the location of accident / incident;

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-V
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 VI

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-VII
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-VIII
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-IX
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 NTDC 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-X
TREE PLANTATION PLAN

TREE PLANTATION PLAN

The basic purpose of afforestation/plantation of suitable species in the Project area is to reduce the risk made due to the cutting of trees for the proposed Project. The risk made will be compensated by the planting of saplings to enhance green cover and improve the overall environment of the area. Afforestation will not only reduce the risk being made but will also increase the carrying capacity of the area regarding many positive aspects.

It is pertinent to mention that 103 trees may be impacted on site, which is recommended for compensation and cutting should be avoided up to the maximum. Plantation will be done after the construction work immediately. Plantation of indigenous tree species is highly important to maintain 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.

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 ecosystems in which they reside.
- Trees absorb and store rainwater which reduces runoff and sediment deposit after storms. This helps the groundwater 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 enhance 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 has a positive impact on the project area.
- To reduce sedimentation by plantation in the project area which will act as a protection wall against wind-born dust particles.

AREA ENHANCEMENT PLAN

Plants will be raised along the nearby available area or roads. Total number of plants to be planted is **1740** Number for this Project.

**The concerned Authority may update the standards of planting and choice of species as per the actual requirements and site suitability.*

TREES RECOMMENDED

Table-1 shows the recommended trees for afforestation for the Project.

Table-1: Recommended Trees 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*
7.	Silver Oak	*Grevillea robusta*
8.	*Pilkan*	*Ficus virens Spp*
9.	Jaman	*Eugenia jambolina*
10.	Kachnar	*Bauhinia variegate*
11.	Amaltas	*Cassia fistula*
12.	Arjun	*Terminalia arjuna*

COST

BREAKUP OF EXPENDITURE FOR PLANTING AND MAINTENANCE PER ACER AT THE DAILY WAGES RAT RS.1500/- PER COOLY DAY

Year	**Particular of work**	**Quantity**	**Rate**	**Amount**
1st	Side Clearance including cutting of un-scalable growth such as Wan, Karry, Mallah, Kikri, Muskat, Stubbing of Kahna etc.	01 Acer	05/CD	7500/-
	Collection of Debris and its burning	01 Acer	03/CD	4500/-
	Leveling of land by Machinery	01 Acer	10/CD	15000/-
	Ploughing	01 Acer	10/CD	15000/-
	Planing (Sohaga)	01 Acer	10/CD	15000/-
	Layout and Dag Balling	01 Acer	02/CD	3000/-

Year	Particular of work	Quantity	Rate	Amount
	Earth Work Digging of Pasels/Trunches (Undressed). Digging of Mains/Branches/Khals Dressing of Pattries a) Mains/Khals b) Minors Digging of Pits (10/10) 435 Nos.	5000 Cft	05/CD Per 1000 Cft	37500/-
	Cost of Plants including 15% Restocking 435+65 =500	01 Acer.	350 Each	175000/-
	Irrigation 01 Acer x 36 time	01 Acer	1/2/CD	27000/-
	Weeding 01 Acer x 02 time	01 Acer	10/CD	15000/-
	Spray against Termite, Borer & White Bug attack etc.	01 Acer	L.S	7500/-
	Unforeseen	01 Acer	L.S	250/-
TOTAL:-				**322250/-**

Year	Particular of work	Quantity	Rate	Amount
2nd	Noksafai with kassi 03 inch depth a) Minors b) Mains/Branches c) Khals	1000 cft	 03/CD 02/CD 02/CD	 4500/- 3000/- 3000/-
	Grass clearance (Noksafai with sickle onside of the channel) a) Minors b) Mains/Branches c) Khals	1000 cft	 02/CD 1.5/CD 01/CD	 3000/- 2250/- 1500/-
	Silt Clearance a) Minors b) Mains/Branches c) Khals	1000 cft	 03/CD 2.5/CD 2.5/CD	 4500/- 3750/- 3750/-
	Repair of Banks/Pattries of Channel	1000 cft	05/CD	7500/-
	Cutting of Berms and throwing of earth and silt	1000 cft	02/CD	3000/-
	Reopening of Trunches	1000 cft	05/CD	7500/-
	Rat earth clearance	01/Acer	02/CD	3000/-
	Restocking 10%	43 Nos.	350 Each	15050/-
	Irrigation 01 Acer x 25 time	01 Acer	1/2/CD	18750/-

Year	Particular of work	Quantity	Rate	Amount
	Spray against Termite, Borer & White Bug attack etc.	01 Acer	L.S	7500/-
	Unforeseen	01 Acer	L.S	950/-
TOTAL:-				**92500/-**

Year	Particular of work	Quantity	Rate	Amount
3rd	Noksafai with kassi 03 inch depth d) Minors e) Mains/Branches f) Khals	1000 cft	 03/CD 02/CD 02/CD	 4500/- 3000/- 3000/-
	Grass clearance (Noksafai with sickle onside of the channel) d) Minors e) Mains/Branches f) Khals	1000 cft	 02/CD 1.5/CD 01/CD	 3000/- 2250/- 1500/-
	Silt Clearance d) Minors e) Mains/Branches f) Khals	1000 cft	 03/CD 2.5/CD 2.5/CD	 4500/- 3750/- 3750/-
	Repair of Banks/Pattries of Channel	1000 cft	05/CD	7500/-
	Cutting of Berms and throwing of earth and silt	1000 cft	02/CD	3000/-
	Reopening of Trunches	1000 cft	05/CD	7500/-
	Rat earth clearance	01/Acer	02/CD	3000/-
	Restocking 10%	43 Nos.	350 Each	15050/-
	Irrigation 01 Acer x 18 time	01 Acer	1/2/CD	13500/-
	Spray against Termite, Borer & White Bug attack etc.	01 Acer	L.S	7500/-
	Unforeseen	01 Acer	L.S	500/-
TOTAL:-				**86800/-**

ABSTRACT

Year	Area (Acre)	Rate (PKR)	Amount (PKR)
1ST Year	1 Acre (Planting)	382730	382730
2nd Year	1 Acre (Maintenance)	134500	134500
3rd Year	1 Acre (Maintenance)	117040	117040
		Total	**634270**

Cost of Planting one acre (01 acre) (PKR) = 634,270
Cost of Planting four acres(04 acres) (PKR) = 634,270x4= 2,537,080

Amount in Million (PKR)= 2.537

***The above calculations and standards are approximate and tentative provided based on available data which may be updated by the implementing agency as per actual, during implementation.*

ANNEX-XI
BREAKUP OF HEALTH AND SAFETY COST

Annex-XI

BREAKUP OF HEALTH AND SAFETY COST

Items	Quantity	Cost / Item (Rs.)	Total Cost (Rs.)	Rationale
(A) Personal Protective Equipments PPEs				
Dust masks	4,800	30	144,000	One dust mask to be used in a week by each labourer for 12 months and for 48 weeks.
Safety Shoes	200	3,000	600,000	Two safety shoes are supposed to be used for 12 months by each labourer and for 100 labourers for 12 months construction period .
Gloves	1,200	200	240,000	twelve pairs of gloves is to be used by each labourer for 12 months and 1,200 gloves are estimated to be used by 100 labourers.
First Aid Box	4	5,000	20,000	One First Aid Box is proposed for 25 labourers and for 100 labourers 04 aid boxes are estimated.
Ear Plugs	4,800	50	240,000	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 4,800 for 100 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)	200	800	160,000	Two safety Jacket (Hi Vis) to be used by each labourer for 12 months to be used by 100 labourers.
Sub-Total (A)			***2,004,000***	
(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)			***2,064,500***	

Time required for Construction = 12 Months
No. of labour required during construction = 100